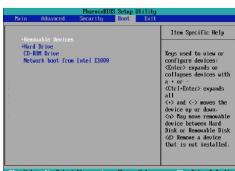


BIOS - Basic Input/Output System



- Configure boot order (DVD-ROM, Hard drive, etc.)
- Enable and disable system components
- Backup all settings before upgrading
- BIOS is software (firmware)
- BIOS settings are stored in the CMOS (Complimentary metal-oxide semiconductor)
- CMOS configuration is maintained with a battery on the motherboard

Motherboards

ATX

- Standardized by Intel in 1995
- Still very popular

microATX

- Small Form-Factor (SFF)
- Backward compatibility with similar mounting points and power connections as a full-size ATX motherboard

ITX form-factor

- Various Small Form-Factor (SFF) sizes

Expansion Slots and Bus Speeds

PCI

Legacy expansion slots - Speeds from 133 MB/s to 533 MB/s

PCI-X (PCI Extended)

- Designed for servers (this is not PCI Express)
- 1,064 MB/s throughput

PCI Express (PCle)

- Serial communication - x1, x2, x4, x8, x16, x32 lanes
- High performance for devices like high-end graphics adapters
- PCI Express throughput per-lane in each direction
 - Speeds from 250 MB/s to 2 GB/s

AGP (Accelerated Graphics Port)

- Covers the gap between PCI and PCI Express
- AGP 1x (266 MB/s), AGP 2x (522 MB/s),
AGP 4x (1.07 GB/s), AGP 8x (2.1 GB/s)

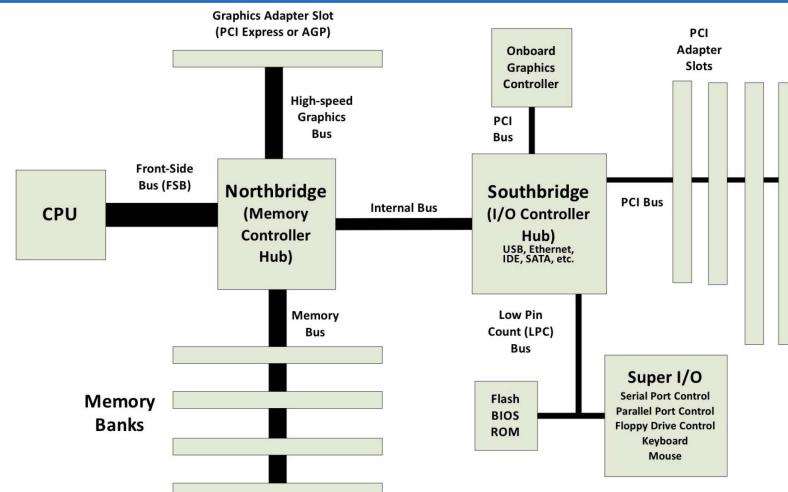
Custom Configurations

Workstation	Processor	Video	RAM	Storage	Audio	Notes
Graphics / CAD / CAM	✓	✓	✓			Maximum RAM
Audio/Video Editing		✓		✓		Fast storage, dual monitors
Virtualization Workstation	✓		✓			Maximum CPU and RAM
Gaming PC	✓	✓			✓	High-end cooling
Home Theater PC		✓			✓	HDMI, surround sound, TV tuner
Standard Thick Client						Recommended Windows requirements
Thin Client						Basic applications

Chipsets

Northbridge

- Manages the connection between the CPU and memory
- May also connect high-end graphics such as AGP or PCI Express



Southbridge

- Relatively slower connections
- USB, Ethernet, PATA, SATA, etc.

Newer CPUs integrate the Northbridge

- Processor cores
- Memory controller
- Graphics processing unit (GPU)

Memory Types



72-pin SIMM (Single In-line Memory Module)

- Electrical contacts are the same on both sides



184-pin RIMM (Rambus Inline Memory Module)

- Proprietary memory type from Rambus
- Every memory slot must be filled with a Continuity and Termination RIMM (CT-RIMM)



DIMM (Dual In-line Memory Module)

- Electrical contacts are different on each side
- SDRAM - 168 pins
- DDR SDRAM - 184 pins
- DDR2 and DDR3 SDRAM - 240 pins



SO-DIMM (Small Outline Dual In-line Memory Module)

- Used almost exclusively in laptops and mobile devices
- DDR and DDR2 SDRAM - 200 pins
- DDR3 SDRAM - 204 pins

ROM (Read-Only Memory)

- Can't be changed or erased

PROM

(Programmable Read-only Memory)

- Programmable ROM
- Write once

EPROM (Erasable PROM)

- Write / Erase / Write again

EEPROM (Electrically Eraseable PROM)

- Flash memory

SRAM (Static RAM)

- Maintains data without constant refreshing
- Very fast, very expensive
- Used often in processor caches

