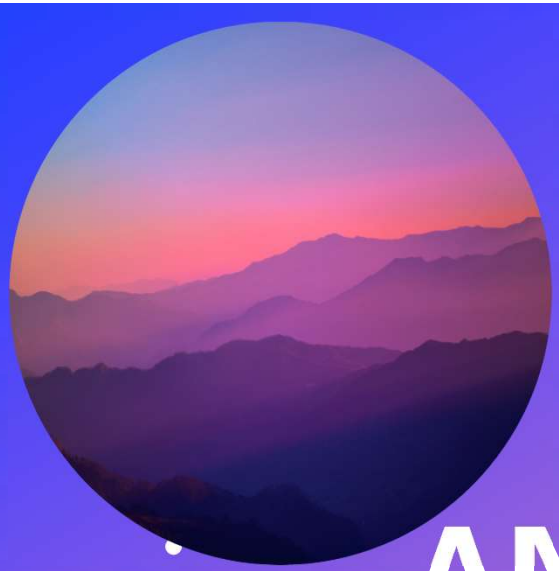
MINNESOTA TECH FOR SUCCESS

Week 8-10: Networking Basics

1/24/2024

Agenda

- **Announcements**
- **Classroom (25 min)**
  - Common network devices and setups
  - Basic network problem-solving
- **Break (5 min)**
- **Warehouse (1.5 hrs)**
  - Recycling



ANNOUNCEMENTS

Week 9

Announcements for 1/24

- **Calendar**
  - Current Session – Week 9
  - Next session: **Wednesday, 2/7/2024**

- Week 8-10: Networking Basics – Jan.17th, 24th, & 31st
  - No session on the 31st – Great River School field trip

- Week 11-12: IT Security – Feb. 7th & 14th

Values

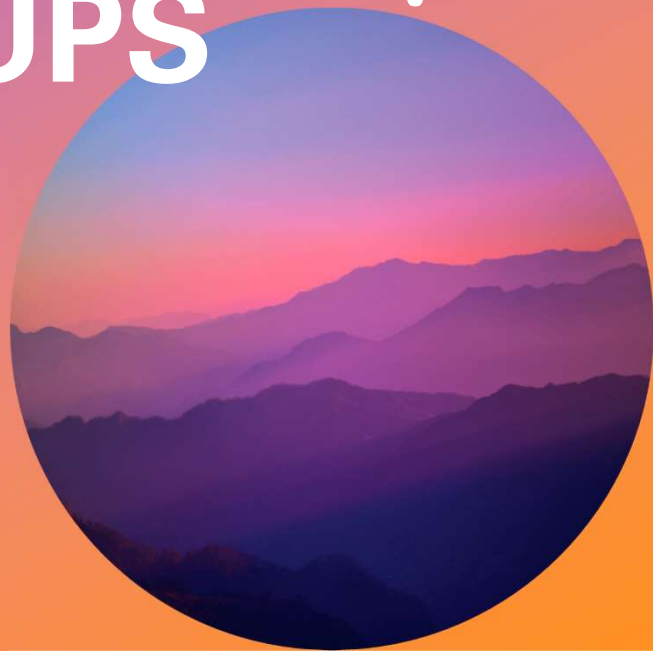
- **R**espect
- **A**ccountability
- **I**mprovement
- **S**teadfast
- **E**ncouragement

Networking Basics Objectives:

- Introduction to networking
  - What computer networks are and their importance in connecting devices and sharing resources
- Types of networks and their uses
  - An overview of different network types and their practical applications
- Common network devices and setups
  - Introduction to common network hardware and how they are used in network configurations
- Basic network problem-solving
  - Identifying and addressing simple network issues

NETWORK SETUPS

Hardware and Configurations



Network Setups: Definitions

- Host – Any computing device connected to a network
- Local host – The computer or workstation that is in front of the user
- Remote host – Other computing device on the network or reachable beyond the network
- Web server – a remote computer that stores files that make up a website
  - Uses programs to store and share data and provides access to websites
  - May connect to larger databases
- File Server – a networked host with access files and folders
- Web browser – a web client that requests for the webpage to be displayed on the computer
- Resource – anything that one computer may share with another

Network Setups: Goal & Criteria

Goal of Networking: Connect computers to share resources or access to other shared resources

