

The University of Dodoma

School of Informatics
IS 102: Basic Computer Applications
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Introduction to Computers

- ❑ A computer is an electronic device that accepts data, processes the data, stores and output information.
- ❑ Computers are used all over the world and in all types of environments. They are used in businesses, manufacturing environments, homes, government offices and non-profit organizations. Schools use computers for instruction and for maintaining student records. Hospitals use computers to maintain patient records and to provide medical care.
- ❑ In addition to these types of computers, there are also many customized computers designed for specific purposes. These computers can be integrated into devices such as televisions, cash registers, sound systems, and other electronic devices. They can even be found embedded in appliances such as stoves and refrigerators and used in automobiles, and aircraft
- ❑ Computers have a significant role as they improve speed, reliability, consistency,
Storage and Communication.

Computer Features

- Computers are used for many reasons and in many different places. They may be of different sizes and processing power, but all computers have some features in common. In order for most computers to perform useful functions, there are two things that have to work together
- Hardware - the physical components, both internal and external, that make up a computer
- Software - Software is the set of instructions for the hardware. It is the programme which make the computer do the work. This includes

Operating System - a set of computer programs that manages the hardware of a computer. An operating system controls the resources on a computer, including memory and disk storage. An example of an operating system is Windows XP.

Application Software - programs loaded on the computer to perform a specific function using the capabilities of the computer. An example of application software is a word processor or a computer game.

Application Software

- The computer is only as useful as the program or application on it. Applications can be divided into two general categories:
- Business/Industry Software - Software designed for use by a specific industry or market. Examples include: medical practice management tools, educational tools and legal software.
- General Use Software - Software used by a wide range of organizations and home users for various purposes. These applications can be used by any business or individual.

General use software includes integrated applications packages known as Office Suites. They usually include applications such as word processing, spreadsheet, database, presentation and contacts/schedule management

Application Software

- In addition to Business/Industry and General Use software, an application can be classified as local or networked.
- Local application - A local application is a program, such as a word processor, that is stored on the hard disk of the computer. The application runs only on that computer.
- Network application - A network application is one that is designed to run over a network, such as the Internet. A network application has two components, one that runs on the local computer and one that runs on a remote computer. Email is an example of a network application.
- Most computers have a combination of local and network applications installed.

Classes of computers

There are many different types of computers available including:

- ❑ Mainframes
- ❑ Servers
- ❑ Desktops
- ❑ Workstations
- ❑ Laptops
- ❑ Hand-held portable devices

Each type of computer has been designed with a particular purpose in mind, such as portable access to information, processing of detailed graphics, and so on.

The most common types of computers used in homes and businesses are servers, workstations, desktops, laptops and other portable devices. Mainframes, on the other hand, are large centralized computers found in sizeable enterprises and purchased through specialized resellers.

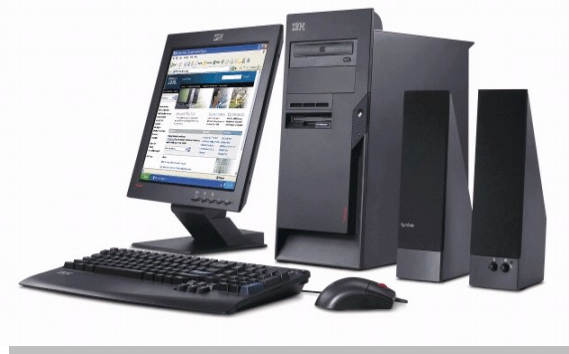
Servers

- ❑ Servers are high performance computers used in businesses and other organizations. Servers provide services to many end users or clients.
- ❑ Server hardware is optimized for quick response time to multiple network requests. Servers have multiple Central Processing Units (CPUs), large amounts of Random Access Memory (RAM) and multiple high capacity disk drives that provide very fast information retrieval.
- ❑ The services provided by a server are often important and may need to be available to users at all times. Servers, therefore, often contain duplicate, or redundant, parts to prevent them from failing. Automatic and manual backups of data are also usually done on a regular basis. Servers are usually kept in secure areas where access is controlled.
- ❑ Their design may be one of several types: they can be a stand alone tower design, be rack mounted, or have a blade design. Since a server is typically used as a storage point and not a day-to-day end-user device, it may not have a monitor or keyboard, or may share a monitor and keyboard with other devices.
- ❑ Common services found on a server include file storage, email storage, web pages, print sharing and others.



