INTRODUCTION TO COMPUTERS IN AGRICULTURE (C-ID AG-AB 108 108)



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Introduction to Computers in Agriculture (C-ID AG-AB 108 108)

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1.1: Chapter Introduction

Introduction to Agricultural Computer Applications

A computer is a powerful electronic device designed to process, store, and retrieve data. At its core, a computer consists of several basic components: the central processing unit (CPU), which performs calculations and executes instructions; memory, which temporarily holds data and program instructions; storage, such as hard drives or solid-state drives, where data is kept permanently; and input/output devices, like keyboards, mice, and monitors, which facilitate interaction between the user and the machine. These fundamental components work together to enable a wide range of tasks, from simple calculations to complex data analysis.

In the agricultural sector, computers and related technologies have become indispensable tools, revolutionizing how farms are managed and operated. Spreadsheets, for instance, are used extensively for organizing and analyzing data related to crop yields, financial transactions, and inventory management. Applications such as Microsoft Excel and Google Sheets allow farmers to efficiently handle large amounts of data, perform calculations, and generate reports, thus improving decision-making and operational efficiency.

Word processing software, like Microsoft Word and Google Docs, is equally important, providing a platform for creating and managing documentation, reports, and communication. This software helps farmers document processes, maintain records, and communicate effectively with stakeholders.

The advent of the World Wide Web and the Internet has further expanded the capabilities of agricultural technology. Online resources and platforms offer access to market prices, weather forecasts, and best practices. The Internet also enables the use of cloud-based software and applications, which provide integrated solutions for managing various aspects of farming operations.

In addition to these foundational tools, specialized software and mobile apps are tailored to specific agricultural needs. For livestock management, software can track health, breeding, and inventory, while crop management apps monitor growth conditions and optimize inputs. GPS technology and precision farming tools enhance field operations, improving accuracy and productivity.

Together, these technologies contribute to more effective and efficient agricultural practices, enabling farmers to manage their operations with greater precision and insight.



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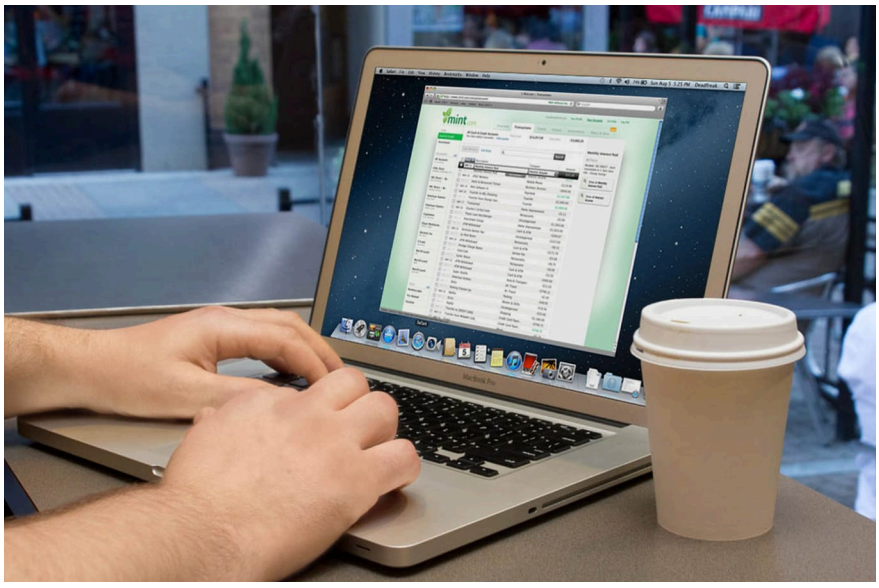
1.2: Chapter Learning Objectives

Learning Objectives: Introduction to Agricultural Computer Systems, Software, Apps, The Internet, and The World Wide Web

1. **Introduction to Computers:**
   - **Learning Objective:** Understand the fundamental components and functions of computers, including hardware and software, and how they interact to perform basic tasks.
2. **Software:**
   - **Learning Objective:** Identify different types of software (system, application, and utility) and understand their roles and uses in various computing environments.
3. **Apps:**
   - **Learning Objective:** Explore the purpose and functionality of mobile and desktop applications, including how to install, use, and manage them effectively.
4. **Internet:**
   - **Learning Objective:** Gain a foundational understanding of how the Internet works, including basic concepts such as IP addresses, DNS, and protocols for connecting and navigating online.
5. **World Wide Web:**
   - **Learning Objective:** Distinguish between the Internet and the World Wide Web, and understand how web browsers, web pages, and web servers work together to deliver information online.
6. **Agricultural Software/Apps:**
   - **Learning Objective:** Learn about the various software and applications designed for agriculture, including their functionalities, benefits, and how they can be utilized to enhance farm management and productivity.

These objectives aim to provide a foundational understanding of each topic and how they relate to one another.

By achieving these learning objectives, learners will gain a comprehensive understanding of the fundamental tools and technologies necessary for effective use of computers, software, and digital applications in agriculture.



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1.2.1: Computer Hardware Learning Objectives

Learning Objectives

If you do well in this module, you should be able to:

- Indicate the names and functions of hardware ports and the parts of the motherboard.
- Identify the names and distinguishing features of different kinds of input and output devices.
- Describe how the CPU processes data and instructions and controls the operation of all other devices.
- Identify the names, distinguishing features, and units for measuring different kinds of memory and storage devices.
- Search your personal computer for the various hardware components it contains.

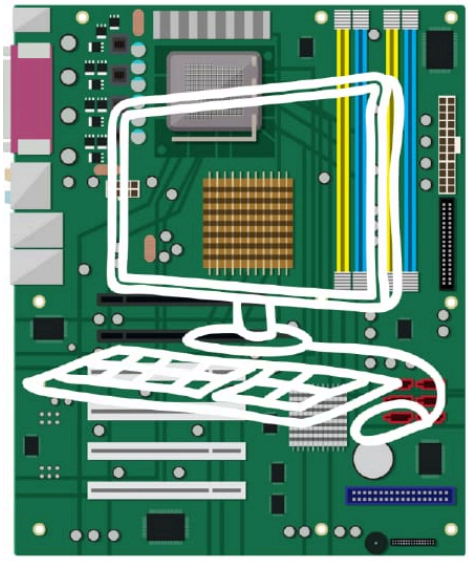


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1.2.2: Reading - Introduction to Computer Hardware

In this section, we'll explore the essentials of computer hardware and why understanding it is important in agriculture. Computers play a vital role in modern farming—from managing data to operating machinery—so it's helpful to grasp how the physical parts of a computer work together to support these tasks. We'll start by looking at the key components inside every computer, like the processor (the "brain"), memory (for storing information), and input/output devices (how we interact with the computer). By the end of this section, you'll have a solid foundation in hardware, helping you make more informed decisions when using technology in agriculture.

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1.2.2.1: Additional Reading- The PC

Additional description of the hardware components of computer hardware is available at Make Use Of. You can find many useful free ebooks on this website. The following is the book that you may want to refer to:

1. Your PC, Inside and Out Part I: Chassis, Power Supply and Motherboard
2. Your PC Inside and Out Part II: CPU, RAM, Storage, Video Card and Expansions



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1.2.2.2: Hardware

Introduction

As we start exploring the nuts and bolts of computer hardware, let's first take a moment to connect it to something you might not immediately think about—agriculture. You might be wondering, "What do computers have to do with agriculture?" Well, a lot more than you might expect!

Picture a modern farm. It's not just fields and tractors anymore; it's a high-tech operation where computers are as crucial as any traditional tool. From sensors that monitor soil moisture to drones that survey crops from the sky, computer technology is transforming agriculture into a cutting-edge industry. These advancements aren't just about making farming easier—they're about making it smarter, more efficient, and more sustainable.

In this section, we're going to dive into the world of computer hardware. Understanding these components will not only give you insights into how your personal computer works but also how these technologies are being used to revolutionize agriculture. Whether it's a CPU crunching numbers to predict the best planting times or sensors feeding data into a system to optimize water usage, the hardware we'll discuss is the backbone of this agricultural tech revolution.

So, as we get into the details of motherboards, CPUs, and input devices, keep in mind that this isn't just abstract knowledge—it's the foundation of the technology that's feeding the world and pushing the boundaries of what's possible in farming. Ready to dig in? Let's get started!

Hardware

Let's consider the hardware of an information system through an agricultural lens, comparing the various types of computing devices to different agricultural tools and machinery. Hardware is the most visible part of any information system: the equipment such as computers, scanners and printers that is used to capture data, transform it and present it to the user as output. Although we will focus mainly on the personal computer (PC) and the peripheral devices that are commonly used with it, the same principles apply to the complete range of computers:



1. Supercomputers: Think of supercomputers as the heavy-duty tractors or combine harvesters of the tech world. Just as these machines handle the most demanding farming tasks—such as plowing large fields or harvesting massive crops—supercomputers

tackle exceptionally complex scientific computations and data processing.

2. Mainframe Computers: These are akin to large-scale irrigation systems or silos that manage and store vast amounts of resources for numerous farms. Mainframes offer substantial processing power and data storage, supporting many users in managing extensive agricultural operations and resources efficiently.

3. Servers: Imagine servers as central grain elevators or cooperative storage facilities. They provide significant storage capacity and enable multiple users (farmers, agronomists, etc.) to access and share resources, although the actual processing—like analyzing crop data—often happens at individual farms (or users' machines).

4. Workstations: Workstations are similar to specialized farm equipment, like high-performance soil testers or precision planters. They offer advanced capabilities for detailed and demanding tasks—such as analyzing soil samples or optimizing planting patterns—allowing farmers to handle complex agricultural computations on their own.

5. Personal Computers: These are like versatile multipurpose farm tools or small tractors. They come with all the basic equipment needed for various tasks (monitor, keyboard, CPU) and can be used independently or as part of a larger system (like a farm management network). They're flexible and handy for everyday agricultural tasks, such as tracking farm inventories or analyzing crop data.

6. Mobile Devices: Think of mobile devices as portable farming tools—like handheld soil moisture meters or GPS devices. They offer maximum portability and can connect wirelessly to farm management systems, though they don't replace the full functionality of larger equipment or systems.

7. Wearable Computers: Wearables are akin to advanced monitoring systems for livestock or crops, like automated collars for tracking animal health or sensors embedded in fields to monitor environmental conditions. They provide specialized, real-time data collection for specific agricultural needs.

8. Embedded Computers: These can be compared to integrated systems in modern farm machinery or smart irrigation controllers. They're built into various appliances (from tractors to weather stations) to handle specific tasks, improving efficiency and functionality within the broader agricultural system.

9. Smart Cards: Finally, smart cards are like digital farm passports or key fobs that provide secure access and identification. They can hold crucial information, such as farm management details, livestock records, or access rights to equipment, streamlining various aspects of farm operations.

By viewing computing hardware through an agricultural lens, we can better understand how each component plays a role in managing, processing, and optimizing agricultural tasks and resources.

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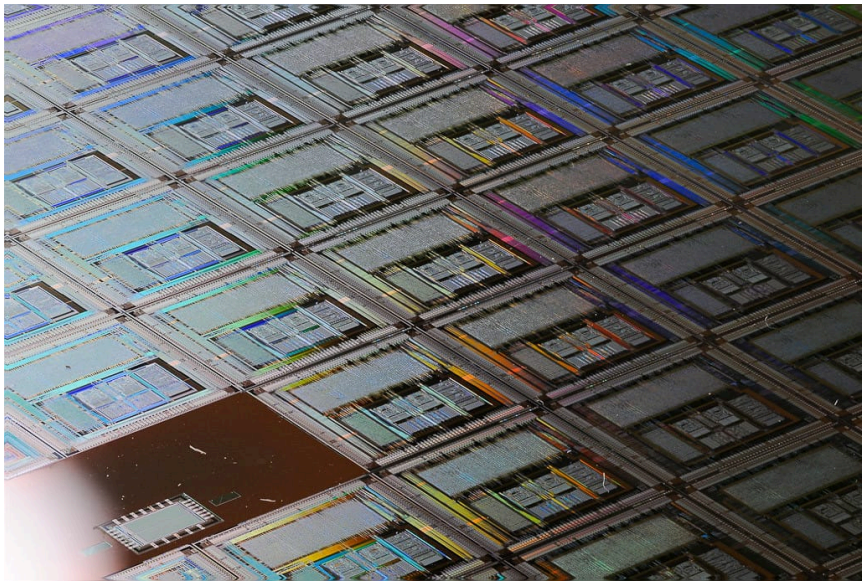
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1.2.2.3: Central Processing Unit (CPU)

Central Processing Unit (CPU)



Once data has been entered into a computer, it is acted on by the CPU, which is the real brain of the computer. The CPU takes specific program instructions (usually one at a time), applies them to the input data and transforms the input into output.

To understand the role of the CPU in data processing through an agricultural lens, let's draw parallels between this critical component of a computer and the various functions and processes on a farm:

1. The CPU as the Farm Manager:

Think of the CPU as the farm manager or the head farmer. Just as the farm manager oversees and directs the operations on the farm, the CPU is responsible for processing and managing data. The farm manager receives specific instructions or plans (e.g., crop planting schedules, irrigation plans) and applies them to the farm's resources (land, equipment, labor). Similarly, the CPU takes program instructions and applies them to the input data to generate meaningful output.

2. Program Instructions as Farming Tasks:

Program instructions are akin to the specific tasks or directives given to the farm manager. These instructions could include tasks like planting seeds, watering crops, or harvesting. For instance:

- **Planting Seeds:** Just as a specific instruction might be to plant a certain type of seed in a particular field, a CPU instruction might be to perform a calculation or process a piece of data.
- **Irrigation Plans:** An irrigation plan could be compared to a set of instructions that tells the CPU how to manage and transform data, ensuring crops receive the right amount of water based on current conditions.

3. Input Data as Raw Materials:

The input data entered into the computer is similar to raw materials on a farm, such as seeds, soil, and water. Just as these materials need to be processed and managed to grow crops, input data needs to be processed by the CPU to produce useful results. For example:

- **Seeds:** Representing raw data that needs careful handling and placement, just like how input data is carefully processed by the CPU.
- **Soil and Water:** Essential resources that support the growth of crops, much like how input data provides the foundation for the CPU's processing tasks.

4. Output as Farm Products:

The output generated by the CPU is analogous to the end products of farming, such as harvested crops or livestock. After processing the raw materials (seeds, soil, water) and applying specific instructions, the farm manager yields final products that are ready for market or consumption. Similarly, the CPU transforms input data into output that can be used for various purposes, such as generating reports, making decisions, or displaying information.

5. Processing Efficiency and Optimization:

In agriculture, the efficiency of processes and the optimal use of resources are crucial for maximizing yields. Similarly, the efficiency of the CPU in processing instructions and handling data is critical for the overall performance of the computer system. A well-optimized farm might use modern techniques and equipment to improve productivity, just as a computer with a powerful and well-tuned CPU can process data more quickly and effectively.

6. Specialized Tasks and Equipment:

Just as different tasks on a farm might require specialized equipment (e.g., tractors for plowing, combines for harvesting), the CPU handles various types of instructions and tasks through its processing capabilities. Specialized CPUs or processors might be used for different applications, such as high-performance computing for complex calculations, much like how specialized farm equipment is used for specific agricultural tasks.

In Summary:

The CPU in a computer functions similarly to a farm manager in an agricultural setting. It takes input data (raw materials), applies specific instructions (farming tasks), and transforms the input into output (final products). The efficiency and effectiveness of this process are crucial, just as they are in agriculture, where optimizing the use of resources and equipment leads to successful outcomes. Each component of the system, whether it's the CPU or the farm manager, plays a critical role in ensuring that the overall operation runs smoothly and effectively.

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1.2.2.4: Review- Hardware Jeopardy

A Jeopardy game is attached to assist you in your review. You will need the PowerPoint application or a PowerPoint viewer to play the game. You can perform these exercises on your mobile devices with access to Office 365 Mobile or a separate App for your Apple or Android device.

Jeopardy: Hardware Review

NOTE: The Jeopardy Game should open in the Slide Show view and be immediately playable. If it opens in the regular PowerPoint presentation view, go to the SLIDE SHOW tab on the ribbon and start the show from THE BEGINNING (command on the far left). You can play the game as many times as you like and in any order you like.

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1.2.2.5: The Keyboard

The keyboard

A lot of input still happens by means of a keyboard. Usually, the information that is entered by means of a keyboard is displayed on the monitor. The layout of most keyboards is similar to that of the original typewriter on which it was modeled. Ironically, this “QWERTY” keyboard layout was originally designed to slow the operator down, so that the keys of the typewriter would not get stuck against each other. This layout now works counter-productively since a computer can process keyboard input many times faster than even the fastest typist can manage. A number of attempts have been made to design alternative layouts by rearranging the keys (the Dvorak keyboard) or by reducing the number of keys. None of these alternative designs has really caught on. Special keyboards have also been designed for countries that use a non-Roman alphabet, and also for disabled people.

Let's translate the concept of keyboard input and its evolution into an agricultural context:

1. The Traditional Tool and Its Evolution:

In agriculture, traditional tools like a classic plow or scythe were designed based on the technology and needs of their time. For example, the old-fashioned plow was designed to break up soil efficiently, much like the QWERTY keyboard was designed to prevent typewriter jams. Over time, as technology advanced, new tools and techniques were developed. Modern farmers might use advanced tractors with GPS technology, which is analogous to how modern keyboards, despite their historical origins, have evolved to work efficiently with digital systems.

2. The Keyboard as a Basic Tool:

Just as a farmer relies on fundamental tools like shovels or seed drills, many people still rely on the keyboard as a primary input device. It’s a standard tool that’s familiar and widely used, similar to how basic agricultural tools are essential for everyday tasks. The keyboard layout, rooted in historical constraints, has become a standard despite the availability of potentially more efficient options.

3. Attempts at Improvement:

In agriculture, there are always attempts to improve efficiency—like developing more ergonomic tools or introducing mechanized systems to replace manual labor. Similarly, alternative keyboard layouts like Dvorak are akin to newer farming techniques or tools designed to increase productivity and comfort. These alternative layouts attempt to improve typing speed and efficiency, just as modern plows or automated irrigation systems aim to enhance farming operations. However, much like how some new farming tools or techniques may not immediately replace traditional methods, alternative keyboard layouts have not widely replaced the QWERTY layout.

4. Specialized Tools for Specific Needs:

In agriculture, specialized tools are created for specific needs—like ergonomic tools for farmers with physical limitations or equipment adapted for different types of crops. Similarly, specialized keyboards have been designed for various needs:

- **Non-Roman Alphabets:** Keyboards adapted for different languages or scripts (like Cyrillic or Arabic keyboards) are akin to how agricultural equipment is modified for use in different regions or for different types of crops.
- **Disability-Friendly Designs:** Keyboards designed for people with disabilities can be compared to adaptive farming tools that assist farmers with specific physical challenges, making the work more accessible and manageable.

5. The Balance of Tradition and Innovation:

In agriculture, there’s a balance between traditional practices and innovative methods. Farmers might use a combination

of old and new techniques to achieve the best results. Similarly, the QWERTY keyboard, despite its historical design flaws, remains prevalent due to its established role in typing. Innovations like alternative keyboard layouts or specialized designs are continuously explored, but traditional methods often persist due to familiarity and widespread use.

In summary, the evolution of the keyboard and the quest for efficiency can be paralleled with the development of agricultural tools and techniques. Both fields see ongoing improvements and adaptations, yet also retain certain foundational elements due to their practicality and established use.

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1.2.2.6: Input Devices

Input devices

Data may enter an information system in a variety of different ways, and the input device that is most appropriate will usually depend on the type of data being entered into the system, how frequently this is done, and who is responsible for the activity. For example, it would be more efficient to scan a page of typed text into an information system rather than retyping it, but if this happens very seldom, and if typing staff are readily available, then the cost of the scanner might not be justified. However, all of the input devices described in this chapter have at least one thing in common: the ability to translate non-digital data types such as text, sound or graphics into digital (i.e. binary) format for processing by a computer.

Let's apply an agricultural perspective to the idea of data input devices in an information system:

1. Scanning vs. Typing:

In agriculture, different methods are used to collect and record data about crops, livestock, and farm operations. For instance, if you need to record detailed field observations, you might use a drone to capture aerial images instead of manually writing notes. Similarly, using a digital scanner to input typed text into a system can be likened to using a modern sensor to gather soil moisture data rather than relying solely on manual measurement.

2. Choosing the Right Tool:

Just as different farming tasks require specific tools—such as using a combine harvester for large-scale grain harvesting versus a hand trowel for planting small quantities of seedlings—the choice of data input device depends on the nature of the data and its frequency of use. For instance:

- **Frequent Data Collection:** If you frequently measure soil pH levels across multiple fields, you might use a portable digital pH meter to streamline the process, similar to how a regular input device like a keyboard or scanner is used frequently for data entry.
- **Infrequent Data Collection:** For less frequent tasks, such as taking periodic crop yield assessments, a more specialized device might be used, just as a high-end scanner might be justified for occasional but detailed document digitization.

3. Cost vs. Efficiency:

Just as investing in high-end agricultural equipment (like a GPS-guided tractor) makes sense for large-scale operations where efficiency gains justify the cost, the decision to invest in sophisticated data input devices (like high-speed scanners or voice recognition systems) depends on whether the efficiency improvements outweigh the costs. For smaller operations or infrequent tasks, simpler, more cost-effective solutions (like manual data entry or basic measuring tools) might be sufficient.

4. Translating Data into a Usable Format:

In agriculture, translating physical observations into useful data might involve converting visual observations of crop health into digital records, much like how input devices translate non-digital data (text, sound, graphics) into a digital format. For example:

- **Visual Data:** Just as drones or cameras capture visual information of crops, input devices like scanners convert physical documents into digital formats.
- **Sound Data:** Microphones recording animal sounds or machinery noise can be translated into data for analysis, analogous to how voice input devices capture and convert spoken information into text.

5. Role of Each Device:

Each agricultural tool or device serves a specific purpose, enhancing productivity and precision in its area of use. Similarly, each data input device—whether it's a keyboard, scanner, or microphone—has a role in translating different types of data into a digital format for processing. Just as farmers select tools based on their specific needs, choosing the right input device depends on the type and frequency of data collection, as well as the efficiency and cost considerations.

In summary, much like selecting the appropriate agricultural equipment based on the task at hand, choosing the right data input device involves evaluating the nature of the data, how often it needs to be collected, and the overall cost-effectiveness. Each device plays a role in converting real-world data into a digital format, just as different tools help in converting physical farm activities into productive outcomes.

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1.2.2.7: Output Devices

Output Devices

The final stage of information processing involves the use of output devices to transform computer-readable data back into an information format that can be processed by humans. As with input devices, when deciding on an output device you need to consider what sort of information is to be displayed, and who is intended to receive it.

One distinction that can be drawn between output devices is that of hardcopy versus softcopy devices. Hardcopy devices (printers) produce a tangible and permanent output whereas softcopy devices (display screens) present a temporary, fleeting image.

Display screens

The desk-based computer screen is the most popular output device. The standard monitor works on the same principle as the normal TV tube: a “ray” gun fires electrically charged particles onto a specially coated tube (hence the name Cathode-Ray Tube or CRT). Where the particles hit the coating, the “coating” is being “excited” and emits light. A strong magnetic field guides the particle stream to form the text or graphics on your familiar monitor.

CRTs vary substantially in size and resolution. Screen size is usually measured in inches diagonally across from corner to corner and varies from as little as 12 or 14 inches for standard PCs, to as much as 40+ inches for large demonstration and video-conferencing screens. The screen resolution depends on a number of technical factors.

A technology that has received much impetus from the fast-growing laptop and notebook market is the *liquid crystal display* (LCD). LCDs have matured quickly, increasing in resolution, contrast, and colour quality. Their main advantages are lower energy requirements and their thin, flat size. Although alternative technologies are already being explored in research laboratories, they currently dominate the “flat display” market.

Organic light-emitting diodes (OLED) can generate brighter and faster images than LED technology, and require thinner screens, but they have less stable colour characteristics, making them more suitable for cellular telephone displays than for computers.

Another screen-related technology is the *video projection unit*. Originally developed for the projection of video films, the current trend towards more portable LCD-based lightweight projectors is fuelled by the needs of computer-driven public presentations. Today’s units fit easily into a small suitcase and project a computer presentation in very much the same way a slide projector shows a slide presentation. They are rapidly replacing the flat transparent LCD panels that needed to be placed on top of an overhead projection unit. Though the LCD panels are more compact, weigh less and are much cheaper, their image is generally of much poorer quality and less bright.

Printers and plotters

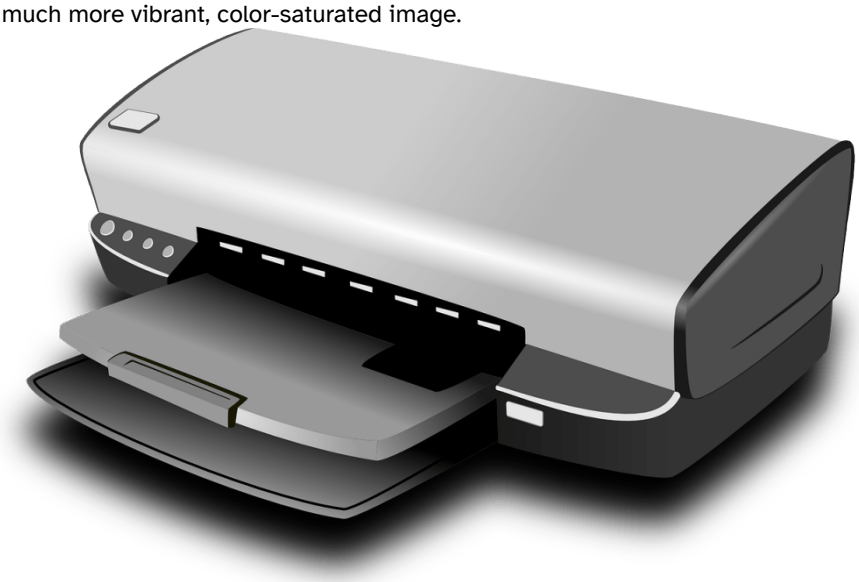
Printers are the most popular output device for producing permanent, paper-based computer output. Although they are all hardcopy devices, a distinction can be made between impact and non-impact printers. With impact printers, a hammer or needle physically hits an inked ribbon to leave an ink impression of the desired shape on the paper. The advantage of the impact printer is that it can produce more than one simultaneous copy by using carbon or chemically-coated paper. Non-impact printers, on the other hand, have far fewer mechanically moving parts and are therefore much quieter and tend to be more reliable.

The following are the main types of printers currently in use.

- *Dot-matrix printers* used to be the familiar low-cost printers connected to many personal computers. The print head consists of a vertical row of needles each of which is individually controlled by a magnet. As the print head moves

horizontally across the paper, the individual needles strike the paper (and ribbon in between) as directed by the control mechanism to produce text characters or graphics. A close inspection of a dot-matrix printout will reveal the constituent dots that make up the text. Although it is one of the cheapest printer options, its print quality is generally much lower that that of laser and ink-jet printers. However, today's models are quick and give a much better quality by increasing the number of needles.

- *Laser printers* are quickly growing in market share. They work on the same principle as the photocopier. A laser beam, toggled on and off very quickly, illuminates selected areas on a photo-sensitive drum, where the light is converted into electrical charge. As the drum rotates into a "bed" of carbon particles ("toner") with the opposite charge, these particles will adhere to the drum. The blank paper is then pressed against the drum so that the particles "rub off onto the paper sheet. The sheet then passes through a high-temperature area so that the carbon particles are permanently fused onto the paper. Current high-end laser printers can cope with extremely large printing volumes, as is required e.g. by banks to print their millions of monthly account statements. The laser technology continues to develop in tandem with photocopier technology. Laser printers can now handle colour printing, double-sided printing or combine with mail equipment to perforate, fold, address and seal automatically into envelopes. At the lower end of the scale are the low-cost "personal" laser printers, which give a very good printing quality at a relatively modest cost.
- *Thermal printers* use heat to print. The older thermal printers used heat-sensitive paper, similar to the special fax paper. A slight heat or pressure will leave a darker area. This produced very cheap but low-quality output. Currently, thermal-printing technology is used mainly for high-quality color printing. These new thermal printers use colored wax sticks and melt the wax onto the paper. Although they are slower than competing color laser and inkjet technologies, they give a much more vibrant, color-saturated image.



- *Inkjet printers* are probably the most popular low-cost printing technology. Liquid ink is squirted onto the paper in the form of tiny droplets. These printers are about the same price as dot-matrix printers, albeit more expensive in terms of consumables. Their quality is close to that of the laser printers. Their great advantage is that the printers can easily be adapted to use coloured ink, thus making popular color printers.
- *Plotters* are mainly used for engineering and architectural drawings. A plotter consists of one (or several – in the case of color plotters) pen(s) affixed to an arm. As the arm moves across the sheet of paper, the pen draws lines onto the paper. It is ideal for line drawings such as plans, especially in cases where the paper size exceeds that which can be accommodated by the other types of printers.
- *Chain and line printers* are still popular in mainframe environments for the quick production of large volumes of internal printing. The line printer consists of a horizontal, rotating "drum" with 132 cylinders, each containing a full character set. As the 132-column wide paper moves up past the drum, a line at a time, each one of the 132 hammers on the other side of the paper strikes at the exact moment that the corresponding cylinder "shows" the correct character. The hammer hits the drum (and ink ribbon) and leaves an imprint of the character on the paper. The chain printer works on the same principle, but uses a horizontally rotating chain with engraved characters, instead of a drum. As anyone with some working experience in a large organization knows, the print quality of these "computer printouts" is not very high.

Figure 4-4 compares the various output devices in terms of a number of characteristics.

Figure 4: Comparison of output devices

Device	Technology	Quality	Speed	Duplicates?	Graphics?	Fonts?	Colour?
CRT	softcopy	high	very fast	n/a	yes	yes	yes
LCD	softcopy	fair	very fast	n/a	yes	yes	yes
Plotter	hardcopy	fair	slow	no	yes	yes	yes
Chain/line printer	hardcopy	low	very fast	yes	no	no	no
Laser printer	hardcopy	high	fast/fair	no	yes	yes	yes
Dot-Matrix printer	hardcopy	fair	fast/fair	yes	yes	yes	some
Inkjet printer	hardcopy	good	fair	no	yes	yes	yes

Audio-output devices

A type of output that is becoming increasingly popular different types of audio output. is audio output. There are many different types of audio output.

- *Sound output* is required by most multimedia applications and sophisticated games. The sound card in many of today's personal computers synthesizes sound by drawing from a library of stored sounds, essentially using the same process as found in music keyboards. More advanced multimedia workstations are equipped for full stereo multi-channel surround sound and easily surpass many a modern hi-fi system in cabling and speaker complexity.
- *MIDI in/output*. Modern day music production would be impossible without a vast array of electronic instruments and keyboards. These are typically controlled by a personal computer by means of Musical Instrument Digital Interface (MIDI), a common standard for linking, controlling and processing electronic music.
- *Speech synthesis* is the production of speech-like output using an artificial voice. Although the lack of intonation still makes the voice sound artificial, the technology is reasonably mature and can be found anywhere from talking clocks and luxury cars to automated responses for telephonic directory enquiries.

Other Output Devices

Many other, extremely specialized input and output devices have been developed. Process control, for example, is a very specialized field but extremely important for automated factories (car manufacturing, canneries), continuous process environments (nuclear plants, refineries) or hazardous places (microbiological research laboratories, space exploration). For these applications, the computer relies on a multitude of sensors for its inputs: temperatures, speed, pressure, flow rates, weight, position, ... These sensor inputs are then processed by the computers, which in turn control directly robot arms and other mechanical devices such as cutters, welding equipment, valves, switches, mixers etc.

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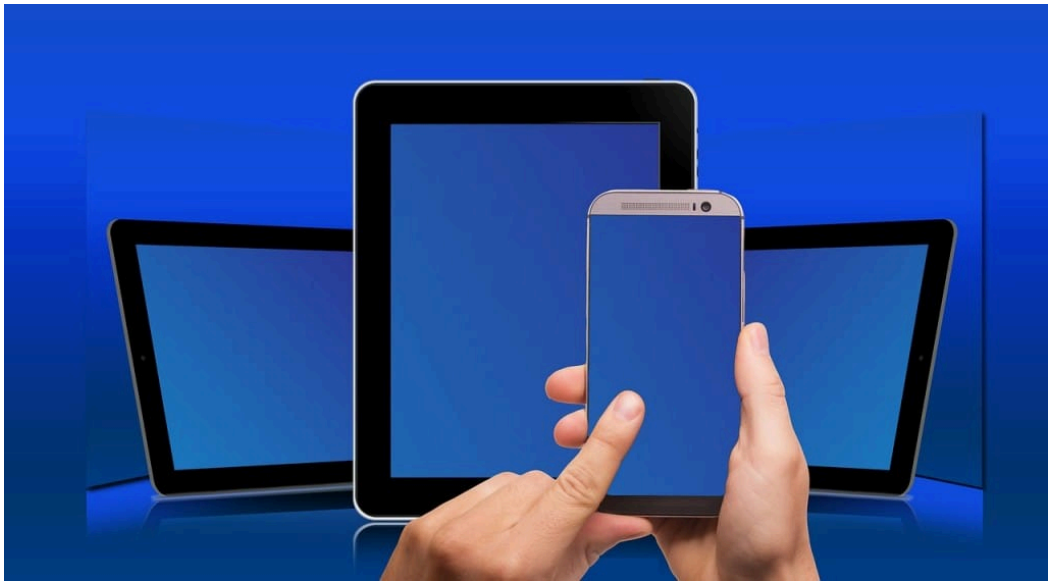
1.2.2.8: Pointing Devices

Pointing devices



The now ubiquitous electronic *mouse* is an essential input device for use with any graphical user interface. It consists of a plastic moulded housing, designed to fit snugly in the palm of the hand, with a small ball at its bottom. Moving the mouse across a flat surface will translate the movements into a rolling action of the ball. This is translated into electronic signals that direct the corresponding movement of a cursor on the computer monitor. Buttons on the mouse can then be used to select icons or menu items, or the cursor can be used to trace drawings on the screen.

The less popular *trackball* operates exactly like an “upside-down” mouse except that the ball is much larger and, instead of the mouse being moved over a surface, the user manipulates the ball directly. Since the trackball can be built into the side of the keyboard, it obviates the need for a free surface area and is therefore handy in situations where desktop surface area is at a premium or not available. Originally popular in educational laboratory settings and for laptop computers, trackballs are now mainly confined to exhibition displays and other public terminals.



Touch-screens are computer monitors that incorporate sensors on the screen panel itself or its sides. The user can indicate or select an area or location on the screen by pressing a finger onto the monitor. *Light and touch pens* work on a similar principle, except that a stylus is used, allowing for much finer control. Touch pens are more commonly used with handheld computers such as personal organizers or digital assistants. They have a pen-based interface whereby a stylus (a pen without ink) is used on the small touch-sensitive screen of the handheld computer, mainly by means of ticking off pre-defined options, although the fancier models support data entry either by means of a stylized alphabet, which resembles a type of shorthand, or some other more sophisticated handwriting recognition interface.

Digitizer tablets also use a pressure sensitive area with a stylus. This can be used to trace drawings. A similar conceptual approach is used for the touch pad that can be found on the majority of new notebook computers, replacing the more awkward joystick or trackball. The user controls the cursor by moving a finger across a fairly small rectangular touch-sensitive area below the keyboard, usually about 5 cm by 7 cm.

A large number of game interfaces have been developed to provide a more realistic and natural interface in various gaming situations and simulations: the joy stick, steering wheel, foot pedal and other gaming devices. They all perform functions similar to the mouse in that they allow the user to control a cursor or simulate generally real-time motion control. Contact your nearest game arcade for details.

Although the data glove also fits under the previous category, it is technically a lot more complex. It looks like a hand glove but contains a large number of sensors and has a data cable attached; though the latter is being replaced by means of infrared cordless data transmission. Not only does the data glove allow for full three-dimensional movement but it also senses the position of individual fingers, translating this into a grip. The glove is currently used in virtual reality simulators where the user moves around in an artificially rendered environment projected onto tiny LCD screens fitted into vision goggles. The computer generates various imaginary objects, which the user can “pick up” and manipulate by means of the glove. Advanced models even allow for tactile feedback by means of small pressure pockets built into the glove.

Let’s view these various input devices through the lens of agricultural tools and practices:

1. Electronic Mouse:

Think of the electronic mouse as a versatile hand tool in farming, akin to a trowel or a hand rake. Just as these tools are designed to fit comfortably in the farmer’s hand and help with precise tasks like planting seeds or weeding, the mouse fits in the palm and helps navigate and control a computer. The movement of the mouse across a surface translates to cursor movements on the screen, much like how a hand tool’s movements translate into changes in the soil or garden bed.

2. Trackball:

The trackball can be compared to specialized farming tools like a hand-cranked seed dispenser or a manual grain mill. Instead of moving the entire tool (or mouse) across a surface, you manipulate the ball directly, which is similar to how certain manual tools are operated. For farmers with limited space or specific needs—like working in tight garden beds or confined areas—the trackball’s design eliminates the need for a large working surface, much like how a compact, multi-functional tool is advantageous in small or challenging farming conditions.

3. Touch-Screens:

Touch-screens are akin to modern farming technology like automated irrigation systems or touchscreen-controlled tractors. Just as touch-screens allow farmers to interact directly with a display by touching it, these modern systems let farmers manage irrigation schedules or tractor functions with a touch interface. The fine control provided by touch pens or styluses can be compared to using precision tools for specific tasks, like adjusting settings on a greenhouse climate control system.

4. Digitizer Tablets:

Digitizer tablets are similar to advanced mapping tools used in agriculture, such as GPS-guided field planners. Just as these tablets let farmers trace and annotate maps for precision farming, digitizer tablets let users draw and create detailed designs. The touchpad on laptops, much like compact farm gadgets, provides a more convenient and integrated approach to controlling

functions without needing a lot of space.

5. Gaming Interfaces:

Gaming interfaces like joysticks, steering wheels, and foot pedals can be likened to simulation equipment used in agricultural training or virtual farm management systems. For example, a joystick might resemble a steering mechanism on a modern tractor simulator, allowing farmers to practice driving or maneuvering without being on an actual tractor. These interfaces help simulate real-time control and motion, much like how training tools simulate real-world farming tasks.

6. Data Glove:

The data glove can be viewed as an advanced, high-tech farming tool, akin to sophisticated machinery with integrated sensors. Just as a data glove uses sensors to detect and interpret movements, modern precision farming equipment uses sensors to monitor soil conditions, crop health, and machinery performance. The glove's ability to provide tactile feedback is similar to how advanced equipment offers real-time data and feedback to enhance the farming experience, allowing for more precise and interactive management of agricultural tasks.

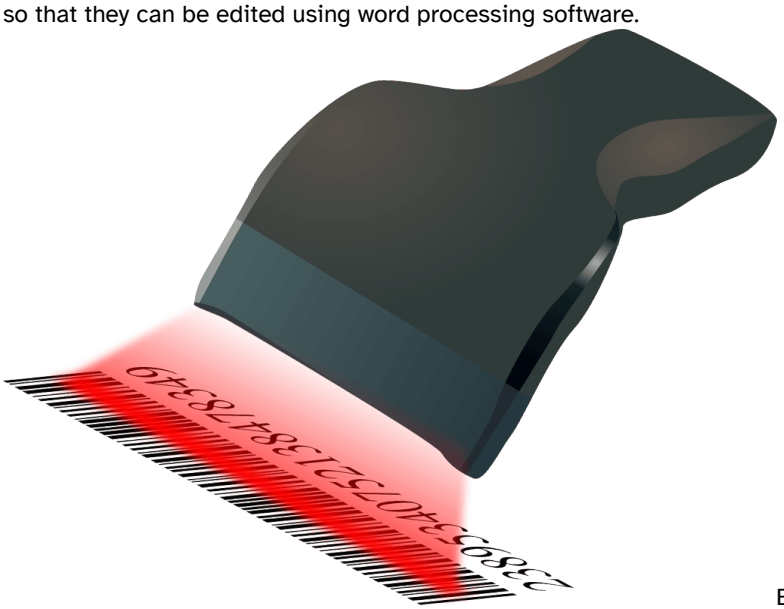
In summary, these input devices can be paralleled with agricultural tools and technologies in terms of their functionality and specialized uses. Just as farmers select tools based on the specific needs and conditions of their work, the choice of input device depends on the type of tasks and the level of control required. Each device, from the traditional mouse to advanced data gloves, offers different ways to interact with systems, similar to how various agricultural tools cater to different aspects of farming.

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1.2.2.9: Optical Scanners and Readers

Optical scanners and readers

There are a number of different optical scanner technologies on the market.

- Optical Scanners use light-emitting devices to illuminate the printing on paper. Depending on how much light is reflected, a light-sensor determines the position and darkness (or color) of the markings on the paper. Special-purpose optical scanners are in use by postal services to read and / interpret hand-written postal codes. General-purpose scanners are used with personal computers to scan in images or text. These vary from handheld devices (see picture) to flatbed scanners which feed input documents one sheet at a time. A common use of optical scanners is the scanning of black-and-white or color images and pictures. When scanning text, it is necessary to load additional optical character recognition (OCR) software that converts the scanned raster-image of the text into the equivalent character symbols, so that they can be edited using word processing software.
- 
Barcode scanners detect sequences of vertical lines of different widths, the ubiquitous barcode as found also on the back of this book. These scanners have become very popular with retailers due to the fact that all pre-packaged products are now required to have a product bar code on their packaging, following the standard laid down by the South African Article Numbering Association (SAANA). Libraries and video shops now also commonly use bar code scanners. They are more generally used for tracking and routing large numbers of physical items such as for asset inventory purposes in many larger organizations, postal items by the postal services and courier services, or for luggage handling by airlines.
- Optical mark readers are capable of reading dark marks on specially designed forms. The red multiple choice answer sheets in use at many educational and testing institutions are a good example.

- Let's apply an agricultural perspective to the various optical scanner technologies:

1. Optical Scanners:

General Optical Scanners: Think of general-purpose optical scanners as the versatile agricultural tools used for multiple tasks, like a multifunctional tractor. Just as a tractor can plow, plant, and harvest, general optical scanners can handle a variety of tasks, from scanning images to text. These scanners come in different forms:

  - **Handheld Scanners:** Similar to hand tools like a hand hoe or a pruning shear, handheld scanners are portable and used for smaller, more specific tasks—like scanning a single page or a small label.
  - **Flatbed Scanners:** These are akin to larger, more comprehensive farm equipment like a combine harvester. They handle larger documents or multiple pages at a time, much like how a combine harvester manages extensive

harvesting tasks efficiently.

2. Special-Purpose Optical Scanners:

Postal Code Readers: These are similar to specialized agricultural machinery designed for niche tasks. For example, just as a soil moisture sensor is used to monitor specific soil conditions, postal code readers are designed to interpret specific types of information (handwritten postal codes). They help streamline and automate processes, similar to how a precision farming tool enhances specific aspects of agricultural operations.

3. Barcode Scanners:

Retail and Inventory Management: Barcode scanners are like the efficient inventory systems used in large-scale farming operations. Just as a farmer might use a computerized system to track and manage crops, livestock, or equipment, barcode scanners are used to track products in retail, libraries, or warehouses. These scanners read barcodes—comparable to how a farmer might catalog produce with specific identifiers to keep track of inventory or streamline distribution.

4. Optical Mark Readers:

Mark Readers for Forms: Optical mark readers are similar to specialized agricultural tools used for particular data collection tasks, such as soil testing equipment that reads specific measurements from samples. Optical mark readers efficiently process multiple-choice answer sheets or other forms with marked selections, much like how specific agricultural tools quickly process certain types of data or conditions.

5. OCR Software Integration:

Text Recognition and Data Conversion: Optical Character Recognition (OCR) software, used to convert scanned text into editable format, can be compared to sophisticated farm management software that interprets data from various inputs (like weather stations or crop sensors). Just as OCR software makes text editable and usable, farm management systems turn raw data into actionable insights, helping farmers make informed decisions based on comprehensive data analysis.

6. Overall Technology Use:

In agriculture, as with optical scanners, the choice of technology is often based on the specific needs of the task at hand. Whether it's a general-purpose tool, a specialized piece of equipment, or a system designed to handle specific data inputs, each piece of technology serves to enhance efficiency and accuracy in its respective field.

In summary, optical scanner technologies, when viewed through an agricultural lens, can be seen as specialized and versatile tools that help streamline and improve various processes, much like the diverse equipment used in farming to handle different tasks efficiently.

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1.2.2.10: Components of the CPU

Components of the CPU

The CPU has two major components.

- The Arithmetic and Logic Unit (ALU) executes the actual instructions. It knows how to add or multiply numbers, compare data, or convert data into different internal formats.
- The Control Unit does the “housekeeping” i.e. ensures that the instructions are processed on time, in the proper sequence, and operate on the correct data.

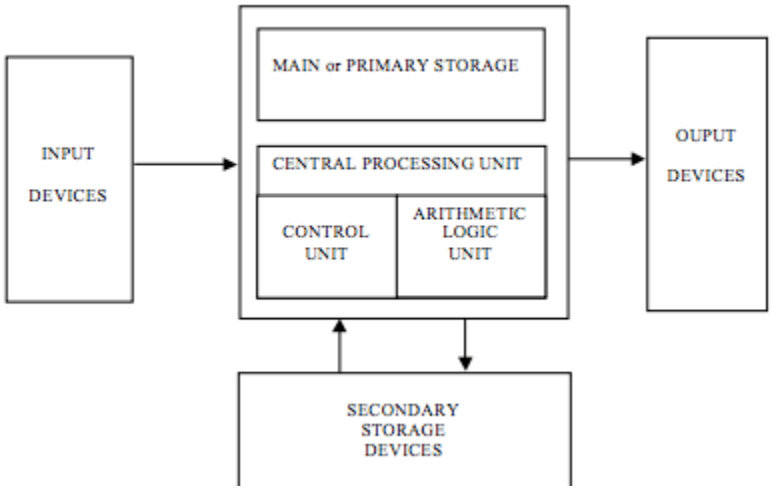


Figure 1: Detailed view of a computer system

Types of CPUs

The CPU is an electronic device based on microchip technology, hence it is also often called the microprocessor. It is truly the showcase and culmination of the state-of-the-art in the electronics industry: a tiny silicon-based chip occupying less than 1 square cm contains several millions of transistor elements, measuring less than a thousandth of a millimeter across. They operate at speeds way beyond our comprehension: a typical CPU can multiply more 7-digit numbers in one second than a human could do in ten lifetimes, but uses less energy than a light bulb!

Think of the motor car industry: there are different manufacturers or makes of cars (Volkswagen, Toyota, etc.), each with different models (Golf, Jetta, ...), which come out in different versions (City Golf, Sports model, coupe, etc.). In addition, there exist custom-made special-purpose cars. It is the same in the computer chip business. There are many different types of CPUs on the market. The best-known manufacturer is Intel, which produces the microprocessors for the IBM-compatible personal computer (PC). Some of its competitors produce clones or imitations (e.g. AMD), others manufacturers produce different types of microprocessors or concentrate on small volumes of highly specialized or very fast microprocessors. Intel has produced a large number of CPU types: the earliest model used in the Personal Computer was the 8088, followed by the 8086, the 80286, the 386, 486 and the line of Pentium processors.

Applying an agricultural lens to the concept of the CPU and its evolution can help make sense of its role and development in a familiar context. Here’s how we can relate the CPU to agricultural machinery and practices:

1. The CPU as a Modern Agricultural Engine:

Microchip Technology and the CPU: The CPU, as a microchip, can be likened to a modern, high-efficiency engine in agricultural machinery. Just as a powerful engine drives a combine harvester or a tractor, a CPU drives the computational power of a computer. It packs immense processing capability into a tiny chip, similar to how advanced engines provide exceptional performance while being compact and efficient. The precision and speed of a CPU, operating faster than a human can comprehend, are akin to the sophisticated engines in agricultural machinery that can perform complex tasks quickly and efficiently.

2. Varieties and Models in Agriculture:

Different Types of CPUs: Just as the automotive industry has various manufacturers and models of cars to meet different needs, the CPU industry offers a range of microprocessors designed for specific applications. In agriculture, different types of machinery are designed for different tasks:

- **Standard Tractors:** Like the mainstream CPUs used in general computing tasks, standard tractors handle a broad range of agricultural tasks.
- **Specialized Equipment:** Similar to specialized CPUs used in niche applications, specialized agricultural equipment—such as high-performance combine harvesters or precision planting machines—is designed for specific functions and high efficiency.

3. Evolution of Technology:

Evolution of CPUs: The evolution of CPUs from early models like the 8088 to advanced processors like the Pentium reflects technological progress, much like the evolution of agricultural machinery:

- **Early Models:** The earliest agricultural machinery, such as basic plows and early steam-powered engines, represented the starting point of agricultural technology.
- **Modern Models:** The latest CPUs, with multiple cores and advanced features, are akin to modern, highly specialized agricultural machines that offer enhanced performance and efficiency. Just as newer tractors and harvesters come with advanced features and capabilities, newer CPUs offer greater processing power and efficiency.

4. Custom and Specialized Models:

Custom CPUs and Agricultural Equipment: Just as there are custom-built CPUs for specialized tasks (e.g., high-speed computations, embedded systems), there are custom and specialized agricultural machines:

- **Custom CPUs:** These might be designed for specific industries or high-performance tasks, similar to how some agricultural machinery is customized for unique farming needs.
- **Specialized Equipment:** For example, precision-guided planters and drones for crop monitoring are highly specialized tools, just as there are CPUs designed for specific technical applications or high-speed processing.

5. Manufacturers and Market Variety:

Different CPU Manufacturers: In the same way that different car manufacturers produce a range of vehicles, the CPU market has various manufacturers with their own lines of microprocessors:

- **Major Brands:** Intel and AMD are like the major agricultural machinery brands such as John Deere and Case IH, known for their broad range of products and innovations.
- **Niche Players:** Smaller or specialized manufacturers, akin to niche agricultural equipment makers, focus on unique applications or high-performance requirements.

6. Efficiency and Power Consumption:

Efficiency in CPUs and Machinery: The efficiency of CPUs, using less energy than a light bulb while performing complex tasks, is comparable to modern agricultural machinery that achieves high productivity with optimized fuel or energy use. Just as contemporary farm equipment is designed to maximize output while minimizing resource consumption, advanced CPUs are engineered to deliver powerful performance with minimal energy use.

In Summary:

The CPU, with its advanced technology and efficiency, can be understood through agricultural analogies. It is like a high-performance engine in modern farm machinery—compact, powerful, and highly specialized. The range of CPUs available, from basic to highly specialized, mirrors the variety of agricultural equipment designed for different tasks and conditions. The evolution of CPUs reflects the ongoing advancements in technology, just as agricultural machinery has evolved to meet the growing demands of modern farming.

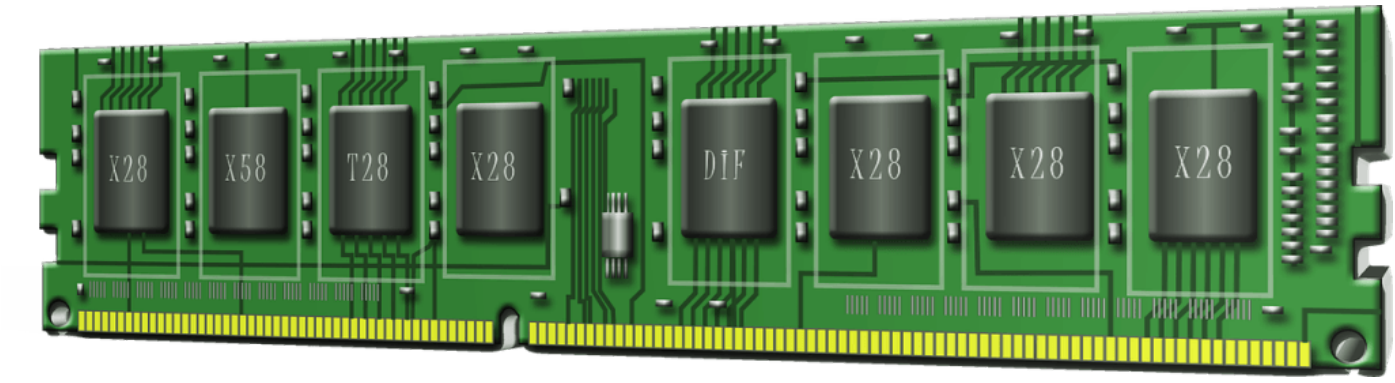
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1.2.2.11: Main Memory

Main Memory

The function of main memory (also referred to as primary memory, main storage or internal storage) is to provide temporary storage for instructions and data during the execution of a program. Main memory is usually known as RAM, which stands for Random Access Memory. Although microchip-based memory is virtually the only technology used by today's computers, there exist many different types of memory chips.

Random Access Memory (RAM)



RAM consists of standard circuit-inscribed silicon microchips that contain many millions of tiny transistors. Very much like the CPU chips, their technology follows to the so-called law of Moore, which states that they double in capacity or power (for the same price) every 18 months. A RAM chip easily holds hundreds of Megabytes (million characters). They are frequently pre-soldered in sets on tiny memory circuit boards called SIMMS (Single In-line Memory Modules) or DIMMS (Dual ...) which slot directly onto the motherboard: the main circuit board that holds the CPU and other essential electronic elements. The biggest disadvantage of RAM is that its contents are lost whenever the power is switched off.

There are many special types of RAM and new acronyms such as EDO RAM, VRAM etc. are being created almost on a monthly basis. Two important types of RAM are:

- Cache memory is ultra-fast memory that operates at the speed of the CPU. Access to normal RAM is usually slower than the actual operating speed of the CPU. To avoid slowing the CPU down, computers usually incorporate some more expensive, faster cache RAM that sits in between the CPU and RAM. This cache holds the data and programs that are needed immediately by the CPU. Although today's CPUs already incorporate an amount of cache on the circuit itself, this on-chip cache is usually supplemented by an additional, larger, cache on the motherboard.
- Flash RAM or flash memory consists of special RAM chips on a separate circuit board within a tiny casing. It fits into custom ports on many notebooks, hand-held computers and digital cameras. Unlike normal RAM, flash memory is non-volatile i.e. it holds it contents even without external power, so it is also useful as a secondary storage device.

Read-Only Memory (ROM)

A small but essential element of any computer, ROM also consists of electronic memory microchips but, unlike RAM, it does not lose its contents when the power is switched off. Its function is also very different from that of RAM. Since it is difficult or impossible to change the contents of ROM, it is typically used to hold program instructions that are unlikely to change during the

lifetime of the computer. The main application of ROM is to store the so-called boot program: the instructions that the computer must follow just after it has been switched on to perform a self-diagnosis and then tell it how to load the operating system from secondary storage. ROM chips are also found in many devices which contain programs that are unlikely to change over a significant period of time, such as telephone switch boards, video recorders or pocket calculators. Just like RAM, ROM comes in a number of different forms:

- PROM (Programmable Read-Only Memory) is initially empty and can be custom-programmed once only using special equipment. Loading or programming the contents of ROM is called burning the chip since it is the electronic equivalent of blowing tiny transistor fuses within the chip. Once programmed, ordinary PROMs cannot be modified afterwards.
- EPROM (Erasable Programmable Read-Only Memory) is like PROM but, by using special equipment such as an ultra-violet light gun, the memory contents can be erased so that the EPROM can be re-programmed.
- EEPROM (Electrically Erasable Programmable Read-Only Memory) is similar to EPROM but it can be re-programmed using special electronic pulses rather than ultraviolet light so no special equipment is required.

Secondary Storage Devices

Since the main memory of a computer has a limited capacity, it is necessary to retain data in secondary storage between different processing cycles. This is the medium used to store the program instructions as well as the data required for future processing. Most secondary storage devices in use today are based on magnetic or optical technologies.

Disk drives

The disk drive is the most popular secondary storage device, and is found in both mainframe and microcomputer environments. The central mechanism of the disk drive is a flat disk, coated with a magnetizable substance. As this disk rotates, information can be read from or written to it by means of a head. The head is fixed on an arm and can move across the radius of the disk. Each position of the arm corresponds to a “track” on the disk, which can be visualized as one concentric circle of magnetic data. The data on a track is read sequentially as the disk spins underneath the head. There are quite a few different types of disk drives.

In Winchester hard drives, the disk, access arm and read/write heads are combined in one single sealed module. This unit is not normally removable, though there are some models available where the unit as a whole can be swapped in and out of a specially designed drive bay. Since the drives are not handled physically, they are less likely to be contaminated by dust and therefore much more reliable. Mass production and technology advances have brought dramatic improvements in the storage capacity with Terabyte hard drives being state of the art at the end of 2006. Current disk storage costs as little Rl per gigabyte.

Large organizations such as banks, telcos and life insurance companies, require huge amounts of storage space, often in the order of many terabytes (one terabyte is one million megabytes or a trillion characters). This was typically provided by a roomful of large, high-capacity hard drive units. Currently, they are being replaced increasingly by redundant arrays of independent disks (RAIDs). A RAID consists of an independently powered cabinet that contains a number (10 to 100) of microcomputer Winchester-type drives but functions as one single secondary storage unit. The advantage of the RAID is its high-speed access and relatively low cost. In addition, a RAID provides extra data security by means of its fault-tolerant design whereby critical data is mirrored (stored twice on different drives) thus providing physical data redundancy. Should a mirrored drive fail, the other drive steps in automatically as a backup.



A low-cost, low-capacity version of the hard disk was popularized by the microcomputer. The diskette consists of a flexible, magnetic ti^J surface coated mylar disk inside a thin, non-removable, plastic sleeve. The early versions of the diskette were fairly large (8″ or 5W) and had a flexible sleeve, hence the name floppy diskette. These have rapidly been replaced by a diskette version in a sturdier sleeve, the stiffy disk, that despite its smaller size (3 W') can hold more data. Although the popular IBM format only holds 1,44 megabytes, a number of manufacturers have developed diskette drives that can store from 100 to 250 megabytes per stiffy. An alternative development is the removable disk cartridge, which is similar in structure to an internal hard drive but provides portability, making it useful for backup purposes.

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1.2.2.12: Other Input Devices

Other input devices

A magnetic card reader reads the magnetized stripe on the back of plastic credit-card size cards. These cards need to be pre-recorded following certain standards. Although the cards can hold only a tiny amount of information, they are very popular for access (door) control and financial transactions (ATMs and point-of-sale terminals).

Magnetic ink character recognition (MICR) uses a special ink (containing magnetizable elements) and a distinct font type. It is used mainly in the banking sector for the processing of cheques.

Touch-tone devices can use a voice telephone to contact computer-based switchboards or enter information directly into remote computers. Many corporate telephone help-lines rely on the customer pressing the touch-tone telephone buttons to route his/her call to the correct operator by selecting through a menu of possible options. South African banks also enable their clients to perform a number of banking transactions via telephone.

Digital cameras allow you to make pictures of physical objects directly in a digital, i.e. computer-readable, format. Relatively low-cost digital still picture cameras are now available that capture images directly on electronic disk or RAM media instead of the traditional film. Apart from being very compact, most of these digital cameras can also interface directly with personal computers and are thus becoming a popular tool to capture pictures for e-mailing or loading on the world-wide Web.

Biometric devices are used to verify personal identity based on fingerprints, iris or retinal scanning, hand geometry, facial characteristics etc. A scanning device is used to capture key measurements and compare them against a database of previously stored information. This type of authentication is becoming increasingly important in the control of physical access.

Finally, voice input devices are coming of age. Voice-recognition has recently made a strong entry into the market with the availability of low-cost systems that work surprisingly well with today's personal computers. These systems allow for voice control of most standard applications (including the operating system). With voice control, the computer recognizes a very limited number (50 or less) of frequently used, programmable system commands ("save", "exit", "print"...) from a variety of users. In fact, these systems are not only used for the interface of computer programs; they are also slowly making an appearance in consumer appliances, novelty items and even motor cars!

Much more difficult to achieve than voice control, is true voice dictation used to dictate e.g. a letter to your word processor. The difficulty is that the computer must not only distinguish between many tens of thousands of possible words, but it must also recognize the almost unnoticeable breaks in between words, different accents and intonations. Therefore, voice dictation typically requires a user to train the voice recognition software by reading standard texts aloud. Nevertheless, for personal purposes and slow typists, voice recognition is rapidly becoming a viable alternative to the keyboard.

Applying an agricultural lens to these various input and identification technologies can help illustrate their practical uses and innovations in farming and agriculture:

1. Magnetic Card Readers:

Magnetic Card Readers in Agriculture: Imagine magnetic card readers as specialized equipment used to manage access to secure areas on a farm, such as barns, greenhouses, or equipment storage. Just as magnetic card readers help control access or financial transactions, similar technology might be used to regulate entry to different sections of a farm or to track equipment usage and employee access. For example, a magnetic card system could be used for access control to a high-tech greenhouse or to secure gates for different sections of a large farm.

2. Magnetic Ink Character Recognition (MICR):

MICR in Agriculture: MICR technology is used in banking to read checks, and it can be likened to specialized labeling systems in agriculture. For instance, MICR-like technology could be used to process and sort agricultural products based on coded labels or tags. Imagine a system that reads coded labels on bags of seed or livestock identification tags, helping with inventory

management and traceability, ensuring that each product can be tracked throughout the supply chain.

3. Touch-Tone Devices:

Touch-Tone Devices in Agriculture: Touch-tone devices are used for routing calls and entering information. In farming, similar technology could be used for managing automated irrigation systems or farm management systems. For example, a touch-tone system could allow farmers to interact with a remote irrigation controller, entering commands to adjust watering schedules or access information about soil moisture levels from a remote location.

4. Digital Cameras:

Digital Cameras in Agriculture: Digital cameras are like advanced tools for documenting and analyzing crops, livestock, or farm conditions. Farmers can use digital cameras to capture high-resolution images of plant health, livestock conditions, or machinery performance. These images can be used for monitoring crop growth, diagnosing plant diseases, or documenting field conditions for reports or insurance claims. With direct computer interfacing, digital cameras simplify the process of analyzing and sharing agricultural data.

5. Biometric Devices:

Biometric Devices in Agriculture: Biometric devices can be seen as the advanced security measures on a farm. Similar to how biometric systems verify identity using fingerprints or facial recognition, farms could use biometric technology to ensure secure access to valuable equipment, control entry to sensitive areas, or track the identities of farm workers. For example, biometric systems could manage access to high-tech greenhouses or sensitive livestock facilities, enhancing security and operational efficiency.

6. Voice Input Devices:

Voice Input Devices in Agriculture: Voice input devices can be likened to modern farm management tools that use voice commands for control and automation. Imagine a farmer using voice commands to operate irrigation systems, control machinery, or input data into a farm management system. Just as voice input devices are becoming more common in personal computing and consumer appliances, they could enhance hands-free operations on the farm, allowing for more efficient multitasking and data entry.

Voice Dictation in Agriculture: Voice dictation can be compared to voice-controlled field notes or automated reporting systems. Farmers could use voice dictation to record observations, update crop management records, or create reports without having to type manually. This would be particularly useful in situations where hands-free operation is beneficial, such as while inspecting fields or handling livestock.

In Summary:

In agriculture, each technology provides a way to enhance efficiency and accuracy, much like how specialized farming tools and equipment serve different needs on the farm. Magnetic card readers and MICR could streamline access and inventory management, touch-tone devices could simplify remote control of systems, digital cameras aid in documentation and analysis, biometric devices enhance security, and voice input and dictation technologies facilitate easier data entry and control. Each of these technologies, like modern agricultural tools, helps optimize farm operations and improve overall productivity.

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1.2.2.13: Speed of Processing

Speed of processing

How does one measure the speed of, say a Porsche 911? One could measure the time that it takes to drive a given distance e.g. the 900 km from Cape Town to Bloemfontein takes 4'/2 hours (ignoring speed limits and traffic jams). Alternatively, one can indicate how far it can be driven in one standard time unit e.g. the car moves at a cruising speed of 200 km/hour.

In the same way, one can measure the speed of the CPU by checking the time it takes to process one single instruction. As indicated above, the typical CPU is very fast and an instruction can be done in about two billionths of a second. To deal with these small fractions of time, scientists have devised smaller units: a millisecond (a thousandth of a second), a microsecond (a millionth), a nanosecond (a billionth) and a picosecond (a trillionth).

However, instead of indicating the time it takes to execute a single instruction, the processing speed is usually indicated by how many instructions (or computations) a CPU can execute in a second. This is exactly the inverse of the previous measure; e.g. if the average instruction takes two billionths of a second (2 nanoseconds) then the CPU can execute 500 million instructions per second (or one divided by 2 billionths). The CPU is then said to operate at 500 MIPS or 500 million of instructions per second. In the world of personal computers, one commonly refers to the rate at which the CPU can process the simplest instruction (i.e. the clock rate). The CPU is then rated at 500 MHz (megahertz) where mega indicates million and Hertz means "times or cycles per second". For powerful computers, such as workstations, mainframes and supercomputers, a more complex instruction is used as the basis for speed measurements, namely the so-called floating-point operation. Their speed is therefore measured in megaflops (million of floating-point operations per second) or, in the case of very fast computers, teraflops (billions of flops).

In practice, the speed of a processor is dictated by four different elements: the "clock speed", which indicates how many simple instructions can be executed per second; the word length, which is the number of bits that can be processed by the CPU at any one time (64 for a Pentium IV chip); the bus width, which determines the number of bits that can be moved simultaneously in or out of the CPU; and then the physical design of the chip, in terms of the layout of its individual transistors. The latest Pentium processor has a clock speed of about 4 GHz and contains well over 100 million transistors. Compare this with the clock speed of 5 MHz achieved by the 8088 processor with 29 000 transistors!

Moore's Law (see Figure 2) states that processing power doubles for the same cost approximately every 18 months.

Here's how the various aspects of CPU performance can be understood through agricultural analogies:

1. Measuring Speed: The Tractor Analogy

Measuring Speed:

- **Porsche 911 Example:** Just as you can measure a car's speed by tracking how long it takes to cover a certain distance (e.g., 900 km in 4.5 hours) or by its cruising speed (e.g., 200 km/hour), you can measure a CPU's speed by the time it takes to process a single instruction or by how many instructions it can handle in a second.

Agricultural Analogy:

- **Tractor Speed:** Imagine you're measuring the speed of a tractor in a field. You could measure how long it takes for the tractor to plow a certain length of a field, or you could measure its operating speed in terms of how many hectares it can plow per hour. Similarly, you can measure a CPU's speed by how many instructions it can process in a given time (like hectares per hour for a tractor) or by the time it takes to execute a single instruction.

2. Measuring Units: Efficiency in Farming

Units of Time:

- **CPU Time Measurement:** For CPUs, measurements are in milliseconds, microseconds, nanoseconds, or even picoseconds. The faster the CPU, the smaller the time unit it operates in.

Agricultural Analogy:

- **Harvesting Efficiency:** In farming, you might measure how long it takes to harvest a single row of crops or how many rows a harvester can process in a given time. Just as with CPUs, smaller time units (e.g., minutes versus hours) can show greater efficiency. A harvester that can process more rows per hour (smaller time unit) is more efficient, similar to a CPU that operates in nanoseconds being faster than one in microseconds.

3. Processing Speed: Output and Capacity

Processing Speed:

- **CPU Speed Measurement:** CPU speed is often described by how many instructions it can execute per second (e.g., 500 million instructions per second or MIPS) or by the clock rate (e.g., 500 MHz).

Agricultural Analogy:

- **Production Capacity:** Think of a combine harvester's capacity to process grain. You can measure its efficiency by how many bushels of grain it can process per hour (akin to instructions per second) or by its operational speed (similar to MHz for a CPU). For example, a combine that processes 500 bushels per hour is analogous to a CPU that performs 500 MIPS.

4. Key Performance Factors:

Performance Factors:

- **Clock Speed, Word Length, Bus Width:** CPU performance is influenced by these factors—clock speed (cycles per second), word length (bits processed at once), and bus width (data moved at once).

Agricultural Analogy:

- **Tractor Specifications:** Consider a tractor's performance factors:
  - **Engine Power (Clock Speed):** The engine power determines how fast the tractor can operate, similar to a CPU's clock speed.
  - **Width of the Plow (Word Length):** A wider plow can cover more ground in one pass, similar to a CPU's word length which affects how much data can be processed at once.
  - **Attachment Size (Bus Width):** Larger or more attachments allow the tractor to move more material in a single pass, like the bus width affecting data movement.

5. Technological Advancement:

Technological Progress:

- **Moore's Law:** Moore's Law states that processing power doubles approximately every 18 months, reflecting rapid advancements in technology.

Agricultural Analogy:

- **Improvements in Machinery:** Just as Moore's Law describes the exponential growth in CPU power, the agricultural industry sees similar advancements with improvements in machinery. For example, the efficiency and capabilities of harvesters, tractors, and irrigation systems have grown rapidly over the years, making farming more productive and efficient.

6. Historical Comparison:

Historical Comparison:

- **Old vs. New CPUs:** Comparing early CPUs (like the 8088) to modern processors (like the latest Pentium), you see significant improvements in speed and complexity.

Agricultural Analogy:

- **Old vs. New Machinery:** Comparing early farming equipment (such as a basic hand plow) to modern machinery (like advanced combines and tractors), you can see similar leaps in efficiency and capability.

In Summary:

Just as measuring the speed and efficiency of agricultural equipment involves tracking how much work it can do in a given time or how quickly it performs tasks, measuring CPU speed involves similar metrics: how many instructions it can process in a second and how quickly it can execute tasks. The evolution of CPUs and agricultural machinery reflects advancements in technology and efficiency, making both sectors more productive and effective over time.

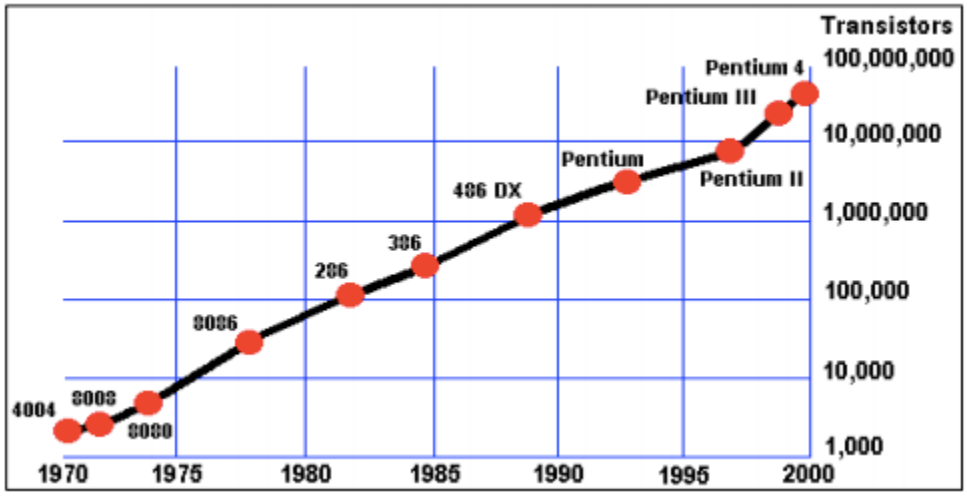


Figure 2. Illustration of Moore's Law

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1.2.2.14: Video- Basic PC Parts

Definition: Basic PC Parts

Basic PC parts refer to the essential components that make up a personal computer, including the central processing unit (CPU), motherboard, memory (RAM), storage devices (such as hard drives or SSDs), power supply, and input/output devices like the keyboard, mouse, and monitor. Each of these parts plays a crucial role in the computer's overall functionality.

In the context of agriculture, these basic PC parts are the backbone of the technology that powers modern farming operations. For example, the CPU processes data from sensors placed in fields to monitor soil moisture, while storage devices keep track of important farm management records and crop data. The reliability and performance of these components directly impact the efficiency of tasks such as precision farming, livestock monitoring, and managing agricultural business operations.

Watch this video to learn about the basic parts of a PC by clicking the following link:

https://youtu.be/yYA5DP_zPu0?si=qaxfgGt5Nn-TcabU



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- Basic Personal Computer (PC) Tutorial - To Know PC Componets System Parts (Complete Chapter). **Authored by**: papercoinagevideo. **Located at**: https://www.youtube.com/watch?v=yYA5DP_zPu0&feature=youtu.be. **License**: *Other*. **License Terms**: Standard YouTube License

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1.2.2.15: Video- Binary for Beginners

Definition: Binary

Binary, in computer concepts, refers to the basic language of computers, consisting of only two digits: 0 and 1. These digits, known as bits, are used in combinations to represent and process all types of data within a computer system. Everything from simple calculations to complex algorithms is broken down into binary code that the computer can understand and execute.

In agriculture, binary is the foundation of the digital systems that drive modern farming technologies. For instance, binary code enables the processing of data collected by sensors in the field, such as soil moisture levels or temperature readings. This data, once processed, can help farmers make informed decisions about irrigation, planting schedules, and crop management, ultimately leading to more efficient and sustainable farming practices.

Watch this video to learn how to convert traditional numbers and letters into binary code by clicking the following link:

https://youtu.be/huI5N02AHKM?si=QzVrjFC7aZM6FjcW

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- Converting Numbers into Binary for Beginners & Some fun with ASCII. **Authored by**: EFTanker. **Located at**: https://youtu.be/huI5N02AHKM. **License**: *Other*. **License Terms**: Standard YouTube License

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1.2.2.16: Video- Computer Interfaces and Ports

> Watch this video to learn about common ports and connectors on a PC.
>
> https://youtu.be/BjpZoFsR2h8?si=K8-qyTGip91LV50o

Watch this video to learn about common ports and connectors on a PC.



Definition: Computer Interfaces & Ports

Computer interfaces and ports are the connection points on a computer that allow it to communicate with external devices. Interfaces refer to the standards or protocols used to manage these connections, while ports are the physical sockets on the computer where devices such as keyboards, mice, printers, and USB drives are plugged in. Common types of ports include USB, HDMI, Ethernet, and audio jacks, each serving a specific function, whether it's transferring data, connecting to displays, or accessing networks.

Agriculture Lens: In agriculture, computer interfaces and ports are vital for integrating various technologies into farming operations. For example, USB ports might be used to connect data loggers that collect environmental data, while Ethernet ports provide stable connections to networks for real-time monitoring of irrigation systems or weather conditions. These interfaces ensure that different tools and devices can work together seamlessly, enabling farmers to efficiently manage equipment, analyze data, and implement precision agriculture techniques that enhance productivity and sustainability.

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- CompTIA A+ 220-601: 1.1 - Common Computer Connectors. **Authored by**: Professor Messer. **Located at**: https://www.youtube.com/watch?v=BjpZoFsR2h8&feature=youtu.be. **License**: *Other*. **License Terms**: Standard YouTube License

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1.2.2.17: Video- An Overview of Storage Devices

Definition: Storage Devices

Storage devices are essential components of a computer system used to save, retrieve, and manage data. They come in various forms, including hard drives, solid-state drives (SSDs), USB flash drives, and optical discs like CDs and DVDs. Storage devices can be categorized into two types: primary storage (like RAM, which is temporary) and secondary storage (like hard drives, which are permanent). These devices store everything from the operating system and applications to documents, photos, and other types of data.

Agriculture Lens: In agriculture, storage devices are crucial for managing the vast amounts of data generated by modern farming operations. For example, data collected from drones surveying crop health, sensors monitoring soil conditions, and records of past crop yields all need to be stored securely for analysis and future planning. Reliable storage devices ensure that this critical information is readily accessible, helping farmers make data-driven decisions that improve efficiency, sustainability, and productivity in their agricultural practices.

Watch this video for an overview of the different types of computer storage devices by clicking the following link.

https://youtu.be/FcAjsCIhCOg?si=5t76xxe4uhodPHLr

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1.2.3: Reading- Operating Systems

Introduction

As we dive into the world of operating systems, let's consider how this fundamental software impacts not just our personal computers, but also the rapidly evolving world of agriculture. In today's high-tech farms, operating systems are the unseen orchestrators that allow all the digital tools and devices to work seamlessly together. Whether it's managing the software that controls irrigation systems, running the analytics that predict crop yields, or even handling the communication between drones and ground sensors, the operating system is at the heart of it all.

Imagine a modern farm where multiple applications run simultaneously: a weather forecasting tool is predicting the best planting times, a soil management system is monitoring moisture levels, and a business management app is tracking sales and inventory. The operating system ensures that all these applications can operate smoothly, share resources, and provide the farmer with the information needed to make timely decisions. Just like on your own computer, where you might be streaming music while typing a paper and downloading a file, the operating system on a farm's computer or network is multitasking to keep everything running efficiently.

In this section, we'll explore the various roles an operating system plays, from multitasking and managing memory to handling the peripherals and communications that are so vital in both business and agriculture. Understanding these concepts will give you a better grasp of how technology is driving the future of farming, making it more efficient, sustainable, and data-driven. Ready to see how the software behind the scenes powers the farms of tomorrow? Let's get started!



The PC of a business end-user will quite commonly provide a number of different application programs, but no program development tools. It is also possible (although unlikely) that the PC of a programmer could provide development tools only, and no other commercial applications. But the one thing that all these machines would definitely have is an operating system (OS). The operating system is an essential piece of software that resides on virtually every computer. It allows the computer to run a number of different applications apparently simultaneously, and shares resources such as printers between a number of different users, while at the same time performing those functions that are critical to the correct operating of the computer system, regardless of which application is running.

Different types of computers may require different operating systems. Most mainframe computers have a proprietary operating system, such as IBM's MVS or Siemen's BS2000. At the opposite end of the market, we find that the leading operating system for the IBM compatible Personal Computers is Microsoft Windows (having all but replaced its predecessor MS-DOS) although Mac-OS and Unix variants such as Linux also have strong followings.

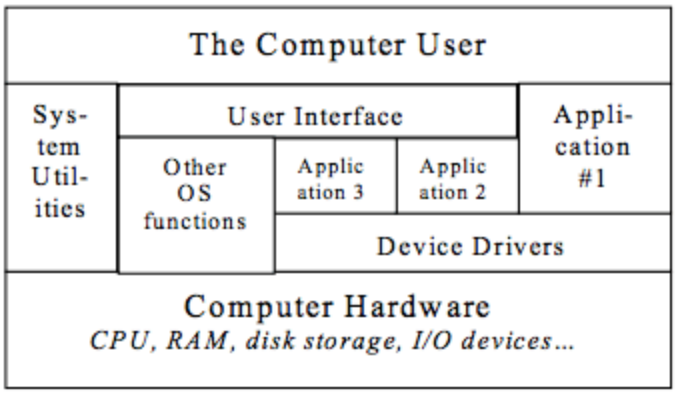


Figure 5-4: Some operating system components

Today's operating systems are true marvels of engineering and rate among the most complex artifacts designed by humans. Their complexity stems from the increasing number of functions that an operating system is required to handle.

Multitasking

Today's computers handle many applications at the same time: you could be downloading a file from the Internet at the same time as you update a spreadsheet that is embedded within a word-processing document (while at the same time your virus scanner is running in the background). Each application needs to share the CPU, main memory and all peripheral devices. The OS sees to it that all conflicts are resolved and each application gets a fair share of the common resources, often in accordance with a certain priority schedule. An important task, therefore, is that of the proper scheduling of different tasks. The OS also ensures that illbehaving applications do not impact on the integrity of the other applications and their data. (By the way, when a single application program runs multiple tasks simultaneously, this is known as multithreading.)

Multi-user management

Barring the personal computer, computers have more than a single user at any one time – a typical mainframe may have to handle many thousands of simultaneous users. Each of the users may operate a different application (see multitasking) but will not be prepared to wait for other users to finish their tasks. So the OS sees to it that each user gets a fair share of the CPU of the mainframe, by slicing each second in tiny fractions and allocating them to the different users. In addition, each user may have a different profile in terms of access to certain peripheral devices and data. This requires sophisticated security and data management.

Memory management

Apart from the CPU, primary memory is often the most expensive and scarcest component of a computer system. Efficient memory management is a key component of any OS, especially in multitasking and multi-user environment. The likelihood that there is sufficient memory to load all the data and software for all users simultaneously is extremely small. In practice, a technique of virtual memory is used whereby the available amount of main memory is extended by using secondary storage devices, usually the hard disk. During a typical program execution, not all program instructions and data are required at once. The OS will swap out all unused software and data segments onto disk, until they are actually required.

