

Unit 13

SCSI and USB Systems

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13.1 Introduction

In unit 8 and unit 11 you have studied various peripheral devices which are used for input and storage media. In unit 8, section 8.6 you studied Flash memory which can be externally connected to a port. You need some device to connect these devices. Also In order to achieve a greater performance in the data transmission between system and the peripheral devices, you can connect computer devices to each other with less cable. Therefore you can use Small Computer System Interface was introduced this became famous as SCSI systems (also pronounced as 'scuzzy'). In this unit you will study about SCSI devices through which you can connect your peripheral devices to computer and to each other.

SCSI is a set of standards that define commands, protocols, and electrical and optical interfaces for physical connection and data transmission between computers and peripheral devices. SCSI provided a single adapter which can operate a number of unique devices simultaneously, bonded by same signal cable. SCSI systems can handle all the devices like, CD-ROM, hard drives by a system fitted with a SCSI adapter through which they can

achieve data throughputs better than the other low-end PCs. These low-end PCs used separate adapters for each of these devices.

In this unit we will discuss on the overview of SCSI interface. We shall cover the essential installation tips of a SCSI host adapter. You can also get to know the guidelines to resolve SCSI problems.

We always wanted to have devices that do not require installation and updating the new PC device. This idea gave rise to the birth of USB. Universal Serial Bus is hardware interface that is used to attach secondary hardware devices like pen drive, hard disk, etc., in a PnP way. In this unit you will also study the general concepts of USB. You will get to know the guidelines for troubleshooting the USB in case of problems.

Objectives:

After studying this unit you will be able to:

- Understand the essential concepts of SCSI systems
- Perform installation of a SCSI host adapter
- Discuss some of the SCSI issues
- Resolve the SCSI problems through troubleshooting
- Understand the general concepts of USB
- Explain the architecture of USB
- Resolve the USB problems through troubleshooting

13.2 SCSI Systems

SCSI stands for Small Computer System Interface. It was designed to allow the peripheral devices to operate on single adapter rather than using separate adapters for each device. This increases throughput and performance of the system.

13.2.1 SCSI concepts

SCSI uses single adapter to operate number of devices simultaneously. This concept is based on device-level interfaces like Parallel and serial port. We have studied this in unit 9 and unit 10 respectively.

The PC does not bother about the name of the device attached to it. It sends the command and data to the device and waits for the device to respond. For example, the printer that was there working fine 10 years ago will work properly with the recent processor of the computer when

connected because it only works with the command and data. This means the computer peripherals and hardware components are completely free from compatibility issues because it is taken care by SCSI devices.

- **Device independence:** In order to maintain the device independence feature of the device, SCSI is both a BUS and a command set. SCSI is a bus which is a collection of cables and switches where each cable has its name and specific purpose. A command set is a limited set of instructions that is used to allow the computer and peripheral device to transmit data over the bus. For example, The SCSI *Test Unit Ready command* is used to determine if a device is ready to transfer data (read/write), i.e. if a disk spins up or the disk is ready or loaded. The example for SCSI are hard drives, optical devices, printers etc. The appearance of these devices is one and same because any old device can be easily replaced by a new device without modifications. Since the method to connect to the device is done by the peripherals device and not by microprocessor, the computer can employ some small set of instructions that flow to and fro between the peripheral and computer.
- **Bus length:** SCSI devices are connected with a 50 pin or 68-pin cable whose total length will measure the overall bus length. There are two types of SCSI devices based on the length of the buses. They are internal SCSI devices and external SCSI devices. Some of the system may have either internal or external or both.

Internal SCSI device are those that are connected to the computer through passive terminators installed in the drive. These devices are connected to a SCSI controller ribbon cable.

External SCSI devices are Inline terminators connected in series.

These devices have closed ended terminators plugged into a bus connector. When the system has only internal SCSI devices, the bus length is measured from the SCSI host adapter to the last internal SCSI device on the terminated device. When there are only external SCSI devices, the bus length is measured from the SCSI host adapter to the last external SCSI device on the terminated device. If there are both internal and external SCSI devices, then the bus length is measured from the last external device to the last internal device. With the use of short bus length the implementations of SCSI have become faster.