DRAM (Dynamic RAM)

- Requires constant refreshing to maintain data

SDRAM (Synchronous Dynamic RAM)

- Synchronous with the common system clock

DDR (Double Data Rate SDRAM)

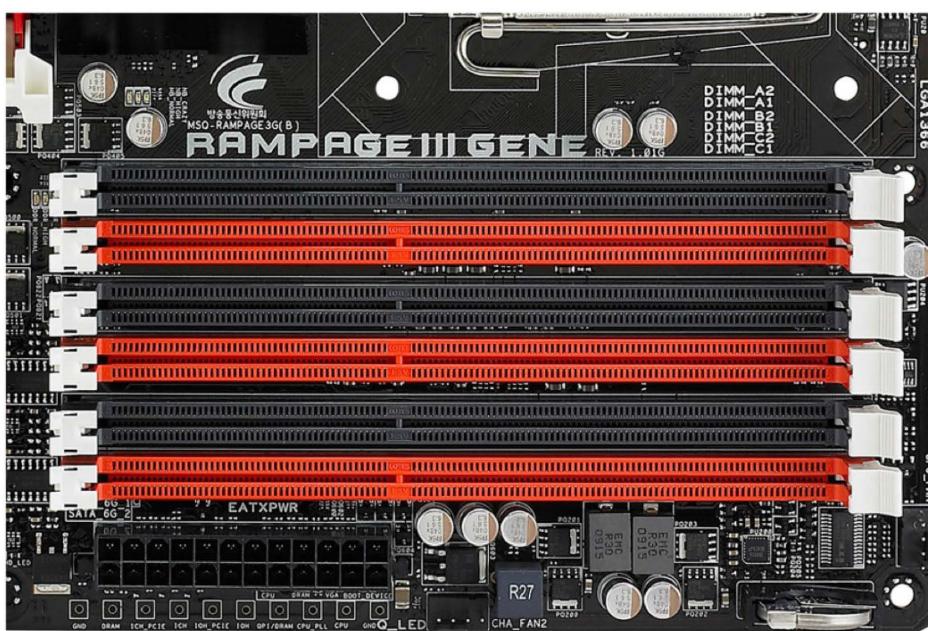
- Twice the data rate of SDRAM
- Used often in processor caches

DDR2 (Double Data Rate 2 SDRAM)

- 2x the bus clock multiplier of DDR

DDR3 (Double Data Rate 3 SDRAM)

- 4x the bus clock multiple of DDR



Parity Memory

- Additional parity bit
- Can't correct an error

Error Correcting Code (ECC) Memory

- Detects errors
- Corrects on the fly
- Ideal for servers

Multi-channel memory

- DDR RAM
- Installed in pairs or trios for maximum throughput
- Memory channels have identical colors

Installing Expansion Cards

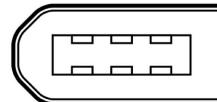
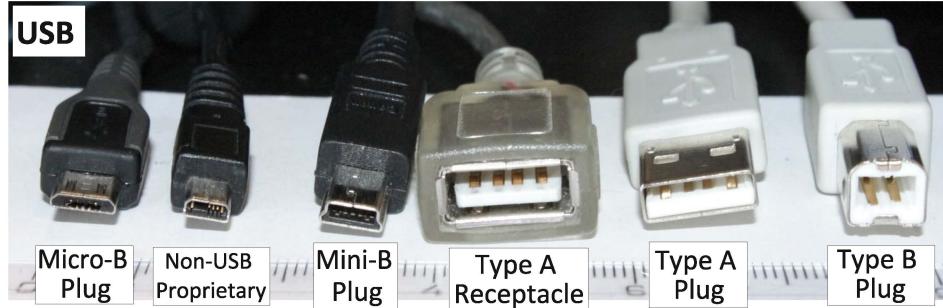
- Check your motherboard documentation to determine number and type of slots
- Check adapter card documentation for hardware and software requirements
- Use ESD strap, anti-static bag, and other electrostatic discharge precautions
- Confirm driver installation through Windows Device Manager

Optical Formats

- CD - 700 MB
- DVD - 4.7 GB (single layer), 8.5 GB (dual-layer)
- Blu-ray - 25 GB (single layer), 50 GB (dual-layer)
- ROM - Read-only memory - Cannot write to media
- RW - Read-write - Used for backups

Connectors

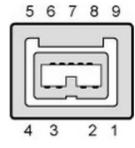
USB



6-pin Alpha (powered)



4-pin Alpha (unpowered)



9-pin Beta (powered)