Secondary storage management

All applications require disk storage – if only to store the application software itself. The OS provides the common access routines to the secondary disk storage devices. It will keep track of data and program file names, physical locations and perform common functions such as the copying, erasing or backing up of data. It also makes the differences in physical hardware as transparent as possible: a data file will appear the same to an application whether the data is being loaded from a diskette, a hard disk or an optical CD-ROM.

Peripheral handler

Apart from managing the memory and secondary storage devices, the OS is usually also responsible for the handling of other peripheral devices. Again, a major objective is to relieve the application from the responsibility of having to cater for a multitude of different possible input and output devices. Thanks to the OS, a program (developer) does not need to cater for the differences between a trackball, mouse or other pointing device. The OS will also ensure that your document will be printed correctly, regardless of whether you have a colour inkjet, a laser or lowly dot-matrix printer attached. Equally, individual programs no longer have to worry about the resolution or capability of your computer monitor. The critical element is again that the applications do not have to worry about the actual hardware connected to the computer system. This is usually achieved by means of device drivers, small software routines that become part of the operating system and help it to interface correctly with specific hardware devices. The device drivers for popular or standard devices are usually already included in the operating system. More esoteric or very new hardware devices will come with a separate disk containing the proper device drivers. These then have to be installed as part of the operating system at the same time as connecting the hardware.

Communications Management

Communications software allows a computer to recognise the presence of other machines on a network, and to grant or restrict access to local files. It also manages network traffic, by monitoring communications lines and diagnosing problems, as well as sending and receiving data to and from remote devices. While PC operating systems include some basic networking and communications facilities, network operating systems (NOS) such as Novell and Unix provide sophisticated management tools for large networks.

User interface

Until the late 1980s, operating systems focussed on the efficient management of resources, tasks and secondary storage. The popularity of personal computers meant that a whole class of less-technical end-users entered the world of computing. This pressured the IT industry into developing a user-friendlier graphical user-interface and the user interface is quickly becoming a significant part of microcomputer operating systems. Different types of user interface have already been discussed earlier in this chapter.

System Utilities

As a logical extension of the operating system, additional system utilities are often required to assist with the proper and optimal use of the computer. Some system utilities may be provided along with the operating system, while others are marketed by

independent third-party vendors. A number of system utilities focuses on improving the functionality of the operating system (e.g. better hard disk management) while others provide additional functions (e.g. anti-virus or encryption software). More examples of system utilities are editors, additional security utilities, performance monitors, file viewers, data compression software etc.

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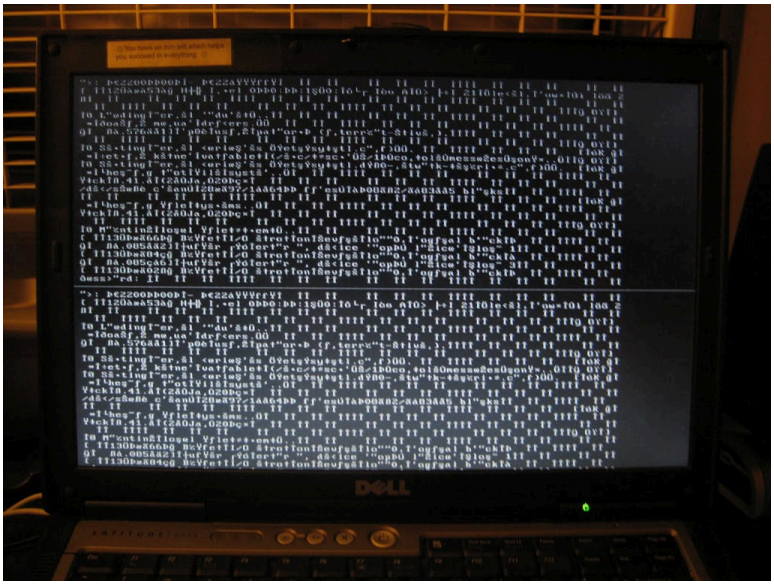
1.2.3.1: Reading- Booting

Introduction

Before we dive into the intricacies of booting, let's consider why this process is crucial, especially in the context of agriculture. Booting is the initial process that brings a computerized system to life, allowing it to perform all the tasks it's designed for. In modern agriculture, particularly in regions like California's Central Valley, the efficiency and reliability of this process can make a significant difference in daily operations.

Imagine a farm in the Central Valley that relies on automated irrigation systems, weather monitoring tools, and data analytics to optimize crop yields. Each morning, these systems must boot up and be ready to gather data, analyze conditions, and control machinery. A delay or failure in the booting process could mean missed opportunities to water crops at the optimal time, potentially impacting the entire day's operations. For example, if a system that controls irrigation fails to boot properly, it might not deliver the precise amount of water needed, leading to either overwatering or under-watering, both of which can affect crop health and yield.

Understanding the booting process is not just about knowing how computers start; it's about ensuring that the technology you depend on—whether it's for running a business or managing a farm—operates smoothly from the moment you power it on. In the context of agriculture, this knowledge is crucial for maintaining the reliability of the systems that are essential to modern farming practices. So, let's get into the details of how booting works and why it's a foundational aspect of any computerized system.



In computing, **booting** (or **booting up**) is the initialization of a computerized system. The system can be a computer or a computer appliance. The booting process can be "hard", after electrical power to the CPU is switched from off to on (in order to diagnose particular hardware errors), or "soft", when thosepower-on self-tests (POST) can be avoided. Soft booting can be initiated by hardware such as a button press, or by software command. Booting is complete when the normal, operative, runtime environment is attained.

A **boot loader** is a computer program that loads an operating system or some other system software for the computer after completion of the power-on self-tests; it is the loader for the operating system itself, which has its own loader for loading ordinary user programs and libraries. Within the hard reboot process, it runs after completion of the self-tests, then loads and runs the software. A boot loader is loaded into main memory from persistent memory, such as a hard disk drive or, in some older computers, from a medium such as punched cards, punched tape, or magnetic tape. The boot loader then loads and executes the processes that finalize the boot. Like POST processes, the boot loader code comes from a "hard-wired" and persistent location; if that location is too limited for some reason, that primary boot loader calls a second-stage boot loader or a secondary program loader.

On modern general purpose computers, the boot up process can take tens of seconds, and typically involves performing a power-on self-test, locating and initializing peripheral devices, and then finding, loading and starting an operating system. The process of hibernating or sleeping does not involve booting. Minimally, some embedded systems do not require a noticeable boot sequence to begin functioning and when turned on may simply run operational programs that are stored in ROM. All computing systems are state machines, and a reboot may be the only method to return to a designated zero-state from an unintended, locked state.

Boot is short for *bootstrap* or *bootstrap load* and derives from the phrase *to pull oneself up by one's bootstraps*. The usage calls attention to the requirement that, if most software is loaded onto a computer by other software already running on the computer, some mechanism must exist to load the initial software onto the computer. Early computers used a variety of ad-hoc methods to get a small program into memory to solve this problem. The invention ofread-only memory (ROM) of various types solved this paradox by allowing computers to be shipped with a start up program that could not be erased. Growth in the capacity of ROM has allowed ever more elaborate start up procedures to be implemented.

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1.2.3.2: Reading- Utility Software

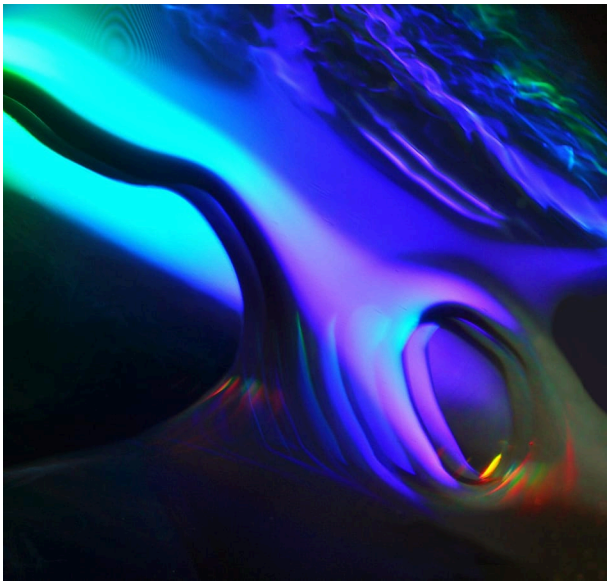
Introduction

Utility software might sound like something only IT professionals need to worry about, but in the world of modern agriculture, it's actually a crucial tool that can keep your farm running smoothly. Whether you're managing a small family farm or a large-scale agricultural operation, utility software helps ensure that your technology is performing at its best, which directly impacts everything from crop management to business operations.

Imagine you're a farmer in the Central Valley, using advanced irrigation systems to optimize water use and increase crop yields. These systems rely on a variety of software and hardware working together seamlessly. Utility software plays a vital role here—it keeps your computer systems running efficiently, prevents potential issues before they disrupt your work, and ensures that your data is secure and backed up. For example, disk checkers and defragmenters can help maintain the performance of the computers that control your irrigation systems, ensuring they run smoothly without delays or failures.

Another key area is data synchronization. In agriculture, you might be collecting data from various sources—weather stations, soil sensors, and market prices—all of which need to be consistent and up-to-date across your devices. Utility software that handles data synchronization ensures that this information is accurate and readily available when you need it, helping you make informed decisions quickly.

Utility software isn't just a behind-the-scenes player; it's an essential part of the technology that helps modern farms stay productive, efficient, and competitive. In the fast-paced world of agriculture, where timing and precision can make all the difference, utility software is like the unseen hand that keeps everything running smoothly. So, as we explore these tools, think about how they can be applied to streamline your operations and protect the vital data that drives your farm.

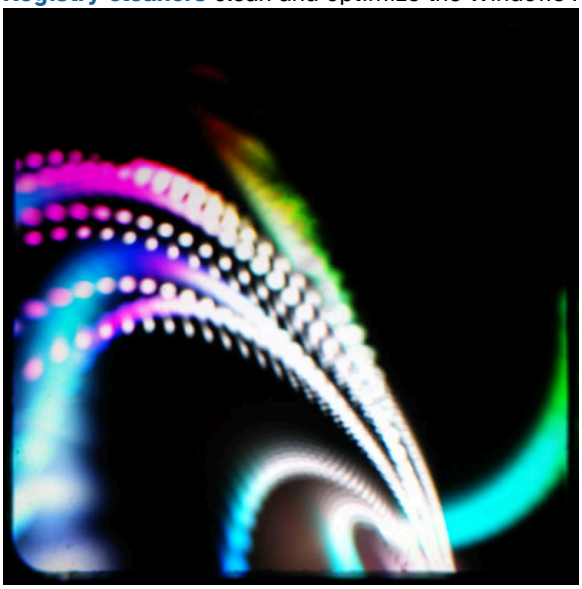


Utility software is system software designed to help analyze, configure, optimize or maintain a computer.

Utility software usually focuses on *how* the computer infrastructure (including the computer hardware, operating system, software and data storage) operates. Utility software, along with operating system software, is a type of system software, distinguishing it from application software.

Utility software

- **Anti-virus** utilities scan for computer viruses.

- **Archivers** output a stream or a single file when provided with a directory or a set of files. Archive utilities, unlike archive suites, usually do not include compression or encryption capabilities. Some archive utilities may even have a separate un-archive utility for the reverse operation.
- **Backup software** can make copies of all information stored on a disk and restore either the entire disk (e.g. in an event of disk failure) or selected files (e.g. in an event of accidental deletion).
- **Clipboard managers** expand the clipboard functionality of an operating system .
- **Cryptographic** utilities encrypt and decrypt streams and files.
- **Data compression** utilities output a shorter stream or a smaller file when provided with a stream or file.
- **Data synchronization** utilities establish consistency among data from a source to a target data storage and vice versa. There are several branches of this type of utility:
  - **File synchronization** utilities maintain consistency between two sources. They may be used to create redundancy or backup copies but are also used to help users carry their digital music, photos and video in their mobile devices.
  - **Revision control** utilities are intended to deal with situations where more than one user attempts to simultaneously modify the same file.
- **Debuggers** are used to test and "debug" other programs, mainly to solve programming errors. Also utilized for reverse engineering of software or systems.
- **Disk checkers** can scan operating hard drive.
- **Disk cleaners** can find files that are unnecessary to computer operation, or take up considerable amounts of space. Disk cleaner helps the user to decide what to delete when their hard disk is full.
- **Disk compression** utilities can transparently compress/uncompress the contents of a disk, increasing the capacity of the disk.
- **Disk defragmenters** can detect computer files whose contents are scattered across several locations on the hard disk, and move the fragments to one location to increase efficiency.
- **Disk partitions** can divide an individual drive into multiple logical drives, each with its own file system which can be mounted by the operating system and treated as an individual drive.
- **Disk space analyzers** for the visualization of disk space usage by getting the size for each folder (including sub folders) & files in folder or drive. showing the distribution of the used space.
- **Disk storage** utilities
- **File managers** provide a convenient method of performing routine data management tasks, such as deleting, renaming, cataloging, uncataloging, moving, copying, merging, generating and modifying data sets.
- **Hex editors** directly modify the text or data of a file. These files could be data or an actual program.
- **Memory testers** check for memory failures.
- **Network utilities** analyze the computer's network connectivity, configure network settings, check data transfer or log events.
- **Package managers** are used to configure, install or keep up to date other software on a computer.
- **Registry cleaners** clean and optimize the Windows Registry by removing old registry keys that are no longer in use.
- 
- **Screensavers** were desired to prevent phosphor burn-in on CRT and plasma computer monitors by blanking the screen or filling it with moving images or patterns when the computer is not in use. Contemporary screensavers are used primarily for entertainment or security.

- **System monitors** for monitoring resources and performance in a computer system.
- **System profilers** provide detailed information about the software installed and hardware attached to the computer.

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1.2.3.3: Video- Utility Software

Definition:Utility Software

Utility software is a type of system software designed to help manage, maintain, and optimize computer performance. It includes tools such as antivirus programs, file management systems, disk cleanup tools, and backup software, all of which ensure that the computer runs smoothly and efficiently. Utility software performs specific tasks that support the overall functionality of the operating system and the applications running on the computer.

Agriculture Lens: In agriculture, utility software plays a crucial role in maintaining the digital systems that modern farms rely on. For example, antivirus software protects valuable data on crop yields, weather patterns, and farm operations from malicious attacks. Backup software ensures that important records and data collected from sensors and other farm technology are securely stored and can be recovered in case of a system failure. By keeping agricultural technology running efficiently, utility software helps farmers focus on optimizing their operations and improving productivity.

Watch this video to learn about what open source utility software is available to improve the performance of your computer by clicking this link: https://youtu.be/pmqxAxSiaqI?si=ACndtX4V4tInKvAs.



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1.2.3.4: Video- Utility Software

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1.2.3.5: Video- Understanding Operating Systems

Definition: Operating Systems

An operating system is the most important software that runs on a computer. It manages the computer's memory, processes, and all of its software and hardware. It also allows you to communicate with the computer without knowing how to speak the computer's "language." Without an operating system, a computer is useless.

In agriculture, the operating system is essential for running the software that controls everything from automated irrigation systems to data analysis tools that help optimize crop yields and farm management.

Watch the video to learn about operating systems.

https://youtu.be/fkGCLIQx1MI?si=kcHwVXACbjcp4hcB

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1.3: End of Chapter Summary

Summary: The Use of Computers and Software in Agricultural Applications

Computers and their software play a transformative role in modern agriculture, enhancing efficiency, productivity, and sustainability across various farming practices. These applications leverage technology to address diverse agricultural needs, from crop management to financial planning.

1. **Farm Management: Software tools such as **FarmLogs** and **Ag Leader SMS** streamline the management of farm operations by tracking field activities, resources, and financials. This enables farmers to monitor performance, plan activities, and make informed decisions based on comprehensive data analysis.

2. **Precision Agriculture: Technologies like **Climate FieldView** and **Trimble Ag Software** support precision agriculture by using data-driven insights to optimize field management. These tools help in monitoring crop health, managing irrigation, and applying inputs precisely, thereby enhancing crop yields and reducing resource wastage.

3. **Data Analytics: Applications such as **AgFunder Network Partners** utilize data analytics to provide insights into market trends, investment opportunities, and industry developments. This helps stakeholders make informed decisions and adapt to changing agricultural landscapes.

4. **Weather and Climate Monitoring: Software like **The Weather Network** and **Weather Underground** provides accurate weather forecasts and climate data. This information is crucial for planning planting and harvesting schedules, managing irrigation, and mitigating weather-related risks.

5. **Livestock Management: Tools such as **Allflex Livestock Intelligence** and **CattleMax** are used to track and manage livestock health, breeding, and performance. These applications help in maintaining optimal herd management and improving overall productivity.

6. **Irrigation Management: Software and systems like **Netafim** and **Rachio Smart Sprinkler Controller** optimize irrigation practices by using real-time data and advanced technologies to ensure efficient water use and crop health.

7. **Remote Sensing and Drones: Technologies such as **DJI Terra** and **Pix4Dfields** utilize drones and remote sensors to capture high-resolution imagery and data for monitoring crop conditions, assessing field health, and managing resources effectively.

8. **Financial and Supply Chain Management: Software like **QuickBooks for Farmers** and **AgriChain** assists in managing farm finances and supply chain operations. These tools enable efficient budgeting, transaction management, and logistics planning.

In summary, computers and software have become integral to modern agriculture, providing tools that enhance operational efficiency, support data-driven decision-making, and contribute to sustainable farming practices.



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1.4: End of Chapter Discussion

Discussion Topics: Computer Basics and Their Applications in Agriculture

1. Understanding Computer Components and Their Functions

- **Discussion Topic:** Explore the key components of a computer, including the CPU, memory, storage, and input/output devices. Discuss how each component contributes to the overall performance of agricultural software and applications.
- **Key Points:**
  - How does CPU performance impact the speed of agricultural software processing?
  - The importance of sufficient memory and storage for handling large datasets in farm management systems.
  - The role of input devices (e.g., keyboards, touchscreens) in ease of use for agricultural applications.

2. The Role of Operating Systems in Agricultural Software

- **Discussion Topic:** Analyze how different operating systems (e.g., Windows, macOS, Linux) support various agricultural software applications. Consider compatibility issues and how different OS environments affect software performance.
- **Key Points:**
  - Compatibility of popular farm management systems with different operating systems.
  - How OS stability and updates impact agricultural software reliability.
  - Choosing the right OS for specific agricultural tasks or software needs.

3. Spreadsheet Software for Farm Management

- **Discussion Topic:** Discuss how spreadsheet software (e.g., Microsoft Excel, Google Sheets) is used for farm management tasks such as budgeting, crop tracking, and data analysis.
- **Key Points:**
  - Techniques for using spreadsheets to track crop yields and input costs.
  - The benefits of using formulas and functions to analyze farm data.
  - Collaborative features of online spreadsheets for managing farm operations with a team.

4. Word Processing Applications for Agricultural Documentation

- **Discussion Topic:** Examine the role of word processing software (e.g., Microsoft Word, Google Docs) in creating and managing agricultural documents, such as reports, research papers, and operational manuals.
- **Key Points:**
  - Creating detailed reports and documentation for farm management and compliance.
  - The importance of templates and formatting tools for professional agricultural documentation.
  - Sharing and collaborating on documents with stakeholders and partners.

5. Internet and World Wide Web for Agricultural Research and Communication

- **Discussion Topic:** Explore how the Internet and World Wide Web are used in agriculture for research, networking, and accessing online resources and services.
- **Key Points:**
  - Utilizing online databases and research articles to stay updated on agricultural advancements.
  - The impact of social media and online forums for networking with other farmers and industry experts.
  - Accessing cloud-based agricultural tools and services through web applications.

6. Cloud Computing and Data Storage in Agriculture

- **Discussion Topic:** Discuss the advantages of cloud computing and online data storage solutions for managing agricultural data and applications.
- **Key Points:**
  - Benefits of using cloud storage for backing up farm data and accessing it from multiple devices.
  - The role of cloud-based farm management systems in real-time data access and collaboration.
  - Security considerations and data privacy issues related to cloud storage in agriculture.

7. Agricultural Software Applications and Their Integration

- **Discussion Topic:** Examine various agricultural software applications (e.g., farm management systems, crop monitoring tools) and how they integrate with computer systems and other technologies.
- **Key Points:**
  - Integration of software with hardware like GPS systems and IoT sensors for precision agriculture.
  - Challenges and benefits of integrating multiple software solutions for comprehensive farm management.
  - Case studies of successful software integration in modern farming practices.

8. Troubleshooting and Support for Agricultural Technology

- **Discussion Topic:** Discuss common technical issues encountered with agricultural software and computers and strategies for troubleshooting and support.
- **Key Points:**
  - Identifying and resolving common problems with agricultural software installations and updates.
  - Resources for technical support and troubleshooting, including online forums and manufacturer support.
  - The importance of regular software updates and maintenance for ensuring reliable performance.

9. Future Trends in Agricultural Computing

- **Discussion Topic:** Explore emerging trends and technologies in agricultural computing, such as artificial intelligence, machine learning, and advanced data analytics.
- **Key Points:**
  - How AI and machine learning can enhance decision-making and predictive analytics in agriculture.

- The potential impact of advanced data analytics on optimizing farm operations and productivity.
- Future developments in agricultural technology and their potential benefits for farmers.

By discussing these topics, participants will gain a deeper understanding of how computer basics apply to agriculture and how leveraging technology can enhance various aspects of farm management and operations.



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2: WORD-PROCESSING APPLICATIONS IN AGRICULTURE

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2.1: Chapter Introduction

Introduction to Word-Processing Applications in Agriculture

Word-processing applications are indispensable tools in agriculture, offering a range of functionalities that support various administrative and operational tasks. These applications enhance productivity by facilitating the creation, editing, and management of textual documents, which are crucial for efficient farm management and communication.

1. Typing and Editing:

- **Purpose:** Word-processing applications allow users to efficiently type and edit text, making it easier to draft and refine documents related to farm operations. This includes updating records, writing reports, and preparing correspondence.
- **Functionality:** Features such as spell check, grammar correction, and text formatting tools ensure that documents are clear and professional.

2. Printing:

- **Purpose:** These applications support the printing of physical copies of documents, which is essential for record-keeping, regulatory compliance, and distribution of information.
- **Functionality:** Users can format documents for printing, including adjusting page layouts, margins, and font sizes, to produce high-quality printed materials.

3. Creating and Formatting Documents:

- **Purpose:** Word-processing tools enable users to create a variety of documents including reports, manuals, and brochures. Formatting options help in organizing content and making documents visually appealing and easy to read.
- **Functionality:** Includes features such as headers, footers, tables, bullet points, and styles, which help in structuring and presenting information effectively.

4. Creating Business Documents:

- **Purpose:** Word-processing applications are essential for producing professional business documents such as proposals, business plans, and contracts. These documents are crucial for managing relationships with stakeholders, securing funding, and outlining farm operations.
- **Functionality:** Provides templates and design tools to create polished documents that adhere to business standards and effectively communicate key information.

Applications in Agriculture:

- **Documentation and Reporting:** Draft annual reports, research papers, and compliance documents with structured formats and precise data.
- **Record Keeping:** Maintain detailed records of farm activities, including planting schedules, crop performance, and financial transactions.
- **Communication:** Prepare letters, emails, and proposals to communicate with clients, suppliers, and regulatory bodies.
- **Training and Education:** Develop instructional materials and training manuals to educate farm staff on new practices or equipment.
- **Marketing and Promotion:** Design promotional materials such as brochures and flyers to market agricultural products and services.
- **Grant and Proposal Writing:** Craft grant applications and research proposals to obtain funding and support for agricultural projects.

- **Custom Templates and Forms:** Create templates for inventory management, field surveys, and compliance documentation to streamline operations.

In summary, word-processing applications are versatile tools that play a critical role in the agricultural sector by simplifying the creation, formatting, and management of a wide range of documents. They enhance administrative efficiency, support effective communication, and contribute to the overall organization and growth of agricultural operations.



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2.2: Chapter Learning Objectives

Here are some brief learning objectives for Word-Processing Applications in Agriculture:

Learning Objectives

1. **Document Creation and Formatting:**
   - **Learning Objective:** Understand how to create and format agricultural documents, including reports, plans, and records, using word-processing tools to ensure clarity and professionalism.
2. **Template Utilization:**
   - **Learning Objective:** Learn to use and customize templates for common agricultural documents such as crop reports, farm management plans, and equipment maintenance logs to streamline document creation.
3. **Data Integration:**
   - **Learning Objective:** Explore how to integrate and manage data within word-processing applications, including importing data from spreadsheets and incorporating tables, charts, and graphs into agricultural reports.
4. **Collaboration and Sharing:**
   - **Learning Objective:** Understand how to use collaboration features in word-processing applications to share documents with team members, review changes, and manage feedback effectively.
5. **Document Review and Revision:**
   - **Learning Objective:** Develop skills in reviewing and revising agricultural documents using tools for tracking changes, comments, and version control to ensure accuracy and completeness.
6. **Mail Merge for Agricultural Communications:**
   - **Learning Objective:** Learn to use mail merge functionality to create personalized communications such as newsletters, invitations, or notices for agricultural stakeholders and clients.

These objectives aim to equip learners with the essential skills needed to effectively use word-processing applications in the context of agricultural documentation and communication.

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2.2.1: PRELIMINARIES

In the next section, we'll learn about file management and the undo command, two essential skills that make working with computers smoother and more efficient. File management helps you organize, store, and access important documents and data, which is especially crucial when handling large amounts of information in agriculture. The undo command, on the other hand, is a simple yet powerful tool that lets you quickly correct mistakes. Mastering these basics will help you save time and avoid frustration as you navigate various computer tasks in your daily work.

2.2.1.1: Files Management

2.2.1.2: Undo Command

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2.2.1.1: Files Management

Learning Objectives

- Simple instructions for managing files using USB drives.

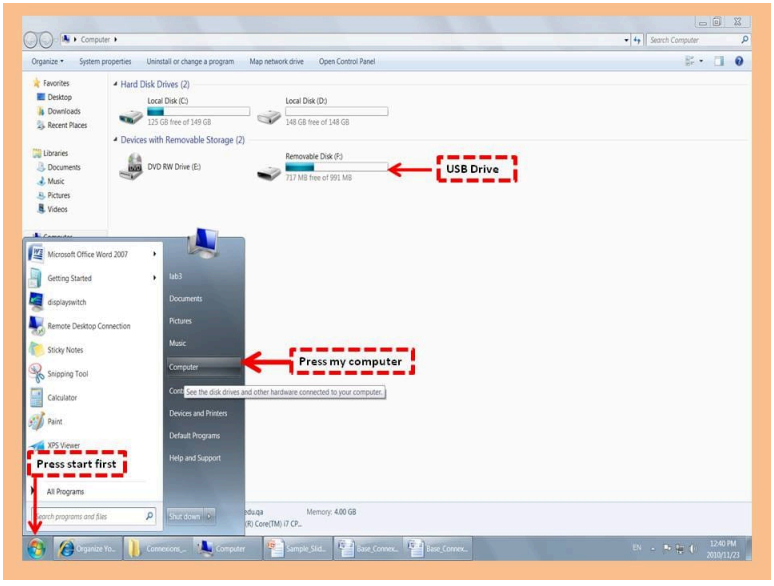
In today's digital age, effective file management is just as crucial on the farm as it is in the office. Whether you're tracking crop yields, storing soil analysis reports, or backing up data from your precision farming tools, organizing and managing your files efficiently can make a significant difference in your agricultural operations. Proper file management not only ensures that important information is easily accessible when needed, but it also helps protect your data from loss or corruption.

In the following section, we'll explore the basics of file management, focusing on practical steps you can take to organize, store, and protect your files using tools like USB drives. Just as careful planning and organization are essential in farming, managing your digital files with care will help streamline your workflow and support the success of your agricultural endeavors.

USB Drive

Usb drive can be used for storing file and folders, it can be used for backing up files, and it is Easy to share and travel with.

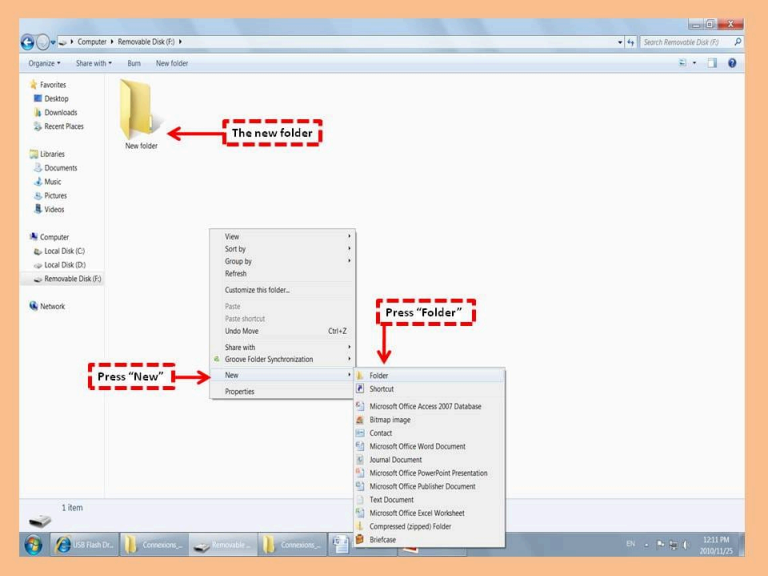
- You can find the USB Drive in my computer in start.
- You will find it under Devices with removable storage.
- You can rename the USB Drive by clicking the right side of the mouse.



To create a folder in the USB Drive

Folders can be created in Documents and in the Desktop, with creating folders you can create a folder within the folder that’s called “Subfolders”.

- Start my computer.
- Double-Click on the removable disk
- Right click on the empty space find the word “New” – find the word “Folder”.



To save fills in the folder USB Drive

Saving files is very easy, you can save files anywhere in the computer, you can rename the file; change the saving location of the file, and save it in a Different type.

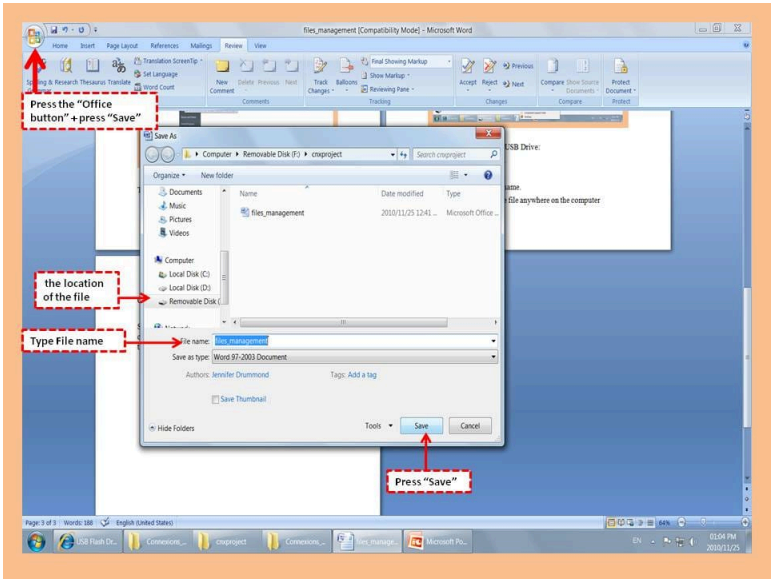
Press the “office button”.

Click on “Save as”.

Type the file name.

Change the location of the file anywhere on the computer

Click “Save”.



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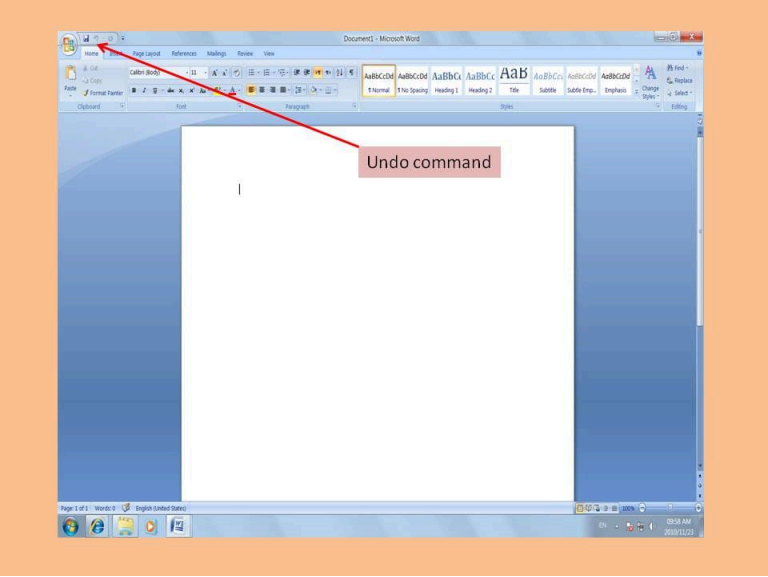
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2.2.1.2: Undo Command

Learning Objectives

- When and how to use the "undo" command when using word processing.

The undo command is used to quickly undo any recent key strokes. It is used when mistakes occur and the user wishes to undo it. For example when a user was typing some text then suddenly it disappears through pressing the wrong key, the easiest way to retrieve the data is through the undo command. The undo command is located next to the save button.



As shown in the image above you will have to press the undo command to commence undoing.

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2.2.2: Typing

Typing is one of the most fundamental computer skills, essential for efficiently navigating digital tasks in agriculture. Whether you're entering data about livestock, crops, or machinery, being able to type quickly and accurately can save time and reduce errors. In this overview, we'll cover the basics of proper typing technique, including hand positioning, speed, and accuracy tips. Mastering this skill not only improves your workflow but also helps you stay organized and communicate effectively when using various agricultural software programs. Developing strong typing skills will make your computer tasks more efficient, leaving you more time to focus on the hands-on aspects of your work.

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2.2.3: IMPROVING TEXT

2.2.3.1: Selecting Text and Applying Effects

2.2.3.2: Styles

2.2.3.3: Using the Thesaurus

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2.2.3.1: Selecting Text and Applying Effects

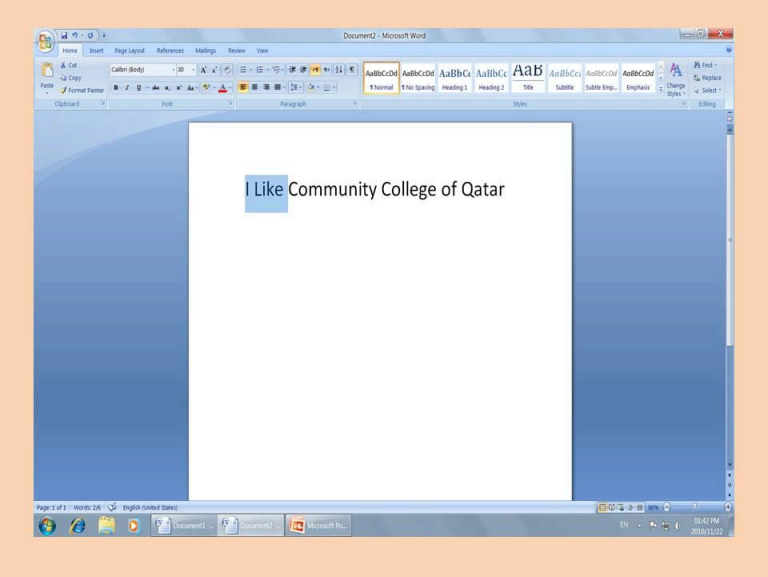
Learning Objectives

- How to select text within a document coupled with how to apply commonly used effects such as bold, font types, etc. onto the selected text.

Selecting Text

If you want to **select** a text you have to:

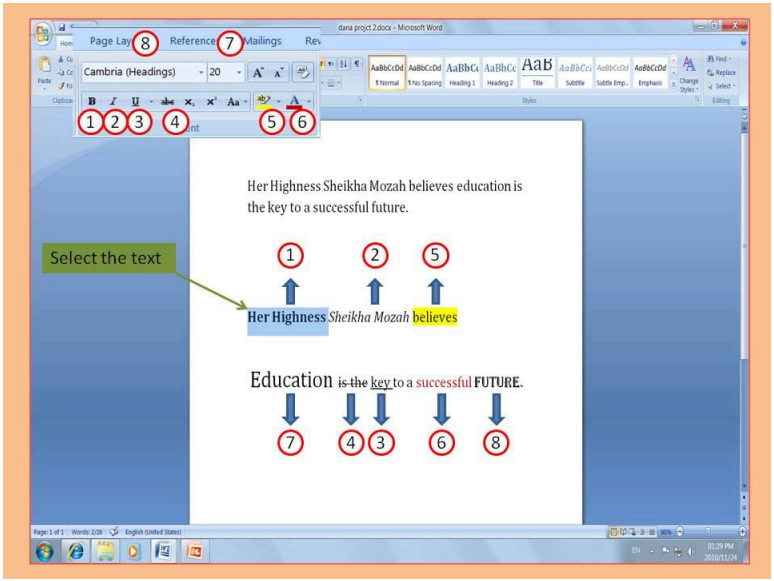
- Move insertion point to the word that you want to select
- left click in the mouse and select the wanted text



Applying Effects

If you want to **apply effect** in your text:-

- From the **font** box which is placed in **home** tab you can apply effects in your text such as, font, size, bold, underlined, italic ...
- You have to select the text, and then press the icon that you desire.



The explanations for these numbers are:-

1. **Bold**: to make your type apper **like this.**
2. **Italic**: to make your type face curve or (bend) to the right *like this.*
3. **Underline**: to make a line below your text Like this.
4. **Strikethrough**: to cross the text or make a line at the middle of the text.
5. **Highlight color**: to highlight a text.
6. **Font color**: to change the font color.
7. **Font size:** to change the text size.
8. **Font:** to change the font hand writing or style**.**

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2.2.3.2: Styles

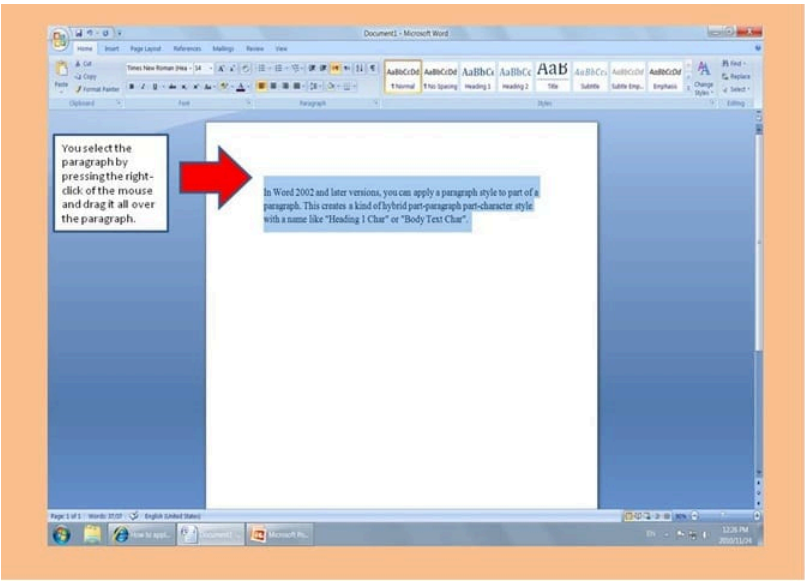
Learning Objectives

- How to use the "Heading 1" style, plus how to change styles for an entire document.

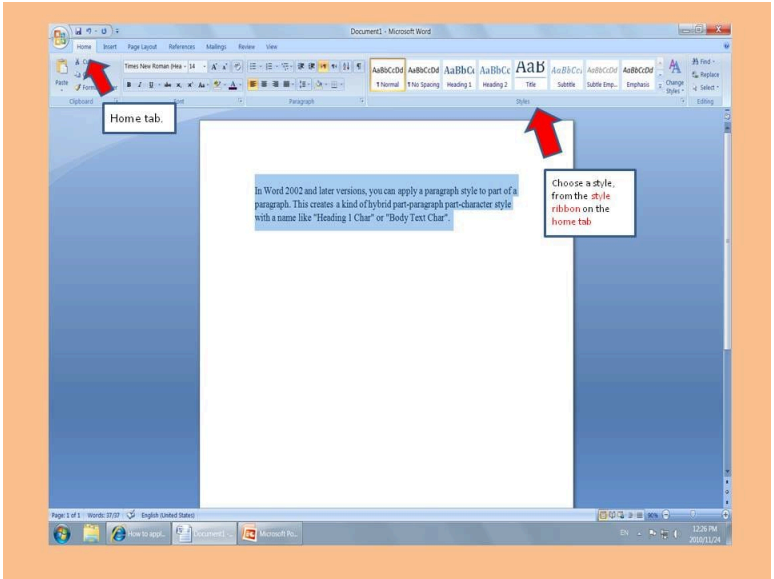
All formatting in Microsoft Word is controlled by styles. A style is a set of formatting instructions. Word applies the formatting instructions when you apply a style. Microsoft Word comes with dozens of built-in styles.

Here are the steps of applying a style:

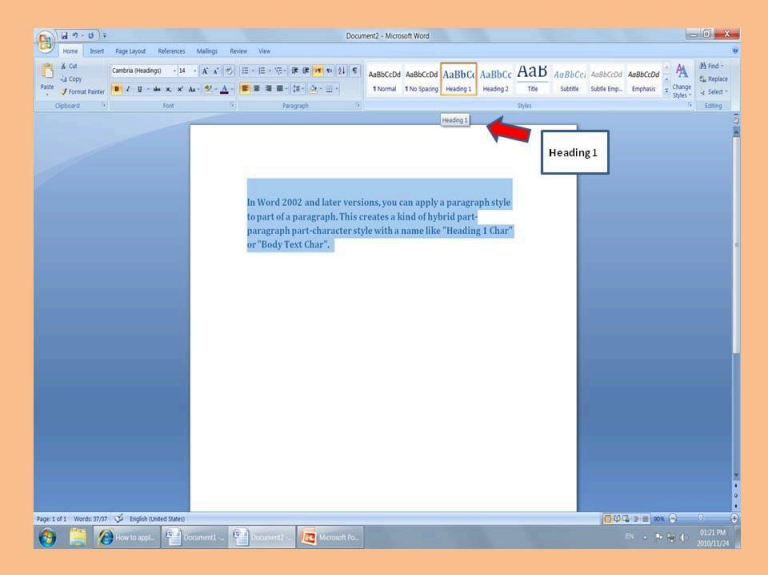
Step 1: Select the text.



Step 2: Apply the style: using the mouse.



The results when choosing Heading 1:



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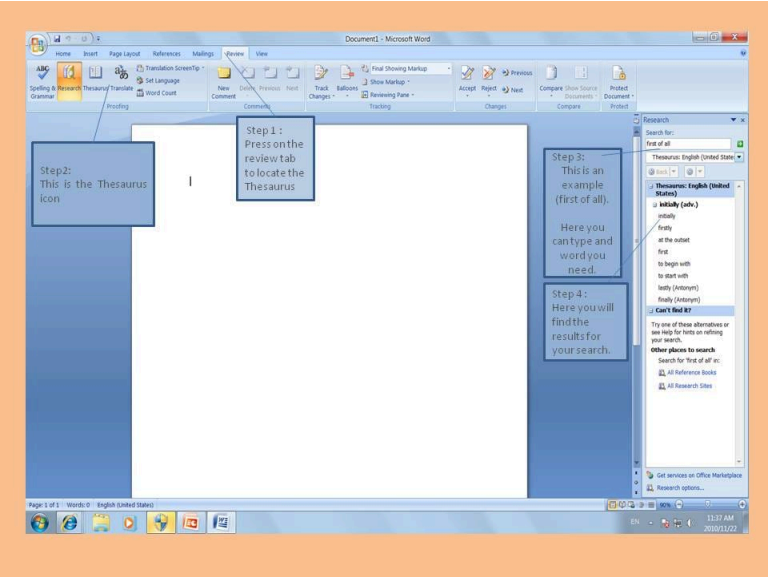
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2.2.3.3: Using the Thesaurus

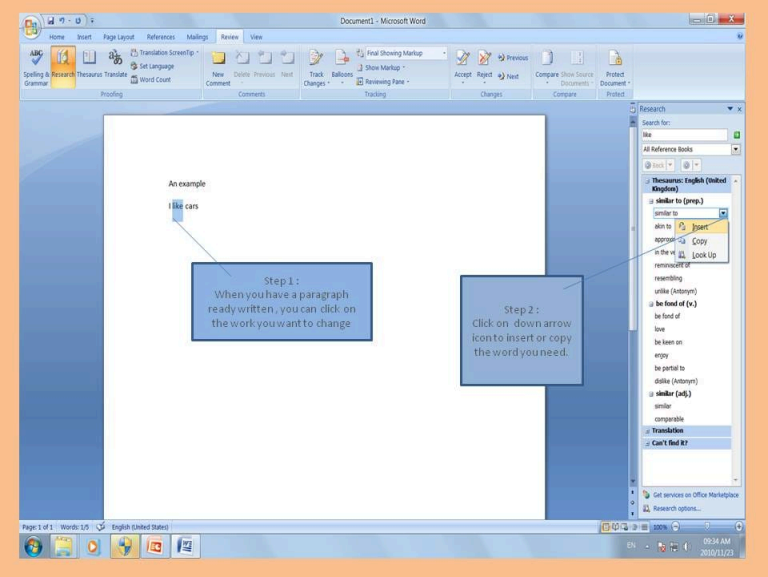
Learning Objectives

- How to use the thesaurus to improve a docoument.

What is a Thesaurus: A thesaurus is a reference work that lists words grouped together according to similarity of meaning (containing synonyms and sometimes antonyms), in contrast to a dictionary, which contains definitions and pronunciations.



Here are the first basic steps on how to use the thesaurus.



Here its explaining on when you have a paragraph written instead of typing the word in the search bar, you can just click on the word you want to change.

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2.2.4: PRINTING

2.2.4.1: Title Page
2.2.4.2: Headers and Footers
2.2.4.3: Citations with Footnotes or Endnotes
2.2.4.4: Citations In-Line with Bibliography
2.2.4.5: Print Preview and Printing

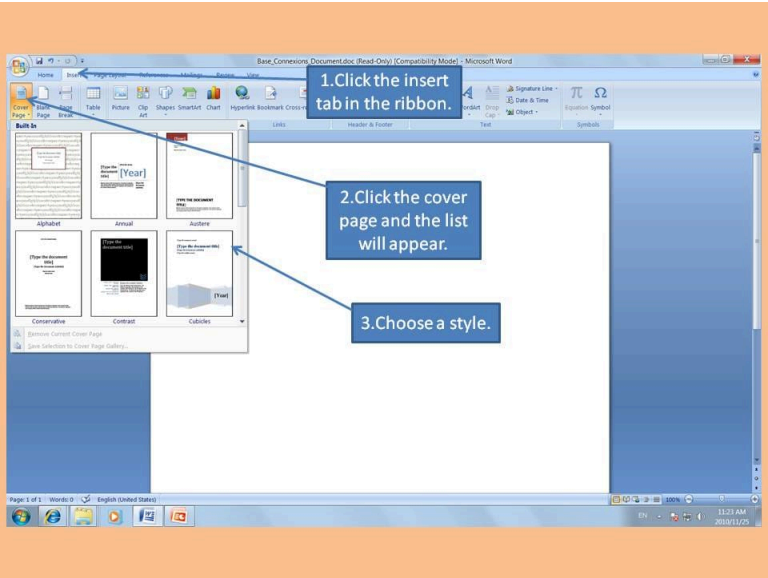
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Learning Objectives

- How to create a title page for a document.

Most research papers have a title page (sometimes called a cover page). The slide below shows simple instructions to make a title page.



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2.2.4.2: Headers and Footers

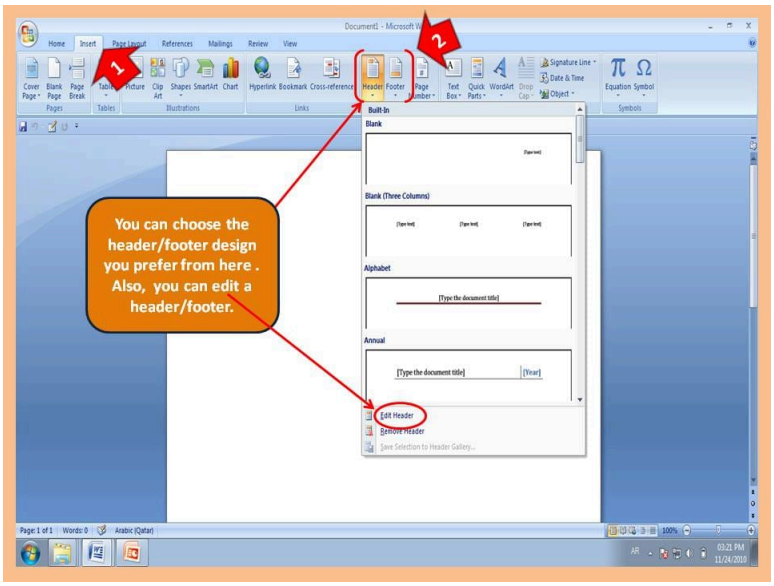
Learning Objectives

- How to create headers and footers for a document.

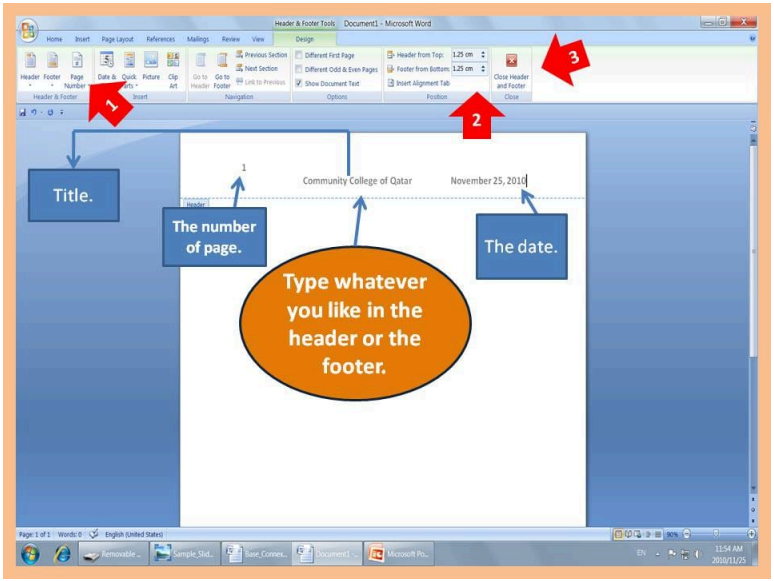
Header and Footer are to insert whatever you need (such as page numbers, title, date...Etc.) into the head (top) and the foot (bottom) of each page. However, the main purpose for the header and footer is to add various scripts to track the access to the blog (such as Google...Etc.).

To create a header or a footer:

1. Click the Insert tab.
2. Click on the Header/Footer pop-down menu.



After you insert the header/footer, type in header or footer whatever you like...



1. You can insert page numbers as it shown in the picture above by choosing the design you like.
2. Also, you can change the height of the Header/footer from the Position group as it shown in the picture above.
3. After finishing editing the header/footer, to exit click the (" Close Header and Footer", the red X next to the Position group).

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2.2.4.3: Citations with Footnotes or Endnotes

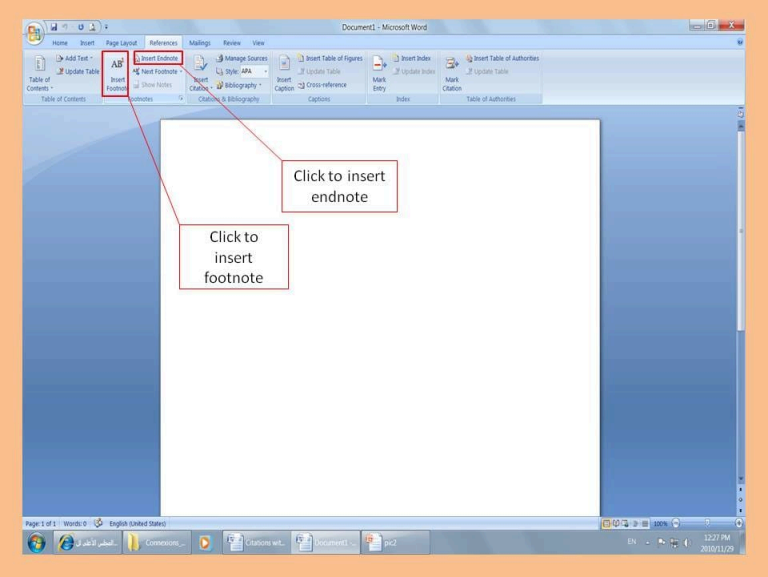
Learning Objectives

- How to cite references using either footnotes or endnotes.

Footnotes and endnotes make it easy to give credit to your sources or to add explanatory material. A footnote appears at the end of the page, and the endnote appears at the end of the document. Footnotes and endnotes are also used for additional information about a topic.

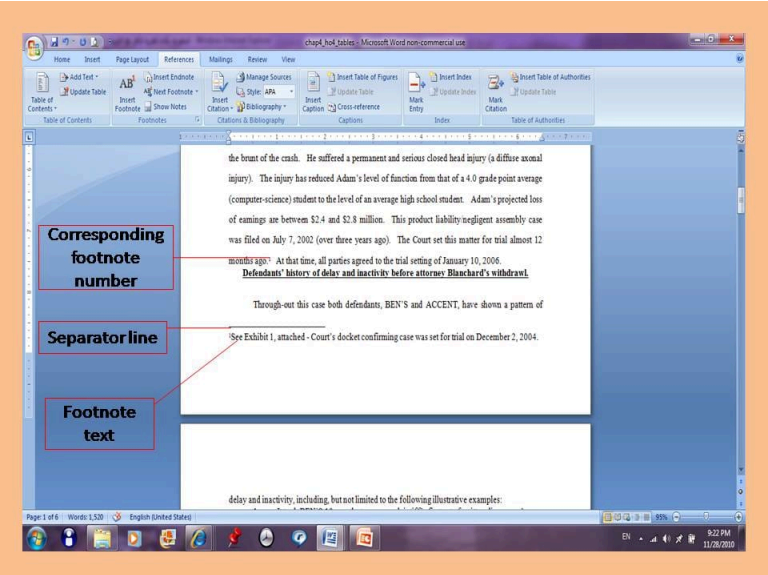
To insert footnote or endnote do the following as shown in figure below:

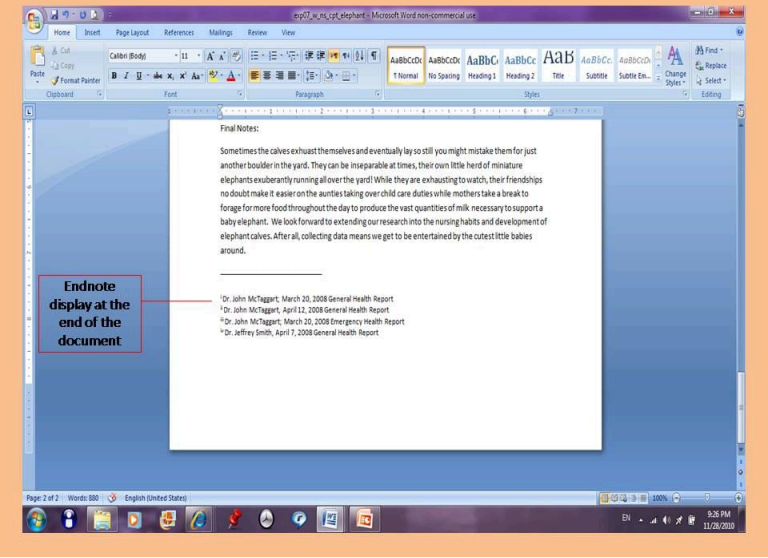
1. Place the pointer where you want to insert the reference note.
2. Go to the references tab.
3. In the Footnotes group, click Insert Footnote or Insert Endnote.
4. Type your text, and click back to the text.



Automatically, Word places footnotes at the end of each page and endnotes at the end of the document.

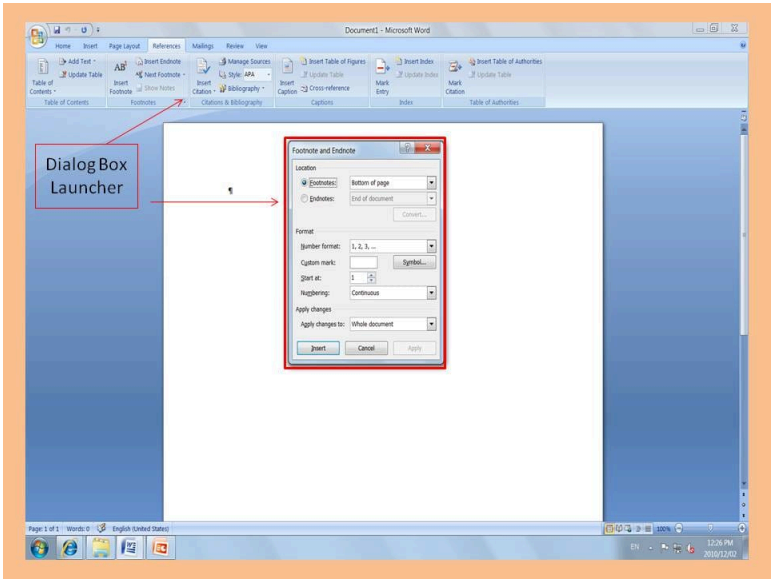
Footnotes and endnotes are both separated from the body text by a short horizontal line. Both footnotes and endnotes contain a note reference mark in the body text to indicate that additional information as shown in figures below. The footnote uses sequenced numerals (1, 2 ...) and the endnote uses sequenced Roman numerals (i, ii...). If add or delete notes, numbers automatically modified.



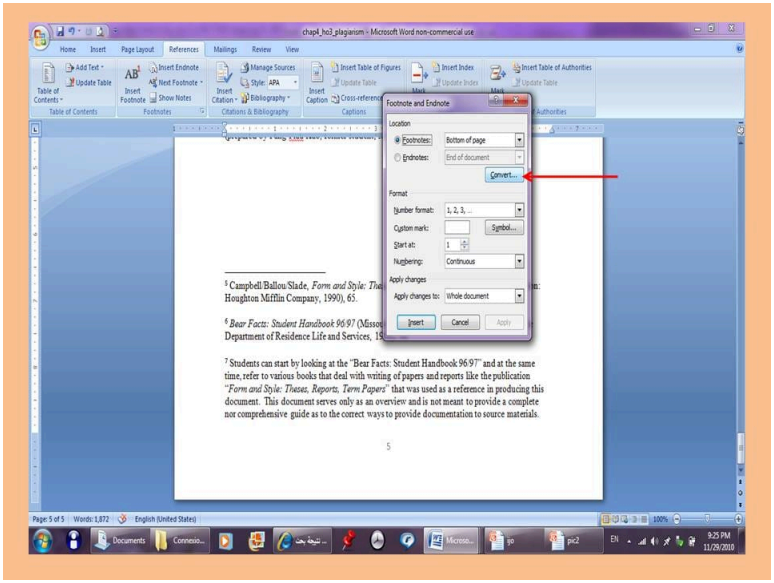


Note text can be formatted as any other text. You can change its color, size, style, etc. You can easily modify your notes simply by clicking inside the note and edit it. To delete note select its note reference number in the text and press Delete.

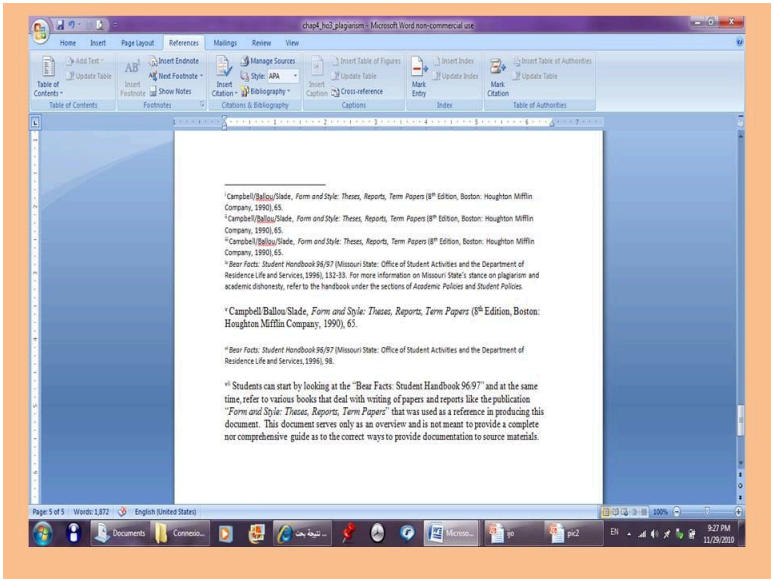
Also you can modify it by clicking the Footnote and Endnote Dialog box launcher. Use the dialog box launcher (a little box with an arrow) at the lower-right corner of the Footnotes group of the References tab.



To convert the footnote to endnote or opposite, click on convert in the Footnote and Endnote Dialog box launcher.



After converting:



[i] Campbell/Ballou/Slade, *Form and Style: Theses, Reports, Term Papers* (8th Edition, Boston: Houghton Mifflin Company, 1990), 65.
[ii] Campbell/Ballou/Slade, *Form and Style: Theses, Reports, Term Papers* (8th Edition, Boston: Houghton Mifflin Company, 1990), 65.
[iii] Campbell/Ballou/Slade, *Form and Style: Theses, Reports, Term Papers* (8th Edition, Boston: Houghton Mifflin Company, 1990), 65.
[iv] *Bear Facts: Student Handbook 96/97* (Missouri State: Office of Student Activities and the Department of Residence Life and Services, 1996), 132-33. For more information on Missouri State's stance on plagiarism and academic dishonesty, refer to the handbook under the sections of *Academic Policies* and *Student Policies*.

[v] Campbell/Ballou/Slade, *Form and Style: Theses, Reports, Term Papers* (8th Edition, Boston: Houghton Mifflin Company, 1990), 65.

[vi] *Bear Facts: Student Handbook 96/97* (Missouri State: Office of Student Activities and the Department of Residence Life and Services, 1996), 98.

[vii] Students can start by looking at the "Bear Facts: Student Handbook 96/97" and at the same time, refer to various books that deal with writing of papers and reports like the publication "*Form and Style: Theses, Reports, Term Papers*" that was used as a reference in producing this document. This document serves only as an overview and is not meant to provide a complete nor comprehensive guide as to the correct ways to provide documentation to source materials.

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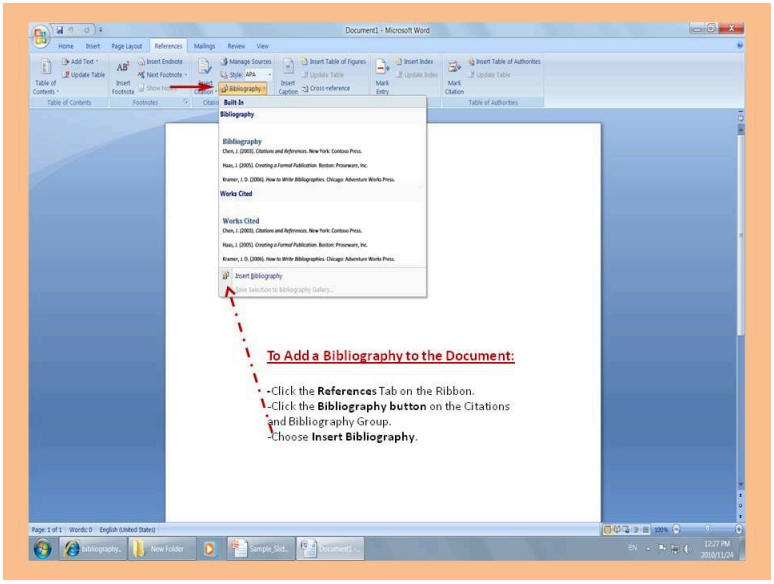
- 4.3: Citations with Footnotes or Endnotes is licensed CC BY 4.0.

2.2.4.4: Citations In-Line with Bibliography

Learning Objectives

- How to cite references in-line then adding a bibliography.

A **bibliography** is a list of works cited by an auther and should be included with the document when published. Select either Bibliography or work cited from the list of **Bilt-In Bibliographies**. After you add the sources using the Insert Citations feature, you click **Bibliography** in the **Citations & Bibliography group** on the **References tab**, and then click **Insert Bibliography**. The insert Bibliography selection at the bottom will work the same way it just won't format the bibliography like the **Bilt-In selections**.



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2.2.4.5: Print Preview and Printing

Learning Objectives

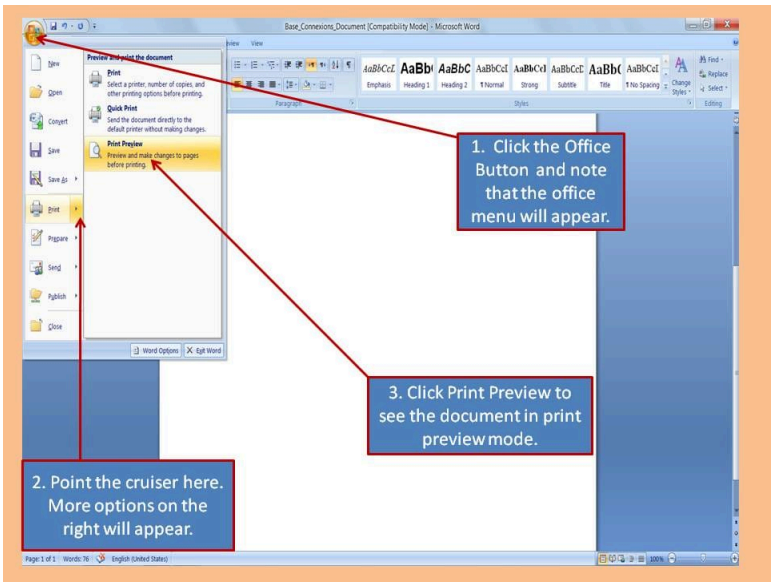
- How to print preview a document to review for problems, plus how to print from the print preview screen.

In the Print Preview, you can see what your document looks like before printing. It helps you to make your paper looks perfect and organized which saves more papers .

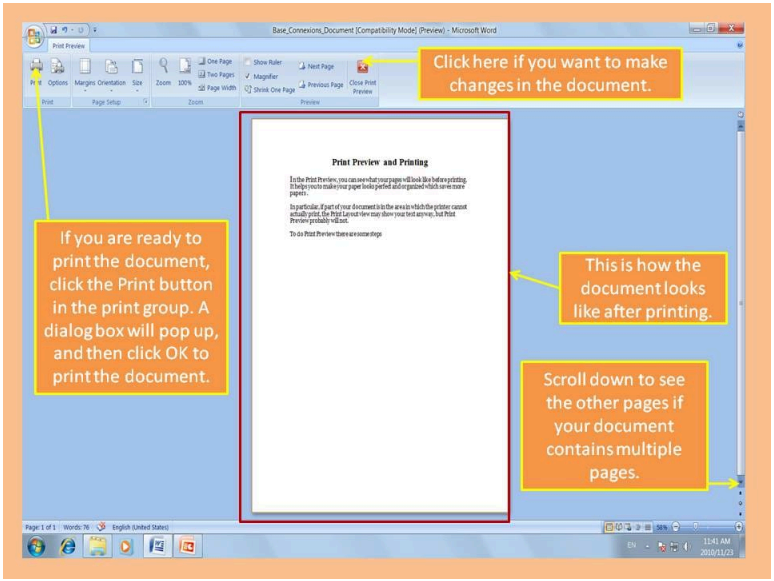
In particular, if a part of your document is in the area in which the printer cannot actually print, the Print Layout view may show your text anyway, but Print Preview probably will not.

Students must print preview their documents before printing to make sure that the document looks perfect and to avoid wasting papers.

To start Print Preview, do the following steps.



This is how the Print Preview mode looks like.



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2.2.5: APPENDIX

2.2.5.1: Show Hide File Extensions

2.2.5.2: Using the Longman Dictionary

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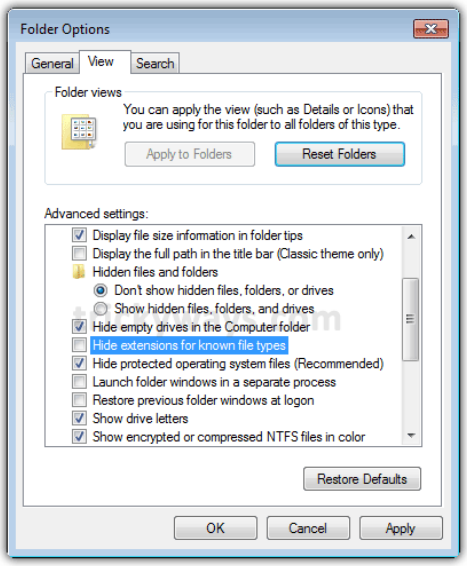
2.2.5.1: Show Hide File Extensions

Learning Objectives

- General instructions on how to show or hide file extensions. Specific instructions and web page links for Windows XP, Windows Vista and Windows 7 operating systems.

By default, file extensions for known file types are hidden in Windows operating systems. However, you can change this setting so that file extensions are shown for all file types. Being able to see file extensions can be very helpful for students taking computer courses because those course instructions often refer to file extensions.

All Windows operating systems navigate you to the “Folder Options” menu, then have you select the “View” tab. Indeed the box is identical in Windows XP, Windows Vista and Windows 7.



The check in the box acts like a toggle switch. With a check present, it will hide known file types. Without the check present, it will show all file types. Click on the box to make the check appear [hide file extensions] or disappear [show file extensions] and then select “OK”.

Instructions for navigating to the “Folder Options” for various Windows operating systems along with an Internet link for additional help are provided below.

Windows XP

With the Windows Explorer open, slect the “Tools” tab and then “Folder Options”.

Link for additional help: http://www.fileinfo.net/help/windows-show-extensions.html or http://dotwhat.net/page/displayextensions/

Windows Vista

Select the “Start” button, then “Control Panel”, then “Appearance and Personalization” and then “Folder Options”.

Link for additional help: http://windows.microsoft.com/en-us/windows-vista/Show-or-hide-file-name-extensions

Windows 7

Select the “Start” button, then “Control Panel” and then “Folder Options”.

Link for additional help: http://maximumpcguides.com/windows-7/hide-file-extensions/

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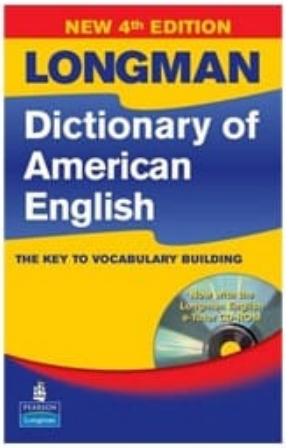
2.2.5.2: Using the Longman Dictionary

Learning Objectives

- Simple instructions to help students more effectively use the Longman dictionary.

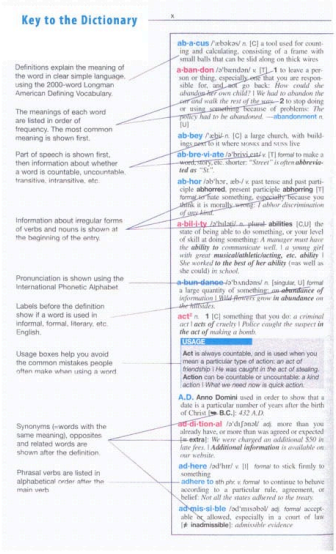
Introduction

The world's best-selling learner dictionary of American English and Still the only intermediate-level dictionary completely based on authentic spoken and written English.Widely used in ESL programs including the ESL programs at The Community College of Qatar.



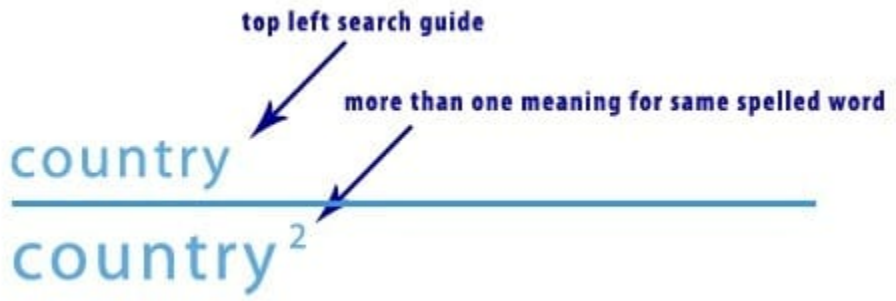
Key to the Dictionary

You will find below some simple explanations that would help you comprehend the major elements of the Longman dictionary.

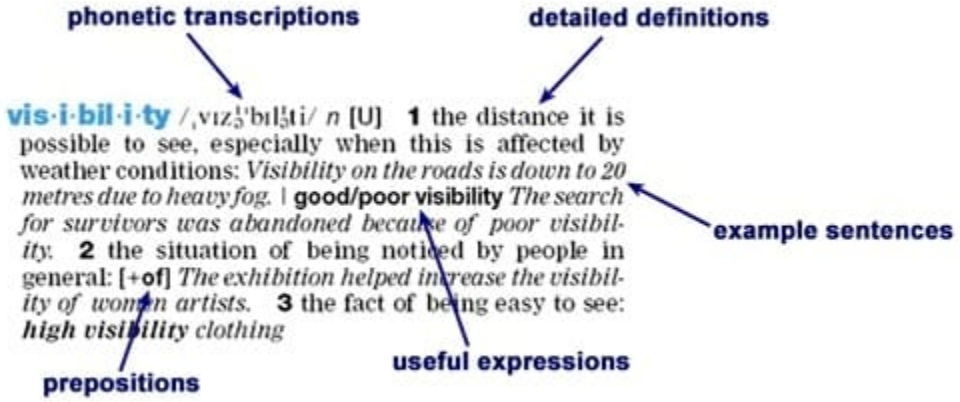


Searching for a Word

The key to search for a word is the upper left/right smaller font words which represents a guide for the search as shown below.



Phonetics & Detailed Definitions



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- 5.2: Using the Longman Dictionary is licensed CC BY 4.0.

2.2.6: GETTING STARTED WITH MICROSOFT WORD AND GOOGLE DOCS

In this unit, we discuss the basic on-screen elements of Microsoft Word and Google Docs. We explore the toolbars, menus, commands, and taskbars. Toolbars and menus are located at the top of the screen and list options that allow you to insert, view, or change the layout of a document. Each menu option lists different commands that let you format, save, and print documents. We also discuss the Quick Access Toolbar and learn how to add and delete commands. As you go through this unit, open up your version of Microsoft Word or Google Docs and follow along with the tutorials. This will help you learn as you explore the window and menu environment.

Upon successful completion of this unit, you will be able to:

- open documents in Microsoft Word and Google Docs;
- identify the parts of documents created in Microsoft Word and Google Docs;
- identify each of the menu elements in Microsoft Word and Google Docs; and
- identify and describe important commands in Microsoft Word and Google Docs.

2.2.6.1: Microsoft Word Window and Menu Environment

2.2.6.2: Google Docs Window and Menu Environment

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2.2.6.1: Microsoft Word Window and Menu Environment

Microsoft Word is a popular word processing program that is part of the Microsoft Office Suite. Many businesses use it to create, edit, format, and organize documents.

How to Open a Microsoft Word Document

Watch this introductory video to learn how to open a new document, insert text, name your document, use spell check, center your text, change your font, and use the basic navigation tools in Microsoft Word.

YouTube Video

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Microsoft Word Layout Basics

Watch this video to explore the Microsoft Word interface, such as the title bar, the task bar, ribbon display options, and the quick access toolbar. The presenter also shows how to maximize and minmize the windows in your screen space.

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Microsoft Word's Quick Access Toolbar

Watch this video to learn how to use Microsoft Word's Quick Access toolbar to easily perform common commands.

YouTube Video

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2.2.6.2: Google Docs Window and Menu Environment

Google Docs is a free web-based word processor offered by Google. Many businesses use it to create, edit, and format documents. Google Docs are especially easy to share online and to collaborate with colleagues. You can access them from anywhere, view and restore older versions of documents if necessary, and allow several users to edit at the same time.

How to Open a Google Docs Document

Watch this brief video for a quick overview of how to open and create a new Google Docs document.

YouTube Video

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View this YouTube Video online

Google Docs Layout Basics

Watch this video on how to navigate the Google Docs interface, including the layout of the menu bar, toolbar, and document area.

Click the following link to view this YouTube: https://youtu.be/cPi1jGR1bT8?si=AXIN23IMKK87IG7e

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2.2.7: CREATING AND FORMATTING DOCUMENTS

In this unit, we explore how to use Microsoft Word and Google Docs to create new documents and documents based on templates. We review the different commands used to format documents, and introduce options for saving and printing documents. As with the previous unit, we encourage you to open up your version of Microsoft Word or Google Docs to follow along with the tutorials. This will help you learn as you practice creating and formatting documents.

Learning Objectives

Upon successful completion of this unit, you will be able to:

- create a new blank document in Microsoft Word and Google Docs;
- create documents in Microsoft Word and Google Docs using templates;
- use commands such as font, bold, italics, and underline to format text;
- use themes and colors to change the look of a document;
- save and print documents;
- insert images into documents; and
- share a document using Google Doc's sharing tools.

2.2.7.1: Creating Documents

2.2.7.2: Using and Creating Document Templates

2.2.7.3: Basic Tools

2.2.7.4: Basic Formatting Commands

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2.2.7.1: Creating Documents

Now that we have looked into the basic Microsoft Word and Google Docs environment, let's explore how to create a new document. In this section we demonstrate how to use commands to change the font style, such as bold, italics, and underline, and how to save and print your work. We also discuss how you can use themes and colors to change the overall look of your document.

Creating a Microsoft Word Document

Watch this video to learn the basics of how to create a new document in Microsoft Word, add text, and use basic formatting such as bold, italics, and underline.

YouTube Video

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View this YouTube Video online

Creating a Google Docs Document

Watch this video to learn how to create a document in Google Docs, and for a quick tutorial of basic formatting tools, such as how to change the font size of text; add headings, titles, and subtitles; create links to other pages; and rename your document. An advantage of Google Docs is that it saves your work while you are typing and you can review past versions of your document.

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2.2.7.2: Using and Creating Document Templates

A template is a pre-designed document you can use as a starting point to create your own document. When you open the template, the fonts, styles, margins, and paragraph settings are already set. For example, one template might include all the formatting elements of a standard business letter, which you would then modify to fit your needs. You can also create your own templates to use later, such as when you need to create the same kind of document over and over.

Microsoft Word Templates

Watch this video to learn how to use and create templates in Microsoft Word. A variety of templates are available, such as for business letters, resumes, and newsletters. You also can save your edits to create your own new template which you can use later. Microsoft Word and Google Docs have document elements you can insert into your template that update automatically, such as the date or time.

YouTube Video

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Google Docs Templates

Watch this video to learn how to find, use, and create templates in Google Docs.

YouTube Video

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View this YouTube Video online

More Google Templates

Watch this video to see the gallery of templates available in Google Docs click the link below.

https://youtu.be/wDUT1dWZ1OI?si=n2kDLkdIDXHEW86K

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2.2.7.3: Basic Tools

Let's dive in and look at several ways to save and print a document, some simple editing tools, how to insert and resize an image, and how to share documents with Google Docs. Microsoft Word and Google Docs make it easy to create and edit documents that look professional and are easy to read.

Note that while some of these videos present commands or features of Google Docs or Microsoft Word, both programs share most of these same basic commands.

Save and Save As

Watch this video to learn about the difference between the Save and Save As commands, which you can use to replace or create new versions of your document.

YouTube Video

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View this YouTube Video online

Watch this video learn how to use the print command in Google Docs. The presenter reviews some additional commands on the Google Docs toolbar, such as different style headers which you can use to format the text throughout your document. Note that the version of Google Docs in this video will look different than your version, but the principles are the same.

YouTube Video

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View this YouTube Video online

Printing Selected Text

Watch this video to learn how to print a document or a portion of a document.

YouTube Video

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View this YouTube Video online

Reviewing and Editing

This video discusses the editing features in Google Docs. When you are collaborating with someone in Google Docs, you can make "suggested edits" that allow the document owner to review, accept, or reject your suggestions. The "voice type" tool lets you input text with your voice. You can also use these features on your phone.

