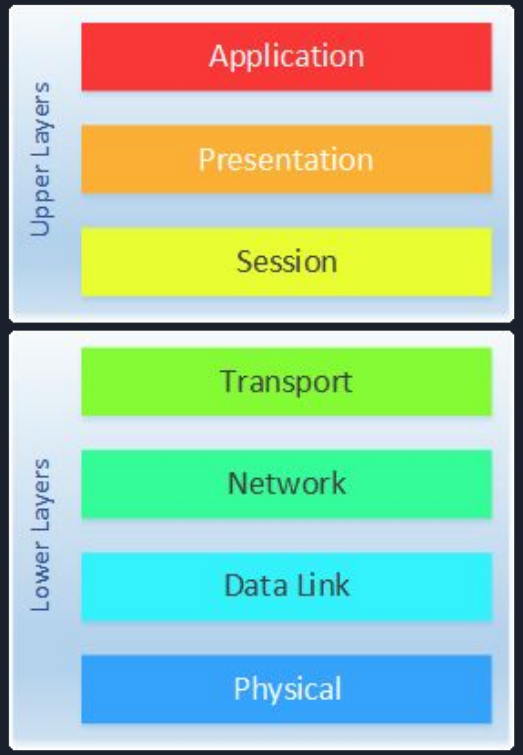
Cisco but fast

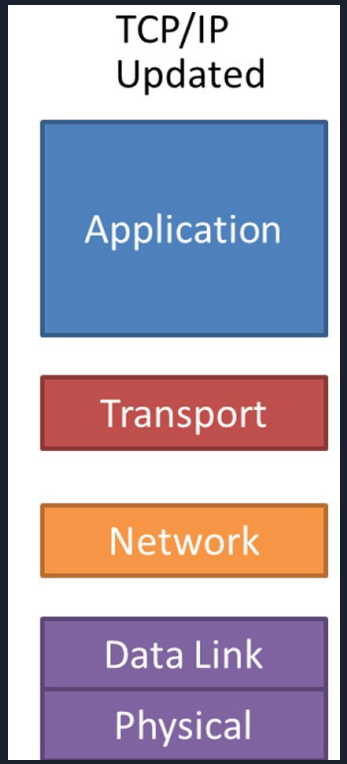
Really fast

How does it work

OSI MODEL



TCP/IP



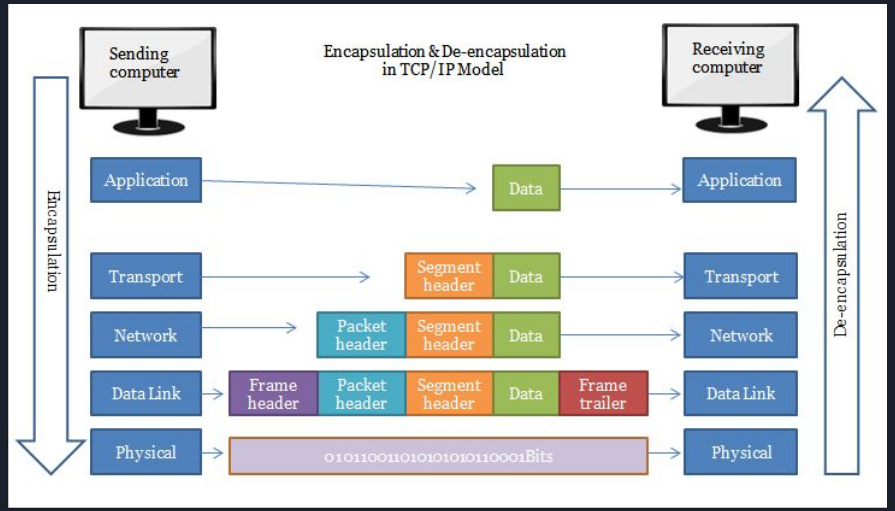
How does it work part 2

PDUs

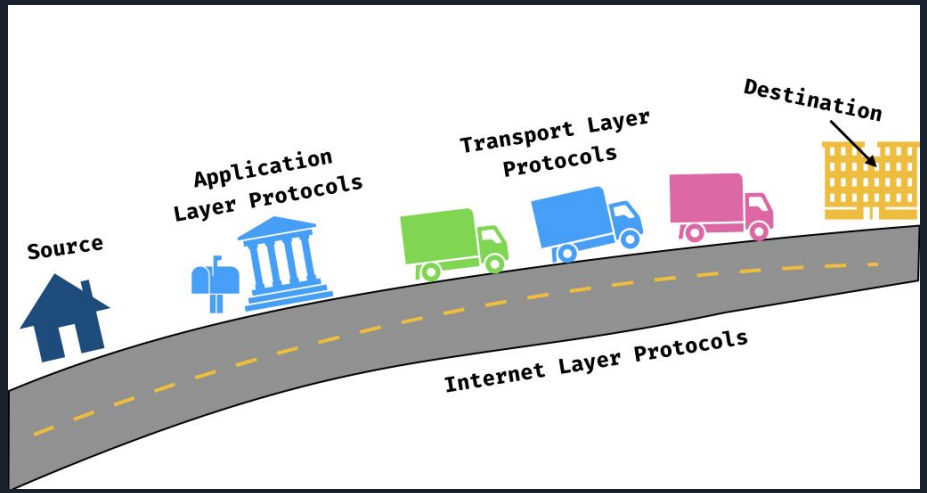
PDUs are pieces of data called payloads encapsulated by headers (and footers sometimes)

Headers contain important metadata like IP addresses, MAC addresses, ports, etc