DVI
Analog and Digital Video



HDMI Digital Video and Audio



VGA
15-pin DB15 Analog Video



Component and Composite Analog Video with
RCA Connectors



DisplayPort and Mini DisplayPort
Digital Video and Audio



BNC Connectors



S-Video 4- or 7-pin Analog Video



IEEE 1394 / FireWire



PS/2 - Keyboard and Mouse



Serial - 9-pin DB9



Parallel - Centronics Connector
Printer Connection



RJ-45 Ethernet



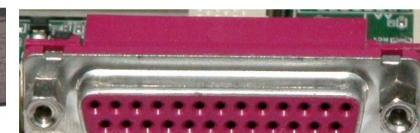
RJ-11
Phone/Modem



TRS - Tip/Ring/Sleeve
Analog Audio Cable



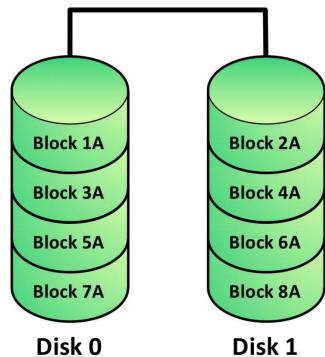
TRS - Tip/Ring/Sleeve
Analog Audio Jacks



Parallel - DB25 Connector
Computer Connection

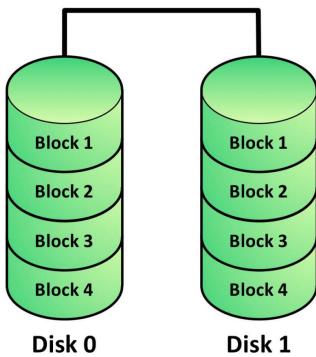
RAID (Redundant Array of Independent Disks)

RAID 0 - Striping



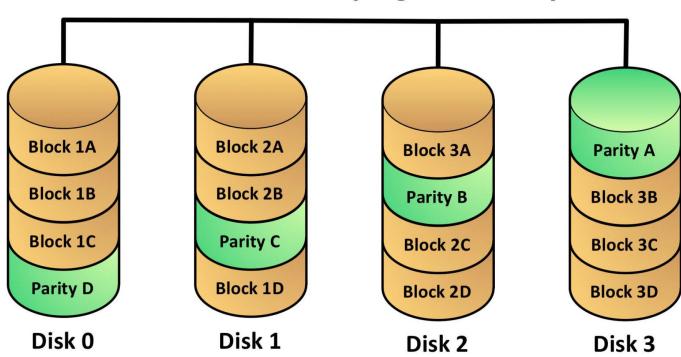
- File blocks are split between physical drives
- High performance
- No redundancy
- Minimum of 2 drives

RAID 1 - Mirroring



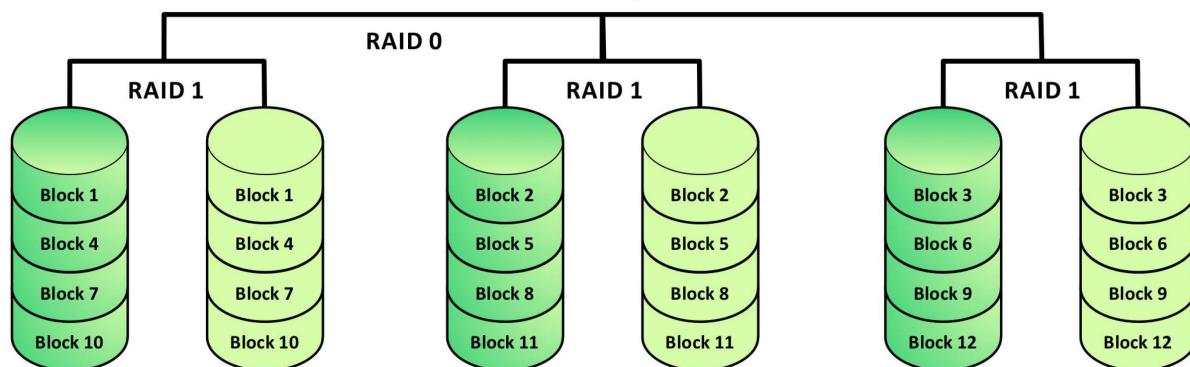
- File blocks are duplicated between physical drives
- High disk space utilization
- High redundancy
- Minimum of 2 drives

RAID 5 - Striping with Parity



- File blocks are striped along with a parity block
- Efficient use of disk space
- High redundancy
- Minimum of 3 drives

RAID 1+0 - A Stripe of Mirrors



- Stripe file blocks across mirrored drives
- High disk space utilization
- High redundancy
- Minimum of 4 drives

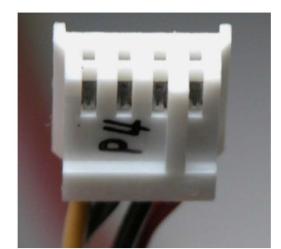
Intel CPUs and Sockets

Socket	Pins	Type	Supported CPUs	Supported Memory
Socket T	775 pins	LGA	Later Pentium 4s and Core 2	DDR2 / DDR3
Socket B	1,366 pins	LGA	Core i7	DDR3 (triple-channel)
Socket H	1,156 pins	LGA	Core i3/i5/i7 (Nehalem)	DDR3 (dual-channel)
Socket H2	1,155 pins	LGA	Core i3/i5/i7 (Sandy Bridge)	DDR3 (dual-channel)