- **Initiators and targets:** Based on the type of SCSI bus, the devices can be initiators and targets. An initiator is a device that starts communication when something has to be done. A target is a device that responds to the initiator's commands. The organisation for initiator and target is a two way process and interactive. An initiator may become target in the course of data transfer cycle and vice-versa. There must be at least one initiator and one target in the system. Usually the SCSI adapter card will be the initiator and all the other devices like hard drives or CD-ROMs are usually the targets.
- **Synchronous and asynchronous:** SCSI needs a handshaking protocol to organise data transfer from sending end to receiving end.

There are three types of handshaking protocols. They are asynchronous, synchronous and fast synchronous.

Asynchronous protocol works like a parallel port in which whenever each byte is received it must be acknowledge and request is sent before the next byte can be sent. This type of operation leads to reliable but slow performance.

Synchronous and fast synchronous operations do not bother about request and acknowledge handshake only for data transfer. Therefore the operations will be slightly faster with a fixed amount of delay time called as offset.

The fast synchronous protocol uses shorter signals, which gives faster speed. The protocol to be used is chosen by the initiator and the target through their communications.

- **Disconnect and Reconnect:** SCSI gives features of disconnect and then reconnecting the devices again later. This feature is the main reason of SCSI desirability in the multitasking environment and allows different operations to operate simultaneously. The initiator can decide whether it can give the feature authority of disconnecting the device to the target.
- **Terminators:** It is a small resistor array which is used to enhance with SCSI signal integrity.

The SCSI cable must be terminated with a location of terminating resistor depending upon the devices that are added to the Bus. Since there is a

particular limit to the number of devices that can be added to the cable, the termination have become a big deal. They just have to add the resistor. Termination has become a very important element of SCSI setup and troubleshooting. The incorrect termination can cause lot of signal problem. There are two types of terminators, active terminator and passive terminator. Active terminator provides its own regulated power sources. This feature will influence the longer cable. Passive terminator has resistor pack that can be plugged into SCSI device.

Passive terminator is suited for short distances usually work for cable length inside the PC.

- **SCSI IDs and LUNs:** SCSI bus is designed to support eight devices at a time (hard drive, DVD drive, host adapter, Scanner, Printer, etc.) called as logical unit. A logical unit number must have its own unique ID number ranging from 0 to 7. The SCSI IDs are the set for SCSI adapter. Each SCSI device uses jumpers or DIP switches (A series of tiny switches built into circuit boards which helps us to configure a circuit board for the specific types of the computer or the applications.). Generally the SCSI adapter is set for ID7 (SCSI ID 7 is the preset SCSI ID for the SCSI host bus adapter giving it the highest priority on the SCSI bus), the primary SCSI hard drive is set to ID0 (it is the standard ID used for an internal drive) and the secondary SCSI hard drive is set to ID1 (low priority comparatively). From ID2 to ID6 are the unique ID numbers in which the other devices can be placed.

A logical unit number or LUN is a number used to identify a logical unit, which is a device addressed by the SCSI protocol or similar protocols. Logic unique numbers (LUNs) are similar to SCSI ID that is used to identify a logical unit. LUNs indicate devices within devices. Every SCSI ID from 0 to 7 can have up to eight LUNs that mean there can be eight sub devices for every given device ID. You can also make your device ID consisting of more than eight sub devices. For example, suppose you have three hard drives E:, F: and G:, ID2 can be used by all three drives but E: can be assigned to LUN0, F: to LUN1, G: to LUN2. Unfortunately, an SCSI user cannot decide randomly to use LUNs assignment because there must be a hardware designed for that purpose. If you have a device that uses LUNs like CD juke box, you may need to enable LUNs support in the host adapter's bios or device drivers.

- **Bus Configuration:** As we know, SCSI uses single ended cabling that support an eight bit data bus also known as A-cable. This eight bit data Bus is a 50-pin assembly. SCSI cable with 50-pin single ended system consists of 3 major sections. They are ground wire, data signal and control signal. The brown line is carried by at least half of the single ended interface. There are eight data lines from D0 to D7 and one data parity bit (DPAR). The parity bit is always an odd number in SCSI. There are four terminator power lines (TERM PWR) and nine control signal wire.