- Layer 1: Bit
- Layer 2: Frame
- Layer 3: Packet
- Layer 4: Segment



How it works part 3

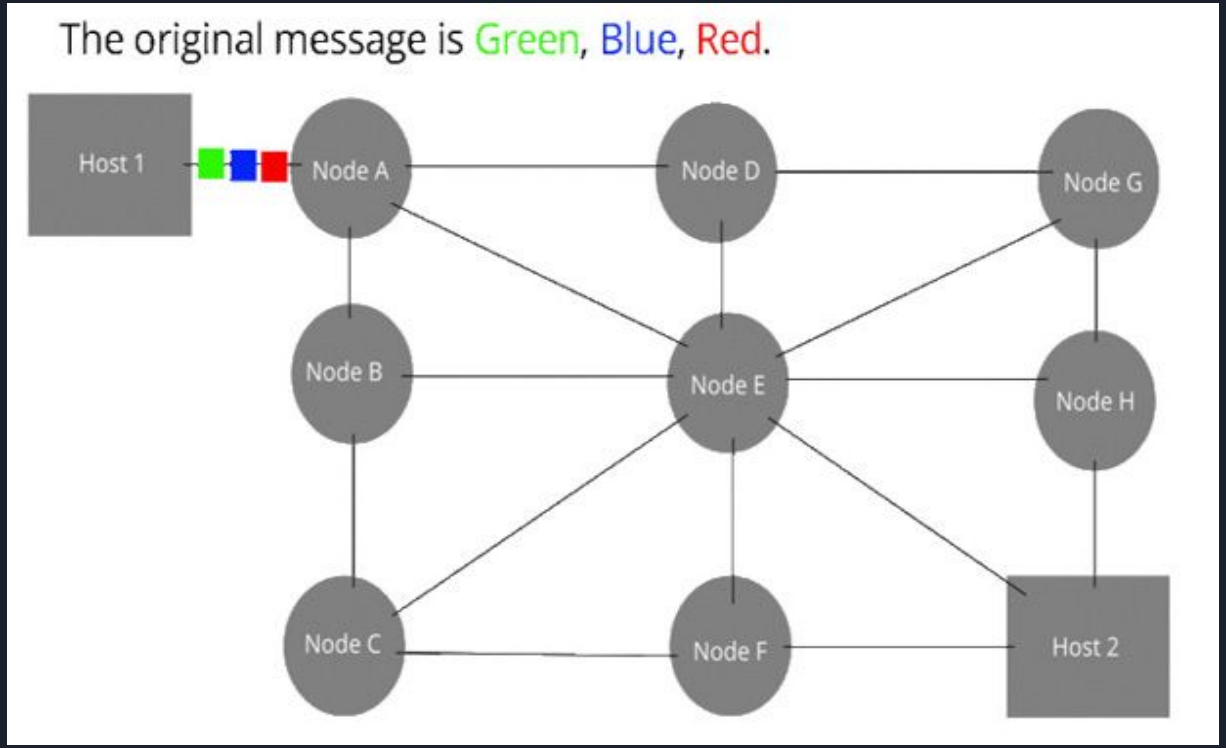


Protocols

Protocols are rules that govern the data sent and received

- Layer 1: IEEE 802.11, bluetooth
- Layer 2: ARP, PPP
- Layer 3: IP
- Layer 4: TCP, UDP
- Layer 5: NetBIOS
- Layer 6: SSL/TLS
- Layer 7: FTP, HTTP