View the voice typing on Google docs here: https://youtu.be/LIz9UWi5z4w?si=cJvU46Qq2JRrsioy

View the suggested edits in Google docs here: https://youtu.be/vytBjbfv9Qw?si=6lmVc_rYiNOpkBq0

Inserting an Image

Watch this video to learn how to insert and resize images you have saved on your computer into Google Docs.

YouTube Video

This interactive element is not available in this format. Visit the link or scan the QR code to access it online.

View this YouTube Video online

Dragging Pictures

Watch this video to learn how to insert, move, and resize images and pictures in Microsoft Word.

YouTube Video

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View this YouTube Video online

Sharing with Google Docs

This video demonstrates two ways to share documents you create in Google Docs with someone else. Google offers different types of sharing permissions so you can simply allow your work colleagues to view your materials, or you can offer editing permissions so you can all insert comments and suggest edits to collaborate on a single document.

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2.2.7.4: Basic Formatting Commands

Formatting refers to the appearance of a document. A confusing layout can be frustrating to read and difficult to understand. Documents that are organized and properly formatted are not only easier to read, but you probably want to highlight the data and information you want your audience to see clearly. For example, you may want to showcase how you and your team were able to achieve a difficult sales goal. In this section, we demonstrate how to use Microsoft Word and Google Docs to format documents as you want them to appear.

As we noted in the previous section, while some of these videos present commands or features of Google Docs or Microsoft Word, both programs share most of these same basic commands.

How to Format Your Text

Watch this video to learn about some basic Microsoft Word tools you can use to change the format your text, such as font size, bold, italics, strikethrough, subscript, superscript, and underline.

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Using Themes, Fonts, and Colors

Watch this video to learn how to use colors, fonts, and themes to change the appearance of your document.

YouTube Video

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View this YouTube Video online

Character Spacing

Watch this video to learn how to use Microsoft Word's character spacing options.

YouTube Video

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View this YouTube Video online

Using Styles

This video demonstrates how to use style commands to easily change the appearance of the text in your document. This formatting technique which is available in Google Docs and Word is especially useful when you create multi-page documents. Your materials will look more organized and are easier-to-read when the font type and spacing for each different level of header shares the same style.

YouTube Video

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View this YouTube Video online

More Tips for Formatting Multi-page Documents

Watch this video to learn some techniques for organizing multi-page Microsoft Word documents, such as using different types of headings, a table of contents, headers, and page numbers. We explore headers and footers in more detail at the end of Unit 3.

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Collaborating with Google Docs

While this tutorial is intended to prepare teachers who plan to use Google Docs to share materials and editing commands with their students, the principles apply to the workplace as well.

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More Advanced Google Docs Tools

This tutorial reviews advanced Google Docs features for making documents more visually appealing, such as adding new fonts to your toolbox, inserting media and tables, and using Google's explore panel to find additional resources.

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2.2.8: CREATING BUSINESS DOCUMENTS

In this unit, we discuss how to create and format two standard business documents, block-style business letters and memos. Word processing tools allow us to incorporate a variety of font styles to emphasize text. These techniques include creating text that is in bold type, in italics, and underlined. We can also use borders to create a visual break between sections of a document. Finally, we explore how you can add headers and footers to present a polished, professional, and organized business document.

Learning Objectives

Upon successful completion of this unit, you will be able to:

- outline the elements of a business letter and memo;
- format document margins and adjust spacing between headings and body text;
- add headers, footers, page numbers, and borders to a document;
- create a basic block-style business letter; and
- create a basic block-style business memo.

2.2.8.1: What is a Business Letter?

2.2.8.2: Creating a Block-Style Letter or Memo

2.2.8.3: Adjusting the Margins and Page Borders of your Business Letter

2.2.8.4: Creating Headers and Footers for your Business Letter

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2.2.8.1: What is a Business Letter?

Many businesses use standard templates and styles for their memos, letters, and emails. Since these formats are standardized, you can use these templates to quickly create business documents in the proper format.

How to Construct a Business LetterPage

Read this handout which discusses business writing and the proper way to format business letters. As you read, think about a work-related letter you have sent or received. Did you or the author follow these guidelines?

What this Handout is About

This handout will help you write business letters required in many different situations, from applying for a job to requesting or delivering information. While the examples that are discussed specifically are the application letter and cover letter, this handout also highlights strategies for effective business writing in general.

Principles to Keep in Mind

Business Writing is Different

Writing for a business audience is usually quite different than writing in the humanities, social sciences, or other academic disciplines. Business writing strives to be crisp and succinct rather than evocative or creative; it stresses specificity and accuracy. This distinction does not make business writing superior or inferior to other styles. Rather, it reflects the unique purpose and considerations involved when writing in a business context.

When you write a business document, you must assume that your audience has limited time in which to read it and is likely to skim. Your readers have an interest in what you say insofar as it affects their working world. They want to know the “bottom line”: the point you are making about a situation or problem and how they should respond.

Business writing varies from the conversational style often found in email messages to the more formal, legalistic style found in contracts. A style between these two extremes is appropriate for the majority of memos, emails, and letters. Writing that is too formal can alienate readers, and an attempt to be overly casual may come across as insincere or unprofessional. In business writing, as in all writing, you must know your audience.

In most cases, the business letter will be the first impression that you make on someone. Though business writing has become less formal over time, you should still take great care that your letter’s content is clear and that you have proofread it carefully.

Pronouns and Active versus Passive Voice

Personal pronouns (like I, we, and you) are important in letters and memos. In such documents, it is perfectly appropriate to refer to yourself as I and to the reader as you. Be careful, however, when you use the pronoun we in a business letter that is written on company stationery, since it commits your company to what you have written. When stating your opinion, use I; when presenting company policy, use we.

The best writers strive to achieve a style that is so clear that their messages cannot be misunderstood. One way to achieve a clear

style is to minimize your use of the passive voice. Although the passive voice is sometimes necessary, often it not only makes your writing dull but also can be ambiguous or overly impersonal. Here's an example of the same point stated in passive voice and in the active voice:

Passive voice: "The net benefits of subsidiary divestiture were grossly overestimated."

[Who did the overestimating?]

Active voice: The Global Finance Team grossly overestimated the net benefits of subsidiary divestiture.

The second version is clearer and thus preferable.

Of course, there are exceptions to every rule. What if you are the head of the Global Finance Team? You may want to get your message across without calling excessive attention to the fact that the error was your team's fault. The passive voice allows you to gloss over an unflattering point—but you should use it sparingly.

Focus and Specificity

Business writing should be clear and concise. Take care, however, that your document does not turn out as an endless series of short, choppy sentences. Keep in mind also that "concise" does not have to mean "blunt"—you still need to think about your tone and the audience for whom you are writing. Consider the following examples:

After carefully reviewing this proposal, we have decided to prioritize other projects this quarter.
Nobody liked your project idea, so we are not going to give you any funding.

The first version is a weaker statement, emphasizing facts not directly relevant to its point. The second version provides the information in a simple and direct manner. But you don't need to be an expert on style to know that the first phrasing is diplomatic and respectful (even though it's less concise) as compared with the second version, which is unnecessarily harsh and likely to provoke a negative reaction.

Business Letters: Where to Begin

Reread the description of your task (for example, the advertisement of a job opening, instructions for a proposal submission, or assignment prompt for a course). Think about your purpose and what requirements are mentioned or implied in the description of the task. List these requirements. This list can serve as an outline to govern your writing and help you stay focused, so try to make it thorough. Next, identify qualifications, attributes, objectives, or answers that match the requirements you have just listed. Strive to be exact and specific, avoiding vagueness, ambiguity, and platitudes. If there are industry- or field-specific concepts or terminology that are relevant to the task at hand, use them in a manner that will convey your competence and experience. Avoid any language that your audience may not understand. Your finished piece of writing should indicate how you meet the requirements you've listed and answer any questions raised in the description or prompt.

Application Letters and Cover Letters

Many people believe that application letters and cover letters are essentially the same. For purposes of this handout, though, these kinds of letters are different. The letter of application is a sales letter in which you market your skills, abilities, and knowledge. A cover letter, on the other hand, is primarily a document of transmittal. It identifies an item being sent, the person to whom it is being sent, and the reason for its being sent, and provides a permanent record of the transmittal for both the writer and the reader.

Application Letters

When writing an application letter, remember that you probably have competition. Your audience is a professional who screens and hires job applicants—someone who may look through dozens or even hundreds of other applications on the day she receives yours. The immediate objective of your application letter and accompanying resume is to attract this person's attention. Your ultimate goal is to obtain an interview.

As you write your application letter, be sure you complete three tasks: catch the reader's attention favorably, convince the reader that you are a qualified candidate for the job, and request an interview.

Application Letter Checklist:

- Identify the job by title and let the recipient know how you heard about it.
- Summarize your qualifications for the job, specifically your work experience, activities that show your leadership skills, and your educational background.
- Refer the reader to your enclosed resume.
- Ask for an interview, stating where you can be reached and when you will be available. If your prospective employer is located in another city and you plan to visit the area, mention the dates for your trip.
- If you are applying for a specific job, include any information pertinent to the position that is not included in your resume.

To save your reader time and to call attention to your strengths as a candidate, state your objective directly at the beginning of the letter.

I am seeking a position as a manager in your Data Center. In such a management position, I can use my master's degree in information systems and my experience as a programmer/analyst to address business challenges in data processing.

If you have been referred to a company by one of its employees, a career counselor, a professor, or someone else, mention that before stating your job objective.

Example:

> I am seeking a position as a manager in your Data Center. In such a management position, I can use my master's degree in information systems and my experience as a programmer/analyst to address business challenges in data processing.
>
> If you have been referred to a company by one of its employees, a career counselor, a professor, or someone else, mention that before stating your job objective.

Example:

> During the recent ARRGH convention in Washington, D.C., one of your sales representatives, Dusty Brown, informed me of a possible opening for a manager in your Data Center. My extensive background in programming and my master's degree in information systems make me highly qualified for the position.

In subsequent paragraphs, expand on the qualifications you mentioned in your opening. Add any appropriate details, highlighting experience listed on your resume that is especially pertinent to the job you are seeking. Close with a request for an interview. Proofread your letter carefully.

Two sample letters of application are presented below. The first letter (Sample Number 1) is by a recent college graduate responding to a local newspaper article about the company's plan to build a new computer center. The writer is not applying for a specific job opening but describes the position he seeks. The second letter (Sample Number 2) is from a college senior who does not specify where she learned of the opening because she is uncertain whether a position is available.

Sample Number 1

6123 Farrington Road, Apt. B11
Chapel Hill, NC 27514

January 11, 2005

Taylor, Inc.
694 Rockstar Lane
Durham, NC 27708

Dear Human Resources Director:

I just read an article in the News and Observer about Taylor's new computer center just north of Durham. I would like to apply for a position as an entry-level programmer at the center.

I understand that Taylor produces both in-house and customer documentation. My technical writing skills, as described in the enclosed resume, are well suited to your company. I am a recent graduate of DeVry Institute of Technology in Atlanta with an Associate's Degree in Computer Science. In addition to having taken a broad range of courses, I served as a computer consultant at the college's computer center where I helped train users to work with new systems.

I will be happy to meet with you at your convenience and discuss how my education and experience match your needs. You can reach me at my home address, at (919) 233-1552, or at krock@devry.alumni.edu.

Sincerely,

Raymond Krock

Sample Number 2

6123 Farrington Road, Apt. G11
Chapel Hill, NC 27514

January 11, 2005

Taylor, Inc.
694 Rockstar Lane
Durham, NC 27708

Dear Ms. Jones:

I am seeking a position in your engineering department where I may use my training in computer sciences to solve Taylor's engineering problems. I would like to be a part of the department that developed the Internet Selection System but am unsure whether you have a current opening.

I expect to receive a Bachelor of Science degree in Engineering from North Carolina State University in June and by that time will have completed the Computer Systems Engineering Program. Since September 2000, I have been participating, through the University, in the Professional Training Program at Computer Systems International in Raleigh. In the program I was assigned to several staff sections as an apprentice. Most recently, I have been a programmer trainee in the Engineering Department and have gained a great deal of experience in computer applications. Details of the academic courses I have taken are included in the enclosed resume.

If there is a position open at Taylor Inc., please let me know whom I should contact for further information. I look forward to hearing from you soon. I may be reached at my office (919-866-4000 ext. 232) or via email (Brock@aol.com).

Sincerely,

Rebecca Brock

Cover Letters

As mentioned previously, application letters and cover letters are not the same. A cover letter identifies an item being sent, the person to whom it is being sent, and the reason for its being sent. A cover letter provides a permanent record of the transmittal for both the writer and the reader.

In a cover letter, keep your remarks brief. Your opening should explain what you are sending and why. In an optional second paragraph, you might include a summary of the information you are sending. A letter accompanying a proposal, for example, might point out sections in the proposal that might be of particular interest to the reader. The letter could then go on to present a key point or two explaining why the writer's firm is the best one for the job. The closing paragraph should contain acknowledgements, offer additional assistance, or express the hope that the material will fulfill its purpose.

The following are examples of cover letters. The first letter (Sample Number 1) is brief and to the point. The second letter (Sample Number 2) is slightly more detailed because it touches on the manner in which the information was gathered.

Sample Number 1

Your Company Logo and Contact Information

January 11, 2005

Brian Eno, Chief Engineer
Carolina Chemical Products
3434 Pond View Lane
Durham, NC 27708

Dear Mr. Eno:

Enclosed is the final report on our installment of pollution control equipment at Eastern Chemical Company, which we send with Eastern's Permission. Please call me collect (ext. 1206) or email me at the address below if I can answer any questions.

Sincerely,

Nora Cassidy
Technical Services Manager
ncassidy@company.com

Enclosure: Report

Sample Number 2

Your Company Logo and Contact Information

January 11, 2005

Brian Eno, Chief Engineer
Ecology Systems, Inc.
8458 Obstructed View Lane
Durham, NC 27708

Dear Mr. Eno:

Enclosed is the report estimating our power consumption for the year as requested by John Brenan, Vice President, on September 4.

The report is the result of several meetings with Jamie Anson, Manager of Plant Operations, and her staff and an extensive survey of all our employees. The survey was delayed by the transfer of key staff in Building A. We believe, however, that the report will provide the information you need to furnish us with a cost estimate for the installation of your Mark II Energy Saving System.

We would like to thank Billy Budd of ESI for his assistance in preparing the survey. If you need more information, please let me know.

Sincerely,

Nora Cassidy
New Projects Office
ncassidy@company.com

Enclosure: Report

Works Consulted

We consulted these works while writing this handout. This is not a comprehensive list of resources on the handout's topic, and we encourage you to do your own research to find the latest publications on this topic. Please do not use this list as a model for the format of your own reference list, as it may not match the citation style you are using.

- Covey, Stephen R. *FranklinCovey Style Guide for Business and Technical Writing*. 5th ed. Upper Saddle River, N.J.: Franklin Covey, 2012.
- *Business and Administrative Communication* . Boston: McGraw-Hill, 2012.
- Source: The Writing Center, University of North Carolina at Chapel Hill, https://writingcenter.unc.edu/tips-and-tools/business-letters/

How to Construct a Business MemoPage

Read this chapter to learn how to formulate a business memo or email.

Memos

A memo (or memorandum, meaning "reminder") is normally used for communicating policies, procedures, or related official business within an organization. It is often written from a one-to-all perspective (like mass communication), broadcasting a message to an audience, rather than a one-on-one, interpersonal communication. It may also be used to update a team on activities for a given project or to inform a specific group within a company of an event, action, or observance.

Memo Purpose

A memo's purpose is often to inform and represent the business or organization's interests, but it occasionally includes an element of persuasion or a call to action. All organizations have informal and formal communication networks. The unofficial, informal communication network within an organization is often called the grapevine, and it is often characterized by rumor,

gossip, and innuendo. On the grapevine, one person may hear that someone else is going to be laid off and start passing the news around. Rumors change and transform as they are passed from person to person, and before you know it, the word is that they are shutting down your entire department.

One effective way to address informal, unofficial speculation is to spell out clearly for all employees what is going on with a particular issue. If budget cuts are a concern, then it may be wise to send a memo explaining the changes that are imminent. If a company wants employees to take action, they may also issue a memorandum.

Memo Format

A memo has a header with guide words that clearly indicate who sent the memo, who the intended recipients are, the date of the memo, and a descriptive subject line. The content of each guide word field aligns. The message then follows the header, and it typically includes a declaration (introduction), a discussion, and a summary.

Figure 4.1.1 shows a sample memo.

To: All employees
From: Larry Ogawa, IT Manager, The Widget Research Company
Date: June 15, 2018
Subject: New photocopier installations – July 5

On July 5, new photocopiers will be installed in the photocopier room on each floor. The installation will take place from 8:30 – 11:30 a.m. During this time, printing, scanning, and photocopying will not be available.

The old photocopiers will be disconnected from the network on the morning of July 5. Technicians will be on-site to simultaneously install the new machines on every floor in order to minimize printing downtime.

The new photocopiers have all of the same functionality as the ones they are replacing but will be faster and quieter. Training sessions will be organized so all employees can learn how to use the new machines. More details about these training sessions will be shared by the end of this month.

Please direct any questions or concerns to me.

Figure 4.1.1. A sample memo (Melissa Ashman, 2018, CC-BY-NC 4.0 international license)

Five Tips for Effective Business Memos

1. Audience Orientation

Always consider the audience and their needs when preparing a memo (or any message for that matter). An acronym or abbreviation that is known to management may not be known by all the employees of the organization, and if the memo is to be posted and distributed within the organization, the goal is to be clear and concise communication at all levels with no ambiguity.

2. Professional Tone

Memos are often announcements, and the person sending the memo speaks for a part or all of the organization. Use a professional tone at all times.

3. Subject Emphasis

The topic of the memo is normally declared in the subject line, and it should be clear, concise, and descriptive. If the memo is

announcing the observance of a holiday, for example, the specific holiday should be named in the subject line—for example, use “Thanksgiving weekend schedule” rather than “holiday observance.”

4. Direct Format

Some written business communication allows for a choice between direct and indirect formats, but memorandums are almost always direct. The purpose is clearly announced immediately and up-front, and the explanation or supporting information then follows.

5. Maintain Objectivity

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2.2.8.2: Creating a Block-Style Letter or Memo

When creating the basic block-style that many offices use for their emails, memos, and letters, be sure to pay attention to spacing between paragraphs and words, since it is an important component of block-style documents.

How to Create a Block-Style Letter in Microsoft Word

Watch this video for a tutorial on how to create a block-style letter using Microsoft Word.

YouTube Video

This interactive element is not available in this format. Visit the link or scan the QR code to access it online.

View this YouTube Video online

How to Create a Block-Style Letter in Google Docs

This video demonstrates how to create a block-style letter using Google Docs.

YouTube Video

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Block-Style Memos

Watch this video to learn how to create a block-style business memo.

Click here to watch: https://youtu.be/FZguY1Jlc9o?si=9-CUxw8OGRbVO-U6

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2.2.8.3: Adjusting the Margins and Page Borders of your Business Letter

Margins are the space between the text and edge of a document. By default, margins in Microsoft Word and Google Docs are set to one inch from the right, top, left, and bottom of the page. You may want to adjust the page margins if, for example, your company uses a logo at the top of the page. We can use page borders to customize documents with background colors and shading. You can apply a border to an entire page, a paragraph, or a section of text.

Margins in Microsoft Word

This video demonstrates how to change the margins in Microsoft Word.

YouTube Video

This interactive element is not available in this format. Visit the link or scan the QR code to access it online.

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Margins in Google Docs

While this video focuses on how to set up MLA formatting, it also shows how to adjust the page margins in Google Docs. Note that scholars use three main style conventions to format their documents depending on the subject matter: APA (American Physiological Association), MLA (Modern Language Association), and Chicago Manual of Style.

YouTube Video

This interactive element is not available in this format. Visit the link or scan the QR code to access it online.

View this YouTube Video online

Page Borders

Watch this brief video to learn how to add page borders to document.

YouTube Video

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2.2.8.4: Creating Headers and Footers for your Business Letter

This section focuses on how to use headers and footers which we often use when creating documents that have multiple pages. For example, they may contain information, such as the author's name, date and time, or page numbers. As their names suggest, headers appear at the top of a document, while footers appear at the bottom.

Headers and Footers in Google Docs

Watch this video to learn how to create headers and footers in Google Docs.

YouTube Video

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Headers and Footers in Microsoft Word

Watch this video to learn how to create headers and footers in Microsoft Word.

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2.3: End of Chapter Summary

Summary: Introduction to Word-Processing Applications in Agriculture

Word-processing applications are crucial tools in agriculture, significantly enhancing productivity by facilitating the creation, editing, and management of textual documents. They support various administrative and operational tasks, crucial for efficient farm management and communication.

1. **Typing and Editing:** These applications enable efficient drafting and refining of documents, including reports and correspondence, with features like spell check and grammar correction ensuring professional quality.
2. **Printing:** They support the production of physical documents for record-keeping and compliance, offering formatting options to produce high-quality printed materials.
3. **Creating and Formatting Documents:** Word-processing tools allow users to create diverse documents such as reports and brochures, with formatting options that enhance readability and presentation.
4. **Creating Business Documents:** Essential for producing professional documents like proposals and contracts, these applications provide templates and design tools for effective communication with stakeholders.

Applications in Agriculture:

- **Documentation and Reporting:** Draft detailed reports and compliance documents.
- **Record Keeping:** Maintain comprehensive records of farm activities.
- **Communication:** Prepare letters, emails, and proposals.
- **Training and Education:** Develop instructional materials for farm staff.
- **Marketing and Promotion:** Design promotional materials.
- **Grant and Proposal Writing:** Craft applications for funding.
- **Custom Templates and Forms:** Create templates for operational tasks.

In summary, word-processing applications streamline the creation and management of agricultural documents, enhancing administrative efficiency and supporting various operational and communication needs.



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2.4: End of Chapter Discussion

Discussion Topics: Word Processing and Its Application to Agriculture

1. Creating Effective Farm Reports

- **Discussion Topic:** Discuss how word-processing tools can be used to create comprehensive and well-organized farm reports, including crop yields, financial summaries, and operational reviews.
- **Key Points:**
  - Best practices for structuring farm reports to ensure clarity and completeness.
  - The use of templates and styles for consistent formatting.
  - Incorporating tables, charts, and graphs to visually represent data.

2. Developing Agricultural Documentation and Manuals

- **Discussion Topic:** Explore the role of word-processing software in developing detailed documentation and operational manuals for farm management, including Standard Operating Procedures (SOPs) and equipment manuals.
- **Key Points:**
  - How to create clear and user-friendly manuals for farm equipment and processes.
  - The benefits of using headings, bullet points, and numbered lists for easy navigation.
  - The importance of version control and updating documents as procedures change.

3. Drafting Proposals and Grant Applications

- **Discussion Topic:** Analyze how word-processing applications assist in drafting and formatting proposals and grant applications for agricultural projects and funding.
- **Key Points:**
  - Structuring proposals to effectively communicate project goals, methodology, and budget.
  - Using features like comments and track changes for collaborative proposal writing.
  - Tips for adhering to specific formatting guidelines required by funding agencies.

4. Managing Agricultural Correspondence

- **Discussion Topic:** Discuss the use of word-processing tools for managing correspondence, including letters to suppliers, communications with stakeholders, and customer service responses.
- **Key Points:**
  - Creating and using templates for common types of correspondence.
  - Strategies for ensuring professional and consistent communication.
  - Using mail merge features to handle bulk communications efficiently.

5. Documenting Research Findings and Data

- **Discussion Topic:** Examine how word-processing software can be used to document and present research findings, including experimental results, field studies, and market analyses.
- **Key Points:**
  - Organizing research documents with sections for methodology, results, and conclusions.
  - Incorporating references and citations to support research findings.
  - Using footnotes and endnotes to provide additional context and details.

6. Developing Marketing Materials for Agricultural Products

- **Discussion Topic:** Explore how word-processing tools are used to create marketing materials such as brochures, flyers, and product labels for agricultural products.
- **Key Points:**
  - Design principles for creating visually appealing and informative marketing materials.
  - Incorporating images, graphics, and branding elements effectively.
  - Techniques for customizing materials for different target audiences.

7. Managing Farm Records and Logs

- **Discussion Topic:** Discuss the role of word-processing applications in maintaining detailed records and logs for farm activities, including planting schedules, equipment maintenance, and livestock management.
- **Key Points:**
  - Setting up templates for various types of records and logs.
  - Strategies for keeping records accurate and up-to-date.
  - Benefits of digitizing records for easier access and analysis.

8. Creating Training Materials and Educational Content

- **Discussion Topic:** Analyze how word-processing software is used to create training materials and educational content for farm staff and agricultural education programs.
- **Key Points:**
  - Designing training manuals and instructional guides that are clear and engaging.
  - Using visual aids such as diagrams and illustrations to enhance learning.
  - Ensuring that content is accessible and relevant to the target audience.

9. Collaboration and Document Sharing

- **Discussion Topic:** Explore the collaborative features of word-processing software and their application in agricultural settings, including document sharing and teamwork on farm-related projects.
- **Key Points:**
  - Using collaborative features like comments, tracked changes, and shared editing.

- Managing document versions and ensuring all team members have access to the latest information.
- Strategies for effective communication and collaboration on documents.

10. Ensuring Document Security and Privacy

- **Discussion Topic:** Discuss the importance of document security and privacy when using word-processing software for sensitive agricultural data and information.
- **Key Points:**
  - Implementing password protection and encryption for confidential documents.
  - Best practices for managing document access and permissions.
  - Addressing potential risks and ensuring compliance with data protection regulations.

By engaging with these discussion topics, participants will gain insights into the practical applications of word-processing tools in agriculture, enhancing their ability to manage, communicate, and document various aspects of farm operations effectively.



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3: SPREADSHEET APPLICATIONS IN AGRICULTURE

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3.1: Chapter Introduction

Introduction to Using Spreadsheets in Agricultural Applications

In modern agriculture, spreadsheets have become indispensable tools for managing and analyzing a wide range of data. A spreadsheet is a digital tool that organizes data into rows and columns, allowing users to perform calculations, create graphs, and manage information efficiently. The versatility of spreadsheets makes them highly valuable in agriculture, where precise data management and analysis are crucial for optimizing productivity and ensuring sustainable practices.

Spreadsheets, such as Microsoft Excel and Google Sheets, offer a variety of functions that are particularly beneficial for agricultural applications. These include the ability to perform complex calculations, track financial transactions, and analyze crop yields. Farmers and agricultural managers can utilize spreadsheets to maintain detailed records of planting schedules, monitor input costs, and evaluate the performance of different crops or livestock. The ability to use formulas and functions within spreadsheets facilitates the automation of calculations, reducing manual errors and saving time.

Furthermore, spreadsheets enable the visualization of data through charts and graphs, which helps in understanding trends and making informed decisions. For instance, a farmer can create graphs to compare crop yields over different seasons or analyze the impact of various fertilization strategies on crop performance.

The collaborative nature of cloud-based spreadsheets allows multiple users to access and update data simultaneously, which is advantageous for team-based farm management and decision-making. Additionally, spreadsheets support data import and export, making it easier to integrate information from other software systems or share data with stakeholders.

Overall, spreadsheets serve as powerful tools in agricultural applications by enhancing data organization, improving decision-making processes, and increasing overall operational efficiency. As technology advances, leveraging spreadsheets effectively can provide farmers with valuable insights and help them achieve their agricultural goals.



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3.2: Chapter Learning Objectives

Learning Objectives: Introduction to Spreadsheets and Applying Spreadsheets to Agriculture

Learning Objectives

1. Understanding Spreadsheet Basics

- **Objective:** Identify and describe the key components of a spreadsheet, including cells, rows, columns, and worksheets.
- **Outcome:** Learners will be able to navigate and utilize basic features of spreadsheet software, such as Microsoft Excel or Google Sheets.

2. Creating and Formatting Spreadsheet Documents

- **Objective:** Demonstrate the ability to create, format, and organize spreadsheet documents to suit agricultural data management needs.
- **Outcome:** Learners will be able to set up and format spreadsheets effectively, including adjusting cell sizes, applying styles, and using conditional formatting to highlight key data.

3. Utilizing Formulas and Functions

- **Objective:** Apply basic and advanced formulas and functions to perform calculations and analyze agricultural data.
- **Outcome:** Learners will be able to use formulas for common agricultural tasks such as calculating crop yields, input costs, and financial projections, as well as employ functions for data analysis.

4. Managing Agricultural Data with Spreadsheets

- **Objective:** Organize and manage agricultural data efficiently using spreadsheets, including data entry, sorting, and filtering.
- **Outcome:** Learners will be able to input and manage farm-related data, such as planting schedules, irrigation logs, and livestock records, ensuring data accuracy and accessibility.

5. Visualizing Agricultural Data

- **Objective:** Create charts and graphs to visualize agricultural data for better understanding and decision-making.
- **Outcome:** Learners will be able to generate various types of charts (e.g., bar charts, line graphs, pie charts) to represent crop performance, financial trends, and other key metrics.

6. Analyzing and Interpreting Agricultural Data

- **Objective:** Analyze and interpret agricultural data using spreadsheet tools to make informed decisions and identify trends.
- **Outcome:** Learners will be able to perform data analysis tasks, such as trend analysis and scenario modeling, to support decision-making in areas like crop management and resource allocation.

7. Collaborating and Sharing Spreadsheet Data

- **Objective:** Utilize collaborative features of cloud-based spreadsheets to share and work on documents with team members or stakeholders.
- **Outcome:** Learners will be able to collaborate on spreadsheet documents, manage permissions, and track changes to enhance teamwork and data sharing in agricultural projects.

8. Integrating Spreadsheets with Other Agricultural Tools

- **Objective:** Integrate spreadsheet data with other agricultural software and tools to streamline data management and improve operational efficiency.
- **Outcome:** Learners will be able to import and export data between spreadsheets and other systems (e.g., farm management software, GPS tools) to ensure consistency and enhance data analysis.

9. Ensuring Data Accuracy and Security

- **Objective:** Implement practices to ensure the accuracy and security of agricultural data stored in spreadsheets.
- **Outcome:** Learners will be able to apply data validation techniques, create backup copies, and use security features to protect sensitive agricultural information.

By achieving these learning objectives, learners will gain the skills necessary to effectively use spreadsheets for managing and analyzing agricultural data, leading to improved decision-making and operational efficiency in farming and agriculture.

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3.2.1: What is a Spreadsheet?

A **spreadsheet** is a collection of data that is organized into rows and columns. Microsoft® Excel is a spreadsheet application used to store and analyze quantitative data. An Excel file is called a **workbook**, and it is saved with an .xlsx extension. A workbook file consists of one or more **worksheets** which consists of many columns and rows. **Columns** are the vertical part of a worksheet grid identified by letters. Rows are the horizontal part of a worksheet grid identified by numbers. The intersection of a row and column is called a **cell**. Each cell can store a single item of data. The data can contain text, numbers, formulas, and/or functions. Clicking a cell with the mouse pointer will make the selected cell the **active cell**. The active cell's contents are displayed in the formula bar.

Typical uses for Excel include:

- Accounting reports (Balance Sheets, Income Statements, etc)
- Budgets
- Calendars
- Checklists and task lists
- Contact/Address lists
- Expense tracking
- Inventory control
- Invoices
- Mortgage and other financial calculations
- Operational statistics
- Sales price lists, forecasts and analysis

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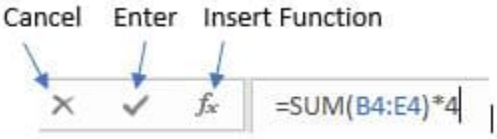
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3.2.2: Entering Data

Type of Data	Purpose
Label	Any text. Cannot be used in calculations. Left-aligned.
Value	Numbers that can be used in calculations. Right-aligned.
Date/Time	Can be used in calculations. Right-aligned.
Formula	An expression that starts with an equal sign and produces a result that may contain numbers, text, operators and/or functions.

Types of Data

Excel is great tool for generating useful information from data. However, the data has to be entered before it can be analyzed and manipulated. There are numerous types of data, and numerous ways to streamline data entry. As data is typed, it appears in the active cell and in the formula bar. Pressing the Enter key will complete data entry and make the next cell in the column the



active cell. If moving to the next cell after completing data entry is not the desired outcome, try clicking the Enter check mark in the formula bar. The data will be entered, but the active cell remains the current cell. Pressing the Esc key before completing data entry will cancel data entry and restore the original cell contents.

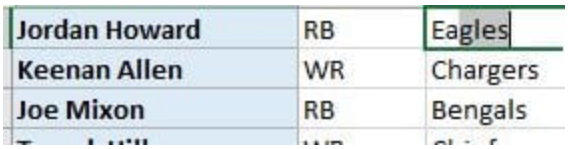
Streamlining data entry in Excel can be accomplished using several different features including keyboard shortcuts and Automatic Completion. **Keyboard shortcuts** allow rapid navigation in a worksheet without having to use the mouse.

Keyboard Shortcut	Result
Ctrl + C	Copy the cell contents to the clipboard.
Ctrl + X	Cut the cell contents and copy to clipboard.
Ctrl + V	Paste the contents from the clipboard.
Ctrl + N	Open a new workbook.
Ctrl + S	Save the current workbook (with same name).
F12	Opens the Save As window (save to a new location or with a new name).
Ctrl + P	Print the file.
Ctrl + F2	Open Print Preview window.
Ctrl + Z	Undo last action.
Ctrl + A	Select the entire worksheet.

Excel shortcuts

There are hundreds of keyboard shortcuts available in Excel and many are also available in other Microsoft Office applications. A few keyboard equivalents are illustrated at right, but for more examples, use the shortcut F1 to open the Help pane, and type *keyboard shortcuts* in the Excel Help field.

When entering data into a sheet that contains a lot of duplicates, Excel uses the Automatic Completion feature to speed up data entry. After typing a couple of characters, Excel guesses how to fill the rest of the cell based on data previously entered in the cells above.



To accept the suggestion (in highlighted text), press Enter, or alternatively, continue typing to replace the automatic entry.

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3.2.3: Selecting Data

After entering data, a common practice is to begin formatting the data. However, before a user can format the data, they must first select the data. Selecting data has multiple techniques based on user intent. Clicking on a single cell makes that cell the active cell. The cell reference appears in the Name box to the left of the formula bar. To select an entire column of data, just click the column letter heading. To select an entire row, click the row number heading. If a user wants to select several cells adjacent to each other, this would be considered selecting contiguous cells. Clicking the middle of the cell and dragging horizontally or vertically will select a **contiguous** range of cells. Another way to select a contiguous range of sequential cells is to click the first cell, hold down the Shift key, and click the last cell in the range. For example, clicking cell A3, and then holding down the Shift key and selecting F7 would select all of the cells from A3 through F7. The range reference would be written as A3:F7.

	A	B	C	D	E	F	G
1	Little Lizzie's Girl Scout Cookie Sales						
2							
3	Date	Thin Mints	Chocolate /Peanut Butter	Carmel D'Lites	Peanut Butter Sandwich	Sales $$	
4	1-Feb	13	10	8	3	$136	
5	2-Feb	11	18	13	7	$196	
6	3-Feb	12	19	8	4	$172	
7	4-Feb	13	18	4	4	$156	
8	5-Feb	15	11	7	3	$144	
9	6-Feb	8	9	2	5	$96	
10	7-Feb	2	3	0	2	$28	

Contiguous Range

Selecting a non-contiguous range of cells requires the use of the Ctrl key. To select **non-contiguous cells**, click the first cell, hold down the Ctrl key, and click each additional cell. This practice is sometimes referred to as “cherry-picking” cells. In the example below, the selected range of cells are A4,A6,A7,F4,F6,F7. This practice can be used for selecting non-adjacent rows or columns as well.

	A	B	C	D	E	F
1	Little Lizzie's Girl Scout Cookie Sales					
2						
3	Date	Thin Mints	Chocolate /Peanut Butter	Carmel D'Lites	Peanut Butter Sandwich	Sales $$
4	1-Feb	13	10	8	3	$136
5	2-Feb	11	18	13	7	$196
6	3-Feb	12	19	8	4	$172
7	4-Feb	13	18	4	4	$156
8	5-Feb	15	11	7	3	$144
9	6-Feb	8	9	2	5	$96

Non-Contiguous cells

To select the entire worksheet, click the triangle box located to the left of column A and above row 1, or by pressing the keyboard shortcut: Ctrl+A.

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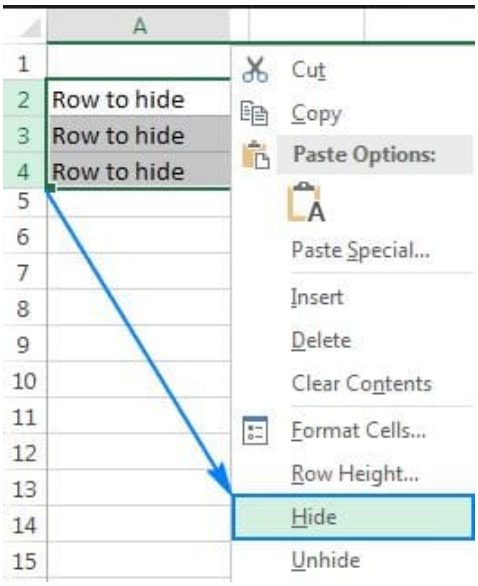
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3.2.4: Inserting Data

It is usually easy to add data to an existing worksheet, because Excel has seemingly unlimited columns and rows of cells. (There are limits, but this is not Jeopardy!) Nonetheless, sometimes it is necessary to insert a column or row into the middle of an existing range of cells.

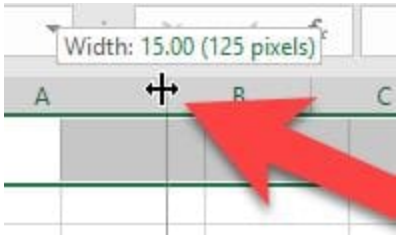


To insert a new column, select the column heading to the right of where you want the new column to appear, and click the top-half of the Insert button from the Home tab. Alternatively, just right-click the column heading to the right of the destination, and choose Insert from the **Context Menu.** Deleting columns is very similar. Whichever column(s) that are selected will be deleted if using the Delete button instead of the Insert button. Inserting and deleting rows is also very similar. Selecting the row below the intended new row and either choosing Insert from the ribbon or from the Context Menu will create a new row above the selection. For example, right-clicking row 10, and choosing Insert from the Context Menu will create a new, blank row 10, and all existing data will move down one row.



Shortcut menu Excel

Using the right-click method is a little faster than clicking the worksheet and then clicking the ribbon, as the shortcut menu avoids the need to move the mouse to the ribbon. The Context Menu, also known as Shortcut Menu, provides added functionality by offering actions that can be taken with the selected item. In addition to inserting and deleting, formatting column widths and row heights, as well as hiding and unhiding columns and rows are options from the Context Menu. Adjusting the column width is a common action since excessively wide columns prohibit efficient worksheet printing. Therefore, it is often preferable to widen a column width by double-clicking the boundary bar that separates the column heading letters. This is known as **auto-fitting** the column width since the column will resize its width to be just wide enough to display the longest data contained in that column.



Column width pointer

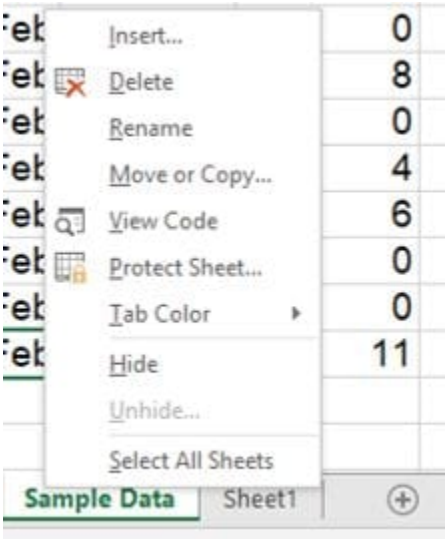
Clicking and dragging the double-arrow pointer to the left or right allows users to manually adjust the column width.

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3.2.5: Manipulating Sheets

An Excel workbook consists of one or more worksheets.



Sheet Shortcut menu

Much like a binder can have multiple sections of sheets divided by colorful tabs, an Excel workbook can multiple sheets that can be re-arranged, colored and renamed to fit individual organization plans. Inserting and deleting worksheets is similar to the inserting of columns and rows. In addition to using the Insert or Delete buttons from the ribbon, right-clicking an existing sheet tab will produce a Context Menu with a plethora of options.

Just as inserting a new column will add the column to the left of the selected column, the newly inserted worksheet will appear to the left of the selected sheet tab. Options exist to insert a blank worksheet or a new sheet based off of an existing template. Clicking and dragging sheet tabs are easy method to rearrange the order of sheets. However, the Move or Copy... command offers the opportunity to move or place a duplicate sheet within an existing, open workbook. Adding tab colors and the Rename option can help organize sheets to user-specific criteria. Sheets can also be hidden and unhidden. If it is necessary to prevent others from unhiding sheets, the workbook can be protected with a password to be able to modify the sheets. The tab scrolling buttons to the left of the sheet tabs are enabled when too many sheets exist to be displayed above the status bar. To quickly add a new, blank sheet to the workbook, click the plus button  to the right of the sheet tabs.

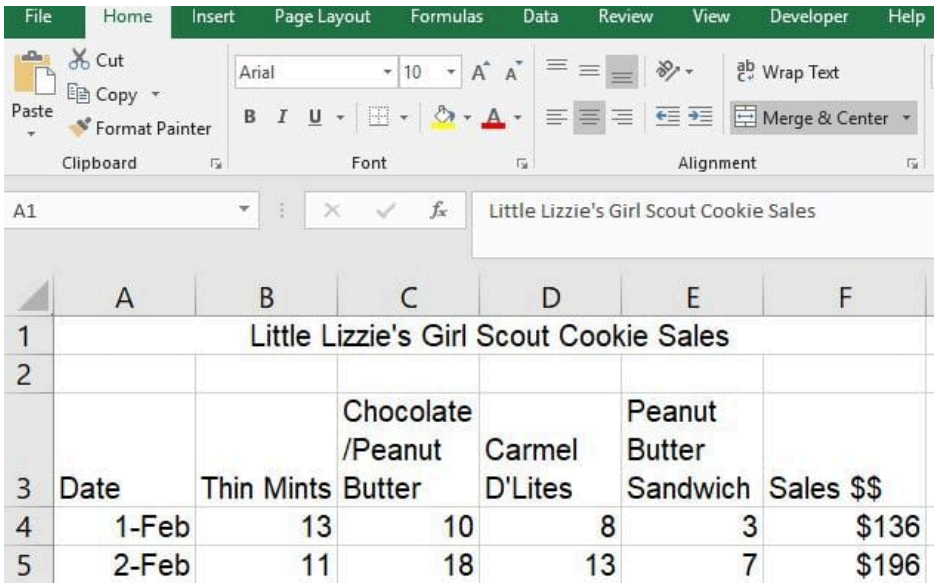
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3.2.6: Formatting Worksheets

Formatting data generally makes it easier to comprehend, and more attractive. The goal of formatting a business spreadsheet should be to make it look professional, accurate, and understandable. Options to format worksheet data depends a lot on the type of data. Formatting text in Excel is very similar to formatting text in Word. Using the Font and Alignment group icons on the Home tab of the ribbon, users can manually format all of the data in a cell or in a range of cells. Changing default formats includes things like changing the font color, style, size, text alignment in a cell, or apply formatting effects – all in an effort to make the data appear more visible.

Excel's tabular layout (organized into labeled columns and numbered rows) sometimes limits the amount of data that can be efficiently displayed.



	A	B	C	D	E	F
1	Little Lizzie's Girl Scout Cookie Sales					
2						
3	Date	Thin Mints	Chocolate /Peanut Butter	Carmel D'Lites	Peanut Butter Sandwich	Sales $$
4	1-Feb	13	10	8	3	$136
5	2-Feb	11	18	13	7	$196

Alignment of data

Using the Alignment group options can help format data to make it appear as much like a word processed report as possible. In the screenshot above, two Excel-unique formatting features help make the data more readable. In row 1, the text has been merged and centered across cells A1:F1. This required the cell range A1:F1 be selected before clicking the **Merge & Center** button from the Alignment group. This is very popular for worksheet titles. If the wrong cell range was selected and the Merge & Center is not effective, the user must re-select the Merge & Center button to unmerge the data, so the correct range can be selected before again clicking the Merge & Center button.

Another popular Excel text-formatting feature illustrated above is the **Wrap Text** tool, which will prevent text from being truncated by wrapping the text into multiple rows within the same cell. If a cell has a lot of text, the data will overlap into the next cell to the right of the active cell. However, if the adjacent cell already has data, the text will be truncated (cut-off) without applying this feature. Cells C3:E3 in the above screenshot each have the Wrap Text feature applied.

While Excel has some pretty useful text-formatting functionality, the majority of data entered into Excel is usually numerical data. Therefore, utilizing Excel's number formats effectively is crucial to make the worksheet as professional as possible. Professional formatting relies a lot on consistent formatting. Therefore, using the Format Painter tool (introduced in the Word chapters) and workbook themes are very helpful to maintain that consistency. Changing the existing **theme** will dynamically update the appearance of all worksheets in a workbook by modifying the fonts, styles, colors and/or effects.

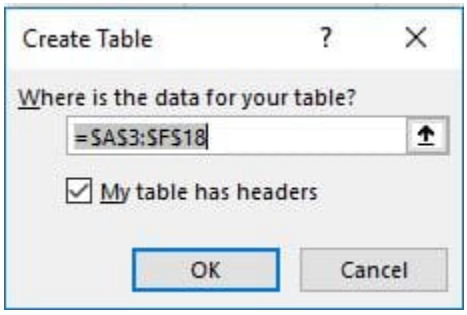
Applying the correct cell format to numerical data is more than just style – it is substance too, because applying the wrong format can impact how other, related cell results are interpreted. The following graphic describes some of the more popular number formats. In addition to the examples provided, there are also other formats, including date & time values, which can be accessed by clicking the Number Format drop-down list.

	A	B	C	D	E	F	G	H	I	J
1	Number Formats									
2	Format Name	Example	Ribbon Icon	Description						
3	General	7500		Default format; displays the numbers the way they were typed.						
4	Number	7500.00		Displays the number with two decimal places.						
5	Currency	$7,500.00		Displays the number with a currency symbol and two decimals.						
6	Accounting	$ 7,500.00	$	Similar to Currency format except the currency symbol left aligns.						
7	Percentage	750000.00%	%	Displays the number as a percentage and two decimals.						
8	Comma	7,500.00	,	Displays the number with two decimal places.						

Number Formats

Changing the number of decimals displayed can be manipulated by the Increase Decimal and Decrease Decimal buttons in the Number group. The displayed value could change to a rounded value, however, the actual value stored in the cell has not changed unless a ROUND function has been applied. Formatting only affects how the value is displayed. Applying formats can result in number signs (#####) being displayed in a cell. This is not an error, but an indication that the cell width is not wide enough to display the formatted number.

Excel data can also be formatted as a table. A **table** is a collection of related data, organized into a tabular layout of rows and columns, that can be manipulated via sorting, filtering and formulas. To create a table, select the data and click Insert > Table from the ribbon to open the Create Table dialog window.



Create table

Applying a table style will format the table with a predefined set of special table properties that includes options to define a header row or total row, and to band the row and/or columns to make the data easier to read. The filter buttons can also be removed. If the table functionality is no longer desired, click the Convert to Range option in the Tools group of the Design tab to convert the table to a normal range.

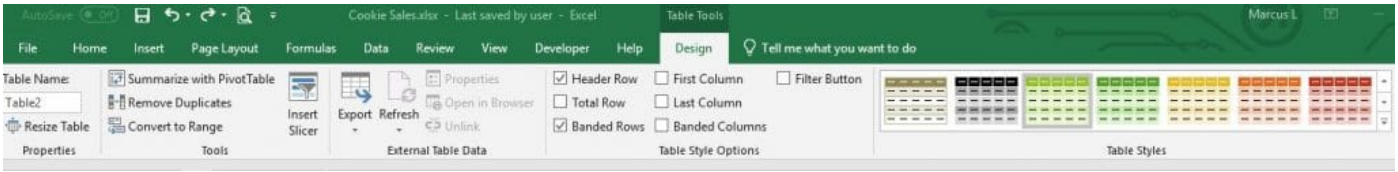


Table Tools Design tab

	A	B	C	D	E	F
1	Little Lizzie's Girl Scout Cookie Sales					
2						
3	Date	Thin Mints	Chocolate/ Peanut Butter	Carmel D'Lites	Peanut Butter Sandwich	Sales $$
4	1-Feb	13	10	8	3	$136
5	2-Feb	11	18	13	7	$196
6	3-Feb	12	19	8	4	$172
7	4-Feb	13	18	4	4	$156
8	5-Feb	15	11	7	3	$144
9	6-Feb	8	9	2	5	$96
10	7-Feb	2	3	0	2	$28

Table style Blue, Table Style Medium 16 with banded rows, a header row, and filter buttons.

There are many additional formatting tools available within Excel, but it is important to consider that sometimes, less is more! Too much formatting can be overkill and reduce the readability of a worksheet. Try to limit the use of multiple colors, fonts, and background colors/graphics. Format with a design purpose, not to entertain, and don't forget to use the Spell Check tool (F7) to proof your workbook before printing or sharing!

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3.2.7: Creating Formulas to Perform Calculations

Perhaps the biggest benefit of using Excel is its ability to create formulas that, when written correctly, can dynamically update when predecessor data is updated. Formulas are mathematical calculations using data in the existing workbook to calculate new values. All formulas in Excel must begin with an equal sign (=), and can contain cell references, ranges of cell references, arithmetic operators, and constants as part of the formula's **syntax**. Calculations in Excel follow normal math rules as it pertains to the order of operations rule. There are mnemonics available in various dialects to help decipher the order. The following graphics illustrate the order of operations rules and different formula syntax examples:

Order of Operations Rules		
American	**British**	**Canadian**
(P) Parenthesis	(B) Brackets	(B) Brackets
(E) Exponentiation	(O) Orders	(E) Exponentiation
(M) Multiplication	(D) Division	(D) Division
(D) Division	(M) Multiplication	(M) Multiplication
(A) Addition	(A) Addition	(A) Addition
(S) Subtraction	(S) Subtraction	(S) Subtraction

Formula Example	Description
=A4 + B4	Uses cell references and the plus sign mathematical operator.
= (A4 + B4) * 4	Uses cell references, parenthesis, a plus sign and multiplication symbol, as well as a constant value.
=SUM(A4:A11)	Uses a function and a cell range.

Formula Rules

Formulas typically reference values stored in other cells. For example, in the Accounting equation: Assets = Liabilities + Owner's Equity, one could calculate the Owner's Equity using a formula. Assume that the value for Total Assets resides in cell D30, and the value for Total Liabilities resides in D60. The formula for Owner's Equity in D65 using cell references would be =D30-D60. Using cell references is advantageous because if any of the cells that generate either the Total Assets or Total Liabilities is changed, the formulas in D30, D60 and D65 will also get updated. Another advantage is when a cell containing a formula is copied to another location, the formula will dynamically update to the new location's reference information. This is called **Relative Cell Referencing**. If the formulas in column D are copied to column E, the new formula for Owner's Equity in column E will be =E30-E60. Additionally, if rows are added or deleted in the range that the Total formulas reference, the formula will automatically update to the new formula range.

Entering the syntax for a formula can be accomplished through typing the formula components, using a **pointing** technique or a combination of both. The pointing method can help avoid typing errors. In the Owner's Equity example, the user would start by typing the equal sign, and then instead of typing D30, just click on D30. Continue by pressing the minus sign, and then click on cell D60, and the click the Enter check mark on the formula bar. Using the point method is even more practical when defining large cell ranges in formulas. Just make sure not to reference the active cell in the formula. This will likely create a **circular reference** error, which is a formula in a cell that directly or indirectly refers to its own cell.

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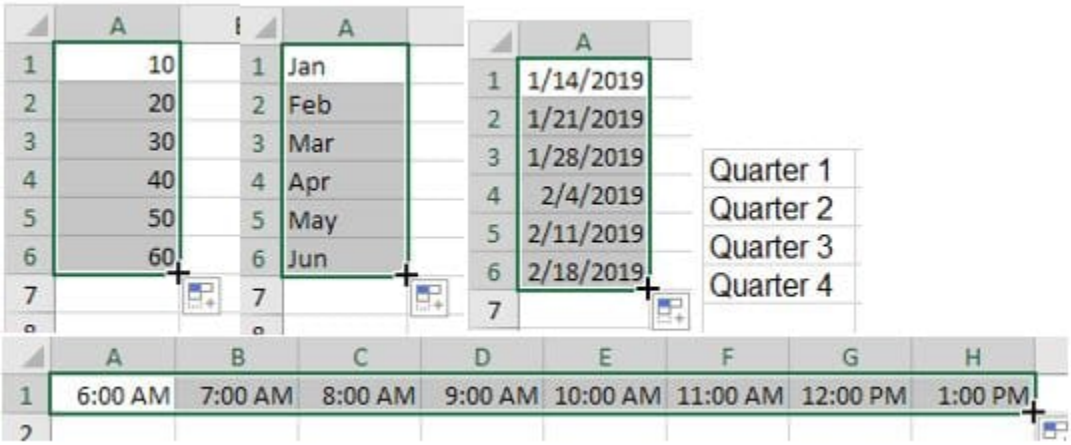
3.2.8: Copying and Pasting Formulas



Cut copy paste icons

Data in Excel can be cut, copied and pasted using similar shortcut menu options, keyboard equivalents, and ribbon icon commands as seen in Microsoft Word. Following operating system file management principles, moving data is synonymous with using the “Cut” and “Paste” commands, while duplicating data is the same as using the “Copy” and “Paste” commands. Other terminology that should be recognized is “source”, which is the cell or range to be moved or duplicated, and “destination”, which is the upper-left cell in a worksheet where the data is to be pasted.

Copying and pasting formulas contain cell references is a very powerful feature, and to expedite this process, Excel has a nifty feature called **AutoFill.** The AutoFill procedure utilizes the **fill handle**, which is the solid, green square in the lower-right corner of the active cell or cell range. Clicking and dragging the fill handle to adjacent cells (horizontally or vertically) will copy and paste the contents and update the destination cells with relative cell references or sequential data aligned with built-in Custom Lists. This should save significant time, and likely improve accuracy, and AutoFill has many uses.



AutoFill Examples

Not only can AutoFill copy formulas, but it also be used to complete lists that have a recognizable pattern. It is helpful to select the source cells that demonstrate a pattern, then hover the mouse pointer over fill handle. The mouse pointer will change from the default pointer icon to a thin, black plus sign. The patterns can be numbers, dates, months, days of the week, etc. If AutoFill incorrectly guesses the series pattern, the AutoFill Options icon is available to change the paste actions. In the screenshots below, the fill handle in cell D5 will by copied to cells D6:D13. The results shown in the second screenshot will update the formula from D5 with relative cell references to rows 6:13. What is happening in cells D7:D8?

D5 =B5-C5

	A	B	C	D
1	Peach Sales Profits			
2	Rotary Club			
3				
4	Year	Income	Expenditures	Balance
5	2012	9,000.00	3,952.96	5,047.04
6	2013	6,895.00	6,649.45	
7	2014	8,536.00	10,807.94	
8	2015	7,560.00	10,104.10	
9	2016	9,019.80	9,865.99	
10	2017	12,113.60	9,838.57	
11	2018	14,816.00	10,183.40	
12				
13		67,940.40	61,402.41	
14				

AutoFill before filling

D5 =B5-C5

	A	B	C	D
1	Peach Sales Profits			
2	Rotary Club			
3				
4	Year	Income	Expenditures	Balance
5	2012	9,000.00	3,952.96	5,047.04
6	2013	6,895.00	6,649.45	245.55
7	2014	8,536.00	10,807.94	#######
8	2015	7,560.00	10,104.10	#######
9	2016	9,019.80	9,865.99	-846.19
10	2017	12,113.60	9,838.57	2,275.03
11	2018	14,816.00	10,183.40	4,632.60
12				0.00
13		67,940.40	61,402.41	6,537.99
14				

AutoFill after

Practice 5: Test Scores

	A	B	C	D	E
1	Student Name	Test 1	Test 2	Test 3	Total Points
2	Amir	98	77	80	
3	Beto	85	90	88	
4	C.C.	100	84	96	
5	Dharma	89	66	94	
6	Evan	69	89	88	
7	Felix	75	80	80	

Excel Test Scores Start

1. In a new Excel workbook, enter the above data.
2. Make sure to apply bold formatting to row 1, and text wrapping to cell E1.
3. Format the data as a table with a header row and banded rows, but no Filter buttons.
4. Apply the Facet theme.
5. Ensure that cell E1 has the text wrapping format applied and then resize the column width of column E to be 7 points wide and the height of row 1 to 36 points.
6. AutoFit columns B, C & D.
7. In cell E2, enter the following formula: =B2+C2+D2 and click Enter. Your worksheet should look like the screenshot at right. Notice that Excel automatically filled in formulas for the rest of column E cells using relative cell references! If this action is unwanted, click the lightning icon, and choose to Undo the Calculated Column.

	A	B	C	D	E
1	Student Name	Test 1	Test 2	Test 3	Total Points
2	Amir	98	77	80	255
3	Beto	85	90	88	263
4	C.C.	100	84	96	280
5	Dharma	89	66	94	249
6	Evan	69	89	88	246
7	Felix	75	80	80	235

Excel Test Scores Step 7

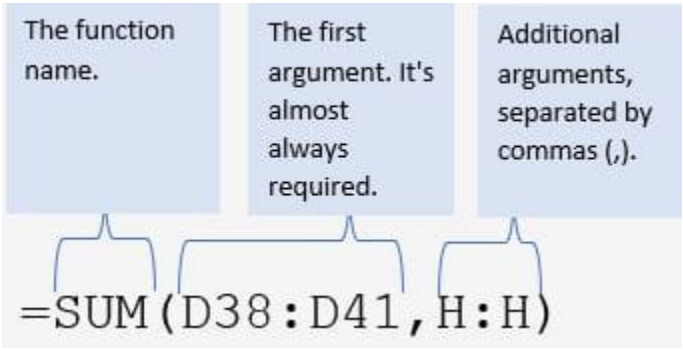
8. Press F12 to invoke the Save As command and save the file as Test Scores.xlsx.

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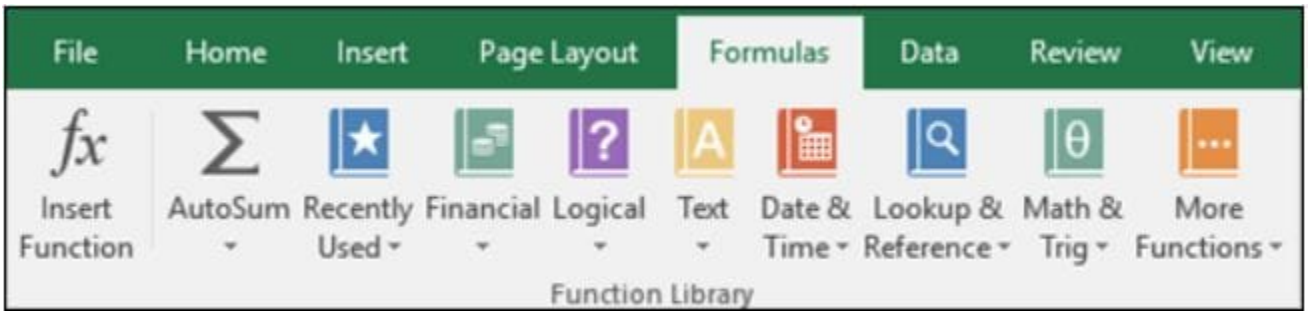
3.2.9: Adding Basic Functions to Formulas

Excel contains over 400 built-in functions that can be included in a formula to perform common calculations. A **function** performs a calculation on data called arguments to compute a result. **Arguments** are variables or values the function requires and are contained within parenthesis, and usually consist of cell references, but can also contain constants, text, cell ranges, and even other functions! The syntax of a formula using a function is: *function name*(argument1, argument2, etc.)



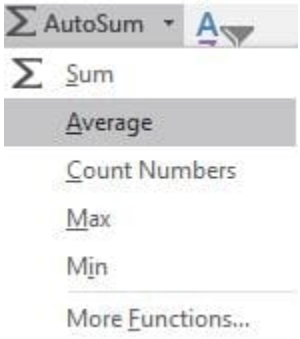
Sample function syntax

Functions can be typed with the help of a ScreenTip, or added from the Insert Function window, which can be opened by clicking the f_x symbol found at the left of the formula bar, or at the left side of the Function Library found in the Formulas tab of the ribbon.



Function library

The most popular functions are also the easiest to comprehend, which might be correlated! Some of these most popular functions are easily accessible from the AutoSum button in the Editing group on the Home tab of the ribbon. Look for the Greek sigma symbol. This feature is invaluable when it comes to entering functions, especially for common calculations computed via the SUM, COUNT, AVERAGE, MAX or MIN functions.



AutoSum

There are multiple ways to utilize AutoSum, but the following procedure is probably the simplest. In the screenshot below, assume

the desire is to total the number of boxes of Thin Mints cookies were sold the first 15 days of February. Make B19 the active cell (the destination cell), then click the AutoSum button. The defaulting SUM option will be inserted into the formula bar with a defaulting cell range (the source cells) inside parenthesis. The cell range that defaults appears on screen with a scrolling marquee surrounding the cell range. This range is usually correct, but not always. If Excel chooses the wrong range, simply type in the cell range, or use the mouse to re-select the correct range (pointing method), and then click the Enter check mark.

	A	B	C	D	E	F
1	Little Lizzie's Girl Scout Cookie Sales					
2						
3	Date	Thin Mints	Chocolate/Peanut Butter	Carmel D'Lites	Peanut Butter Sandwich	Sales $$
4	1-Feb	13	10	8	3	$136
5	2-Feb	11	18	13	7	$196
6	3-Feb	12	19	8	4	$172
7	4-Feb	13	18	4	4	$156
8	5-Feb	15	11	7	3	$144
9	6-Feb	8	9	2	5	$96
10	7-Feb	2	3	0	2	$28
11	8-Feb	0	0	0	0	$0
12	9-Feb	5	8	3	6	$88
13	10-Feb	1	0	0	1	$8
14	11-Feb	2	4	7	3	$64
15	12-Feb	9	6	1	2	$72
16	13-Feb	0	0	0	0	$0
17	14-Feb	0	0	0	0	$0
18	15-Feb	6	11	2	2	$84
19						
20						
21						
22						

AutoSum Example 1

The formula that defaults should be =SUM(B4:B18). Once this formula is submitted, the result, 97 will display. The intent of the **SUM** function is pretty self-explanatory. The **AVERAGE** function takes the SUM function one step further by dividing the sum of the values by the number of cells in the range. The **MIN** and **MAX** functions are used to find the smallest and largest values in a range of cells. These can be useful to identify outlier data that might skew the results. Each of these functions ignore cells that contain text or are empty. Alternatively, the **COUNT** function totals the number of cells that contain values. If a cell contains the value 0 (zero), it will be counted. However, if the cell is blank or contains the text zero, the cell will not be counted. This function is useful for determining the number of people who mark a checkbox in an Employee roster. For example, how many employees identify as a Veteran? Those who don't, wouldn't have a value, and therefore, would not be counted. If the desire if to count all cells that contain any data – use the **COUNTA** function.

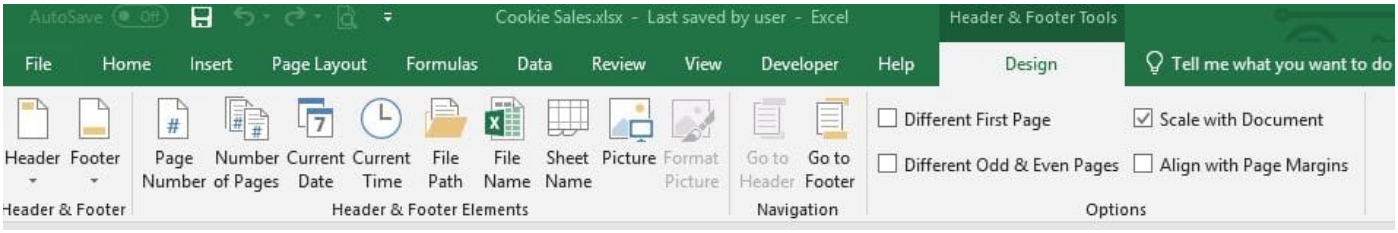
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3.2.10: Inserting Headers and Footers

In Excel, **headers** and **footers** are lines of data that print at the top (header) and bottom (footer) of each page in a worksheet to help identify printouts. Headers and footers can contain descriptive text, graphics, and/or fields, such as titles, dates, or page numbers. Header and footer information does not display in Normal view, so to edit a header or footer, click Insert > Header & Footer to open the sheet in Page Layout view, and activate the Header & Footer Tools contextual tab on the ribbon. There are left, center and right sections for both the header and footer areas.

Users have the option to use one or more of the many built-in headers and footers, or they can click any of the buttons in the Header & Footer Elements group on the Header & Footer Tools Design toolbar to create custom fields.



Header and Footer toolbar

Command buttons in the Header & Footer Elements group include:

- **Page Number**: Click this button to insert the `&[Page]` code that puts in the current page number.
- **Number of Pages:** Click this button to insert the `&[Pages]` code that puts in the total number of pages.
- **Current Date:** Click this button to insert the `&[Date]` code that puts in the current date.
- **Current Time:** Click this button to insert the `&[Time]` code that puts in the current time.
- **File Path:** Click this button to insert the `&[Path]&[File]` codes that put in the directory path along with the name of the workbook file.
- **File Name:** Click this button to insert the `&[File]` code that puts in the name of the workbook file.
- **Sheet Name:** Click this button to insert the `&[Tab]` code that puts in the name of the worksheet as shown on the sheet tab.
- **Picture:** Click this button to insert the `&[Picture]` code that inserts the image that you select from the Insert Picture dialog box that enables you to select a local image (using the From File option) or download one from an online source using a Bing Image Search.
- **Format Picture:** Click this button to apply the formatting that you choose from the Format Picture dialog box to the `&[Picture]` code that you enter with the Insert Picture button without adding any code of its own.

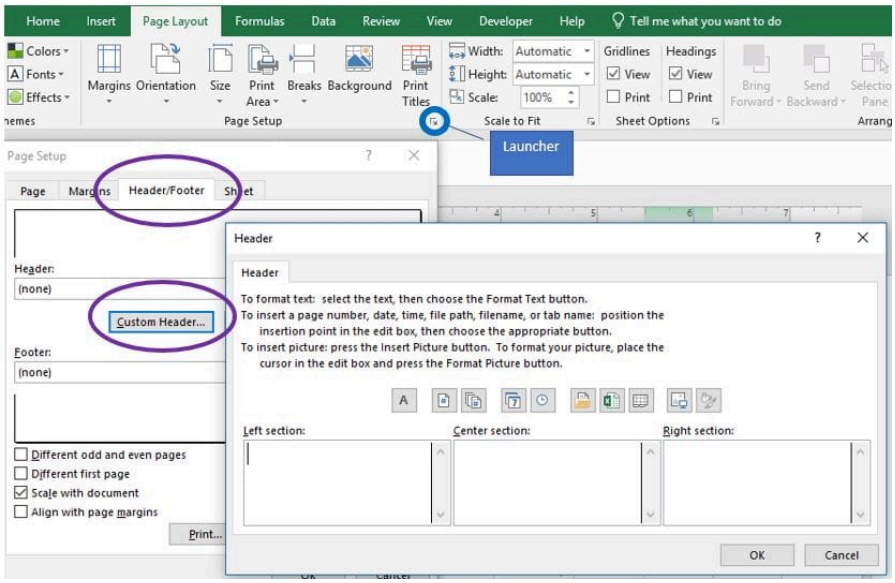
The following screenshot illustrates fields in each section of the header. The Page Number and Number of Pages fields are in the left section. Manually entered text is in the center section, and finally, the Current Time and Current Date fields are being inserted into the right section.



Sample Excel Header

To create a custom header or custom footer, click the Launcher icon in the Page Setup group of the Page Layout ribbon to open the Page Setup window. Next, click the Header/Footer tab, and then choose to open either the Custom Header... or Custom

Footer... buttons.



Header Footer dialog windows

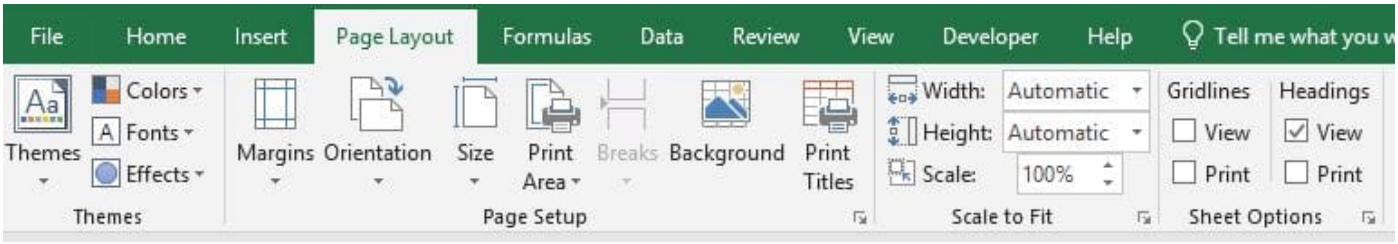
Four checkboxes appear at the bottom of the “Header/Footer” tab, and in the Options group of the Design tab of the ribbon. To remove headers and footers from the first printed page, select the **Different First Page** check box. To specify that the headers and footers on odd-numbered pages should differ from those on even-numbered pages, select the **Different Odd & Even Pages** check box. These options are similar to those in Microsoft Word. The other two options are unique to Excel. To specify whether the headers and footers should use the same font size and scaling as the worksheet, select the **Scale with Document** check box. To make sure the header or footer margin is aligned with the left and right margins of the worksheet, select the **Align with Page Margins** check box.

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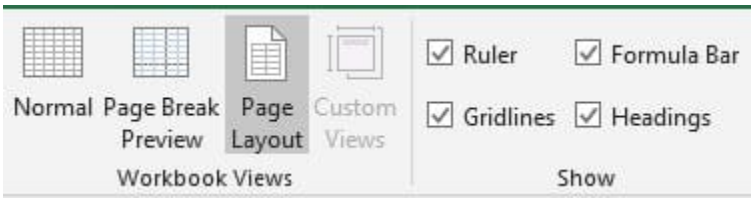
3.2.11: Adjusting the Page Layout and Preparing to Print

The size of Excel workbooks tend to grow the more each worksheet is manipulated, typically by adding more columns and rows, and sometimes, more sheets. This added complexity makes physical output of Excel data somewhat challenging. Too many columns will result in the sheet not being able to be printed on one sheet of paper, and too many rows make make it difficult to interpret data on pages beyond the first page. Fortunately, the Page Layout tab can help fit the data on fewer sheets of paper and make each page easier to understand.



Page Layout tab

While themes can help modify the appearance of a spreadsheet's colors and fonts, the other groups in the Page Layout tab can impact the arrangement of data, and streamline the readability of the output. Starting with the Page Setup group, Excel allows tremendous flexibility with the margins of each worksheet. For example, Narrow **margins** allow more data to fit on one page by reducing the amount of white space on the edges of the sheet. A quick and easy way to allow more columns to print on one sheet, is to change the **orientation** from the default Portrait, to Landscape, which allows more columns and fewer rows to print on one sheet. The effects of these Setup decisions can be more easily illustrated by switching from the default Normal workbook view to the Page Layout. The View tab also allows users to to enable/disable the Ruler, Formula Bar, and on-screen gridlines and headings.



View tab

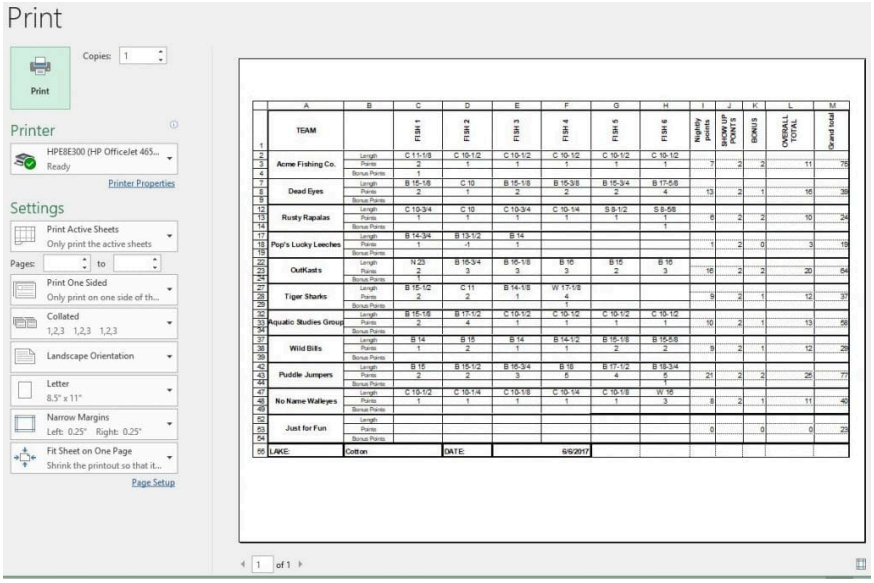
If changing the margins and/or orientation is not resolving the issue of getting extra columns to print on the same page, an alternative could be changing the paper size. The default printer determines the paper sizes available from the Size drop-down list. To check the range of paper sizes that a printer can print on, consult the printer manual, or view the paper sizes that are currently set for the printer in the **Print Setup** dialog box. Some users have the option of printing to Legal (8.5″ x 14″) or even 11″ x 17″ (tabloid) printers, especially if commonly printing large worksheets.

A final, more drastic option to keep data from overlapping into multiple sheets, is to utilize the scaling feature. Using the Scale to Fit group from the Layout tab, a printed worksheet can be scaled by to modify the font size of printed output by either shrinking or enlarging the output. The options exist to scale the output to fit to 1 page wide (width) by 1 page tall (height). It might make sense to only modify the width, or by choosing a Scale percentage, which adjusts the overall sheet height and width proportionately. Keep in mind the needs of your audience. Too small of font might make the spreadsheet unreadable, and for certain audiences, the output might need to be scaled to a larger font than the editing view.

The Sheet Options group of the Layout tab provides two significant print features for basic Excel printing. These include the options to have gridlines and/or headings appear in printed output. By default, the options appear in the Viewing screen, but do not appear when printed. Without Headings, the output would be very difficult to explain to others, and gridlines, much like banded rows, make it easier for the eye to line up the intersections of rows and columns.

More advanced options exist for enhancing page layout and printing options by clicking the launcher button in each group. Additionally, several print settings can be adjusted in the Print Preview window. The sheet in the screenshot below is modified to print in landscape orientation with Narrow Margins and it is scaled to Fit on One Page. It also has headings included in the print

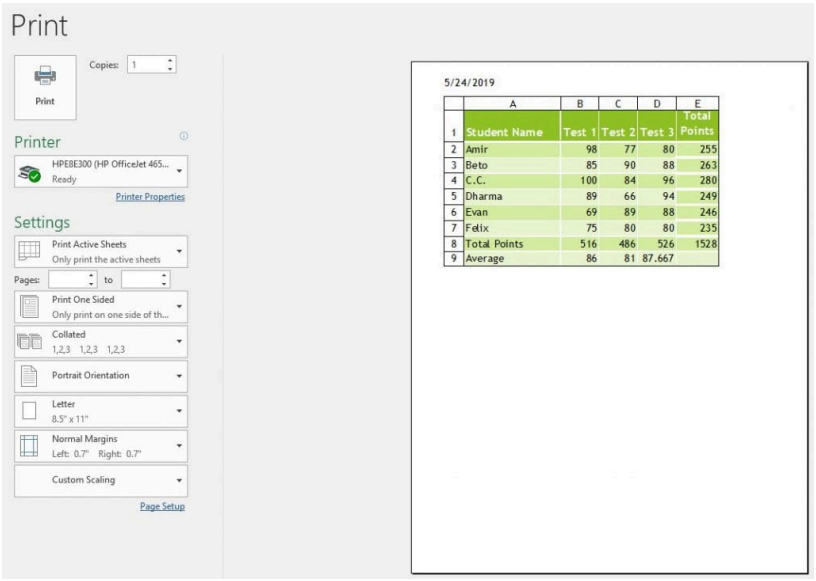
output.



Excel Print Preview

Practice 6: Test Scores, continued

1. Open the Test Scores workbook previously saved.
2. In the Table Tools Design tab, click the Convert to Range button remove the table functionality from the data. (Click Yes to the message)
3. Type the labels: Total Points in cell A8 and Average in cell A9.
4. In cell B8, click the AutoSum button to insert the SUM function. Accept the range that Excel proposes for the formula by clicking the Enter check mark on the formula bar. The formula should be: =SUM(B2:B7).
5. With B8 as the active cell, use the fill handle to copy the formula to the destination cells C8:D8.
6. In cell B9, enter a formula using the AVERAGE function without using the AutoSum functionality. Instead, use the Insert Function button to select the AVERAGE function, and enter the range B2:B7 as the arguments. NOTE: B8 should not be included in the range of argument cells. Use the fill handle to copy the formula to cells C9 and C10.
7. In cell E2, double-click the fill handle. See what happens!
8. Change the view to Page Layout.
9. Add a header that includes the Current Date field from the Header & Footer Tools Design ribbon in the left side of the header.
10. Ensure the Gridlines and Headings appear in printouts, scale the sheet to 150%, then view the file in Print Preview. Your worksheet should resemble the following:
11. Save the file as TestScores2.xlsx.



	A	B	C	D	E
1	Student Name	Test 1	Test 2	Test 3	Total Points
2	Amir	98	77	80	255
3	Beto	85	90	88	263
4	C.C.	100	84	96	280
5	Dharma	89	66	94	249
6	Evan	69	89	88	246
7	Felix	75	80	80	235
8	Total Points	516	486	526	1528
9	Average	86	81	87.667	

TestScores2

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3.2.12: Agricultural Spreadsheet Application Creation

Agricultural Spreadsheet Application Exercise

Objective: Create and manage a spreadsheet for tracking crop production costs, income, and profit for a small farm. This exercise will guide you through creating, formatting, editing, and using formulas in Excel.

Exercise Overview

1. **Create a Spreadsheet for Crop Management**
2. **Format the Spreadsheet for Clarity**
3. **Edit and Input Data**
4. **Apply Formulas to Calculate Costs, Income, and Profit**

Step 1: Create the Spreadsheet

1. **Open Excel** and create a new blank workbook.
2. **Rename the Worksheet** to "Crop Management".

Step 2: Define the Columns and Headers

1. **In cell A1**, type **"Crop Name"**.
2. **In cell B1**, type **"Area Planted (Acres)"**.
3. **In cell C1**, type **"Cost per Acre ($)"**.
4. **In cell D1**, type **"Total Cost ($)"**.
5. **In cell E1**, type **"Income ($)"**.
6. **In cell F1**, type **"Net Profit ($)"**.

Step 3: Format the Spreadsheet

1. **Bold the Headers**: Select cells A1 to F1 and click the **Bold** button on the Home tab.
2. **Adjust Column Widths**: Double-click the boundary between the column headers to auto-fit the width.
3. **Apply Borders**: Select the range A1(or however many rows you anticipate needing) and add borders using the **Borders** button on the Home tab.
4. **Format Cells**:
    - **Currency Format**: Select columns D, E, and F, right-click and choose **Format Cells**. Select **Currency** to format these columns.

Step 4: Input Sample Data

1. **In cell A2**, type **"Corn"**.
2. **In cell B2**, type **"50"**.
3. **In cell C2**, type **"200"**.
4. **In cell E2**, type **"5000"**.
5. **In cell A3**, type **"Soybean"**.

6. **In cell B3**, type **"30"**.
7. **In cell C3**, type **"150"**.
8. **In cell E3**, type **"2400"**.
9. **In cell A4**, type **"Wheat"**.
10. **In cell B4**, type **"40"**.
11. **In cell C4**, type **"180"**.
12. **In cell E4**, type **"3200"**.