The following will explain each of the signals:

- C/D - Control/Data: This signal is target driven that allows the target device to select whether it will be returning a command or data to the initiator.
- I/O: This signal is target driven that allows the target device to determine whether it will be receiving the data or sending the information along the data Bus.
- MSG - Message: This signal is target driven that allows the target device to send coded status or error messages back to the initiator during the message portion of SCSI Bus cycle.
- REQ - Request: This signal is data strobe signal that is also target driven which allows a potential target device to obtain data on the Bus.
- ACK - Acknowledge: This signal is initiated driven which is also called as data strobe signal that is sent in response to target! REQ signals that inform the target device that it has gained the use of the Bus.
- BSY - Busy: This signal is either target driven or initiated driven. This signal allows the device to inform the Bus that the target device is busy
- SEL - Select: This signal is neither target driven or initiated driven that is used by an initiator to select a target device.
- ATN - Attention: This signal is initiator driven that is produced by the initiator which informs the target device that initiator has message ready. The target should switch to the message phase.
- RST - Reset: This signal is target driven or initiator driven and is strobe signal that triggers a Bus-wide Reset off all devices. Usually only one device produces a reset signal.

13.2.2 Installing a SCSI system

Ideally SCSI host adapters are PnP devices that can automatically detect the resource connected to the PCI slot. Problems occur because of incorrect hardware or software installations. In this section, you will understand the overview of SCSI adapter installation process and SCSI BIOS setup.

- *Internal Hardware installation:* you need to install the SCSI host adapter and connected to at least one SCSI device.

You must follow the steps below to perform installation of a typical SCSI host adapter:

1. Switch off the computer and unplug it.
2. Unbolt the case and detach the screws and keep it in a safe place.
3. While replacing the SCSI host adapter with new one, remove the older device carefully and keep it on a antistatic surface or antistatic bag.
4. Identify the new SCSI host adapter which is usually connected to PCI slot or ISA slot. Remove the cover of the new slot and keep the screw in a safe place.
5. Insert the SCSI host adapter card slowly and firmly inside the slot. Fix the screw to tighten the bracket.
6. Connect the computer's drive activity LED cable to the suitable connector of the SCSI card.
7. You should ensure that all the other bus connections are proper if needed.

You should have proper terminator for SCSI bus and no SCSI IDs. The SCSI IDs of each SCSI device must be verified and the termination end point must be properly checked.

- *Software Installation:* Any hardware requires the appropriate software available for proper execution of the device. You must install the necessary device drivers for the SCSI device you have installed.

You need to follow the instructions below to properly install the software to the windows.

1. It should automatically detect the SCSI device when windows start up.
2. Click on Driver which is provided by the device manufacturer in the Disk. Then click OK.

3. Driver CD should be inserted into CD ROM, then select CD-ROM drive. Then click OK. This will load the SCSI drivers into the windows
4. Once loading is finished verify for installation success. When your desktop returns then Click start → highlight settings → click control panel.
5. Next double click on the system icon → click the Device Manager Lab.
6. Double click on the SCSI Controllers branch to expand it.
7. Now it is possible to see that your new SCSI host adapter is listed in the system properties. If you can see the name of the device drivers then it means that your new device is installed properly. If not, then you need to check the installation.
8. Once you get to see the device in the system properties you can now exit the Device Manager and start the use of your SCSI adapter.

13.2.3 SCSI considerations

While adding or upgrading the SCSI support on your computer you must consider the four important elements. They are the SCSI peripheral, the SCSI host adapter, the SCSI cable assembly, and the SCSI software driver. If any of these elements is missing, then the installation will suffer from problems.

- **The SCSI peripherals:** you need to find out the compatible devices with the architecture of the SCSI controller such as SCSI hard drive or CD-ROM. You must know about the wide range of SCSI ID settings of each of the SCSI device. The peripheral device must be flexible to run on any of the eight SCSI IDs (0-7). SCSI peripheral should support SCSI parity.