Fragmentation

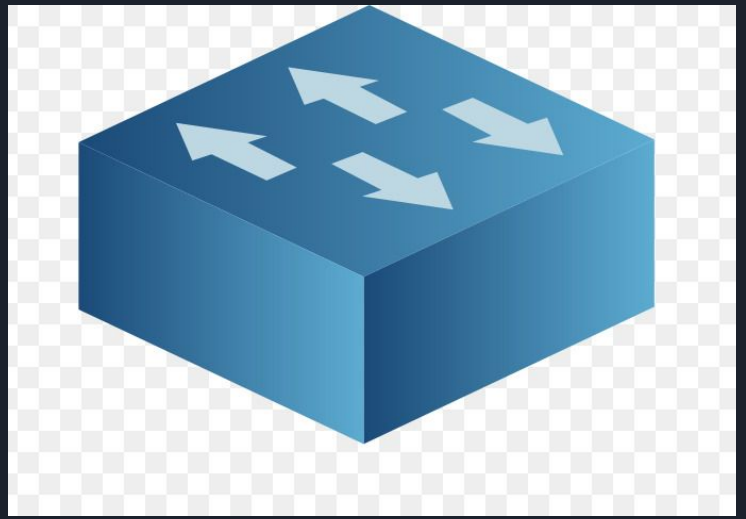


End Devices

- Can be communicated with through their virtual ports
- Ports are the doors to communicating with all devices
- Lowest layer (layer 1)
- The end node

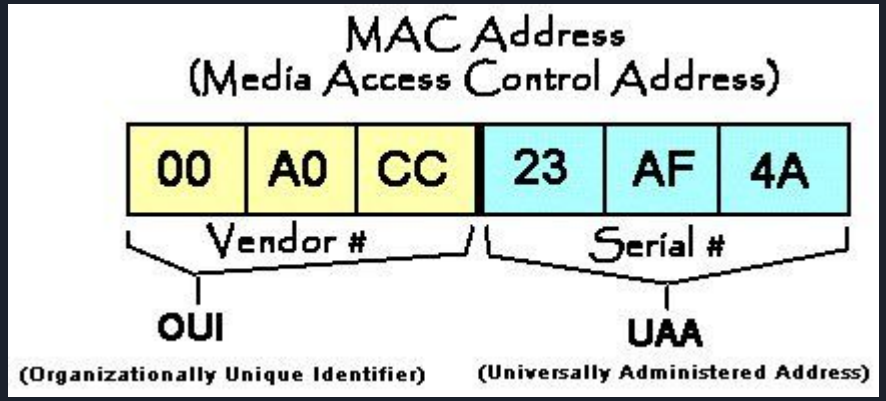
Switches

- A step below routers and above end devices (layer 2)
- Connects at a LAN level and forwards information to specific devices
- Uses MAC addresses and switching protocols to figure out where to send PDUs



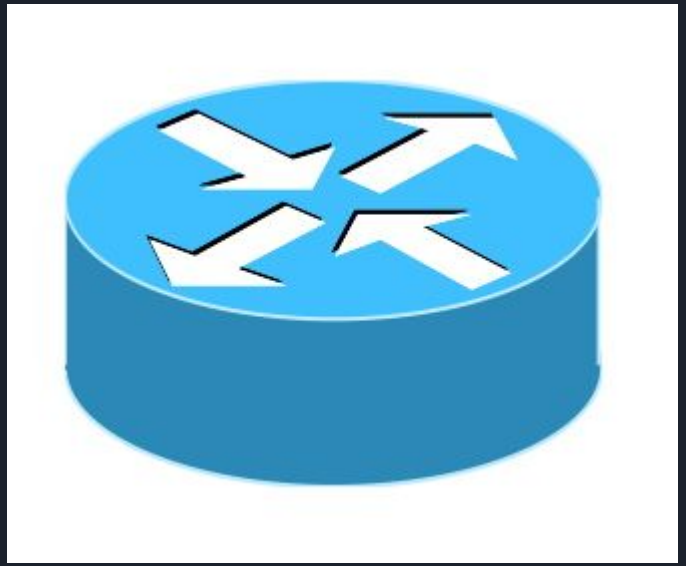
MAC Addresses

- Also known as physical addresses
- Used by switches on the data link layer (layer 2)
- First 3 hex pairs are the OUI
- Switches have MAC address tables, routers generally don't