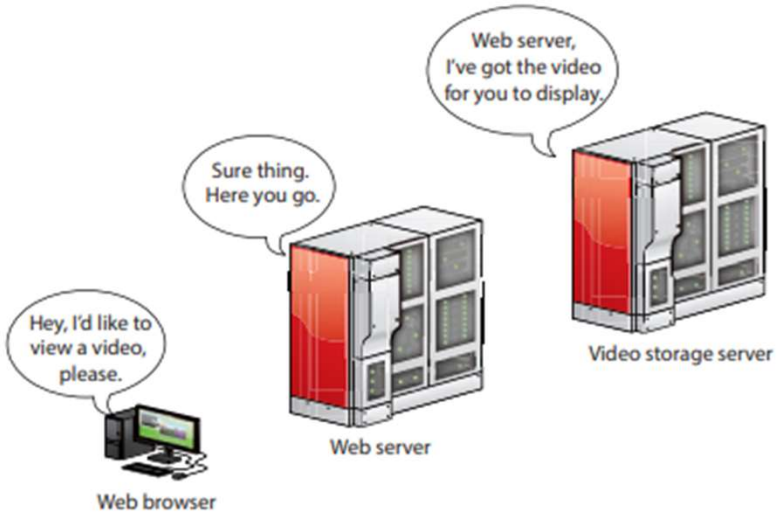
Networks must have the following requirements/criteria:

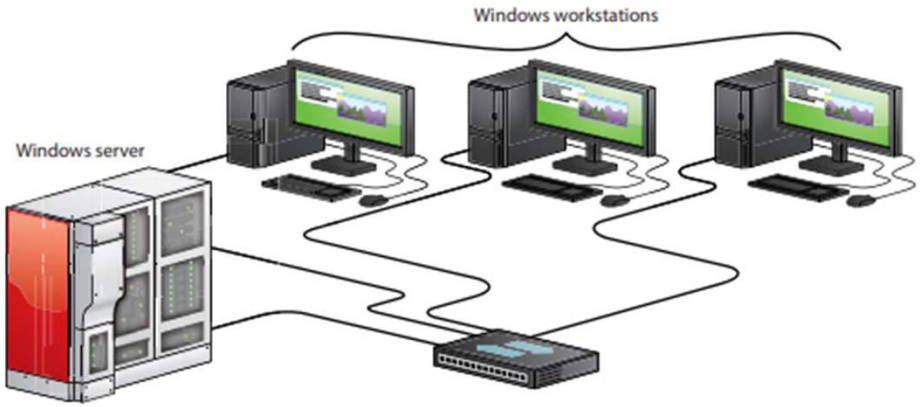
1. A defined and standardized design & operation of cabling, network cards, and interconnection of multiple computers

2. An addressing method that enables clients to find servers and enables servers to send data to clients (size of the network does not matter)