Desktops

- ❑ Desktops support many options and capabilities. A wide variety of cases, power supplies, hard drives, video cards, monitors and other components are available. Desktops can have many different connection types, video options, and a wide array of supported peripherals.
- ❑ Desktops are commonly used to run applications such as word processing, spreadsheets and networked applications such as email and web browsing.
- ❑ There is another type of computer that may look similar to a desktop, but is much more powe



Workstation

- Workstations are high-powered business computers. They are designed for specialized, high-end applications like engineering programs such as CAD (Computer Aided Design). Workstations are used in 3-D graphics design, video animation and virtual reality simulation. They may also be used as management stations for telecommunications or medical equipment. As with servers, workstations typically have multiple CPUs, large amounts of RAM and multiple, high-capacity disk drives that are very fast. Workstations usually have very powerful graphics capabilities and a large monitor or multiple monitors.
- Servers, desktops and workstations are all designed as stationary devices. They are not portable, like laptops.

Portable devices

- Laptop or notebook PC, Tablet PC, Pocket PC, Personal Digital Assistant (PDA), Gaming device and Cell phones

Laptops, also called notebooks, are comparable to desktops in usage and processing capability. However, they are portable devices built to be lightweight and use less power, with a built-in mouse, monitor and keyboard. Laptops can also be plugged into a docking station which allows the user to utilize a larger monitor, mouse, full-sized keyboard and have more connection options.

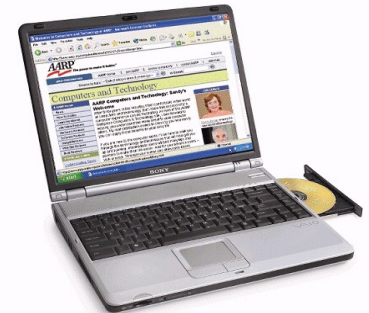
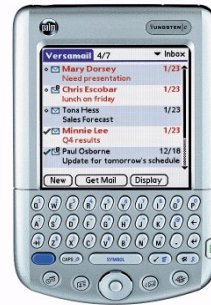
Despite this, laptops have a limited number of configurations available, such as video options and connection types. They are also not as easily upgradeable as the desktop.

Other portable devices, such as PDAs or pocket PCs, have less powerful CPUs and less RAM. They have small screens with limited display capabilities and may have a small input keyboard.

The key advantage of portable computers is that information and services are available immediately, almost anywhere. For example, mobile phones have built-in address books for contact names and telephone numbers. PDAs are available with built-in telephone, web browser, email, and other software.

Portable devices

- The functions of these individual devices can be combined into one multifunction device. The multifunction device can combine a PDA, cell phone, digital camera, and music player. It can provide Internet access and wireless networking capability, but has limited processing power similar to the PDA.



Representing information digitally

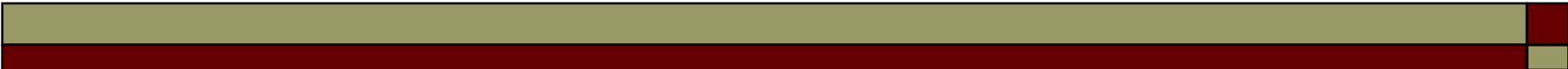
- Within a computer, information is represented and stored in a digital binary format. The term bit is an abbreviation of binary digit and represents the smallest piece of data. Humans interpret words and pictures; computers interpret only patterns of bits.
- A bit can have only two possible values, a one digit (1) or a zero digit (0). A bit can be used to represent the state of something that has two states. For example, a light switch can be either On or Off; in binary representation, these states would correspond to 1 and 0 respectively.
- Computers use binary codes to represent and interpret letters, numbers and special characters with bits. A commonly used code is the American Standard Code for Information Interchange (ASCII). With ASCII, each character is represented by a string of bits. For example:
 - Capital letter: A = 01000001
 - Number: 9 = 00111001
 - Special character: # = 00100011
- Each group of eight bits, such as the representations of letters and numbers, is known as a byte.
- Codes can be used to represent almost any type of information digitally: computer data, graphics, photos, voice, video and music.