AMD CPUs and Sockets

Socket	Pins	Type	Supported CPUs	Supported Memory
Socket 940	940 pins	PGA	Athlon 64 FX	DDR (dual-channel)
Socket AM2	940 pins	PGA	Athlon 64 (FX, X2) / Phenom Xx	DDR2 (dual-channel)
Socket AM2+	940 pins	PGA		
Socket F	1,207 pins	LGA	Athlon 64 FX	DDR2 (dual-channel)
Socket AM3	941 pins	PGA	Athlon II / Phenom II	DDR2/DDR3 (dual-channel)
Socket AM3+	942 pins	PGA		
Socket FM1	905 pins	PGA	A Series / Athlon II	DDR3 (dual-channel)

Power connectors



Interface Speeds and Distances

USB - Maximum of 127 ports

USB 1.1

- Low speed: 1.5 megabits per second, 3 meters
- Full speed: 12 megabits per second, 5 meters

USB 2.0

- 480 megabits per second, 5 meters

USB 3.0

- SuperSpeed: 5 gigabits per second, 3 meters

802.11a

- 5 GHz, 54 Mbit/s, 120 meters

802.11b

- 2.4 GHz, 11 Mbit/s, 140 meters

802.11g

- 2.4 GHz, 54 Mbit/s, 140 meters

802.11n

- 5 GHz and/or 2.4 GHz, 600 Mbit/s, 250 meters

FireWire 400 (Alpha mode) - IEEE 1394a

- 100, 200, or 400 Mbit/s half-duplex
- 4.5 meters (15 feet), 72 meters max

FireWire 800 (Beta mode) - IEEE 1394b

- 800 Mbit/s full-duplex
- Optical connections - 100 meters max

IrDA

- 4 Mbit/s speed
- Line of sight, 1 meter

Bluetooth

- Version 2.0 + EDR, 3 Mbit/s
- 10 meters for Class 2 devices
- 1 meter for Class 3 devices

PATA

Maximum cable length: 18 inches

- Ultra ATA/33 - 33 MBps
- Ultra ATA/66 - 66 MBps
- Ultra ATA/100 - 100 MBps
- Ultra ATA/133 - 133 MBps

SATA

- Revision 1.0 - 1.5 Gbit/s, 1 meter
- Revision 2.0 - 3.0 Gbit/s, 1 meter
- Revision 3.0 - 6.0 Gbit/s, 1 meter

eSATA

- Matches the associated SATA revision
- 2 meters

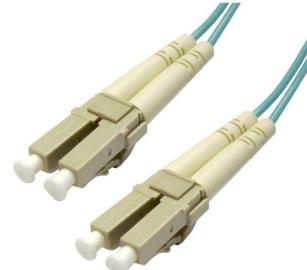
Network Connectors



Fiber optics with ST Connector



Fiber with SC Connector



Fiber with LC Connector



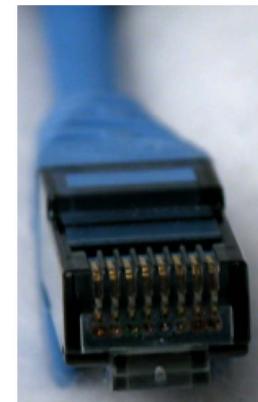
BNC Connector with RG-58 Cable and Terminator



