Chapter 2

Overview

This module discusses how computers work. The module begins with a system overview. The student will learn the boot process. The boot process includes initializing and testing the system, loading the OS, and the boot sequence that is required to operate the computer.

Computer Hardware is explained in detail and illustrations are included. In addition to the components of the desktop computer, this module will provide information relating to laptops or portable computers.

System resources are shared between computer components and devices. Interrupt requests (IRQs), direct memory access (DMA), and Input/Output (I/O) addresses enable the CPU to handle multiple requests.

Hardware Components - Modems

A modem is the primary way to connect to the Internet with Windows 9x through a dialup networking connection. The word modem is actually an acronym for modulator/demodulator. A modem is in essence, a device that converts the digital data used by computers into analogue signals that is suitable for transmission over a telephone line, and converts the analogue signals back to a digital signal at the destination.

A modem plugged to one of the expansion slots inside a PC is known as an internal modem. Such a modem usually has two types of connectors called registered jack type 11, more commonly called RJ-11 jacks. One is for the phone line while the other is used to attach a traditional telephone handset.

Monitors

Computers are usually connected to a display, also called a monitor. Monitors are available in different types, sizes, and characteristics.

Monitor screen sizes are measured in inches, just like televisions. The most common sizes are 14", 15", 17", 19", and 21" screens, measured diagonally. Note that the visible size is actually smaller than the measurement size. Have this in mind when shopping for a monitor for the computer.

Pixels are picture elements. The screen image is made of pixels (tiny dots), which are arranged in rows across the screen. Each pixel consists of three colours: red, green, and blue (RGB). Examine the screen closely to see them.

Basic Computer Operation

Turning on the PC

To turn on a PC, there is an external switch (or pair of switches that must be activated) in order to power up the computer. The rear switch, if included, provides the physical connection between the house power (via the wall outlet) and the computer power supply. This switch has to be on prior to turning on the front switch. Most PCs will have a single switch in the front that is activated to provide power.

Starting a computer is also referred to as booting the system. A **cold boot** is performed when the PC is turned on using the power button. At the end of this process the Windows operating system desktop will be displayed. Only during the cold boot are the POST tests run.

To test the computer hardware, the bootstrap program runs a program called power-on self-test or POST. In this test, the computer central processing unit (CPU) checks itself first and then checks the computer system timer. The POST checks the RAM by writing data to each RAM chip and then reading that data. Any difference indicates a problem.

If the POST finds errors, it sends a message to the computer monitor. If the POST finds errors that cannot be displayed on the monitor, it sends errors in the form of beeps. If the POST does not find errors, the POST sends one beep and the screen begins to display OS loading messages. The meaning of any beep code depends on the manufacturer of the BIOS.

Restarting the PC

Restarting a PC that has already been powered up is referred to as a **warm boot**. This can be achieved by pressing the reset button on the front panel. Alternatively, press **Ctrl + Alt + Delete**, and click **Restart** from the menu that displays.

Small Computer Systems Interface (SCSI)

The Small Computer Systems Interface (SCSI) controller was developed in 1979 at Shugart Associates Standard Interface (SASI). Like EIDE, SCSI devices have the controlling electronics on each of the drives. SCSI devices are typically connected in a series, forming a chain that is commonly referred to as a daisy chain.

The SCSI bus identifies each device by a SCSI ID number. Most SCSI buses can handle a total of 7 devices and a SCSI controller per channel, which are numbered from 0 through 7. Some versions of SCSI support a total of 15 devices and a SCSI controller per channel, which are numbered 0 through 15. Each device on a SCSI channel must have a unique SCSI ID. Such devices may include hard drives, CD-ROM drives, tape drives, scanners, and removable drives. Each SCSI device in the chain, including the SCSI controller card, is given a SCSI ID number from 0 to 7; #0 for the primary boot device (hard drive), and #7 for the SCSI controller card.

Each device on a SCSI channel must have a unique SCSI ID. SCSI ID numbers do not have to be sequential or in order, but no two devices can have the same number.

Three major versions of the SCSI standard are currently on the market. They are SCSI-1, SCSI-2, and SCSI-3. Installation of SCSI devices among the three different SCSI standards is very similar. The differences are mainly in the size of the SCSI connector that is used to connect the SCSI disk drive to the SCSI cable.

SCSI-1

originally just known as SCSI. By today's standards it was rather slow. SCSI-1 generally supported a single channel per SCSI controller. The SCSI-1 internal cable was a ribbon cable that was attached to the disk controller by a 50-pin connector. Maximum cable length of SCSI-1 is 6 meters.

SCSI-2

Uses two different signalling systems, known as single-ended interface and differential interface. Due to bus length restrictions, single-ended SCSI-2 cabling is usually found inside a server chassis. SCSI-2 uses the same 50-pin connector on the internal SCSI cable that is used by SCSI-1 devices.

