CompTIA A+ (220-1101) Day 4

Networking Tools - Section 2.8

Crimper and Stripper

- Refers to an RJ45 crimping tool.
- Used to terminate an Ethernet cable with an RJ45 end.
    - Can be pass-through or modular.
- Most crimping tools contain a stripper.
    - A stripper removes the outer jacket to expose individual wires.

Wi-Fi Analyzer

- Used to determine Wi-Fi parameters at a location:
    - Signal strength
    - Channel used
    - Frequency used
- Some have bandwidth testing capabilities.

Toner Probe

- Used to trace a wire from one end to another.
    - A tone is attached at one end and emits a signal.
    - A probe is used at the other end to pick up the signal and identify the wire.

Punchdown Tool

- Used to attach Ethernet cable to a receptacle, such as a patch panel.
- Trims excess wire while punching down.

Cable Tester

- Tests Ethernet cables:
    - Detects shorts
    - Detects breaks
    - Detects misconfigured wiring order

Loopback Plug

- Tests a port such as a network port.
    - Helps troubleshoot issues like no connectivity with a network interface card or a switch port.

Network Tap

- A hardware device that physically connects to network cabling.
    - Used to split or copy data packets for analysis as they move through the cable.
    - These packets are saved on a device such as a laptop for analysis.

Section 3.1 - Technology Cables

Video Cables

VGA (Video Graphics Array)

- DB-15 connector aka DE-15
- 15 pins
- Blue color
- Video only
- Analog signals (Degrades after 5 to 10 meters)
    - No digital

DVI (Digital Visual Interface)

- Single Link
    - 3.7 Gbps (HDTV @ 60 FPS)
- Dual Link
    - 7.4 Gbps (HDTV @ 85 FPS)
- No audio support

DVI-A

- Analog signals

DVI-D

- Digital signals

DVI-I

- Integrated
- Digital and analog in the same connector

HDMI (High-Definition Multimedia Interface)

- Video and audio stream
- ~20 meters before degradation
- 19-pin (Type A) connector
    - Proprietary connector

DisplayPort (DP)

- Digital information sent in packetized form
    - Like Ethernet and PCI Express
    - Carries both audio and video
    - Has locks to keep the connector in place and must be released to disconnect
    - Compatible with HDMI and DVI

Adapter and Converters

- Convert between different connectors:
    - Electrically compatible
        - e.g., DVI-D to HDMI (Digital), DVI-A to VGA (Analog)
- Convert from one format to another:
    - USB to Ethernet
    - Also used to convert from digital to analog

USB Hub

- Connect many devices
    - High-speed USB connectivity
    - Multiple types of connections supported

Communication Cables (Internet)

Coaxial Cables

- Two or more forms share a common axis.
- RG-6 is used in television/digital cable and high-speed internet over cable.

Ethernet Cabling

- Twisted pair copper cabling.
- Balanced pair operation:
    - Two wires with equal and opposite signals
    - Transmit+, Transmit- / Receive+, Receive-
- The twist keeps a single wire constantly moving away from interference.
- Some pairs have different amounts of twists.
- Traditional cable jacket:
    - Polyvinyl chloride (PVC)

Ethernet Standard	Cable Category	Maximum Supported Distance
1000BASE-T	Category 5	100 meters
1000BASE-T	Category 5e	100 meters
10GBASE-T	Category 6	Unshielded: 55 meters / Shielded: 100 meters
10GBASE-T	Category 6A	100 meters

Plenum-Rated Cable

- Fire-rated cable jacket:
  - Fluorinated ethylene polymer (FEP) or low-smoke PVC
- May not be as flexible (bend radius)

Unshielded and Shielded Cable

- **UTP (Unshielded Twisted Pair):**
  - No additional shielding
  - Most common twisted pair cabling
- **STP (Shielded Twisted Pair):**
  - Additional shielding protects against interference
  - Shields each pair and/or the overall cable
  - Requires grounding

Abbreviations

- U = Unshielded
- S = Braided Shielding
- F = Foil Shielding

(Overall cable) / (individual pairs) TP:

- S/FTP: Braided shield around the entire cable and foil around the pairs
- F/UTP: Foil around the cable and no shielding around the pairs

Direct Burial STP

- Used when overhead cable isn't ideal
  - Cable is placed in the ground
- Provides protection from the elements:
  - Designed to be waterproof
  - Often filled with gel to repel water
  - Conduit may not be needed

- Shielded Twisted Pair:
    - Provides grounding
    - Adds strength
    - Protects against signal interference

Copper Connectors

RJ11 Connector (Registered Jack 11)

- 6 positions, 2 conductor (6P2C)
- Telephone or DSL connection

RJ45 Connector (Registered Jack 45)