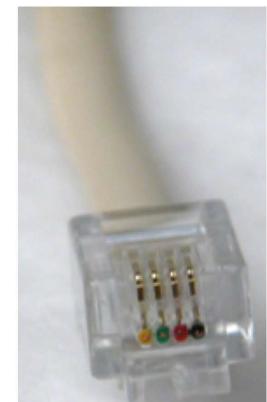
RG-6/U Cable with F-connector



F-connector



RJ-45 Cable



RJ-11 Cable

TIA/EIA 568A

1	White and Green
2	Green
3	White and Orange
4	Blue
5	White and Blue
6	Orange
7	White and Brown
8	Brown

TIA/EIA 568B

1	White and Orange
2	Orange
3	White and Green
4	Blue
5	White and Blue
6	Green
7	White and Brown
8	Brown

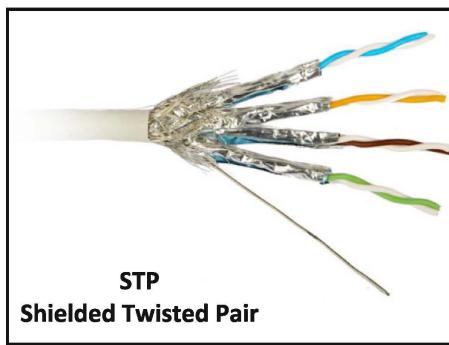


Pin assignments from the EIA/TIA-568-B standard

Network Connectors

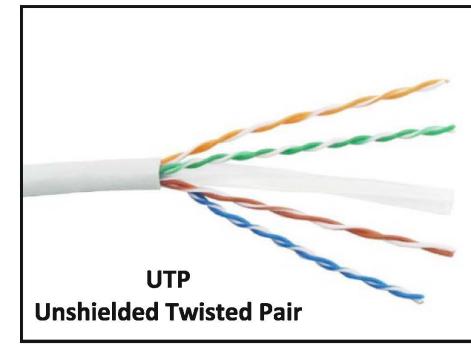
Multimode Fiber

- Short-range communication, up to 2 km



Single-mode Fiber

- Long-range communication, up to 100 km

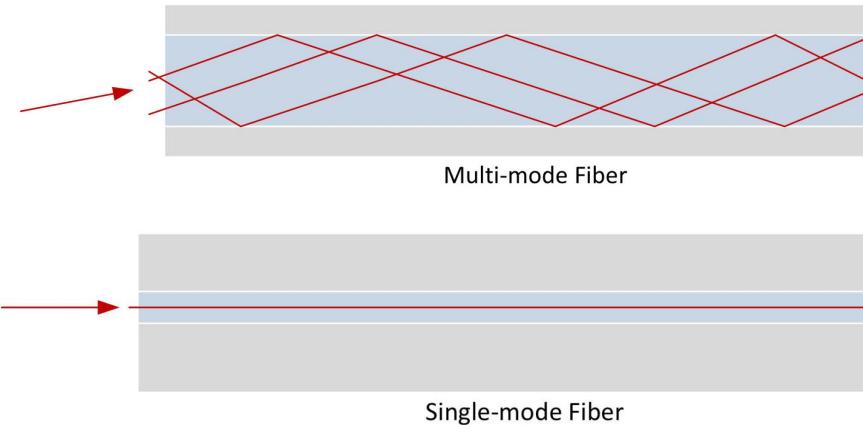
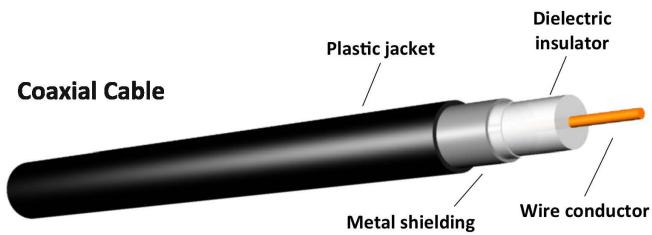


Twisted pair copper cabling

- STP (Shielded Twisted Pair)
- UTP (Unshielded Twisted Pair)
- Plenum-rated cable
 - Fire-resistant cable jacket

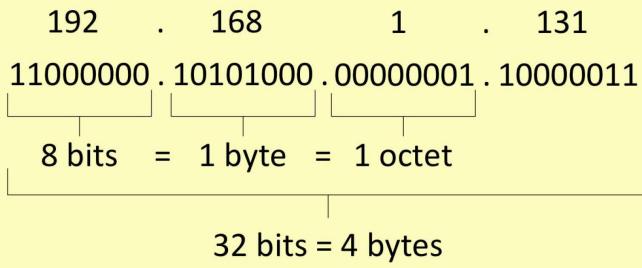
Coaxial cabling

- Older Ethernet networks (RG-8/U)
- Broadband Internet (RG-56)
- Short-distance video (RG-59)



TCP/IP Addressing and Subnets

IPv4 Addressing



IPv4 Classes

Class	Leading Bits	Number of Networks	Hosts per Network	Default Subnet Mask
Class A	0xxx 1-126	128	16,777,214	255.0.0.0
Class B	10xx 128-191	16,384	65,534	255.255.0.0
Class C	110x 192-223	2,097,152	254	255.255.255.0

IPv4 TCP/IP Addressing

- 32 bit addresses

IPv6 TCP/IP Addressing

- 128 bit addresses

RFC 1918 Private Addresses

- Used on private networks
- Not routable over the Internet

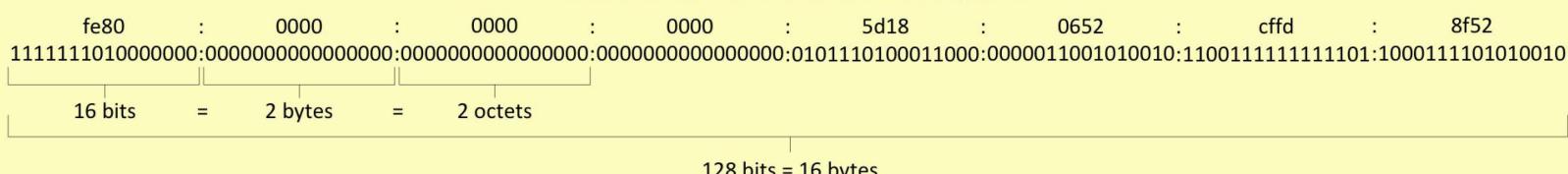
APIPA (Automatic Private IP Addressing)