3. A method of sharing resources and accessing those shared resources

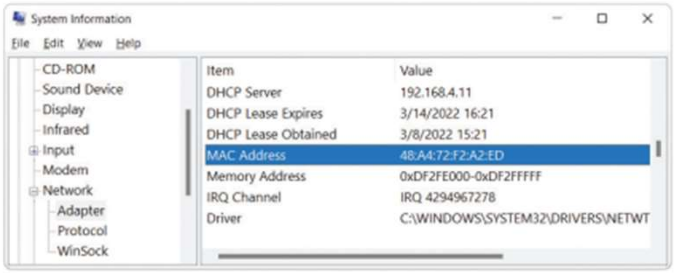
Network Setups: Typical Network





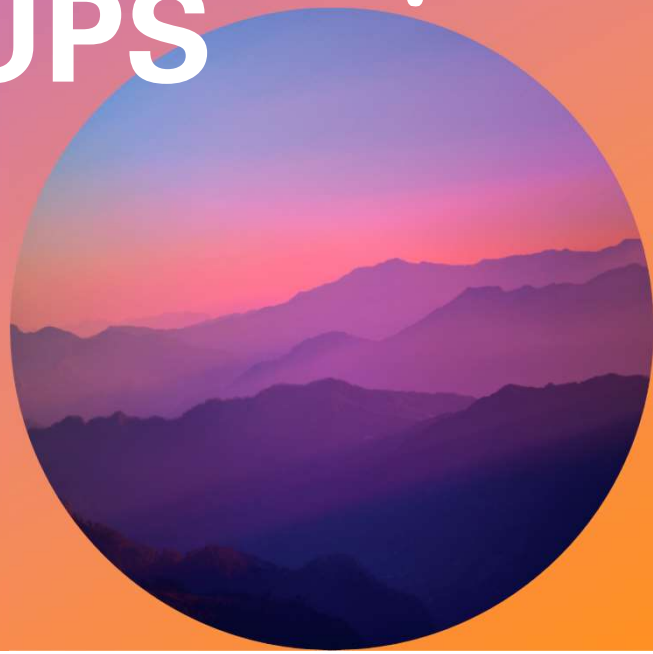
Network Setups: More Definitions

- Network Interface Controller/Card (NIC) – define and label the machine on the network, as well as breaking files into smaller data units to send across the network and reassembles the units it receives into whole files
- Media Access Control (MAC) Address - A built-in identifier unique to that network card
- Modem – provided by your ISP (Internet Service Provider) that enables network access to the internet. Hybrid modem/router may also be provided
- Medium– something that delivers data units between two or more devices
  - Ex. wires, radio waves or other wireless methods that can carry electrical pulses
- Frame – Data moved from one device or another in discrete blocks



NETWORK SETUPS

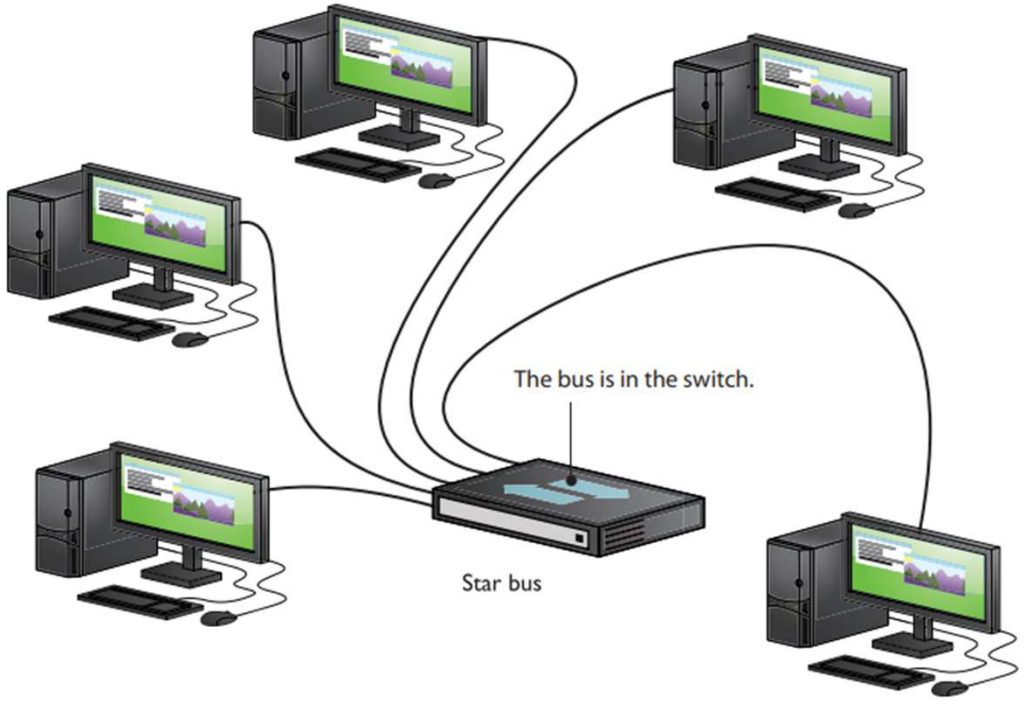
Hardware and Configurations



Network Setups: Hardware Definitions

- Ethernet – series of standards that defines everything necessary to get data from one computer to another
  - Can have any combination of hardware devices and cabling using different Ethernet flavors on a single Ethernet network
- Ethernet Flavors - future improvements through cabling, signaling, and speed
  - 10BASE-T networks run at 10 Mbps
  - 100BASE-TX networks (called Fast Ethernet) run at 100 Mbps
  - 1000BASE-T networks (called Gigabit Ethernet) run at 1000 Mbps, or 1 Gbps
  - 10GBASE-T runs at speeds of up to 10 Gbps
  - All four Ethernet technologies use a star bus topology and connect via a type of cable called unshielded twisted pair (UTP).
- Ethernet Box Star Bus – a central box that each individual host and systems connects to it via cables to special ports
  - Manages details required by networks to get frames sent to the correct systems