- 8 position, 8 conductor (8P8C)
    - Modular connector
    - Ethernet connector

F-Connector

- Cable television
- Cable modem
    - DOCSIS (Data Over Cable Service Interface Specification)

Punchdown Block

- Wire-to-wire patch panel
- Wires are "punched" into the block
- Additional wires punched into connection block

USB 1.1/2.0

- Standard-A plug used in computers
- Standard-B plugs used in printers
- Mini-B and Micro-B plugs used in mobile devices

USB 3.0

- Changes the design on A, B, and Micro
- Typically has blue on the inside

USB-C

- 24-pin double-sided USB connector
    - Can be plugged in either way
    - Used for both hosts and devices
    - Used for USB, Thunderbolt

Molex Connector

- 4-pin peripheral power connector
    - AMP MATE-N-LOK
    - Provides +12V and +5V
    - Typically used for storage drives and fans

Lightning Connector

- Apple proprietary
    - 8-pin digital signals
- Advantages over Micro-USB:
    - Higher power output for phones and tablets
    - Can be inserted either way

DB-9

- D-subminiature or D-sub
- Commonly used for RS-232
- Management of console ports for infrastructure devices

International ISO/IEC 11801 Cabling Standards

- Define classes of networking standards

Telecommunications Industry Association (TIA)

- Standards, market analysis, trade shows, government affairs, etc.
- ANSI/TIA-568: Commercial Building Telecommunications Cabling Standard
- Two standards: T568A and T568B
    - You can't mix the standards when building a cable

T568A Standard

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

(8P8C = Eight Pins, Eight Connectors)

T568B Standard

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

Fiber Communication

- Transmission by light
    - The visible spectrum
- No RF signal (no interference)
- Very difficult to monitor or tap
- Signal slow to degrade
    - Transmission over long distances

Two Different Types of Fiber

Multimode Fiber

- Short-range communication (up to 2 km)
- Relatively inexpensive light source
    - e.g., LED

Single-mode Fiber

- Long-range communication (up to 100 km without processing)
- Expensive light source
    - Commonly uses lasers

Fiber Connectors

- LC - Lucent Connector
- ST - Straight Tip
- SC - Subscriber Connector (square-like)

Peripheral Cables

USB (Universal Serial Bus)

- Simplifies connections
    - Printers, storage devices, keyboard, mouse

USB 1.1

- Low Speed: 1.5 Mbps (3 meters)
- Full Speed: 12 Mbps (5 meters)

USB 2.0

- 480 Mbps (5 meters)

USB 3.0 / 3.1 Gen1 / 3.2 Gen1

- SuperSpeed
- 5 Gbps (~3 meters)
- Standard does not specify a maximum cable length

USB 3.1 Gen2 / USB 3.2 Gen2

- SuperSpeed+
- 10 Gbps

USB 3.2

- Released September 2017
- Changed all the base names of 3.1
- Bandwidth can double with USB-C cables
- Uses an extra "lane" of communication associated with the flip-flop wires in USB-C
    - **USB 3.2 Gen 1x2** - 10 Gbps using two Gen1 lanes
    - **USB 3.2 Gen 2x2** - 20 Gbps using two Gen2 lanes

USB-C

- Doesn’t matter how you plug it in

Thunderbolt

- High-speed connector. Data and power on the same cable.
    - Thunderbolt v1
        - Two channels
        - 10 Gbps per channel
        - 20 Gbps total throughput
        - Mini DisplayPort connector
    - Thunderbolt v2
        - 20 Gbps bidirectional
        - Mini DisplayPort connector
    - Thunderbolt v3
        - 40 Gbps aggregated throughput
        - USB-C connector
        - Maximum 3 meters (copper)
        - Optical allows for 60 meters
        - Can daisy-chain up to 6 devices

Serial Console Cables

- DB-9 or DB-25
    - 9 and 25 pins respectively
    - Commonly used for RS-232
    - Can be used in modem communication, printers, mice, networking

Serial Advanced Technology Attachment (SATA)

SATA Revision	Transmission Speed	Distance
1.0	1.5 Gbps	1 Meter
2.0	3.0 Gbps	1 Meter
3.0	6.0 Gbps	1 Meter
3.2	16.0 Gbps	1 Meter
eSATA	Matches version	2 Meters

- 22 pins total: 15 for power, 7 for data
- 1 cable per storage device

eSATA

- External device connections
- Similar in size to SATA
    - Connectors are physically different
    - L-shape inside for internal SATA, line shape for external eSATA

The SCSI Standard (Small Computer Systems Interface)