Measuring data storage capacity

- While a bit is the smallest representation of data, the most basic unit of digital storage is the byte. A byte is 8 bits and is the smallest unit of measure (UOM) used to represent data storage capacity.
- When referring to storage space, we use the terms bytes (B), kilobytes (KB), megabytes (MB), gigabytes (GB), and terabytes (TB).
- One kilobyte is a little more than one thousand bytes, specifically 1,024. A megabyte represents more than a million bytes or 1,048,576. A gigabyte is 1,073,741,824 bytes and so on. The exact number is gained by taking 2^n power. Example: KB = 2^{10} ; MB = 2^{20} ; GB = 2^{30} .
- In general, when something is represented digitally, the greater the detail, the greater the number of bits needed to represent it. A low-resolution picture from a digital camera will use around 360KB, and a high-resolution picture could use 2 MB or more.
- Kilobytes, megabytes, gigabytes, and terabytes are typically used to measure the size or storage capacity of a device. Examples of components and devices that use byte storage include: random access memory (RAM), hard disk drive space, CDs, DVDs, and MP3 players.

Computer system

- There are many types of computers. What makes one computer better suited to play a new game or play a new audio file over another? The answer is the components and peripherals that make up the computer system.
- The requirements for a machine dedicated mainly to word processing are very different than one designed for graphics applications or gaming. It is important to determine the intended uses for a computer before deciding on the type of computer and components to purchase.
- Many manufacturers mass produce computer systems and sell them either through direct marketing or retail chains. These computer systems are designed to function well for a variety of tasks. There are also a number of vendors that can custom assemble computer systems to the end-user's specifications. There are advantages and disadvantages for both.



Preassembled Computer

Advantages:

- ❑ Lower cost
- ❑ Adequate to perform most applications
- ❑ No waiting period for assembly
- ❑ Typically used by less knowledgeable consumers who do not require special needs

Disadvantages:

- ❑ Often lack the performance level that can be obtained from custom built computers

Custom Built Computer

Advantages:

- The end-user can specify exact components that meet user needs
- Generally support higher performance applications such as graphics, gaming, and server applications

Disadvantages:

- Generally more costly than a preassembled device
- Longer waiting periods for assembly

It is also possible to purchase the individual parts and component of a computer and build it. Regardless of the decision to buy a preassembled or custom built system or build it, the final product must match the requirements of the end user. Some of the items to consider when purchasing a computer include: the motherboard, processor, RAM, storage, adapter cards, as well as the case and power options.

Peripheral devices

A Peripheral

- A peripheral is a device that is added to the computer to expand its capabilities. These devices are optional in nature and are not required for the basic functioning of the computer. Instead they are used to increase the usefulness of the machine. Peripheral devices are connected externally to the computer using a specialized cable or wireless connection.
- Peripheral devices can fit into one of four categories: input, output, storage or networking devices. Examples of some common peripherals include:
- Input devices - trackball, joystick, scanner, digital camera, digitizer, barcode reader, microphone
- Output devices - printer, plotter, speakers, headphones
- Storage devices - secondary hard drive, external CD/DVD devices, flash drives
- Networking - external modems, external NIC