We must be sure about the type of SCSI devices as the SCSI devices are of two types such as internal and external. If you use internal SCSI device then there must be enough space inside the PC to fit the device inside. If you are using external device then there should be two SCSI connectors on the adapter to allow the chain connectivity for adding devices later. Device drivers must be compatible with the same standard protocol used by adapters. Compatibility is an issue because if the device drivers are not compatible then it will not work properly. The peripheral you are using must offer built-in cable termination.

- **SCSI host adapter:** SCSI host adapter is an important device. The adapter chosen should be compatible with the existing PC bus. It should support the standards. The adapters must be flexible enough to work with all SCSI IDs from 0 to 7. The host adapter also requires device driver to run properly. Therefore, the same standard device driver must be used that is compatible with the host adapter.
- **SCSI cables:** Though the recent cabling is highly standardised, check for proper cabling. While choosing the peripherals, be aware of the cable requirement. Don't use specialized cables because all devices may not support them. Keep the cable length short and use the good quality cabling. You must also take care of termination and end point of cabling. The termination and ending of the cables must be thoroughly checked and verified.
- **SCSI drivers:** Device driver provides instructions that allow the SCSI host adapter to communicate with the PC as well as with the peripherals. The peripheral as well as host adapter requires device drivers to operate. Therefore you must use the same standard device drivers that are compatible to the devices.

13.2.4 Troubleshooting

In many cases, the troubles are caused during installation, setup, and operation of the devices that is on the bus. When you are installing a device, install one by one then you will have less problems. You must first check the host adapter SCSI BIOS initialization message. If you don't find the initialization message when you switch on the computer then it is sure that there is some problem with system SCSI host adapter. This means that either the adapter is installed properly or device itself is defective. If this test is passed in the SCSI checking them probably the problem is in the driver installation. You must ensure that any old CMOS settings are mapped wrongly to the new device. Then you need to unselect the settings. Below are the general tips or checklist for troubleshooting the SCSI device in the following.

- You must ensure the power supply of the computer is sufficient enough to handle all the SCSI devices in the computer.
- The quality of the cable must be good and securely attached to each device.

- The orientation of each connector on the SCSI cable must be verified properly.
- SCSI ID of the device must be properly selected. You must make sure that duplicate IDs are not allowed unless LUNs designations are used.
- You must ensure that the two ends of the cable must have proper terminations and should have active terminators.
- You must verify for the proper configuration of SCSI controller. There must be no conflicts in the SCSI controller in case of IRQs, BIOS addresses, or I/O. you must check the SCSI host adapter BIOS. The SCSI BIOS can be disabled if you are not using SCSI hard drives in booting. This decreases the problem related to performance or compatibility issues can be solved.
- You must check for CMOS setup for drive configuration. If the SCSI drives are in the system and IDE drives are not in the system then make the drive entries under CMOS as “none”.
- You need to check for the PCI slot containing the SCSI host adapter is active or not and ensure that it is using the unique IRQ.
- You need to check the DOS drivers for host adapter and non HDD devices are installed properly in CONFIG.SYS and AUTOEXEC.BAT. CONFIG.SYS is the primary configuration file for the DOS and OS/2 operating systems. It is a special file that contains setup or configuration instructions for the computer system. AUTOEXEC.BAT is a root directory batch file that is responsible for executing commands at system start up.
- You need to check for the protected mode drivers if you are working under windows. You must see that any necessary protected drivers for the host adapter and SCSI devices are installed properly.

Self Assessment Questions

1. _____ is a set of standard that define commands, protocols and electrical and optical interfaces for physical connection and data transmission between computer and peripheral devices.
2. SCSI stands for _____.
3. SCSI devices use _____ cable to get connected.
4. SCSI needs _____ protocol to organize data transfer from sending end to receiving end.

5. _____ is a small register used to enhance with SCSI signal integrity.
6. _____ indicate devices with in devices.
7. You don't need to install SCSI host adapter and no need to connect any SCSI device in order to configure SCSI. (True/False).