SCSI-2 also has a variant called Wide SCSI-2, which can transfer 16 bits at a time as opposed to the 8 bits at a time used by normal SCSI-1 and normal SCSI-2. This extra bus width requires the use of a 68-pin connector. Wide SCSI-2 allows for 16 devices on the SCSI-2 channel, whereas normal SCSI-2 (also called narrow SCSI-2) and SCSI-1 only allow 8 devices on the SCSI channel.

SCSI-3

SCSI-3 is the latest standard of the SCSI family. It combines all the best features of the previous SCSI standards.

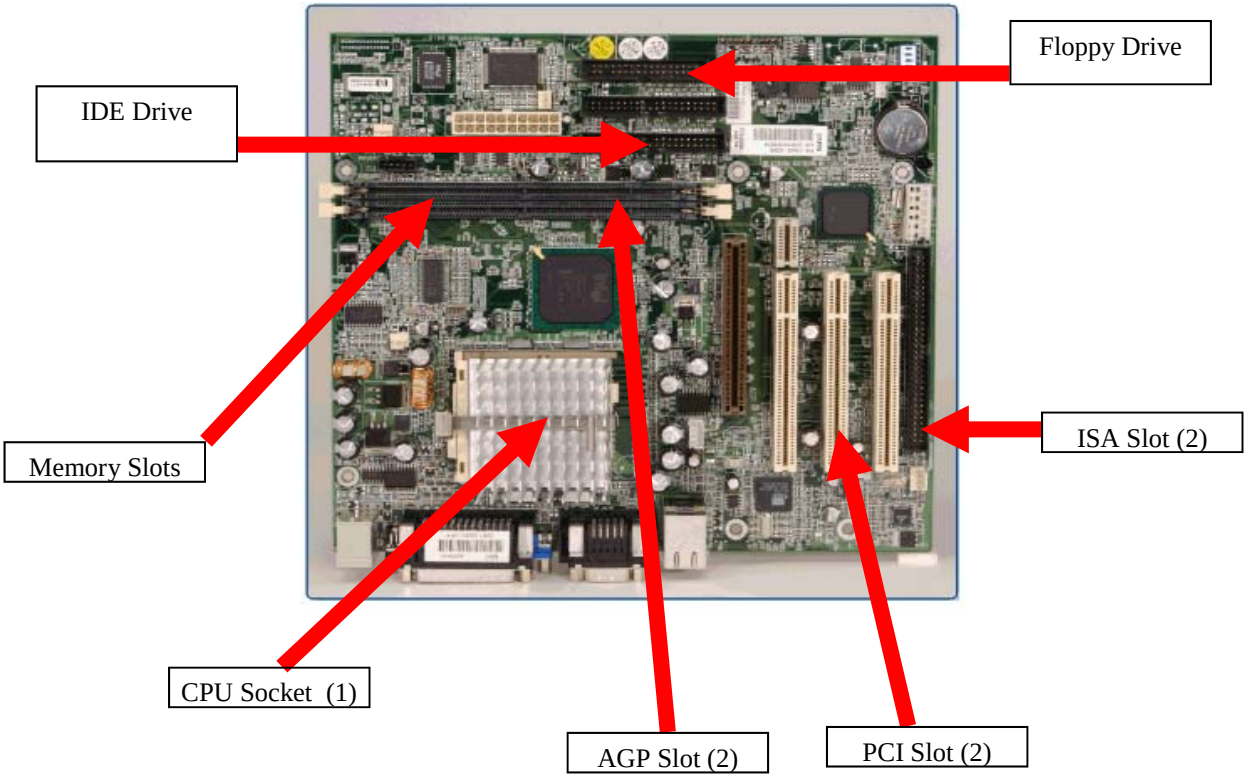
Portable Hardware

Portables are built with the intention of being lightweight and fitting within a certain size or form factor. This has led to special considerations in developing the hardware components that go into a portable computer.

PCMCIA Cards

The Personal Computer Memory Card International Association (PCMCIA) card, introduced in 1989, is a special expansion card type designed primarily to accommodate the needs of the portable computer market. Recently, the term PCMCIA has been used less often and has been replaced by the more easily spoken PC Card. There are three types of PCMCIA slots and cards:

Type I cards are 3.3mm thick and used as memory expansion units.
Type II cards are 5mm thick and are used for any expansion device except hard drives.
Type III cards are 10.5mm thick and designed to be used solely for hard drives.



1. Processors

CPU descriptions as Pentium 133, Pentium 166, or Pentium 200 are well known. These numbers are specifications that indicate the maximum (reliable) operating speed at which the CPU can execute instructions. The CPU speed is not controlled by the microprocessor itself, but by an external clock located on the motherboard. The speed of the processor is determined by the frequency of the clock signal. It is typically expressed in megahertz (MHz), and the higher the number, the faster the processor.