Motherboard

- A motherboard is a large circuit board used to connect the electronics and circuitry required which comprise the computer system. Motherboards contain connectors which allow major system components such as the CPU and RAM to attach to the board. The motherboard moves data between the various connections and system components.
- A motherboard can also contain connector slots for network, video and sound cards. However, many motherboards now come equipped with these features as integrated components. The difference between the two is how they are upgraded. When using connectors on the motherboard, system components are easily unplugged and changed or upgraded as technology advances.
- When upgrading or replacing an on-board feature, it cannot be removed from the motherboard. Therefore, it is often necessary to disable the on-board functionality and add an additional dedicated card using a connector.
- When selecting a motherboard it must:
 1. Support the selected CPU type and speed
 2. Support the amount and type of system RAM required by the applications
 3. Have sufficient slots of the correct type to accept all required interface cards
 4. Have sufficient interfaces of the correct type

Motherboard Components

- Central Processing Unit (CPU)

The CPU, or processor, is the nerve center of the computer system. It is the component that processes all of the data within the machine. The type of CPU should be the first decision made when building or updating a computer system. Important factors when selecting a CPU are the processor speed and bus speed.

- Processor Speed

Processor speed measures how fast a CPU cycles information. It is generally measured in MHz or GHz. The higher the speed the faster the performance. Faster processors consume more power and create more heat than their slower counterparts. For this reason, mobile devices, such as laptop computers, typically use processors that are slower and consume less power in order to extend the time they can operate using batteries.

Motherboard Components

- Bus Speed

CPUs transfer data between various types of memory on the system board during its operation. The pathway for this movement of data is called the bus. In general, the faster the bus, the faster the computer will be.

- When selecting a CPU, keep in mind that applications continue to evolve. Purchasing a CPU of moderate speed may satisfy current requirements. Future applications, however, may be more complicated and require, for example, fast high resolution graphics; if the CPU is not sufficiently fast, the overall performance, measured in terms of response time, will be slower.

Adapter Cards

- ❑ Adapter cards add functionality to a computer system. They are designed to be plugged into a connector or slot on the motherboard and become part of the system. Many motherboards are designed to incorporate the functionality of these adapter cards on the motherboard itself thus removing the necessity to purchase and install separate cards. While this does provide basic functionality, the addition of dedicated adapter cards can often provide an enhanced level of performance.

Some of the more common adapter cards include:

- ❑ Video cards
- ❑ Sound cards
- ❑ Network interface cards
- ❑ Modems
- ❑ Interface cards
- ❑ Controller cards

Storage Devices

A storage device records and retrieves information to and from a storage medium

A storage medium is a physical material on which data, instructions and information are stored

Random Access Memory (RAM)

- RAM is a type of data storage used in computers. It is used to store programs and data while being processed by the CPU. Stored data is accessed in any order, or at random, as needed. All computer programs run from RAM. Besides the CPU, the amount of RAM is the most important factor in computer performance. RAM is also called a primary memory.
- When power is removed from the computer, any data stored in RAM is lost. Programs and user data must be stored in a form that will not disappear when the power is removed. This is known as non-volatile storage. Many types of non-volatile storage are available for computer systems including; Magnetic storage devices, Optical storage devices, Static memory (flash). They are also called Secondary Memory

Storage devices

Magnetic Storage

Magnetic storage devices are the most common form found in computers. These

devices store information in the form of **magnetic fields**. They include:

- ❑ Hard disk drives
- ❑ Floppy drives
- ❑ Tape drives

Optical Drives

- ❑ Optical storage devices use **laser beams** to record information by creating differences in optical density. These devices include CDs and DVDs and come in three different formats:
 - ❑ Read only: CD, DVD
 - ❑ Write once: CD-R, DVD-R
 - ❑ Write many: CD-RW, DVD-RW

Storage devices

- The prices of these devices continue to fall and most computers now incorporate DVD-RW drives that can store approximately 4.7 GB of data on a single disc.
- Another form of DVD drive, called Blu-ray is also available. It uses a different type of laser to read and write data. The color of the laser used to store this information is blue-violet. For this reason, disks are called Blu-ray, to distinguish them from conventional DVDs which use a red laser. Blu-ray disks have storage capacities of 25 GB and more.