13.3 USB systems

Universal serial Bus (USB) is a serial Bus standard for connecting the device to the computer without installing the driver when the computer is shut down and restarted. It is termed as intelligent serial interface and a technology for high speed data transfer over cable. USB is often used for connecting keyboard, mouse and portable data storage devices to the computer. It is very user friendly when compared to alternative port such as parallel and serial port.

In this section you will study the general concept of USB and get to know the troubleshooting procedures to solve the problems with implementation and performance on windows platform. You will also study the architecture of USB.

13.3.1 USB Concept

The USB interface simplifies the problem faced by external peripheral devices such as printer, scanner, drive, etc due to integration. Using USB interface you can directly pin the devices to the computer. The USB is a hardwired connection linking two or more hardware components within a computer system and is designed to provide a fast and functional means for adding external components to a PC. With the help of USB there is no need to install and reconfigure the system of a dedicated computer. Computer peripherals automatically configure as soon as they get attached to the computer without rebooting a system or executing the CMOS setup routine.

USB allows up to 127 USB devices to run simultaneously on computer.

USB devices: Each USB device has the same potential as every bit, as diverse as the personnel computer itself. Some of the devices that is designed for USB in the computer are telephones, modems, keyboards, mouse, CD-ROM drives, joystick, scanners, digital cameras and printers. Additional to these devices USB's 12Mbps/s data rate supports other peripherals such as MPEG-2 video (MPEG-2 is a standard for the generic

coding of moving pictures and associated audio information. It describes a combination of lossy video compression and lossy audio data compression methods which permit storage and transmission of movies using currently available storage media and transmission bandwidth.) Based product, data gloves (device which is in a form of gloves with concept of virtual reality measure the movements of the fingers who wear the gloves and transmits them to computer) and digitizer(it is device for converting analog signals into digital signals which combines two operations of sampling the input data and quantizing samples). USB also acts as DSL interface (Digital Subscriber Line) and accommodate cable modem. DSL is a technology that provides data transmission over the telephone network without interfering with the voice service.

- **Implementing USB:** It is simply a matter of attaching a USB hub such as USB keyboard and then attaching USB device to the hub. If there is no USB available in the system. You will need to upgrade the motherboard to a chipset that contains USB-complaint. Once the new motherboard is placed USB device can be attached.
- **Enabling USB:** BIOS control the USB port on the motherboard that enables through the system CMOS setup utility. you can locate the USB configuration setting section once you enter the CMOS setup. You can find these settings under input output port configuration menu or peripheral setup menu. Enable the USB ports, before using the USB
- **Types of USB host controller:** There are two types of USB host controller. They are UHCI (Universal Host Controller Interface) and OHCI (Open Host Controller Interface). These types are responsible for having an impact on USB device compatibility. UHCI is a register level interface that enables a host controller for USB or fireware hardware to communicate with a host controller driver in the software. OHCI is a register level interface to assure software works properly with any hardware. OHCI does not support all the USB devices USB devices often work fine with UHCI. For example, sometimes you find that a USB peripheral may not function properly in any USB port that is when you attempt to use it Compaq USB camera with an OHCI, the camera may not get detected or may not work properly. This probably means that your camera is designed to work on the UHCI host controller and not

supported on OHCI controller. OHCI host controller has optimization feature that allow multiple transaction submitted in a single frame whereas UHCI host controller send only a single transaction per frame. This means your camera cannot respond to a second transaction within a second frame.

In order to find the type of the USB host controller in your computer you must use the following steps,

1. You need to click start → settings → control panel
2. Double click on the system icon and select the Device Manager tab
3. Expand the universal serial Bus entry by clicking the plus sign (+) in front of it. This is to be done to see controller information dialogue.
4. Locate UHCI or OHCI on the dialogue box.