Ethernet Star Bus Topology



Network Setups: Hardware Definitions

- Topology - physical or logical layout of the network connections
- Star – wires leading from the box to the hosts
- Bus – internal Wiring in the box
- Switch (Central Box) – common point of connection for network devices that contains a variety of ports
  - Consumer: 4-8 ports
  - Business: 32+ ports
  - Memorize the MAC addresses of all the connected devices and only send out repeated signals to the correct host
- Network Switch - forwards data packets between devices. Only sends data to the single device it is intended for (i.e. another switch, a router, or a user's computer)

Network Setups: Cable Definitions

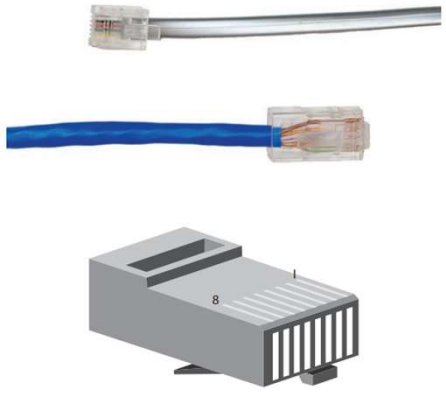
- Segment – connection between a computer and switch
- Unshielded Twisted Pair (UTP) – specified cabling with 4-paired color types of wires for 100/1000BASE-T and 10GBASE-T
- Shielded Twisted Pair (STP) – Similar to UTP, but has a foil shield covers wires to protect against electromagnetic interference leaking in and out of the cable

Cat 1	Standard telephone line.
Cat 3	Designed for 10-Mbps networks; a variant that used all four pairs of wires supported 100-Mbps speeds.
Cat 5	Designed for 100-Mbps networks.
Cat 5e	Enhanced to handle 1-Gbps and 2.5-Gbps networks at 100-meter segments.
Cat 6	Supports 1-Gbps, 2.5-Gbps, and 5-Gbps networks at 100-meter segments; 10-Gbps networks up to 55-meter segments.
Cat 6a	Supports 10-Gbps networks at 100-meter segments.
Cat 6e	A nonstandard term used by a few manufacturers for Cat 6 or Cat 6a.
Cat 7	Supports 10-Gbps networks at 100-meter segments; shielding for individual wire pairs reduces crosstalk and noise problems. Cat 7 is not an ANSI/TIA standard.

Network Setups: Cable Definitions

- RJ45 – plugs that feature eight pins to which the wire strands of a cable interface electrically.
  - Each plug has eight locations spaced about 1 mm apart into which individual wires are inserted using special cable crimping tools

- Fiber Optic – uses light instead of electricity to transmit Ethernet network frames
  - Immune to electrical problems such as static, lightning, and short circuits
  - Signals travel much farther, 2000 meters or more (compared with 100 meters on UTP)



Network Setups: Cable Definitions

- Coaxial –cable that is still used primarily for cable modems and satellite connections
  - Consists of a center cable (core) surrounded by insulation and is covered with a shield of braided cable
  - The center core carries the signal. The shield effectively eliminates outside interference, and then the entire cable is surrounded by a protective insulating cover
  - Uses F-type connector (shown on the bottom right)

Network Setups: Router Definition

- Router – a networking device that forwards data packets between computer networks (packet-switched networks or subnetworks)
  - It serves two primary functions:
    1. Manages traffic between these networks by forwarding data packets to their intended IP addresses
    2. Allow multiple devices to use the same Internet connection

- There are several types of routers, but most routers pass data between LANs and WANs. A LAN usually requires a single router.