Step 5: Apply Formulas

1. **Calculate Total Cost**:
   - **In cell D2**, enter the formula: `=B2*C2`
   - **Drag the fill handle** (small square at the bottom-right corner of the cell) down to apply the formula to cells D3 and D4.
2. **Calculate Net Profit**:
   - **In cell F2**, enter the formula: `=E2-D2`
   - **Drag the fill handle** down to apply the formula to cells F3 and F4.
3. **Calculate Totals** (optional for a summary):
   - **In cell B6**, type **"Total"**.
   - **In cell D6**, enter the formula: `=SUM(D2:D4)`
   - **In cell E6**, enter the formula: `=SUM(E2:E4)`
   - **In cell F6**, enter the formula: `=SUM(F2:F4)`

Step 6: Review and Finalize

1. **Check Formulas**: Verify that all formulas are correctly applied and calculating as expected.
2. **Save Your Work**: Save the workbook with a meaningful name such as "Farm_Management.xlsx".

Summary

In this exercise, you created an Excel spreadsheet to manage and track crop production costs, income, and profit. You learned to:

- **Create a Spreadsheet**: Set up headers and input data.
- **Format the Spreadsheet**: Make it readable and professional with formatting tools.
- **Edit Data**: Input sample data for crops.
- **Use Formulas**: Calculate total costs, income, and net profit.

By following these steps, you now have a basic agricultural accounting tool to help manage and analyze farm operations effectively.

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3.2.13: Agricultural Accounting Examples (Excel)

Here are a few simple examples of agricultural accounting applications that you can create in Excel. These examples include templates for tracking farm income, expenses, and budgeting.

1. Farm Income Tracker

Purpose: To record and monitor income from various agricultural activities.

Columns:

- **Date**
- **Source of Income** (e.g., Crop Sales, Livestock Sales)
- **Amount**
- **Payment Method** (e.g., Cash, Check, Online)
- **Notes**

Example Data:

Date	Source of Income	Amount	Payment Method	Notes
2024-04-15	Corn Sale	1500	Online	Sold to local market
2024-05-20	Soybean Sale	1200	Check	Payment received
2024-06-10	Livestock Sale	2500	Cash	Sold 10 cows

Basic Formula:

- **Total Income:** `=SUM(C2:C4)`

2. Farm Expense Tracker

Purpose: To track various expenses associated with farm operations.

Columns:

- **Date**
- **Expense Category** (e.g., Seeds, Fertilizers, Labor)
- **Amount**
- **Vendor**
- **Notes**

Example Data:

Date	Expense Category	Amount	Vendor	Notes
2024-04-01	Seeds	500	Local Supplier	Purchased corn seeds
2024-04-15	Fertilizers	300	Agri Corp	Organic fertilizer
2024-05-01	Labor	600	Farm Workers	Planting season labor

Basic Formula:

- **Total Expenses:** `=SUM(C2:C4)`

3. Budget Planner

Purpose: To plan and track the budget for various farm activities.

Columns:

- **Category** (e.g., Income, Expenses)
- **Budgeted Amount**
- **Actual Amount**
- **Difference**

Example Data:

Category	Budgeted Amount	Actual Amount	Difference
Income	5000	4700	=B2-C2
Expenses	2000	1800	=B3-C3
Net Profit	=B2-B3	=C2-C3	=B4-C4

Basic Formula:

- **Difference:** `=B2-C2` (for each row)
- **Net Profit:** `=B2-B3` and `=C2-C3`

4. Crop Production Costs

Purpose: To calculate the costs associated with growing specific crops.

Columns:

- **Crop Name**
- **Area Planted (Acres)**

- **Cost per Acre**
- **Total Cost**

Example Data:

Crop Name	Area Planted (Acres)	Cost per Acre	Total Cost
Corn	50	200	=B2*C2
Soybean	30	150	=B3*C3
Wheat	40	180	=B4*C4

Basic Formula:

- **Total Cost:** `=B2*C2` (for each crop)

5. Monthly Financial Summary

Purpose: To summarize the monthly financial performance.

Columns:

- **Month**
- **Total Income**
- **Total Expenses**
- **Net Profit**

Example Data:

Month	Total Income	Total Expenses	Net Profit
January	3000	1200	=B2-C2
February	2500	1100	=B3-C3
March	3200	1400	=B4-C4

Basic Formula:

- **Net Profit:** `=B2-C2` (for each month)

Summary

These simple Excel applications help manage and monitor different aspects of agricultural accounting. By using these templates, you can keep track of income and expenses, plan budgets, calculate production costs, and summarize monthly financial performance. Excel's functionality allows for easy data entry, formula application, and analysis, making it a valuable tool for effective farm management.

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3.2.14: Examples of Agricultural SpreadSheet Applications

Here are some examples of agricultural applications you can create or manage using Excel spreadsheets. Each example addresses different aspects of farm management and agriculture.

1. Crop Management Tracker

Purpose: To monitor and manage crop production, including planting and harvesting schedules.

Columns:

- **Crop ID**
- **Crop Name**
- **Planting Date**
- **Harvest Date**
- **Field Location**
- **Quantity (Bushels)**
- **Notes**

Example Data:

Crop ID	Crop Name	Planting Date	Harvest Date	Field Location	Quantity (Bushels)	Notes
001	Corn	2024-04-15	2024-08-15	North Field	120	Organic variety
002	Soybean	2024-05-01	2024-09-01	South Field	85	High yield
003	Wheat	2024-03-10	2024-07-10	East Field	200	Winter wheat

2. Farm Financial Tracker

Purpose: To track income and expenses for budgeting and financial planning.

Columns:

- **Date**
- **Description**
- **Category** (e.g., Equipment, Seeds, Labor)
- **Amount**
- **Income/Expense** (mark whether it's income or expense)

Example Data:

Date	Description	Category	Amount	Income/Expense
2024-04-01	Seed Purchase	Seeds	500	Expense

Date	Description	Category	Amount	Income/Expense
2024-05-15	Corn Sale	Sales	1500	Income
2024-06-20	Labor Cost	Labor	600	Expense

3. Livestock Inventory

Purpose: To manage livestock details, including breed, age, and health status.

Columns:

- **ID**
- **Breed**
- **Date of Birth**
- **Purchase Date**
- **Health Status**
- **Current Weight (lbs)**
- **Notes**

Example Data:

ID	Breed	Date of Birth	Purchase Date	Health Status	Current Weight (lbs)	Notes
001	Angus	2022-01-10	2024-01-15	Healthy	1200	Regular check-up
002	Jersey	2022-06-25	2024-02-20	Needs attention	950	Minor injury

4. Irrigation Schedule

Purpose: To plan and track irrigation activities for different fields.

Columns:

- **Field Location**
- **Crop Name**
- **Irrigation Start Date**
- **Irrigation End Date**
- **Frequency** (e.g., Weekly, Bi-weekly)
- **Amount of Water (Gallons)**
- **Notes**

Example Data:

Field Location	Crop Name	Irrigation Start Date	Irrigation End Date	Frequency	Amount of Water (Gallons)	Notes
North Field	Corn	2024-04-15	2024-08-15	Weekly	5000	Monitor soil moisture
South Field	Soybean	2024-05-01	2024-09-01	Bi-weekly	3000	Adjust based on rainfall

5. Equipment Maintenance Log

Purpose: To track maintenance and repairs of farm equipment.

Columns:

- **Equipment ID**
- **Equipment Name**
- **Last Maintenance Date**
- **Next Scheduled Maintenance**
- **Type of Maintenance**
- **Cost**
- **Notes**

Example Data:

Equipment ID	Equipment Name	Last Maintenance Date	Next Scheduled Maintenance	Type of Maintenance	Cost	Notes
001	Tractor	2024-03-01	2024-06-01	Oil Change	150	Check filters
002	Harvester	2024-01-15	2024-07-15	Engine Check	500	Service parts needed

6. Crop Yield Forecast

Purpose: To predict crop yields based on historical data and current conditions.

Columns:

- **Year**
- **Crop Name**
- **Area Planted (Acres)**
- **Yield per Acre (Bushels)**
- **Total Expected Yield (Bushels)**
- **Notes**

Example Data:

Year	Crop Name	Area Planted (Acres)	Yield per Acre (Bushels)	Total Expected Yield (Bushels)	Notes
2024	Corn	50	100	5000	Use new fertilizer
2024	Soybean	30	80	2400	Monitor pests

Summary

These Excel spreadsheet applications provide a range of functionalities for agricultural management. By organizing data into structured tables, you can efficiently track crop production, manage finances, oversee livestock, schedule irrigation, log equipment maintenance, and forecast yields. Excel's versatility and built-in functions make it a valuable tool for effective farm management.

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3.3: End of Chapter Summary

In this chapter, we explored the fundamentals of spreadsheets and their practical applications in agriculture. We learned how to enter, select, and manipulate data, as well as create and use formulas to perform essential calculations. By mastering these skills, you can automate repetitive tasks and analyze data more effectively. We also covered how to copy and paste formulas, add basic functions, insert headers and footers, adjust page layouts, and prepare spreadsheets for printing.

Through real-world agricultural examples, such as creating a custom spreadsheet for managing crop yields or livestock feed, we saw how spreadsheets can be a powerful tool in farming operations. Additionally, we looked at agricultural accounting using Excel, demonstrating how these skills can directly improve your record-keeping and financial planning. By applying what you've learned, you can streamline data management in your agricultural practices, making your farm more efficient and organized.

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3.4: End of Chapter Discussion

Exercise 3.4.1

1. How can the use of spreadsheets improve data management in agricultural practices, such as crop rotation planning or livestock tracking? Discuss specific examples where spreadsheet functions, like data manipulation or formulas, could streamline tasks on a farm.
2. What are the advantages of using spreadsheets for agricultural accounting compared to traditional paper-based methods? In what ways can functions like sorting data, using formulas for calculations, and adjusting layouts for printout improve financial planning on a farm?
3. In the context of agricultural operations, how might spreadsheet tools like headers, footers, and page layout adjustments help create professional reports or presentations for stakeholders or regulatory agencies? Share an example of how you would organize and present key agricultural data using Excel.

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4: DATABASE APPLICATIONS IN AGRICULTURE

4.1: Chapter Introduction

4.2: Chapter Learning Objectives

4.2.1: What is a Database?

4.2.2: The Four Main Objects in a Database

4.2.3: Database Design

4.2.4: Creating a Table

4.2.5: Primary and Foreign Keys

4.2.6: Table Relationships

4.2.7: Entering and Editing Records

4.2.8: Creating Forms

4.2.9: Various Agricultural Production Management Applications

4.2.10: Creating An Agricultural Database Exercise (Excel)

4.3: End of Chapter Summary

4.4: End of Chapter Discussion

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4.1: Chapter Introduction

Introduction to Databases and Their Applications in Agriculture

Databases are fundamental tools for organizing and managing large volumes of data, providing a structured way to store, retrieve, and manipulate information. In agriculture, database applications play a pivotal role in optimizing various aspects of farm management and operations. By offering efficient solutions for data management, analysis, and reporting, these applications support farmers and agribusinesses in making informed decisions and enhancing productivity.

Databases allow users to handle extensive and complex data sets with ease, thanks to their structured format and powerful querying capabilities. This functionality is particularly beneficial in agriculture, where managing information related to crops, livestock, equipment, and finances is crucial for success. Database applications facilitate effective tracking, monitoring, and analysis, thereby improving operational efficiency and decision-making.

In essence, the integration of database applications into agricultural practices enhances the ability to manage resources, maintain records, and analyze performance, leading to more streamlined operations and better outcomes in the farming sector.

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4.2: Chapter Learning Objectives

Learning Objectives

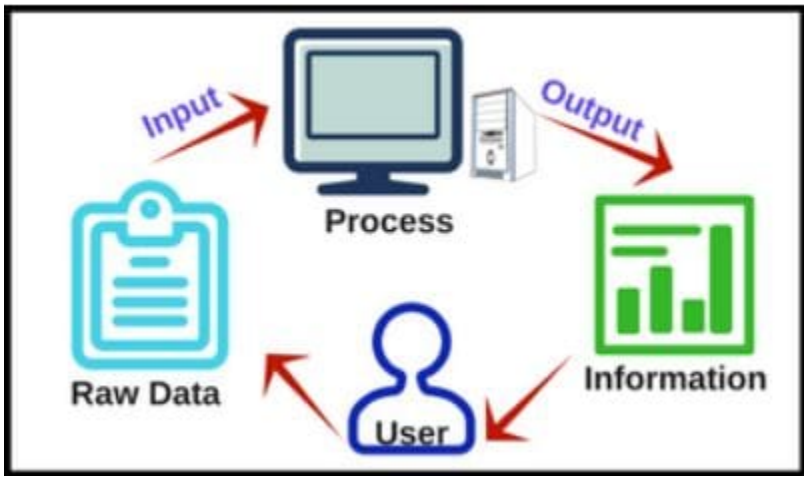
1. **Database Design and Structure:**
    1. **Learning Objective:** Understand the principles of designing and structuring databases, including defining tables, fields, and relationships, tailored to agricultural data management needs.
2. **Data Entry and Management:**
    1. **Learning Objective:** Learn to efficiently enter, update, and manage agricultural data within a database, including data types, validation, and integrity constraints.
3. **Querying and Data Retrieval:**
    1. **Learning Objective:** Develop skills to construct and execute queries to retrieve specific agricultural data from the database, using SQL or other query languages for analysis and reporting.
4. **Data Analysis and Reporting:**
    1. **Learning Objective:** Utilize database tools to generate reports and analyze agricultural data, including summarizing trends, visualizing data, and making data-driven decisions.
5. **Database Security and Backup:**
    1. **Learning Objective:** Understand best practices for securing agricultural databases and implementing backup procedures to protect data from loss or unauthorized access.
6. **Integration with Other Tools:**
    1. **Learning Objective:** Learn to integrate databases with other agricultural software and tools, such as GIS or farm management systems, to enhance data utility and streamline workflows.

These objectives aim to provide foundational skills in using database applications to manage and analyze agricultural data effectively.

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4.2.1: What is a Database?

A **database** is a collection of related data that is organized so that it can be easily access, managed and updated. Databases can store details about people, products, orders, or anything else. **Data** can be defined as facts and statistics about people, objects, events and ideas. Organizations interpret, process and analyze data to turn the data into useful **information**. This information is used to make better decision-making.



Data process

In the past, many databases were paper-based. Paper records were stored in files within file cabinets. File cabinets still exist today, in large part due to the fears associated with the insecurity of electronic records being compromised. The individual documents (records) are categorized into different folders (tables) to streamline user access. However, this process is labor-intensive, susceptible to errors, and an office eyesore!

Databases are used for two major purposes: for processing transactions and analytical research. Transactional databases track daily operations. This data can be extracted into other software programs for further manipulation, summation and classification. This allows users to perform analytical research and prepare reports to help create strategic information.

Computerized databases organize data into rows, columns and tables, and is indexed to make it easier to find things quickly. Data gets updated, expanded and deleted as new data is added. Automated processes quickly manipulate the data, and data accuracy is enhanced through automated rules. The advancements in database software technologies have contributed to the Information Age that currently exists. The growth of the filing cabinet market cannot compare to the growth of electronic data contained in private and public networks, and web sites throughout the Internet!

While a spreadsheet can function as a database, with it's utilization of columns and rows, the flat-file structure creates redundancies and inconsistencies which limit the ability to find and understand the data. In contrast, a relational database uses a tabular structure so that data can be easily reorganized and accessed in a number of different ways. Relational databases are made up of a set of tables with data that fits into predefined categories (fields). Each table has at least one data category (field) in a column, and each row has a certain data instance for the categories (fields) which are defined in the columns.

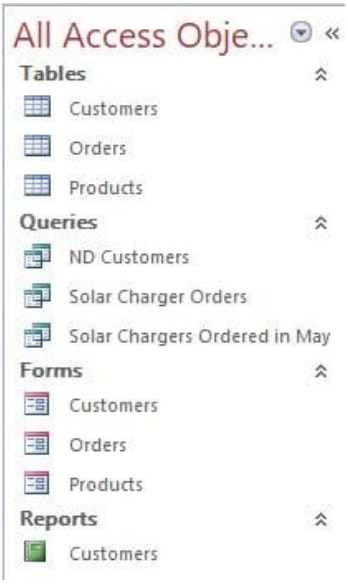
Microsoft's relational database software program available in Office 365 is called Access. Access only functions with Windows operating systems (not available on a Mac O/S), and is not available in all Office versions. Access is a tool to organize, store, and manipulate data, in order to report on the data stored in tables. The power of a database comes from the ability to link tables together to provide data processing efficiencies for large sets of data. Access' integration with the other Microsoft Office programs makes it a very popular and economical relational database solution.

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4.2.2: The Four Main Objects in a Database

While Microsoft Access is made up of seven components, this text will focus on the main objects: tables, forms, queries and reports. Together, these objects allow users to enter, store, analyze and compile data in various ways.



Navigation Pane

When an Access database is opened, the objects are illustrated in the **Navigation Pane** on the left side of the window. The standard view in the Navigation Pane displays all objects in the database organized by object type. The Navigation Pane is used to run, open, and manage the objects of a database. Double-clicking an object will open the object in a document window.

A **table** is the database object that stores data organized in an arrangement of columns and rows. Each row is a **record** and each column is a **field** within each record. A record is all of the data pertaining to a person, place, thing or event. Each record will have one or more fields and every database must have at least one table. A relational database must have more than one table.

The other three objects are typically based off of the tables, so take the time to set up the tables correctly, the first time! A **form** object is typically used for entering new records into a table, or edit/deleting/display existing records in a table. Forms are the primary interface that most users of a database enter and display data. A **query** object retrieves specific data from other database objects and then displays only the data that the user specifies. Queries are the equivalent of asking questions about the data. The **report** object summarizes the records from a table or query into an easy-to-read format suitable for printing or exporting to other software programs.

Access objects have several views. Each **view** gives users different perspectives and offer different functionality. The two most important views are Datasheet view and Design view. **Datasheet view** displays a table in a datasheet where fields are in columns and records are in rows.

Customers

CustomerID	First Name	Last Name	Phone	Street Address	City	State/Provir	Zip/Postal C	Click to Add
1	Devinder	Patel	218-555-5641	212 Ash Street	Aurora	MN	59990	
2	Maria	Escobar	218-555-5146	212 Birch Street	Lake Cosmos	MN	59991	
3	Ahmed	Rashad	218-555-1658	212 Cedar Street	Park Falls	MN	59992	
4	Arnold	Hammer	218-555-8811	212 Elm Street	Aurora	MN	59990	
5	Susan	Wong	(218) 555-0182	212 Fir Street	Aurora	MN	59990	
(New)								

Datasheet view of a Customer table

This view is useful for comparing records and is often used when sorting or filtering data. This view is also practical for printing

data since many of the records can fit on a single sheet of paper. Records can be added in datasheet view, but forms are a more typical object for data entry. Nonetheless, the asterisk (*) that appears to the left of the row below the last record indicates where a new record will appear. The grey box to the left of each record is a record selector. Clicking a record selector will make the record active. Right-clicking the record selector will allow users to delete the selector record or add a new record to the table. **Design view** allows users to setup and edit the fields in an object.

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4.2.3: Database Design

A properly designed database will divide data into tables to eliminate duplicate information (also known as *data redundancy)*. **Redundancy** occurs when data is repeated several times in a database. Redundant data is bad, because it wastes space and increases the likelihood of errors and inconsistencies. A good database prevents redundant data when, for example, customer data (ID, Name, Address, etc) is stored in one table and then other tables store just the customer ID to refer to the customers. Another important design consideration to maintain is data accuracy. A common motto when performing data entry is “garbage in, garbage out”. The correctness and completeness of information is important if the user wants to rely on their data. If your database contains incorrect information, any reports that pull information from the database will also contain incorrect information. As a result, any decisions you make that are based on those reports will then be misinformed.

Creating a new database involves determining the database schema, which is a description of the data and the organization of the data into tables. Designing a schema consists of the following steps:

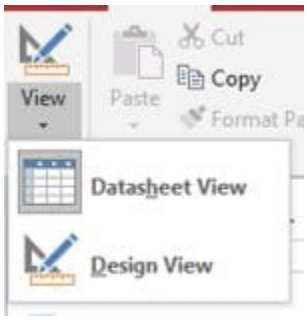
1. Determine the purpose of the database and which data to include in the database. It is a good idea to write down the purpose of the database on paper — its purpose, how you expect to use it, and who will use it.
2. Divide information into related groups to create tables and then give each table a descriptive name. Data should be grouped to ensure there is little to no redundancy. Each table must have data related to at least one other table through a table relationship.
3. Describe the fields and determine the primary key for each table.

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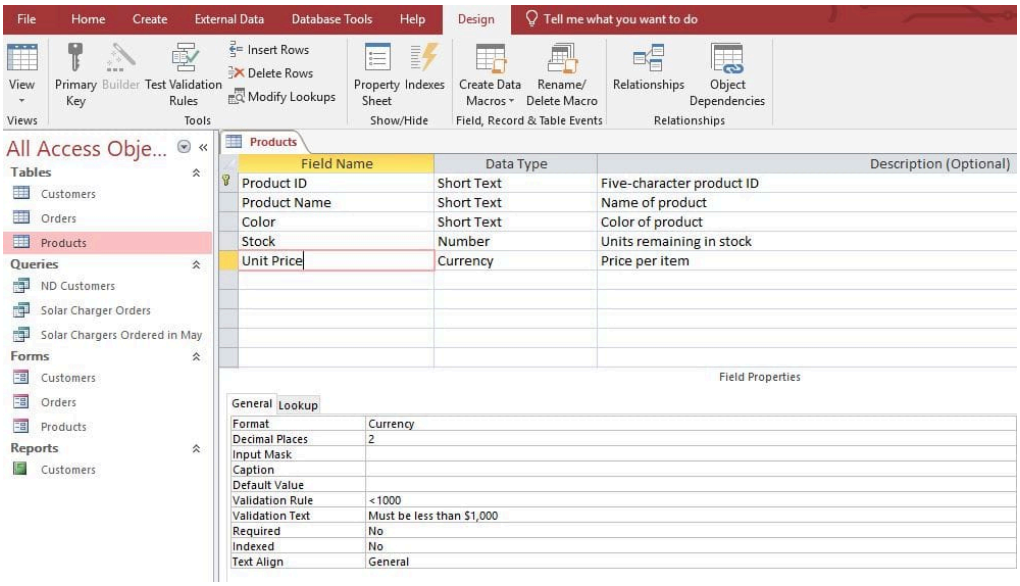
4.2.4: Creating a Table

As previously stated, a database cannot exist without at least one table. Therefore, when a new database is created in Access, the first object that opens is a table in datasheet view.



Access View tab

Switching the view to Design View allows the user to make many design decisions in a much more intuitive view. Many users like to use Datasheet View to paste data copied from Excel. However, setting up the fields in Design View makes it easier to define each field's properties and data type.



Design View

Design View doesn't display any data. Therefore, there's more space available to display other settings. In Design View, you can see the data type listed next to each field. When a user clicks on a field (in the top frame), the bottom frame displays the properties for that field. The user can then change these properties as desired.

Creating a table in Design View allows the user to define advanced settings, like data types and properties, for each field in the table. However, the first step is defining the field names. Here are a few guidelines when creating field names:

- Names can include numbers, UPPER and lowercase letters, and any combination. Avoid special characters (exclamation points, periods, brackets, quotes, etc.)
- No leading spaces. Spaces between words is acceptable, but not common practice, because:
- Make the names as short as possible without excessive abbreviation. Formatting column widths for displaying in printouts can be challenging with excessively long field names. For example, Order # or Order Number are better than Customer Order Number.
- Ensure the names are unique per table. If a table has fields for Customer ID and Product ID, neither field should be

named simply ID. Likewise with the word Name. It is too generic and needs an prefix identifier.
- Break data into multiple fields. For example, instead of one field for Customer Name, create fields for First Name and Last Name. This will allow sorting and filtering on single fields. Another example would be separating an address into multiple fields for Street Address, City, State/Province and Zip/Postal Code.

Every field has a data type. A field's **data type** indicates the kind of data that the field stores, such as large amounts of text or attached files. A field's data type determines what other properties the field has including its size and formatting options. Field data types are defined in the table design grid, where as field properties are defined in the Field Properties pane in the bottom of the Table Design View window. Data types include:

Data type	Description	Size
Short Text	Use for text or combinations of text and numbers (i.e. Phone Numbers).	Up to 255 characters
Long Text	Use for larger amounts of alphanumeric data, including sentences and paragraphs. **Note:** You cannot sort a memo field. However, they are searchable.	Up to 1 GB
Number	Numeric values.	4 bytes
Large Number	Numeric values. Stores a non-monetary, numeric value and is compatible with the SQL_BIGINT data type in ODBC. Use this data type to efficiently calculate large numbers.	8 bytes
Currency	Use for monetary data. Holds up to 15 digits of whole dollars, plus 4 decimal places. **Tip:** You can choose which country's currency to use.	8 bytes
AutoNumber	Unique value generated by Access for each new record, usually starting at 1.	4 bytes
Date/Time	Use for dates and times.	8 bytes
Yes/No	A logical field can be displayed as Yes/No, True/False, or On/Off. In code, use the constants True and False (equivalent to -1 and 0). **Note:** Null values are not allowed in Yes/No fields.	1 byte
Ole Object	Can store pictures, audio, video, or other BLOBs (Binary Large OBjects).	Up to 2 GB
Hyperlink	Contain links to documents or other files, e-mail addresses, or web pages.	Up to 8 bytes
Attachment	Attach pictures, documents, etc. Can contain an unlimited number of characters per record. Access will compress the file.	Up to 2 GB
Calculated	Use to create an expression that uses data from one or more fields. You can designate different result data types from the expression.	Dependent on the data type of the result type property
Lookup Wizard	When selecting this entry, a wizard starts to help define either a simple or complex lookup field. A simple lookup field uses the contents of another table or a value list to validate the contents of a single value per row. A complex lookup field allows you to store multiple values of the same data type in each row.	Dependent on the data type of the lookup field

After creating a field and setting its data type, users can set additional field properties. The field's data type determines which other properties that can be set. The **field size** is the number of characters or the type of number it can store. For Number and Currency fields, the Field Size property is especially important, because it determines the range of field values. For example, a one-bit Number field can store only integers ranging from 0 to 255. In the **Field Properties** pane, on the General tab, enter the new field size in the Field Size property. Users can choose from the following values:

- **Byte** — For integers that range from 0 to 255. Storage requirement is a single byte.
- **Integer** — For integers that range from -32,768 to +32,767. Storage requirement is two bytes.
- **Long Integer** — For integers that range from -2,147,483,648 to +2,147,483,647. Storage requirement is four bytes.
- **Single** — For numeric floating point values that range from -3.4 x 1038 to +3.4 x 1038 and up to seven significant digits. Storage requirement is four bytes.

- **Double** — For numeric floating point values that range from -1.797 x 10308 to +1.797 x 10308 and up to 15 significant digits. Storage requirement is eight bytes.
- **Replication ID** — For storing a GUID that is required for replication. Storage requirement is 16 bytes.
- **Decimal** — For numeric values that range from -9.999... x 1027 to +9.999... x 1027. Storage requirement is 12 bytes.

Numeric and date/time fields can have a specified format to define how the data is displayed. Short text, long text, and hyperlink fields usually have no format. Predefined numeric field formats include:

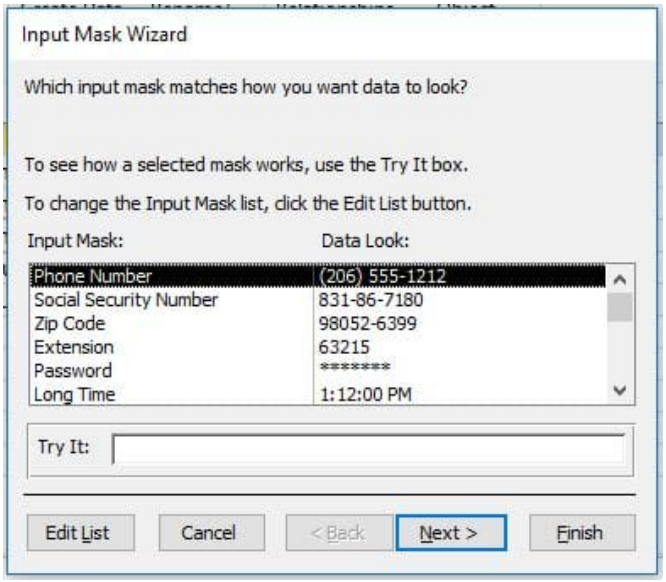
- **General Number** – (Default) Display the number as entered.
- **Currency** – Use the thousand separator; follow the settings specified in the regional settings of Windows for negative amounts, decimal and currency symbols, and decimal places.
- **Euro** – Use the euro symbol (€), regardless of the currency symbol specified in the regional settings of Windows.
- **Fixed** – Display at least one digit; follow the settings specified in the regional settings of Windows for negative amounts, decimal and currency symbols, and decimal places.
- **Standard** – Use the thousand separator; follow the settings specified in the regional settings of Windows for negative amounts, decimal symbols, and decimal places.
- **Percent** – Multiply the value by 100 and append a percent sign (%); follow the settings specified in the regional settings of Windows for negative amounts, decimal symbols, and decimal places.
- **Scientific** – Use standard scientific notation.

When it comes to date/time fields, Access automatically displays the date and time in the **General Date** and **Long Time** formats. The dates appear as, mm/dd/yyyy in the U.S. and as, dd/mm/yyyy outside the U.S. where mm is the month, dd is the day, and yyyy is the year. The time is displayed as, hh:mm:ss AM/PM, where hh is the hour, mm is minutes, and ss is seconds. Here are some other predefined formats for date/time fields:

- **Long Date** – Displays only date values, as specified by the Long Date format in your Windows regional settings. i.e. Monday, May 13, 2018.
- **Medium Date** – Displays the date as dd/mmm/yy, but uses the date separator specified in your Windows regional settings. i.e. 13-May-2018.
- **Short Date** – Displays date values, as specified by the Short Date format in your Windows regional settings. i.e. 5/13/2018.
- **Medium Time** – Displays hours and minutes followed by AM or PM. Access uses the separator specified in the Time setting in your Windows regional settings. i.e. 9:23 AM.
- **Short Time** – Displays only hours and minutes. Access uses the separator specified in the Time setting in your Windows regional settings. i.e. 9:23.

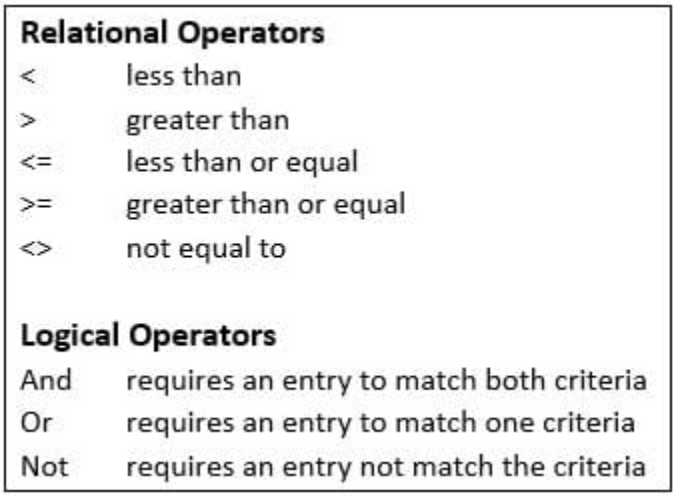
Other popular (not all inclusive) field properties that appear based on certain data types include:

- **Decimal Places** – Specifies the number of decimal places to use when displaying numbers.
- **Input Mask** – Controls how data is entered and is useful when text or date entries should follow a certain format. Access has several predefined masks. To open the Input Mask Wizard, click the ellipses (...) at the end of the Input Mask field. Popular existing input masks include the Phone Number and Zip Code masks. Typically, clicking Next to accept the default options throughout the wizard will create the most common input masks. Custom masks can be created by clicking the Edit List button. Mask characters include the digits 0 and 9. A 0 placeholder means that a digit is required, whereas a 9 means that a digit is optional. For example, the last four characters of a Zip Code are often optional, so the mask would display as 00000-9999.



Input Mask Wizard

- **Caption** – The label text that is displayed for this field by default in forms, reports, and queries. If this property is empty, the name of the field is used. Any text string is allowed.
- **Default Value** – Automatically assigns the specified value to this field when a new record is added. Popular with State or Country fields for data entry in regional uses.
- **Validation Rule** – Helps ensure accurate data through creation of an expression criterion that must be true whenever the value is added or changed in the field. Validation rules are popular for numeric and date entries, and are formed with one or more relational operators and/or logical operators. A typical rule in an Order Entry table/form might require the Quantity be at least one. The rule in the Quantity field could be >=1.



Operators

- **Validation Text** – If an entry breaks the rule, it is cleared from the entry box and the Validation Text is displayed in a dialog box. Highly recommended to be used in conjunction with the Validation Rule so the data entry person knows why their entry is not acceptable.
- **Required** – Specifies if data must be entered or not. Choice is Yes or No. Default is No.
- **Indexed** – Specifies whether the field has an index. There are three available values: Yes (No duplicates) – Creates a unique index; Yes (Duplicates OK) – Creates a non-unique index; No – Removes any index on the field. If users often search a table in Access or sort its records by a particular field, users can speed up these operations by creating an index for the field. Access uses indexes in a table as people use an index in a book: to find data, Access looks up the location of the data in the index. In some instances, such as for a primary key, Access automatically creates an index. At other times, it may be necessary to create an index manually.

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4.2.5: Primary and Foreign Keys

Fields that are part of a table relationship are called keys. A key usually consists of one field, but may consist of more than one field. There are two kinds of keys:

- **Primary key** – To ensure that no two records in a table are identical, one field in each table is designated the primary key. A primary key consists of one or more fields that uniquely identify each record that you store in the table. Often, there is a unique identifier, such as an ID number (Employee ID, Customer ID, etc), a serial number, or a social security number that serves as the primary key. Always choose a primary key whose value will not change. A key icon appears next to the name of the primary key field. AutoNumber data type fields make good primary keys.
- **Foreign key** – A table can also have one or more foreign keys. A foreign key contains values that correspond to values in the primary key of another table. For example, you might have an Orders table in which each order has a customer ID number that corresponds to a record in a Customers table. The customer ID field is a foreign key of the Orders table.

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4.2.6: Table Relationships

Access is a relational database management system. In a relational database, users divide information into separate, subject-based tables. Keeping data separated in related tables produces the following benefits:

- **Consistency** – Because each item of data is recorded only once, in one table, there is less opportunity for ambiguity or inconsistency. For example, storing a customer's name only once in a table about customers versus storing it repeatedly (and potentially inconsistently) in a table that contains order data.
- **Efficiency** – Recording data in only one place results in less disk space used. Additionally, smaller tables tend to provide data more quickly than larger tables. Finally, not using separate tables for separate subjects will introduce null values (the absence of data) and redundancy into the tables, both of which can waste space and impede performance
- **Comprehensibility** – The design of a database is easier to understand if the subjects are properly separated into tables.

In relational database terms, a ***relationship*** is a situation where multiple tables can contain related data that is linked by a common field. A relationship consists of a parent table and a child table. The child table references the parent table by having a field that matches a field in the parent table. The child's field is the foreign key, whereas the parent's field is the primary key. In a relationship, any data entered into the child's foreign key field must match a value from the parent's primary key field. By ensuring that the foreign key's data matches data in the primary key, Access ensures that all records in the child table will have an associated record in the parent table. There are three types of relationships:

- **One-to-One** – A row in table A can have only one matching row in table B, and vice versa. i.e. A baseball player can have only one Jersey Number.
- **One-to-Many** – A row in table A can have many matching rows in table B, but a row in table B can have only one matching row in table A. i.e. A baseball player can have many games played.
- **Many-to-Many** – A row in table A can have many matching rows in table B, and vice versa. This is achieved through the use of a third table (commonly called a *junction table*) that contains lookup data for both tables. Multiple players can play multiple games.

Determining the relationships between tables helps ensure that the right tables and columns exist. When a one-to-one or one-to-many relationship exists, the tables involved need to share a common column or columns. When a many-to-many relationship exists, a third table is needed to represent the relationship.

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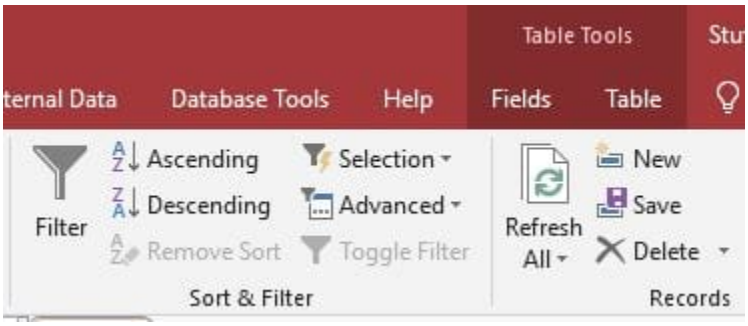
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4.2.7: Entering and Editing Records

Entering records directly into Datasheet View is probably the most intuitive way to enter data into a database. In Access, this is common because many Access databases are considered single-user databases. With multi-users databases, data integrity policies would discourage most users from having editing rights directly to the tables. Therefore, in these databases, the more common method for entering and editing records in a database would be via a form. Nonetheless, entering records directly into Datasheet View has some advantages, including:

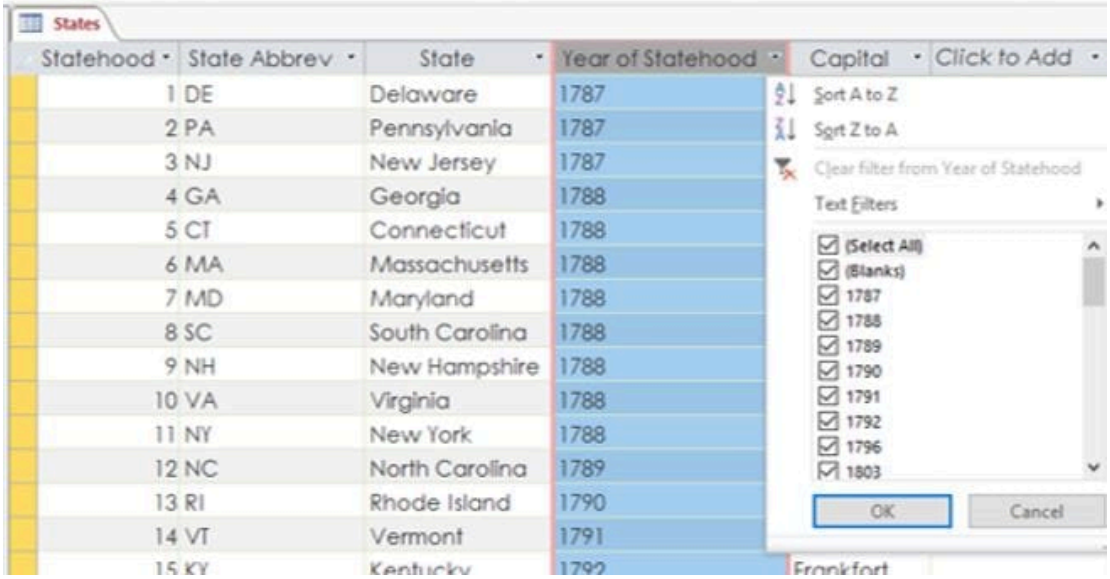
- Users can look at their data in columns and rows in a datasheet without using any special formatting.
- When a user opens a table in Datasheet View it resembles an Microsoft Excel worksheet, and the user can paste or add data in one or multiple fields. Data can be copy and pasted from a Word table or Excel worksheet into Access.
- Printing a table's datasheet in Portrait or Landscape orientation. Use Print Preview to change the orientation and margins before printing. Output can also be sent to a PDF file.
- Users don't need to explicitly save their data. Access commits user's changes in the table when they move their cursor in the same row towards a new field, or if they move their cursor towards another row.
- Sorting and filtering data is very similar to Microsoft Excel.

Access allows users to **sort** data in Datasheet View one iteration at a time in either **Ascending** or **Descending** order. Ascending order is also referred to as *alphabetical* order when the sort is based on a text field, *chronological* order when the field is a date/time data type or *numerical* order when the data type of the field is Number. Sorting a datasheet does not affect the order that the records are displayed in a form.



Sort & Filter

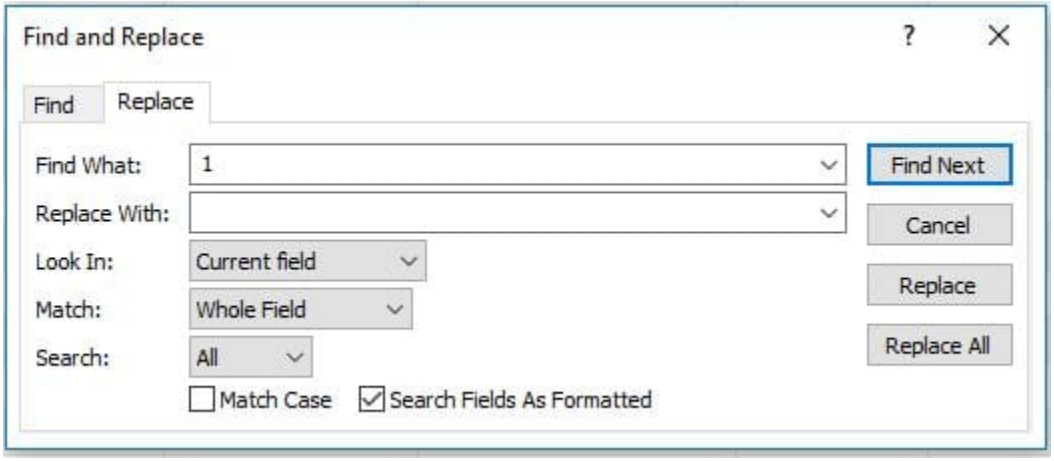
Displaying records based on specified criteria is called **filtering**. When a filter is applied, records that do not meet the specified criteria are hidden from view until the filter is removed. To filter records based on the data in a field, click in the field to base the filter on and then click on the Filter button on the ribbon or click the drop-down triangle to display a menu similar to the graphic below.



Filtered table

To remove a filter, clear the check boxes, and click OK or click the Filter button again or click the Advanced button on the ribbon and choose Clear All Filters.

Most databases contains hundreds, if not thousands, of records. Therefore, when a table becomes so large that the records and data do not fit in the datasheet window without scrolling, the Find feature becomes very practical.



Find and Replace

In Datasheet view, use the Find command, from the Home tab, to quickly locate specific records using all or part of a field value entered in the Find What: field. If in the States table above, if the user entered the value North in the Find What field, Access would find two records for North Carolina and North Dakota, but only if the Match: value was changed from Whole Field to Any Part of Field or Start of Field. Using **wildcard characters** can be extremely helpful if the user does not know the exact spelling of the value they are looking for.

Wildcard Character	Usage
?	Used to match any single character; to search for a three-letter word that starts with “d” and ends with “g”, use d?g.
*	Used to match any number of characters; to search for a word that ends in “son”, use *son.
#	Used to match any single numeric character; to search for a three-digit number that starts with “3”, use 3##.

Wildcards

A wildcard character can replace a single character or multiple characters, which can be both text and numbers. Clicking the Replace tab will allow the user to replace the data in the Find What: field with the data entered in the Replace With: field. This could be very useful when updating name changes, such as when Kentucky Fried Chicken changed their name to KFC in 1991.

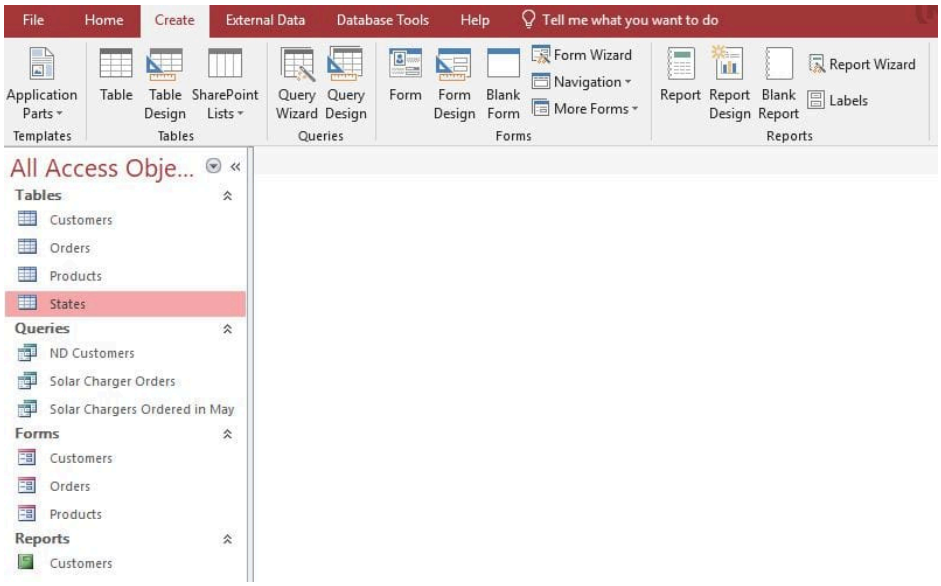
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4.2.8: Creating Forms

A form is a database object that offers an alternative interface to a table beyond the Datasheet view of the table. Forms can improve data entry proficiency by rearranging the order and tab sequence of fields within a table. Forms can also be designed to hide certain fields from appearing. For example, a credit limit or credit card number field might only be accessible from the table Datasheet view to limit the access to sensitive data from users who do not have rights to view or edit tables. In Access, users have the option of creating a blank form from scratch, using the Form Wizard, or having Access automatically create a form from a table or query.

A basic form can be easily created by using the Form tool. Simply select the table (or query) in the Navigation Pane that the form should be based off of, and then click Create > Form (from the Forms group). all the fields from the underlying data source are placed on the form. If Access finds a single table that has a one-to-many relationship with the table or query that you used to create the form, Access adds a datasheet to the form that is based on the related table or query.

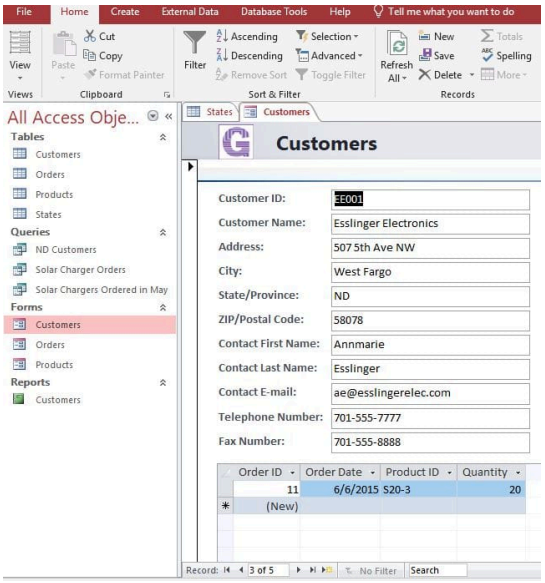


Access Create tab

A split form can be created by clicking More Forms from Create tab, and then choosing Split Form. A split form displays two views of the data simultaneously — a Form view and a Datasheet view. Working with split forms provides the benefits of both kinds of forms in a single form. For example, a user can use the datasheet portion of the form to quickly locate a record, and then use the form portion to view or edit the record.

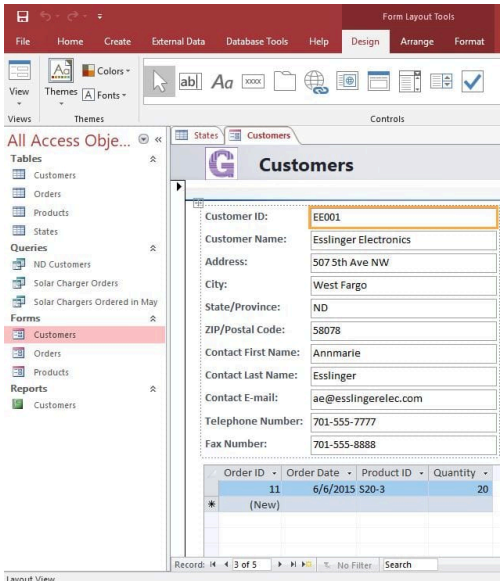
To be more selective about what fields appear on your form, use the Form Wizard. This multi-step process allows the user to define how the data is grouped and sorted, and in some instances, fields from multiple tables/queries can be added to the same form. Once a form is created, use the different views to modify the forms design or populate the forms with data. Forms have three views:

- **Form view** – shows the data in the form. This is the view to use to enter or change data. Record controls at the bottom of the form are used to display specific records and add a new record (the right arrow with the yellow star). The form's design properties cannot be changed in this view.



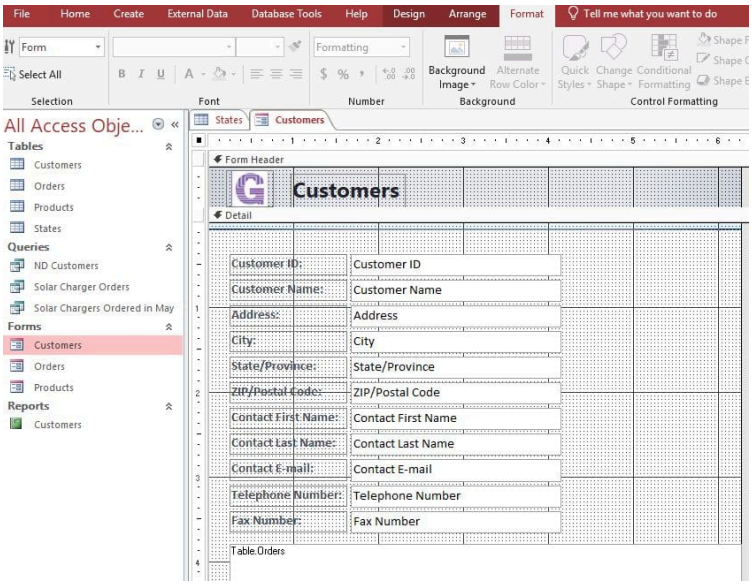
Form view

- **Layout view** – shows the form and the data in a visual layout. This is the view that opens when a form is initially created. Some of the form design properties, such as field fonts and column widths, can be changed in this view. However, the data cannot be changed in this view. Notice the Form Layout Tools contextual tabs!



Form Layout view

- **Design view** – shows the form design, but not the data. Any aspect of the form's design can be changed in this view, but the data cannot be changed. The Design, Arrange and Format contextual tabs appear for this view too. The *Design* tab allows the user to modify the color, fonts or theme of the form. A logo, title and/or date/time field can also be added to the form. Form controls (buttons, text boxes, combo boxes, etc) can also be added. The *Arrange* tab is used for modifying the order and position of the fields on the form. The Format tab allows the user to modify the style of the form including the fonts and a background image can be added.



Form design view

A user can switch between views as often as desired while customizing the form. Switching views can be done by using the View button on the Ribbon, or the three icons at the bottom right of the Access window.

Note

If a field in a table has been modified after the form is created, the existing form does not automatically update. The form can be modified, but sometimes it is easier to delete the existing form and recreate it based off of the new table settings.

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4.2.9: Various Agricultural Production Management Applications

Production Management Applications

1. **John Deere Operations Center**
   - **Description:** Manages field operations, tracks machinery, and analyzes crop performance.
   - **Website:** John Deere Operations Center
2. **Trimble Ag Software**
   - **Description:** Provides precision agriculture solutions for field mapping, crop management, and equipment control.
   - **Website:** Trimble Ag Software
3. **Climate FieldView**
   - **Description:** Offers real-time insights into field conditions and crop performance for data-driven decisions.
   - **Website:** Climate FieldView
4. **Ag Leader SMS Software**
   - **Description:** Comprehensive field management with data analysis and precision agriculture tools.
   - **Website:** Ag Leader SMS Software

Farm Management Applications

1. **FarmLogs**
   - **Description:** Tracks field activities, manages finances, and monitors crop performance.
   - **Website:** FarmLogs
2. **AgriWebb**
   - **Description:** Streamlines operations for livestock and mixed farms with tools for record-keeping and task management.
   - **Website:** AgriWebb
3. **Farm Management Pro by AG Leader**
   - **Description:** Manages farm operations, including expense tracking and field data management.
   - **Website:** Farm Management Pro
4. **Cropio**
   - **Description:** Provides real-time data on crop conditions and field activities for farm management.
   - **Website:** Cropio
5. **FarmERP**
   - **Description:** An integrated solution for managing various agricultural sectors, including crop and livestock management.
   - **Website:** FarmERP
6. **Tend**
   - **Description:** Aimed at small to mid-sized farms, offering tools for crop and livestock management.
   - **Website:** Tend
7. **Agris**
   - **Description:** Integrates with various data sources for insights into crop performance and operational efficiency.
   - **Website:** Agris

These applications cover a range of functionalities from managing field operations and crop performance to financial tracking and operational efficiency.

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4.2.10: Creating An Agricultural Database Exercise (Excel)

Creating an Agricultural Database in Excel: Comprehensive Exercise

Objective: This exercise will guide you through creating an agricultural database in Microsoft Excel, including inputting data, modifying tables, and generating simple queries and reports.

Step-by-Step Instructions

1. Create the Database Structure

1.1 Open Microsoft Excel:

- Start Excel and open a new blank workbook.

1.2 Define the Database Structure:

- Create a table to track various aspects of agricultural data. For this exercise, we will use a table for crop management.

1.3 Enter Column Headers:

- In the first row of your spreadsheet, enter the following column headers:
    - A1: `Crop ID`
    - B1: `Crop Name`
    - C1: `Planting Date`
    - D1: `Harvest Date`
    - E1: `Field Location`
    - F1: `Quantity (Bushels)`
    - G1: `Notes`

2. Input Data

2.1 Format as Table:

- Highlight the range A1(including headers) and several rows below.
- Go to the “Insert” tab and click “Table.” Ensure “My table has headers” is checked and click “OK.”

2.2 Enter Sample Data:

- Input the following data into your table:

Crop ID	Crop Name	Planting Date	Harvest Date	Field Location	Quantity (Bushels)	Notes
001	Corn	2024-04-15	2024-08-15	North Field	120	Organic variety
002	Soybean	2024-05-01	2024-09-01	South Field	85	High yield
003	Wheat	2024-03-10	2024-07-10	East Field	200	Winter wheat

3. Modify Tables

3.1 Add New Columns:

- Click on any cell in the table and select “Table Design” from the ribbon.
- Click “Resize Table” to adjust the table range if needed.
- To add a new column, right-click on the header of an existing column (e.g., Column H) and select “Insert.”

3.2 Example New Column:

- Add a column header `Crop Type` in H1 and fill in values such as “Grain” or “Legume” for each crop.

4. Perform Queries

4.1 Use Filters:

- Click on the filter dropdown arrows in the header row.
- For example, to filter crops by “Field Location,” click the dropdown in Column E and select “North Field” to see only crops planted in that location.

4.2 Use Conditional Formatting:

- Highlight cells in Column F with a Quantity greater than 100.
- Select Column F, go to “Home” > “Conditional Formatting” > “Highlight Cell Rules” > “Greater Than,” and enter 100. Choose a format and click “OK.”

5. Generate Reports

5.1 Create a Summary Report:

- Add a new worksheet by clicking the “+” icon at the bottom.
- In the new worksheet, create a summary report of total quantities per crop type.
- Use the “SUMIF” function to calculate totals. For example:
  - In cell A1: `=SUMIF(Table1[Crop Type], "Grain", Table1[Quantity (Bushels)])`

5.2 Create a Pivot Table:

- Select any cell in your table, go to “Insert” > “PivotTable.”

- Place the PivotTable in a new worksheet.
- Drag “Crop Name” to the Rows area and “Quantity (Bushels)” to the Values area to see a summary of quantities by crop.

5.3 Design a Chart:

- Highlight the data you want to chart (e.g., Crop Name and Quantity).
- Go to “Insert” > “Charts” and select a chart type (e.g., Column Chart) to visually represent your data.

Exercise Summary

In this exercise, you created an agricultural database using Excel, including:

- **Database Structure:** Defined columns and formatted as a table.
- **Data Input:** Entered and formatted sample crop data.
- **Table Modification:** Added new columns and adjusted table settings.
- **Queries:** Applied filters, conditional formatting, and used functions for data analysis.
- **Reports:** Generated summary reports, created PivotTables, and designed charts for visual data representation.

This comprehensive exercise provides a solid foundation for using Excel to manage and analyze agricultural data effectively.

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4.3: End of Chapter Summary

Summary: Introduction to Databases and Their Applications in Agriculture

Databases are essential tools for organizing and managing data, providing a structured method for storing and retrieving information. In agriculture, database applications enhance farm management by efficiently handling data related to crops, livestock, and finances. They support tracking, monitoring, and analysis, which helps in making informed decisions and improving productivity. By integrating databases into agricultural practices, farmers and agribusinesses can streamline operations, maintain accurate records, and optimize resource management.

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4.4: End of Chapter Discussion

Here are some discussion topics related to the application of databases in agriculture:

1. **Precision Agriculture:**
   - How can databases enhance precision agriculture practices?
   - Discuss the role of Geographic Information Systems (GIS) in managing agricultural data.
2. **Data Integration:**
   - What are the challenges of integrating data from various sources (e.g., weather stations, soil sensors, satellite imagery)?
   - How can databases facilitate seamless data integration for better decision-making?
3. **Predictive Analytics:**
   - How can predictive analytics and machine learning be applied to agricultural databases?
   - Explore examples of how predictive models can forecast crop yields or pest outbreaks.
4. **Supply Chain Management:**
   - Discuss the role of databases in optimizing agricultural supply chains.
   - How can databases help in tracking and managing the supply chain from farm to table?
5. **Farm Management Systems:**
   - What features should be included in a comprehensive farm management database system?
   - How can databases be used to manage crop planning, resource allocation, and financials?
6. **Climate and Weather Data:**
   - How can historical and real-time weather data be leveraged to make better agricultural decisions?
   - Discuss the impact of climate change on database management and agricultural forecasting.
7. **Soil Health and Management:**
   - How can databases support soil health monitoring and management?
   - Explore the use of databases in tracking soil nutrients, pH levels, and other critical factors.
8. **Crop Disease and Pest Management:**
   - How can databases help in tracking and managing crop diseases and pest infestations?
   - Discuss the role of data in developing integrated pest management (IPM) strategies.
9. **Data Security and Privacy:**
   - What are the best practices for ensuring data security and privacy in agricultural databases?
   - How can farms protect sensitive data from unauthorized access and breaches?
10. **User Training and Adoption:**
    - What are the challenges of training farmers and agricultural professionals to use database systems effectively?
    - Discuss strategies for improving user adoption of database technologies in agriculture.
11. **Regulatory Compliance:**
    - How can databases assist in meeting regulatory requirements and compliance standards in agriculture?
    - Explore the role of databases in documenting and reporting environmental impact, food safety, and other regulatory aspects.
12. **Data Quality and Management:**
    - What are the common issues related to data quality in agricultural databases?
    - Discuss techniques for ensuring accurate, reliable, and timely data collection and management.
13. **Emerging Technologies:**
    - How are emerging technologies, such as IoT devices and blockchain, influencing agricultural databases?
    - Discuss potential future trends and innovations in agricultural data management.
14. **Economic Impact:**
    - What is the economic impact of implementing advanced database systems in agriculture?
    - Explore case studies where database applications have led to significant cost savings or increased profitability.
15. **Global vs. Local Databases:**
    - Compare the benefits and challenges of global versus local agricultural databases.
    - How can local databases be integrated into global systems for better data sharing and collaboration?

These topics can spark engaging discussions and help explore the multifaceted role of databases in transforming agricultural practices.

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5: THE INTERNET, WORLD WIDE WEB AND AGRICULTURAL TELECOMMUNICATIONS

5.1: Chapter Introduction

5.2: Chapter Learning Objectives

5.2.1: Brief History of the Internet

5.2.2: Current Trends

5.2.3: Web Servers

5.2.4: Network Basics

5.2.5: Website Design

5.2.6: Development

5.3: End of Chapter Summary

5.4: End of Chapter Discussion

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5.1: Chapter Introduction

Introduction to the Internet and the World Wide Web in Agriculture

The Internet and the World Wide Web have revolutionized many sectors, including agriculture. While the Internet provides the foundational infrastructure for global data communication, the World Wide Web offers a user-friendly interface for accessing and interacting with information online. Together, these technologies have facilitated the development of numerous agricultural applications that enhance farm management, weather forecasting, market access, and more.

The Internet is a vast network of interconnected computers and servers that communicate using standardized protocols. It supports various services such as email, file transfers, and online communication. **The World Wide Web**, on the other hand, operates on top of the Internet and consists of interlinked web pages and multimedia content accessible via web browsers.

Historical Timeline:

- **The Internet** began in the 1960s with early network projects like ARPANET and evolved through the development of key protocols such as TCP/IP. It became publicly accessible in the late 1980s and early 1990s.
- **The World Wide Web** was introduced in 1991 by Tim Berners-Lee as a system for navigating the Internet through hypertext documents, significantly enhancing user accessibility and interaction.

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5.2: Chapter Learning Objectives

Here are brief learning objectives for each of these topics:

Learning Objectives

1. **The Internet:**
   - **Learning Objective:** Understand the basic structure and functioning of the Internet, including key concepts such as IP addresses, protocols, and network connectivity, and their implications for agricultural applications.
2. **World Wide Web:**
   - **Learning Objective:** Distinguish between the Internet and the World Wide Web, and comprehend how web browsers, websites, and web servers interact to deliver information and services relevant to agriculture.
3. **Agricultural Telecommunications:**
   - **Learning Objective:** Explore how telecommunications technologies, including mobile networks, satellite communications, and broadband, are used to enhance connectivity, data exchange, and communication in agriculture.

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5.2.1: Brief History of the Internet

Brief History of the Internet

As far back as the early stirrings of the Cold War, the concept of a network connecting computers was under development by both government and university researchers looking for a better means to communicate and share research. The military at the time relied in part on microwave transmission technology for communications. An unexpected attack on some of these towers demonstrated how susceptible the technology was to failure of even small portions of the transmission path. This led the military to seek a method of communicating that could withstand attack. At the same time, university researchers were trying to share their work between campuses, and were struggling with similar problems when their transmissions suffered drops in signal. Parties from both groups ended up at the same conference with presentations, and decided to collaborate in order to further their work.

At the time, computers were far from what we know them as today. A single computer was a large, immobile assortment of equipment that took up an entire room. Data entry was done by using punched cards of paper, or the newest method of the time, magnetic tapes. Interacting with the computer meant reserving time on the equipment and traveling to where it was. Most machines were owned by universities, large corporations, or government organizations due to the staffing demands, size, and cost to acquire and maintain them. The image below depicts the UNIVAC 1, a system used by the United States Census Bureau and other large organizations like universities. One of the fastest machines at the time, it could perform roughly 1000 calculations per second.

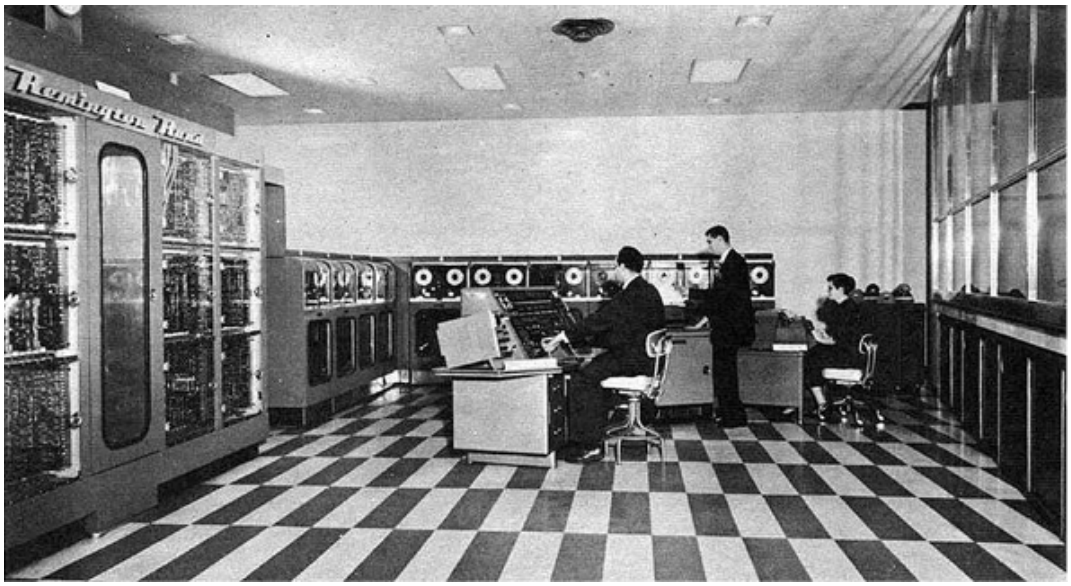


Figure 5.2.1.1: *UNIVAC Computer System*. (US Army, Public Domain, via Wikimedia)

In comparison, the K computer, a super computer produced in 2012 by the Japanese company Fujitsu, was capable of 10 petaflops per second when it was launched. Before you reach for your dictionary or calculator, we will break that down. FLOPS stands for floating point operations per second, or in basic terms, the number of calculations the system can finish in one second. A petaflop is a numerical indicator of how many 1015 (10 with 15 zeroes after it) calculations are completed per second. So, 10 petaflops means the K computer can complete 1015 calculations ten times in one second. If we fed the UNIVAC 1 just a single petaflop of data the day it was turned on, it would still be working on the problem today. In fact, it would barely be getting started, just a mere 60+ years into a roughly 317,098-year task!

ADDITIONAL NOTES

You may have heard of **Moore's Law**, commonly defined as the tendency of technology's capability to double every two years. Moore's actual prediction was that this would apply to transistors, an element of circuits, and that it would continue for ten years after seeing its trend from 1958 to 1964. His prediction has shown to be applicable to memory capacity, speed, storage space as well as other factors and is commonly used as a bench mark for future growth.

As cold war tensions grew and Sputnik was launched, the United States Department of Defense (DoD) began to seek additional methods of transmitting information to supplement existing methods. They sought something that was decentralized, allowing better resiliency in case of attack, where damage at one point would not necessarily disrupt communication. Their network, Arpanet, connected the DoD and participating universities together for the first time. In order to standardize the way networked systems communicated, the Transfer Control Protocol/Internetwork Protocol (TCP/IP) was created. As various network systems migrated to this standard, they could then communicate with any network using the protocol. The Internet was born.

Email was soon to follow, as users of the networks were interested in the timely transmission and notification of messages. This form of messaging fit one of their initial goals. As time progressed, additional protocols were developed to address particular tasks, likeFTPfor file transfers andUDPfor time-sensitive, error-resistant tasks.

Ongoing improvements in our ability to move more information, and move it faster, between systems progressed at a rate similar to the calculative power of the computers we saw earlier. This brings us to where we are today; able to watch full-length movies, streamed in high quality right to our phones and computers, even while riding in a car.

LEARN MORE

Keywords, search terms: History of the Internet, Arpanet

A Brief History of NSF and the Internet: http://www.nsf.gov/od/lpa/news/03/fsnsf_internet.htm

How the Internet Came to Be: http://www.netvalley.com/archives/mirrors/cerf-how-inet.html

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5.2.2: Current Trends

As important as it is to know how we reached where we are today, it is also important to stay current in web development. New products and innovations can greatly affect the landscape in a short amount of time. We can look to the rapid rise in Facebook, Twitter, and the myriad of Google services now relied upon around the world as examples of how fast new technology is embraced.

Cloud Computing

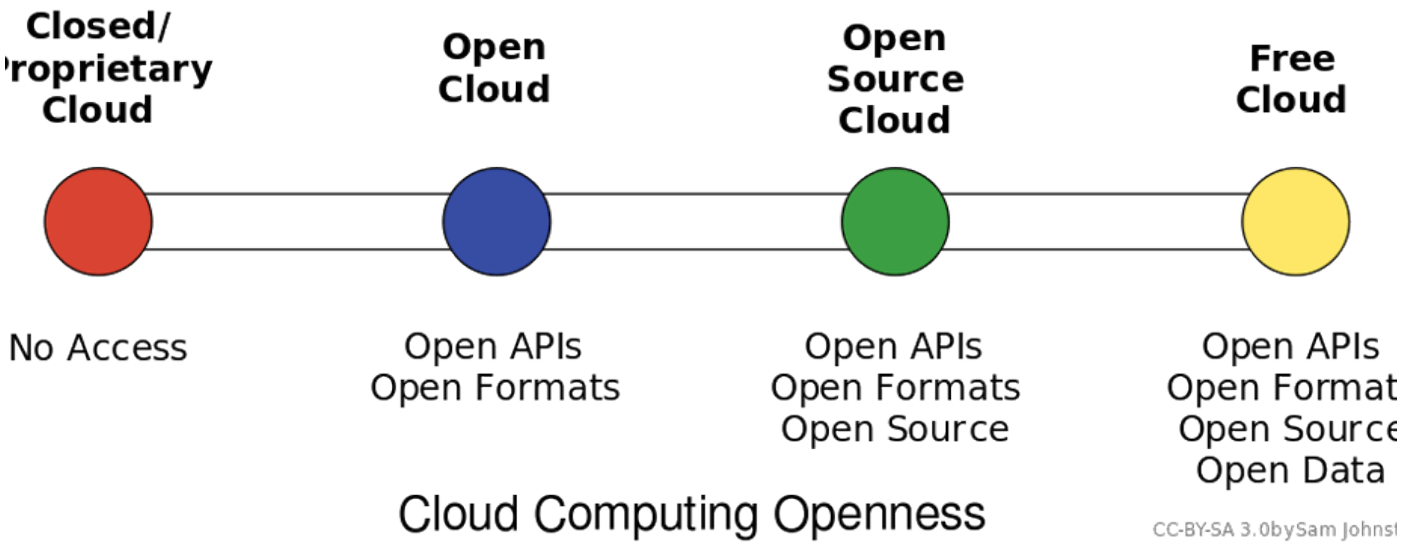


Figure 5.2.2.1: *Cloud Computing Styles*

Cloud computing can be loosely defined as the allocation of hardware and/or software under a service model (resources are assigned and consumed as needed). Typically, what we hear today referred to as cloud computing is the concept of business-to-business commerce revolving around “Company A” selling or renting their services to “Company B” over the Internet. A cloud can be public (hosted on a public internet, shared among consumers) or private (cloud concepts of provisioning and storage are applied to servers within a fire wall or internal network that is privately managed), and can also fall into some smaller subsets in between, as depicted in the graphic above.

Under Infrastructure as a Service (IaaS) computing model, which is what is most commonly associated with the term cloud computing, one or more servers with significant amounts of processing power, capacity, and memory, are configured through hardware and/or software methods to act as though they are multiple smaller systems that add up to their capacity. This is referred to as virtualizing, or virtual servers. These systems can be “right sized” where they only consume the resources they need on average, meaning many systems needing little resources can reside on one piece of hardware. When processing demands of one system expand or contract, resources from that server can be added or removed to account for the change. This is an alternative to multiple physical servers, where each would need the ability to serve not only the average but expected peak needs of system resources.

Software as a Service, Platform as a Service, and the ever-expanding list of “as-a-service” models follow the same basic pattern of balancing time and effort. Platforms as a service allow central control of end user profiles, and software as a service allows simplified (and/or automated) updating of programs and configurations. Storage as a service can replace the need to manually process backups and file server maintenance. Effectively, each “as-a-service” strives to provide the end user with an “as-good-if-not-better” alternative to managing a system themselves, all while trying to keep the cost of their services less than a self-managed solution.

Additional Notes

One of the best methods to keep current is by following trade magazines, industry leader blogs, and simply browsing the internet looking for new items or site features you have not noticed before. Content aggregators like Zite, Feedly, and Slashdot are some of my favorites.

As a micro-scale example, imagine you and four friends are all starting small businesses. Faced with the costs of buying servers and software for data storage, web hosting, and office programs, each of you would invest funds into equipment and the staff to maintain it, even though much of it may get little use in the early stages of your company. This high initial investment reduces available funding that may have been used elsewhere, and your return on investment becomes longer. Instead, each of you would create an account with Amazon's cloud services for file storage and website hosting, which are private to you, but physically stored on servers shared by other users. Since these services are managed offsite by Amazon staff, none of you need to hire IT staff to manage these servers, nor do you have to invest in the equipment itself. Just by not needing to hire a system administrator (estimated at $40,000 salary) you can pay for just over 3 years of Amazon service (calculated using Amazon's pricing calculator1 for basic web services and file storage). When you combine the savings of that employee's fringe costs like health care, along with those of not purchasing your own hardware, this approach can make your initial investment last longer.

These lowered costs are attractive to small businesses and startups for obvious reasons, but are also attractive to large companies with highly fluctuating levels of need. For example, a football team's website sees far more traffic on game days than the off-season. They do not need the ability to serve the same amount of users all the time. Some tangible examples of "as-a-service" tools you may already be using are file hosting services like Dropbox2 or Google Drive.3 Your files are kept on servers along with those from other users that you do not see (unless you share with them intentionally) and you can add or remove extra space to your account whenever you like. Similarly, services like Amazon Web Services4 offer the ability to host your files, applications, and more to both home consumers and commercial clients.

Virtualization

Server virtualization is the act of running multiple operating systems and other software on the same physical hardware at the same time, as we discussed in Cloud Computing. A hardware and/or software element is responsible for managing the physical system resources at a layer in between each of the operating systems and the hardware itself. Doing so allows the consolidation of physical equipment into fewer devices, and is most beneficial when the servers sharing the hardware are unlikely to demand resources at the same time, or when the hardware is powerful enough to serve all of the installations simultaneously.

The act of virtualizing is not just for use in cloud environments, but can be used to decrease the "server sprawl," or overabundance of physical servers, that can occur when physical hardware is installed on a one-to-one (or few-to-one) scale to applications and sites being served. Special hardware and/or software is used to create a new layer in between the physical resources of your computer and the operating system(s) running on it. This layer manages what each system sees as being the hardware available to it, and manages allocation of resources and the settings for all virtualized systems. Hardware virtualization, or the stand alone approach, sets limits for each operating system and allows them to operate independent of one another. Since hardware virtualization does not require a separate operating system to manage the virtualized system(s), it has the potential to operate faster and consume fewer resources than software virtualization. Software virtualization, or the host-guest approach, requires the virtualizing software to run on an operating system already in use, allowing simpler management to occur from the initial operating system and virtualizing program, but can be more demanding on system resources even when the primary operating system is not being used.

Ultimately, you can think of virtualization like juggling. In this analogy, your hands are the servers, and the balls you juggle are your operating systems. The traditional approach of hosting one application on one server is like holding one ball in each hand. If your hands are both "busy" holding a ball, you cannot interact with anything else without putting a ball down. If you juggle them, however, you can "hold" three or more balls at the same time. Each time your hand touches a ball is akin to a virtualized system needing resources, and having those resources allocated by the virtualization layer (the juggler) assigning resources (a hand), and then reallocating for the next system that needs them.

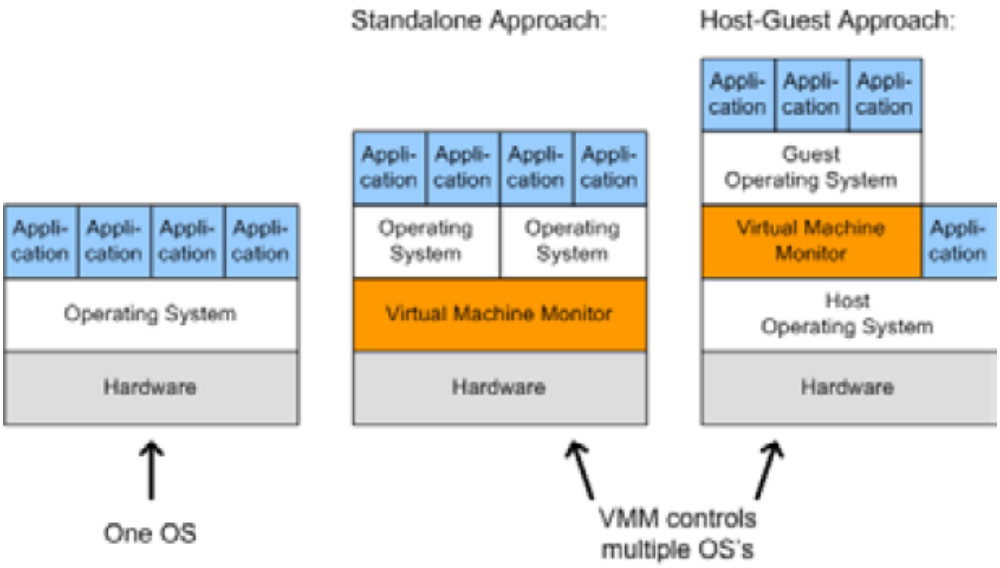


Figure 5.2.2.2: *Virtualization Styles*. (*By Daniel Hirschbach [CC-BY-SA-2.0 Germany] via Wikimedia*)

The addition of a virtual machine as shown above allows the hardware or software to see the virtual machine as part of the regular system. The monitor itself divides the resources allocated to it into subsets that act as their own computers.

Net Neutrality

This topic is commonly misconstrued as a desire for all Internet content to be free of cost and without restrictions based on its nature. In fact, net neutrality is better defined as efforts to ensure that all content (regardless of form or topic) and the means to access it, are protected as equal. This means Internet Service Providers (ISPs) like your cable or telephone company cannot determine priority of one site over another, resulting in a "premium" Internet experience for those able to pay extra. Additional concerns are that without a universal agreement, a government may elect to restrict access to materials by its citizens (see North Korea censorship5), and similarly that corporations controlling the physical connections would be able to extort higher prices for privileged access or pay providers to deny equal access to their competitors.

Useful Features

Legislation continues to change regarding what is and is not legal or acceptable content on the internet. Laws change over time as well as across jurisdictions and can greatly differ. Just because material is legal in your area does not mean it is in others and you may still be in violation of laws applicable in the location of your server.

Existing laws vary around the world, some protecting the providers, some protecting the user. The United States received considerable attention in 2012 for anti-piracy bills that were highly protested both with physical rallies and online petitions. Each bill drew debate over what affects the stipulations would have not only within the United States, but over the Internet as a whole. Even though SOPA6 (introduced by the House) and PIPA7 (introduced by the Senate after the failure of COICA8 in 2010) were not ultimately ratified, The United States and other countries had at that point already signed ACTA9 in 2011, which contained provisions that placed the burden on ISPs to police their users regardless of sovereign laws in the user's location.

Learn more

Keywords, search terms: Cloud computing, virtualization,
virtual machines (VMs), software virtualization, hardware virtualization

Xen and the Art of Virtualization: http://li8-68.members.linode.com/~caker/xen/2003-xensosp.pdf

Virtualization News and Community: http://www.virtualization.net

Cloud Computing Risk Assessment: http://www.enisa.europa.eu/activities/risk-management/files/deliverables/cloud-computing-risk-assessment

Without formal legislation, judges and juries are placed in positions where they establish precedence by ruling on these issues, while having little guidance from existing law. As recently as March 2012 a file sharing case from 2007 reached the Supreme Court, where the defendant was challenging the constitutionality of a $222,000 USD fine for illegally sharing 24 songs on file sharing service Kazaa. This was the first case for such a lawsuit heard by a jury in the United States. Similar trials have varied in penalties up to $1.92 million US dollars, highlighting a lack of understanding of how to monetize damages. The Supreme Court denied hearing the Kazaa case, which means the existing verdict will stand for now. Many judges are now dismissing similar cases that are being brought by groups like the Recording Industry Association of America (RIAA10), as these actions are more often being seen as the prosecution using the courts as a means to generate revenue and not recover significant, demonstrable damages.

As these cases continue to move through courts and legislation continues to develop at the federal level, those decisions will have an impact on what actions are considered within the constructs of the law, and may have an effect on the contents or location of your site.

Cyber Warfare

Intentional, unauthorized intrusion of systems has existed about as long as computers have. While organized, coordinated attacks are not new, carrying them out in response to geopolitical issues is now emerging, as was found in the brief 2008 war between Russia and Georgia. Whether the attacks on each country's infrastructures were government sanctioned or not is contested, but largely irrelevant. What is relevant is that these attacks will only continue, and likely worsen, in future disputes.