USB Features

You can list few of the features of USB as follows,

1. When USB device connects to a computer, the computer acts as the host device.
2. You can connect up to 127 devices to the host using USB.
3. The USB 2 has the maximum data rate of 480 megabits per second. USB 2.0 is an external serial interface used on computers and other digital devices to transfer data using a USB cable. The designation 2 refers to the standard or version of the USB interface.
4. You can connect two wires of the USB cable to power supply. One wire for voltage supply and other wire for grounding.
5. For low power devices like keyboard, mouse they can be directly connected to the computer and draw their power supply from the BUS. High power devices such as printer, scanners have their own power supplies and draw minimum power from the BUS.
6. You can plug the USB devices into the BUS and unplug them at any time.
7. When the computer goes to power saving mode the USB devices can automatically put to sleep mode by the host computer.

13.3.2 USB Architecture

USB is a connection with two points in which one point is a master on host and another point works as slave. Host is usually a computer that may have 127 slaves connected at a time. Computer has 2 to 4 USB connectors but hub number may increase up to 127.

The USB system architecture consists of three main components they are Host computer, USB device and USB cable.

- **HOST computer:** It controls the communication between the computer and USB devices. There are two layers in the host computers. They are USB host controller hardware layer and a software layer. The software layer includes USB device drivers for a wide range of USB peripherals such as keyboards, mice, digital still cameras, scanners, mass storage devices etc.

USB hardware layer is responsible for the following

- ✓ To Detect the attachment and remove the USB devices
- ✓ Monitor device status and collect activity statistics
- ✓ Provide power to attached USB devices
- ✓ Manages control and data flow between the USB host and USB devices.
- ✓ Checks the basic validity of bus transactions

USB software layer is responsible for the following

- ✓ Handles USB devices and their connectivity
- ✓ USB devices enumeration and configuration
- ✓ Appropriate device drives will be loaded.
- ✓ Power management on the bus and bus bandwidth
- ✓ Manages the data transfer between the software and hardware

USB Devices: These devices are the peripherals of the computers that communicate with the host computer using USB protocol. Some of the devices are flash Drive, MP3 player, image still camera, video camera, etc. Additional to this, there is special type of USB device called as USB hub that gives the additional attachment points to connect more peripherals. USB Hub is a device that has multiple USB ports which is used to plug the various USB devices and other hubs.

USB Cable: cable is a wire that is used to connect host computer and USB device.

Figure 13.1 shows a USB cable.



Figure 13.1: USB cable

The maximum length of standard USB cable limits to 5 meters for high speed devices and 3 meters for low speed devices. The reason behind using short cable length is the maximum allowed delay of the signal is limited to shorter time above which the connection will be lost. Practically, some USB devices may work with longer than specified cable. When longer cable is used it may decrease the signal quality provided by the USB bus. This avoids the USB device to work properly or may not work at all.

13.3.3 Troubleshooting

Usually USB problems are not severe. But still there are few steps which can control these small problems such as hardware failure, device driver's configuration problems, cabling problems, firmware/BIOS problems, Root hub configuration problems, etc.

The steps are as follows:

- ✓ **Hardware failures or Configuration problems:** There may be some hardware problems such as high or low power, limited bandwidth, malfunctioning, etc. In this case, make sure that the root is working properly through the Device Manager. If you find an exclamation mark in a yellow circle or triangle along with root hub then it means there is some error. USB Root Hubs are both physical and virtual installation ports that can be found on your computer that are used for implementing and installing additional hardware files and components to your computer's hard drive. You need to verify that the BIOS assign the Interrupt request line (IRQ) to the root USB controller. This is very important as it loads the device drivers. If the devices are not working when you plug the device to a root hub then check the power requirement of the bus. If the device tries to draw more power than the

capacity of the bus then the device don't work. Otherwise if the port gets less power, then port is not at all active. Then also it will not work.