Socket	Processor
Socket 7	Pentium I, 75—200mhz
Slot 1	Pentium II, 233—450mhz. Pentium III, 450mhz and up.
Socket 478	Pentium IV, 1Ghz— 2.4Ghz+

2. Expansion Slots

Industry Standard Architecture (ISA)

Is a 16-bit expansion slot developed by IBM. It transfers data with the motherboard at 8 MHz. ISA slots are becoming obsolete and are being replaced by PCI slots in new systems. However, many motherboard manufacturers may still include one or two for backward compatibility with older expansion cards

The Peripheral Component Interconnect (PCI)

32-bit local bus slot developed by Intel. Since they talk to the motherboard at 33 MHz, the PCI bus slots offer a significant improvement over ISA expansion slots. PCI expansion slots are the most commonly used type in motherboards today.

The Accelerated Graphics Port (AGP)

Developed by Intel, AGP is a dedicated high-speed bus that is used to support the high demands of graphical software. This slot is reserved for video adapters. This is the standard graphics port in all new systems.

Input/Output (I/O) addresses

In addition to an IRQ, computer components also need to be assigned an I/O port number. An I/O port number is a memory address where data is temporarily stored as it moves in and out of the devices. The I/O address is very similar to a post office box. As mail comes in, it is stored temporarily in a post office box. No two boxes can have the same number or the mail can end up in the wrong box. The same is true for I/O ports. No two devices can have the same I/O address.

I/O Address	Default Device
3F8-3FF	COM 1 Serial Port
2F8-2FF	COM 2 Serial Port
3E8-3EF	COM 3 Serial Port
060-060, 064-064	Keyboard

DMA Channels.

Direct Memory Access (DMA) channels allow devices to bypass the processor and directly access the computer memory. Devices with a DMA channel assignment, as a result, gain the advantage of faster data transfers. DMA channels are typically used by high-speed communication devices for transferring large amounts of data at high speeds.

DMA Channel	Default Device
1	Sound Card
2	Floppy Disk Controller
3	Available.

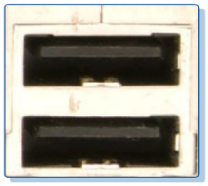
IRQ Channels.

Modern computers and operating systems owe their reliability to the organized way in which they handle internal transactions. Various hardware devices, for example, may want to tell the CPU that they have some information available that is ready for transfer. The devices indicate this by making an interrupt request, or IRQ. It is a general rule that IRQs cannot be

IRQ	Common Device
0	System Timer
1	Keyboard
6	Floppy Disk Controller
7	Parallel Port 1 (LPT1), or Sound Card (Shared)
8	Real Time Clock
12	PS/2 Mouse (Available if not used)

I/O Ports

All peripheral devices that connect to the computer such as printers, scanners, and so on, use connectors on the back of the computer known as I/O ports. An I/O port is a pathway into and out of the computer. There are different types of ports on the computer that serve different purposes.

	**Serial ports** can be used to connect devices that use a serial interface such as a modem, scanner, mouse, etc. Generally, a PC can identify up to four serial ports, but the typical computer contains only two, referred to as COM1 and COM2. The **DB-9** (9-pin) connector is used on most new computers for the serial ports.
	**PS/2 keyboard or PS/2 mouse ports** are used to connect the PC to its keyboard and mouse. Though both ports look identical, the mouse and keyboard ports are not interchangeable. Usually both ports are colour coded or labelled to avoid any confusion.
	**The Universal Serial Bus (USB)** is an external port, that allows the user to connect up to 127 external PC peripherals, including USB keyboards, mice, printers, modems, scanners, and external disk drives. USB devices can be hot-plugged (hot-swapped). This means that they can be attached while the computer is already powered up and running. USB devices are also plug-and-play.

Memory

Random access memory (RAM) is the place in a computer where the OS, application programs, and data in current use are kept so that they can be quickly reached by the processor.

The cache (pronounced CASH) is a place to store something temporarily. The type of RAM that is used for cache memory is called SRAM. SRAM is relatively more expensive, but it is fast and holds data when the power is turned off for a brief period of time. This is useful in such circumstances as an unexpected loss of power. SRAM stands for Static RAM.

Try to remember : Cache memory needs to be quick. Pretend that the S in SRAM stands for Speedy! So the type of memory used for the cache is called Speedy RAM!

Identifying SIMMs and DIMMs
A SIMM plugs into the motherboard with a 72-pin or 30-pin connector. The pins connect to the system bus, creating an electronic path through which memory data can flow to and from other system components.

A DIMM plugs into the system memory bank using a 168-pin connector. The pins establish a connection with the system bus, creating an electronic path through which data can flow between the memory chip and other system components.