In the United States and other countries, equipment that controls aging infrastructure for utilities is increasingly connected, with control computers at facilities for electric, water, gas, and more being placed online to better facilitate monitoring and maintenance. However, many of these systems were not developed with this level of connectivity in mind, therefore security weaknesses inherent in the older equipment can result in exploits that allowHackersto cause real, permanent damage to physical equipment, potentially disrupting the utilities we rely on every day.

Tehran's uranium enrichment development facilities were targeted in late 2010 by a custom-created virus that focused on equipment used in the refining of nuclear material. The virus would randomly raise or lower the speed of the equipment in a manner that would not create alarms, but enough to strain the equipment. This would lead to equipment failures, after which the replacement hardware would be similarly infected. Eventually discovered, the virus had been running for many months, delaying the project and increasing its costs. This virus was intentionally designed to run in that particular environment and was based on the specificSCADAhardware involved, and in this case was such a sophisticated attack that it is widely believed to have been facilitated by the United States and Israel.

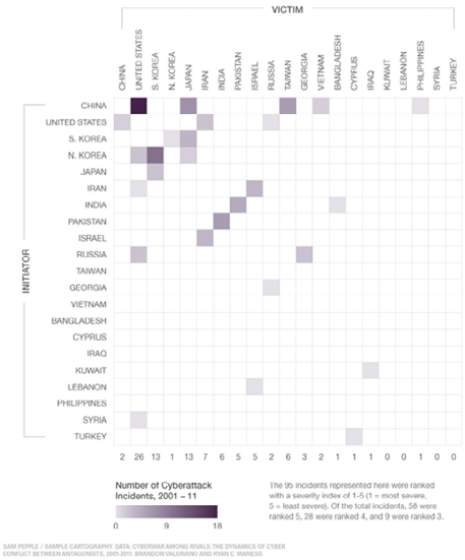


Figure 5.2.2.3: *10 Years of Known Cyber Attacks (*foreignaffairs.com)

The graph above, from foreignaffairs.com, provides an idea of how prevalent government to government attacks are becoming. We should keep in mind that the ninety-five incidents depicted are only the known, reported incidents, and the true number is likely higher.

Botnets

Botnets are not exactly a new threat to the Internet, but they remain one of the most persistent threats to the average user and their computer. The word botnet, an amalgamation of the words robot and network, is an accurate description of what it entails. Botnets are programs that use a network connection to communicate with each other to coordinate and perform tasks. Originally, botnets were created as part of programs for Internet Relay Chat (IRC) to help establish and control channels people would log into to talk to each other. They are still in frequent use today for a number of legitimate, non-malicious tasks.

We have also seen a rise in malicious botnets, designed to work undetected in the background of your computer. The controller (typically referred to as the command and control server) uses the infected machines to complete tasks that require large amounts of processing power and/or bandwidth to complete, like finding or exploiting weaknesses in networks or websites, or to “mine” infected systems for personal data such as credentials, credit card numbers, and other information that can then be used or sold to others.

Additional Notes

It did not take long for the first virus to enter the internet. Just two years after the first systems were connected, The Creeper (a self-replicating script) was created in 1971, which did no harm but displayed “I’m the creeper, catch me if you can” on infected machines. It was immediately followed by The Reaper, the first anti-virus program, which too self-replicated, removing the Creeper wherever it was found.

Some botnet controllers have grown so large and organized that they act as businesses in competition, typically “renting” their botnet out as a service or tool to others for agreed upon rates. Efforts by security researchers to detect and analyze botnets often involve close coordination with government agencies and law enforcement as the size of an average botnet typically involves computers from multiple countries. Simply shutting down or attempting to remove the malicious files from infected systems could cause unintended damage to the machines, further complicating the process of eliminating a botnet.

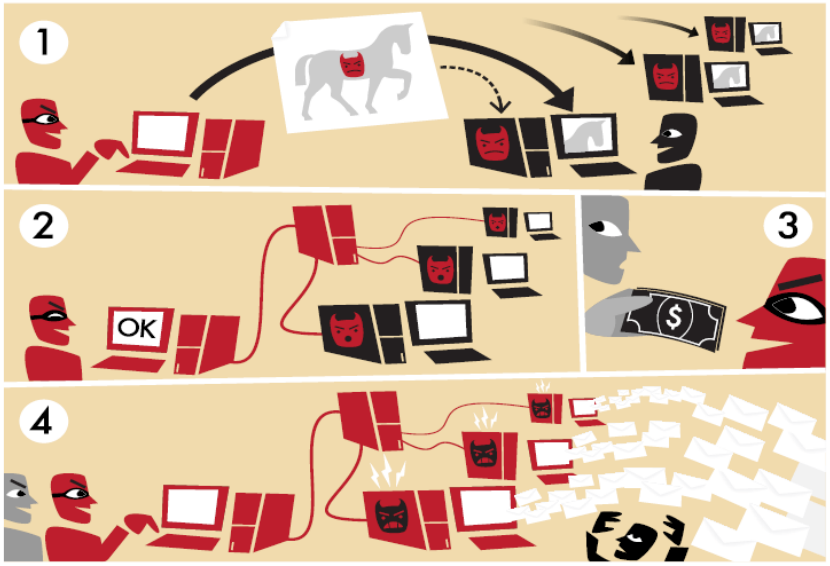


Figure 5.2.2.1: *Botnets*. (*By Tom-B [CC-BY-SA-3.0], via Wikimedia*)

Learn more

Keywords, search terms: Botnets, command and control system, malware, network security

Build Your Own Botnet: http://howto.wired.com/wiki/Build_your_own_botnet_with_open_source_software

Honeynet Project: http://www.honeynet.org/papers/bots/

Internet of Things

In much the same vein of the connection of older equipment to the networks of the modern world, the newest devices emerging into the market can also be a bit more non-traditional. This results in an internet that is soon to be awash with live connections from everything from cars to ovens and refrigerators, an explosion of devices no longer focused on delivering information to the masses as much as aggregating many data sources of interest to a small set of recipients. Some cars now include the ability for consumer service companies to perform tasks like remotely shutting down your car if stolen; coordinating use of these tools with law enforcement allows them to stop a vehicle before or during a pursuit. While these are innovative tools with positive uses, they also add new vectors for a malicious person to attack. Instead of the thief being thwarted, he might use a device to shut your car down at an intersection, eliminating your ability to simply drive away when he approaches. The very tool intended to stop him afforded him a means to gain access to your vehicle. This is not merely waxing philosophically, either. It has been demonstrated as a proof of concept11
backed by researchers funded by DARPA.

As more devices are introduced to the Internet, the amount of interaction with things as simple as small appliances is increasing. Comments like “We have to stop by the store on the way home, the toaster report said we will need at least one loaf of bread for the week” seem silly to us now, but could eventually exist in the same breath as “The fridge called, it ordered our groceries for the week.” For about $2,700 USD, Samsung already offers a fridge with interactive features similar to these ideas.

Items embedded withRFIDtags contribute to the Internet of Things, as they can be tracked and provide information that can be aggregated and applied to processes. Shipping crates with RFID expedite taking inventory as their tags can be scanned automatically in transit. Access cards not only allow privileged access to restricted areas but also let us know where people (or, at least their cards) are located and where they have been. Home automation systems allow lights, locks, cameras, and alarms to

be managed by your smart phone to the extent that your lights can come on, doors unlocked, and garage door opened, when it detects that your phone has entered the driveway. All of these are items—not people—interacting with the Internet to fulfill a task, and are part of the emerging Internet of Things.

Proliferation of Devices

As reliance on the Internet and the drive for constant connection proliferate through our societies, and technology becomes more affordable and adaptable, we have not only left the age of one computer per home, but meandered even past the point where everyone in the house has their own device, and now the average consumer has multiple devices. The proliferation allows us to adjust technology to fit where we need it in our lives. I use my desktop for hardware intensive applications at home, or for doing research and web development where multiple monitors eases my need to view several sources at once. Out of the house, my tablet allows me to consume information and is easily slid into a keyboard attachment that allows it to operate as a laptop, turning it into a content creation device by reducing the difficulty of interacting by adding back a keyboard and mouse.

Improvements in software both in efficiency and ease of use allow older hardware to get second lives. My laptop, though ten years old, is still running happily (albeit without a useful battery life) and is still capable of browsing the internet and being used as a word processor due to a lightweight Linux operating system that leaves enough of its aging resources available for me to complete these tasks. When the average lifespan of a laptop is typically considered to be only three years, many older devices like mine have not left operation, and are still finding regular use in our growing set of tech tools.

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5.2.3: Web Servers

While we could simply focus on how to create web pages and websites, none of this is possible without the underlying hardware and software components that support the pages we create. Examining what these components are and how they interact helps us understand what our server is capable of.

The diagram below represents the basic elements of a web server. Hardware, an operating system, and an http server comprise the bare necessities. The addition of a database and scripting language extend a server's capabilities and are utilized in most servers as well.

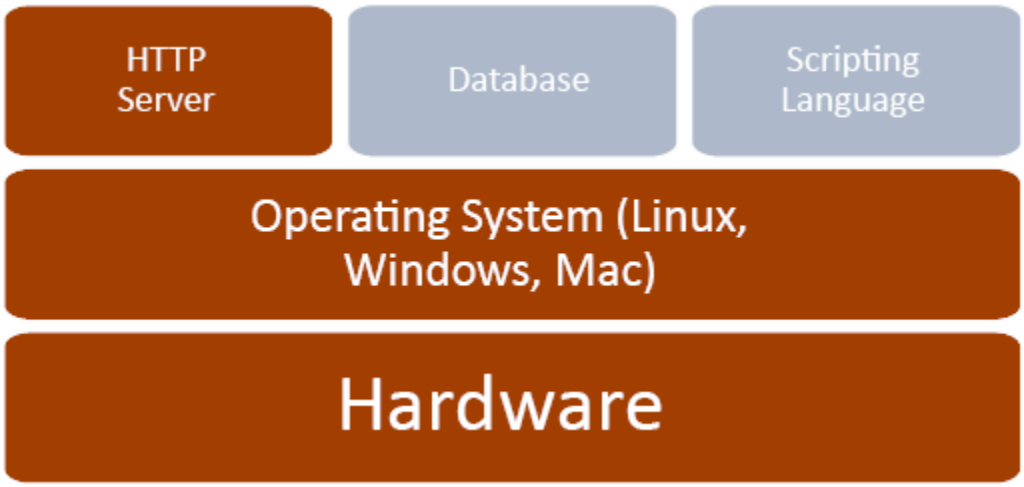


Figure 5.2.3.1: *Web Server Software Structure*

Hardware

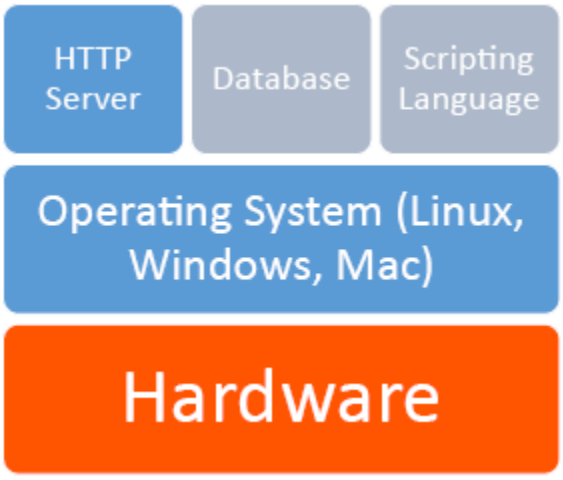


Figure 5.2.3.2: *Web Server Structure emphasizing Hardware*

The mention of phrases like data center, hosting provider, or even big name companies like Microsoft and Google can invoke mental images of large, sterile rooms full of tall racks of hardware with blinking lights and a maze of wires. Those more familiar with such rooms will also know the chill resulting from the heavily air conditioned atmosphere and droning whir of fans that typically accompany them. This, however, is not a requirement nor an accurate portrayal of a great deal of servers connected to the Internet. With the addition of the right software (assuming you are consuming this text digitally), the device you are using

to read this with could become an internet connected server. While it would not sustain the demands made of domains like Amazon.com or MSN.com, you would be able to perform the basic actions of a server with most of today's devices.

Even though we have reached this point, it is difficult to forget the mental picture conjured by the thoughts of the data center. In the current "traditional" model, thin, physically compact servers are stacked vertically. These are referred to as rack mount hardware. Many rack mount systems today contain hardware similar to what we have in our desktops, despite the difference in appearance.

A number of companies, including Google, Yahoo, and Facebook, are looking to reinvent this concept. Google for instance has already used custom-built servers in parts of its network in an effort to improve efficiency and reduce costs. One implementation they have tried proved so efficient that they were able to eliminate large power backup units by placing a 9 volt battery in each server—giving it enough emergency power to keep running until the building's backup power source could kick in. They have also experimented with alternative cooling methods like using water from retention ponds, or placing datacenters where they can take advantage of natural resources like sea water for cooling or wind and solar for energy.

Additional Notes

Take note! While all of the programs we refer to in our LAMP stack have free, open source versions, not all uses may be covered by those licenses (using them for study and research purposes is covered).

Even small, low powered devices are finding demand as servers in part to enable the Internet of Things. Devices like the Raspberry Pi12 and an explosion of similar products like "android sticks" can be purchased for as little as $25 USD. These small, "just-enough-power" devices are used to connect data from the environment or other devices to the Internet, leaving the data center behind and living instead at the source of the data itself.

Software

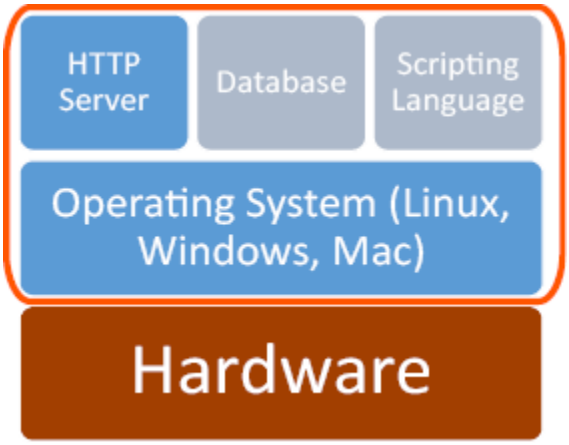


Figure 5.2.3.3: *Web Server Structure emphasizing ware*

A typical web server today contains four elements in addition to the physical hardware. These are the operating system, web server, a database and a scripting language. One of the most popular combinations of these systems has been abbreviated to LAMP, standing for Linux, Apache, MySQL, and PHP, named in the same order. There are many combinations of solutions that meet these features, resulting in a number of variations of the acronym, such as WAMP for Windows, Apache, MySQL, PHP or MAMP, identical with exception of Mac (or, rightfully, a Macintosh developed operating system). Among the plethora of combinations, the use of LAMP prevails as the catch all reference to a server with these types of services.

All that is ultimately required to convey static pages to an end user are the operating system and HTTP server, the first half of the WAMP acronym. The balance adds the capability for interactivity and for the information to change based on the result of user interactions.

Operating System—Linux

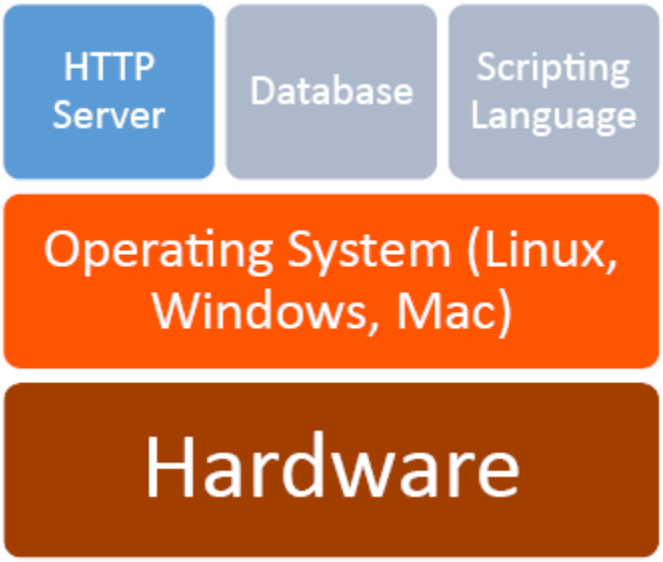


Figure 5.2.3.4: *Web Server Structure emphasizing Hardware*

Your operating system is what allows you to interact with the applications and hardware that make up your computer. It facilitates resource allocation to your applications, and communication between hardware and software. Typically, operating systems for servers fall under three categories: Linux based, Windows based, and Mac based. Within each of these categories are more options, such as various version of Mac and Windows operating systems, and the wide variety of Linux operating systems. We will utilize Linux, the predominant choice.

Developed by Linus Torvalds in the early 1990s while he was a student, Linux was created so Linus could accessUNIXsystems at his university without relying on an operating system. As his project became more robust, he decided to share it with others, seeking input but believing it would remain a more personal endeavor. What he could not have predicted was the community that would come together and participate in helping shape it into what is today. As the basis of a large number of Linux-based operating systems (or “flavors” of Linux), the Linux core can be found around the world, even in the server rooms of its competitors like Microsoft.

HTTP Server—Apache

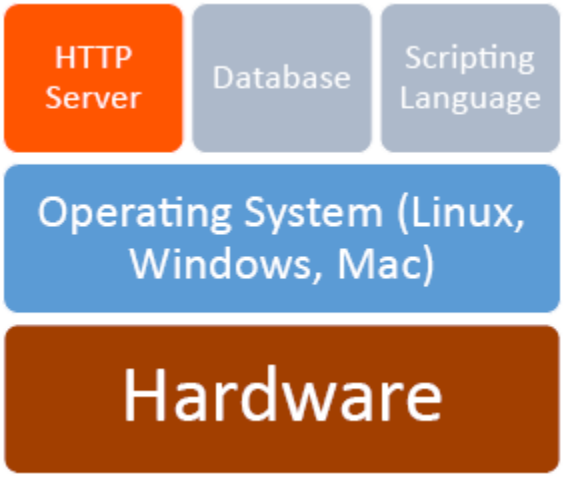


Figure 5.2.3.5: *Web Server Structure emphasizing Hardware*

Apache is an open source web server originally developed for UNIX systems. Now supported on most platforms including UNIX, Linux, Windows, and Mac, Apache is one of the most utilized server applications. First developed in 1995, Apache follows a similar open source approach as Linux, allowing users to expand on the software and contribute to the community of users. The user group around Apache developed The Apache Foundation, which maintains a library of solutions for web services.

In a web server, Apache serves as the HTTP component, which compiles the results from scripting languages, databases, and HTML files to generate content that is sent to the user. Apache (or any web service) will track which files on the server do and do not belong to the website, and also controls what options are available to the end user through its configuration files.

Apache and other HTTP servers allow us to share our webpages, scripts, and files with our end users. Any output from our database and scripting languages is turned into HTML output that the client's browser displays as our webpage. While we can view HTML and JavaScript files on a computer that is not a webserver, we need an http server to view them as a destination on a network.

Configuration Files

When we create a new system, settings may not be exactly as we want them, or the time may come where we want to add, remove, or change something about our server. To do this, we will need to edit the configuration files that control the different pieces of our system. Our actual web server config file is called httpd.conf. For PHP settings, we need to refer to php.ini, and for MySQL we refer to my.cnf. These files may be located in different places depending on the operating system, and the version in use, so it is best to use your system's file search tools to find where they are on your machine. Configuration (or setting) files are typically a plain text format file with one setting on each line with comments near each value describing the setting's use. These files will also use the same commenting delimiter for their notes to enable or disable individual settings. Typically the delimiter used is a semi colon ; or pound sign #.

If you want to change settings about your server itself such as the port it listens on, what folder it looks for files in, its name, or other related features, look to the httpd.conf file. From the php.in file you can control elements like which modules are installed and enabled for your system, how much data scripts are allowed to consume, and more. Similarly your MySQL config file determines what port it listens on, which user it runs as on your server, what your admin account's credentials are, and more.

Changes to these files typically require you to restart your web server (in our case, for apache or PHP changes), or at least

the service that you are changing (in our case, MySQL changes). This can be done using the control panel if you are using a combination program like Wamp 2, or by using your operating system's service tools or by using system commands at a command prompt. Restarting Wamp 2 in a GUI operating system like Windows can be done be right clicking on Wamp's icon in the tray. In a Cent OS server, the same effect can be achieved by typing "service httpd restart." If all else fails, you can always physically restart the machine (referred to as "bouncing"), but this is something you will want to avoid on a live system as it will cause a much longer period of down time.

If you use installer packages, or a combo installer like Wamp 2, you will probably get by initially without making any changes to these files. Binary installers however will not know where or how to make changes to config files and you will need to follow the instructions to edit these files by hand to integrate all of your elements.

Why would I use a combination other than Linux, Apache, My SQL, and PHP?

Given the popularity of this particular combination of four, it is easy to wonder why it has not simply become *the* system. However, needs and preferences may change why a particular approach is selected. Perhaps you are in an all Windows environment and feel more comfortable with a Windows operating system. Maybe your data is already available in a flat file or XML format and you want a database that can use XML files, like MongoDB.13 Or, you might prefer the approach and packages available in Python to those found in PHP. Each system has its particular strengths and weaknesses, and should be chosen based on the needs of the project.

Open Source

At this point, you have come across many references to terms like free, free to edit, and open source throughout the text. In fact, all of the elements in our example LAMP are free, open source solutions. Open source means the provider of the software allows the end user access to the actual code of their software, allowing the end user to make changes anywhere in the program.

This differs from traditional software where you own a copy or license to use the program, but cannot extend or change elements of the program beyond what the developer allows. An executable in Windows for example is closed source. You cannot open the executable to read its code or make changes. If you wanted to change the program, the developer would have to provide you with the files used to create it (called source code) so you could make changes and compile your own, modified, executable program.

Open source is growing in popularity but the concept has existed for quite some time. Recently, larger governments have begun to embrace free, open source solutions as a means to reduce costs and achieve modifications that customize programs to fit their needs. Historically open source was viewed as a security risk as anyone could submit changes to the project, and it was feared that vulnerabilities or malicious code would be inserted. In fact, with so many users able to view and modify the files, it has actually made those with malicious intent less able to hide their modifications (sometimes called the "many eyes" approach to reliability). Development time has also been reduced as the community of developers on a popular open source project can greatly exceed that of a closed source solution with limited development staff.

A popular acronym referring to these projects is FOSS—Free, Open Source Software. As not all open source programs are free in terms of purchasing or licensing, FOSS indicates solutions that are free of costs as well as free to change. These solutions may be developed entirely by a community of volunteers, or may come from a commercial company with developers dedicated to the project. While it is odd to think of a company giving away its creation for free, these companies generate revenue by building advertising into their software or offering premium services such as product support or contracting with clients to customize the product. Many companies will also offer only some tools as open source alongside other products they sell, or offer a "freemium" model where the open sourced platform contains most of the features of their software. Here, additional features or add-ons beyond the open source package carry additional licensing and costs.

FTP

While not included in LAMP acronyms, another important element to note is the existence of a file transfer protocol (FTP) server. As you typically will want to perform development activities on private server before editing your live server, you will need a mechanism that allows you to move files between the two. FTP is designed for moving files between systems, allowing you to synchronize items when you are ready. In addition to an FTP server, you will also likely want an FTP client application for the machine(s) that contain the files you want to move. The client allows you to see files in both locations and interact with them to determine which file is moved to which machine. There are a number of free file transfer programs available, some of which can even be integrated into browsers like Chrome by using browser extensions.

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5.2.4: Network Basics

IP Addresses

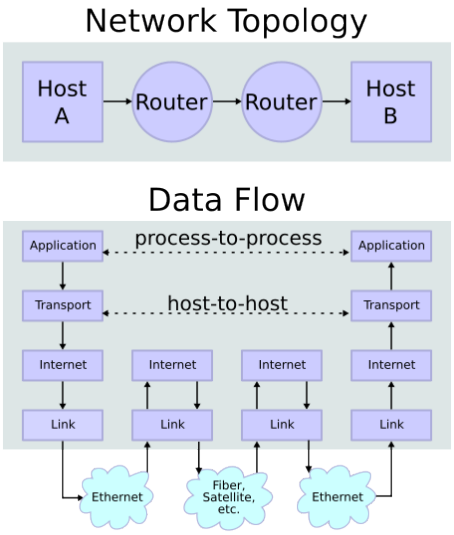


Figure 5.2.4.1: *Network Topology*. (*By User:Kbrose [CC-BY-SA-3.0] via Wikimedia*)

An IP (Internet Protocol) address is a unique code that identifies a piece of equipment connected to a network. These addresses are used in messages between network devices like the network or wireless card in your computer, the equipment from your ISP (internet service provider), and all pieces of equipment between your machine and the one your computer needs to talk to.

IP Addresses live in the network layer, which is one of seven layers in the protocol suite defined in the OSI Model. The OSI model stands for Open Systems Interconnection, and was created by the International Organization for Standardization, an international non-governmental group of professionals who strive to establish standards and best practices in a variety of fields. The OSI Model for networking breaks the system of transmitting data into the layers show below in an attempt to delineate where certain actions should take place.

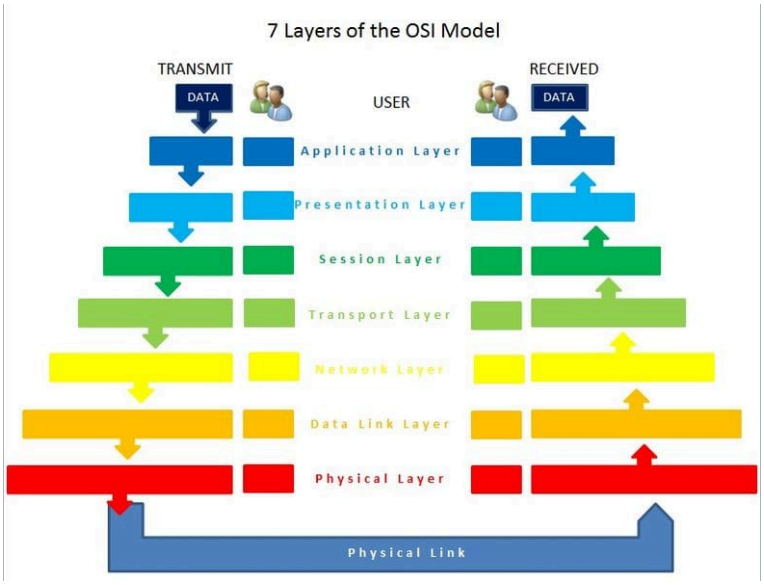


Figure 5.2.4.2: *OSI 7 Layer Model*. (*By MrsValdry [CC-By-SA 3.0] via Wikimedia*)

The seven layers depicted above make up the OSI body's recommended protocol suite. In the diagram, transmission of data crosses two routers and over the Internet to reach its destination. By following the data along the arrows, we see it pass through various layers of communication and processing as it crosses the internal network, through the first router, across the public network (internet connection), into the recipient's router, and then is reassembled into its original form.

Until recently, most network equipment has operated on IPv4, the fourth standard released for IP addresses, which has been in place for about thirty years. Addresses in this format are typically represented as a pattern of four blocks of up to three digits separated by periods, with no block of numbers exceeding 255 such as 127.0.0.1 or 24.38.1.251. This is referred to as dot-decimal representation, and although it is not the only way to express an IPv4 address it is the most recognized form. Segments of the addresses within the ranges of 192.168.xxx.xxx, 172.16.xxx.xxx to 172.31.xxx.xxx, and 10.0.xxx.xxx to 10.255.xxx.xxx are reserved for private networks, meaning they are used within a network in your house, at work, or anywhere else where a group of computers share a connection to the internet.

Each of these networks uses one or more of these blocks of numbers for devices on that network. Only the equipment connecting that local network to the Internet needs a unique address from the rest of the world. That equipment will track which computer inside the network to send data to and from by reading packets—the individual pieces of messages that are sent across networks. This means your computer might be 192.168.1.25 at home, and so might your computer at work, according to your home and work networks. The connection between your house and office thought still have a different, unique number assigned to them.

This separation of networks was done to reduce the speed at which unique addresses were consumed. Although this scheme allows for almost 4.3 billion (accurately, 232) addresses, the last one was officially assigned on February 4th, 2012. To sustain today's growing number of devices, IPv6 was created, which is depicted as eight blocks of four hexadecimal digits now separated by colons. These new addresses might look like 2001:0db8:85a3:0042:1000:8a2e:0370:7334, and can support roughly 4 billion unique addresses. Since the new range is so staggeringly large, additional protocols were created that specify when certain values or ranges are used in addresses. This allows additional information about the device to be conveyed just from the address.

The actual messages sent between machines are broken down into multiple pieces. These pieces, called packets, are sent piece by piece from sender to recipient. Each packet is sent the fastest way possible, which means some packets may take different routes—picture a short cut, or getting off a congested road to take a different one. This helps to ensure that the message gets from sender to receiver as fast as possible, but also means packets may arrive in a different order than they were sent.

Additional Notes

Hexadecimal is a number scheme that allows 0 through 9 and A through F as unique values, which means we can count to 15 with one character.

To account for this, each piece of the message, or payload, is wrapped in a header—additional information that describes how many other pieces there are, what protocol is being used, where the packet came from and is headed to, along with some other related information.

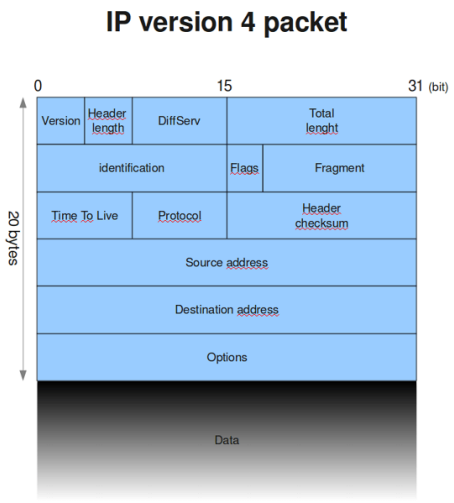


Figure 5.2.4.3: *IP 4 Packet*. (*Nicolargo [CC-BY-SA-3.0-2.5-2.0-1.0] via Wikimedia Commons*)

After the packets are reassembled, the receiving computer sends any necessary responses, and the process repeats. This all takes place in fractions of a second, beginning with the “hello,” or handshake packet to announce a communication request, to the last piece of the packet.

URL

Seeing as most of us would have a hard time remembering what IP address is needed to get to, say, Facebook (173.252.100.16) or the Weather Channel (96.8.80.132) we instead use URLs, universal resource locators. This allows us to use www.facebook.com and www.weather.com to get to where we want to go without referring to a long list of IP addresses. Specialized servers (called name servers) all around the world are responsible for responding to requests from computers for this information. When you type facebook.com into your address bar, if your router does not have a note of its own as to where that is, it will “ask” a name server, which will look it up in its records and reply.

There are three parts to a network address: the protocol, name, and resource id. The protocol represents how we want to send and receive messages, for example we can use http:// for accessing websites and ftp:// for moving files. The name is what we associate with the site, like www.facebook.com, and the resource id, or URI, is everything after that, which points to the particular file we want to see.

Ports

While an IP address and a URL will bring you to a particular web server, there may be more than one way you want to interact with it, or more than one thing you want it to do. Maybe you also want the server to provide email services, or you want to use FTP to update your files. These ports act as different doors into your server, so different applications can communicate without getting in each other’s way. Certain ports are typically used for certain activities, for example port 80 is the standard port for web traffic (your browser viewing a page), as opposed to ftp, which typically uses port 21. Using standard ports is not a rule, as applications can be configured to use any available port number, but it is recommended in most cases as firewalls and other security devices may require additional configuring to keep them from blocking wanted traffic because it is arriving at an unusual, fire walled, or “locked” port.

Hosting Facilities

If you are using a server that is not under your physical care, and is managed by an off-site third party, then you likely have an agreement with a hosting facility. Hosting facilities are typically for-profit companies that manage the physical equipment necessary to provide access to websites for a number of clients. Many offer web development and management services as well, but if you are still reading, then that tidbit is probably of little interest as you are here to build it yourself.

Additional Notes

Up Time is the average amount of time that all services on a server are operational and accessible to end users. It is a typical measurement of a hosting company's ability to provide the services they promise.

The benefit of using a hosting service falls under the same principles as other cloud computing services. You are paying to rent equipment and/or services in place of investing in equipment and managing the server and Internet connection yourself. Additionally, hosting facilities are equipped with backup power sources as well as redundant connections to the internet, and may even have multiple facilities that are physically dispersed, ensuring their clients have the best up time as possible. Ads like the one below are common to these services and often emphasize their best features. Price competition makes for relatively affordable hosting for those who are not looking for dedicated servers and are comfortable with sharing their (virtual) server resources with other customers.



Domain Registrar

Domain registrars coordinate the name servers that turn URLs into the IP addresses that get us to our destinations. These companies are where you register available names in order to allow others to find your site. One of the most recognized registrars right now is GoDaddy—you may know them from their ads, which feature racecar driver Danica Patrick. Like many registrars, GoDaddy also offers other services like web and email hosting as well as web development in an effort to solve all of your website needs.

Learn more

Keywords, search terms: Networking, network topology, OSI, network architecture

Cisco Networking Example: http://docwiki.cisco.com/wiki/Internetworking_Basics

List and description of all top level domains: http://www.icann.org/en/resources/registries/tlds

Ongoing comparison of hosting providers: http://www.findmyhosting.com/

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5.2.5: Website Design

Website design is a topic of study often neglected until after a programming background has been developed. Worse, it may be entirely ignored or missed by computer science students when courses covering the topic are in other programs like graphic arts or media. This results in programmers trying to understand how to write code meant for layout and design elements without understanding design. By studying these elements first, we can develop a better knowledge of the concepts of web design before we write code. Progressing through the topics in this section during your site design will greatly ease your development efforts in the future, allowing stakeholders to understand the project and provide feedback early on, reducing (re)development time.

A number of factors affect design in web development, complicating what would otherwise appear to the end user to be a relatively simple process of displaying a picture or document. In truth, the development process involves not only the HTML and multimedia that make up the visual aspects of the page but also considerations of software engineering, human-computer interaction, quality assurance and testing, project management, information and requirement engineering, modeling, and system analysis and design.

Today's sites are now becoming more application centered than traditional sites. This further complicates our projects as we integrate with legacy software and databases, strive to meet real-time data demands, address security vulnerabilities inherent to the environment we are working in, and ongoing support and maintenance typical of robust software applications.

In response to these advances in complexity and capability, web development has grown to embrace many of the same development processes of software development. We will consider some of these processes below, which you may wish to use depending on the size and complexity of a given project.

Planning Cycle

Web development is best achieved as a linear process, but is usually completed asynchronously. The planning process described is intended to build upon itself to refine project requirements, look and feel, and development plans. However, limitations in timelines, mid-project revisions, and the extensive time that can be invested into the early stages of design lead many programmers to begin development while a project is still in design.

Starting early with programming during design planning can accelerate a project when the elements created early on are unlikely to be affected by later changes in the scope. When done carefully, early programming also allows an opportunity to test concepts before investing time into an idea that may not work. It is important to avoid aspects that are assumed to change, like visual layout or particular pieces of content, instead focusing on data structure, frameworks, and other components that are easily adapted to design changes.

While you are planning, keep an eye out for indicators that things are going off-track. Some of the more important flags that should be resolved include:

1. Vaguely defined use cases and inadequate project requirements
2. Overly broad or undefined scope of features
3. Unresolved disputes between stakeholders about project features
4. Unrealistic time table, budget, or inadequate resources

When considering your milestones, tasks, objectives, or whatever label you or your team place on objectives, a handy acronym to reference is SMART. SMART stands for Specific, Measurable, Attainable, Realistic, and Timely. The idea is to check all of your objectives against these criteria to determine if they are appropriate and well developed. By ensuring all of your objectives meet the SMART criteria, you will have a better chance of keeping your project on time and well planned.

Specific:

Is your objective specific enough to convey its full scope? While you do not want to specify implementation of the objective, you should convey enough specific information that the person assigned to the objective can begin their portion of implementation.

Good Example: Deliver our standard proposal with adjusted price quotes to reflect customer's discount rate of 15%.

Bad Example: Deliver a proposal to the customer.

Measurable:

Your objective should have a clear indicator of when it is complete.

Good Example: Complete the first 15 pages identified in the site plan.

Bad Example: Complete the first 20% of the site.

Attainable:

Is it possible, at all, to complete the objective?

Good Example: Get the server to a FedEx store by close of business on delivery date.

Bad Example: Drive the server from New York to California within 24 hours.

Realistic:

Is it possible to complete the objective given the timeline and resources on hand?

Good Example: Have Team A (staff of 20) complete 10 pages by tomorrow.

Bad Example: Have Bob the Intern complete 10 pages by tomorrow.

Timely:

Will the objective be useful if it is completed at (not near or before) its deadline?

Assuming a proposal deadline of Friday morning:

Good Example: Have draft sitemap completed by the end of Wednesday to include in the proposal.

Bad Example: Have draft sitemap completed by the end of Friday to include in the proposal.

“But, wait, Attainable and Realistic sound like the same thing!” Well, yes they are quite similar. However the difference lies in what else you know about the project, timeline, resources and objectives. In our Realistic example this is highlighted by specifying the resources available for the objective. While our example company could assign sufficient resources to complete 10 pages in a day, it could never drive a server from New York to California in a day no matter how many people it has or how fast their car is given current speed limits. In the same vein, the objective of creating 10 pages in a day is perfectly attainable for our example company, but is not realistic if your company lacks enough manpower to complete the task.

While we broke these examples down to highlight the particulars of each element of our litmus test, real world objectives would contain all of these together in up to two or three brief sentences:

Team A will complete the customer’s proposal using our standard forms including their discount and a sample site plan by the 15th for delivery the 20th.

Now we need to test it. Is the objective specific? Yes. We are not left needing basic questions asked before we could work on the objective. Is it Measurable? Yes. We have a deadline of the 15th of the month for a specific list of items. Is it Attainable? Yes. With appropriate resources there is nothing impossible about the objective. Is it Realistic? Assuming Team A has enough time and manpower to complete the task by the deadline, yes. Is it Timely? The work is due 5 days before delivery, allowing time for review, changes, or delays, and its deadline does not extend beyond its useful life, so yes, we have a SMART objective.

How do we come up with our objectives? We extract them as the “big things” that need to be done from the customer’s request, the mission statement, or other sources of information that define the scope of your project.

What do we do with our objectives? The individual(s) tasked to the objective will break it into actionable tasks, or individual items that need to be completed. For example, our hypothetical objective of ten pages in a day could be broken down into ten tasks, one for each page. Helpful Hint: SMART can be applied to tasks, too (really any future planning/goal).

Why bother with any of this? Why even create a scope document in the first place if we know things will change? Well, we do it because things will change. New ideas will crop up, problems might be found, or something might be forgotten in the mix. The planning stage will define for us and our client exactly what we are going to do, and what our price, time, terms, etc. are meant to cover. As a project is in progress, especially if iterative meetings are held with the client, new requests will come into play. These may be great ideas. They may be terrible. They may derail the project’s success if they are not completed. However, each of them will affect your timeline and resources. The tendency to squeeze in “one more idea” over and over again is called Feature Creep, as it creeps into your project and eventually eats away at your resources and profit.

Learn more

Keywords, search terms: Website planning, web development plan, planning templates, project management

Good Planning Worksheet: http://www.goodworkmarketing.com/docs/WebsitePlanningGuide.pdf

BusinessBalls.com Guide to Project Management: http://www.businessballs.com/project.htm

The Fold

As we begin to develop our pages, we need to begin to consider where we want to place pieces of our content. If you look at newspapers, you will find that the most attractive story of the day (as decided, at least, by the publisher) is emblazoned in large letters near the middle or top of the front page, surrounded by the name of the paper, the date, and other pieces of information that quickly lend to your decision of whether or not to purchase a given paper. This is done intentionally, to make the paper attract your attention and get you to buy their edition over their competitors. In the printed news industry, the prime retail space in the paper is the top half of the front page, or what you see when the newspaper is folded normally at a newsstand. This is referred

to as “above the fold,” and is crucial to getting their audience’s attention. This also applies to websites, except in our case, our “above the fold” is what the user sees on the landing page for our site, without having to scroll down or use any links.

What you typically find here is the name and or logo of the company, and what they feel is most important for you to see first. As you begin to analyze web pages in this light, you will find it very easy to determine what kind of site they are, or what they want or expect from you as their guest. News sites will typically follow a similar setting to a printed paper, leading with headlines and links to other sections. Companies will lead with a featured product or sale to attract your attention, and search engines will make the search bar prominent, usually with ad space close by to increase their revenue streams.



The concept of “The Fold” is another of the many highly argued concepts in web development. Proponents are quick to point out the same example I used of traditional print media methods, while detractors will argue that if it were true, scrolling would never have been created, or users would lose interest in following links. While I endorse “The Fold” as a useful approach to landing pages, I do not mean to imply that all of your pages should fit on only one, non-scrolling screen.

Recent trends on sites like Facebook and LinkedIn show us there are in fact places for scrolling. Indefinitely, as it were. Both sites now feature status pages where older content is continuously appended each time you near the bottom of the page. This is quite similar to the concept of paging, but instead of clicking a link to the next page, the content is simply written in at the bottom creating a never-ending feel to the page. Ultimately, your design phase will help identify where following “The Fold“ is not really an option, or if there is enough content to warrant indefinite scrolling, and all other ranges in between.

Typography

Typography is the study of font. While an important topic in media arts, it has until recently received little attention in web development. Utilizing unusual fonts used to be a complicated process that required the end user to have your font(s) installed in order to see the site as you intended. Now, advances in CSS allow us to use unusual fonts by connecting to them through our styling. This allows us to use a tremendous variety of fonts in our sites to add to our look and feel, adding an aspect that has unlocked new approaches to design. Some of the elements of typography include the study of features like readability, conveying meaning or emotion through impression, and the artistic effect of mixing styles.

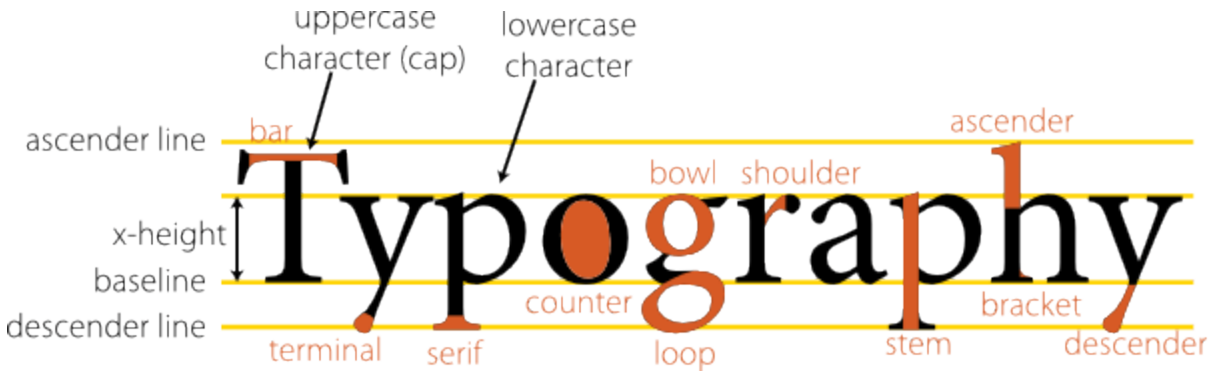


Figure 5.2.5.1: *Typography*. (*Public Domain—openclipart.org*)

For ease of reading and to avoid a cluttered appearance, most sites keep to two or three fonts when creating their design. One for text, and one or two for headings, titles, and distinguishing marks. All of these should be kept in the same family for a more congruous experience, and each unusual font defined in your site should include fallback definitions in case there are problems loading your primary style (we will see this in examples later on). You may want to set your regular text as one of the standards supported by all browsers as users are most familiar and usually comfortable with that set.

Web Fonts

To tap into this aspect of design, a great place to start is with the Google Fonts14 website. This site is a repository of character sets for a great variety of fonts that you can link to or download and include in your own site's files. We will look at connecting to these later, but browsing the site now will give you an initial look at the amount of variety that is available for design.

Site Maps

A site map is a file that contains a master list of links to the pages on your site, and can provide information about those pages like how often they are updated, how pages connect to each other, and how important it is relative to the other pages. It can be a reference tool to bothBotsthat index your site for search engines, as well as your visitors trying to find particular content. Site map files areXMLdocuments arranged in hierarchical format that bots read to gain understanding of your site layout, page relevance, and organization. The file may also be a human readable page that diagrams how pages relate to one another, and serve as a master list of the pages in your site. Site maps are best kept in the root of your website, at the same level as your initial index page.

While a complete site map cannot be finalized until after your site is ready to be published, I include site maps under development methods because laying out your site's organization on paper will help with developing your menu system, logically organizing content, and in defining the scope and purpose of your site. The more content or pages you can define at the beginning of the process will reveal information that will help during your design phase.

To create a site map, you can start by creating a running list of all the content you wish to have on your site. Anyone involved in the production or validation of content should be in room! In each of these steps, it is important to identify your stakeholders. As you are creating your running list, it is often helpful to use index cards so you can determine by card color or pile where a particular piece of content should be. This will help you discover your menu system, as you create names for piles of cards as your menu title. After, as you diagram what cards are with what pile and where that pile is relative to others, your site map will begin to take shape.

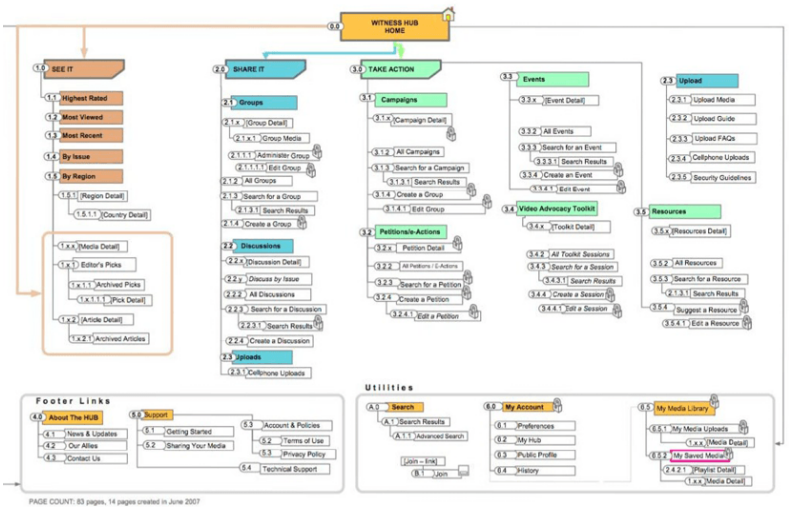


Figure 5.2.5.2: *Site Map*. (*Creative Commons 2.0 Licensed by Kent Bye*)

If you are rebuilding an existing site, you may wish to adapt the existing menu system or scrap it entirely and start new. Larger sites or those with a large number of stakeholders involved will need more time to complete this step. To break larger projects down, you may wish to begin by defining what type(s) of content you do *not* want on your site. For example, if your target audience is casual shoppers looking for in-home plants, you can eliminate information on plants not suited for indoor living, or restrict the amount of information provided to basic care and maintenance, as opposed to the greater detail professional landscapers will look for. Distributing the process of identifying what material needs to be published into several groups of stakeholders who share interests in certain categories will also help streamline this process.

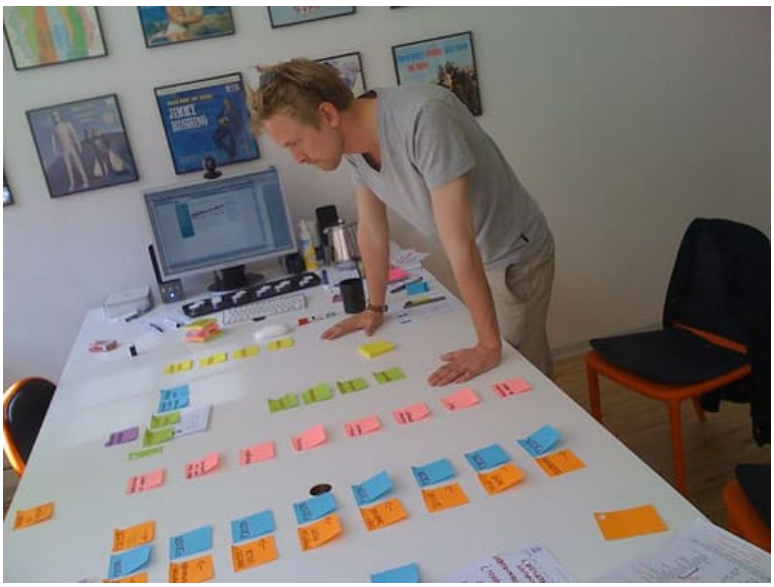


Figure 5.2.5.3: *Website Planning*. (*Photo by Jonas Maaløe Jespersen (CC BY-SA 2.0)*)

The sitemap you create should follow the URL standards RFC-398615 (notably the use of entity escape codes) and the standards for XML.16 Your character encoding must also be in UTF-8, which means some special characters and markings beyond those traditionally used in text will not be available. Once your sitemap is complete and uploaded, you can add it to your robots.txt file as:

1. Sitemap: http://www.yourwebsite.com/yourfilename.xml

You can also submit your site (and sitemap) for crawling directly to the search engines. While this may not happen immediately, it lets them know that your site is new or has changed. Some engines, like Google17 provide tools and reporting for a comprehensive

experience while others like Bing18 have quick entry forms that only require your site's main URL and a confirmation that you are, in fact, human (which seems amusing when you consider the point of what you are doing is to trigger a bot).

Let us plan a small site of just a few links: our index page, a contact page, an information page, and publications and research pages off of our information page. As an XML file, our visual sitemap above would be expressed as the following:

1.
2. http://www.sitemaps.org/schemas/sitemap/0.9>
3.
4. http://www.oursite.com/
5. 2013-01-13
6. 0.8
7.
8.
9. http://www.oursite.com/contact.htm
10. 2013-01-13
11. 0.9
12.
13.
14. http://www.oursite.com/publications.htm
15. 2013-01-13
16. 0.5
17. monthly
18.
19.
20. http://www.oursite.com/information.htm
21. 2013-01-13
22. 0.5
23.
24.
25. http://www.oursite.com/research.html
26. 2013-01-13
27. 0.7
28.
29.

As we are focusing on the sitemap aspects of this example at the moment (we will learn more about XML later), just take note that the , , and tags for location are required. Everything else is optional, but adds more information for site crawlers. You will also note that in this example you cannot deduce the menu or hierarchy that we saw in our visual diagram—indexing services do not care about this. For a site visitor, we would style this page differently or create a sitemap optimized for our visitors to read.

Robots.txt

Robots are automated scripts typically used to index, or take inventory, of the content in a website for use in things like web searching sites or collecting statistics. A robots file is a basic text file kept in the root folder of your website that instructs these robots on what sections or types of content in your site you do or do not want them to index. Legitimate robots will read this file when they first arrive on your site to honor your request. Keep in mind this is an enforceable act, and malicious or less-than-reputable robots are still perfectly capable of reading through all non-privileged (i.e. no login required) content on your site.

The simplest robots.txt file involves only two lines:

1. User-agent: *
2. Disallow: /

The first specifies that the rules below apply to all robots that read the file. The second adds that nothing is allowed below

(meaning deeper, or all the files and folders inside of) the root folder (/ represents the main folder of the site). If we wanted to be more specific about what sections we want to keep bots out of, we can identify them individually instead of the whole site:

1. User-agent: *
2. Disallow: /pictures/reserved/
3. Disallow: /index.php
4. Disallow: /media
5. Disallow: /scripts

To distinguish cases where a particular bot has a different set of permissions, we can use the bot's name in place of our "all" wildcard:

1. User-agent: BadBot
2. Allow: /About/robot-policy.html
3. Disallow: /
4. User-agent: *
5. Disallow: /pictures/reserved/
6. Disallow: /index.php
7. Disallow: /media
8. Disallow: /scripts

The above settings tell BadBot that it is allowed to see the policy file, but nothing else. It still specifies the blocked paths for the rest of the bots that might visit.

Wireframes

Wireframes in the web development world are not exactly their literal three dimensional counterparts in the real world, but they bear a similar purpose. A wireframe may include things like location and size of elements such as a login button, where banners and content sections will sit, and provide an overall idea of how a site will operate. When wire framing a website, the idea is to create a mockup of one or more designs that portray how the interface might appear to the user. By the end of your wire framing process, you should have an idea of how the site will operate, and have resolved questions over where users will find particular features and elements.

Wireframes typically do not include color, actual content, or advanced design decisions like typography. Some of these considerations will have been at least partly addressed when creating your site map, and the rest will come once we begin storyboarding.



Figure 5.2.5.4: *Wireframe*. (*Creative Commons 2.0 Braden Kowitz*)

Storyboarding

Storyboarding a website is quite similar to storyboarding a TV show, comic, or other forms of media. Using our wireframes, we can begin to add color, font, and rough images to our documents. Keep in mind at this point we are probably still in a graphics editor or document style program like PowerPoint, Photoshop, etc. Real code is coming soon, but we can do more mock-ups faster without taking the time to make it function.

As you storyboard, you will create separate pages, or panels, for the screen a user would see as they complete the most important processes on your site. If you are selling something, for example, your storyboard may include examples of product pages, adding items to their cart, logging in, and completing their purchase.

By paging through these panels, you can see how the user experience will progress and identify potential problems like a confusing check out process, or you may discover that your shopping cart block from wire framing may be better off in a different, more predominant location. This process may be repeated several times until a final version is accepted by everyone in the decision process.

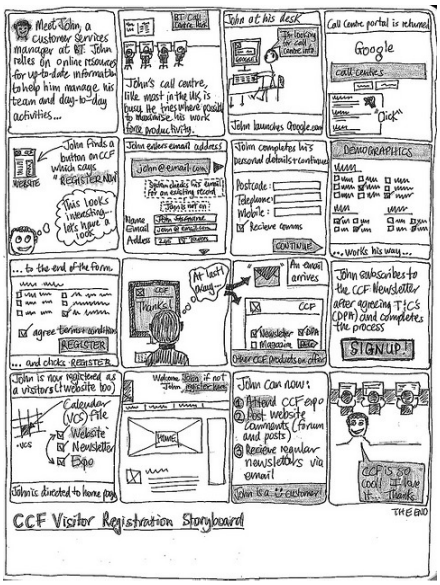


Figure 5.2.5.5: *Storyboarding*. (*Creative Commons 2.0 Rob Enslin*)

Color Schemes

The process of determining the color(s) involved in your site could fill a book. In fact, it does.19 Regardless of the varying opinions of what emotions colors instill, or represent, the quickest way to alienate a user is to give them a visual experience that is unappealing. The layout, appearance, and cohesiveness of your site are something that are immediately judged when a user first visits. These elements influence everything from their impression of what the site represents, its reputability, and even its trustworthiness as an ecommerce option. If your site appears to be disorganized, dated and out of style, or seems too "busy" or complicated, you canlose users in less than ten seconds.20

You can address this issue (even without an artistic eye) by following the techniques we discussed earlier to plan out a simple, intuitive interface, and by using tools to help you select and compare color schemes like http://colorschemedesigner.com/ or http://www.colorsontheweb.com/colorwizard.asp.

Whether you choose to study other books on the subject or not, a great way to keep current is to get ideas from what others are doing by following sites that list or rate sites by appearance such as the annual Times review21 and http://www.thebestdesigns.com/.

Learn more

Keywords, search terms: Web design, aesthetics, graphics, typography

Web Style Guide 3rd Edition: http://webstyleguide.com/wsg3/8-typography/index.html

TypeCulture: http://www.typeculture.com/academic_resource/

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- 3.4: Headings has no license indicated.

5.2.6: Development

Below are just a few examples of different methods of programming found in the workplace. This is not an exhaustive list, but is meant to induce some personal analysis of what approaches might be effective for you. We will look at examples of styles based on the number of programmers—one, two, or many—to demonstrate how programming can be approached as team sizes change.

Staffing Styles

Single Developer

Also called The Lone Cowboy or Lone Wolf. Typically found in small companies, benefits of being a single developer are that you are intimately familiar with the entire code base (at least while you are writing it—we will get to that under Good Practices), do not have to agree on coding styles, branching, or integrating code, and your functions and classes are built to what you specify.

Downfalls however are also large. A second pair of eyes or fresh mind can help find bugs faster, the workload burden is entirely yours, and any security issues or bugs you are not aware of are likely to be found the hard way, by an end user or malicious visitor.

Paired Programming

Sometimes referred to as Holmes and Watson programming, paired programming is the practice of assigning two programmers to the same task, and having them (quite literally) work side by side. This allows one person to write while the other contemplates code interactions, watches for bugs, and keeps track of tasks. By altering which programmer in the pair is the lead at different intervals both programmers are able to contribute and learn from each other. Proponents of this model will highlight studies that show decreases in bugs, increased performance (it is, after all, harder to sneak in that Facebook post when co-workers are regularly using your screen), increased knowledge across staff members, and less distraction.

This approach may or may not work well depending on the culture present, and paying two staff members to complete one task can be more expensive, possibly offsetting reduced programming time. Poor pairing decisions (e.g., two programmers with little experience) and other factors like addressing sick time and vacations that interrupt teams can also reduce the potential benefits of this approach.

Team Development

Team development allows the work involved in a project to be dispersed among a group of individuals (a necessary step for most large scale projects) and reduces overall development time. A team with well-defined divisions of labor who adhere to an agreed upon set of methods can be a highly effective group.

Detractors are found where agreements on labor or method are ill defined or not adhered to. They can also arise from personal issues or conflicts of personality, and physically dispersed teams may find issues with time zone differences, limitations of communication methods, and increased “lag” time caused by not being face-to-face for immediate communication.

Project Management Methods

Once you move beyond programming alone and into groups, or have multiple parties working on the same project, a management approach will be needed to determine pace, goals, deadlines, and to maintain order and understanding of the project. There are a great deal of approaches to this problem, and we will take a quick look at some of the currently popular solutions.

Agile

While some of the principles of agile development go against the planning process we examined above, it can be effective in instances where fast turnaround is necessary and a highly iterative release process is acceptable. Some of its tenets are frequent communication between parties, self-organized groups motivated for the project, and requirements that are changed as ideas progress through the project. Changing requirements are driven by what is revealed through the iterative releases, and this fluidity is one of the strengths to be found in this approach.

Ultimately, the guiding principle here is to work in the mindset where you get the best people, trust in them, and focus more on the customer's wishes and the project itself than length contracts, internal processes, and bureaucracy. You are most likely to run into this approach in start-ups that are not burned by an internal bureaucracy and heavily structured atmosphere.

The twelve principles of agile development, according to a published manifesto22 by seventeen software developers are as follows:

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity—the art of maximizing the amount of work not done—is essential.
11. The best architectures, requirements, and designs emerge from self-organizing teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

Scrum

The Scrum process is a more focused and organized approach than agile development. The Scrum process maintains the defined roles of team members while pursuing the fast-paced development goals of agile. Daily meetings are held at the same time/place, and are typically held standing, to encourage shorter meetings. Core team members lead the 15-minute meeting by briefly reporting on what they did since the last meeting, their plans for the day, and any obstacles they have come across. Stumbling blocks brought up in these reports are addressed by the Scrum Masters, who address obstacles in order to keep the rest of the team on task.

Scrum goals are organize into Sprints, blocks of time usually shorter than 30 days, in which certain tasks of the project should

be completed. Sprints are kicked off with planning meetings, and the goal is to have those portions of the project in full working order by the Sprint's completion.

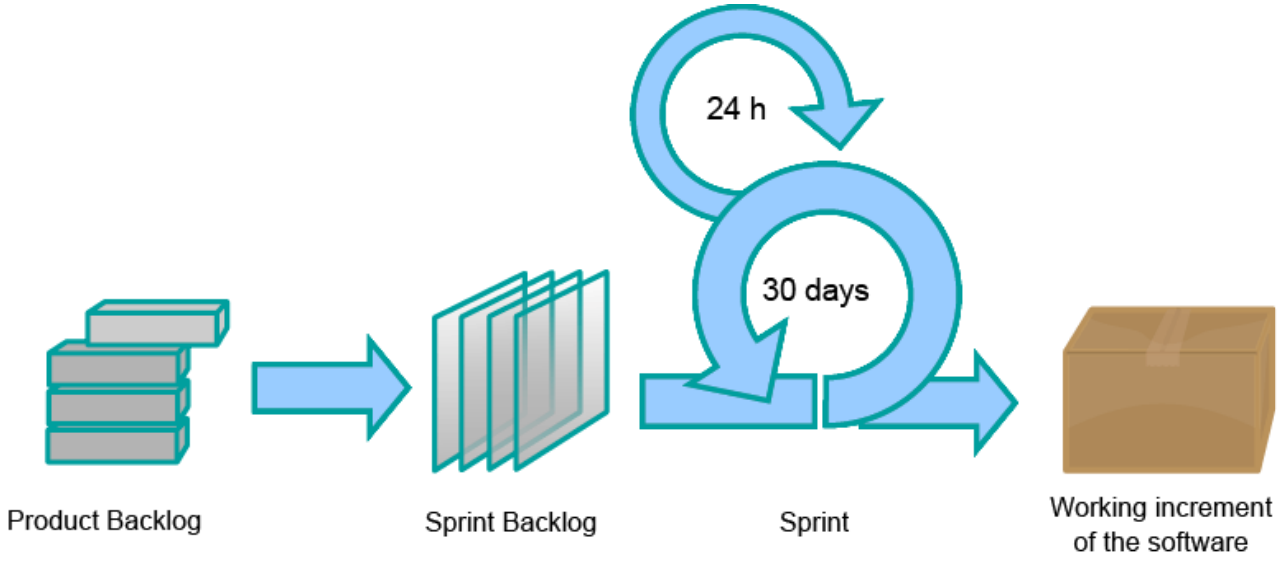


Figure 5.2.6.1: *Scrum.* (*By Lakeworks [CC-BY-SA-3.0-2.5-2.0-1.0], via Wikimedia Commons*)

Waterfall

The Waterfall approach to project management recognizes the projects are typically cyclical, and builds that recognition into its five stage approach to management:

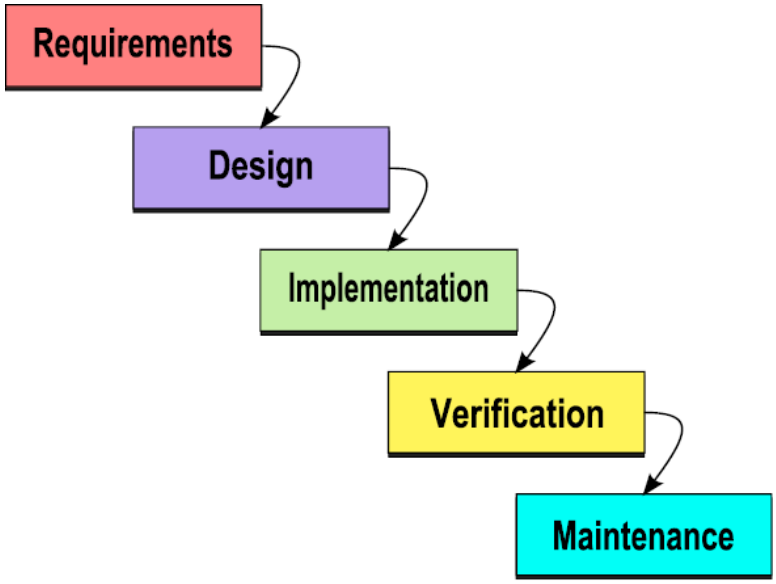


Figure 5.2.6.2: *Waterfall Diagram.* (*Paulsmith99 at en.Wikipedia CC-BY-3.0, via Wikimedia Commons*)

Requirements

Requirement gathering can be interactions with your users that generate feature requests, initial project definition like its scope, or discovery of other important information during the planning phase of a project.

Design

Development of pseudo-code, storyboards, wireframes, or any other materials necessary to depict what will be implemented to satisfy the requirements. See sections: Pseudo-Code First!, Storyboarding, and Wireframes.

Implementation

The actual programming and development phase to generate the working solution.

Verification

Testing and debugging the solution to ensure it meets the requirements and works as intended.

Maintenance

Ongoing tasks such as database maintenance, modifications to support changing requirements, or new tasks created by the discovery of bugs.

Items discovered in this phase trigger the process to begin again in order to address them. Eliminating a bug, for example, requires determining how to fix the problem, after which the bug resolution will move through the rest of the steps just like the project did initially. New ideas or feature requests will also trigger the requirements stage to begin. As these events will not occur at the same time, the waterfall effect occurs as individual items in the project will be in different phases as the cycle continues.

Structural Patterns

More decisions! Now that we have our team(s), and an approach for managing the project as a whole, we need to determine how to manage the development of the code as well. How the code is organized contributes to how easy or difficult change management becomes, how flexible the system is, and how portable it is. The options of how to approach organizing the actual code are called Architectural Patterns.

Model View Controller

In the MVC approach, we create three distinct concepts in our code. The image below depicts a de-coupled approach to MVC, where the model and view have no direct communication.

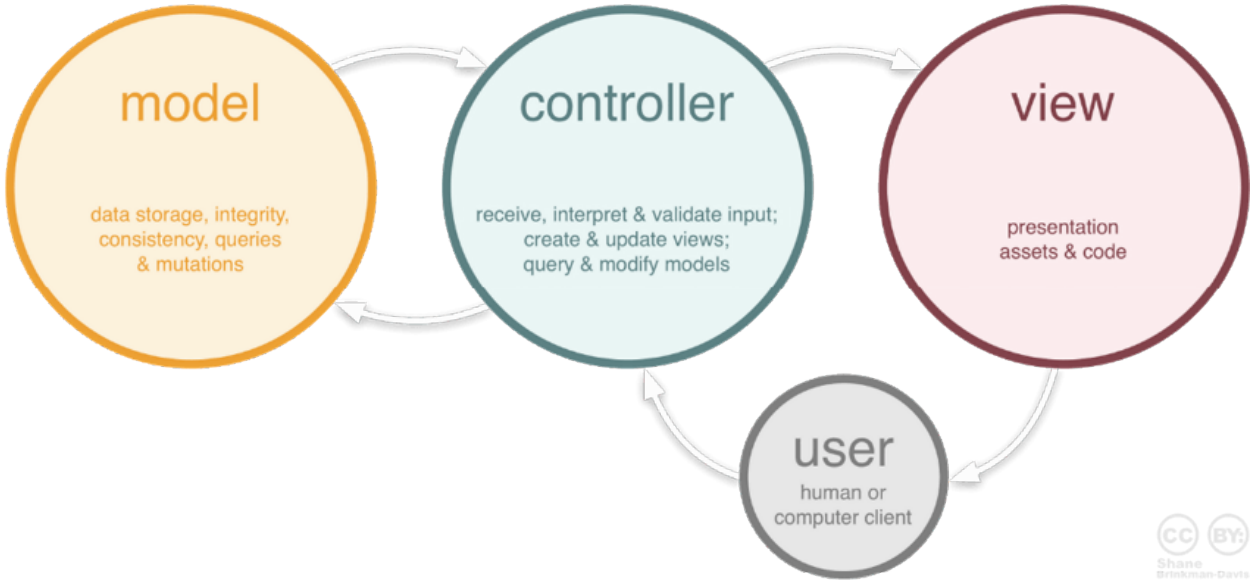


Figure 5.2.6.3: *Model View Controller.* (*Shane Brinkman-Davis, December 2012 CC-A 3.0*)

Models

Our models contain the logic, functions, and rules that manipulate our data. A model is the only piece of the system that should interact directly with your data source. It should also respond to a request with a consistently formatted reply, and not simply return messages from the data source. This allows you to utilize multiple different sources for your data, or easily change how it is stored, as you would only need to edit your model's interactions and connections instead of adjusting code throughout your entire site.

Views

Views generate the output that is presented to the user. They request, or are given, the data needed to complete the page by the model. In some interpretations of MVC, the controller may also act as a mediator between the model and view—the important fact is that you should not see code in a view section that completes any actions other than formatting and presenting output. The view contains the images, tables, styling, and page formatting that make up the site itself. By keeping these items isolated from the models and controllers, we can easily duplicate our site's appearance somewhere else, or "skin" several sites differently, but have them all use the same data and models for interaction.

Controllers

Controllers recognize changes and events, such as user interaction and results of model responses that drive other actions. The

controller will then call the appropriate model(s) to interact with data, and the appropriate view(s) to reflect the changes made. When controllers also manage passing data from the model to the view, the system is considered passive, or de-coupled, as the models and views have no awareness of each other.

Variations

MVC was originally developed as a method for traditional software development. Migrating it to web development is not a simple task, as the concepts become muddled when interacting with multiple languages, and a client-server model of communication. Other approaches to interpreting the MVC method for web development such as model/view/presenter, model/view/adapter, and presentation/abstraction/control attempt to resolve and clarify implementing this approach online.

Service-Oriented Architecture

SOA is a modular style approach to interaction. It is used in web services and Cloud Computing (APIs) as a method of providing tools, actions, and information to other systems that allows for larger and/or multiple systems to integrate into. Each item in an SOA approach is oblivious to the actions of other services. It only knows how to request information or actions contained in other services as they are needed.

By building in this approach, the programmers can specify and limit what actions are available and under what conditions (end user's authentication level, nature of data, etc.) all while keeping the actual systems removed from direct interaction with the consumer. This helps protect internal systems by limiting access to raw data and intellectual property while still providing an organized platform from which developers can retrieve what they need.

Larger companies might develop an API that provides information from multiple data sources from one place. By creating the common platform, their developers can connect to the data from other applications or websites without having to connect to each data source. These companies might also allow their partners to access their API in order to provide automate communication between companies, create other add-on tools, or to contribute their own information. Walgreens recently opened a portion of their internal API for just this reason. By allowing third parties access, outside vendors were able to create applications like printing from Instagram right at your local store, or refilling prescriptions from a mobile device.

Unit Testing

Unit testing is an exercise in writing each element of your software to meet very specific requirements. By reducing your project to its smallest testable component, each part can be tested individually. These modules are then connected together to form the larger whole. It is included under methods instead of practices as it is an important approach that needs to be followed by each team member if it is to be used at all. Testing these units before including them in the software should reduce debugging, and more readily allows for testing components before a full implementation has been assembled. This technique can also be combined with other methods because it is more of a coding practice than an approach to project implementation.

Unit testing is frequently used in fast paced approaches like Scrum to help ensure a less error prone product. Keep in mind that this is not a perfect solution. While individual units may test fine, logical problems can still be created as these modules are combined. Continued testing of the results of not only single units but also units working in combination will help in addressing this potential point of failure.

Learn more

Keywords, search terms: Project management, programming architecture, software planning and development

Architectural Blueprints—The “4+1” View Model of Software Architecture http://www.cs.ubc.ca/~gregor/teaching/papers/4+1view-architecture.pdf

Project Management Advisor http://www.pma.doit.wisc.edu/index.html

Good Practices

File Organization

As we begin to create more and more files to complete our website, keeping everything in one folder will quickly grow cluttered. To address this, we can create folders just like we do when sorting files in My Documents. Traditionally you can find folders for images, scripts, pages or files, or for different sections of content or tasks, like an admin folder or ecommerce store. How and why these folders are created varies to personal taste or group determinations, and in some cases is done to maintain a particular method of writing code such as model-view-controller.

Pseudo-Code First!

Whiteboards, notepads, and napkins are your friends. Writing out how you plan to tackle a particular problem will help you identify logic problems before you are halfway through coding them, and will help you keep track of what you need to work on as you progress. Creating pseudo-code is the process of writing out in loosely structured sentences what needs to be done. For example, if my task is to look at each element in an array and tell the user if it is true or false, we might draft the following:

1. foreach(thing in array){
2. if(thing / 2 is 0) then show Even
3. else show Odd
4. }

Imagine that while writing this example out we realize that we want to store the responses for use again later, not just show them to the user. So, let us update our pseudo-code to take that use case into mind:

1. foreach(thing in array){
2. if(thing / 2 is 0) then add to even array
3. else add to odd array
4. send arrays back in an array
5. }

Reviewing what we have now, not much looks different, but so far we have not had to rewrite any code either. After some thought, it might occur to us that creating two additional arrays could be more memory intensive and less efficient than editing the one we already have. So, to simplify things and possibly improve performance, we might try this:

1. foreach(thing in array){
2. if(thing / 2 is 0) then add it to even array, delete from this array
3. send arrays back in an array
4. }

Finally, since we are now editing our existing array, we need to make sure we reference it (ensuring our changes are reflected after the foreach completes), which also means we only have to pass back our even array:

1. foreach(reference! Thing in array){
2. if(thing / 2 is 0) then add it to even array, delete from this array
3. send even array back
4. }

While none of the above examples would work (they are just pseudo-code), we were able to edit a conceptual version of our program four times. Alternatively we would have spent time creating and revising actual lines of code three times, only to keep finding an issue, backing up, and make lots of changes.

Comments

To quote Eagleson's Law, "Any code you have not looked at for six or more months might as well have been written by someone else." This is not to say that your style or approach will change drastically over time, but that your immediate memory of what variables mean, why certain exceptions were made, or what the code, ultimately, was meant to address may not be as apparent as when you last worked on the file. It is natural for us to feel that we will remember these details as they are so obvious when we are creating them. The need for good commenting becomes immediately apparent when reviewing someone else's work, and you are wallowing in frustration trying to figure out what that person was trying to do.

This is not meant to endorse comments that are obvious to the reader from the line, like:

1. $int = 2 + 2 //we added 2 and 2 together

Rather, comments are best suited to explaining why agreed upon methods were not used or what difficult to understand code might be doing, like:

1. // This block of code checks each text file in the folder for the given date and deletes it
2. // This is legacy code from when Frank M. worked here. If we change anything, payroll breaks

Order of Assignment

Many scripting languages distinguish between assignment statements and logical tests based on the number of equal signs used in the statement. For example, giving the variable $temp the value of 10 (also called "setting" or "assigning" the variable) can be expressed as *$temp = 10,* while checking the value would look like *if ($temp == 10)*. It is very easy to forget the extra = when writing logic statements, since we are so conditioned to using it in singular form.

This creates issues as a logic test written as *if ($temp = 10)* will always be true. First, we are executing what is in the parenthesis—in this case, setting temp equal to 10. When this occurs, the system returns returns a result of "true" to the script—the request has been completed. This is like asking if true is true—it always is! Since this does not cause a problem that stops the program from running, we will not get any errors before running it. The errors will be discovered only when the program does not behave as intended, and depending on the nature of the logic statement we wanted, that might be a rare case, making for some frustrating debugging. These are called logical errors, as the compiler or engine can run the code we gave it, and the error lies between expected execution and what the system is actually programmed to do. We will look at this further in Chapter 27.

To protect ourselves from this, we can invert our logic statements to put our values first. Since we cannot assign a variable to a number, writing *10 = $temp* would be considered invalid, as 10 does not represent a place in system memory. Neither variables nor constants can start with a number, even $10 is invalid. However, *if (10 == $temp)* is still valid, as the system compares both sides of the equation to each other, and is indifferent to the order.

By placing values first in our logic statements, if we forget to use the correct number of =, we will get an error from the engine early on that we can immediately find and fix. Otherwise we are left with a logic error that needs to be traced through our program later when we discover it is not working correctly.

Read Me

Closely connected with the concept of good commenting is the ubiquitous readme file—familiar to many users as the basic text file no one ever reads despite its title's quiet plea. The readme file's continued prevalence in such an antiquated file format is done to ensure it is legible on the widest variety of operating systems, and is still considered the best delivery format.

Within your readme file should be notes targeting your end users. Unless you release open source code, they would not be able to read your comments. These notes should tell the user what the application's requirements are, how to install it, how to get help, and if you like, what notable changes are in the version they are looking at compared to its predecessor(s). Typically, the most common location to put a readme file is in the root folder of your files, or in a sub folder in which the readme notes apply to.

Spacing

Just as we use spacing in documents to convey that a topic change is occurring, we can break up longer string of commands by putting spaces around lines that are grouped together to complete a particular task, signifying that the next set of lines is for another task.

Brackets

Some languages require the programmer to use a combination of parenthesis and brackets to identify what pieces of code belong together. This allows the engine or compiler to delineate between the code that should be tested as a logic statement, code that gets executed if that statement is true, and code that belongs to functions or classes.

As we write our code and reach instances where we need these elements, it is good practice to immediately enter both the starting and ending marker first, then create space between them to enter your code. This will help ensure that you do not forget to close brackets later, or close them in the wrong places when nesting code. Depending on your text editor, it may assist you by automatically adding closing brackets and helping you identify which opening and closing brackets go together.

Indentation

To make your code easier to read, you can use indentation to give the reader an idea of what lines of code belong to different sections. This is typically done inside functions, classes, and control structures. When we nest code, extra indentations are added for each layer within, moving those blocks of text further right to visually distinguish. As we finish the contents of a loop or function, our closing bracket is lined up with our function definition or logic statement to show that the section of code belonging to it is complete.

While our program will run just fine without indentation, it makes it easier to see where you are in your program and where the line you are looking at is intended to be in the logic flow.

```
<!DOCTYPE html>
<html>
<head>
    <title>Card Display</title>
    <link rel="stylesheet" href="style.css">
</head>
<body>
    <div id="card-container"></div>
    <button id="new-card-button">New Card</button>

    <script src="script.js"></script>
</body>
</html>
```

Figure 5.2.6.4:*Code Formatting Examples*

Figure 18 Code Formatting Examples

Meaningful Variable Names

When you create variables and functions, try to create names that will have meaning not only to you, but to others who may read your code. While it can be tempting to use a lot of short variable names while writing your code, it will be more difficult later to follow what the variable is supposed to represent. You might decide to use short names like queryResult or query_result or something longer like numberOfResumesReceived. While the latter takes longer to type while coding, the name is very clear on what it represents. As spaces are generally prohibited in variable names, these examples show us a few ways to approach longer names. The method you use is up to you, but should be used consistently throughout your code to reduce confusion. Differences in how and where you use capitalization or underscores can be used to represent different types of variables like classes or groups of variables.

Short variable names like a simple x or generic name like temp may have their places in your code, but are best reserved for when they identify a small variable or one which will have a very short shelf life in your code.

Versioning

This is the process of creating multiple versions of your software, instead of continuously overwriting your sole edition of code. By creating different copies of your program as you create new features, you can preserve working copies or even create different versions of your program. This allows you to “roll back” or restore previous versions if unforeseen errors are created in new code, or to allow different features to be tried and discarded over time. Naming conventions for different versions of your code might involve numbers, letters, release stages (i.e. alpha, beta, release candidate, and release) a combination of all of these, or just “development” and “live.”

GitHub

A popular tool for collaborating on projects right now is GitHub.[23] Focusing on open source projects, GitHub is a cloud service with locally installed application options that focuses on branching. Branching facilitates multiple working versions with varying features to co-exist in the same project space, giving the developers the ability to selectively merge new code into their project's official repository. The platform supports code sharing, generating branches, and includes discussion boards, bugs, and feature request areas.

Development Tools

The following tools can be very useful in accelerating project development by reducing repetitive tasks and providing collections of tools to help you write your code. I would encourage you to refrain from using them until you have at least mastered the material in this text, otherwise, you may complicate your debugging tasks or not fully understand what those tools are doing.

Frameworks

Frameworks are compilations of code that you can use to quickly start a site with a collection of features already in place. In a home building analogy, it would be akin to ordering parts of your house already completed, and having special tools in your toolbox for putting the pre-built pieces together.

A typical framework is a set of files that come with their own instructions, and can be so extensive that they take on a life and syntax beyond the language they are written in. They extend the features normally found in the language they are written in by adding their own classes, functions, and capabilities. The goal is that by giving the framework a few commands, we can create much larger processes like a menu system or complete color scheme. Some frameworks focus on the automation of repetitive tasks like generating forms and pages based on tables in a database, or applying in depth style and structure across a website.

Multiple frameworks can be combined in a single project in order to add a combination of features, for example using one framework for the site layout and another for generating database interactions. Each framework will require some time learning how to use its features, just like learning a programming language. This may be an important factor when deciding when and how many to use in your work.

Smarty[24]

The Smarty template engine targets the separation of application logic and presentation. While it creates delineations between the code necessary to generate the content and the code to present the content, it is not a full model-view-controller design. A smarty template page supports special tags and commands that are part of the smarty engine. These elements help to generate what the end product will look like, after generating the PHP necessary to build the page. Smarty also uses a template caching approach to facilitate delivering pages faster, only updating cached templates when changes to a smarty file or its dependencies are detected.