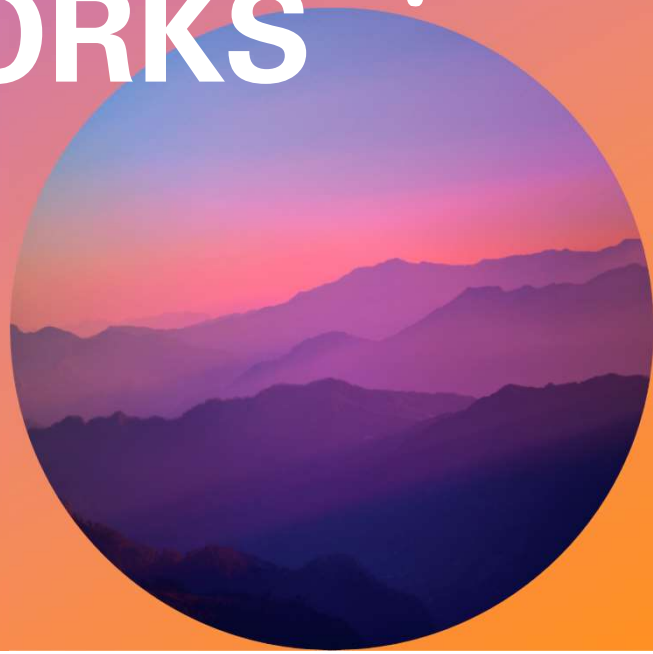
- Large organizations and companies that operate in multiple locations across the country, will need separate LANs for each location, which then connect to the other LANs to form a WAN. It often utilizes multiple routers and switches.

- Important: A network switch forwards data packets between groups of devices in the same network, whereas a router forwards data between different networks.

Network Setups: Router Topology

TYPES OF NETWORKS

Examples



Types of Networks: Examples

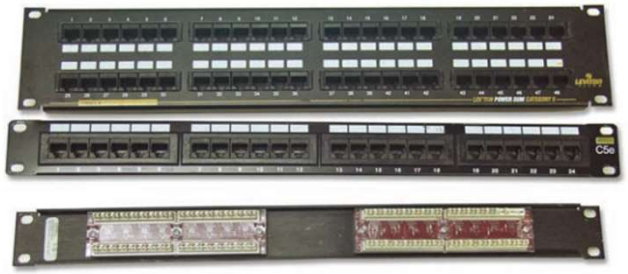
- **LAN** – a group of networked computers that are close to each other
  - Is almost always a broadcast domain
  - Ex. 2 broadcast domains; 2 LANs

Types of Networks: Examples

- **Equipment Rack –** safe and stable platform to cater to different hardware components
  - Short Equipment rack
  - Floor-to-ceiling rack

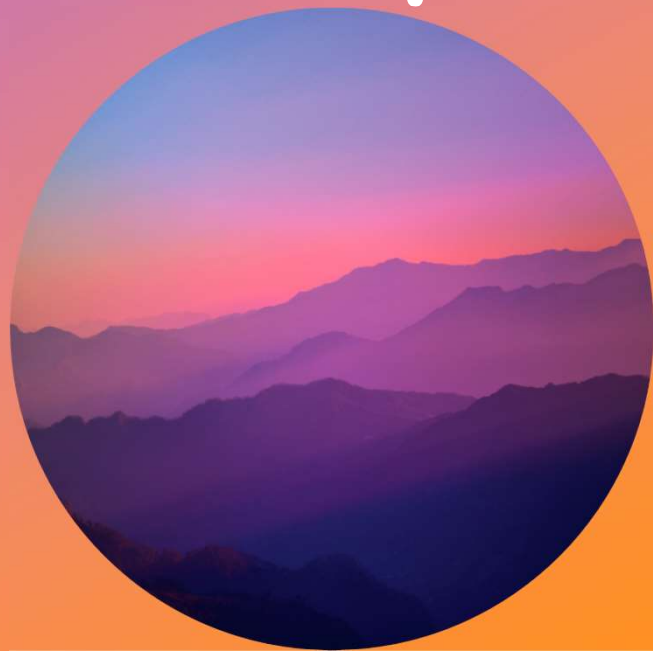
Types of Networks: Other things to note

- Rack-mounted equipment uses a height measurement known as - RU.
  - An RU is 1.75 inches. A device that fits in a 1.75-inch space is called a 1RU
  - A device designed for a 3.5-inch space is a 2RU; 7-inch space is called a 4RU
  - Most rack-mounted devices are 1RU, 2RU, or 4RU
- **Patch Panel –** a box with a row of female connectors (ports) in the front and permanent
  - connections in the back for connecting the horizontal cables
- **Uninterruptible Power Supply (UPSs)** – ensure power for hardware on the racks are supplied with out interruption