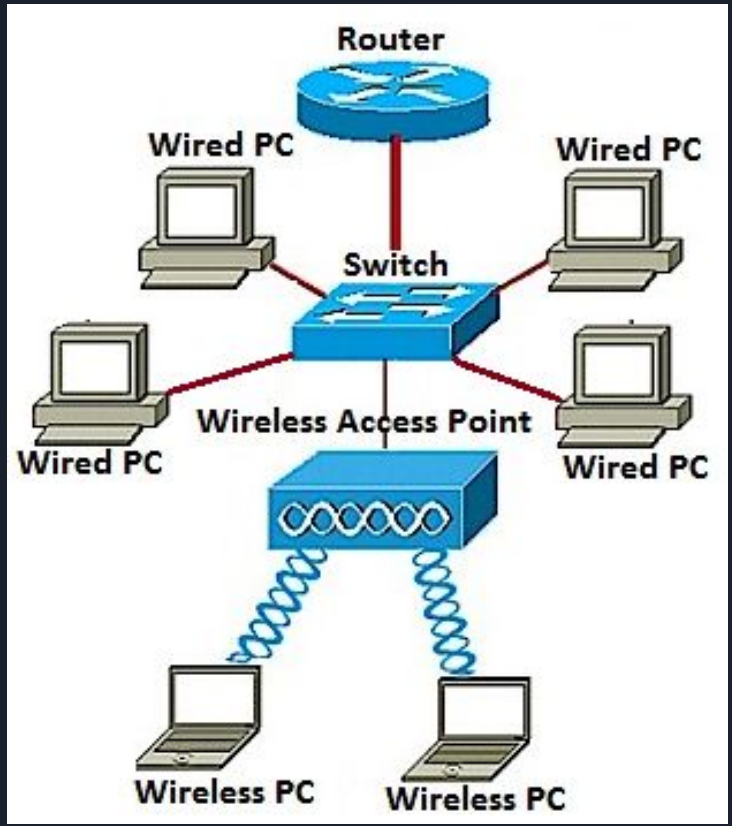
Routers

- Layer 3
- Connects everything at the highest level across long and/or short distance
- Relies on IP addresses and routing protocols to figure out where to send PDUs
- Most configuration of actual network interconnectedness occurs here (backbone of internet)



Access points

- Devices that creates a WLAN
- Connects to a wired router, switch, or hub through ethernet
- Provides Wi-Fi signal for a certain area
- Basically, allows people to wirelessly access the network