Yii Framework25

The Yii framework focuses on reducing SQL statement writing, follows Model View Controller methods, and helps create themes, web services, and integration with other platforms. It also includes security, authentication, and unit based approaches to development.

Zend Framework26

The Zend framework is focused heavily on modularity, performance, and maintaining an extensible approach to allow continued integration. This framework is popular at the enterprise level, and includes some of the original creators of PHP on staff. Zend itself is a full service PHP company, providing training, development services, and the continued refinement of the PHP language itself.

Templates

Similar to the idea behind frameworks, templates are sets of files that dictate the basic structure that provides a layout to your site. Templates typically create a grid format you can select from, like two or three columns, fixed or relative width and height, etc. If you are starting a site fresh and putting it into an empty template, there may be some placeholder content and styling as well. Templates are useful for getting the look and feel of a site up and running fast and there is little concern about the particulars of appearance, or whenever the template meets your needs well. When inserting your content dynamically, multiple templates can be used for one site to change the look and feel quickly based on which one is applied. This might be determined by what type of device your guest is using, or what type of authentication they are using.

Templates can be both freestanding, or can be an extension of a content management system or framework.

Bootstrap27

Bootstrap was created by Twitter in order to help them manage their extremely popular service. As it matured, they made it open source to allow others to utilize the toolset. Their framework provides tools for styling, interaction elements like forms and buttons, and navigation elements including drop downs, alert boxes, and more. Using this frame work involves little more than linking to the appropriate JavaScript and CSS files and then referencing the appropriate style classes in your code.

Foundation28

The Foundation system focuses on front end design and follows the principles of responsive web design (see next section). Their approach uses a grid layout to allow flexibility, accelerate prototyping and wire framing, and provides integrated support for multi-platform designs.

Responsive Web Design

As often as possible, this text will focus on coding methods that support responsive web design. This approach replaces the practice of developing several version of your site in order to support different devices. An example of this is when you come across sites with a regular site, a mobile site (for example m.yoursite.com) and then provide an app for each of the tablet platforms, or force tablet users into their mobile or desktop experience.

Instead, we will create one set of files that changes its own layout and appearance based on what we know. By using information made available in the initial http request to our site, we can determine the features the user's browser supports, width and height of their screen, and more. We can use this information to instruct our CSS files on what rules to apply when styling the page, how much or little to resize elements on our page, what we want to eliminate or hide on smaller screens, and more.

While this approach is still not a perfect solution, it gives us a much-improved ability to support a wide variety of devices without managing several code bases and developing across multiple proprietary platforms.

Integrated Development Environments

This list is by no means comprehensive. These editors are sufficient to get you started. If you wish to continue in web programming, you may elect to invest in a development platform like Adobe Dreamweaver or another professional product that supports more advanced design, or try any number of other IDEs available that focus on a variety of different languages.

You might consider the following programs to help you write your code (listed in no particular order). Each of these has features particular for web development and should be sufficiently capable to get you through the examples in this text.

Jedit29

A free editor based around Java. Works on multiple platforms (Windows, Mac and Linux) and includes syntax highlighting.

Notepad++30

Notepad++ is a source code text editor with syntax highlighting, multiple document handling using tabs, auto-completion of keywords (customizable), regular expressions in the search and replace function, macro recording and playback, brace and indent highlighting, collapsing and expanding of sections of code, and more.

Bluefish31

Supports many programming and markup languages. An open source development project, multi-platform, and runs on Linux, FreeBSD, MacOS-X, Windows, OpenBSD and Solaris.

TextWrangler32

This editor is related to BBEdit. It does not include as many tools, but retains syntax highlighting and the ability to use FTP within the editor.

HTML-Kit33

This editor is intended for use by web developers, and comes with support for writing HTML, XML and scripts. Among its features are internal preview of your web, integration with HTML Tidy, auto-completion of keywords, etc. Look for the “Previous” version for their free copy.

Application Programming Interfaces

Commonly referred to as APIs, pronounced as the letters of the acronym, application programming interfaces allow us to interact with features and data of a system other than its primary means, whether it is an application or website. Created to address needs of data exchange and integration between systems, APIs provide a controlled method of allowing others to use a system without having direct, unfettered access to the code or database it runs on. Examples of APIs in action are maps on non-google website that are fed from Google Maps with markers, that highlight paths and routes, automate directions, or outline places of interest. All of this is done from within their site or system without you leaving to interact with Google. Another example is the growing popularity of sites for clans or groups of friends in multi-player games that provide results, show game statistics, screen shots, and rankings from a site they create by using the game developer’s API to access their data.

Web-based APIs are, essentially, limited websites. They allow the pages and scripts end users create to communicate with the data source by using a predetermined vocabulary and fixed amount of options. When the user’s message reaches the API, the API completes the requested task such as getting a certain piece of data, or validating credentials, and returns the results, hiding anything the developers do not want revealed, and only provides the features they are comfortable with others using.

The result is that end users are free (within the limits of the API) to create their own systems exactly as they want, interfacing with their own systems, or creating all new systems the developers of the API had not thought of or decided not to pursue. APIs can cut down on the development time of your own system as you can use them to support your project, like our example of embedding Google Maps instead of creating or installing a map system. By combining several disparate systems through their APIs, a mashup is created, which is a new feature, application, or service created by combing several others. APIs are often included as part of a software development kit (SDK) that includes the API, programming tools, and documentation to assist developers in creating applications.

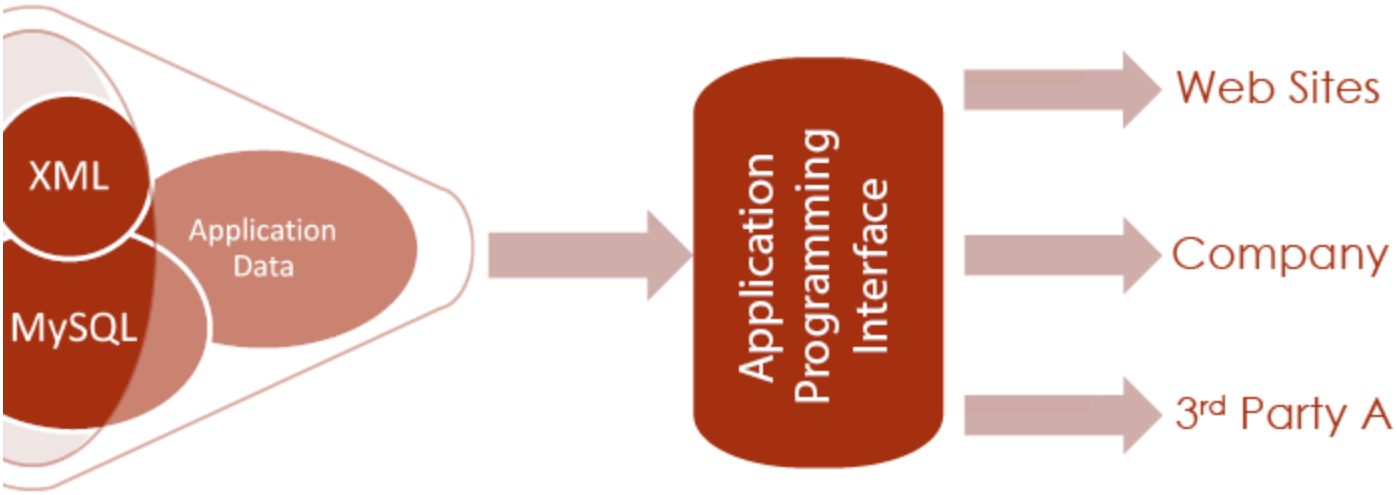


Figure 5.2.6.5: *API Data Flow*

Learn more

Keywords, search terms: Development methods, coding practices, team development

Cisco Networking Example: http://docwiki.cisco.com/wiki/Internetworking_Basics

List and description of all top level domains: http://www.icann.org/en/resources/registries/tlds

Ongoing comparison of hosting providers: http://www.findmyhosting.com/

Software Development Philosophies: http://en.Wikipedia.org/wiki/List_of_software_development_philosophies

1 http://calculator.s3.amazonaws.com/index.html

2 http://www.dropbox.com

3 http://drive.google.com

4 http://aws.amazon.com

5 https://www.google.com/search?q=nort...net+censorship

6 http://thomas.loc.gov/cgi-bin/bdquery/z?d112:h.r.3261:

7 http://www.opencongress.org/bill/112-s968/show

8 http://www.govtrack.us/congress/bills/111/s3804/text

9 http://www.ustr.gov/acta

10 http://www.riaa.com

11 http://www.forbes.com/sites/andygree...e-wheel-video/

12 http://www.raspberrypi.org

13 http://www.mongodb.org/

14 http://www.google.com/fonts/

15 http://asg.web.cmu.edu/rfc/rfc3986.php

16 http://www.w3.org/TR/REC-xml/

17 https://www.google.com/webmasters/tool

18 http://www.bing.com/toolbox/submit-site-url

19 https://www.google.com/search?q=website+visual+design

20 http://www.nngroup.com/articles/how-...-on-web-pages/

21 http://techland.time.com/2013/05/06/...-websites-2013

22 http://www.agilemanifesto.org/

23 http://www.github.com

24 http://www.smarty.net

25 http://www.yiiframework.com

26 http://framework.zend.com/

27 http://twitter.github.io/bootstrap/

28 http://foundation.zurb.com/

29 http://jedit.org

30 http://notepad-plus.sourceforge.net/

31 http://bluefish.openoffice.nl/

32 http://www.barebones.com/products/textwrangler

33 http://www.chami.com/html-kit/

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5.3: End of Chapter Summary

Summary

The Internet and the World Wide Web have had a profound impact on agriculture by enabling various online applications that improve efficiency and productivity:

- **Internet-Based Agricultural Applications** include tools like **FarmLogs**, which offers cloud-based farm management, and **Weather Underground**, providing localized weather forecasts. Platforms such as **AgFunder Network Partners** facilitate connections between investors and agricultural startups.
- **World Wide Web-Based Agricultural Applications** feature platforms like **Climate FieldView**, which delivers real-time data and analytics for precision agriculture, and **AgTalk**, an online forum for agricultural professionals. Additionally, **AGRIS** provides access to a vast repository of agricultural research.

These technologies leverage the Internet and the World Wide Web to offer valuable resources, streamline operations, and foster collaboration within the agricultural sector, driving advancements and enhancing overall farm management practices.

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5.4: End of Chapter Discussion

Here are some discussion topics related to The Internet, the World Wide Web, and agricultural telecommunications:

1. **Digital Infrastructure for Agriculture:**
   - How has the Internet and World Wide Web transformed agricultural practices and operations?
   - Discuss the role of digital infrastructure in improving connectivity for remote farms.
2. **Telecommunications in Precision Agriculture:**
   - How do telecommunications technologies support precision agriculture?
   - Explore the impact of cellular networks and satellite communications on precision farming techniques.
3. **IoT and Smart Farming:**
   - What role does the Internet of Things (IoT) play in modern agricultural practices?
   - Discuss the benefits and challenges of implementing IoT devices in agriculture for monitoring and management.
4. **Data Transmission and Real-Time Monitoring:**
   - How can agricultural data be transmitted and accessed in real-time using the Internet?
   - Explore the technologies that enable real-time monitoring of weather, soil conditions, and crop health.
5. **Agricultural E-Commerce:**
   - Discuss the impact of the World Wide Web on agricultural e-commerce platforms.
   - How have online marketplaces transformed the way farmers buy and sell products?
6. **Telemedicine for Veterinary Care:**
   - How can telemedicine and online consultation services improve veterinary care in agriculture?
   - Discuss the benefits and limitations of remote veterinary services.
7. **Challenges of Connectivity in Rural Areas:**
   - What are the main challenges in providing reliable Internet and telecommunications services to rural and remote agricultural areas?
   - Explore potential solutions to bridge the digital divide in agriculture.
8. **Blockchain for Agricultural Supply Chains:**
   - How can blockchain technology, facilitated by the Internet, enhance transparency and traceability in agricultural supply chains?
   - Discuss use cases and potential benefits of blockchain in tracking the origin and quality of agricultural products.
9. **Social Media and Agricultural Communities:**
   - How are social media platforms used by farmers and agricultural professionals to share knowledge and build communities?
   - Discuss the role of social media in agricultural advocacy and marketing.
10. **Cybersecurity in Agricultural Systems:**
    - What are the cybersecurity risks associated with Internet-connected agricultural systems?
    - Explore strategies for protecting sensitive agricultural data and systems from cyber threats.
11. **Cloud Computing and Data Management:**
    - How does cloud computing benefit agricultural data management and storage?
    - Discuss the advantages of using cloud-based solutions for data analysis and decision-making in agriculture.
12. **Remote Sensing and Satellite Data:**
    - How do remote sensing technologies and satellite data contribute to agricultural monitoring and management?
    - Discuss the integration of satellite data with Internet-based platforms for enhanced agricultural insights.
13. **Telecommunications Policy and Regulation:**
    - What are the key policy and regulatory issues affecting telecommunications in agriculture?
    - Explore how different countries are addressing connectivity challenges and supporting digital agriculture.
14. **Virtual Reality (VR) and Augmented Reality (AR) in Agriculture:**
    - How can VR and AR technologies, supported by Internet infrastructure, be used for agricultural training and simulation?
    - Discuss potential applications of VR and AR in improving farm management and education.
15. **Educational Platforms and Online Learning:**
    - How have online educational platforms influenced agricultural training and knowledge dissemination?
    - Discuss the benefits of online courses, webinars, and virtual workshops for agricultural professionals.

These topics should provide a comprehensive overview of how the Internet, World Wide Web, and telecommunications are shaping the agricultural sector and stimulate meaningful discussions on the subject.

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6: PRESENTATION MANAGEMENT APPLICATIONS IN AGRICULTURE

6.1: Chapter Introduction

6.2: Chapter Learning Objectives

6.2.1: Planning a Presentation

6.2.2: Adding and Deleting Slides

6.2.3: Adding Slide Text vs. Slide Notes

6.2.4: Creating Bulleted and Numbered Lists

6.2.5: Comparing Presentation Views

6.2.6: Utilizing Tables and Charts

6.2.7: Inserting and Modifying Graphics

6.2.8: Creating a Photo Album

6.2.9: Inserting and Modifying Shapes

6.2.10: Utilizing WordArt

6.2.11: Inserting SmartArt

6.2.12: Inserting Slide and Handout Footers

6.2.13: Apply Design Themes

6.2.14: Formatting the Slide Background

6.2.15: Replacing Text and Fonts

6.2.16: Printing a Presentation

6.2.17: Agricultural Presentation Applications

6.3: End of Chapter Summary

6.4: End of Chapter Discussion

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6.1: Chapter Introduction

Introduction to Presentation Management Applications in Agriculture

Presentation management applications are crucial tools for agricultural professionals, enabling them to create, organize, and deliver presentations that effectively communicate important information. These applications are valuable for showcasing research findings, sharing farm management data, introducing new technologies, and highlighting industry trends. With a variety of features designed to enhance visual appeal and facilitate collaboration, these tools help ensure that presentations are engaging, informative, and impactful.

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6.2: Chapter Learning Objectives

Learning Objectives

- **Understand the Role of Presentation Management Applications**
  - **Objective:** Describe the importance of presentation management applications in the agricultural industry. Identify key scenarios where these tools are used, such as presenting research findings, farm management data, and new technologies.
  - **Outcome:** Learners will be able to articulate the role and significance of presentation management applications in enhancing communication within the agricultural sector.
- **Identify Key Features of Presentation Management Applications**
  - **Objective:** Recognize and explain the essential features of presentation management applications, such as slide design templates, data visualization tools, and collaborative capabilities.
  - **Outcome:** Learners will be able to identify and describe the key features of various presentation management tools and understand how these features contribute to effective presentations.
- **Demonstrate Proficiency in Using Popular Presentation Management Tools**
  - **Objective:** Gain hands-on experience with popular presentation management applications used in agriculture, such as Microsoft PowerPoint, Google Slides, and Prezi. Learn to create and organize presentations using these tools.
  - **Outcome:** Learners will be able to proficiently use at least two major presentation management tools to create and organize presentations tailored to agricultural topics.
- **Apply Best Practices for Effective Presentation Design**
  - **Objective:** Apply best practices for designing visually appealing and informative presentations, including the use of effective visuals, clear organization, and concise text.
  - **Outcome:** Learners will be able to create presentations that effectively convey information through clear design, appropriate visuals, and structured content.
- **Utilize Data Visualization Tools for Agricultural Presentations**
  - **Objective:** Use data visualization tools within presentation management applications to represent complex agricultural data, such as crop yields, financial metrics, and research results.
  - **Outcome:** Learners will be able to create and integrate charts, graphs, and other data visualizations into presentations to clearly communicate agricultural data.
- **Implement Collaboration Features for Team-Based Projects**
  - **Objective:** Demonstrate the ability to use collaboration features in presentation management applications to work effectively with team members on agricultural projects and presentations.
  - **Outcome:** Learners will be able to collaborate on presentation projects using shared access, comment features, and real-time editing to enhance teamwork and productivity.
- **Evaluate the Effectiveness of Presentation Management Applications**
  - **Objective:** Assess and compare different presentation management applications based on their features, usability, and suitability for agricultural presentations.
  - **Outcome:** Learners will be able to evaluate and recommend presentation management applications based on their effectiveness in meeting the needs of agricultural professionals.
- **Integrate Presentation Management Tools with Other Agricultural Technologies**
  - **Objective:** Explore how presentation management applications can be integrated with other agricultural technologies, such as farm management software and data collection tools, to enhance presentation content.
  - **Outcome:** Learners will be able to integrate presentation tools with other agricultural technologies to create cohesive and informative presentations that leverage data from various sources.
- By achieving these learning objectives, agricultural professionals will be equipped to effectively use presentation management applications to enhance communication, data sharing, and collaboration within the industry.

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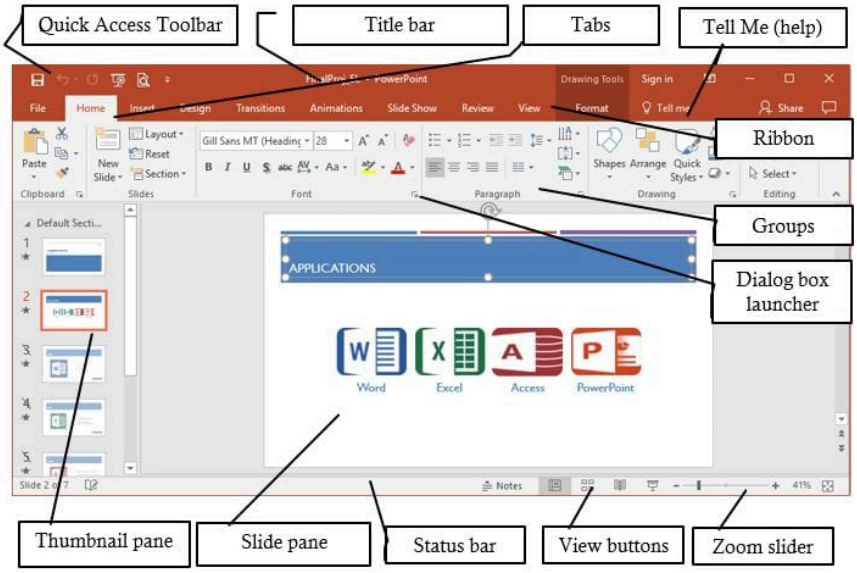
6.2.1: Planning a Presentation

Microsoft PowerPoint is a presentation software program used to organize and present information to others. PowerPoint is a popular presentation aid that utilizes visual and stimulating elements to accompany a presenter's communication through slides and multimedia tools. Planning a presentation necessitates defining the purpose of the presentation, identifying the target audience for the presentation, and deciding the type of output for the information.

The purpose of the presentation can generally be categorized into either of two general areas. The most common purpose for a presentation is to inform an audience by providing facts and figures. Informational presentations often include slides with tables, charts, graphics and text. Classroom lectures that utilize PowerPoint are typically information-type presentations. A secondary purpose of presentations is to persuade or sell the audience on an idea. Sales and political speeches fall into this category of persuasive presentations. Style is almost as significant as content for persuasive presentations. Therefore, design themes are important considerations for this type of presentation.

Another important consideration when planning a presentation is to determine the audience, including the venue in which the presentation will occur. The characteristics of the audience will help distinguish the type of vocabulary, font size, and design themes that would be appropriate. An audience of colleagues will allow more flexibility versus a group of customers, in terms of language and content. Understanding who the audience is, and why they are there can really influence the design and content of a presentation. The venue also influences the design of a presentation. A large room will require larger fonts and louder audio for the presentation to be understood by the audience. Conversely, a smaller room make necessitate a softer design. The presenter should also take time to ensure that the venue has ample and compatible audio-visual equipment (projector, cables, screen, speakers, etc.) to successfully run the presentation.

Get to know the elements of the Microsoft PowerPoint window! Note the similarities to Word and Excel!



Annotated PPT main window

- The **Quick Access toolbar** contains one-click buttons for saving, undoing, redoing, and print previewing a presentation. You can easily modify this toolbar to add your most frequently used commands. Just click the down-arrow on the right edge to customize this toolbar!
- The **title bar** displays the name of current presentation, and the program. A new presentation will default with a temporary file name, such as Presentation1 until you save the file with a different name. The Minimize, Maximize and Exit buttons appear on the right edge of the title bar.
- The **Tell Me** tool is a new way to get assistance with specific tasks in PowerPoint. When the user starts typing, PowerPoint suggests commands that are related to your keyword(s). The tool is context sensitive, and integrated into your current presentation versus opening a separate window. Therefore, if you type *insert picture* into the field, and click the resulting command, PowerPoint will open the Insert Picture dialog window without explaining the navigation

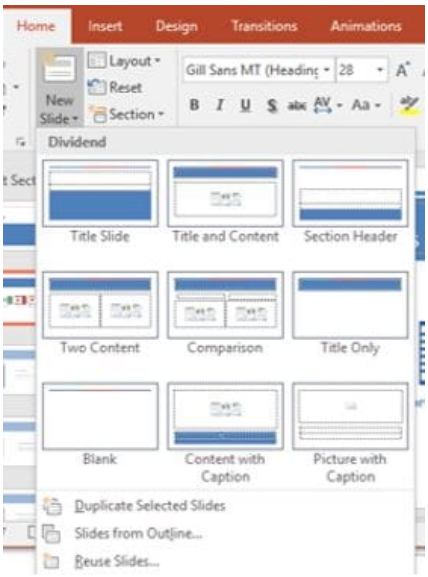
instructions.

- The **Ribbon** interface is a set of toolbars at the top of the window in Office programs designed to help you quickly find the commands that you need to complete a task. The ribbon displays a combination of **icons** and **tabs**. Commands are **grouped** under multiple tabs. Some commands are so extensive that they need additional windows to display their entire functionality. The dialog box launcher icon will open these windows. Contextual tabs will appear only when the user needs them, such as when a picture is selected, or a table is inserted.

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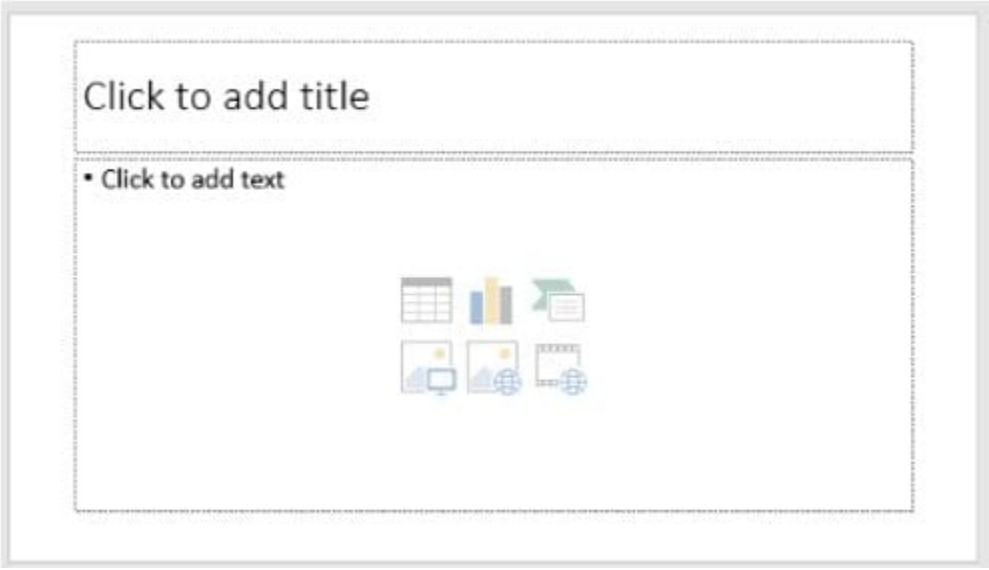
6.2.2: Adding and Deleting Slides



New Slide Gallery

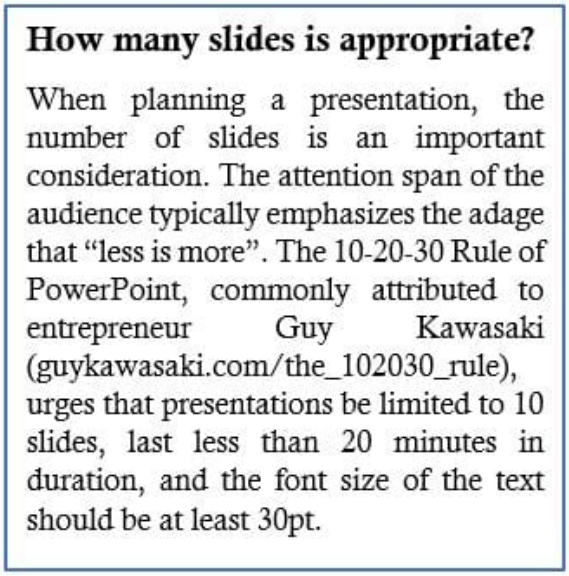
New slides can easily be added to a presentation by clicking the bottom half of the New Slide button in the Slides group of the Home tab. If the top half of the New Slide button is clicked, the default slide layout (Title and Content) will be inserted into the presentation. By clicking the bottom half of the button, a gallery of several different slide layouts will appear.

The type of content the user intends to add will dictate which slide layout is selected. Most slide layouts include one or more placeholder to guide the user where to add content. Placeholders can contain different types of content, including text, graphics, tables, charts, and videos. Placeholders can be resized, reformatted or deleted. The most common slide layout (Title and Content) has two placeholders. The user simply needs to place the cursor inside the placeholder and begin typing to add text, or click an icon to add an object. PowerPoint automatically sizes the text as it is typed to fit within the placeholder.



Title & Content slide

The AutoFit icon  is displayed next to a placeholder when more text than can fit is typed.



10-20-30 Rule

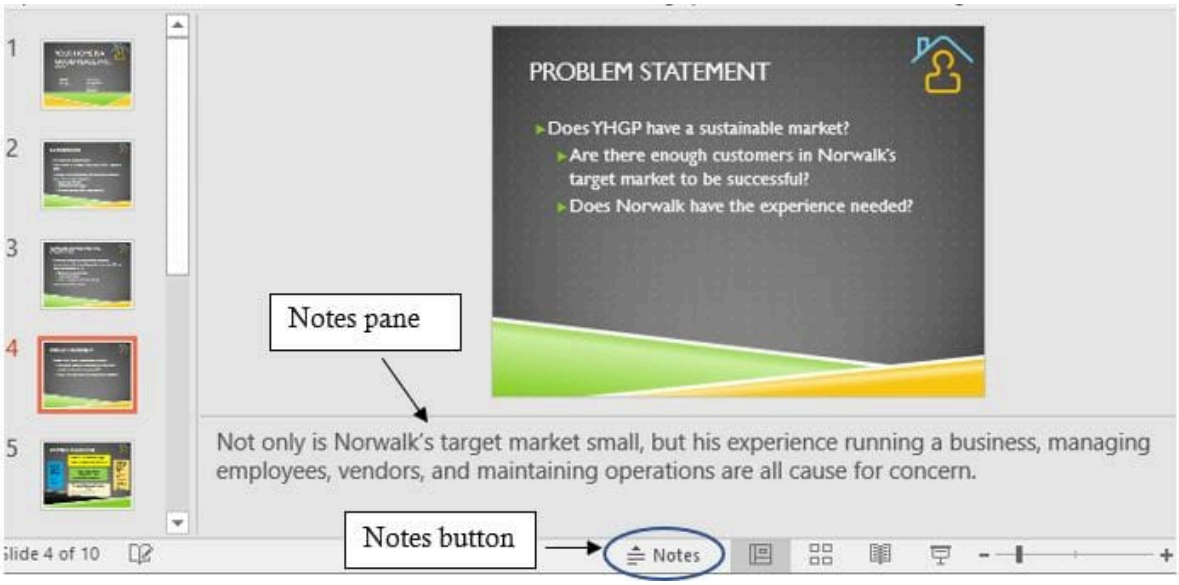
The alignment, font, size, and other formats can be applied to the selected text in a placeholder by using the Mini toolbar or the Home tab. A layout can be changed by clicking the Layout button to the right of the New Slide button, and choose a different layout. To delete a slide, right-click the slide in the thumbnail pane, and choose Delete Slide from the shortcut menu.

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6.2.3: Adding Slide Text vs. Slide Notes

While text can be added to slides via placeholders in various slide layouts, text can be added directly to the Notes pane to create speaker notes for the presenter of the slide show. Maintaining a minimal number of slides requires that each slide only contain summary text, not details. The details need to be added orally through the presentation speaker. The data in the Notes pane does not appear in Slide Show view. The Notes pane can be opened or closed by clicking the Notes button on the status bar.



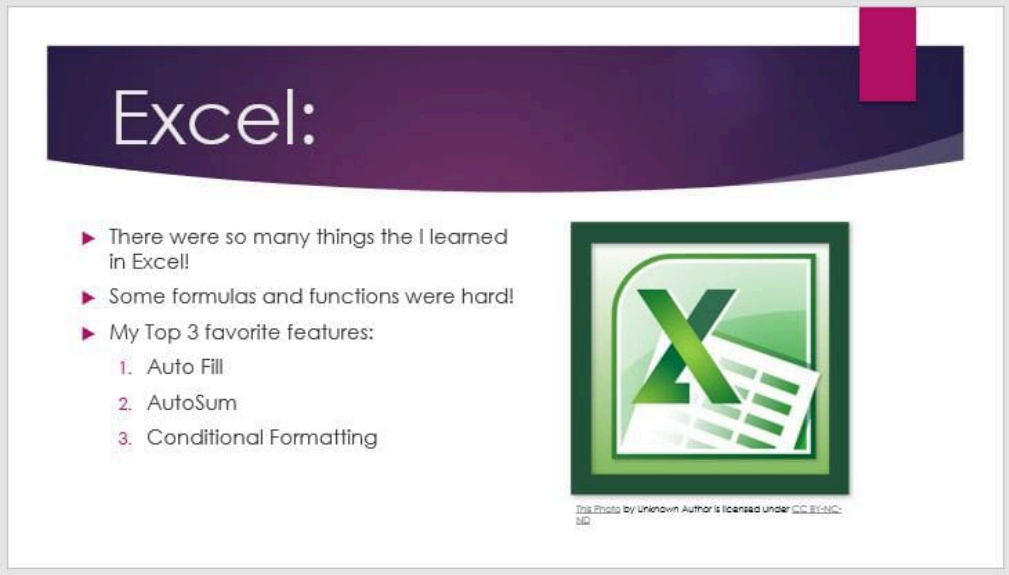
Notes Pane

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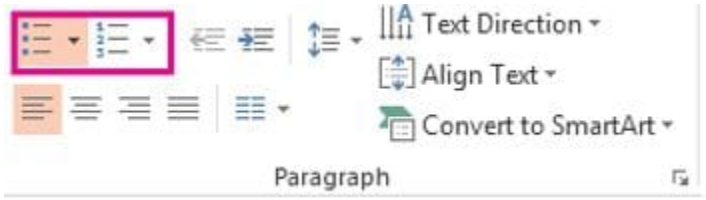
6.2.4: Creating Bulleted and Numbered Lists

The Title and Content slide layout is both the default and the overwhelming most popular slide layout for most slides in a presentation. This the root cause of why so many PowerPoint presentations bore their audiences with mundane amounts of text. The worst offense is when users simply write sentence upon sentence of text, which often gets read to the audience by the presenter. (Not a crowd favorite!) A better approach is to create presentations which utilize bulleted and numbered lists to help organize text, or show sequential processes. Too many slides of the same format can exhaust the audience, so use lists in moderation. However, when used with animation (discussed in the next chapter), lists can really help manage the flow of information by synchronizing the visual elements of the slide show with the verbal accompaniment of the speaker.



Bullets and Numbers PPT slideBullets and Numbers PPT slide

As defined in the Word chapters, bulleted lists differentiate from numbered lists in that numbered lists demonstrate sequencing, whereas bulleted lists simply imply that each item is part of an non-ordered group. Bullets and numbers can be formatted using custom symbols and number formats to synchronize with the presentation design.



Paragraph Group

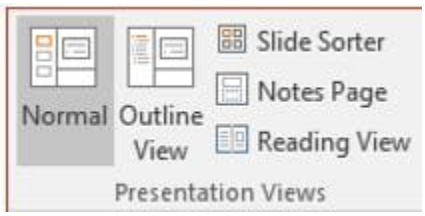
Bullets and numbers can also be indented to create sub lists. The Paragraph group contains the commands to increase and decrease the indentation of bullets and numbers.

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6.2.5: Comparing Presentation Views

PowerPoint can display its slides in several different views, which can be accessed from the View tab, the Status bar, or the Slide Show tab. Each has its own unique purpose as described in the table below.



Presentation Views



View Status Bar

PowerPoint offers a variety of views to display content depending on the situation. Some views help create a presentation, while others help deliver a presentation. Choose wisely!

View	How to Use
Normal	The default view. Used most commonly for editing slide content. Displays the slide pane and the thumbnails pane simultaneously. Clicking the Notes button on the Status bar adds/removes a third pane, which can be used to add and view speaker notes.
Outline View	Similar to Normal view, except that the thumbnails pane is replaced by an outline pane which displays the text from each slide. Graphics do not display in the Outline pane. Text is editable in the Outline pane. Not accessible via the Status bar.
Slide Sorter	Displays only thumbnails of each slide in horizontally sequential order. Slides can be dragged and dropped to be rearranged, and any slide transition timings can be viewed.
Notes Page	Only accessible from the View tab, this view displays a smaller image of the current slide above a large text box placeholder which can be edited to insert speaker notes. Increase the Zoom percentage to make the text box more user-friendly.
Slide Show View	Used to display the slide presentation to an audience. Displays a full-sized screen and hides the PowerPoint window. All inserted multimedia is functional is in this view. Navigation can be controlled by a mouse or the keyboard (arrow keys are the easiest). Can be launched from the Status bar, pressing the F5 key, or the Slide Show tab (recommended). Click the Esc key to exit this view.
Reading View	Similar to the full-screen Slide Show view without the overhead of presenter view controls. The title and status bars remain on screen, and navigation is simpler than Slide Show view. The Windows task bar is also accessible.
Presenter View	Accessible by clicking the icon during Slide Show view, and then choosing Show Presenter View. Allows the presenter to view speaker notes on one display (monitor) while the audience views only the slide show on another display (projector).

Presentation Views

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6.2.6: Utilizing Tables and Charts

The organization of a PowerPoint presentation necessitates that the presentation be concise and meaningful. Tables and charts represent an opportunity to present a lot of data in an organized, structured graphic. Tables can be created and inserted into a slide in a similar process as Word tables. Tables can be inserted from the Insert tab, or by clicking the Table icon  from a Content layout placeholder. Two contextual tabs are available for formatting the table, similar to Word. Adding table styles that match the theme of the presentation is desirable. Creating tables through this process is ideal for tables full of text, such as the table in the illustration below. Tables can also be created in Word, and then copy and pasted into PowerPoint. Either way, tables are a great way to consolidate a lot of information into a single slide.

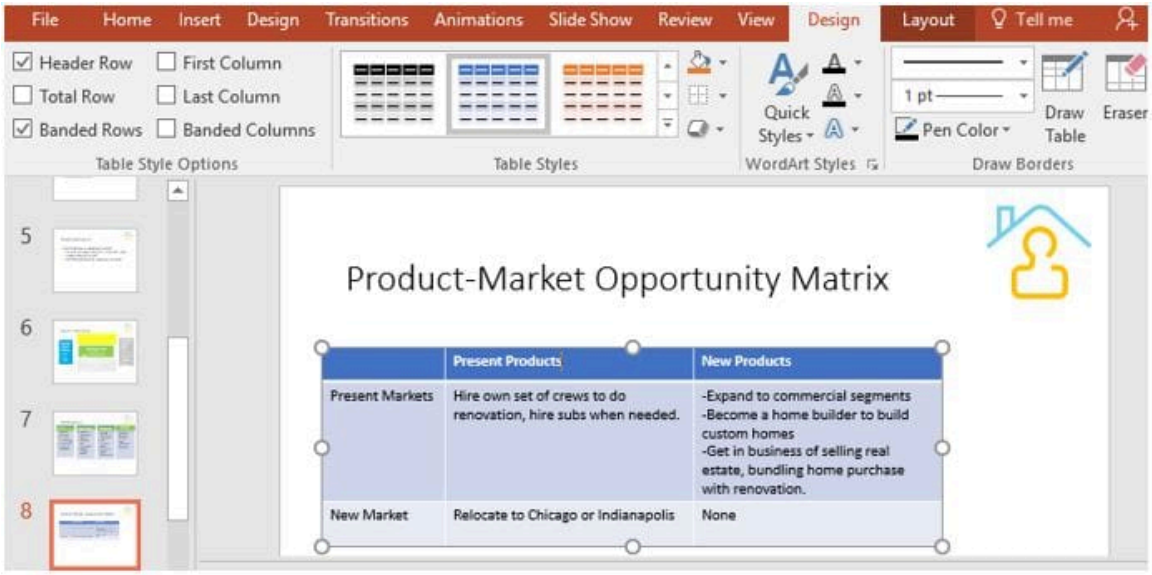


Table Slide

If the table contains a lot numerical data, it might make more sense to create the table in Excel, and paste it into PowerPoint. Data can be edited in PowerPoint using Excel formatting tools. Data can even be linked so that when the Excel file is updated, the PowerPoint slide is also updated. If the data is not linked, it is considered to be an embedded object. Embedded objects become part of the PowerPoint file and, after they are inserted, they are no longer part of the source (Excel) file.

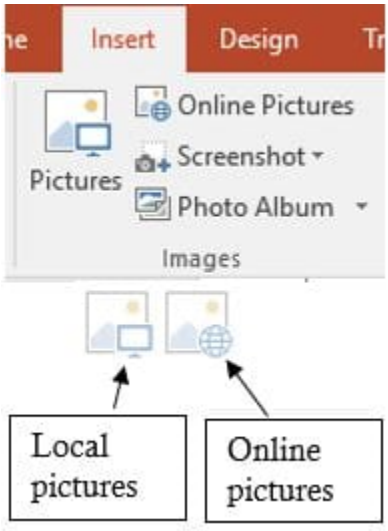
Charts are used to illustrate numerical data, which can help the audience visualize patterns, relationships, or trends in data. The decisions about linking or embedding a table are very similar to the decisions regarding inserting charts. Charts can be created in PowerPoint or Excel, but most are typically already created in Excel and simply need to be pasted into PowerPoint. Then comes the decision about embedding or linking the chart. When a chart is selected on a slide, options on the Chart Tools Design and Format contextual tabs can be used to modify the look of the chart.

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6.2.7: Inserting and Modifying Graphics

Graphics can be utilized to make a presentation more interesting and informative. If the PowerPoint developer is trying to keep the length of a presentation to ten or fewer slides, keep in mind that many believe that a picture is worth a thousand words! Sometimes graphics can be more informative than words and enhance a presentation by evoking emotion in the audience. PowerPoint graphics typically refer to pictures, and pictures can take the form of digital photographs, clip art, or computer-generated imagery (CGI). **Digital photographs** are realistic images captured with a digital camera or scanned to a file by a scanner. **Clip art images** are line-based drawings that are intentionally non-realistic. An example of computer-generated image is a logo, typically produced in a software program such as Adobe Illustrator, or a 3-D graphic, such as an avatar.



Insert Pictures

Inserting graphics into PowerPoint is very similar to Word. However, in addition to using the Images group options on the Insert tab, users can also insert a graphic via an icon in a content placeholder. Graphics can either be inserted from the user's own device, or from online sources.

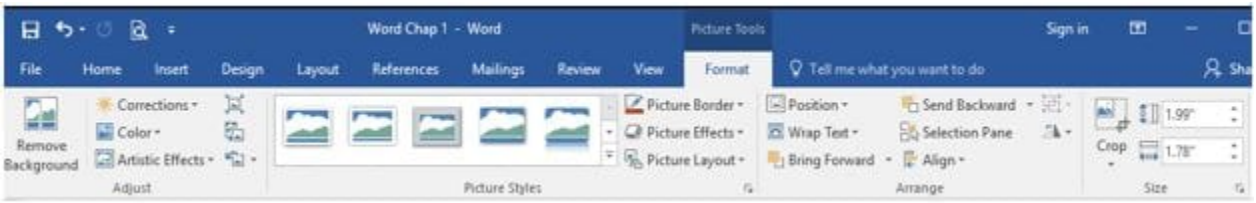
Each type of graphic has its pros and cons. Clip art can be popular because their simplicity results in a compact file size, which can be increased or decreased without distortion. Additionally, the unrealistic nature of these images makes them appropriate for representing sensitive topics that require anonymity. Digital photos are very realistic, which inspire authentic reactions. However, these images result in large files that can be difficult to transfer among devices. Additionally, resizing a digital photo can create undesirable pixilation.

Caution should be used to ensure that graphics are used appropriately by only including images that are relevant to the message being advanced. Graphics usage should also obey applicable copyright laws, especially when downloading images from Internet sources. According the U.S. Copyright Office, a **copyright** is a form of protection for "original works of authorship", and is usually identified by the © symbol. Photos and high-quality artwork that has been self-produced are not at odds to copyright infringement, but images downloaded from online sources should be credited, purchased or defined as royalty-free or be accessed through a Creative Commons (CC) license. By default, Microsoft's Bing Image search engine will only return images licensed under Creative Commons when utilizing the Online Pictures command in PowerPoint.



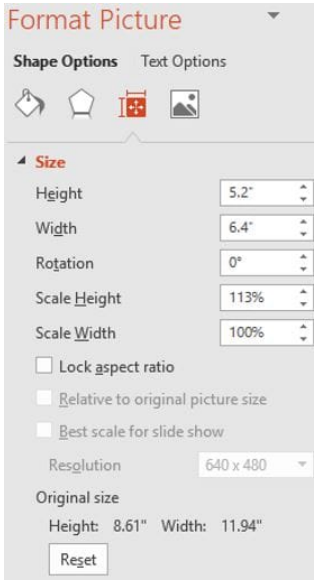
Bing Search Results

The robust photo-editing functionality within PowerPoint makes it easy to manipulate the size, location, and look of inserted graphics. After selecting the graphic, sizing handles will appear around the graphic, and the Picture Tools contextual tab will appear to offer a plethora of image formatting features.



Picture Tools tab

Some of the most commonly used picture formatting tools include:



Format Picture

1. **Resizing and cropping**. The easiest way to resize a graphic is to drag the sizing handles. The corner handles will increase or decrease the image's size proportionally, whereas the middle or top/bottom handles can distort the image's size.

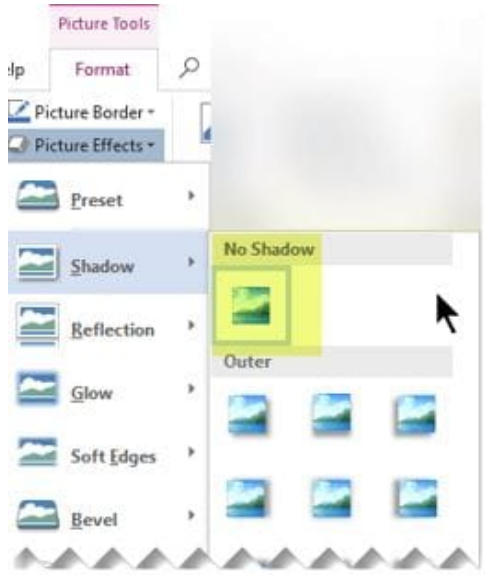
Specific height and width measurements can be defined in the Size group. Click the launcher to open the Format Picture pane. Clearing the Lock Aspect Ratio checkbox will allow the user to define specific sizes for the height or width without proportionally resizing the other dimension.Cropping an image results in a part of the image being removed. This is useful when an image has a lot of unwanted content that can distract from focusing on a certain aspect of an image. An image can even be cropped to fit into a specific shape. To reduce the file size of the presentation, use the Compress Pictures feature, in the Adjust group, to permanently delete the cropped portion of the image. Clicking Reset in the Format Picture pane or Reset Picture in the Adjust group will return the image to its original size.

2. **Corrections and Color adjustments**. If an inserted picture is too dark, the Corrections feature allows the user to edit the picture's brightness and contrast. The picture can be softened or sharpened as well to make the picture blurry or distinct. Color adjustments can also be applied to change the saturation (how vivid the colors are) and tone (the temperature – cool or warm) of a picture. Colored filters can also be overlaid to recolor a picture to fit the presentation's theme.



Picture Styles

3. **Picture styles**. Applying a picture style or effect from the numerous preset gallery options can visually enhance the way a picture appears. Picture styles make the picture look more stylish by applying a combination of borders, 3-D rotations, shadow effects or frame shapes. After selecting the picture, hover the cursor over any of the gallery choices, and PowerPoint will display a live preview of the style applied to the image. Clicking a selection will apply the picture style settings.

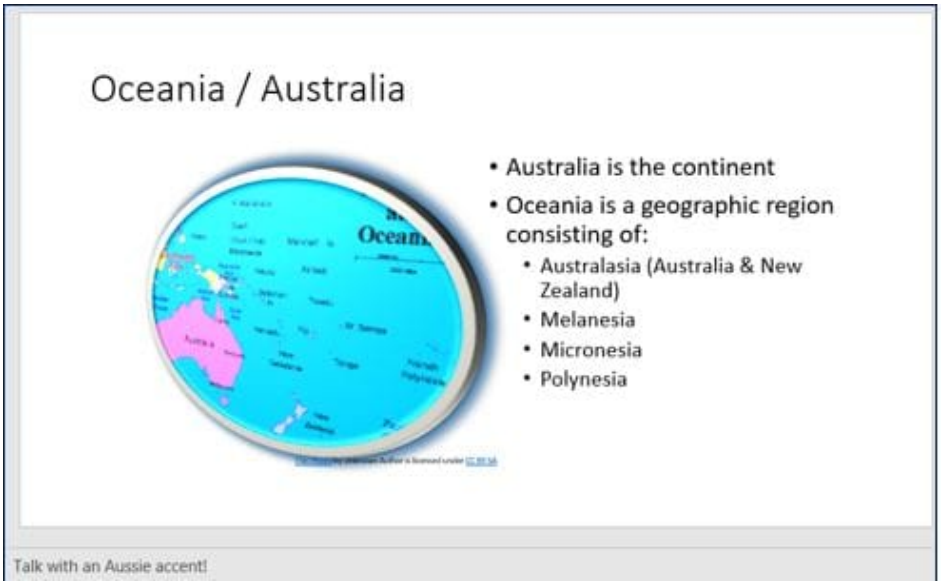


Picture Effects

4. **Picture effects** . Users can enhance a picture by adding effects, such as Shadows, Reflections, Glows, Soft Edges, Bevels or 3-D Rotations. To fine-tune the effect, click Options at the bottom of any effect menu. Multiple effects can be applied to the same picture, such as an outer shadow, an angle bevel and a contrasting right, perspective 3-D rotation.

Practice 5: The Solar System – Part 4

1. Plan your presentation. Your goal is to create a slide show to accompany your presentation regarding the planet Earth. The content will include slides with text, a table and some photos of various continents. The design will be basic. The audience is your fellow classmates.
2. Open the recently edited data file *Continents.pptx* from your data files.
3. View the presentation in Slide Sorter view, and then revert back to Normal view.
4. In the title slide, add your name to the subtitle placeholder.
5. Insert a new Title and Content slide after the title slide (slide 1). Add the title: Earth's Continents, and then add seven bullets to the Content placeholder with the text: North America, South America, Europe, Africa, Asia, Australia, Antarctica. Make the title font 54pt.
6. In slide 3 (North America), add an online picture of North America to the content placeholder using the Online Pictures icon.
7. In slide 4 (South America), change the size of the graphic to have a height of 4.5". Let PowerPoint adjust the width proportionately.
8. In slide 7 (Africa), apply a Brightness +20%, Contrast -20% correction adjustment.
9. In slide 8 (Oceania/Australia), apply a Metal Oval picture style, and a Glow 18pt, blue picture effect, as well as a Perspective: Turned Left, Tilted Up 3-D Rotation picture effect.



Oval Picture Style

10. Add the following speaker not to the Oceania/Australia slide: Talk with an Aussie accent!
11. Change the layout of the Oceania/Australia slide to a Title and Two Content layout. In the new content placeholder, add the following text bullets by referring to the illustration to the right:
12. Save the presentation with the file name My Continents.pptx to your default local folder.

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6.2.8: Creating a Photo Album

If your presentation's purpose is more slanted towards entertaining versus educating, then a photo album is a popular feature that might facilitate that entertainment. PowerPoint's **photo album** allows users to load a bunch of digital photos into a single file, one photo per slide, formatted consistently, with a variety of formatting options. Photo album is a great tool for creating self-running presentations that display photos from an event or a family memory (graduation, wedding anniversary, funeral, etc.) PowerPoint creates a new presentation file when a user chooses to create a photo album.

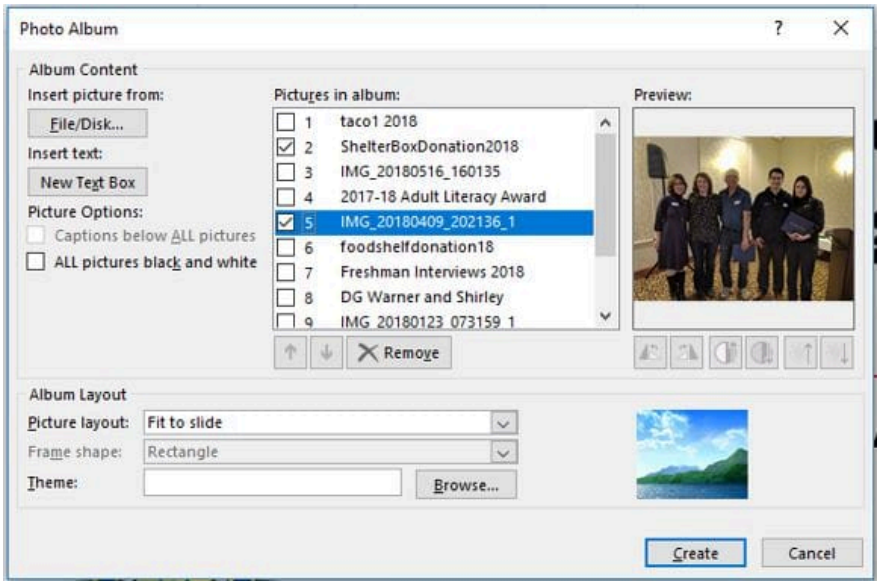


Photo Album

To start, take note of where the photos you want for the album are located (preferably on a local device). Then go to the Insert tab and click the Photo Album button. Once the Photo Album window opens, the next step is to insert the pictures from your device by clicking the File/Disk... button. The Insert New Pictures dialog window will appear. The user should then navigate to where the photo files reside on their device, then select multiple picture files (remember to use the Ctrl button to select multiple non-consecutive files) and choose Insert. The selected files will appear in the Pictures in Album scrolling-window in the Photo Album window. The order of the slides can be rearranged in this window or in the main PowerPoint window.

The more important decisions that should be determined before clicking the Create button pertain to the Album Layout and Picture Options. Notice how the Captions below ALL pictures option is disabled? This is due to the Picture layout currently being set to the Fit to Slide option. Choosing any other Picture layout will enable this option. **Captions** are a great way to add accompanying text to each slide in the album and provide explanation for the photos when no presenter is present. If this feature is skipped and needs reversing, choose the Insert tab, click the Photo Album drop down arrow, and select Edit Photo Album. The picture layout, frame shape, theme and picture options can all be redefined, and pictures can be added or deleted as well. The Insert Text Box is an alternative way to add manually add text to a separate slide versus the captions, which defaults with the operating system's file name as the slide caption. This data can be edited for each slide via the normal PowerPoint view. Photo albums can become even more entertaining when additional (yet to be explained) functionality is added. However, these features, which demand a lot of creative attention, can become very time-consuming! The Photo Album feature was designed to work with the Windows operating system. Therefore, this feature is not available for Mac users.

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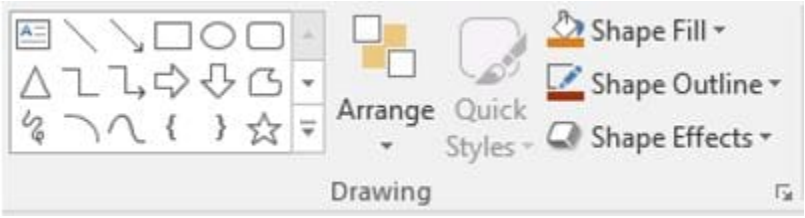
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6.2.9: Inserting and Modifying Shapes

Many different types of shapes can be inserted into a PowerPoint slide to help illustrate concepts and draw attention. Want to emphasize a certain focal point on a slide? Draw an arrow and add a custom format! The basic shapes are found in the Drawing group of the Home tab, but more extensive selections exist from the Shapes drop-down



list from the Insert tab. Shape categories include lines, geometric figures, arrows, stars, callouts, and banners. Once a shape is selected from the gallery, a cross-hair pointer allows the user to draw the shape on a slide. Shapes can be filled, stacked, aligned, grouped and merged using advanced formatting.



Drawing group

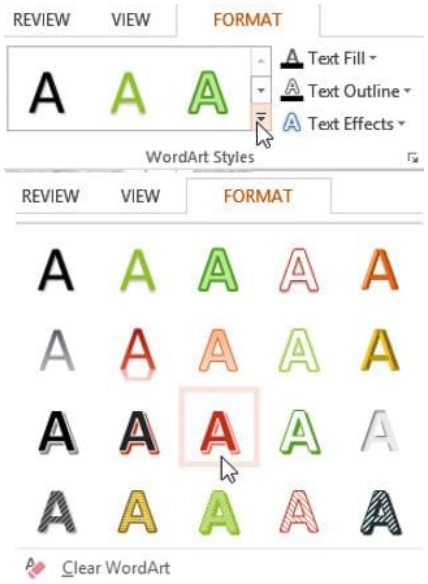
Many aspects of each shape can be further modified, including its line gradient, line color, fill color, weight, outline, shadow and other 3-D effects. Similar to other graphics, like clip art or a photo, a shape can be resized, relocated and reset to complement the design of the presentation. Text can be added to further annotate a shape and explain a concept.

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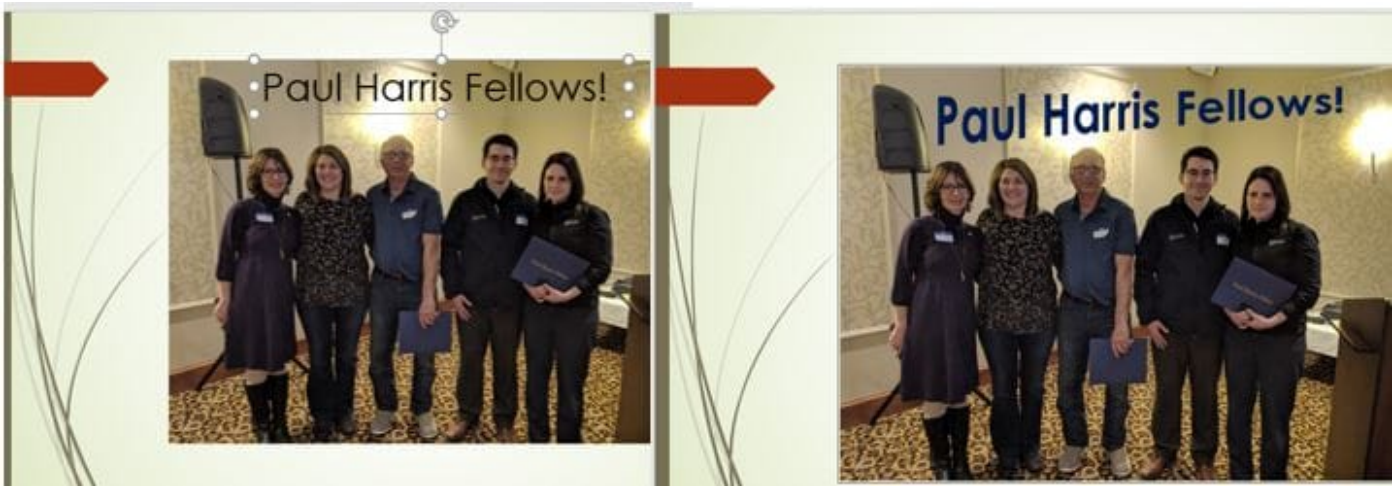
6.2.10: Utilizing WordArt

Keeping the audience's attention requires using non-standard text in order to maintain interest in the presentation. Strong visual elements help hold the audience's attention. As discussed in the Word chapters, **WordArt** is a feature that applies decorative text styles and text effects to any text object in order to attract the audience's attention. Features such as shadows, outlines, colors, glows, bevels, gradients, and 3-D effects can convert ordinary text into something extraordinary! The easiest way to utilize WordArt is to select an existing text object, then from the Drawing Tools contextual Format tab, click a predefined WordArt style from the gallery of choices. Clicking the More drop-down arrow will expand the gallery. After selecting a style, the text will appear in the selected style, and can be further customized by choosing text fill, outline or effect options.



WordArt gallery

WordArt is a great replacement for title text. Notice the difference between the two titles with normal text versus WordArt with text fill color, and a transform 3-D text effect.



3D WordArt

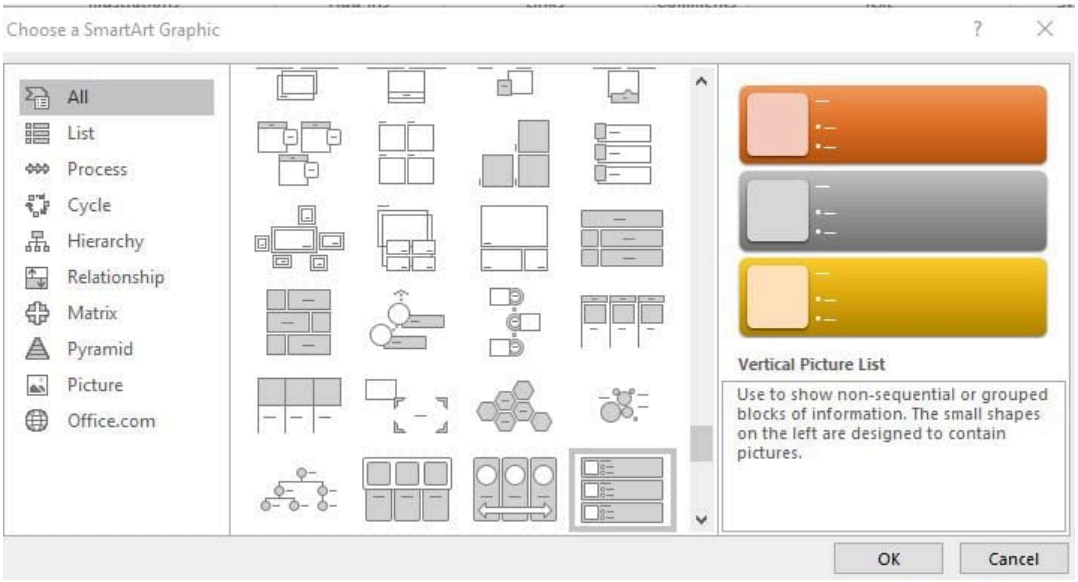
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6.2.11: Inserting SmartArt

Like WordArt, SmartArt is a cross-application feature that adds appeal, design and intrigue to an Office file. A **SmartArt** graphic is a professional-quality diagram that visually illustrates text using a variety of shapes. Like WordArt, a SmartArt graphic can be created from scratch or text can be converted with a few simple clicks. Converting a bulleted list to a SmartArt list is very easy! To create a SmartArt diagram from scratch, click the icon on the Insert tab. A gallery of graphics will appear.





SmartArt gallery

Users can choose from among many different layouts to effectively communicate a complex concept. Categories range from process and cycle diagrams to list and relationship graphics. Choosing the appropriate graphic is key, because some of these diagrams are complex, and therefore, can be more confusing than informative. Other considerations when choosing to use a SmartArt graphic include the amount of text that will be included with the shapes versus the amount of legible space available on a slide. Too many shapes can easily overcrowd a slide to the point that it is illegible. Users can quickly and easily switch layouts, so try different layouts (across types) until you find the one that best illustrates your message.

After selecting a SmartArt graphic, the diagram will replace the content placeholder of the slide. New [Text] placeholders will appear to allow the user to customize the diagram. Alternatively, a Text pane should appear to the left of the graphic to ease the insertion of text. If the pane does not automatically appear, click the arrow control on the left size of the SmartArt graphic.



SmartArt slide

After adding text, and possibly photos, additional formatting is available from the SmartArt Tools contextual Design and Format tabs. The Change Colors and SmartArt Styles options offer radical format changes. A **SmartArt style** is a preset combination of numerous effects, such as line style, bevel, or 3-D, which can be applied to a SmartArt graphic to create a unique and professional design.



Convert to Text

To create a SmartArt graphic from existing text on a slide, place the cursor inside the text, click the Convert button from the SmartArt Tools Design tab, and then choose the Convert to Text option. This is a great way to liven up basic bulleted lists to eye-popping information!

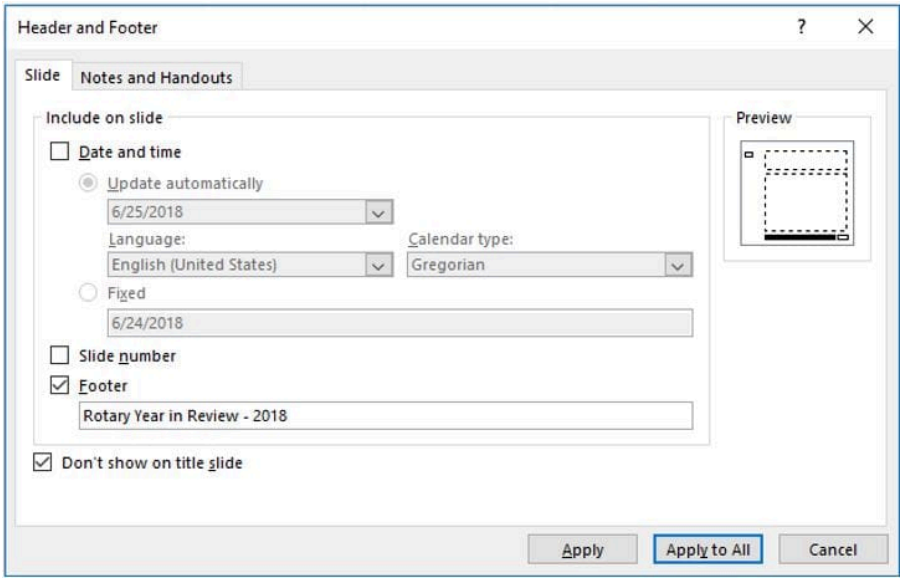
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6.2.12: Inserting Slide and Handout Footers

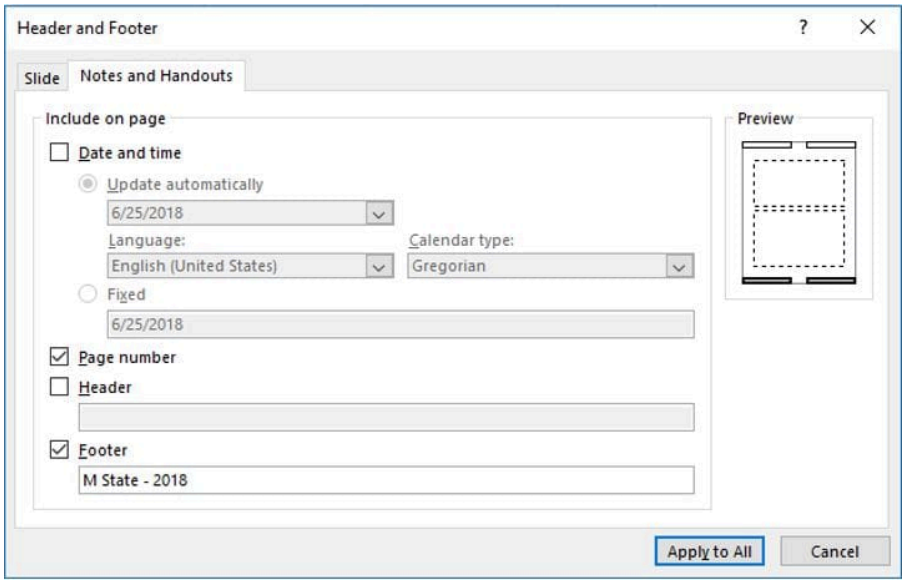
Slide footers represent another way to further customize the look of the presentation. Slide footers are typically displayed at the bottom of the slide, depending on the presentation's theme. Several fields are available to be added to each slide, including the date, a slide number or a customizable text field. A combination of these fields can be included or excluded. From the Insert tab, choose the Header & Footer option from the Text group to open the Header and Footer window.





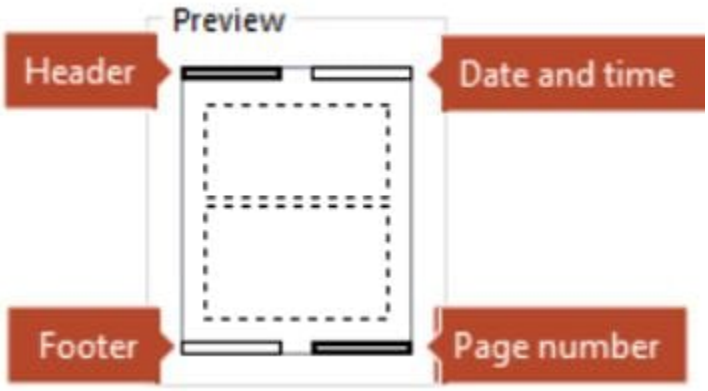
Header and Footer dialog

Two options that often get overlooked are the Don't show on title slide checkbox, and the Apply versus Apply to All buttons. The Don't show on title slide option is usually selected to prevent the footer from appearing the title slide. To assign the footer options to the current slide, choose the Apply button. Alternatively, the Apply to All button assigns the footer options to all slides, except the title (if the Don't show on title slide checkbox is marked).



Notes and Handouts Header and Footer

Slide footers are different than handout footers. Both can exist in the same presentation, but each has their own uses. While the slide footers appear on screen during slide shows, the Notes and Handout footer is designed for hard copy printouts. Similar fields are available as the Slide Footer, although the Header text box represents a new option, and only the Apply to All button exists, since the header and/or footer will appear on all pages of the handouts/notes pages.



Header Footer diagram

The Header and Footer fields often contain data like company or author names, copyright notices, and keywords like Confidential, Sample, Draft, etc.

To delete any header and footer information from the Notes and Handouts printouts, 

open the Header & Footer window, click the Notes and Handouts icon, and clear all fields and checkboxes before clicking the Apply to All button.

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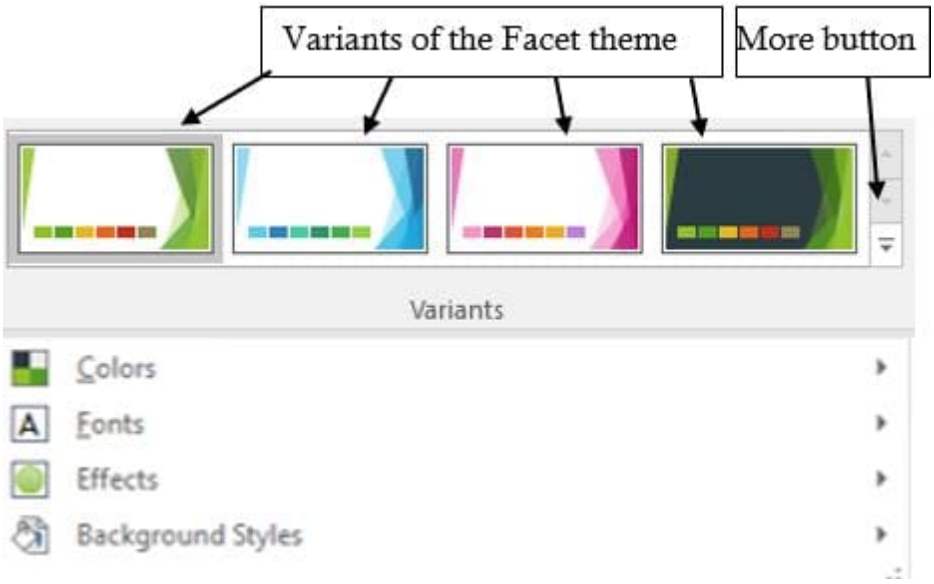
6.2.13: Apply Design Themes

The most significant way to add visual impact to a PowerPoint presentation is to apply a design theme. A **design theme** is a named combination of formats that comprise of colors, fonts, backgrounds, and other effects. Themes exist throughout Microsoft Office so that files created in one application tie together with files created in other Office applications. While the default Office theme is plain and boring, users can choose from a gallery of other themes to give the presentation a new look and feel. To change the theme, select a theme from the Themes group on the Design tab. More themes are available by clicking the More button.



Design themes more button

Hover over a theme thumbnail to see the theme name. It's also easy to quickly change the look and feel of a theme by using variants in PowerPoint. Each theme has its own Variants that apply some predefined color and effect variations. Variants appear to the right of the themes in the Design tab. Variants can be further customized by clicking the More button to modify the theme colors, fonts, effects or background styles. To further customize a design theme, it is easy to apply a new variant while everything else about the theme remains the same.



Theme Variants

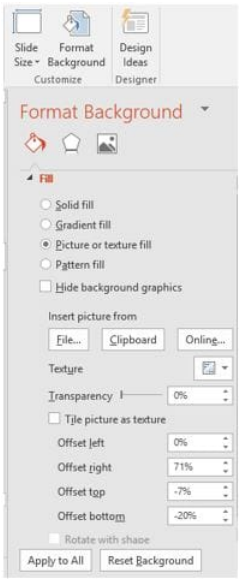
Many organizations have a standard, recognizable theme that should be consistently used to follow the organization's branding standards. While a theme can be applied to individual slides, it is advisable to apply one theme to an entire presentation, which creates a uniform, professional look.

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6.2.14: Formatting the Slide Background

While each design theme has its own background colors, patterns or images, every slide in a PowerPoint presentation can modify a background by changing colors, gradient fills, or adding/subtracting graphics. The **background** is the area behind the text and graphics on a slide.



Format Background

To customize the presentation's background, click the Format Background button in the Customize group of the Design tab. The Format Background pane will appear to the right of the slide pane. When choosing a different color or gradient fill for the slide background, consider ensuring that a proper contrast between the font colors and the background make the presentation easy to read for your projected audience. A dark background might be appropriate with good lighting, but a dark room might necessitate using a light background color. The Transparency slide bar can mute the color by increasing the transparency percentage. A graphic can be inserted and strategically located to the side of the content placeholder by adjusting the Offset percentages.

After defining all background settings, click the Apply to All button to update all slides with the new background. The slide illustrated below has the Facet theme with a custom background and a graphic offset to appear to the left of the content placeholder.



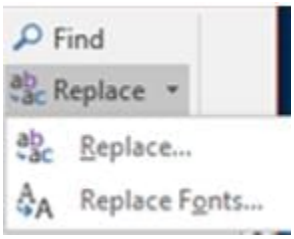
Facet theme slide

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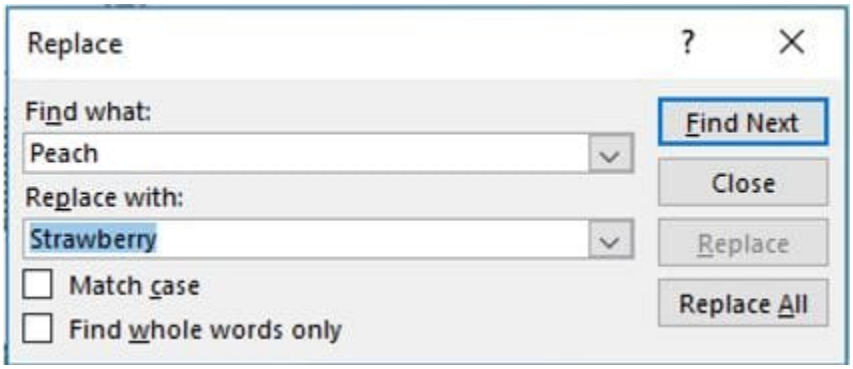
6.2.15: Replacing Text and Fonts

Popular presentations that get used over extended periods of time often need updating due to product, personnel or company name changes. This is particularly the case in technology companies. Instead of relying on manual editing to find specific words that need to be changed, the Find or the Find & Replace features can be much more accurate to accomplish the same goal.



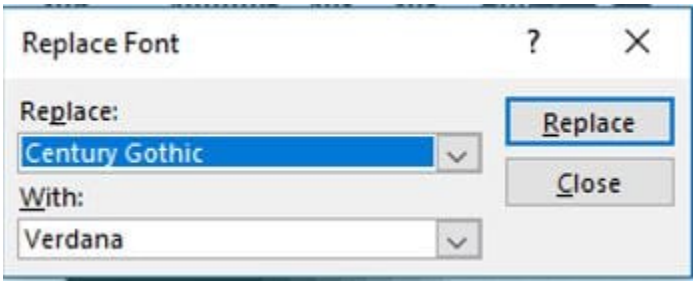
Find Replace

In the Editing group of the Home tab, click the Replace drop-down list, and choose Replace ... to open the Replace window. Use the Find what: and Replace with: fields to update the presentation by replacing certain text with new text. Exact case settings can be required to ensure words like Mark versus mark are not replaced inadvertently.



Replace

Sometimes a new design requires that a font be changed throughout the entire presentation. Changing fonts throughout a presentation is very similar to changing certain text throughout a document or throughout a presentation. In the Editing group of the Home tab, click the Replace drop-down list, and choose Replace Fonts... to open the Replace Font window. In the Replace: drop-down list, choose the existing font that needs to be replaced, and then in the With: drop-down list, select the new font that should appear instead.



Replace Font

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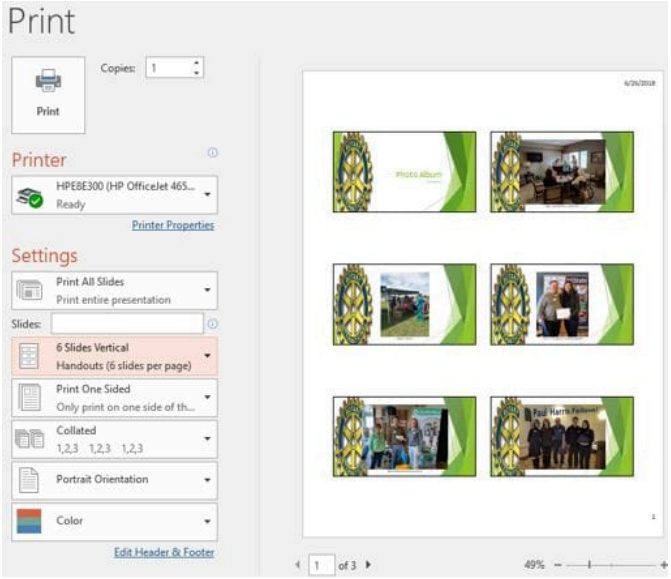
6.2.16: Printing a Presentation

A hard copy of a presentation may be printed for a variety of reasons. A copy might be printed to provide an editor to review and edit. A second reason might be to generate speaker notes for the presenter. A third reason might be to produce handouts for audience members. Whichever reason is chosen, previewing the printout in Print Preview can resolve a lot of unforeseen issues before wasting a lot of time, paper and ink/toner.



Print Preview icon

It is recommended to add the Print Preview icon to the Quick Access Toolbar to make it easy to review the presentation's accuracy and organization.



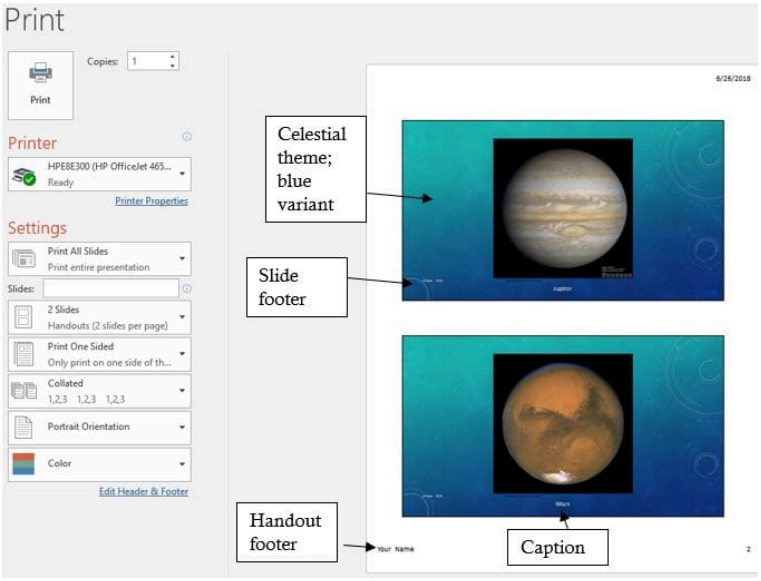
PPT Print Preview

The most common reason to print a PowerPoint file is to produce handouts, but this objective demands further consideration. How will the audience use the handouts? Will they use them as a reference, or will they be used to take notes? The answer to this decision will affect the first option under the Slides setting. The default is Full Page Slides, which is rarely the preferred selection since each slide is printed on its own sheet. Notes Pages should be the option if the intent is to generate speaker notes. The Outline option will print the presentation in outline format which prints text, but no graphics, tables or photos. This option is popular if saving paper is a goal. The nine different Handouts options offer various numbers of thumbnail versions of each slide per sheet of paper. Three slides is appropriate if it is desired to give the audience room to take notes, whereas six slides is suitable if the goal is simply to provide reference materials. Once the print options have been selected, click Print or the Print icon to print the presentation.

Practice 6: The Solar System – Part 5

1. Download the *Planets.zip* file from the Course Data Files. Extract the files to a location on your device where you save files for this course.
2. Open a new, blank presentation in PowerPoint.
3. Insert a new photo album using the eight photos unzipped from step 1. Choose the 1 picture, Picture layout. Include captions below all pictures.

4. Apply the Celestial theme, along with the blue variant.
5. Change the title text to Our Planets, then change the text to WordArt with the Lime, Accent color 1 Pattern fill.
6. Insert a slide footer with M State – 2018 on all slides except the title slide. Include a handout footer with your name.
7. Capture a screenshot of Print Preview displaying handouts, 2 Slides per page in full color.
8. Compare your results with the screenshot below. Cancel the printing and save the file as Our Planets.pptx.