- ✓ **Device driver configurations problems:** when the device is connected to the root hub, it should automatically load and configure the device without even asking a device driver. If the computer prompts you for device driver then you need to enquire with the manufacturer of the device that the windows you are using support the specific device.
- ✓ **Cabling problems:** USB has two types of cables. They are high speed and low speed cables. If you plug high speed cable in to a low speed cable, then it can cause signal distortion over a long distance. The major difference between the two types of cabling is their shielding.
- ✓ **Firmware/BIOS problems:** Firmware is software that is stored permanently inside the ROM. It is the key to all USB devices. All the information about the device is present in the device's firmware. Port reset itself once the descriptors in the firmware are loaded into the system. Verify the root hub and you must have up-to-date firmware for both BIOS and USB device. Malfunctioning of firmware results in loading the second copy of the device in the Device Manager. When you remove and insert the device, the device becomes available again and appears as the second instance of the same device. When you find this you must verify that you have the most up-to-date firmware for that device.
- ✓ **Root Hub Configurations Problems:** This problem is related to computer set up. IRQ line need to be assigned by an USB controller in the computer BIOS. You must assign the IRQ through CMOS setup.

Self Assessment Questions

8. Which devices are termed as intelligent serial interface?
9. UHCI stands for _____.
10. The two types of cables are _____ and _____.
11. State whether the following statement are true or false
 - a. Hardware problems are due to high or low power and limited bandwidth

- b. When the USB device is connected to the root hub we need to load the device drivers and configure the device by using drivers in the disk.
- c. Firmware is antivirus software.
- d. Root hub configuration problem is a problem related to computer set up.

Activity 1

What will you do when you find the PC hangs when working with USB?

Hint: Refer the concept of USB symptoms under the book on troubleshooting, maintaining, and repairing PCs by S. J. Bigelow

13.4 Summary

SCSI is a set of standards that define commands, protocols, and electrical and optical interfaces for physical connection and data transmission between computers and peripheral devices. The computer peripherals and hardware components are completely free from compatibility issues because it is taken care by SCSI devices. Installation of SCSI devices is very easy because it is similar to PnP devices. The different checklist can be used to verify the installation of SCSI devices. It is very easy to troubleshoot the connectors and wires since it will not give much trouble. The trouble may cause during installation, setup, and operation of the devices that is on the bus.

Universal serial Bus (USB) is a serial Bus standard for connecting the device to the computer without installing the driver when the computer is shut down and restarted. USB allows up to 127 USB devices to run simultaneously on computer. USB is a connection with two points in which one point is a master on host and another point works as slave. Host is usually a computer that may have 127 slaves connected at a time. Computer has 2 to 4 USB connectors but hub number may increase up to 127. The USB system architecture consists of three main components, Host computer, USB device and USB cable.

Though the USB problems are not severe, there are few steps which can control these small problems such as hardware failure, device driver's configuration problems, cabling problems, firmware/BIOS problems, Root hub configuration problems, etc.

13.5 Glossary

Term	Description
Firmware	Is a software that are stored permanently inside the ROM.
Root hub	Are both physical and virtual installation ports that can be found on your computer that are used for implementing and installing additional hardware files and components to your computer's hard drive.
USB hub	Is a device that has multiple USB ports which is used to plug the various USB devices and other hubs.
DSL	Is a technology that provides data transmission over the telephone network without interfering with the voice service.
MPEG-2	Is a standard for the generic coding of moving pictures and associated audio information. MPEG-2 (Motion Picture Experts Group – 2) is a compression standard for digital television. It enables digital television broadcasters to transmit video streams with higher resolution and audio streams with higher quality sound while using as little bandwidth as possible.

13.6 Terminal Questions

1. Explain the SCSI concepts in detail.
2. Describe how to perform installation of SCSI system.
3. Write the steps involved in troubleshooting procedure in SCSI system.
4. Explain the essential concepts of USB system
5. Describe the working of USB.
6. What are the general procedures for troubleshooting USB?

13.7 Answers

Self Assessment Questions

1. SCSI
2. Small Computer System Interface
3. 50 pin or 68-pin
4. Handshaking
5. Terminator
6. LUN
7. False
8. USB

9. Universal host controller interface
10. High speed and low speed
11. a. True
b. False
c. False
d. True

Terminal questions

1. Refer section 13.2.1, SCSI concepts
2. Refer Section 13.2.2, Installing a SCSI system
3. Refer Section 13.2.4 troubleshooting
4. Refer section 13.3.1, USB concepts
5. Refer section 13.3.2, SCSI architecture
6. Refer Section 13.3.3, troubleshooting

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