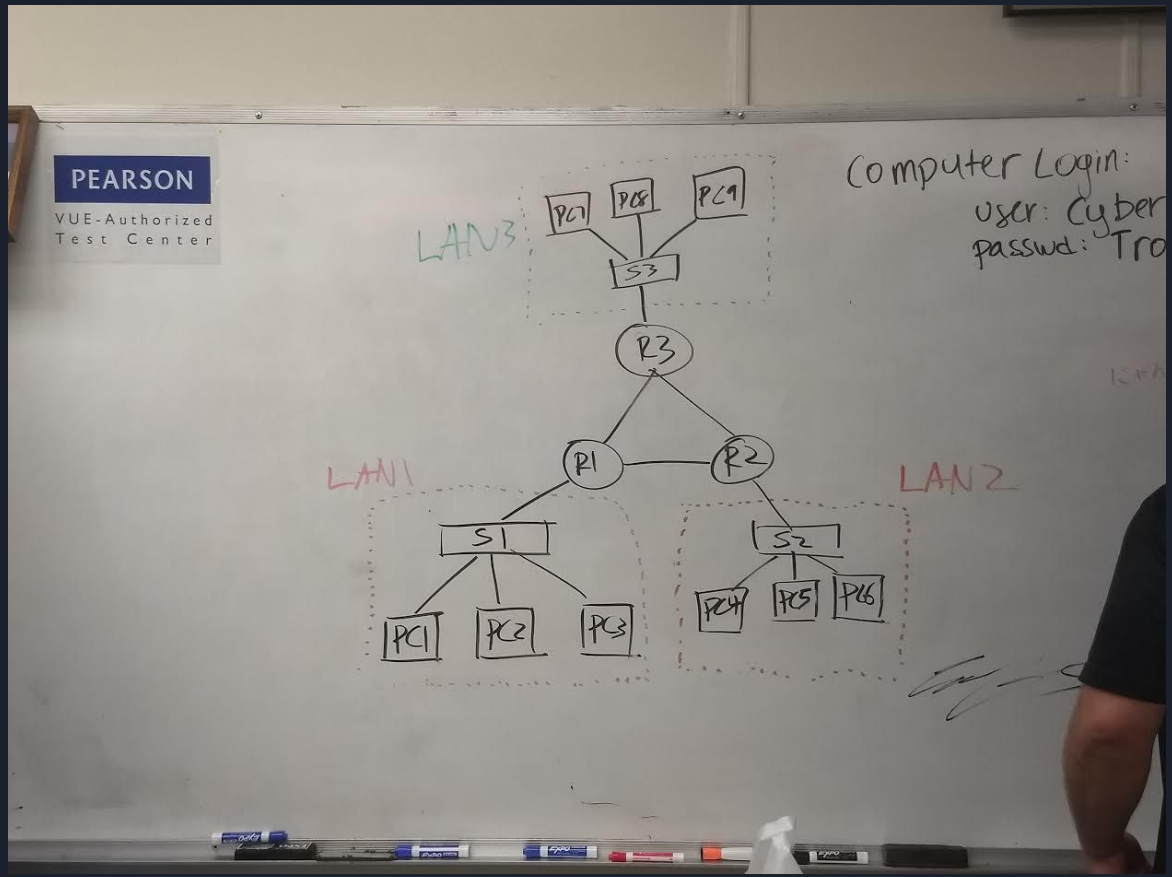


IPv4 addressing

- Used for logical addressing
- Groups devices into different networks
- Each device has one so they can be reached by other devices across the internet
- Classful addressing is how addresses were initially given out but it was inefficient

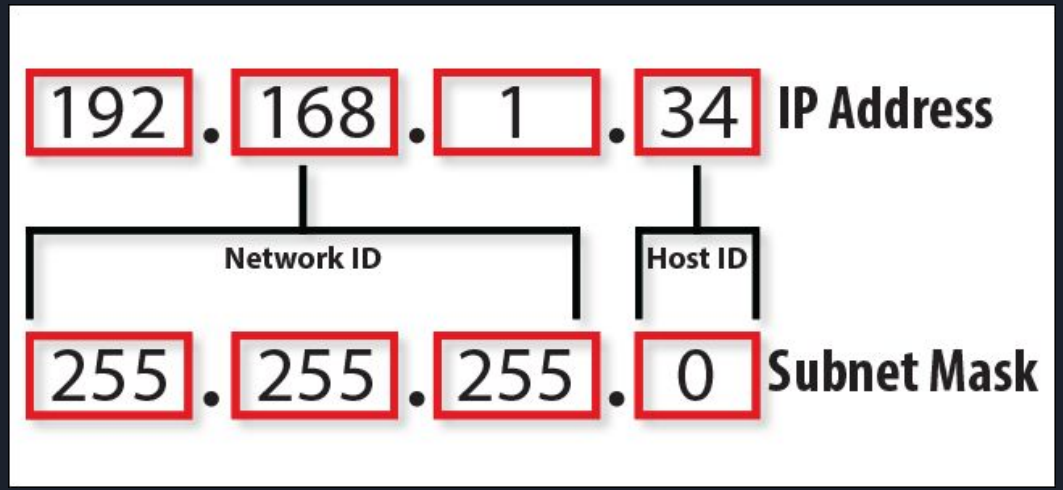
CLASS	LEADING BITS	NET ID BITS	HOST ID BITS	NO. OF NETWORKS	ADDRESSES PER NETWORK	START ADDRESS	END ADDRESS
CLASS A	0	8	24	2^7 (128)	2^{24} (16,777,216)	0.0.0.0	127.255.255.255
CLASS B	10	16	16	2^{14} (16,384)	2^{16} (65,536)	128.0.0.0	191.255.255.255
CLASS C	110	24	8	2^{21} (2,097,152)	2^8 (256)	192.0.0.0	223.255.255.255
CLASS D	1110	NOT DEFINED	NOT DEFINED	NOT DEFINED	NOT DEFINED	224.0.0.0	239.255.255.255
CLASS E	1111	NOT DEFINED	NOT DEFINED	NOT DEFINED	NOT DEFINED	240.0.0.0	255.255.255.255