Our Planets Print Preview

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6.2.17: Agricultural Presentation Applications

Presentation management applications in agriculture are tools designed to help professionals create, organize, and deliver presentations effectively. These applications are useful for showcasing research findings, farm management data, new technologies, and industry trends. Here are some key presentation management applications used in agriculture:

1. Microsoft PowerPoint

- **Description:** A widely used tool for creating slideshows and presentations. It allows users to incorporate text, images, charts, and multimedia into their presentations.
- **Features:** Customizable templates, integration with Excel for data charts, and tools for adding animations and transitions.
- **Website:** Microsoft PowerPoint

2. Google Slides

- **Description:** A cloud-based presentation tool that allows for real-time collaboration and easy sharing. Ideal for creating presentations that can be accessed and edited from anywhere.
- **Features:** Cloud storage, real-time collaboration, and integration with other Google Workspace tools like Google Sheets and Google Docs.
- **Website:** Google Slides

3. Prezi

- **Description:** A presentation software that uses a non-linear format, allowing users to create dynamic and visually engaging presentations. It's known for its zooming user interface.
- **Features:** Zooming effects, customizable templates, and interactive elements that can make presentations more engaging.
- **Website:** Prezi

4. Canva

- **Description:** An online design tool that includes features for creating presentations, infographics, and other visual content. Offers a range of templates and design elements.
- **Features:** Drag-and-drop interface, customizable templates, and a vast library of images and icons.
- **Website:** Canva

5. Keynote

- **Description:** Apple's presentation software for macOS and iOS. Known for its clean and sleek design capabilities and seamless integration with other Apple products.
- **Features:** Advanced graphics tools, customizable templates, and easy integration with iCloud for accessing presentations across devices.
- **Website:** Keynote

6. Slidebean

- **Description:** An AI-powered presentation tool that helps users create visually appealing slides by automating design elements. Useful for creating professional presentations quickly.
- **Features:** Design automation, customizable templates, and data visualization tools.
- **Website:** Slidebean

7. Zoho Show

- **Description:** A cloud-based presentation tool that integrates with other Zoho applications and offers collaborative features.
- **Features:** Real-time collaboration, cloud storage, and a variety of templates and themes.
- **Website:** Zoho Show

8. Visme

- **Description:** A visual content creation tool that allows users to design presentations, infographics, and reports. It offers a range of templates and design elements tailored for various purposes.
- **Features:** Interactive features, customizable templates, and a variety of charts and graphics.
- **Website:** Visme

9. Haiku Deck

- **Description:** A simple tool for creating visually attractive presentations with a focus on ease of use and design.
- **Features:** High-quality images, templates for various topics, and tools for adding text and visual elements.
- **Website:** Haiku Deck

10. Adobe Spark

- **Description:** A suite of design tools that includes capabilities for creating presentations, social media graphics, and web pages. Known for its easy-to-use interface and integration with Adobe Creative Cloud.
- **Features:** Customizable templates, video creation tools, and integration with Adobe Creative Cloud.
- **Website:** Adobe Spark

Applications in Agriculture

- **Research Presentations:** Share findings from agricultural research or trials.
- **Training Workshops:** Educate farm staff or agricultural professionals about new technologies or best practices.
- **Marketing:** Present new products, services, or technologies to potential clients or partners.
- **Reports:** Provide updates on farm performance, financials, or market trends to stakeholders.

These tools help agricultural professionals effectively communicate information, whether for internal training, stakeholder updates, or public outreach.

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6.3: End of Chapter Summary

Summary

Presentation management applications are essential for agricultural professionals to communicate and present data effectively. Key applications include:

- **Microsoft PowerPoint**: A widely used tool for creating detailed presentations with customizable templates and multimedia integration.
- **Google Slides**: A cloud-based tool offering real-time collaboration and seamless integration with Google Workspace.
- **Prezi**: Known for its dynamic and non-linear presentation format with zooming effects.
- **Canva**: An online design tool for creating visually appealing presentations with a drag-and-drop interface.
- **Keynote**: Apple's presentation software featuring advanced graphics tools and seamless integration with iCloud.
- **Slidebean**: An AI-powered tool that automates design elements to quickly create professional presentations.
- **Zoho Show**: A cloud-based tool that integrates with other Zoho applications and supports real-time collaboration.
- **Visme**: A visual content creation tool for designing presentations, infographics, and reports.
- **Haiku Deck**: A user-friendly tool focusing on high-quality images and simple design.
- **Adobe Spark**: Part of Adobe Creative Cloud, it offers customizable templates and design tools for creating presentations and social media graphics.

These applications support various agricultural activities, including research presentations, training workshops, marketing, and reporting. By leveraging these tools, agricultural professionals can effectively communicate their findings, educate others, and present information in a clear and engaging manner.

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6.4: End of Chapter Discussion

Here are some discussion topics related to presentation management applications in agriculture:

1. **Role of Presentation Tools in Agricultural Training:**
   - How can presentation management applications enhance training programs for farmers and agricultural professionals?
   - Discuss examples of effective training presentations that use visual aids to convey complex agricultural concepts.
2. **Data Visualization for Agricultural Decision-Making:**
   - How can presentation tools be used to visualize agricultural data (e.g., crop yields, soil health, weather patterns) for better decision-making?
   - Explore the impact of charts, graphs, and infographics on understanding and interpreting agricultural data.
3. **Creating Impactful Farm Management Reports:**
   - What features should presentation management applications have to create detailed and effective farm management reports?
   - Discuss best practices for presenting financial reports, crop plans, and operational summaries.
4. **Mobile and Remote Presentation Solutions:**
   - How can presentation management applications support mobile and remote presentations for agricultural consultants and extension services?
   - Explore the advantages of cloud-based and mobile-friendly presentation tools for on-the-go access.
5. **Integration with Other Agricultural Software:**
   - How can presentation management applications integrate with farm management software, GIS systems, and other agricultural tools?
   - Discuss the benefits of seamless integration for creating comprehensive and interactive presentations.
6. **Designing Presentations for Different Audiences:**
   - How should presentations be tailored for different stakeholders, such as farmers, investors, policymakers, and the public?
   - Explore strategies for customizing content and design to meet the needs of diverse agricultural audiences.
7. **Collaborative Presentation Development:**
   - What are the benefits of collaborative features in presentation management applications for agricultural teams?
   - Discuss how real-time collaboration and feedback can enhance the quality and effectiveness of agricultural presentations.
8. **Use of Multimedia in Agricultural Presentations:**
   - How can multimedia elements (e.g., videos, animations, interactive diagrams) be used to make agricultural presentations more engaging?
   - Explore examples of multimedia use in agricultural education, marketing, and research presentations.
9. **Presentation Management for Research Dissemination:**
   - How can presentation tools help in disseminating agricultural research findings and innovations?
   - Discuss the role of presentations in conferences, workshops, and academic publications.
10. **Creating Interactive and Engaging Content:**
    - What techniques can be used to create interactive presentations that engage agricultural audiences?
    - Explore the use of interactive elements such as polls, quizzes, and clickable content in presentations.
11. **Best Practices for Data Accuracy and Integrity:**
    - How can presentation management applications ensure the accuracy and integrity of agricultural data presented?
    - Discuss the importance of data verification and the role of presentation tools in maintaining data quality.
12. **Training and Support for Presentation Tools:**
    - What training and support resources are available for users of presentation management applications in agriculture?
    - Explore strategies for helping agricultural professionals effectively utilize presentation tools.
13. **Impact of Presentation Design on Audience Understanding:**
    - How does presentation design influence audience comprehension and retention of agricultural information?
    - Discuss the role of design principles in creating clear, concise, and effective agricultural presentations.
14. **Adapting Presentations for Different Formats:**
    - How can presentations be adapted for various formats such as webinars, in-person meetings, and online platforms?
    - Explore the challenges and solutions for creating presentations that work across different mediums.
15. **Future Trends in Presentation Management for Agriculture:**
    - What are the emerging trends in presentation management applications that could impact agriculture?
    - Discuss potential innovations and technologies that may shape the future of agricultural presentations.

These topics can help guide discussions on how presentation management applications are utilized in the agricultural sector, addressing both current practices and future possibilities.

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7: USING APPLICATIONS IN AGRICULTURE

7.1: Chapter Introduction

7.2: Chapter Learning Objectives

7.2.1: Introduction

7.2.2: Transforming Businesses through Information

7.2.3: Linking Up- Computer Networks

7.2.4: Management Information Systems

7.2.5: Technology Management and Planning

7.2.6: Protecting Computers and Information

7.2.7: Trends in Information Technology

7.3: End of Chapter Summary

7.4: End of Chapter Discussion

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7.1: Chapter Introduction

In the modern agriculture industry, software solutions play a crucial role in enhancing efficiency, productivity, and decision-making. From comprehensive farm management systems to specialized tools for livestock and crop management, the right software can streamline operations, improve data accuracy, and ultimately boost profitability. This overview explores various software options available in the agriculture sector, evaluating their strengths and weaknesses to help stakeholders choose the most suitable tools for their needs.

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7.2: Chapter Learning Objectives

Farm Management Software (General)

Farm management software generally aids in operational efficiency by tracking field activities and managing inputs and outputs. While beneficial for streamlining farm operations, such software may have limitations in advanced features and integration with other systems (Farm Management Software, n.d.).

1. Granular

Granular offers a robust platform for managing various aspects of farming, including field operations, financials, and workforce management. Its comprehensive data analytics and user-friendly interface are major advantages. However, its cost can be high, and the extensive features may be overwhelming for those seeking simpler solutions (Granular, n.d.).

Pros:

- **Comprehensive Management:** Granular offers an extensive suite of tools for farm management, including crop planning, financial management, and field operations.
- **Data-Driven Insights:** Advanced analytics help farmers make informed decisions based on detailed data.
- **User-Friendly:** Designed with an intuitive interface to facilitate ease of use.

Cons:

- **Cost:** It can be expensive, which might be prohibitive for smaller farms.
- **Complexity:** The depth of features might be excessive for users who need basic functionalities.

Reference: Granular. (n.d.). Retrieved from https://granular.ag/

2. AGRIVI

AGRIVI provides an integrated solution for both crop and livestock management, with multilingual support and mobile access being notable benefits. On the downside, it may have limited customization options and integration challenges with other systems (AGRIVI, n.d.).

Pros:

- **Integrated Solution:** AGRIVI covers various aspects of farm management, including crop and livestock management.
- **Multilingual Support:** Useful for international users.
- **Mobile Access:** Enables management from mobile devices.

Cons:

- **Customization:** Limited in customization options which may affect its adaptability to specific needs.
- **Integration:** Difficulties in integrating with other existing systems.

Reference: AGRIVI. (n.d.). Retrieved from https://www.agrivi.com/

3. FarmLogs

FarmLogs is known for its simplicity and effective field management tools, including tracking field activities and inputs. Its ease of use and mobile access are advantages, but it may lack some advanced features and have a cost associated with premium features (FarmLogs, n.d.).

Pros:

- **Field Management:** Provides tools for tracking field activities, managing crops, and recording inputs.
- **Ease of Use:** Designed for simplicity and ease of use, making it accessible for users without extensive technical expertise.
- **Mobile App:** Allows for on-the-go management and data entry.

Cons:

- **Limited Features:** May lack some advanced features found in more comprehensive systems.
- **Cost:** Advanced features require a paid subscription.

Reference: FarmLogs. (n.d.). Retrieved from https://www.farmlogs.com/

4. Trimble

Trimble excels in precision agriculture with its GPS guidance, auto-steering, and field mapping capabilities. Its comprehensive tools improve precision and efficiency, though the complexity and cost might be significant drawbacks (Trimble Agriculture, n.d.).

Pros:

- **Precision Agriculture:** Offers solutions for precision farming, including GPS guidance and auto-steering.
- **Comprehensive Tools:** Includes field mapping, soil analysis, and variable rate technology.

Cons:

- **Cost:** High-end features can be expensive.
- **Complexity:** Some users may find the array of features overwhelming.

Reference: Trimble Agriculture. (n.d.). Retrieved from https://agriculture.trimble.com/

5. Conservis

Conservis offers a highly customizable farm management solution that integrates various data sources. While its customization and data integration are strong points, the software's complexity and cost can be barriers to adoption (Conservis, n.d.).

Pros:

- **Customizable:** Highly customizable to fit specific farm operations and needs.
- **Integrated Data:** Allows for integration of various data sources for better decision-making.

Cons:

- **Complexity:** The range of features can be complex for users seeking simpler solutions.
- **Cost:** Can be pricey, especially for smaller farms.

Reference: Conservis. (n.d.). Retrieved from https://www.conservis.ag/

6. Croptracker

Croptracker is effective for compliance and record-keeping, providing a user-friendly interface for tracking crop health and activities. However, it may be limited in scope and integration with other systems (Croptracker, n.d.).

Pros:

- **Compliance and Record-Keeping:** Excellent for managing compliance, traceability, and records for crops.
- **User-Friendly:** Provides a straightforward interface for ease of use.

Cons:

- **Limited Scope:** Primarily focused on crop tracking and may not cover other aspects of farm management.
- **Integration:** May have limited integration with other software systems.

Reference: Croptracker. (n.d.). Retrieved from https://www.croptracker.com/

7. ArcGIS Field Maps

ArcGIS Field Maps provides advanced mapping and spatial data analysis capabilities. It integrates well with GIS applications but can be complex to learn and costly for advanced features (Esri, n.d.).

Pros:

- **Advanced Mapping:** Provides detailed field mapping and spatial data analysis capabilities.
- **Integration with GIS:** Integrates well with other GIS applications for comprehensive spatial analysis.

Cons:

- **Complexity:** May have a steep learning curve for users unfamiliar with GIS technologies.
- **Cost:** Can be expensive, especially when including advanced GIS features.

Reference: Esri. (n.d.). ArcGIS Field Maps. Retrieved from https://www.esri.com/en-us/arcgis/products/arcgis-field-maps/overview

8. FarmERP

FarmERP offers an extensive ERP solution tailored for agriculture, suitable for large-scale operations. Its scalability and comprehensive features are advantageous, though it may be complex to implement and expensive (FarmERP, n.d.).

Pros:

- **Enterprise Resource Planning:** Provides a comprehensive ERP solution tailored for the agriculture industry.
- **Scalability:** Suitable for large-scale farming operations.

Cons:

- **Complex Implementation:** Can be complex to implement and may require significant time and resources.
- **Cost:** Higher cost associated with full-featured ERP solutions.

Reference: FarmERP. (n.d.). Retrieved from https://www.farmerp.com/

9. Crop Monitoring

Crop Monitoring software provides real-time data on crop health and growth conditions, including predictive analytics. While it enhances crop management, its focus on monitoring alone might not address all farm management needs, and costs can be high (Crop Monitoring, n.d.).

Pros:

- **Real-Time Data:** Offers real-time monitoring of crop health and growth conditions.
- **Predictive Analytics:** Provides forecasts and alerts based on environmental data.

Cons:

- **Specialization:** Focuses primarily on crop monitoring and may not address other farm management needs.
- **Cost:** Advanced monitoring features may come with a high price tag.

Reference: Crop Monitoring. (n.d.). Retrieved from https://cropmonitoring.com/

10. EasyFarm

EasyFarm is known for its user-friendly interface and affordability, making it accessible for smaller operations. However, it may lack advanced features and customization options (EasyFarm, n.d.).

Pros:

- **User-Friendly:** Designed for ease of use, with a straightforward interface.
- **Affordability:** More affordable compared to some other solutions.

Cons:

- **Limited Features:** May lack advanced functionalities needed for larger or more complex operations.
- **Customization:** Limited in customization options.

Reference: EasyFarm. (n.d.). Retrieved from https://www.easyfarm.com/

11. AI Solutions for Precision Agriculture

AI solutions utilize artificial intelligence for precise crop management, including yield prediction and disease detection. They offer automation and enhanced accuracy but can be costly and complex (AI Solutions for Precision Agriculture, n.d.).

Pros:

- **Enhanced Accuracy:** Utilizes AI for precise crop management, including yield prediction and disease detection.
- **Automation:** Offers automation of routine tasks, improving efficiency.

Cons:

- **Cost:** Implementing AI solutions can be expensive.
- **Complexity:** Requires understanding of AI technologies and might need specialized training.

Reference: AI Solutions for Precision Agriculture. (n.d.). Retrieved from https://www.aisolutionsforprecisionagriculture.com/

12. Agriculture Accounting Software

Agriculture accounting software focuses on managing farm finances, including budgeting and expense tracking. While it integrates well with other management tools, it may be limited to financial aspects and require accounting knowledge (Agriculture Accounting Software, n.d.).

Pros:

- **Financial Management:** Tailored for managing farm finances, including budgeting, expense tracking, and financial reporting.
- **Integration:** Often integrates with other farm management tools for seamless data flow.

Cons:

- **Focus:** Primarily focused on accounting, which may not cover other aspects of farm management.
- **Complexity:** Some software may be complex and require accounting knowledge to use effectively.

Selecting the right software is crucial for optimizing farm operations and achieving better productivity and efficiency in the agriculture sector. Whether the focus is on comprehensive farm management, specialized livestock care, or advanced crop monitoring, understanding the pros and cons of each software option is essential. By leveraging the appropriate tools, agricultural stakeholders can enhance their operational capabilities, drive innovation, and ultimately contribute to a more sustainable and profitable industry.

Reference: Agriculture Accounting Software. (n.d.). Retrieved from https://www.agriculturеaccountingsoftware.com/

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7.2.1: Introduction

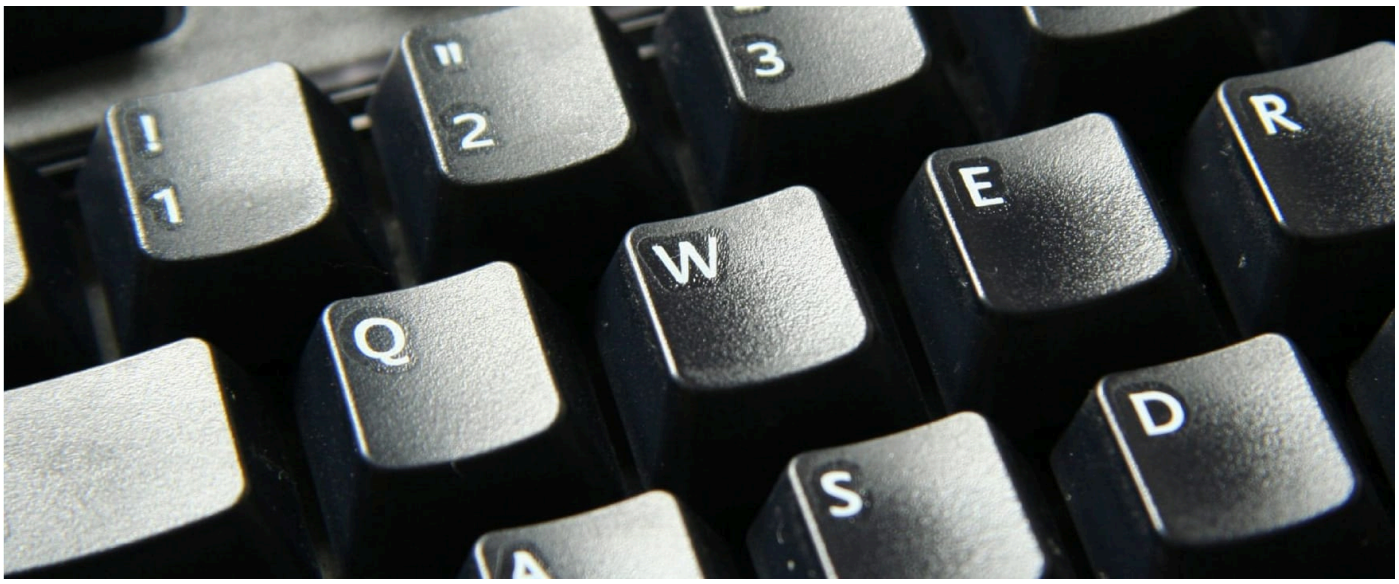


Exhibit **13.1** (Credit: OIST / flickr / Attribution 2.0 Generic (CC BY 2.0))

Learning Outcomes

After reading this chapter, you should be able to answer these questions:

1. How has information technology transformed business and managerial decision-making?
2. Why are computer networks an important part of today's information technology systems?
3. What types of systems make up a typical company's management information system?
4. How can technology management and planning help companies optimize their information technology systems?
5. What are the best ways to protect computers and the information they contain?
6. What are the leading trends in information technology?

EXPLORING BUSINESS CAREERS

John Daly, Daly Investment Management, LLC

When meeting with a Daly Investment (**www.dalyinvestment.com**) financial consultant, most likely you are thinking about money, *your* money. Whether you seek a short-term investment or a retirement nest egg, money will be your focus. You probably will not be thinking about the technological infrastructure required to transmit information throughout a multibillion dollar, nationwide institution such as TD Ameritrade—information that often is private and financial in nature. Luckily for you, however, the company is led by financial advisor John Daly, who works with TD Ameritrade to support his company's technology needs.

After successful careers at Charles Schwab and Morgan Stanley, Daly knew when he started his own firm he would need IT support so that he could ensure the security of the funds he managed for his customers while focusing on the financial aspects of managing their finances. In addition to providing a financial trading platform for individual investors, TD Ameritrade has a robust set of software as a service cloud-based tools that allow Daly to focus on his core competencies rather than having to hire, train, and maintain a complex set of IT resources that his clients can trust.

Given the size of the assets it manages, TD Ameritrade's management information system (MIS) is necessarily large. TD

Ameritrade's open architecture environment enables financial advisors like John Daly to select the technology they want to use. The lesson is that Daly could act as an entrepreneur and start his own firm while providing information technology with the scale that customers expect and providing the personal service that is often missing when dealing with larger organizations.

Sources: "Innovative Technologies," *TD Ameritrade Institutional*, http://www.tdainstitutional.com, accessed February 21, 2018; Daly Investment Management website, www.dalyinvestment.com, accessed February 21, 2018; Daly Investment Management Facebook page, https://www.facebook.com/dalyinvestment, accessed February 21, 2018.

This chapter focuses on the role of information technology (IT) in business, examining the details of MIS organization, as well as the challenges companies encounter in an increasingly technological world. As John Daly learned, harnessing the power of information technology gives a company a significant competitive advantage.

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7.2.2: Transforming Businesses through Information

1. How has information technology transformed business and managerial decision-making?

Information technology (IT) includes the equipment and techniques used to manage and process information. Information is at the heart of all organizations. Without information about the processes of and participants in an organization—including orders, products, inventory, scheduling, shipping, customers, suppliers, and employees—a business cannot operate.

In less than 70 years, we have shifted from an industrial society to a knowledge-based economy driven by information. Businesses depend on information technology for everything from running daily operations to making strategic decisions. Computers are the tools of this information age, performing extremely complex operations as well as everyday jobs such as word processing and creating spreadsheets. The pace of change has been rapid since the personal computer became a fixture on most office desks. Individual units became part of small networks, followed by more sophisticated enterprise-wide networks. **Table 13.1** and **Table 13.2**summarize the types of computer equipment and software, respectively, most commonly used in business management information systems today.

Business Computing Equipment		
Computer Type	**Description**	**Comments**
Tablets	Self-contained computers in which applications (apps) can reside. These devices can also be linked into a network over which other programs can be accessed.	Increasing power, speed, and memory accessed via the cloud make these tablets the dominant computer for many business processes.
Desktop personal computers (PC)	Self-contained computers on which software can reside. These PCs can also be linked into a network over which other programs can be accessed.	Increasing power, speed, memory, and storage make these commonly used for many business processes. Can handle text, audio, video, and complex graphics.
Laptop computers	Portable computers similar in power to desktop computers.	Smaller size and weight make mobile computing easier for workers.
Minicomputers	Medium-sized computers with multiple processors, able to support from four to about 200 users at once.	The distinction between the larger minicomputers and smaller mainframes is blurring.
Mainframe computers	Large machines about the size of a refrigerator; can simultaneously run many different programs and support hundreds or thousands of users.	Extremely reliable and stable, these are used by companies and governments to process large amounts of data. They are more secure than PCs.
Servers	Greatest storage capacity and processing speeds.	These are not subject to crashes and can be upgraded and repaired while operating.
Supercomputers	Most powerful computers, now capable of operating at speeds of 280 trillion calculations per second.	Companies can rent time to run projects from special supercomputer centers.

Table13.1

Application Type	Description
Word processing software	Used to write, edit, and format documents such as letters and reports. Spelling and grammar checkers, mail merge, tables, and other tools simplify document preparation.
Spreadsheet software	Used for preparation and analysis of financial statements, sales forecasts, budgets, and similar numerical and statistical data. Once the mathematical formulas are keyed into the spreadsheet, the data can be changed and the solution will be recalculated instantaneously.

Application Type	Description
Database management programs	Serve as electronic filing cabinets for records such as customer lists, employee data, and inventory information. Can sort data based on various criteria to create different reports.
Graphics and presentation programs	Create tables, graphs, and slides for customer presentations and reports. Can add images, video, animation, and sound effects.
Desktop publishing software	Combines word processing, graphics, and page layout software to create documents. Allows companies to design and produce sales brochures, catalogs, advertisements, and newsletters in-house.
Communications programs	Translate data into a form for transmission and transfer it across a network to other computers. Used to send and retrieve data and files.
Integrated software suites	Combine several popular types of programs, such as word processing, spreadsheet, database, graphics presentation, and communications programs. Component programs are designed to work together.
Groupware	Facilitates collaborative efforts of workgroups so that several people in different locations can work on one project. Supports online meetings and project management (scheduling, resource allocation, document and e-mail distribution, etc.).
Financial software	Used to compile accounting and financial data and create financial statements and reports.

Table13.2

Although most workers spend their days at powerful desktop computers, other groups tackle massive computational problems at specialized supercomputer centers. Tasks that would take years on a PC can be completed in just hours on a supercomputer. With their ability to perform complex calculations quickly, supercomputers play a critical role in national security research, such as analysis of defense intelligence; scientific research, from biomedical experiments and drug development to simulations of earthquakes and star formations; demographic studies such as analyzing and predicting voting patterns; and weather and environmental studies. Businesses, too, put supercomputers to work by analyzing big data to gain insights into customer behavior, improving inventory and production management and for product design.[1] The speed of these special machines has been rising steadily to meet increasing demands for greater computational capabilities, and the next goal is quadrillions of computations per second, or *petaflops*. Achieving these incredible speeds is critical to future scientific, medical, and business discoveries. Many countries, among them the United States, China, France, and Japan, have made petascale computing a priority.[2]

In addition to a business's own computers and internal networks, the internet makes it effortless to connect quickly to almost anyplace in the world. As Thomas Friedman points out in his book *The World Is Flat,* "We are now connecting all of the knowledge centers on the planet together into a single global network, which . . . could usher in an amazing era of prosperity and innovation."[3]The opportunities for collaboration on a global scale increase daily. A manager can share information with hundreds of thousands of people worldwide as easily as with a colleague on another floor of the same office building. The internet and the web have become indispensable business tools that facilitate communication within companies as well as with customers.

The rise of electronic trading hubs is just one example of how technology is facilitating the global economy. Electronic trading hubs are not reserved for large companies of developed economies, however. Alibaba is piloting an e-hub called eWTP in Malaysia that will provide access to small businesses. As Jack Ma, Alibaba co-founder, said at eWTP's launch, "There are a lot of free-trade zones for efficient trade facilitation, but only for big companies. There is no free-trade zone designed for small companies. I have been shouting everywhere, screaming, that every government should do it."[4]

Many companies entrust an executive called the **chief information officer (CIO)** with the responsibility of managing all information resources. The importance of this responsibility is immense. In addition to the massive expansion of information gathered by today's businesses, most of us are **knowledge workers** who develop or use knowledge. Knowledge workers contribute to and benefit from information they use to perform planning, acquiring, searching, analyzing, organizing, storing, programming, producing, distributing, marketing, or selling functions. We must know how to gather and use information from the many resources available to us.



Exhibit **13.2** In today's high-tech world, CIOs must possess not only the technical smarts to implement global IT infrastructures, integrate communications systems with partners, and protect customer data from insidious hackers, but they must also have strong business acumen. Google's acclaimed tech chief Ben Fried manages the technology necessary to deliver more than 9 billion searches daily, with an eye towards greater business efficiency, growth, and profits. *Why is it important for CIOs to possess both technological and business expertise?* (Credit: Enterprise 2.0 Conference/ flickr/ Attribution 2.0 Generic (CC BY 2.0)

EXPANDING AROUND THE GLOBE

E-Hubs Integrate Global Commerce

Thanks to the wonders of technological advancement, global electronic trading now goes far beyond the internet retailing and trading that we are all familiar with. Special websites known as trading hubs, or eMarketplaces, facilitate electronic commerce between businesses in specific industries such as automotive manufacturing, retailing, telecom provisioning, aerospace, financial products and services, and more. Virtually all Forex (Foreign Exchange) is done via trading hubs that provide an open market for trading of a variety of currencies. Because there are a large number of trades involving currencies, the price is discoverable and there is transparency in the market. By contrast, Bitcoin is mainly traded in smaller quantities, and there are often large discrepancies between prices for the cryptocurrency in different exchanges.

The trading hub functions as a means of integrating the electronic collaboration of business services. Each hub provides standard formats for the electronic trading of documents used in a particular industry, as well as an array of services to sustain e-commerce between businesses in that industry. Services include demand forecasting, inventory management, partner directories, and transaction settlement services. And the payoff is significant—lowered costs, decreased inventory levels, and shorter time to market—resulting in bigger profits and enhanced competitiveness. For example, large-scale manufacturing procurement can amount to billions of dollars. Changing to "just-in-time purchasing" on the e-hub can save a considerable percentage of these costs.

Electronic trading across a hub can range from the collaborative integration of individual business processes to auctions and exchanges of goods (electronic barter). Global content management is an essential factor in promoting electronic trading agreements on the hub. A globally consistent view of the "content" of the hub must be available to all. Each participating company handles its own content, and applications such as *content managers* keep a continuously updated master catalog of the inventories of all members of the hub. The *transaction manager* application automates trading arrangements between companies, allowing the hub to provide aggregation and settlement services.

Ultimately, trading hubs for numerous industries could be linked together in a global e-commerce web—an inclusive "*hub of all hubs*." One creative thinker puts it this way: "The traditional linear, one step at a time, supply chain is dead. It will be replaced by parallel, asynchronous, real-time marketplace decision-making. Take manufacturing capacity as an example. Enterprises can bid their excess production capacity on the world e-commerce hub. Offers to buy capacity trigger requests from the seller for parts bids to suppliers who in turn put out requests to other suppliers, and this whole process will all converge in a matter of minutes."

Sources: “Asian Companies Count Losses—Hatch Ways to Cope with Weak Dollar,” *Reuters*, https://www.reuters.com, January 24, 2018; Rob Verger, “This Is What Determines the Price of Bitcoin,” *Popular Science*, https://www.popsci.com, January 22, 2018; Bhavan Jaipragas, “Alibaba’s Electronic Trading Hub to Help Small and Medium-sized Enterprises Goes Live in Malaysia,” *This Week in Asia*, http://www.scmp.com, November 3, 2017.

Critical Thinking Questions

1. How do companies benefit from participating in an electronic trading hub?
2. What impact does electronic trading have on the global economy?

Because most jobs today depend on information—obtaining, using, creating, managing, and sharing it—this chapter begins with the role of information in decision-making and goes on to discuss computer networks and management information systems. The management of information technology—planning and protection—follows. Finally, we’ll look at the latest trends in information technology. Throughout the chapter, examples show how managers and their companies are using computers to make better decisions in a highly competitive world.

Data and Information Systems

Information systems and the computers that support them are so much a part of our lives that we almost take them for granted. These **management information systems** methods and equipment that provide information about all aspects of a firm’s operations provide managers with the information they need to make decisions. They help managers properly categorize and identify ideas that result in substantial operational and cost benefits.

Businesses collect a great deal of *data*—raw, unorganized facts that can be moved and stored—in their daily operations. Only through well-designed IT systems and the power of computers can managers process these data into meaningful and useful *information* and use it for specific purposes, such as making business decisions. One such form of business information is the **database**, an electronic filing system that collects and organizes data and information. Using software called a *database management system (DBMS),* you can quickly and easily enter, store, organize, select, and retrieve data in a database. These data are then turned into information to run the business and to perform business analysis.

Databases are at the core of business information systems. For example, a customer database containing name, address, payment method, products ordered, price, order history, and similar data provides information to many departments. Marketing can track new orders and determine what products are selling best; sales can identify high-volume customers or contact customers about new or related products; operations managers use order information to obtain inventory and schedule production of the ordered products; and finance uses sales data to prepare financial statements. Later in the chapter, we will see how companies use very large databases called data warehouses and data marts.

Companies are discovering that they can’t operate well with a series of separate information systems geared to solving specific departmental problems. It takes a team effort to integrate the systems described and involves employees throughout the firm. Company-wide *enterprise resource planning (ERP)* systems that bring together human resources, operations, and technology are becoming an integral part of business strategy. So is managing the collective knowledge contained in an organization, using data warehouses and other technology tools. Technology experts are learning more about the way the business operates, and business managers are learning to use information systems technology effectively to create new opportunities and reach their goals.

CONCEPT CHECK

1. What are management information systems, and what challenges face the CIO in developing the company’s MIS?
2. Distinguish between data and information. How are they related? Why are data considered a valuable asset for a firm?
3. How does systems integration benefit a company?

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7.2.3: Linking Up- Computer Networks

2. Why are computer networks an important part of today's information technology systems?

Today most businesses use networks to deliver information to employees, suppliers, and customers. A **computer network** is a group of two or more computer systems linked together by communications channels to share data and information. Today's networks often link thousands of users and can transmit audio and video as well as data.

Networks include clients and servers. The *client* is the application that runs on a personal computer or workstation. It relies on a *server* that manages network resources or performs special tasks such as storing files, managing one or more printers, or processing database queries. Any user on the network can access the server's capabilities.

By making it easy and fast to share information, networks have created new ways to work and increase productivity. They provide more efficient use of resources, permitting communication and collaboration across distance and time. With file-sharing, all employees, regardless of location, have access to the same information. Shared databases also eliminate duplication of effort. Employees at different sites can "screen-share" computer files, working on data as if they were in the same room. Their computers are connected by phone or cable lines, they all see the same thing on their display, and anyone can make changes that are seen by the other participants. The employees can also use the networks for videoconferencing.

Networks make it possible for companies to run enterprise software, large programs with integrated modules that manage all of the corporation's internal operations. Enterprise resource planning systems run on networks. Typical subsystems include finance, human resources, engineering, sales and order distribution, and order management and procurement. These modules work independently and then automatically exchange information, creating a company-wide system that includes current delivery dates, inventory status, quality control, and other critical information. Let's now look at the basic types of networks companies use to transmit data—local area networks and wide area networks—and popular networking applications such as intranets and virtual private networks.

Connecting Near and Far with Networks

Two basic types of networks are distinguished by the area they cover. A **local area network (LAN)** lets people at one site exchange data and share the use of hardware and software from a variety of computer manufacturers. LANs offer companies a more cost-effective way to link computers than linking terminals to a mainframe computer. The most common uses of LANs at small businesses, for example, are office automation, accounting, and information management. LANs can help companies reduce staff, streamline operations, and cut processing costs. LANs can be set up with wired or wireless connections.

A **wide area network (WAN)** connects computers at different sites via telecommunications media such as phone lines, satellites, and microwaves. A modem connects the computer or a terminal to the telephone line and transmits data almost instantly, in less than a second. The internet is essentially a worldwide WAN. Communications companies, such as AT&T, Verizon, and Sprint, operate very large WANs. Companies also connect LANs at various locations into WANs. WANs make it possible for companies to work on critical projects around the clock by using teams in different time zones.

Several forms of WANs—intranets, virtual private networks (VPN), and extranets—use internet technology. Here we'll look at intranets, internal corporate networks that are widely available in the corporate world, and VPNs. Although wireless networks have been around for more than a decade, they are increasing in use because of falling costs, faster and more reliable technology, and improved standards. They are similar to their wired LAN and WAN cousins, except they use radio frequency signals to transmit data. You use a wireless WAN (WWAN) regularly when you use your cellular phone. WANs' coverage can span several countries. Telecommunications carriers operate using wireless WANs.

Wireless LANs (WLAN) that transmit data at one site offer an alternative to traditional wired systems. WLANs' reach is a radius of 500 feet indoors and 1,000 feet outdoors and can be extended with antennas, transmitters, and other devices. The wireless devices communicate with a wired access point into the wired network. WLANs are convenient for specialized applications where wires are in the way or when employees are in different locations in a building. Hotels, airports, restaurants, hospitals, retail establishments, universities, and warehouses are among the largest users of WLANs, also known as Wi-Fi. For example, the

Veterans Administration Hospital in West Haven, Connecticut, recently added Wi-Fi access in all patient rooms to upgrade its existing WLAN to improve patient access, quality, and reliability. The new WLAN supports many different functions, from better on-site communication among doctors and nurses through both data transmission and voice-over-internet phone systems to data-centric applications such as its Meditech clinical information system and pharmacy management.[5]

CATCHING THE ENTREPRENEURIAL SPIRIT

Documenting the Future

Potential customers of Captiva Software didn't share company cofounder and chief executive Reynolds Bish's belief that paper wasn't going away. They held to the idea that personal computers and the internet would make paper disappear, and they weren't going to invest in software to organize their documents. That almost caused Captiva to go under. "We really were afraid we weren't going to make it," said Jim Berglund, an early investor in Captiva and a former board member.

But Bish asked investors for another $4 million commitment—on a bet that paper was here to stay. Bish recalls a board member telling him, "Five years from now people are going to either think you're a genius or a complete idiot."

That conversation took place 20 years ago. Captiva Software was named one of the fastest-growing technology companies in San Diego in the early 2000s for its 172 percent increase in revenues. The company was then acquired by EMC Corp.—the sixth-largest software company in the world and top maker of corporate data-storage equipment, with projected annual revenues of more than $9 billion—for $275 million in cash, rewarding embattled early Captiva investors with 10 times their money back. (In 2016, Dell acquired EMC for more than $67 billion.)

Captiva began its journey to the big time in 1989 in Park City, Utah, as TextWare Corp., a small data-entry company. Cofounder Steven Burton's technical expertise, Bish's business background, and a credit card helped them get the business going. "It was pure bootstrapping," Bish said. "We did everything from going without a salary for a year or more to using up our credit cards."

Bish and Burton quickly saw the need for employees to enter data more directly and accurately. The software they developed still required clerks to type information from a paper document, but it could check for inaccuracies, matching zip codes to cities, for instance. In 1996, TextWare produced software that could "read" typewritten words on a scanned piece of paper, which significantly reduced the number of data-entry clerks needed. It found popularity with credit-card processors, insurance companies, shipping companies, and other corporations that handled thousands of forms every day.

TextWare acquired or merged with five firms, went public, changed its name twice, and in 1998 set up its headquarters in San Diego, California, after buying Wheb Systems, which is based there. In 2002, the company merged with publicly held ActionPoint, a San Jose, California, document-processing company, and changed its name to Captiva.

An estimated 80 percent of all information is still paper-based, according to market research firm Forrester Research. Captiva's flagship products, InputAccel and FormWare, process over 85 million pieces of paper worldwide every day, leaving no doubt that Bish's vision was on target. Paper is indeed here to stay.

Sources: "Why Captiva?" https://www.emc.com, accessed February 21, 2018; EMC corporate website, "About Us," https://dellemc.com, accessed February 21, 2018; "Lucera Uses Connectivity Routes of Chicago, New York, London and Tokyo as a Trading Hub in Trading Increases," *BSO*, https://www.bsonetwork.com, October 19, 2017; Ron Miller, "$67 Billion Dell–EMC Deal Closes Today," *Tech Crunch,* https://techcrunch.com, September 7, 2016; Brian Sherman, "Input Management and Opportunities for the Reseller Channel: An Interview with Wayne Ford, VP of Partner Alliances at Captiva," *ECM Connection*, www.ecmconnection.com, December 27, 2005; Kathryn Balint, "Captiva's Paper Chase Paying Off," *San Diego Union-Tribune,* December 9, 2005, pp. C1, C5.

Critical Thinking Questions

1. What role did co-founders Reynolds Bish and Steven Burton play in the evolution of tiny TextWare into hugely successful Captiva?
2. What other unique factors were responsible for the company's remarkable growth?

An Inside Job: Intranets

Like LANs, **intranets** are private corporate networks. Many companies use both types of internal networks. However, because they use internet technology to connect computers, intranets are WANs that link employees in many locations and with different types of computers. Essentially mini-internets that serve only the company's employees, intranets operate behind a *firewall* that prevents unauthorized access. Employees navigate using a standard web browser, which makes the intranet easy to use. They are also considerably less expensive to install and maintain than other network types and take advantage of the internet's interactive features such as chat rooms and team workspaces. Many software providers now offer off-the-shelf intranet packages so that companies of all sizes can benefit from the increased access to and distribution of information.

Companies now recognize the power of intranets to connect employers and employees in many ways, promoting teamwork and knowledge-sharing. Intranets have many applications, from human resource (HR) administration to logistics. For instance, a benefits administration intranet can become a favorite with employees. Instead of having to contact an HR representative to make any changes in personnel records or retirement plan contributions or to submit time sheets, staff members simply log on to the intranet and update the information themselves. Managers can also process staffing updates, performance reviews, and incentive payments without filing paperwork with human resources. Employees can regularly check an online job board for new positions. Shifting routine administrative tasks to the intranet can bring additional benefits such as reducing the size of the HR department by 30 percent and allowing HR staff members to turn their attention to more substantive projects.[6]

Enterprise Portals Open the Door to Productivity

Intranets that take a broader view serve as sophisticated knowledge management tools.

One such intranet is the **enterprise portal**, an internal website that provides proprietary corporate information to a defined user group. Portals can take one of three forms: business to employee (B2E), business to business (B2B), and business to consumer (B2C). Unlike a standard intranet, enterprise portals allow individuals or user groups to customize the portal home page to gather just the information they need for their particular job situations and deliver it through a single web page. Because of their complexity, enterprise portals are typically the result of a collaborative project that brings together designs developed and perfected through the effort of HR, corporate communications, and information technology departments.

More companies use portal technology to provide:

- A consistent, simple user interface across the company
- Integration of disparate systems and multiple sets of data and information
- A single source for accurate and timely information that integrates internal and external information
- A shorter time to perform tasks and processes
- Cost savings through the elimination of information intermediaries
- Improved communications within the company and with customers, suppliers, dealers, and distributors

No More Tangles: Wireless Technologies

Wireless technology has become commonplace today. We routinely use devices such as cellular phones, mobile devices, garage door openers, and television remote controls—without thinking of them as examples of wireless technology. Businesses use wireless technologies to improve communications with customers, suppliers, and employees.

Companies in the package delivery industry, such as UPS and FedEx, were among the first users of wireless technology. Delivery personnel use handheld computers to send immediate confirmation of package receipt. You may also have seen meter readers and repair personnel from utility and energy companies send data from remote locations back to central computers.

Bluetooth short-range wireless technology is a global standard that improves personal connectivity for users of mobile phones, portable computers, and stereo headsets, and Bluetooth wirelessly connects keyboards and mice to computers and headsets to phones and music players. A Bluetooth-enabled mobile phone, for example, provides safer hands-free phone use while driving. The technology is finding many applications in the auto industry as well. Bluetooth wireless technology is now standard in many vehicles today. Many car, technology, and cell phone companies—among them Amazon, Apple, Audi, BMW, DaimlerChrysler, Google, Honda, Saab, Toyota, and Volkswagen—already offer Bluetooth hands-free solutions. Other uses include simplifying the connection of portable digital music players to the car's audio system and transferring downloaded music to the system.[7]



Exhibit **13.3** Although designing a true mobile replacement for the desktop PC has proved elusive for computer manufacturers, ultramobile PCs offer wireless functions many professionals want—web browsing, e-mail, Microsoft Office, and telephony. The Apple iPad Pro runs iOS 10, and with its 10.5-inch LCD touch screen and stylus, the mini-tablet provides the power of a desktop PC and freedom from pen and paper. *What impact might ultramobile computing have on business?* (Credit: Tinh t? Photo/ flickr/ Public Domain)

Private Lines: Virtual Private Networks

Many companies use **virtual private networks** to connect two or more private networks (such as LANs) over a public network, such as the internet. VPNs include strong security measures to allow only authorized users to access the network and its sensitive corporate information. Companies with widespread offices may find that a VPN is a more cost-effective option than creating a network using purchased networking equipment and leasing expensive private lines. This type of private network is more limited than a VPN, because it doesn't allow authorized users to connect to the corporate network when they are at home or traveling.

As **Exhibit 13.4** shows, the VPN uses existing internet infrastructure and equipment to connect remote users and offices almost anywhere in the world—without long-distance charges. In addition to saving on telecommunications costs, companies using VPNs don't have to buy or maintain special networking equipment and can outsource management of remote access equipment. VPNs are useful for salespeople and telecommuters, who can access the company's network as if they were on-site at the company's office. On the downside, the VPN's availability and performance, especially when it uses the internet, depends on factors largely outside of an organization's control.

VPNs are popular with many different types of organizations. Why? Security is one of the main reasons to always use a VPN to access the internet. Because all your data is encrypted once tunneled, if a hacker were trying to intercept your browsing activity, say, while you were entering your credit card number to make an online purchase, the encryption would stymie their efforts. That's why it's a particularly good idea to use VPNs in public settings such as coffee shops and airports.[8]

Software on Demand: Application Service Providers

As software developers release new types of application programs and updated versions of existing ones every year or two, companies have to analyze whether they can justify buying or upgrading to the new software—in terms of both cost and implementation time. **Application service providers (ASP)** offer a different approach to this problem. Companies subscribe, usually on a monthly basis, to an ASP and use the applications much like you'd use telephone voice mail, the technology for which resides at the phone company. Other names for ASPs include on-demand software, hosted applications, and software-as-a-service. **Exhibit 13.5** shows how the ASP interfaces with software and hardware vendors and developers, the IT department, and users.

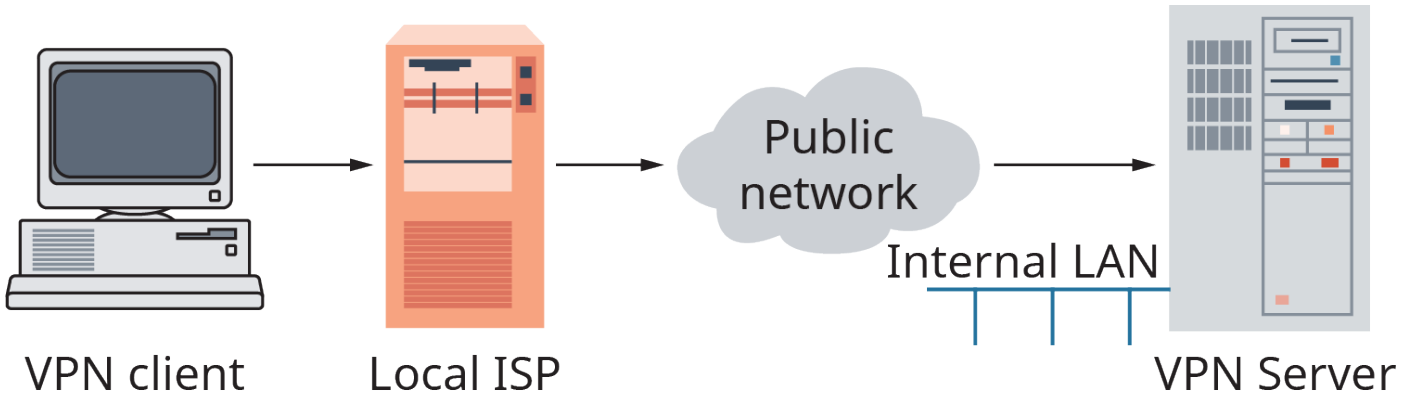


Exhibit **13.4 Virtual Private Networks (VPNs)** (Attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license.)

The simplest ASP applications are automated—for example, a user might use one to build a simple e-commerce site. ASPs provide three major categories of applications to users:

- Enterprise applications, including customer relationship management (CRM), enterprise resource planning, e-commerce, and data warehousing
- Collaborative applications for internal communications, e-mail, groupware, document creation, and management messaging
- Applications for personal use—for example, games, entertainment software, and home-office applications

According to recent surveys, more companies are currently using an ASP, and even moving their legacy systems to the cloud. Estimates suggest revenues from subscriptions to on-demand cloud services were about $180 billion in 2017. This sector is growing much more rapidly—three times faster—than traditional hardware and software.[9] As this market grows, more companies are adding on-demand offerings to their traditional software packages. Amazon (Amazon Web Services), IBM, Microsoft, and Salesforce.comare among the leading cloud service providers.[10]

Until recently, many companies were reluctant to outsource critical enterprise applications to third-party providers. As ASPs improved their technologies and proved to be reliable and cost-effective, attitudes have changed. Companies, both large and small, seek cost advantages such as the convenience ASPs provide. The basic idea behind subscribing to an ASP is compelling. Users can access any of their applications and data from any computer, and IT can avoid purchasing, installing, supporting, and upgrading expensive software applications. ASPs buy and maintain the software on their servers and distribute it through high-speed networks. Subscribers rent the applications they want for a set period of time and price. The savings in licensing fees, infrastructure, time, and staff are significant.

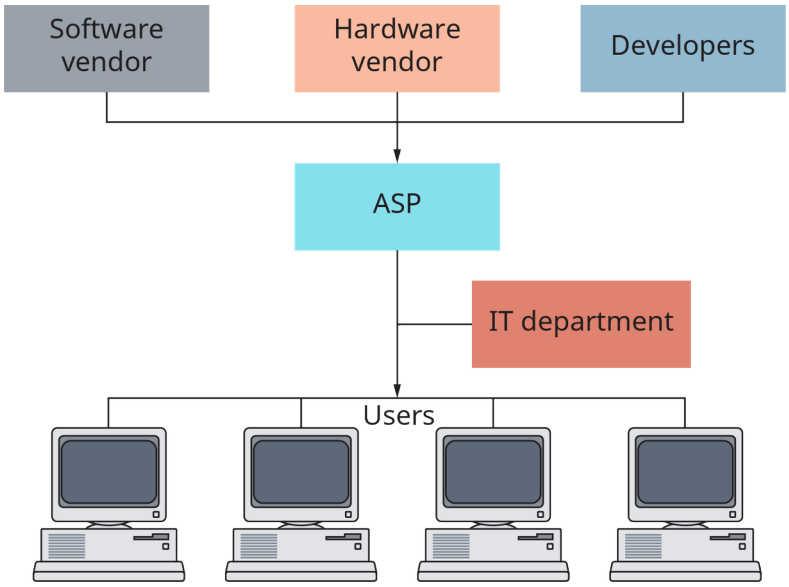


Exhibit **13.5 Structure of an ASP Relationship** (Attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license.)

Managed service providers (MSP) represent the next generation of ASPs, offering greater customization and expanded capabilities that include business processes and complete management of the network servers. The global market for managed IT services reached $149.1 billion in 2016. This market is estimated to reach $256.5 billion in 2021, from $166.7 billion in 2017, at a compound annual growth rate of 11.5 percent for the period 2018 through 2021.[11]

CONCEPT CHECK

1. What is a computer network? What benefits do companies gain by using networks?
2. How do a LAN and a WAN differ? Why would a company use a wireless network?
3. What advantages do VPNs offer a company? What about the cloud, ASPs, and MSPs?

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7.2.4: Management Information Systems

3. What types of systems make up a typical company's management information system?

Whereas individuals use business productivity software such as word processing, spreadsheet, and graphics programs to accomplish a variety of tasks, the job of managing a company's information needs falls to *management information systems:* users, hardware, and software that support decision-making. Information systems collect and store the company's key data and produce the information managers need for analysis, control, and decision-making.

Factories use computer-based information systems to automate production processes and order and monitor inventory. Most companies use them to process customer orders and handle billing and vendor payments. Banks use a variety of information systems to process transactions such as deposits, ATM withdrawals, and loan payments. Most consumer transactions also involve information systems. When you check out at the supermarket, book a hotel room online, or download music over the internet, information systems record and track the transaction and transmit the data to the necessary places.

Companies typically have several types of information systems, starting with systems to process transactions. Management support systems are dynamic systems that allow users to analyze data to make forecasts, identify business trends, and model business strategies. Office automation systems improve the flow of communication throughout the organization. Each type of information system serves a particular level of decision-making: operational, tactical, and strategic. **Exhibit 13.6** shows the relationship between transaction processing and management support systems as well as the management levels they serve. Let's take a more detailed look at how companies and managers use transaction processing and management support systems to manage information.

Transaction Processing Systems

A firm's integrated information system starts with its **transaction processing system (TPS)**. The TPS receives raw data from internal and external sources and prepares these data for storage in a database similar to a microcomputer database but vastly larger. In fact, all the company's key data are stored in a single huge database that becomes the company's central information resource. As noted earlier, the *database management system* tracks the data and allows users to query the database for the information they need.

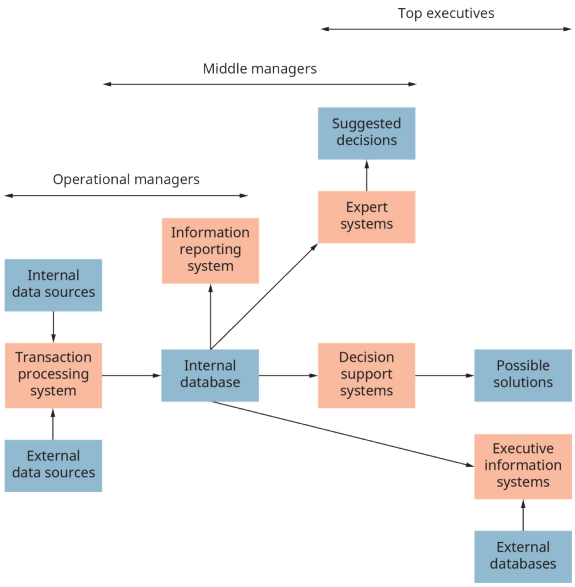


Exhibit **13.6 A Company's Integrated Information System** (Attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license.)

The database can be updated in two ways: **batch processing**, where data are collected over some time period and processed

together, and **online**, or **real-time**, **processing**, which processes data as they become available. Batch processing uses computer resources very efficiently and is well-suited to applications such as payroll processing that require periodic rather than continuous processing. Online processing keeps the company's data current. When you make an airline reservation, the information is entered into the airline's information system, and you quickly receive confirmation, typically through an e-mail. Online processing is more expensive than batch processing, so companies must weigh the cost versus the benefit. For example, a factory that operates around the clock may use real-time processing for inventory and other time-sensitive requirements but process accounting data in batches overnight.

Decisions, Decisions: Management Support Systems

Transaction processing systems automate routine and tedious back-office processes such as accounting, order processing, and financial reporting. They reduce clerical expenses and provide basic operational information quickly. **Management support systems (MSS)** use the internal master database to perform high-level analyses that help managers make better decisions.

Information technologies such as data warehousing are part of more advanced MSSs. A **data warehouse** combines many databases across the whole company into one central database that supports management decision-making. With a data warehouse, managers can easily access and share data across the enterprise to get a broad overview rather than just isolated segments of information. Data warehouses include software to extract data from operational databases, maintain the data in the warehouse, and provide data to users. They can analyze data much faster than transaction-processing systems. Data warehouses may contain many **data marts**, special subsets of a data warehouse that each deal with a single area of data. Data marts are organized for quick analysis.

Companies use data warehouses to gather, secure, and analyze data for many purposes, including customer relationship management systems, fraud detection, product-line analysis, and corporate asset management. Retailers might wish to identify customer demographic characteristics and shopping patterns to improve direct-mailing responses. Banks can more easily spot credit-card fraud, as well as analyze customer usage patterns.

According to Forrester Research, about 60 percent of companies with $1 billion or more in revenues use data warehouses as a management tool. Union Pacific (UP), a $19 billion railroad, turned to data warehouse technology to streamline its business operations. By consolidating multiple separate systems, UP achieved a unified supply-chain system that also enhanced its customer service. "Before our data warehouse came into being we had stovepipe systems," says Roger Bresnahan, principal engineer. "None of them talked to each other. . . . We couldn't get a whole picture of the railroad."

UP's data warehouse system took many years and the involvement of 26 departments to create. The results were well worth the effort: UP can now make more accurate forecasts, identify the best traffic routes, and determine the most profitable market segments. The ability to predict seasonal patterns and manage fuel costs more closely has saved UP millions of dollars by optimizing locomotive and other asset utilization and through more efficient crew management. In just three years, Bresnahan reports, the data warehouse system had paid for itself.[12]

At the first level of an MSS is an *information-reporting system,* which uses summary data collected by the TPS to produce both regularly scheduled and special reports. The level of detail would depend on the user. A company's payroll personnel might get a weekly payroll report showing how each employee's paycheck was determined. Higher-level mangers might receive a payroll summary report that shows total labor cost and overtime by department and a comparison of current labor costs with those in the prior year. Exception reports show cases that fail to meet some standard. An accounts receivable exception report that lists all customers with overdue accounts would help collection personnel focus their work. Special reports are generated only when a manager requests them; for example, a report showing sales by region and type of customer can highlight reasons for a sales decline.

Decision Support Systems

A **decision support system (DSS)** helps managers make decisions using interactive computer models that describe real-world

processes. The DSS also uses data from the internal database but looks for specific data that relate to the problems at hand. It is a tool for answering “what if” questions about what would happen if the manager made certain changes. In simple cases, a manager can create a spreadsheet and try changing some of the numbers. For instance, a manager could create a spreadsheet to show the amount of overtime required if the number of workers increases or decreases. With models, the manager enters into the computer the values that describe a particular situation, and the program computes the results. Marketing executives at a furniture company could run DSS models that use sales data and demographic assumptions to develop forecasts of the types of furniture that would appeal to the fastest-growing population groups.

Companies can use a predictive analytics program to improve their inventory management system and use big data to target customer segments for new products and line extensions.



Exhibit **13.7** Decision support systems help businesses by providing quantitative data and predictive models that aid problem-solving and decision-making. Now the health-care industry wants this technology in hospitals to improve the practice of medicine. Spearheading the effort for a clinical decision-support system is the American Medical Informatics Association, which believes a national DSS could help physicians with diagnosing and treating illnesses. *What are the pros and cons to having medical professionals rely on a DSS for help in treating patients?* (Credit: Axelle Geelen/ flickr/ Attribution 2.0 Generic (CC BY 2.0))

Executive Information Systems

Although similar to a DSS, an **executive information system (EIS)** is customized for an individual executive. These systems provide specific information for strategic decisions. For example, a CEO’s EIS may include special spreadsheets that present financial data comparing the company to its principal competitors and graphs showing current economic and industry trends.

Expert Systems

An **expert system** gives managers advice similar to what they would get from a human consultant. Artificial intelligence enables computers to reason and learn to solve problems in much the same way humans do, using what-if reasoning. Although they are expensive and difficult to create, expert systems are finding their way into more companies as more applications are found. Lower-end expert systems can even run on mobile devices. Top-of-the-line systems help airlines appropriately deploy aircraft and crews, critical to the carriers’ efficient operations. The cost of hiring enough people to do these ongoing analytical tasks would be prohibitively expensive. Expert systems have also been used to help explore for oil, schedule employee work shifts, and diagnose illnesses. Some expert systems take the place of human experts, whereas others assist them.

CONCEPT CHECK

1. What are the main types of management information systems, and what does each do?
2. Differentiate between the types of management support systems, and give examples of how companies use each.

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7.2.5: Technology Management and Planning

4. How can technology management and planning help companies optimize their information technology systems?

With the help of computers, people have produced more data in the last 30 years than in the previous 5,000 years combined. Companies today make sizable investments in information technology to help them manage this overwhelming amount of data, convert the data into knowledge, and deliver it to the people who need it. In many cases, however, the companies do not reap the desired benefits from these expenditures. Among the typical complaints from senior executives are that the company is spending too much and not getting adequate performance and payoff from IT investments, these investments do not relate to business strategy, the firm seems to be buying the latest technology for technology's sake, and communications between IT specialists and IT users are poor.

Optimize IT!

Managing a company's enterprise-wide IT operations, especially when those often stretch across multiple locations, software applications, and systems, is no easy task. IT managers must deal not only with on-site systems; they must also oversee the networks and other technology, such as mobile devices that handle e-mail messaging, that connect staff working at locations ranging from the next town to another continent. At the same time, IT managers face time constraints and budget restrictions, making their jobs even more challenging.

Growing companies may find themselves with a decentralized IT structure that includes many separate systems and duplication of efforts. A company that wants to enter or expand into e-commerce needs systems flexible enough to adapt to this changing marketplace. Security for equipment and data is another critical area, which we will cover later in the chapter.

The goal is to develop an integrated, company-wide technology plan that balances business judgment, technology expertise, and technology investment. IT planning requires a coordinated effort among a firm's top executives, IT managers, and business-unit managers to develop a comprehensive plan. Such plans must take into account the company's strategic objectives and how the right technology will help managers reach those goals.

Technology management and planning go beyond buying new technology. Today companies are cutting IT budgets so that managers are being asked to do more with less. They are implementing projects that leverage their investment in the technology they already have, finding ways to maximize efficiency and optimize utilization.

Managing Knowledge Resources

As a result of the proliferation of information, we are also seeing a major shift from information management to a broader view that focuses on finding opportunities in and unlocking the value of intellectual rather than physical assets. Whereas *information management* involves collecting, processing, and condensing information, the more difficult task of **knowledge management (KM)**focuses on researching, gathering, organizing, and sharing an organization's collective knowledge to improve productivity, foster innovation, and gain competitive advantage. Some companies are even creating a new position, *chief knowledge officer,* to head up this effort.[13]

Companies use their IT systems to facilitate the physical sharing of knowledge. But better hardware and software are not the answer to KM. KM is not technology-based, but rather a business practice that uses technology. Technology alone does not constitute KM, nor is it the solution to KM. Rather, it facilitates KM. Executives with successful KM initiatives understand that KM is not a matter of buying a major software application that serves as a data depository and coordinates all of a company's

intellectual capital. According to Melinda Bickerstaff, vice president of knowledge management at Bristol-Myers Squibb (BMS), any such “leading with technology” approach is a sure path to failure. “Knowledge management has to be perceived as a business problem solver, not as an abstract concept,” Bickerstaff explains.

Effective KM calls for an interdisciplinary approach that coordinates all aspects of an organization’s knowledge. It requires a major change in behavior as well as technology to leverage the power of information systems, especially the internet, and a company’s human capital resources. The first step is creating an information culture through organizational structure and rewards that promotes a more flexible, collaborative way of working and communicating. Moving an organization toward KM is no easy task, but it is well worth the effort in terms of creating a more collaborative environment, reducing duplication of effort, and increasing shared knowledge. The benefits can be significant in terms of growth, time, and money.

At Bristol-Meyers Squibb, a major pharmaceutical company, Bickerstaff began the KM implementation by looking for specific information-related problems to solve so that the company would save time and/or money. For example, she learned that company scientists were spending about 18 percent of their time searching multiple databases to find patents and other information. Simply integrating the relevant databases gave researchers the ability to perform faster searches. A more complex project involved compiling the best practices of drug-development teams with the best FDA approval rates so that other groups could benefit. Rather than send forms that could be easily set aside, Bickenstaff arranged to conduct interviews and lessons-learned sessions. The information was then developed into interesting articles rather than dry corporate reports.[14]

Technology Planning

A good technology plan provides employees with the tools they need to perform their jobs at the highest levels of efficiency. The first step is a general needs assessment, followed by ranking of projects and the specific choices of hardware and software. **Table 13.3**poses some basic questions departmental managers and IT specialists should ask when planning technology purchases.

Questions for IT Project Planning
• What are the company’s overall objectives? • What problems does the company want to solve? • How can technology help meet those goals and solve the problems? • What are the company’s IT priorities, both short- and long-term? • What type of technology infrastructure (centralized or decentralized) best serves the company’s needs? • Which technologies meet the company’s requirements? • Are additional hardware and software required? If so, will they integrate with the company’s existing systems? • Does the system design and implementation include the people and process changes, in addition to the technological ones? • Do you have the in-house capabilities to develop and implement the proposed applications, or should you bring in an outside specialist?

Table13.3

Once managers identify the projects that make business sense, they can choose the best products for the company’s needs. The final step is to evaluate the potential benefits of the technology in terms of efficiency and effectiveness. For a successful project, you must evaluate and restructure business processes, choose technology, develop and implement the system, and manage the change processes to best serve your organizational needs. Installing a new IT system on top of inefficient business processes is a waste of time and money!

CONCEPT CHECK

1. What are some ways a company can manage its technology assets to its advantage?
2. Differentiate between information management and knowledge management. What steps can companies take to manage knowledge?
3. List the key questions managers need to ask when planning technology purchases.

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7.2.6: Protecting Computers and Information

5. What are the best ways to protect computers and the information they contain?

Have you ever lost a term paper you worked on for weeks because your hard drive crashed or you deleted the wrong file? You were upset, angry, and frustrated. Multiply that paper and your feelings hundreds of times over, and you can understand why companies must protect computers, networks, and the information they store and transmit from a variety of potential threats. For example, security breaches of corporate information systems—from human hackers or electronic versions such as viruses and worms—are increasing at an alarming rate. The ever-increasing dependence on computers requires plans that cover human error, power outages, equipment failure, hacking, and terrorist attacks. To withstand natural disasters such as major fires, earthquakes, and floods, many companies install specialized fault-tolerant computer systems.

Disasters are not the only threat to data. A great deal of data, much of it confidential, can easily be tapped or destroyed by anyone who knows about computers. Keeping your networks secure from unauthorized access—from internal as well as external sources—requires formal security policies and enforcement procedures. The increasing popularity of mobile devices—laptops, tablets, and cell phones—and wireless networks requires new types of security provisions.

In response to mounting security concerns, companies have increased spending on technology to protect their IT infrastructure and data. Along with specialized hardware and software, companies need to develop specific security strategies that take a proactive approach to prevent security and technical problems before they start. However, a recent CIO article lamented the lack of basic security policies that companies only implement after a hack or data crisis.[15]

Data Security Issues

Unauthorized access into a company's computer systems can be expensive, and not just in monetary terms. Juniper Networks estimates that cybercrime will cost businesses more than $2 trillion in 2019, compared to just $450 million in 2001. The most costly categories of threats include worms, viruses, and Trojan horses (defined later in this section); computer theft; financial fraud; and unauthorized network access. The report also states that almost all U.S. businesses report at least one security issue, and almost 20 percent have experienced multiple security incidents.[16]

Computer crooks are becoming more sophisticated all the time, finding new ways to get into ultra-secure sites. "As companies and consumers continue to move towards a networked and information economy, more opportunity exists for cybercriminals to take advantage of vulnerabilities on networks and computers," says Chris Christiansen, program vice president at technology research firm IDC.[17] Whereas early cybercrooks were typically amateur hackers working alone, the new ones are more professional and often work in gangs to commit large-scale internet crimes for large financial rewards. The internet, where criminals can hide behind anonymous screen names, has increased the stakes and expanded the realm of opportunities to commit identity theft and similar crimes. Catching such cybercriminals is difficult, and fewer than 5 percent are caught.[18]



Exhibit **13.8** Data security is under constant attack. In 2017, cybercriminals penetrated Equifax, one of the largest credit bureaus in the nation, and stole the personal data of more than 145 million people. To date, it is considered one of the worst data breaches of all time because of the amount of sensitive data stolen, including consumers' Social Security numbers. *What impact do identity theft and other data-security issues have on global networking and e-commerce?* (Credit: Blogtrepreneur/ flickr/ Attribution 2.0 Generic (CC BY 2.0))

Firms are taking steps to prevent these costly computer crimes and problems, which fall into several major categories:

- *Unauthorized access and security breaches.* Whether from internal or external sources, unauthorized access and security breaches are a top concern of IT managers. These can create havoc with a company's systems and damage customer relationships. Unauthorized access also includes employees, who can copy confidential new-product information and provide it to competitors or use company systems for personal business that may interfere with systems operation. Networking links also make it easier for someone outside the organization to gain access to a company's computers.

  One of the latest forms of cybercrime involves secretly installing keylogging software via software downloads, e-mail attachments, or shared files. This software then copies and transmits a user's keystrokes—passwords, PINs, and other personal information—from selected sites, such as banking and credit card sites, to thieves.

- *Computer viruses, worms, and Trojan horses.* Computer viruses and related security problems such as worms and Trojan horses are among the top threats to business and personal computer security. A computer program that copies itself into other software and can spread to other computer systems, a **computer virus** can destroy the contents of a computer's hard drive or damage files. Another form is called a *worm* because it spreads itself automatically from computer to computer. Unlike a virus, a worm doesn't require e-mail to replicate and transmit itself into other systems. It can enter through valid access points.

  Trojan horses are programs that appear to be harmless and from legitimate sources but trick the user into installing them. When run, they damage the user's computer. For example, a Trojan horse may claim to get rid of viruses but instead infects the computer. Other forms of Trojan horses provide a "trapdoor" that allows undocumented access to a computer, unbeknownst to the user. Trojan horses do not, however, infect other files or self-replicate.[19]

  Viruses can hide for weeks, months, or even years before starting to damage information. A virus that "infects" one computer or network can be spread to another computer by sharing disks or by downloading infected files over the internet. To protect data from virus damage, virus protection software automatically monitors computers to detect and remove viruses. Program developers make regular updates available to guard against newly created viruses. In addition, experts are becoming more proficient at tracking down virus authors, who are subject to criminal charges.

- *Deliberate damage to equipment or information.* For example, an unhappy employee in the purchasing department could get into the company's computer system and delete information on past orders and future inventory needs. The sabotage could severely disrupt production and the accounts payable system. Willful acts to destroy or change the data in computers are hard to prevent. To lessen the damage, companies should back up critical information.

- *Spam.* Although you might think that *spam,* or unsolicited and unwanted e-mail, is just a nuisance, it also poses a security threat to companies. Viruses spread through e-mail attachments that can accompany spam e-mails. Spam is now clogging blogs, instant messages, and cell phone text messages as well as e-mail inboxes. Spam presents other threats to a corporation: lost productivity and expenses from dealing with spam, such as opening the messages and searching for legitimate messages that special spam filters keep out.
- *Software and media piracy.* The copying of copyrighted software programs, games, and movies by people who haven't paid for them is another form of unauthorized use. Piracy, defined as using software without a license, takes revenue away from the company that developed the program—usually at great cost. It includes making counterfeit CDs to sell as well as personal copying of software to share with friends.

Preventing Problems

Creating formal written information security policies to set standards and provide the basis for enforcement is the first step in a company's security strategy. Unfortunately, a recent survey of IT executives worldwide revealed that over two-thirds expect a cyberattack in the near future. Stephanie Ewing, a data security expert, states, "Having a documented, tested process brings order to chaotic situations and keeps everyone focused on solving the most pressing issues." Without information security strategies in place, companies spend too much time in a reactive mode—responding to crises—and don't focus enough on prevention.[20]

Security plans should have the support of top management, and then follow with procedures to implement the security policies. Because IT is a dynamic field with ongoing changes to equipment and processes, it's important to review security policies often. Some security policies can be handled automatically, by technical measures, whereas others involve administrative policies that rely on humans to perform them. Examples of administrative policies are "Users must change their passwords every 90 days" and "End users will update their virus signatures at least once a week." **Table 13.4** shows the types of security measures companies use to protect data.

Five Areas of Concern Regarding the Protection of Data	
Percentage	Concern for Protecting Data
52	Aren't sure how to secure connected devices and apps
40	Don't immediately change default passwords
33	Don't think they can control how companies collect personal information
33	Parents admit they don't know the risks well enough to explain to children
37	Use credit-monitoring services

Table13.4 Source: Adapted from Tony Bradley, "Top 5 Concerns to Focus on for Privacy Day," *Forbes*, https://forbes.com, January 27, 2017.

Preventing costly problems can be as simple as regularly backing up applications and data. Companies should have systems in place that automatically back up the company's data every day and store copies of the backups off-site. In addition, employees should back up their own work regularly. Another good policy is to maintain a complete and current database of all IT hardware, software, and user details to make it easier to manage software licenses and updates and diagnose problems. In many cases, IT staff can use remote access technology to automatically monitor and fix problems, as well as update applications and services.

Companies should never overlook the human factor in the security equation. One of the most common ways that outsiders get into company systems is by posing as an employee, first getting the staffer's full name and username from an e-mail message and then calling the help desk to ask for a forgotten password. Crooks can also get passwords by viewing them on notes attached to a desk or computer monitor, using machines that employees leave logged on when they leave their desks, and leaving laptop computers with sensitive information unsecured in public places.

Portable devices, from handheld computers to tiny plug-and-play flash drives and other storage devices (including mobile phones), pose security risks as well. They are often used to store sensitive data such as passwords, bank details, and calendars. Mobile devices can spread viruses when users download virus-infected documents to their company computers.

Imagine the problems that could arise if an employee saw a calendar entry on a mobile device like "meeting re: layoffs," an outsider saw "meeting about merger with ABC Company," or an employee lost a flash drive containing files about marketing plans

for a new product. Manufacturers are responding to IT managers' concerns about security by adding password protection and encryption to flash drives. Companies can also use flash drive monitoring software that prevents unauthorized access on PCs and laptops.

Companies have many ways to avoid an IT meltdown, as **Table 13.5** describes.

Procedures to Protect IT Assets
• Develop a comprehensive plan and policies that include portable as well as fixed equipment. • Protect the equipment itself with stringent physical security measures to the premises. • Protect data using special *encryption* technology to encode confidential information so only the recipient can decipher it. • Stop unwanted access from inside or outside with special authorization systems. These can be as simple as a password or as sophisticated as fingerprint or voice identification. • Install *firewalls*, hardware or software designed to prevent unauthorized access to or from a private network. • Monitor network activity with intrusion-detection systems that signal possible unauthorized access, and document suspicious events. • Conduct periodic IT audits to catalog all attached storage devices as well as computers. • Use technology that monitors ports for unauthorized attached devices and turn off those that are not approved for business use. • Train employees to troubleshoot problems in advance, rather than just react to them. • Hold frequent staff-training sessions to teach correct security procedures, such as logging out of networks when they go to lunch and changing passwords often. • Make sure employees choose sensible passwords, at least six and ideally eight characters long, containing numbers, letters, and punctuation marks. Avoid dictionary words and personal information. • Establish a database of useful information and FAQ (frequently asked questions) for employees so they can solve problems themselves. • Develop a healthy communications atmosphere.

Table13.5

Keep IT Confidential: Privacy Concerns

The very existence of huge electronic file cabinets full of personal information presents a threat to our personal privacy. Until recently, our financial, medical, tax, and other records were stored in separate computer systems. Computer networks make it easy to pool these data into data warehouses. Companies also sell the information they collect about you from sources like warranty registration cards, credit-card records, registration at websites, personal data forms required to purchase online, and grocery store discount club cards. Telemarketers can combine data from different sources to create fairly detailed profiles of consumers.

The September 11, 2001, tragedy and other massive security breaches have raised additional privacy concerns. As a result, the government began looking for ways to improve domestic-intelligence collection and analyze terrorist threats within the United States. Sophisticated database applications that look for hidden patterns in a group of data, a process called **data mining**, increase the potential for tracking and predicting people's daily activities. Legislators and privacy activists worry that such programs as this and ones that eavesdrop electronically could lead to excessive government surveillance that encroaches on personal privacy. The stakes are much higher as well: errors in data mining by companies in business may result in a consumer being targeted with inappropriate advertising, whereas a governmental mistake in tracking suspected terrorists could do untold damage to an unjustly targeted person.

Increasingly, consumers are fighting to regain control of personal data and how that information is used. Privacy advocates are working to block sales of information collected by governments and corporations. For example, they want to prevent state governments from selling driver's license information and supermarkets from collecting and selling information gathered when shoppers use barcoded plastic discount cards. With information about their buying habits, advertisers can target consumers for specific marketing programs.

The challenge to companies is to find a balance between collecting the information they need while at the same time protecting individual consumer rights. Most registration and warranty forms that ask questions about income and interests have a box for consumers to check to prevent the company from selling their names. Many companies now state in their privacy policies that they will not abuse the information they collect. Regulators are taking action against companies that fail to respect consumer privacy.

CONCEPT CHECK

1. Describe the different threats to data security.
2. How can companies protect information from destruction and unauthorized use?
3. Why are privacy rights advocates alarmed over the use of techniques such as data warehouses and data mining?

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7.2.7: Trends in Information Technology

6. What are the leading trends in information technology?

Information technology is a continually evolving field. The fast pace and amount of change, coupled with IT's broad reach, make it especially challenging to isolate industry trends. From the time we write this chapter to the time you read it—as little as six months—new trends will appear, and those that seemed important may fade. However, some trends that are reshaping today's IT landscape are digital forensics, the shift to a distributed workforce, and the increasing use of grid computing.

Cyber Sleuthing: A New Style of Crime Busting

What helped investigators bring suit against Enron, Merck's Vioxx medication, and the BTK serial killer? Digital evidence taken from an individual's computer or corporate network—web pages, pictures, documents, and e-mails are part of a relatively new science called *digital forensics*. Digital-forensics software safeguards electronic evidence used in investigations by creating a duplicate of a hard drive that an investigator can search by keyword, file type, or access date. Digital forensics is also evolving into areas such as cloud computing and blockchain technology. For instance, it is estimated that as much as 3.9 million of the original 21 million bitcoins are "lost" on hard drives confined to landfills and flash drives located in the back of old office desks.[21]

But nowadays digital sleuthing is not limited to law enforcement. Companies such as Walmart, Target, and American Express have their own secret in-house digital forensics teams. And what if you're in New York and need to seize a hard drive in Hong Kong? No problem. Over 75 members of the Fortune 500 now use technology that allows them to search hard drives remotely over their corporate networks. Digital forensics makes it possible to track down those who steal corporate data and intellectual property. Broadcom, a semiconductor chip designer, used computer forensics to investigate and apprehend former employees who were attempting to steal trade secrets. In the process, Broadcom gathered incriminating e-mails, including deleted documents, that gave it solid evidence to use the 2013 Federal Computer Fraud and Abuse Act to stop the former employees from starting up a rival firm.[22]

However, there is a downside to having these advanced capabilities. If this kind of software falls into the wrong hands, sophisticated hackers could access corporate networks and individual computers as easily as taking candy from a baby—and the victims would not even know it was happening. In an age of corporate wrongdoing, sexual predators, and computer porn, your hard drive will tell investigators everything they need to know about your behavior and interests, good and bad. Cybersleuthing means we are all potential targets of digital forensics. As evidenced by the huge increase in identity theft, personal privacy—once an unassailable right—is no longer as sacred as it once was.

ETHICS IN PRACTICE

Unearthing Your Secrets

Cybercrimes in our technologically driven world are on the increase—identity theft, pornography, and sexual predator victim access, to name a few. The FBI's computer analysis response team confirms their caseload includes 800 cases reported *per day* in 2017. To keep up with the changing world we live in, law enforcement, corporations, and government agencies have turned to new crime-fighting tools, one of the most effective being digital forensics.

The leader in this technology is Guidance Software, founded in 1997 to develop solutions that search, identify, recover, and deliver digital information in a forensically sound and cost-effective manner. Headquartered in Pasadena, California, the company employs 391 people at offices and training facilities in Chicago, Illinois; Washington, DC; San Francisco, California; Houston, Texas; New York City; and Brazil, England, and Singapore. The company's more than 20,000 high-profile clients include leading police agencies, government investigation and law enforcement agencies, and Fortune 1000 corporations in the financial service, insurance, high-tech and consulting, health care, and utility industries.

Guidance Software's suite of EnCase® solutions is the first computer forensics tool able to provide world-class electronic investigative capabilities for large-scale complex investigations. Law enforcement officers, government/corporate investigators,

and consultants around the world can now benefit from computer forensics that exceed anything previously available. The software offers an investigative infrastructure that provides network-enabled investigations, enterprise-wide integration with other security technologies, and powerful search and collection tools. With EnCase, clients can conduct digital investigations, handle large-scale data collection needs, and respond to external attacks.

Notably, the company's software was used by law enforcement in the Casey Anthony murder case and the Sony PlayStation security breach, and was used to examine data retrieved by the U.S. special forces in the Osama bin Laden raid.

Guidance Software also helps reduce corporate and personal liability when investigating computer-related fraud, intellectual property theft, and employee misconduct. It protects against network threats such as hackers, worms, and viruses and hidden threats such as malicious code.

In response to increases in the number and scope of discovery requests, Guidance Software developed its eDiscovery Suite. The software package dramatically improves the practice of large-scale discovery—the identification, collection, cataloging, and saving of evidence—required in almost every major legal case these days. eDiscovery integrates with other litigation-support software to significantly decrease the time for corporations to accomplish these tasks. At the same time, it improves regulatory compliance and reduces disruption. The result is many millions of dollars in cost savings. In late 2017, Guidance Software was acquired by OpenText, an enterprise information management company that employs more than 10,000 people worldwide.