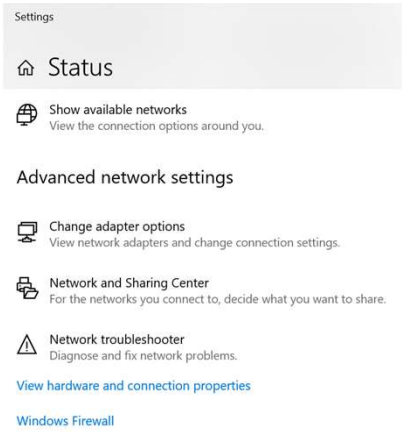
NETWORK PROBLEM-SOLVING

Troubleshooting

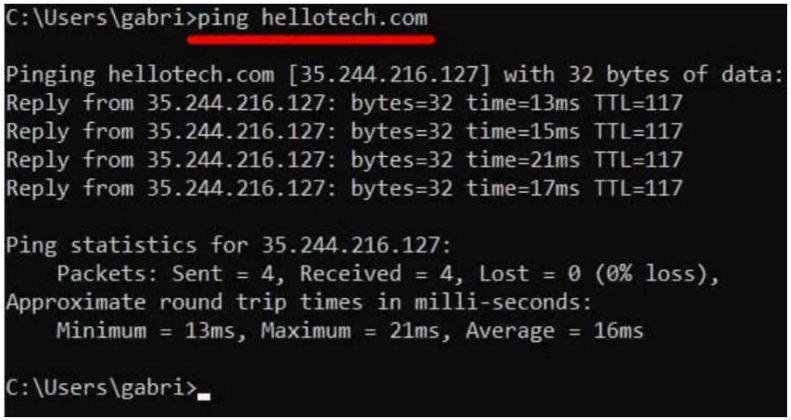


Troubleshooting

- **Windows 11 OS:**
  - Select Start > Settings > Network & internet, then turn on Wi-Fi.
  - Next, select More options (>) next to Wi-Fi, then select Show available networks.
  - If a network you expect to see appears in the list, select it, then select Connect. Open Wi-Fi settings



- **Ping & flush:**
  - Open: PowerShell
  - Type: ipconfig /all
  - Copy: IP address (highlight and use [CTRL] + [C])
  - Type: ping (paste your ip address)
    - Example: ping 2601:445:601:7c20::2003
  - To clear DNS cache, Type: ipconfig /flushdns
  - To reset the IPV6 connection, Type: netsh int ipv6 reset



Troubleshooting: Things to check

- If the OS and command-line steps do not resolve the issue:

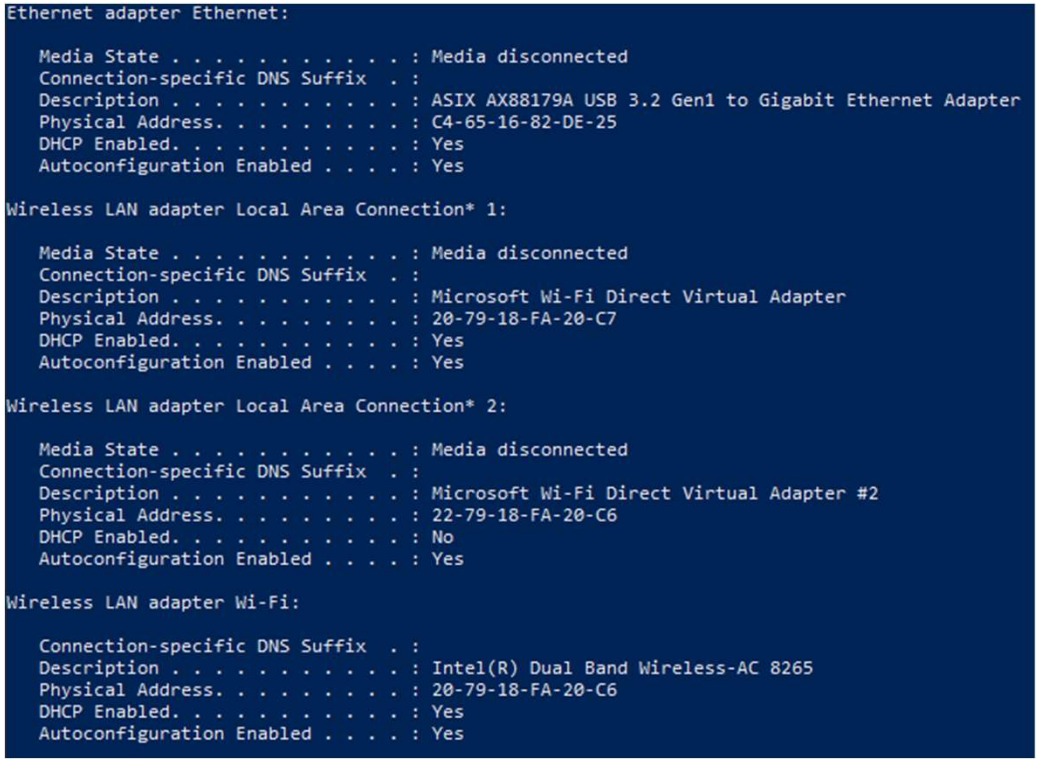
1. Check the physical cabling and diagnose physical problems
2. Check the lights
    1. Link light on the NIC
    2. Link light on the network switch
3. Examine the NIC
    1. Perform a loopback test
4. Cable Testing
5. Toner - term for two separate devices that are used together: a tone generator and a tone probe
    - The tone generator connects to the cable using alligator clips, tiny hooks, or a network jack, and it sends an electrical signal along the wire at a certain frequency
    - The tone probe emits a sound when it is placed near a cable connected to the tone generator
    - May be referred to as 'Fox and Hound', a model of toner made by the Triplett Corporation

ACTIVITY

Find your ip address

Activity 1: Find your MAC Address

1. Type: [Windows] + [x]
2. Select Windows PowerShell (Admin)
3. Type: ipconfig /all
4. Under any adapter/connection, locate:
    1. Physical Address



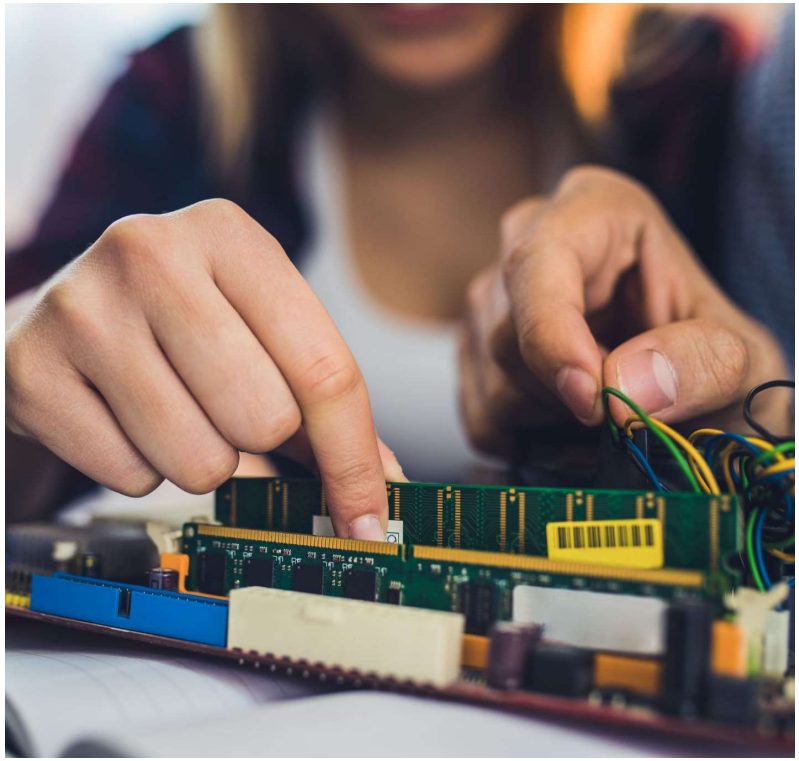
Activity 2: Wipe Room

1. Gather as a group and walk over to observe our Wipe room
2. Identify what is assembled on the rack and what hardware is setup and connected

WAREHOUSE

Warehouse Activity

- 1:30-3:00pm
- Parting/recycling



BREAK

5 minutes