Switches vs Routers



CIDR

- CIDR is the new fancy way of giving addresses
- Instead of having a set number of host bits (8,16,24), we can have any number between them denoted by /[#]
- This saves a ton of addresses



Private

- There's not enough IPv4 addresses so they made private
- These are blocks reserved for reuse by organizations within their organization
- Used with NAT to help preserve addresses

PRIVATE ADDRESSES

10.0.0.0	10.255.255.255
172.16.0.0	172.31.255.255
192.168.0.0	192.168.255.255

NAT & PAT

- NAT takes addresses and translates them to a usable form.
- This means either public->private or private->public depending on the direction
- It is to limit the amount of public addresses used by organizations
- PAT does the same, but instead of being one address to one address, there can be many private addresses mapped to one public address using different ports.

Routing Protocols

Internal

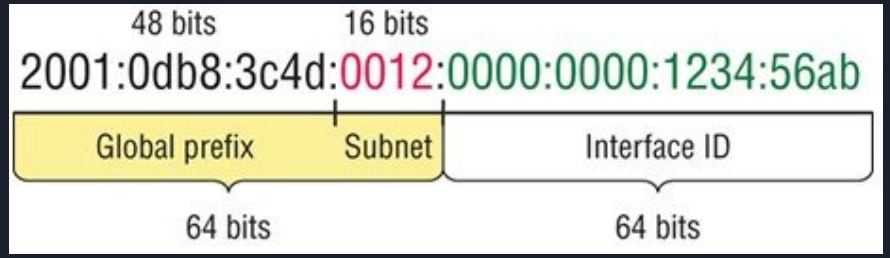
- OSPF
- RIP
- EIGRP

How they work

- These protocols look for the fastest way to get from one point to a final destination
- They use different metrics, hop count vs “distance”

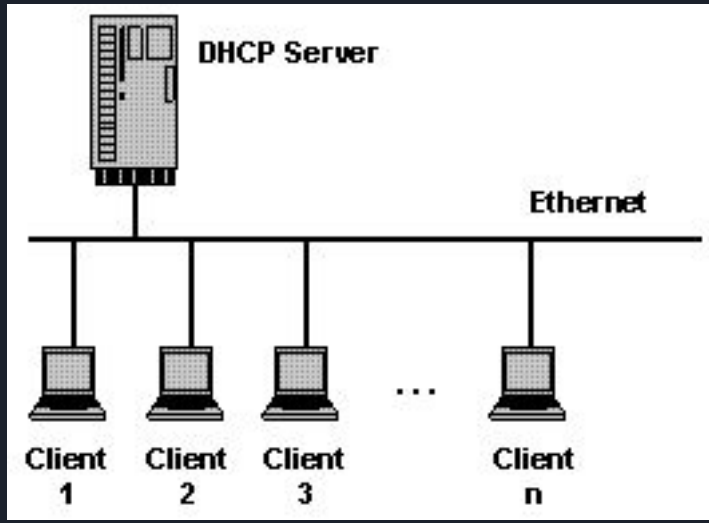
IPV6

- This is what it looks like
- Contiguous zeros can be replaced with double colon
- Also split into network and host portions, just slightly more complex
- Made because we ran out of ipv4 addresses
- Slightly different, more concise header



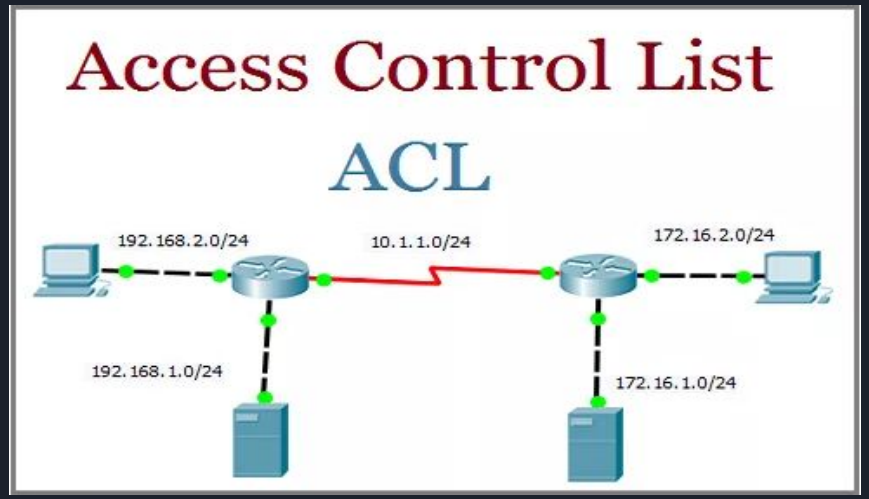
DHCP

- Dynamic Host Configuration Protocol
- Static IP:
  - You set it manually for a device
- Dynamic IP:
  - A DHCP server assigns the IP and you don't have to worry about it
  - Good for large infrastructures, where a network engineer would not want to do everything by hand
- When would you want a static IP?