- Originally designed to string many peripherals together on a single cable/controller
- Up to 16 devices in a SCSI chain
- Can support both PATA and SATA
- Not just for hard drives: scanners, tape drives, CD-ROM drives, etc.
- 8 on narrow bus, 16 on wide bus
- Intelligent interface
- Industry longevity
- Every device connected to SCSI has a unique ID
- Logical Units (LUNs) are defined within each SCSI ID
- Terminator required at the end of a SCSI bus

Serial Attached SCSI (SAS)

- Shift from parallel to serial
    - Increased throughput
    - Similar transition from PATA to SATA
- Point-to-point connection
    - No more daisy chains
- No termination required
- Two-device bus
- Maintains SCSI control and management with serial speed

PATA Standard (Parallel ATA)

- Also known as IDE (Integrated Drive Electronics)
- Western Digital invention
- 2nd generation: Enhanced IDE (EIDE)
- 40- or 80-wire cable
    - Pin layout remains the same
    - Extra wires reduce crosstalk
- Notch and missing pin hole ensure correct orientation

Overview of Memory - Section 3.2

Random Access Memory (RAM)

- Most common
- RAM is not hard drive or SSD storage
- Data and programs must be loaded into RAM to be used
- One of the most important components of a computer
    - Speed is critical

DIMM (Dual Inline Memory Module)

- Electrical contacts differ on each side
- 64-bit data width

SO-DIMM (Small Outline DIMM)

- Used in laptops and mobile devices
- Half the width of a DIMM
- Inserted at an angle and locked in place

Dynamic RAM

- Requires constant refreshing or data is lost
- Random access: any location can be directly accessed
- SDRAM (Synchronous DRAM): synced with the system clock
    - Queues processes while others complete

SDR vs DDR

- SDR: 1 bit per clock cycle
- DDR: 2 bits per clock cycle

DDR Types

- DDR3
    - Twice the data rate of DDR2
    - Up to 16 GB per DIMM
- DDR4
    - Up to 64 GB per DIMM
    - Higher frequencies
- DDR5
    - Faster transfer rates to motherboard
    - Up to 64 GB per DIMM

Memory Technologies

Virtual Memory

- Also called swap file or virtual RAM
- Unused app data moved to storage
- Frees up RAM for active processes
- Managed by the OS, but customizable

Multi-Channel Memory

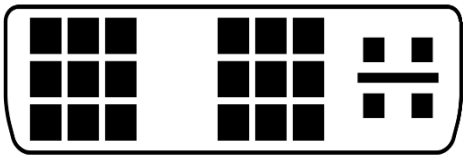
- Dual, triple, or quad-channel
- Matching memory modules recommended
- Slots often color-coded

Self-Checking Memory

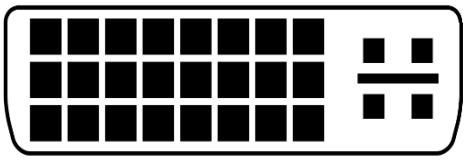
- Common in servers
- **Parity Memory:**
  - Adds a parity bit to detect errors
  - Can detect but not correct errors
- **ECC (Error Correcting Code):**
  - Detects and corrects errors on the fly
  - Not all systems support ECC
  - Looks identical to non-ECC memory

Type	Connector	Cable
SATA Data		
SATA Power		
eSATA Data		
USB A Male		
USB B Male		
USB Micro B Male		
USB Mini B Male		

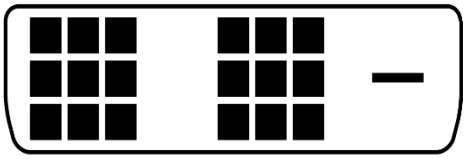
FEMALE LAYOUT



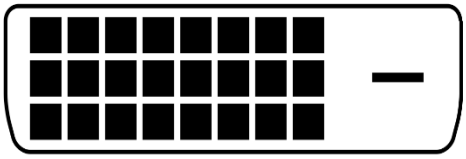
DVI-I (Single Link)



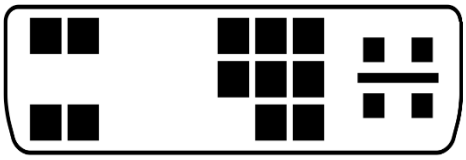
DVI-I (Dual Link)



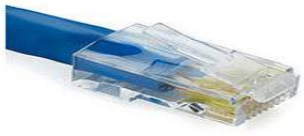
DVI-D (Single Link)



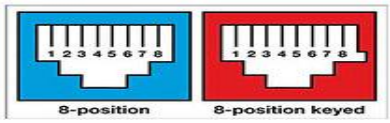
DVI-D (Dual Link)



DVI-A



RJ-45



Type G

MTRJ