- Automatically assigned addresses
- 169.254.1.0 through 169.254.254.255

IP address range	Number of addresses	Classful description	Largest CIDR block (subnet mask)	host id size
10.0.0.0 – 10.255.255.255	16,777,216	single class A	10.0.0.0/8 (255.0.0.0)	24 bits
172.16.0.0 – 172.31.255.255	1,048,576	16 contiguous class Bs	172.16.0.0/12 (255.240.0.0)	20 bits
192.168.0.0 – 192.168.255.255	65,536	256 contiguous class Cs	192.168.0.0/16 (255.255.0.0)	16 bits

fe80::5d18:652:cffd:8f52

fe80:0000:0000:0000:5d18:0652:cffd:8f52



Network Ports and Protocols

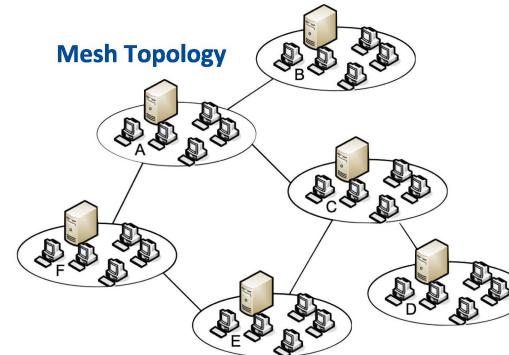
Common TCP and UDP Port Numbers

- tcp/20 - FTP (File Transfer Protocol) Data
- tcp/21 - FTP (File Transfer Protocol) Control
- tcp/23 - Telnet
- tcp/25 - SMTP (Simple Mail Transfer Protocol)
- tcp/53 - DNS (Domain Name Services) zone transfers
- tcp/80 - HTTP (Hypertext Transfer Protocol) web browsing
- tcp/110 - POP3 (Post Office Protocol version 3)
- tcp/143 - IMAP (Internet Message Access Protocol)
- tcp/443 - HTTPS (Hypertext Transfer Protocol Secure)
- tcp/3389 - RDP (Remote Desktop Protocol)
- udp/53 - DNS (Domain Name Services) queries

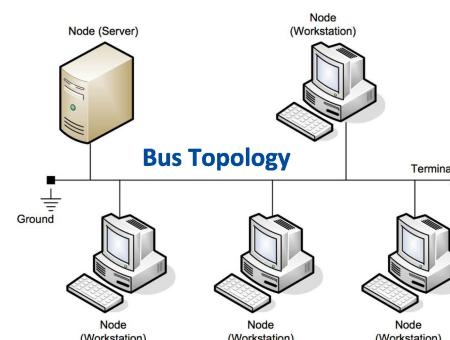
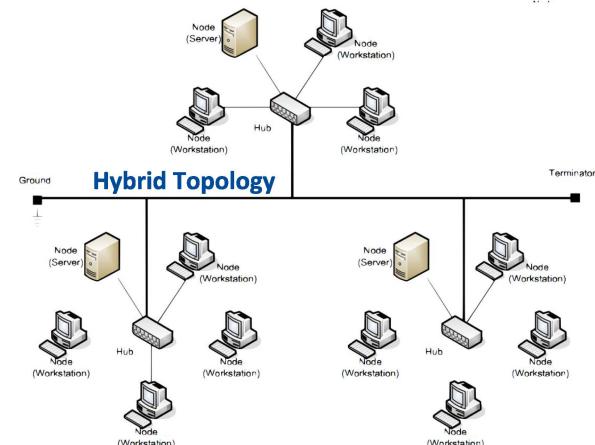
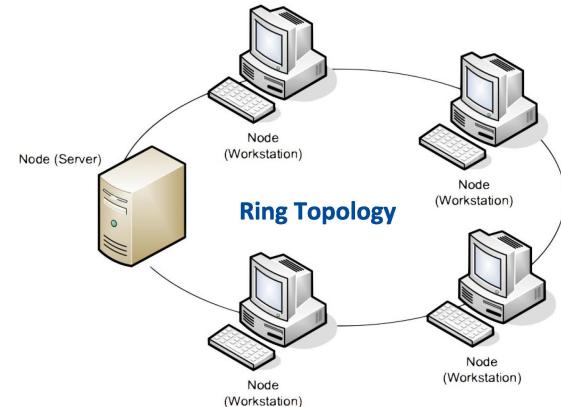
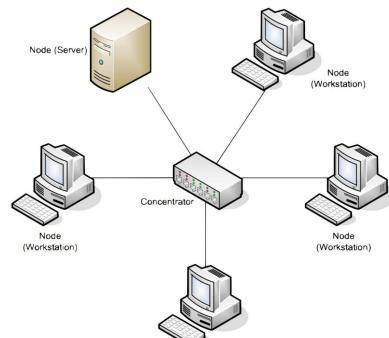
Common Network Protocols