Access Control Lists (ACLs)

- **ACL**: list of permit/deny statements (basically a firewall)



Different topologies

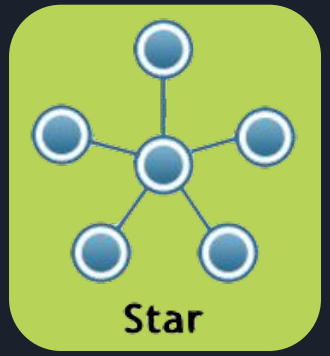
TYPES

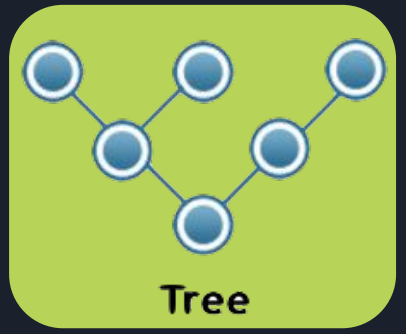
- Mesh
- Star
- Bus
- Ring
- Tree

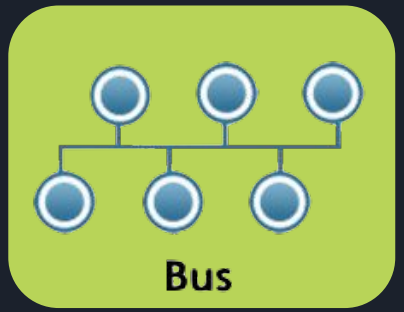
GOALS

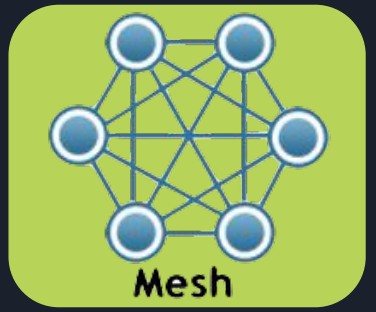
- **Hierarchical design –** tiered approach used to simplify deployment, operation, and management
- **Modularity –** allows for network expansion and adaptability
- **Resiliency –** network must always be accessible
- **Flexibility –** allows intelligent traffic load sharing by using all network resources