Static Memory and Memory Sticks

- Static memory devices use **memory chips** to store information. This information is retained even after power is turned off. They connect to a USB port on the computer and offer capacities of 128 MB or more. Due to their size and shape, these devices are known as USB memory keys or flash drives and have widely replaced floppy disks for transportation of files between systems. Many portable and hand-held devices rely entirely on static memory for storage.

Other Components

Case and Power Supply

- Once all internal components and connections are determined, the case is the next consideration. Some cases are designed to sit on top of the user's desk while others sit below the desk. Computers designed to sit on the desk provide easy access to interfaces and drives but occupy valuable desk space. A tower or mini-tower can either be used on the desk or sit beneath the table. Whatever the case style, select one that has enough space for all components.
- In order to help protect the computer system from these power problems, devices such as surge suppressors and uninterruptible power supplies (UPS) have been developed

Other Components

Surge Suppressor

- A surge suppressor is designed to remove voltage spikes and surges from the power line and prevent them from damaging a computer system. They are relatively inexpensive and easy to install.
- Generally the surge suppressor is plugged into the power outlet and the computer system is plugged into the surge suppressor. Many surge suppressors also have connectors for phone lines to protect modems from damage due to voltage surges that may be carried through the telephone lines.

Uninterruptible Power Supplies

- A UPS is a device that continually monitors the power to a computer system and maintains the charge on an internal battery. If the power is interrupted, the UPS provides backup power to the system without interruption. The backup power comes from a battery inside the UPS and can only power the computer system for a short period of time. UPSs are designed to provide the end-user with sufficient time to properly shut down a computer system should the main power fail. A UPS can also provide an even flow of power to the computer and prevent damage caused by voltage surges.

Safety and best practices

- ❑ Computers are a collection of very complex components and peripherals, all working together to accomplish a task. Occasionally one of these components fails, or needs to be upgraded to improve the functionality of the system. This may require opening the computer and working inside the case.
- ❑ When working inside a computer case, it is important to keep precautions in mind to prevent damage to the system components as well as harm to the technician. Before the computer case is opened, make sure the computer is switched off and the power cable is unplugged.
- ❑ Computer systems and monitors can be very heavy and should be lifted with caution. Before opening a computer system be sure to have a proper work area. The work area should be a clean flat surface, strong enough to support the weight of heavy equipment. It should be well organized, free from clutter and distractions, and adequately lit to prevent eye strain.
- ❑ Wear proper eye protection to prevent accumulated dust, small screws, and components from causing damage to the eyes. Additionally, when opening a computer case, be aware there are sharp edges that should be avoided.

Safety and best practices

- ❑ Power supplies and monitors operate at dangerously high voltages and should only be opened by individuals with special training.
- ❑ Some computer systems are specially designed to enable components to be hot-swapped, meaning that it is not necessary to turn off the computer before adding or removing components. This feature allows the system to remain operational during repairs or upgrades and is usually found in high performance servers.
- ❑ Unless you are sure that the system is hot-swappable, turn it off before opening the case or removing components. Inserting or removing components with the power on, in a system that is not hot-swappable, can cause permanent and serious damage to the system and technician.
- ❑ Internal system components are especially sensitive to static electricity. ESD (Electrostatic Discharge) is static electricity that can be transferred from your body to electronic components in the computer. The static electricity doesn't have to be felt by you in order to occur.

Safety and best practices

- ESD can cause catastrophic failures in components, making them non-functional. ESD can also cause intermittent faults which are very difficult to isolate. For this reason, proper grounding is essential. A special wrist grounding strap is used to connect the technician to the computer case. Grounding ensures that they both reach the same voltage potential and ESD is prevented.
- Excess force should never be used when installing components. Excessive force can damage both the motherboard and the component being installed, and can prevent the system from functioning properly. Damage is not always visible. Force can also damage connectors which, in turn, can damage new system components.
- In order to make certain that all safety precautions are followed it is a good idea to create a safety checklist which can be followed.