- DHCP (Dynamic Host Configuration Protocol) - Automatic IP addressing
- LDAP (Lightweight Directory Access Protocol) - Network directory
- DNS (Domain Name Services) - Map a name to an IP address
- SNMP (Simple Network Management Protocol) - Manage devices
- SMB (Server Message Block) - Windows file and printer sharing
- SSH (Secure Shell) - Encrypted terminal session
- SFTP (Secure FTP over SSH) - Encrypted file transfers

Network Topologies



Star Topology



Wireless Encryption Standards

WEP

- 64-bit or 128-bit key size
- Cryptographic vulnerabilities found in 2001
- WEP can no longer be used



WPA

- Short-term workaround after WEP
- Used RC4 cipher as a TKIP (Temporal Key Integrity Protocol)
- TKIP has its own vulnerabilities

WPA2

- Replaced TKIP with CCMP (Counter Mode with Cipher Block Chaining Message Authentication Code Protocol)
- Replaced RC4 with AES (Advanced Encryption Standard)
- WPA2 is the latest and most secure wireless encryption method

Network Types

LAN

- Local Area Network
- A building or group of buildings

WAN

- Wide Area Network
- Spanning the globe (or the neighborhood)

PAN

- Personal Area Network
- Bluetooth, WiFi
- Automobile, mobile phone, health telemetry

MAN

- Metropolitan Area Network
- Contained in a regional area

Network Devices



Hub

OSI Layer 1 - Multi-port repeater
Traffic going into one port is repeated to every other port



Switch

OSI Layer 2 - Multi-port bridge
Forwards traffic based on data link address



Router

OSI Layer 3
Forwards traffic based on network address



WAP (Wireless Access Point)

Bridges from wired network to wireless

Modem

Modulator/Demodulator
Converts analog sounds to digital signals

NAS (Network Attached Storage)

High-speed storage connected to the network

Firewall

Filters traffic by IP, port number, or application

Common Networking Tools



Crimper

"Pinches" the connector onto the wire
The final step of a cable installation



Multimeter

Measures voltage, current, resistance
Check AC/DC voltage, cable continuity



Toner Probe

Find a specific wire
2 pieces; tone generator and inductive probe



Cable Tester

Measure the quality of a cable installation
Near end crosstalk, attenuation, etc.



Loopback Plug

Used for diagnostics and troubleshooting
Determine if a received signal is the same as the sent signal



Punch-down tool

Forces wires into a wiring block
Trims the wires and breaks the insulation

Laptop Expansion Options



PCMCIA / PC Card

- PCMCIA / PC Card
- Now replaced by CardBus and ExpressCard

ExpressCard

- Two form factors - 34 mm and 54 mm wide
- 54 mm slot also accepts 34 mm cards
- Can be added and removed while the OS is running



SO-DIMM

- Small Outline Dual In-line Memory Module
- RAM upgrade
- Must power down to install



Flash memory

- USB connected
- Use as additional storage
- Increase OS speed with Windows ReadyBoost

Laptop Displays

LCD (Liquid Crystal Display)

- Lightweight
- Low power consumption
- Requires a separate backlight (fluorescent, LED)

OLED (Organic Light Emitting Diode)

- Chemicals that emit light - no backlight required
- Very thin and flexible displays
- Very little power consumption
- Expensive to produce

Wi-Fi Antennas

- Wrap around the laptop screen
- WiFi main and aux antenna
- Bluetooth antenna

Backlight and Inverter

- Fluorescent lamp shines through LCD to provide light
- Inverter converts DC power to AC

Laptop Features

Special Keyboard Function Keys

- Can control external displays and audio

Display Options

- Use the Fn key as a toggle
- Toggle between LCD / external monitor / both
- May also have a physical or magnetic switch

Wireless Control

- Physical switch to enable/disable wireless

Volume Settings

- Fn key or standalone key

Screen Brightness

- Controls the backlight strength
- Helps to conserve battery life

Keyboard Backlight

- Set intensity, duration, or disable

Docking Stations and Port Replicators

- Similar functionality
- Port replicator extends existing laptop interfaces
- Docking station adds additional features, options to include desktop adapter cards

Understanding Printers

Laser Printer

- Uses heat and pressure to melt toner pellets onto the page
- + Very high quality
- + Fast printing speeds
- Many moving parts
- Requires memory in the printer
- Requires high voltages