Network Topologies

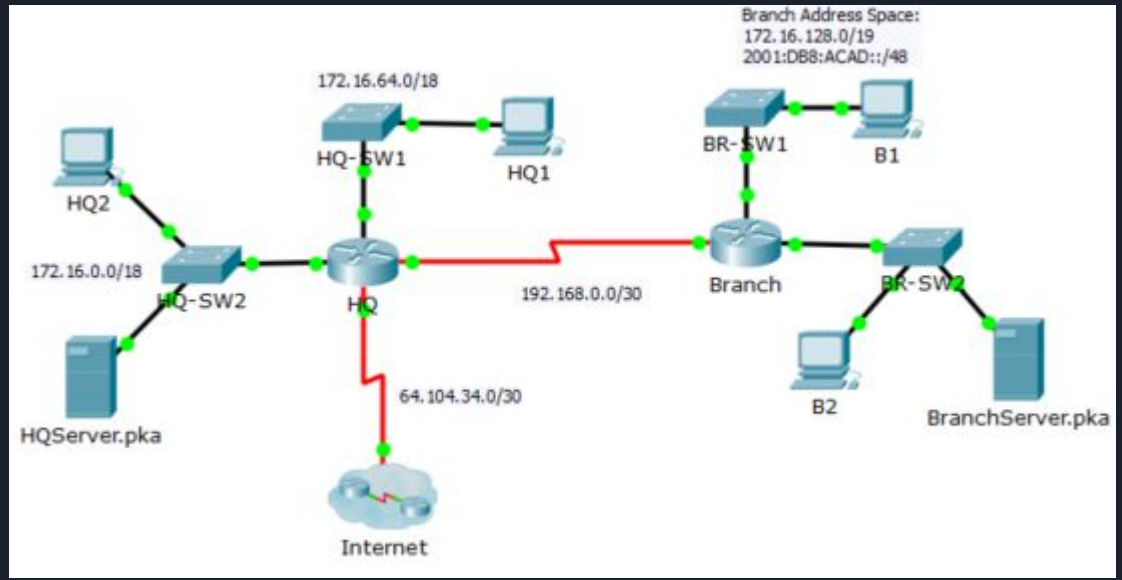




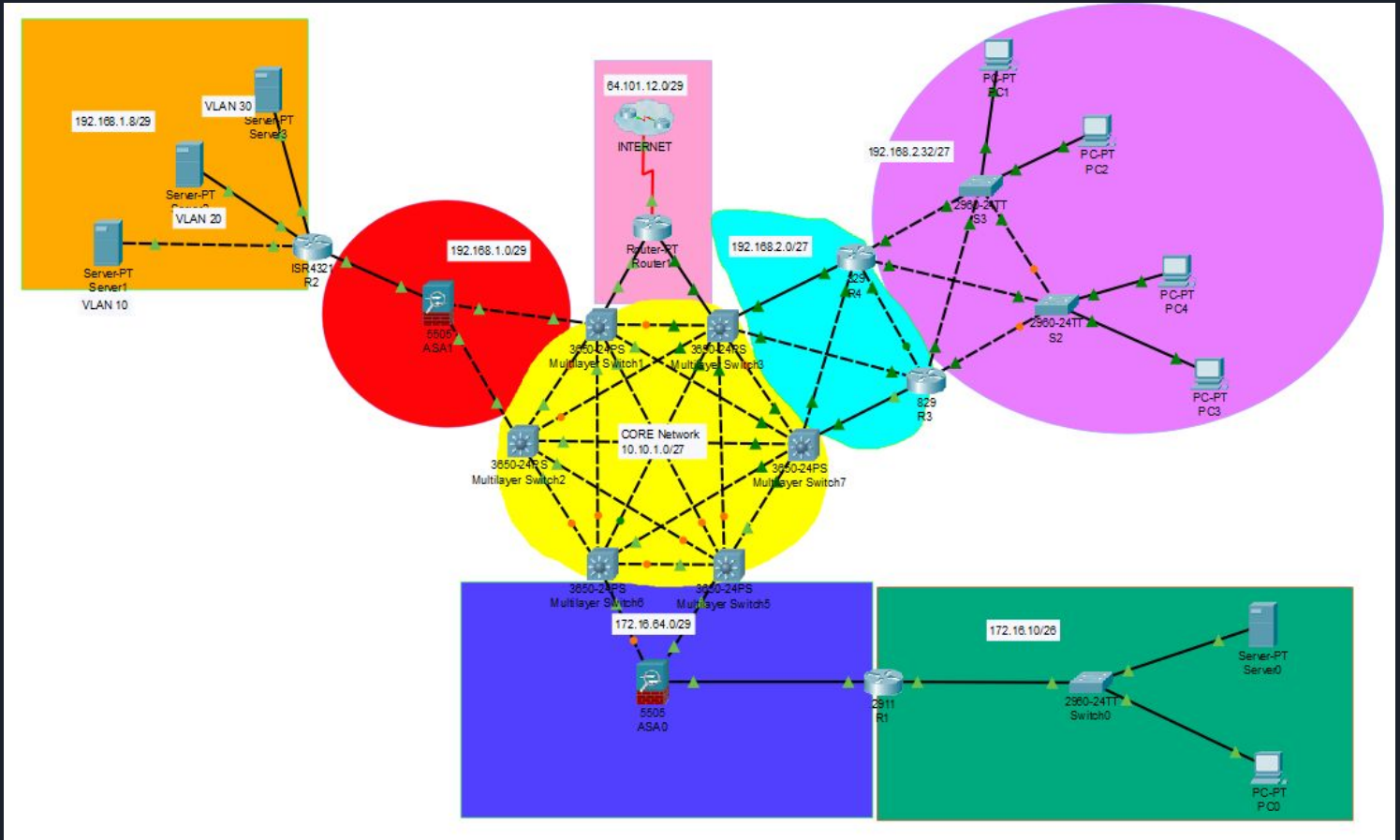




Example topology



Slightly More complex topology



Kahooooot

https://create.kahoot.it/share/ciskahoot-yee/1ff75b87-b227-4994-a31e-dc40bcd12b8c