Sources: FBI website, www.fbi.gov, accessed January 15, 2018; Guidance Software website, https://www.guidancesoftware.com, accessed January 15, 2018; OpenText website, https://www.opentext.com, accessed January 15, 2018; "Casey Anthony: The Computer Forensics," *The State v Casey Anthony website*, https://statevcasey.wordpress.com, July 18, 2011; Declan McCullagh, "Finding Treasures in Bin Laden Computers," *CBS News*, https://www.cbsnews.com, May 6, 2011; Evan Narcisse, " Who's Cleaning Up the PSN Debacle for Sony?" *Time,*http://techland.time.com, May 4, 2011.

Critical Thinking Questions

1. How is Guidance Software responding to and helping to manage changes in our technology-driven world?
2. What other types of forensics software do you foresee a need for in the future? Do you think there are ethical issues in using forensics software, and why?
3. What are the benefits and risks of Guidance Software being acquired by a larger company?

The Distributed Workforce

Insurance company Aetna shuttered 2.7 million square feet of office space, saving the company $78 million, while American Express estimates it saved between $10 to $15 million dollars per year by expanding its distributed workforce. Was this a sign that these company were in trouble? Far from it. Instead of maintaining expensive offices in multiple locations, they sent employees home to work and adopted a new model for employees: the distributed workforce. Employees have no permanent office space and work from home or on the road. The shift to virtual workers has been a huge success, and not only do companies save on their personnel and related costs, but they also have happier, more productive employees.

Aetna and American Express are not alone in recognizing the benefits of distributed workers, especially in companies that depend on knowledge workers. Work Design Collaborative LLC in Prescott, Arizona, estimates that about 12 percent of all workers in the United States fall into this category, and in urban areas the number could be as high as 15 percent. There are estimates that this trend could eventually reach 40 percent over the next decade, as long commutes, high gas costs, and better connecting tools and technologies make this an attractive option for many workers who like the flexibility of not working in an office.[23] Already, employees use the internet to conduct video-conferenced meetings and collaborate on teams that span the globe. On the downside, working from home can also mean being available 24/7—although most workers consider the trade-off well worth it.

According to recent statistics, close to four million U.S. workers work from home at least half of the time. Remote workers continue to be recruited by companies of all sizes, including Amazon, Dell, Salesforce, and others.[24] Intel has a successful virtual-work program that has been popular with working parents. "Technology allows working remotely to be completely invisible," says Laura Dionne, the company's director of supply-chain transformation. At Boeing, thousands of employees participate in the virtual-work program, and it has been a critical factor in attracting and retaining younger workers. Almost half of Sun Microsystems' employees are "location-independent," reducing real estate costs by $300 million. Additional benefits for Sun are higher productivity from these workers and the ability to hire the best talent. "Our people working these remote schedules are the happiest employees we have, and they have the lowest attrition rates," says Bill MacGowan, senior vice president for human resources at Sun. "Would I

rather settle on someone mediocre in the Bay Area, or get the best person in the country who is willing to work remotely?"[25]

Grid and Cloud Computing Offer Powerful Solutions

How can smaller companies that occasionally need to perform difficult and large-scale computational tasks find a way to accomplish their projects? They can turn to *grid* or **cloud computing**, also called *utility computing* or *peer-to-peer computing*. Cloud and grid technology provides a way to divide the job into many smaller tasks and distribute them to a virtual supercomputer consisting of many small computers linked into a common network. Combining multiple desktop machines results in computing power that exceeds supercomputer speeds. A hardware and software infrastructure clusters and integrates computers and applications from multiple sources, harnessing unused power in existing PCs and networks. This structure distributes computational resources but maintains central control of the process. A central server acts as a team leader and traffic monitor. The controlling cluster server divides a task into subtasks, assigns the work to computers on the grid with surplus processing power, combines the results, and moves on to the next task until the job is finished. **Exhibit 13.9** shows how typical grid and cloud setups work, and the differences between the two.

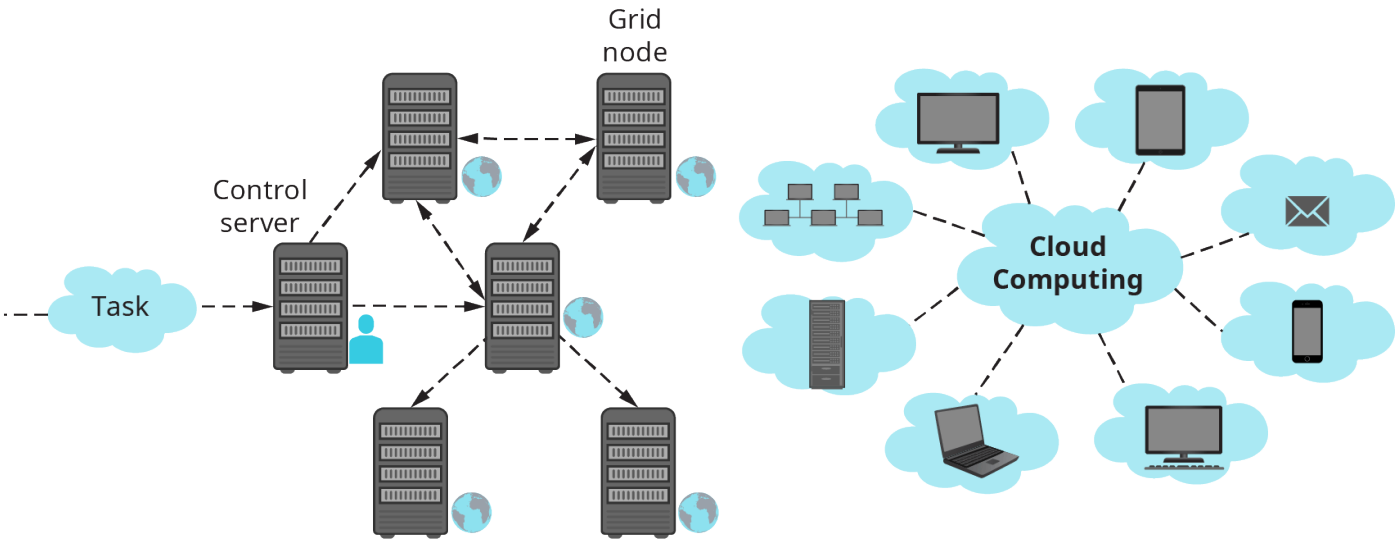


Exhibit **13.9 How Grid and Cloud Computing Work** (Attribution: Copyright Rice University, OpenStax, under CC BY 4.0 license.)

With utility computing, any company—large or small—can access the software and computer capacity on an as-needed basis. One of the big advantages of cloud computing is that companies can update their inventory in real time across their entire organization. For example, suppose you are an appliance retailer and have several outlets throughout the Midwest. If you have one model of a Whirlpool washing machine in your Des Moines, Iowa, store, and a salesperson in your Chicago location can sell that model in Chicago, the sale can be accomplished pretty easily. They can finalize the sale, create the shipping instructions, and update the inventory record automatically—and the Chicago consumer's needs will be met.[26]

Amazon, Google, IBM, Salesforce.com, Oracle, and Hewlett-Packard Enterprise are among the companies providing as-needed cloud and grid services. Although cloud and grid computing appears similar to outsourcing or on-demand software from ASPs, it has two key differences:

- Pricing is set per-use, whereas outsourcing involves fixed-price contracts.
- Cloud and grid computing goes beyond hosted software and includes computer and networking equipment as well as services.

The cloud and grids provide a very cost-effective way to provide computing power for complex projects in areas such as weather research and financial and biomedical modeling. Because the computing infrastructure already exists—they tap into computer capacity that is otherwise unused—the cost is quite low. The increased interest in cloud and grid technology will continue to contribute to high growth.

CONCEPT CHECK

1. How are companies and other organizations using digital forensics to obtain critical information?
2. Why do companies find that productivity rises when they offer employees the option of joining the virtual workforce?
3. What advantages do grid and cloud computing offer a company? What are some of the downsides to using this method?

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7.3: End of Chapter Summary

Summary

The diverse range of software available to the agriculture industry offers various tools tailored to different aspects of farm management, from crop and livestock management to precision agriculture and accounting. Each software solution has its strengths, such as comprehensive data management or user-friendly interfaces, and its limitations, including cost or complexity. By carefully evaluating these options, farmers and agricultural managers can select the software that best fits their operational needs and budget.

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7.4: End of Chapter Discussion

Here are several end-of-chapter discussion topics for a chapter on agriculture software and its applications. These topics are designed to encourage critical thinking and deeper understanding of how various software solutions impact the agriculture industry.

Discussion Topics

1. **Comparative Analysis of Farm Management Software**
   - **Topic:** Compare and contrast the features of Granular, AGRIVI, and FarmLogs. Which software offers the most comprehensive solution for managing large-scale farming operations? Justify your choice based on features, ease of use, and cost.
   - **Guiding Questions:** What are the key features that set these software solutions apart? How do their pricing structures affect their accessibility to different sizes of farming operations?
2. **Impact of Precision Agriculture Tools**
   - **Topic:** Evaluate the role of Trimble and AI Solutions for Precision Agriculture in enhancing farm productivity. How do these tools contribute to precision farming, and what are their limitations?
   - **Guiding Questions:** How do Trimble's GPS and auto-steering systems compare to AI-driven solutions in terms of accuracy and operational efficiency? What are some potential challenges of implementing these technologies?
3. **Integration and Interoperability Challenges**
   - **Topic:** Discuss the challenges of integrating various software systems like FarmERP, Croptracker, and agriculture accounting software. How can these integration challenges be addressed to ensure seamless data flow and operational efficiency?
   - **Guiding Questions:** What are common barriers to integration between different software solutions? What strategies can be used to improve data interoperability?
4. **Cost-Benefit Analysis for Smaller Farms**
   - **Topic:** Analyze the cost-effectiveness of using EasyFarm versus more expensive solutions like Granular or Conservis for a small to medium-sized farm. What are the trade-offs between affordability and feature richness?
   - **Guiding Questions:** How do the costs of these software solutions impact their adoption by smaller farms? What are the potential benefits and drawbacks of opting for a more affordable solution?
5. **Future Trends in Agriculture Software**
   - **Topic:** Predict how emerging technologies such as AI, machine learning, and IoT might shape the future of agriculture software. What innovations are on the horizon, and how might they transform farm management?
   - **Guiding Questions:** What are some recent advancements in agri-tech that could influence future software developments? How might these technologies address current limitations in agriculture software?
6. **Data Privacy and Security Concerns**
   - **Topic:** Explore the data privacy and security implications of using farm management software like AGRIVI and Conservis. How should farms protect their sensitive data while leveraging these technologies?
   - **Guiding Questions:** What types of data are most vulnerable to breaches? What measures can be implemented to safeguard farm data?
7. **User Experience and Accessibility**
   - **Topic:** Assess the user experience and accessibility of software solutions such as Crop Monitoring and ArcGIS Field Maps. How do these factors influence the adoption of technology in agriculture?
   - **Guiding Questions:** How does the complexity of the software impact user adoption and effectiveness? What features contribute to a better user experience?
8. **Compliance and Regulatory Requirements**
   - **Topic:** Discuss how software like Croptracker assists in meeting compliance and regulatory requirements for crop production. What are the implications for farms in terms of record-keeping and reporting?
   - **Guiding Questions:** How does effective record-keeping facilitate compliance with agricultural regulations? What role does technology play in simplifying these processes?
9. **Customization and Scalability**
   - **Topic:** Evaluate the importance of customization and scalability in farm management software, using examples from

FarmERP and AGRIVI. How do these factors affect the suitability of software for different farm sizes and types?
    - **Guiding Questions:** What are the benefits of customizable software for large versus small farms? How does scalability impact long-term software investment?
10. **Ethical Considerations in AI and Automation**
    - **Topic:** Explore the ethical considerations associated with using AI and automation in agriculture software. What are the potential risks and ethical dilemmas of relying heavily on automated systems?
    - **Guiding Questions:** How can farms balance the benefits of automation with potential ethical concerns? What safeguards should be in place to address these issues?

These discussion topics aim to foster a comprehensive understanding of agriculture software, encouraging critical thinking about their applications, benefits, and challenges.

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8: YOUR CAREER IN AGRICULTURE

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8.2: Chapter Learning Objectives

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8.2.3: Developing Interpersonal Skills Is Key to Your Success

8.2.4: Make Your Future Happen- Learn to Plan

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8.2.6: Get Your Career Off on the Right Track

8.2.7: Self-Test Scoring Guidelines

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8.4: End of Chapter Discussion

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8.1: Chapter Introduction

Introduction to Agricultural Machinery and Technology

Agricultural machinery and technology have fundamentally transformed the landscape of farming, driving unprecedented efficiency, productivity, and sustainability. At the heart of modern agriculture, these innovations play a crucial role in optimizing every aspect of farm operations, from planting and irrigation to harvesting and crop management. The evolution of agricultural machinery and technology reflects a continuous quest to meet the growing demands of global food production while addressing challenges such as resource scarcity, climate change, and labor shortages.

Agricultural machinery encompasses a wide range of equipment designed to perform specific tasks with greater speed and precision than traditional manual methods. Tractors, for example, are versatile vehicles that serve as the backbone of modern farming, powering various attachments like plows, seeders, and sprayers. These machines enable large-scale cultivation, soil preparation, and crop protection with remarkable efficiency.

In recent decades, technological advancements have introduced sophisticated machinery equipped with cutting-edge features. Precision agriculture tools, such as GPS-guided tractors and drones, allow for accurate field mapping, targeted planting, and real-time monitoring of crop health. These technologies enable farmers to make data-driven decisions, reduce input costs, and minimize environmental impact.

The integration of digital technologies into agricultural machinery has further enhanced their capabilities. Computerized systems and sensors are now standard in many machines, providing real-time feedback and automated adjustments to optimize performance. For instance, smart irrigation systems use weather data and soil moisture sensors to deliver precise amounts of water, improving water use efficiency and crop yield.

Moreover, advancements in data analytics and machine learning are driving the development of autonomous equipment and advanced monitoring systems. These innovations promise to revolutionize farming practices by increasing automation, reducing labor requirements, and enhancing overall farm management.

As the agricultural sector continues to evolve, the synergy between machinery and technology will remain a critical factor in shaping the future of farming. By leveraging these advancements, farmers can meet the challenges of modern agriculture with greater efficiency and sustainability.

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8.2: Chapter Learning Objectives

Learning Objectives: Types of Agricultural Machinery and Their Benefits

Learning Objectives

1. **Identify and Describe Major Types of Agricultural Machinery**
   - **Objective:** Recognize and describe the primary types of agricultural machinery, including tractors, harvesters, balers, sorters, planes, helicopters, drones, seeders, irrigation systems, and tillage equipment.
   - **Outcome:** Learners will be able to identify various types of agricultural machinery and explain their specific functions in farming operations.
2. **Understand the Versatility and Functionality of Tractors**
   - **Objective:** Explain the various functions of tractors and their attachments, including tasks such as plowing, tilling, seeding, and hauling.
   - **Outcome:** Learners will be able to describe how tractors contribute to multiple agricultural tasks and improve operational efficiency.
3. **Evaluate the Efficiency and Specialization of Harvesters**
   - **Objective:** Assess the role of different types of harvesters in crop collection and their impact on labor, time, and crop quality.
   - **Outcome:** Learners will be able to evaluate how harvesters improve the efficiency and quality of crop harvesting.
4. **Analyze the Benefits of Balers in Crop Management**
   - **Objective:** Discuss the advantages of using balers for compressing and storing crops, including space optimization and preservation.
   - **Outcome:** Learners will be able to explain how balers enhance the handling and storage of crop materials.
5. **Examine the Role of Sorters in Quality Control**
   - **Objective:** Explain how sorters are used to separate and grade crops based on quality, size, and shape, and their impact on production efficiency.
   - **Outcome:** Learners will be able to describe how sorters contribute to quality control and consistency in agricultural processing.
6. **Compare the Use of Planes and Helicopters for Aerial Applications**
   - **Objective:** Compare the benefits and limitations of using planes versus helicopters for aerial applications such as fertilization and pest control.
   - **Outcome:** Learners will be able to compare the effectiveness and suitability of planes and helicopters for various aerial farming tasks.
7. **Utilize Drones for Crop Monitoring and Management**
   - **Objective:** Describe how drones are used for monitoring crop health, soil conditions, and pest activity, and their advantages in data collection.
   - **Outcome:** Learners will be able to explain how drones provide real-time data and improve precision in crop management.
8. **Understand the Precision and Efficiency of Seeders**
   - **Objective:** Discuss the benefits of seeders in planting seeds, including accuracy, speed, and efficiency.
   - **Outcome:** Learners will be able to explain how seeders improve planting practices and contribute to better crop yields.
9. **Explore the Functionality of Modern Irrigation Systems**
   - **Objective:** Describe how different irrigation systems, such as pivot irrigators and drip systems, enhance water management and crop productivity.
   - **Outcome:** Learners will be able to explain the role of modern irrigation systems in efficient water use and crop growth.
10. **Assess the Impact of Tillage Equipment on Soil Preparation**
    - **Objective:** Analyze how tillage equipment, including plows and cultivators, improves soil structure, aeration, and weed control.
    - **Outcome:** Learners will be able to describe the benefits of tillage equipment in preparing soil for planting and enhancing overall soil health.

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8.2.1: Introduction



Exhibit **17.1** (Credit: public Information Office / flickr / Attribution 2.0 Generic (CC BY 2.0))

Learning Outcomes

After reading this chapter, you should be able to answer these questions:

1. How can you enhance your interpersonal skills?
2. Why is learning to plan so important in school and in the real world?
3. What skills should you develop in school that can transfer easily to your professional life and make it a success?
4. What are some strategies that will help you find, keep, and advance in your dream job?
5. What key attributes do employers look for when interviewing job candidates?

You Are a Winner Because You Elected to Go to College!

Never Quit Until You Have Your Degree in Hand!

What makes someone a winner in life? A winner is someone who goes through the various stages of life satisfied in knowing that they have done their best: their best at work, home, and in all pursuits of life. A big part of having a happy life is pursuing a career that offers job satisfaction and financial rewards. If you are going to "be all that you can be," you need a good education.

A college degree unlocks doors to economic opportunity.

Why get a degree?

- **Get and keep a better job.** Because the world is changing rapidly and many jobs rely on new technology, more jobs require education beyond high school. With a college education, you will have more jobs from which to choose.
- **Earn more money.** People who go to college usually earn more than those who do not. Currently, a bachelor's degree is worth a minimum of $20,000 a year more than a high school diploma. If your career spans 45 years, you could earn close to $1 million more than a high school graduate.

- **Get a good start in life.** A business college education helps you acquire a wide range of knowledge in many subjects as well as an advanced understanding of your specialized area of business. College also trains you to express your thoughts clearly in speech and in writing and to make informed decisions.

Simply stated, a degree in business gives you the chance to achieve the quality of life you deserve. The lifestyle, the new friends, the purchasing power of a degree won't guarantee happiness but will put you well on the road to finding it.

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8.2.2: Learn the Basics of Business

You might want to pursue a career as a physician, florist, game warden, systems analyst, or any of a thousand other opportunities. One thing that all careers have in common is that you need to have a basic understanding of business. We hope that you will consider a career in business, but if not, your success in whatever you choose will partially depend on your basic business skills. And that is why this text is so important.



Exhibit **17.2** Finding one's dream job requires combing through job descriptions, researching salary information, taking career-assessment tests, and shadowing others in the workplace. But sometimes people need some career advice or mentorship to "pivot" to a new career or to fine-tune their current job skills. That's where Pivot Planet comes in—the company connects people around the world for a reasonable fee with advisors who offer one-on-one video and phone sessions to answers questions and provide insights about their particular profession. *How can this type of advice and mentorship help individuals longing to change their career paths?* (Credit: U.S. Fish and Wildlife Service Southeast Region/ flickr/ Attribution 2.0 Generic (CC BY 2.0))

Choose a Career

Because this introductory business course gives you a detailed overview of all of the areas of commerce, it will guide you in selecting a major should you elect to get a degree in business. Choosing a major in college is one of life's true milestones. Your major essentially determines how you will spend the next four decades of your life. A marketing major will find a career in sales, marketing research, advertising, or other marketing-related fields. An accounting major will become (you guessed it) an accountant. *Never* take selecting a major lightly. If you work 40 hours a week for the next 45 years (less vacations), you will put in about 90,000 hours on the job. Don't you think you should choose something that you will enjoy?

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8.2.3: Developing Interpersonal Skills Is Key to Your Success

A degree in business is going to offer you many great career opportunities. Once you take your first job, how rapidly you move up the ladder is up to you. People with great interpersonal skills will always do better on and off the job than those who lack them. It has been estimated that up to 90 percent of our workplace success depends on an understanding of other people.[1] Here's how to enhance your interpersonal skills:

1. **Build your people skills.** Learn to build alliances in a group and establish harmony. Make a concerted effort to know what is happening in the lives of those on your team at school and work. About once a month, get together with your group, and pass out a list of issues, concerns, fears, and potential problems. Then invite everyone to give input to solve little problems before the problems become big. If something goes wrong, try to find out where things are not running smoothly and improve them. Be sure to compliment someone in your group who is doing an exceptional job.

   Become a good listener. When you listen well, you are in effect telling the other person that he or she is worth listening to. Listening well includes listening to both what is said and what is not said. Learn to read unspoken gestures and expressions. When giving feedback, plan what you will say in advance. Be positive and specific. Ask the person receiving the feedback if they would like to discuss your comments further.

2. **Understand how to persuade others.** Remember: we all must sell ourselves and our ideas to get ahead in life and in business. Influencing others means overcoming objections, igniting passions, or changing minds. The first step is to build *esprit de corps,* a shared enthusiasm and devotion to the group. Make your vision their vision so that everyone is working toward a common goal. Praise the team as a whole, but recognize the unique contributions different team members have made. The trick is to praise everyone but for different reasons. When you and your team successfully solve a problem, change will result.

   Persuasion rests on trust. You can build trust by being honest, fulfilling your commitments, being concerned about others, and minimizing problems and pain for others whenever possible. In short, if you have integrity, building trust becomes a simple task.

   When people raise objections to your plans or ideas, try to fully understand their comments and the motivation for making them. When you feel that you understand the true objection, answer the objection in the form of a benefit: "Yes, you will need to work next Saturday, but then you can have compensatory time off anytime you wish next month." Determine your persuasion skills by taking the quiz in **Table 17.1.**

3. **Learn to think on your feet.** Top executives say that thinking and speaking well on your feet while under pressure is the best thing that you can do for your career. If you cannot quickly express yourself with confidence, others will lose confidence in you. [2]

4.

Fun Self-Test—Can You Persuade Others?				
Rate your level of agreement with the statements below using the following scale:				
Strongly Agree	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**

1. I prefer to work in a team rather than individually.
2. I enjoy motivating others to help accomplish objectives.
3. I avoid working with difficult people or trying to resolve group differences.
4. I can learn more working in a team rather than working by myself.
5. I would prefer to work with individuals I have known previously.
6. I give up if my team members do not agree with me.
7. I may not always convince my team members to agree with my opinions, but I will go ahead and do what I feel is correct.
8. I think people who can persuade others always possess sound judgment.
9. I will do the work myself if others do not agree to do it.
10. To get the work done, I will listen to a person to understand how he/she wants it to be done.
11. I can get people to voluntarily make commitments and get the work done.[3]

See the scoring guidelines at the end of this chapter to obtain your score.

Table17.1

It will not happen overnight, but you can become an outstanding thinker and speaker. A simple technique is to set a timer for two minutes and ask a friend to begin speaking. When the timer goes off, your friend stops speaking, and you begin talking. The challenge is to use the final thought that your friend spoke as the first word of your two-minute talk. Another technique is to have someone supply you with a series of quotes. Then, without hesitation, give your interpretation.

5. **Empower yourself.** No matter who you are, what position you will hold, or where you will work, you probably will have to report to somebody. If you are fortunate enough to work in a culture of empowerment, you are allowed control over your job (not complete control, but enough control to make you feel your opinion matters). When you are not given an opportunity to provide input, you will eventually lose interest in your job. When empowered, you have the confidence to do something to alter your circumstances. On the job, empowerment means that you can make decisions to benefit the organization and its customers.

   If you want to gain empowerment in your life and work, here are a few tips: be assertive, ask for credit for yourself when it is due, propose ideas to your group and your supervisor, initiate projects without being asked, tie your personal goals to those of the organization, develop your leadership skills, plan to learn on a continuous basis, be informed, don't let others intimidate you, and don't complain about a bad situation—instead, take action to improve it.

6. **Become politically savvy.** Politics is an inevitable part of every organization in the United States, including your school. Politics has always been a part of the workplace and always will be. The trick is to learn to play the political game to your own advantage *and* to the advantage of others without causing harm to anyone else. Being political means getting along with others in order to move them toward accomplishing a specific goal. It does not mean maneuvering for selfish purposes, manipulating in order to deceive, or scheming so others lose while you win.

   Here are some tips and techniques to be an effective player in the political game:

   - *Think about what you say.* Understand the effect your words will have on others before you say or write them.
   - *Empathize.* Try to think of a situation from the other person's perspective.
   - *Suggest a trial period if you meet opposition to an idea you're proposing.* If you are as successful as you are confident, you can then ask to have the trial period extended.
   - *Learn about the political climate in which you are working.* This means knowing, among other things, what actions have led to failure for others, knowing who is "in" and why, determining who is "out" and why, and learning what behaviors lead to promotion.
   - *Volunteer to do the jobs no one else wants to do.* Occasionally pitching in shows your willingness to get the job done. However, do not make this your trademark; you do not want others to think they can take advantage of you.
   - *Work hard to meet the needs of those in authority.* Make certain you fully understand management's requirements; then go out of your way to meet them. If in time you do not think you are getting the recognition or respect you deserve, make your own needs known.

- *Give credit to others.* You never know who may be in a position to hurt or harm you. Consequently, the best policy is to treat everyone with respect and dignity. Show your appreciation to everyone who has helped you. Do not steal credit that belongs to someone else.
- *Learn your supervisor's preferences.* The more you are in sync with your supervisor's style, wishes, and preferences, the better you can do your job. However, do not be a rubber stamp. Rather, work the way your manager works. When necessary, suggest better ways of doing things.
- *Keep secrets—your own and others'.* Resist the temptation to tell all. Not only do you run the risk of being labeled a gossip, but if you share too much about yourself, your words may come back to haunt you. If you are revealing information told to you in confidence, you are bound to lose the trust and respect of those who originally confided in you.

Find out how well you play the political game by taking the quiz in **Table 17.2.**

7. **Become a team builder.** Throughout your college and business career, you will participate on teams. Most U.S. business organizations employ some sort of teamwork. An effective team is one that meets its goals on time and, if a budget is involved, within budget. The first step in creating an effective team is to have goals that are clear, realistic, and supported by each team member and that parallel the larger organization goals. **Table 17.3** lists the questions that teams should answer to ensure their success.

8.

Fun Self-Test—Can You Play the Political Game?				
Rate your level of agreement with the statements below using the following scale:				
Strongly Agree	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**
1. To be successful, you should have a strong relationship with your boss and subordinates. 2. Office politics is not very challenging. 3. Tough people give you a tough time but also teach you tough lessons. 4. Networking and observation play a major role in being good at office politics. 5. There is no ethics or morals in office politics. 6. Corporate politics is not about the individuals; it is about the survival of the corporation. 7. Office politics is the only way; you gain real access to your boss's ear. 8. Those who avoid being political at work may not move forward in their careers, may find themselves resentful and frustrated, and run the risk of being isolated. 9. If you do all of the work on a project, you won't tell the boss because you don't want your coworkers to get in trouble. 10. When faced with gossip and rumors, you prefer to be silent but aware. 11. To master office politics, you should seek a win-lose situation. 12. If a person in authority is out to get rid of you, a good tactic would be to establish allies and position yourself for another job in the company. 13. If you have made any significant contribution to a project, you always make sure that others know about it, which, in turn, adds to your reputation.[4]				
See the scoring guidelines at the end of this chapter to obtain your score.				

Table17.2

Key Questions That Teams Should Answer before Starting a Project
1. What are the goals? 2. Who provides the mission statement? 3. What are our limits? 4. Where will support come from? Who will be our sponsor? 5. Who will be team leader? How is that person selected? 6. What are the deadlines we face? 7. What resources are available? 8. What data will we need to collect? 9. For how long will our team exist? 10. Who are the customers for our team results? What do they expect of us? 11. Will our team responsibilities conflict with our regular jobs? 12. What is the reward for success? 13. How will decisions be made? 14. How will our efforts be measured? 15. Will our intended success be replicated? If so, how and by whom?[5]
See the scoring guidelines at the end of this chapter to obtain your score.

Table17.3

9. **Handle conflict well.** The world is not a perfect place, and there are no perfect people living in it. The best we can hope for is people's willingness to improve life's circumstances. If we are truly committed to the idea of reducing school and workplace conflict, there is much we can do to inspire such willingness in others. Bringing conflict into the open has its advantages. Talking about conflict often helps to clear the air, and thinking about the possibility of conflict often helps to avoid it.

   When conflicts occur, try the K-I-N-D technique. The letters stand for:

   - K = Kind
   - I = Informed
   - N = New
   - D = Definite

   The technique involves your requesting a meeting with the difficult person, whether he or she is having a conflict with you or with others. Start off with kind words, words that encourage cooperation, words that show your determination to make the conflict situation better. Next, demonstrate that you have taken the time to learn more about the person, what is important to him or her, what he or she prefers in terms of work. Show by your words that you have taken the time to become informed about the individual.

   The third step requires you to do something novel, something you have not tried before. Put your creativity to work, and discover a plan to which you can both subscribe (for example, keeping a journal regarding the problem and possible solutions).

   Finally, do not permit the exchange to conclude until you have made a definite overture to ensure future success. What can you promise the other person you will do differently? What are you asking him or her to do differently? Set a time to meet again and review your individual attempts to achieve collective improvement.

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8.2.4: Make Your Future Happen- Learn to Plan

There is a natural conflict between planning and being impulsive, between pursuing a long-range goal and doing what you feel like doing right now. If you have ever had to study while the rest of the family was watching television, you know what that conflict feels like. If you have ever been invited to go eat pizza and hang out with friends but stayed home to work on a class assignment, you know that sticking to a plan is not easy.[6]

Of course, planning and being impulsive are both good. They both have a place in your life. You need to balance them. Having a plan does not mean that you can't act on the spur of the moment and do something that was not planned. Spontaneous events produce some of the happiest, most meaningful times of your life. Problems arise when you consistently substitute impulsive actions for goal-oriented planning. Success in life requires a balance between the two.

If you do not engage in long-range planning and lack the discipline for it, you may limit your opportunities to be impulsive. You are not going to take a weekend fun trip just because you need a break if you have not saved the money to do it. In the short run, planning involves sacrifice, but in the long run, it gives you more options.



Exhibit **17.3** Life requires planning, and the more important one's goals, the more important planning is to achieve these goals. Whether the objective is to graduate from college, develop a professional career, or build a brighter future for one's family and community, personal success depends on a good plan. *How can the six steps of the planning process help individuals achieve their educational, personal, and career dreams?* (Credit: Rodney Martin/ Flickr/ Attribution 2.0 Generic (CC BY 2.0))

What Is a Plan?

A **plan** is a method or process worked out in advance that leads to the achievement of some goal. A plan is systematic, which means it relies on using a step-by-step procedure. A plan also needs to be flexible so that it may be adapted to gradual changes in your goal.

The Planning Process

Whether choosing a college or finding financial aid, you should understand how the planning process helps you accomplish your goals. The following steps outline the planning process.

Step 1: Set a Goal. Identify something you want to achieve or obtain, your **goal**. The goal, which is usually longer term in nature, will require planning, patience, and discipline to achieve. Just living in the present moment is not a goal.

Step 2: Acquire Knowledge. Gain an understanding of your goal and what will be required to achieve it. Gather information about your goal through research, conversation, and thought.

Step 3: Compare Alternatives. Weigh your options, which are the different paths you might take to achieve your goal. Analyze the pluses and minuses of each—the costs, the demands, the likelihood of success.

Step 4: Choose a Strategy. Select one option as the best plan of action. The choice is based on sound information, the experience of others, and your own interests and abilities.

Step 5: Make a Commitment. Resolve to proceed step-by-step toward achieving your goal. Keep your eyes on the prize.

Step 6: Stay Flexible. Evaluate your progress, and when necessary, revise your plan to deal with changing circumstances and new opportunities.

An Example of Planning

The following example illustrates the process of buying a new pair of wireless headphones using this planning process.

Step 1: Set a Goal. Purchase a pair of wireless headphones.

Step 2: Acquire Knowledge. Ask friends if you can try out their headphones. Study standards and specifications. Check on retailers, brands, models, and prices. Consult *Consumer Reports*.

Step 3: Compare Alternatives.

- **Alternative 1:** Purchase a pair of headphones from an online auction website such as eBay.
  - *Pro:* Affordable high-end equipment. Can buy right now.
  - *Con:* Uncertain condition of equipment. Limited warranty.
- **Alternative 2:** Buy wireless headphones for $110.
  - *Pro:* Can afford now; new equipment with warranty.
  - *Con:* Not the best sound quality.
- **Alternative 3:** Buy a high-quality pair of headphones for $500.
  - *Pro:* Excellent sound; new equipment with warranty.
  - *Con:* Costs more than prepared to pay now.

Step 4: Choose a Strategy. Decide to buy the high-quality headphones, but rather than using a credit card and paying interest, will delay the purchase for six months in order to save for them.

Step 5: Make a Commitment. Give up going to the movies or buying coffee drinks from Starbucks for the six-month period, carry a lunch and stop eating out, and place the savings in a designated headphones fund.

Step 6: Stay Flexible. Four months into the plan, a model change sale provides an opportunity to buy comparable equipment for $300. Make the purchase, paying cash.

Planning for Your Life

Using the planning process to make a buying decision is a simple exercise. Making a decision about major parts of your life is far more complex. You will see that no part of life is exempt from the need for planning. It is important to apply thought, creativity,

and discipline to all the interrelated phases of our lives. These phases include the following:

- **Career:** Choosing a field of work and developing the knowledge and skills needed to enter and move ahead in that field. We will offer you some tips to get started on a great career later in this chapter.
- **Self:** Deciding who you are and what kind of person you want to be, working to develop your strengths and overcome your weaknesses, refining your values.
- **Lifestyle:** Expressing yourself in the nature and quality of your everyday life, your recreation and hobbies, how you use your time and money.
- **Relationships:** Developing friendships and learning to get along with people in a variety of contexts. Building family and community ties.
- **Finances:** Building the financial resources and the economic security needed to pursue all the other dimensions of your life.

Dreams and Plans

People are natural dreamers. Dreams give us pleasure. They are also part of making a future. If you do not have dreams or think that you are not worthy of dreaming, something very important may be missing from your life. You have a right to your dreams, and you need them—even if there is little possibility that they will ever come true.

Planning is not the same as dreaming, but it uses dreams as raw materials. It translates them into specific goals. It tests them. It lays out a course of action that moves you toward realizing these goals and sets up milestones you need to achieve. Planning brings dreams down to earth and turns them into something real and attainable. For example, assume you have a dream to visit Spain as an exchange student. To translate this dream into a specific goal, you will need to follow the planning process—gather information about the exchange process, discuss the program with parents and teachers, and improve your Spanish-language skills.

Directions for Your Life

One of the best things about pursuing our dreams is that, even when you fall short, the effort leads to growth and opens a path to other opportunities. The person who practices the piano every day may not achieve the dream of becoming a concert pianist but may eventually put appreciation of music to work as the director of an arts organization. A basketball player may not make it to a professional team but may enjoy a satisfying career as a coach or a sports writer. Without a plan, dreams simply dissolve. With a plan, they give shape and direction to our lives.

Planning involves a lot of thinking and finding answers to lots of questions. The answers and even the plan will change over time as you gain more knowledge and life experience. Planning is a skill that is useful in every area of your life. It is something you have to pursue consciously and thoughtfully. When you plan, you translate your goals and dreams into step-by-step strategies, specific things you can do to test your goals and bring them to reality. You often have to revise your plans, but even when your plans are not fulfilled, planning will have a positive effect on the course of your life.

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8.2.5: Going to College Is an Opportunity of a Lifetime—Never Drop Out

You have already had one of your dreams come true—you are in college. It is indeed a rare privilege because far less than 1 percent of traditional college-age people around the world get to attend college. You're lucky! So make the best of it by finishing your degree and learning the following college skills.[7]

Learn to Concentrate

Concentration is the art of being focused, the ability to pay attention. Without concentration, you have no memory of what you hear, see, and read. Concentration is a frame of mind that enables you to stay centered on the activity or work you are doing. You know when you're concentrating because time seems to go by quickly, distractions that normally take you off task don't bother you, and you have a lot of mental or physical energy for the task.

You are ultimately in charge of how well you concentrate. Here are some ways to make it happen:

- *Choose a workplace*. Avoid the bed—you associate it with relaxing or sleeping. Try a desk or table for studying; you will concentrate better and accomplish more in less time. You will also have a convenient writing space and plenty of space to spread out. Be sure to have good lighting.
- *Feed your body right*. What you eat plays an important role in how well or how poorly you concentrate. Protein foods (such as cheese, meat, fish, and vegetables) keep the mind alert, while carbohydrates (such as pasta, bread, and processed sugars) make you sleepy. Caffeine (commonly found in coffee, tea, soft drinks, and chocolate) acts as a stimulant in low doses.
- *Avoid food*. Food and serious learning don't mix well. Think about it. When you try to eat and study at the same time, which gets more of your concentration? The food, of course. You will be more effective if you eat first and then study.
- *Listen to your own thoughts*. Listening to anything but your own thoughts interferes with good concentration. Eliminating distractions such as music, television, cell phones, email and text beeps, and other people can greatly increase the amount of studying you can accomplish. Hold all calls, and let email and texts wait.
- *Make a to-do list*. If you are trying to study but get distracted by all of the things you need to do, take time to make a to-do list. Keeping track of your thoughts on paper and referring to the paper from time to time can be very effective for clearing your mind and focusing on your task.
- *Take short, frequent breaks*. Since people concentrate for about 20 minutes or less at a time, it would make sense to capitalize on your natural body rhythms and take a short break every 20 to 30 minutes. If you feel you are fully concentrating and involved in a task, then work until a natural break occurs.

Learn to Manage Your Time

There are two ways to make sure you have more time in a day. *The first and most important way to gain more time is to plan it.* It's like getting in a car and going somewhere. You need to know where you are going and have a plan to get there. Without a plan, you will waste your time and take longer to get to your destination—if you get there at all!

A **weekly project planner** will allow you to keep track of your assignments in more detail. It contains a to-do list specific to one day. It looks like a calendar but is divided into five one-day periods with plenty of space to write. Using a weekly project planner is an effective way to keep track of assignments and plan study time according to the school calendar. Free calendars are available at **https://calendar.google.com**.

A second way to gain more time in a day is to do more in less time. This can be as simple as doubling up on activities. For example, if you have three errands, you might try to combine them instead of doing one at a time, making one round-trip instead of three. If you commute on a bus, on a train, or in a carpool, you can study during your ride. At lunch, you can review notes. Use your imagination as to how you can get more done in less time.



Exhibit **17.4** Personal digital assistants (PDAs) have morphed into sophisticated mobile devices that now include phone, internet, email, messaging, and other wireless functions. Putting even more computing power at consumers' fingertips, mobile devices now provide users with personal information managers, to-do lists, calendars, and other functions to help us organize and manage our time. *How might mobile devices help college students to accomplish more and make better use of their time when it comes to everyday activities and learning job skills?* (Credit: Riaz Kanani/ Flickr/ Attribution 2.0 Generic (CC BY 2.0))

Here are some ideas to help you master your time:

- *Prepare for the morning the night before.* Put out your clothes; make lunches; pack your books.
- *Get up 15 minutes earlier in the morning.* Use the time to plan your day, review your assignments, or catch up on the news.
- *Schedule a realistic day.* Avoid planning for every minute. Leave extra time in your day for getting to appointments and studying.
- *Leave room in your day for the unexpected.* This will allow you to do what you need to do, regardless of what happens. If the unexpected never happens, you will have more time for yourself.
- *Do one thing at a time.* If you try to do two things at once, you become inefficient. Concentrate on the here and now.
- *Learn to say "No."* Say no to social activities or invitations when you don't have the time or energy.

How well do you manage your time? Take the quiz in **Table 17.4** to find out.

Use Your Money Wisely

You can get college money from several different sources, including the following.

- **Grants and Scholarships.** This refers to aid you do not have to repay. Grants are usually based on need while scholarships are frequently based on academic merit or other qualifying factors.
- **Educational Loans.** These are usually subsidized by federal and state governments, private lenders, or the colleges themselves. Generally, the loans carry lower interest rates than commercial loans, and you do not have to pay them off until after graduation.
- **Work Aid.** This is financial aid you have to work for, frequently 10 or 15 hours a week on campus.

There are many ways to cut the cost of going to college. Consider these:

- Going to a community college for the first two years and then transferring to a four-year institution
- Attending a nearby college and living at home
- Enrolling in one of thousands of college and universities with cooperative educational programs that alternate between

full-time studies and full-time employment
- Taking a full-time job at a company that offers free educational opportunities as an employee benefit

Fun Self-Test—How Well Do You Manage Your Time?				
Rate your level of agreement with the following statements using the scale below:				
Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree

1. I rarely feel driven by the urgencies that come my way.
2. I keep a log of each activity to be performed in a day. I prioritize them accordingly.
3. I prioritize not by the importance of the work but by its nature.
4. I can manage my schedule without preparing a weekly plan that includes specific activities.
5. I always want to do all the work myself, thinking I can do it better than anyone else.
6. I plan my weekends with my family and friends.
7. I can delegate work to people so that the work gets done on time and the people feel they are a part of the team.
8. I allow time for the unexpected things I cannot control.
9. If something doesn't happen as per my schedule, it doesn't get done.
10. To accomplish a set of objectives doesn't mean to avoid other unexpected problems.
11. I seldom work after office hours.
12. I would never work by hand if a machine could do it faster.
13. I feel it is easier and time-saving to try new ways of doing things.
14. I always find time to do what I want to do and what I should do.[8]

See the scoring guidelines at the end of this chapter to obtain your score.

Table17.4

To learn about college costs and financial aid, one of the first sources to consult is the website of The College Board, a not-for-profit organization that connects students to college success and opportunity. Some of the important topics covered at **www.collegeboard.org** include explaining financial aid, facilitating the application process, and finding colleges that fit. There are other websites that also offer information on financial aid:

- **http://www.fastweb.com:** Fastweb has a database of more than 1.5 million private-sector scholarships, grants, and loans.
- **http://www.ed.gov:** This is the U.S. Department of Education information site for federal aid programs, including student loans and grants.

Gain some insight into your money management skills by taking the quiz in **Table 17.5.**

Study Well

The first key to doing well in a subject is to complete your assignments on time. Most instructors base their assignments on what they will be discussing in class on a given day. So, if you read the pages you are assigned for the day they are due, you will better understand the day's lecture. If you don't complete an assignment when it is due, not only will you be at a disadvantage in the class, but you will also have twice as much work to do for the following class.

Second, know what material to study. This may sound simple, but all too often students do not ask what material they should study and find out too late that they studied the wrong information. The easiest and most accurate way to learn what will be covered on a test is to ask your instructor or read the syllabus.

Tests measure your working memory and knowledge base. To help yourself remember, you can use several memory devices to recall the information you need to study. Here are a few memory devices that have been proven to work:

Fun Self-Test—Are You Good at Managing Money?				
Rate your level of agreement with the following statements, using the scale below:				
Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree

1. I eagerly wait for the day I get my paycheck, because my bank balance is generally below the minimum.
2. I have set my savings and spending priorities and have a budget.
3. When I go shopping, I don't buy anything unless it is on sale or is required.
4. I can easily spend money when I am in school.
5. I can differentiate between what I want and what I truly need.
6. I always max out my credit cards.
7. I don't need to plan for my child's education because there will be plenty of government programs.
8. I don't plan to open or have a savings account.
9. I was raised in a family where I always felt that money was quite tight.
10. Credit cards have been useful to me during times of emergency.
11. It is easy for me to resist buying on credit.[9]

See the scoring guidelines at the end of this chapter to obtain your score.

Table17.5

- *Recite information using your own words.* You will learn more when you reinforce your learning in as many ways as possible. You can reinforce your learning through hearing, writing, reading, reviewing, and reciting.
- *Develop acronyms.* Acronyms are words or names formed from the first letters or groups of letters in a phrase. Acronyms help you remember because they organize information according to the way you need or want to learn it. For example, COD means "cash on delivery," and GDP refers to "gross domestic product." When you study for a test, be creative and make up your own acronyms.
- *Try mnemonic sentences, rhymes, or jingles.* Mnemonic sentences are similar to acronyms; they help you organize your ideas. But instead of creating a word, you make up a sentence. Creating a rhyme, song, or jingle can make the information even easier to remember. The more creative and silly the sentence, the easier it is to remember. Take, for example, the nine planets listed in order according to their distance from the sun:

  Mercury Venus Earth Mars Jupiter Saturn Uranus Neptune

  The first letters of these words are: M V E M J S U N .

  An acronym using these letters would be difficult to remember. But if you create a sentence using the letters in order, you will remember the sequence better. For example: My Very Educated Mother Just Served Us Nine Pizzas.

- *Visualize.* Visualization refers to creating or recalling mental pictures related to what you are learning. Have you ever tried to remember something while taking a test and visualized the page the information was on? This is your visual memory at work. Approximately 90 percent of your memory is stored visually in pictures, so trying to visualize what you want to remember is a powerful study tool.

Table 17.6 helps you evaluate your study skills.

Become a Master at Taking Tests

Taking a formal test is like playing a game. The object is to get as many points as possible in the time you are allowed. Tests are evaluations of what you know and what you can do with what you know. Here are the rules of the test-taking game:

- **Rule 1: Act As If You Will Succeed.** Thought is powerful. When you think negative thoughts, your stress level rises. Your confidence level may drop, which often leads to feelings of failure. When this happens, think about success. Smile and take deep, slow breaths. Close your eyes, and imagine getting the test back with a good grade written at the top.

Fun Self-Test—Do You Have Good Study Habits?

Answer "yes" or "no" to the following questions:

1. Do you usually spend too much time studying for the amount you are learning?
2. Do you spend hours cramming the night before an exam?
3. Do you find it easy to balance your social life with your study schedule?
4. Do you prefer to study with sound (TV or music) around you?
5. Can you sit for long periods and study for several hours without getting distracted?
6. Do you always borrow notes/materials from your friends before the exam?
7. Do you review your class notes periodically throughout the semester while preparing for tests?
8. Is it easy for you to recall what you studied at the beginning of the semester?
9. Do you need to change your reading/learning style in response to the difficulty level of the course?
10. Do you normally write your papers or prepare for your presentations the night before they are due?
11. Do you feel comfortable contacting the instructor and asking questions or for help whenever you need it?
12. Do you prefer to study lying on a bed or couch rather than sitting at a desk or table?[10]

See the scoring guidelines at the end of this chapter to obtain your score.

Table17.6

- **Rule 2: Arrive Ahead of Time.** Being on time or early for a test sets your mind at ease. You will have a better chance of getting your favorite seat, relaxing, and preparing yourself mentally for the game ahead.
- **Rule 3: Bring the Essential Testing Tools.** Don't forget to bring the necessary testing tools along with you, including extra pens, sharpened pencils, erasers, a calculator, laptop, dictionary, and other items you may need.
- **Rule 4: Ignore Panic Pushers.** Some people become nervous before a test and hit the panic button, afraid they don't know the material. **Panic pushers** are people who ask you questions about the material they are about to be tested on. If you know the answers, you will feel confident; however, if you don't, you may panic and lose your confidence. Instead of talking with a panic pusher before a test, spend your time concentrating on what you know, not on what you don't know.
- **Rule 5: Preview the Playing Field.** Here's how to do a preview:
  - Listen to instructions, and read directions carefully.
  - Determine the point spread. Look at the total number of questions and the point value of each. Decide how much time you can spend on each question and still finish the test on time.
  - Budget your time. If you budget your time and stick to your time limits, you will always complete the test in the amount of time given.
  - Use the test as an information tool. Be on the lookout for clues that answer other questions. Frequently, instructors will test you on a single topic in more than one way.
- **Rule 6: Write in the Margin.** Before you begin the test, write key terms, formulas, names, dates, and other information in the margin so you won't forget them.
- **Rule 7: Complete the Easy Questions First.** Answering easy questions first helps build your confidence. If you come across a tough question, mark it so you can come back to it later. Avoid spending so much time on a challenging question that you might run out of time to answer the questions you do know.
- **Rule 8: Know If There Is a Guessing Penalty.** Chances are your tests will carry no penalty for guessing. If your time is about to run out and there is no penalty, take a wild guess. On the other hand, if your test carries a penalty for guessing, choose your answers wisely, and leave blank the answers you do not know.
- **Rule 9: Avoid Changing Your Answers.** Have you ever chosen an answer, changed it, and learned later that your first choice was correct? Research indicates that three out of four times, your first choice is correct; therefore, you should avoid changing an answer unless you are *absolutely sure* the answer is wrong.
- **Rule 10: Write Clearly and Neatly.** If you are handwriting your test (versus using a computer), imagine your instructor reading your writing. Is it easy to read or difficult? The easier your test is for the instructor to read, the better your chances of getting a higher grade.

Here are some websites to help you learn more about taking tests:

- ***Essay tests and a checklist for essay tests***
  - **www.calpoly.edu/~sas/asc/ael/tests.essay.html**
- ***Checklist for essay tests***

- **www.mtsu.edu/~studskl/essay.html**
- ***General test taking***
  - **www.calpoly.edu/~sas/asc/ael/...s.general.html**
- ***Post-test analysis***
  - **www.calpoly.edu/~sas/asc/ael/....analysis.html**

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8.2.6: Get Your Career Off on the Right Track

Mark this section of the text with a permanent bookmark because you are going to want to refer back to it many times during the remainder of your college career. Yes, we are going to give you a road map to find, keep, and advance in that job that is perfect for you.

Think Positively

To be successful in life and in a career, you need to be positive. *Positive thinking* is making a conscious effort to think with an optimistic attitude and to anticipate positive outcomes. *Positive behavior* means purposely acting with energy and enthusiasm. When you think and behave positively, you guide your mind toward your goals and generate matching mental and physical energy.

Positive thinking and behavior are often deciding factors in landing top jobs: your first job, a promotion, a change of jobs—whatever career step you are targeting. That's because the subconscious is literal; it accepts what you regard as fact. Follow these steps to form the habit of positive thinking and to boost your success:

1. **Deliberately motivate yourself every day.** Think of yourself as successful, and expect positive outcomes for everything you attempt.
2. **Project energy and enthusiasm.** Employers hire people who project positive energy and enthusiasm. Develop the habit of speaking, moving, and acting with these qualities.
3. **Practice this positive-expectation mindset until it becomes a habit.** Applicants who project enthusiasm and positive behavior generate a positive chemistry that rubs off. Hiring decisions are influenced largely by this positive energy. The habit will help you reach your peak potential.
4. **Dwell on past successes.** Focusing on past successes to remind yourself of your abilities helps in attaining goals. For example, no one is ever born knowing how to ride a bicycle or how to use a computer software program. Through training, practice, and trial and error, you master new abilities. During the trial-and-error phases of development, remind yourself of past successes; look at mistakes as part of the natural learning curve. Continue until you achieve the result you want, and remind yourself that you have succeeded in the past and can do so again. You fail only when you quit trying![11]



Exhibit **17.5** Aligning one's lifestyle interests with one's career trajectory is essential to long-term career satisfaction. If the idea of working in a big city captivates the imagination, it can become a guide to the types of jobs to pursue. If one is motivated to work with people or animals, then charity organizations or zoos might be a good place to look. *What jobs do you visualize yourself doing, and how can that vision guide your career search?* (Credit: Rich Bowen/ Flickr/ Attribution 2.0 Generic (CC BY 2.0))

Take a Good Look at Yourself

Once you've developed a positive, "can do" attitude, the next step is to better understand yourself. Ask yourself two basic questions: "Who am I?" and "What can I do?"

Who Am I? This question is the start of *self-assessment*, examining your likes and dislikes and basic values. You may want to ask yourself the following questions:

- Do I want to help society?
- Do I want to help make the world a better place?
- Do I want to help other people directly?
- Is it important for me to be seen as part of a big corporation? Or do I prefer to be part of a smaller organization?
- Do I prefer working indoors or outdoors?
- Do I like to meet new people, or do I want to work alone?

Are you assertive? Assess your assertiveness by taking the quiz in **Table 17.7.**

What Can I Do? After determining what your values are, take the second step in career planning by asking, "What can I do?" This question is the start of *skill assessment*, evaluating your key abilities and characteristics for dealing successfully with problems, tasks, and interactions with other people. Many skills—for instance, the ability to speak clearly and strongly—are valuable in many occupations.

Be sure to consider the work experience you already have, including part-time jobs while going to school, summer jobs, volunteer jobs, and internships. These jobs teach you skills and make you more attractive to potential employers. It's never too early or too late to take a part-time job in your chosen field. For instance, someone with an interest in accounting would do well to try a part-time job with a CPA (certified public accountant) firm.

Fun Self-Test—How Assertive Are You?				
Rate your level of agreement with the following statements using the scale below:				
Strongly Agree	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**

1. I don't easily agree to work for others.
2. There are some people who make jokes about the way I communicate and put me down repeatedly.
3. I speak up without fear of what others will think of me.
4. I rarely have to repeat my thoughts to make people understand.
5. I sound like I am asking a question when I am making a statement.
6. I'm more reluctant to speak up on the job than in other situations.
7. I can always think of something to say when faced with rude remarks.
8. I tend to suffer in silence when unfairly criticized or insulted.
9. I tend to respond aggressively when criticized unfairly.
10. People don't listen when I am speaking.
11. If I say "no," I feel guilty.
12. When I have a conflict with someone, the results seem to always go their way.
13. When I speak, people listen.[12]

See the scoring guidelines at the end of this chapter to obtain your score.

Table17.7

In addition to examining your job-related skills, you should also look at your leisure activities. Some possible questions: Am I good at golf? Do I enjoy sailing? Tennis? Racquetball? In some businesses, transactions are made during leisure hours. In that case, being able to play a skillful, or at least adequate, game of golf or tennis may be an asset.

It's hard to like your job if you don't like the field that you're in. Most career counselors agree that finding work you're passionate about is one of the critical factors behind career success. That's why so many career counselors love all those diagnostic tools that measure your personality traits, skill levels, professional interests, and job potential.

The internet is virtually exploding with tests and assessments that you can take. Try, for example, **http://www.self-directed-search.com**. This test is based on the theory that people and work environments can be classified into six basic types: realistic, investigative, artistic, social, enterprising, and conventional. The test determines which three types best describe you, and it suggests occupations that could be a good match. The **Keirsey Character Sorter (http://www.keirsey.com)** is a first cousin of Myers-Briggs. It sorts people into four temperaments: idealists, rationals, artisans, and guardians. Like Myers-Briggs, it not only places you in an overall category, but it also offers a more detailed evaluation of your personality traits. To find a bunch of tests in one place, use a search engine and search "online personality tests."

Understand What Employers Want

Employers want to hire people who will make their businesses more successful. The most desirable employees have the specific skills, transferable career competencies, work values, and personal qualities necessary to be successful in the employers' organizations. The more clearly you convey your skills as they relate to your job target, the greater your chance of landing your ideal job.[13]

Job-Specific Skills. Employers seek job-specific skills (skills and technical abilities that relate specifically to a particular job). Two examples of job-specific skills are using specialized tools and equipment and using a custom-designed software program.

Transferable Skills and Attitudes. Change is a constant in today's business world. Strong transferable career skills are the keys to success in managing your career through change. The most influential skills and attitudes are the abilities to:

- Work well with people.

- Plan and manage multiple tasks.
- Maintain a positive attitude.
- Show enthusiasm.

Employers need workers who have transferable career competencies—basic skills and attitudes that are important for all types of work. These skills make you highly marketable because they're needed for a wide variety of jobs and can be transferred from one task, job, or workplace to another. Examples include these:

- Planning skills
- Research skills
- Communication skills
- Human relations and interpersonal skills
- Critical thinking skills
- Management skills
- Project management skills

Take, for example, a construction supervisor and an accountant. Both must work well with others, manage time and specific tasks, solve problems, read, and communicate effectively—all transferable competencies. They both must be competent in these areas even though framing a house and balancing a set of financial information (the job-specific skill for each field, respectively) are not related. In every occupation, transferable competencies are as important as technical expertise and job-specific skills.

Find Your First Professional Job

The next step is landing the job that fits your skills and desires. You need to consider not only a general type of work but also your lifestyle and leisure goals. If you like to be outdoors most of the time, you might be very unhappy spending eight hours a day in an office. Someone who likes living in small towns may dislike working at the headquarters of a big corporation in Los Angeles, New York City, or Chicago. But make sure that your geographic preferences are realistic. Some parts of the country will experience much greater growth in jobs than others in the coming years.

According to recent research by Glassdoor, the online job listings and career site, the top 10 best cities for jobs in 2017 are:

1. Pittsburgh, PA
2. Indianapolis, IN
3. Kansas City, MO
4. Raleigh-Durham, NC
5. St. Louis, MO
6. Memphis, TN
7. Columbus, OH
8. Cincinnati, OH
9. Cleveland, OH
10. Louisville, KY[14]

You might start answering the question "What will I do?" by studying the *Occupational Outlook Handbook*, published every two years by the U.S. Department of Labor **(https://www.bls.gov/ooh)**. The most recent *Handbook* edition projects job opportunities by industry through the year 2026. The *Handbook* is divided into 25 occupational clusters describing 325 job profiles (with a section on military careers). Among the clusters are education, sales and marketing, transportation, health, and social services. Each job description tells about the nature of the work, working conditions, required training, other qualifications, chances for advancement, employment outlook, earnings, related occupations, and sources of more information. Another good source of job information is the website for the National Association of Colleges and Employers **(http://www.naceweb.org)**. If you are a member of a minority group, you might want to check out **https://www.blackcareernetwork.com** or **http://www.saludos.com**.

Use the Internet to Find a Job

Today, most job searches are done online. Rarely do job seekers use "snail mail" to send a résumé to a potential employer. Therefore, you need to do your homework when it comes to creating a résumé and posting it to various websites, as well as sending it electronically to a specific company's careers web page.

Let's start with the résumé. There are thousands of job-related sites and millions of résumés on the internet. To break through the clutter, you must start with a great résumé—a written description of your education, work experience, personal data, and interests. There are plenty of online resources that can provide you with tips and actual templates to use when creating your résumé. For example, CollegeGrad (**https://collegegrad.com**) provides more than 100 preformatted templates for over 30 college majors on its website that you can use to tailor your résumé and highlight your specific skills and talents.[15] Of course, there are many other sources for creating a résumé, including the actual websites of most online job-listing services.

Once you have created an electronic résumé, you have several options when it comes to your job search. First, you can target specific companies where you would like to work. Then go to their corporate websites and look for a careers page on the website. For example, Google has an extensive careers section on its website that provides detailed information on how to apply to become a "Googler," along with a section on what the company's interview process entails and how Google makes hiring decisions.[16]

You can also try posting your résumé on the top 10 most popular job websites. They are so large that they are worth checking out first. They tend to have more jobs listed, represent more companies, and have larger résumé databases, which attract even more companies.[17]

- Indeed **(www.indeed.com)**
- Monster **(https://www.monster.com)**
- Glassdoor **(https://www.glassdoor.com)**
- CareerBuilder **(https://www.careerbuilder.com)**
- SimplyHired **(https://www.simplyhired.com)**
- JobDiagnosis **(www.jobdiagnosis.com)**
- Nexxt **(https://www.nexxt.com)**
- ZipRecruiter **(https://www.ziprecruiter.com)**
- USAJobs **(https://www.usajobs.gov)**

The Multimedia Résumé

If you are going to become a computer programmer, web developer, graphics designer, artist, sculptor, singer, dancer, actor, model, animator, cartoonist, or anyone who would benefit by the photographs, graphics, animation, sound, color, or movement inherent in a multimedia résumé, then this résumé is for you. For most people, however, a multimedia résumé and personal home page on the internet aren't necessary. Most internet service providers and commercial online services provide some space on their sites for subscriber home pages.[18]

Getting Your Electronic Résumé into the Short Pile

Applicant tracking systems (ATSs) screen for keywords, which either reject your résumé or move it on to the short list. Your task is to use keywords that will produce as many "hits" as possible. Keywords tend to be more of the noun or noun phrase type (Total Quality Management, Walmart, Sales Manager) as opposed to power action verbs often found in traditional résumés (developed, coordinated, organized). Every occupation and career field has its own jargon, acronyms, and buzzwords. There are also general keywords that apply to transferable skills important in many jobs, such as teamwork, writing, and planning.

Use these tips for adding effective keywords to your résumé:

- The best source of keywords is the actual job listing, which is likely to contain many, if not all, of the keywords that an employer will use to search the résumé database.
- Include plenty of keyword nouns and noun phrases throughout your résumé. If you have a "Summary of Qualifications" section at the beginning of your résumé, try not to repeat verbatim the contents of this section.
- If you are applying for technical positions, you can list your skills, separating each noun or phrase by a comma.
- In some fields, a simple list of skills does not sufficiently describe the job seeker's background. Where appropriate, include accomplishments, as well, but be sure to include enough keywords to satisfy the ATS searches.[19]

There are several ways to determine what keywords are appropriate for your industry and job.

- Look through recent job postings online. Certain words will reappear consistently. Those are your "key" words.
- Make sure your résumé contains the keywords and concepts used in the *particular job listing* you are applying to.
- Talk to people in the career field you are targeting, and ask them what keywords are appropriate to the positions you are applying to.
- Research specific company websites that appeal to you in terms of getting a job with that specific organization, and review the "About Us" section. Try to use some of the key words the company uses to describe its corporate environment as part of your résumé descriptions.[20]
- Visit professional association websites, and read the content carefully. Many of these are loaded with industry-related jargon that may be appropriate for your résumé.

If you are *still in college*, try to get at least one internship in the career field you're targeting. Even if your internship lasts only a few weeks, you will significantly increase your keyword count to build a resume, not to mention gain valuable experience that will get the attention of hiring professionals.[21]

I've Landed a Job Interview

If some of the companies you contacted want to speak with you, your résumé achieved its goal of getting you a job interview. Look at the interview as a chance to describe your knowledge and skills and interpret them in terms of the employer's specific needs. To make this kind of presentation, you need to do some research on the company. A great place to start is the company's own corporate website.

As you do your information search, you should build your knowledge in these three areas:

1. **General Information about the Occupational Field.** Learn about the current and predicted industry trends, general educational requirements, job descriptions, growth outlook, and salary ranges in the industry.
2. **Information about Prospective Employers.** Learn whether the organization is publicly or privately owned. Verify company names, addresses, products, or services (current and predicted, as well as trends); history; culture; reputation; performance; divisions and subsidiaries; locations (U.S. and global); predicted growth indicators; number of employees; company philosophies and procedures; predicted job openings; salary ranges; and listings of managers of your targeted department within the organization. Also learn about the competitors and customers.
3. **Information about Specific Jobs.** Obtain job descriptions; identify the required education and experience; and determine prevalent working conditions, salary, and fringe benefits.

Interview Like a Pro

An interview tends to have three parts: icebreaking (about five minutes), in which the interviewer tries to put the applicant at ease; questioning (directly or indirectly) by the interviewer; and questioning by the applicant. Almost every recruiter you meet will be trying to rate you in 5 to 10 areas. The questions will be designed to assess your skills and personality.

Many firms start with a *screening interview*, a rather short interview (about 30 minutes) to decide whether to invite you back for a second interview. Sometimes screening interviews can take place online via Skype, FaceTime, or some other form of

videoconferencing. Only about 20 percent of job applicants are invited back. The second interview is usually a half day or a day of meetings set up by the human resource department with managers in different departments. After the meetings, someone from the human resource department will discuss other application materials with you and tell you when a letter of acceptance or rejection is likely to be sent. (The wait may be weeks or even months.) Many applicants send follow-up letters in the meantime to show they are still interested in the firm.

For the interview, you should dress conservatively. Plan to arrive about 10 to 15 minutes ahead of time. Try to relax. Smile and make eye contact with (but do not stare at) the interviewer. Body language is an important communicator. The placement of your hands and feet and your overall posture say a good deal about you. Here are some other tips for interviewing like a pro:

1. **Concentrate on being likable.** As simplistic as it seems, research proves that one of the most essential goals in successful interviewing is to be liked by the interviewer. Interviewers want to hire pleasant people others will like working with on a daily basis. Pay attention to the following areas to project that you are highly likable:
    - Be friendly, courteous, and enthusiastic.
    - Speak positively.
    - Smile.
    - Use positive body language.
    - Make certain your appearance is appropriate.
    - Make eye contact when you speak.
2. **Project an air of confidence and pride.** Act as though you want and deserve the job, not as though you are desperate.
3. **Demonstrate enthusiasm.** The applicant's level of enthusiasm often influences employers as much as any other interviewing factor. The applicant who demonstrates little enthusiasm for a job will never be selected for the position.
4. **Demonstrate knowledge of and interest in the employer.** "I really want this job" is not convincing enough. Explain why you want the position and how the position fits your career plans. You can cite opportunities that may be unique to a firm or emphasize your skills and education that are highly relevant to the position.
5. **State your name and the position you're seeking.** When you enter the interviewer's office, begin with a friendly greeting and state the position you're interviewing for: "Hello, Ms. Levine, I'm Bella Reyna. I'm here to interview for the accounting position." If someone has already introduced you to the interviewer, simply say, "Good morning, Ms. Levine." Identifying the position is important because interviewers often interview for many different positions.
6. **Focus on how you fit the job.** Near the beginning of your interview, as soon as it seems appropriate, ask a question similar to this: "Could you describe the scope of the job and tell me what capabilities are most important in filling the position?" The interviewer's response will help you focus on emphasizing your qualifications that best match the needs of the employer.
7. **Speak correctly.** Grammatical errors can cost applicants the job. Use correct grammar, word choice, and a businesslike vocabulary, not an informal, chatty one. Avoid slang. When under stress, people often use pet phrases (such as *you know*) too often. This is highly annoying and projects immaturity and insecurity. Don't use *just* or *only*. "I just worked as a waiter." Don't say "I guess." Avoid the word *probably* because it suggests unnecessary doubt. Ask a friend or family member to help you identify any speech weaknesses you have. Begin eliminating these speech habits now.

Also, you should avoid the following "disqualifiers" at all costs. Any one of these blunders could cost you your dream job:

1. Don't sit down until the interviewer invites you to; waiting is courteous.
2. Don't bring anyone else to the interview; it makes you look immature and insecure.
3. Don't smoke or bring a beverage with you.
4. Don't put anything on or read anything on the interviewer's desk; it's considered an invasion of personal space.
5. Don't chew gum or have anything else in your mouth; this projects immaturity.
6. If you are invited to a business meal, don't order alcohol. When ordering, choose food that's easy to eat while carrying on a conversation.
7. Don't offer a limp handshake; it projects weakness. Use a firm handshake.[22]

Select the Right Job for You

Hard work and a little luck may pay off with multiple job offers. Your happy dilemma is deciding which one is best for you. Start by considering the "FACTS":

- *Fit:* Do the job and the employer fit your skills, interests, and lifestyle?

- *Advancement and growth*: Will you have the chance to develop your talents and move up within the organization?
- *Compensation*: Is the employer offering a competitive salary and benefits package?
- *Training:* Will the employer provide you with the tools needed to be successful on the job?
- *Site:* Is the job location a good match for your lifestyle and your budget?

A great way to evaluate a new location is through Homefair **(http://www.homefair.com)**. This site offers tools to help you calculate the cost of moving, the cost of living, and the quality of life in various places. The Moving Calculator helps you figure out how much it will cost to ship your worldly possessions to a particular city. The Relocation Crime Lab compares crime rates in various locations. The City Snapshots feature compares demographic, economic, and climate information for two cities of your choosing. The Salary Calculator computes cost-of-living differences between hundreds of U.S. and international cities and tells you how much you'd need to make in your new city to maintain your current standard of living.

Start Your New Job

No time is more crucial, and possibly nerve-racking, than the first few months at a new job. During this breaking-in period, the employer decides whether a new employee is valuable enough to keep and, if so, in what capacity. Sometimes the employee's whole future with the company rides on the efforts of the first few weeks or months. Most firms offer some sort of formal orientation. But generally speaking, they expect employees to learn quickly—and often on their own. You will be expected to become familiar with the firm's goals; its organization, including your place in the company; and basic personnel policies, such as coffee breaks, overtime, and parking.

Here are a few tips on making your first job rewarding and productive:

- *Listen and learn:* When you first walk into your new job, let your eyes and ears take everything in. Do people refer to one another by first names, or is the company more formal? How do people dress? Do the people you work with drop into one another's open offices for informal chats about business matters? Or have you entered a "memo mill," where anything of substance is put on email and talks with other employees are scheduled through their administrative assistants? Size up where the power lies. Who seems to most often assume a leadership role? Who is the person others turn to for advice? Why has that person achieved that position? What traits have made this person a "political leader"? Don't be misled by what others say, but also don't dismiss their evaluations. Make your own judgments based on what you see and hear. Effective listening skills help you learn your new job responsibilities quickly. Take the quiz in **Table 17.8** to see if you are a good listener.
- *Do unto others:* Be nice. Nice people are usually the last to be fired and among the first to be promoted. Don't be pleasant only with those who can help you in the company. Be nice to everyone. You never know who can help you or give you information that will turn out to be useful. Genuinely nice people make routine job assignments, and especially pressure-filled ones, more pleasant. And people who are dealt with pleasantly usually respond in kind.
- *Don't start out as a maverick:* If every new employee tried to change tried-and-true methods to suit his or her whims, the firm would quickly be in chaos. Individual needs must take a back seat to established procedures. Devote yourself to getting things done within the system. Every manager realizes that it takes time for a new person to adjust. But the faster you start accomplishing things, the faster the boss will decide that you were the right person to hire.
- *Find a great mentor:* The leading cause of career unhappiness is working for a bad boss. Good jobs can easily be ruined by supervisors who hold you back. In contrast, your career will soar (and you will smile every day) when you have a great mentor helping you along the way. If you find a job with a super mentor, jump at the chance to take it.

Fun Self-Test—Are You a Good Listener?				
Rate your level of agreement with the statements below using the following scale:				
Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree

1. A person who takes time to ask for clarification about something that might be unclear is not a good listener.
2. While listening, I am distracted by the sounds around me.
3. I try to not only understand what is being said but also analyze the strength of any ideas that are being presented.
4. I ask questions, make observations, or give opinion when necessary for clarifications.
5. While I am listening, I avoid eye contact but am polite.
6. I am tempted to judge a person whether or not he or she is a good speaker.
7. I feel more comfortable when someone talks to me about a topic that I find interesting.
8. I always jot down key phrases/points that strike me as important points of concern that require a response.
9. My listening style varies from the speaker's style of communication.
10. A good listener requires a good speaker.[23]

See the scoring guidelines at the end of this chapter to obtain your score.

Table17.8

Moving Up

Once you have been on the job for a while, you will want to get ahead and be promoted. **Table 17.9** offers several suggestions for improving your chances of promotion. The first item might seem a bit strange, yet it's there for a practical reason. If you don't really like what you do, you won't be committed enough to compete with those who do. The passionate people are the ones who go the extra mile, do the extra work, and come up with fresh out-of-the-box ideas.

So there you have it. Remember: it's never too early to begin planning your career—the future is now.

How to Move Up

- Love what you do, which entails first figuring out who you are.
- Never stop learning about new technologies and new skills that will help you build a successful career.
- Try to get international experience even if it is only a short stint overseas.
- Create new business opportunities—they could lead to a promotion.
- Be really terrific at what you're doing now, this week, this month.

Table17.9

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8.2.7: Self-Test Scoring Guidelines

After you answer the questions in each of the fun self-tests that appear in this chapter, determine your score and evaluate your skills using the following scoring guidelines.

Table 1 Fun Self-Test: Can You Persuade Others?

For questions 1, 2, 4, 8, 10, and 11, use the following to calculate your score:

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
2 points	1 point	0 points	0 points	0 points

For questions 3, 5, 6, 7, and 9 use the following to calculate your score:

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
0 points	0 points	0 points	4 points	5 points

If your score is between 40 and 55, you have an excellent ability to persuade others. A score between 30 and 39 means you have reasonably good persuasion skills. However, you may need to improve your listening and communicating skills. A score below 30 means that you should consider reading a book or taking a short course on how to persuade others.

Table 2 Fun Self-Test: Are You Good at Office Politics?

For questions 1, 3, 4, 7, 8, 10, 12, and 13, give yourself 1 point if you said “true.” For questions 2, 5, 6, 9, and 11, give yourself 1 point if you said “false.” If your score is 9 or below, you may be good at managing your work, but you need to improve your political skills. Being political means getting along with others in order to move them toward accomplishing a specific goal. If your score is low, consider reviewing the tips offered in the chapter on how to be an effective political player.

Table 4 Fun Self-Test: How Well Do You Manage Your Time?

For questions 2, 6, 8, 9, 11, 13, 14, and 15, use the following to calculate your score:

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
0 points	0 points	0 points	4 points	5 points

For questions 1, 3, 4, 5, 7, 10, and 12, use the following to calculate your score:

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
5 points	4 points	0 points	0 points	0 points

If your score is 60 or higher, you have excellent time management skills. Congratulations—you use your time well! If your score is below 60, consider reading a book on time management, taking a course on time management, or investing in time-management tools such as a weekly project planner. The chapter has additional tips that may be useful in improving your time-management skills.

Table 5 Fun Self-Test: Are You Good at Managing Money?

For questions 2, 3, 5, 6, 10, and 11, use the following to calculate your score:

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
0 points	0 points	0 points	4 points	5 points

For questions 1, 4, 7, 8, and 9, use the following to calculate your score:

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
5 points	4 points	0 points	0 points	0 points

If your score is 44 or higher, you are able to manage money while balancing your expenses and income. You will be ready to handle financial emergencies without turning to friends or relatives. If your score is between 36 and 43, your savings habits may be inconsistent. To achieve better savings, control your expenses and avoid unnecessary purchases. If your score is 35 or below, you spend too much! Remember: it's a lot more painful to earn money than to spend it. You need to gain control of your finances by limiting your spending, paying off credit cards, or investing in a good personal finance book or course. You may also need to meet with a financial advisor to seek direction on your spending and saving habits.

Table 6 Fun Self-Test: Do You Have Good Study Habits?

If you answered "yes" to questions 3, 5, 7, 8, and 11, give yourself 1 point for each answer.

If you answered "no" to questions 1, 2, 4, 6, 9, 10, and 12, give yourself 1 point for each answer.

If your score is 10 or above, congratulations! You have good study habits. If your score is below 10, read the tips offered in the chapter on improving your study skills. You may also meet with someone at your school to help maximize your study time.

Table 7 Fun Self-Test: How Assertive Are You?

For questions 1, 3, 4, 7, 9, and 13, use the following to calculate your score:

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
5 points	4 points	0 points	0 points	0 points

For questions 2, 5, 6, 8, 10, 11, and 12, use the following to calculate your score:

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
0 points	0 points	0 points	4 points	5 points

If your score is 44 or higher, you stand up for your rights while showing respect for others. You quickly respond to unfair criticism. You should be able to fare well in office politics. If your score is 43 or lower, you may want to consider ways to become more comfortable communicating your ideas and opinions and managing your relationships with others.

Table 8 Fun Self-Test: Are You a Good Listener?

For questions 3, 4, 8, and 9, use the following to calculate your score:

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
5 points	4 points	0 points	0 points	0 points

For questions 1, 2, 5, 6, 7, and 10, use the following to calculate your score:

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
0 points	0 points	0 points	4 points	5 points

Listening is an important communication skill that will help you succeed in your career. By becoming an effective listener, you gain respect from your colleagues, pick up insights and ideas on improving your job performance, and develop a skill that is important in managing others. If you have a score of 32 or above, then you are a good listener. If your score falls below 32, you need to improve your listening skills. Search the internet for articles and ideas on becoming a better listener, and begin practicing your new skills with your friends and coworkers.

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8.3: End of Chapter Summary

Conclusion

The wide array of agricultural machinery available today plays a critical role in enhancing farming practices. From tractors and harvesters to drones and irrigation systems, each type of machinery contributes to improved efficiency, productivity, and sustainability in agriculture. By leveraging these advanced tools, farmers can optimize their operations, reduce labor, and meet the growing demands of food production while managing resources more effectively.

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8.4: End of Chapter Discussion

Here are several discussion topics based on the recent overview of agricultural machinery and its benefits:

1. Efficiency and Productivity of Modern Tractors

- **Topic:** Discuss how modern tractors have evolved to improve farm efficiency and productivity. Consider their role in various agricultural tasks and the impact of advanced attachments and technologies.
- **Guiding Questions:** How have advancements in tractor technology increased efficiency in farming operations? What specific features or attachments have made the most significant impact?

2. The Role of Harvesters in Large-Scale Agriculture

- **Topic:** Analyze the impact of harvesters on large-scale farming operations. Discuss how they have transformed the harvesting process for different types of crops.
- **Guiding Questions:** How do different types of harvesters, such as combine harvesters and cotton pickers, improve productivity? What challenges are associated with using these machines?

3. Benefits and Challenges of Using Balers for Crop Management

- **Topic:** Explore the advantages and potential drawbacks of using balers in managing crops like hay and straw. Consider their impact on storage, transportation, and overall efficiency.
- **Guiding Questions:** What are the primary benefits of using balers in crop management? Are there any limitations or challenges that farmers should be aware of?

4. Advancements in Sorting Technology and Quality Control

- **Topic:** Discuss the role of sorting machinery in ensuring the quality and consistency of agricultural produce. Explore how advancements in sorting technology have improved quality control in processing.
- **Guiding Questions:** How does modern sorting technology enhance the quality of agricultural products? What are some examples of recent innovations in sorting machinery?

5. Aerial Applications: Comparing Planes and Helicopters

- **Topic:** Compare the use of planes and helicopters for aerial applications such as crop dusting and pest control. Discuss the advantages and limitations of each.
- **Guiding Questions:** What are the key differences between using planes and helicopters for aerial applications? How do these differences affect their efficiency and effectiveness?

6. The Impact of Drones on Precision Agriculture

- **Topic:** Examine the role of drones in precision agriculture and their benefits for monitoring and managing crops. Consider their impact on data collection and decision-making.
- **Guiding Questions:** How have drones changed the way farmers collect data and manage crops? What are the advantages of using drones over traditional methods?

7. Innovations in Seeder Technology and Their Impact on Planting

- **Topic:** Explore the advancements in seeder technology and their influence on planting practices. Discuss how modern seeders improve planting accuracy and efficiency.
- **Guiding Questions:** What recent innovations in seeder technology have had the most impact on planting practices? How do these innovations contribute to better crop yields?

8. Water Management and Efficiency in Modern Irrigation Systems

- **Topic:** Analyze the role of modern irrigation systems in improving water management and efficiency. Discuss the benefits of systems like pivot irrigators and drip irrigation.
- **Guiding Questions:** How do modern irrigation systems enhance water use efficiency? What are the challenges associated with implementing these systems on different types of farms?

9. The Role of Tillage Equipment in Soil Preparation

- **Topic:** Discuss the importance of tillage equipment in soil preparation and its effects on crop growth. Explore the benefits and potential drawbacks of different types of tillage machinery.
- **Guiding Questions:** How does tillage equipment contribute to soil health and crop production? Are there any environmental or operational challenges associated with its use?

10. Future Trends in Agricultural Machinery and Technology

- **Topic:** Predict future trends in agricultural machinery and technology. Consider advancements such as automation, AI, and sustainable practices.
- **Guiding Questions:** What emerging technologies are likely to shape the future of agricultural machinery? How can farmers prepare for and adapt to these trends?

These discussion topics are designed to stimulate in-depth conversations about the various types of agricultural machinery and their impacts on modern farming practices.

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S

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