Inkjet Printer

- Prints with very fine drops of ink
- + Inexpensive technology
- + High quality
- + Relatively quiet
- Ink is expensive and proprietary
- Eventually fades
- Print head clogs easily

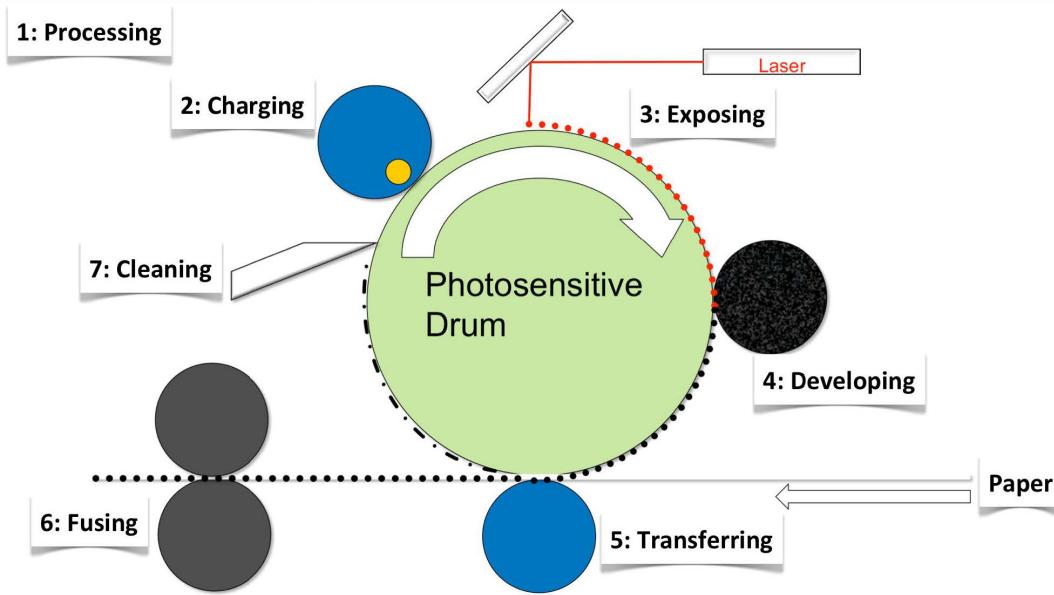
Thermal Printer

- Applies heat to special paper
- + Very inexpensive
- + Almost silent
- Requires a specially coated paper
- Sensitive to light and heat
- Image degrades rapidly

Impact Printer

- Printer head strikes a ribbon and the paper
- + Low cost per page
- + Good for multiple copies
- Very noisy
- Poor graphics

The Laser Printing Process



Step 1: Processing

- Build the entire page in memory

Step 2: Charging

- Prepare the drum with a negative electrostatic charge

Step 3: Exposing

- Write the image with the laser

Step 4: Developing

- Add toner to the charged areas of the imaging drum

Step 5: Transferring

- Move the toner from the drum to the paper

Step 6: Fusing

- Heat and pressure

Step 7: Cleaning

- Remove excess toner

Laser Printer Maintenance

Toner Cartridge Replacement

- Replace cartridge when output is faded
- Keep in the bag to protect OPC from light
- Power down printer before replacement
- Remove packing strips from the new cartridge

Laser Printer Maintenance Kit

- Periodic maintenance based on page count
- Replacement feed rollers, transfer rollers, pickup rollers and fuser unit
- Power down during maintenance
- Reset the page counter when done

Thermal Printer Maintenance

Thermal Paper Replacement

- Relatively inexpensive
- Must use the correct size
- Replace spool and feed through the printer

Cleaning the Heating Element

- Use an isopropyl alcohol (IPA) cleaning pen
- Follow printer manufacturer recommendations
- Usually a small area
- Cleaning cards can be used for the paper path

Impact Printer Maintenance

Printer Ribbon Replacement

- Self-contained cartridge
- Replace when output is faded
- Modular design, replace in a few minutes

Print Head Replacement

- Gets very hot during use
- Another modular part, look for release bar
- Consider replacing both head and ribbon simultaneously for best effect

Study Tips

Exam Preparation

- Download the exam objectives, and use them as a master checklist
- Use as many training materials as possible. Books, videos, and Q&A guides can all provide a different perspective of the same information.
- It's useful to have some hands-on, especially with command-line features and Windows recovery options.

Taking the Exam

- Use your time wisely. You've got 90 minutes to get through everything.
- Choose your exam location carefully. Some sites are better than others.
- Get there early. Don't stress the journey.
- Manage your time wisely. You've got 90 minutes to get through everything.
- Wrong answers aren't counted against you. Don't leave any blanks!
- Mark difficult questions and come back later. You can answer the questions in any order.