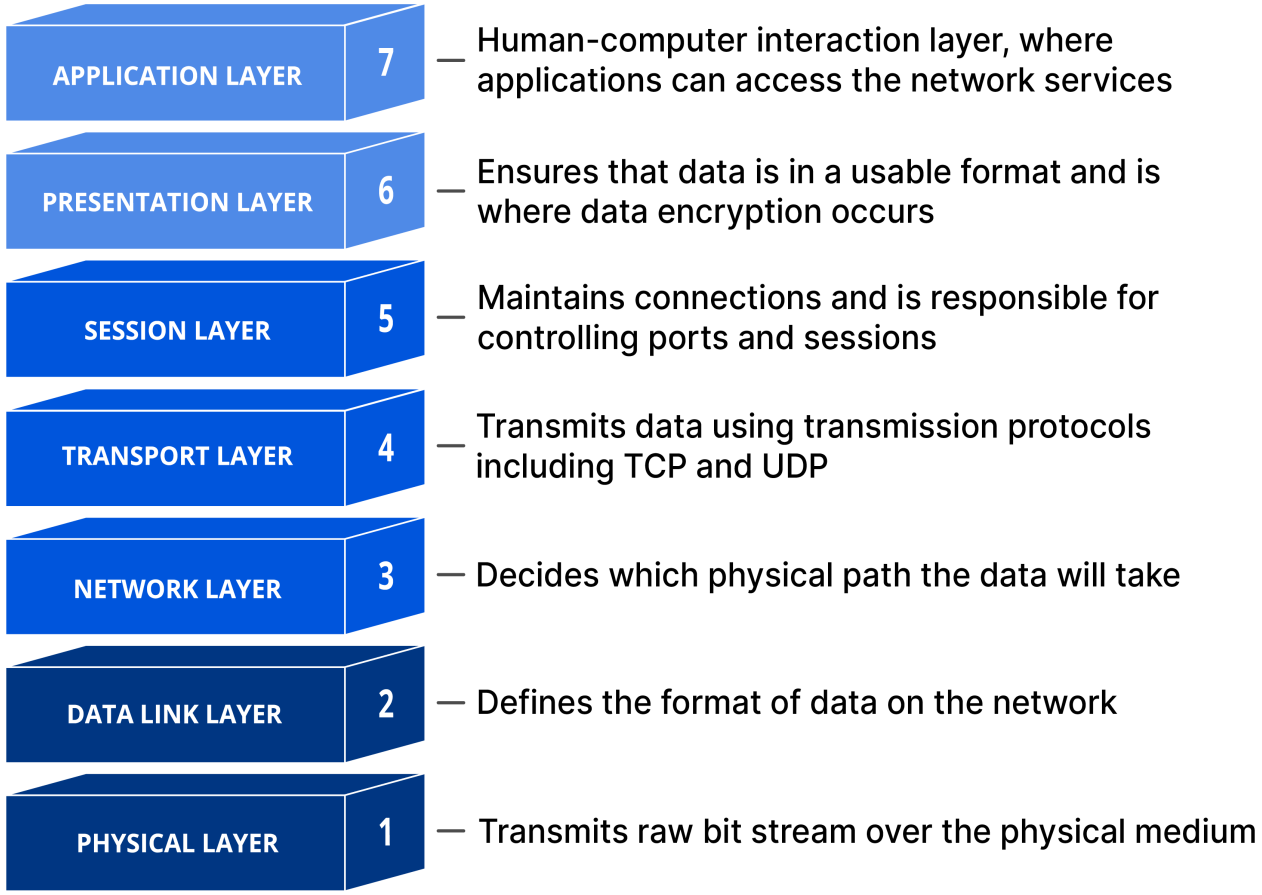
Welcome to Networking

Agenda

- OSI Review
- Data Transmission
- Common Networking Equipment
- Common Network Topologies
- LAN Vs WAN
- MAC Addresses
- IP Addresses
  - Binary Math!
- Network Masks / CIDR Notation



https://www.cloudflare.com/learning/ddos/glossary/open-systems-interconnection-model-osi/

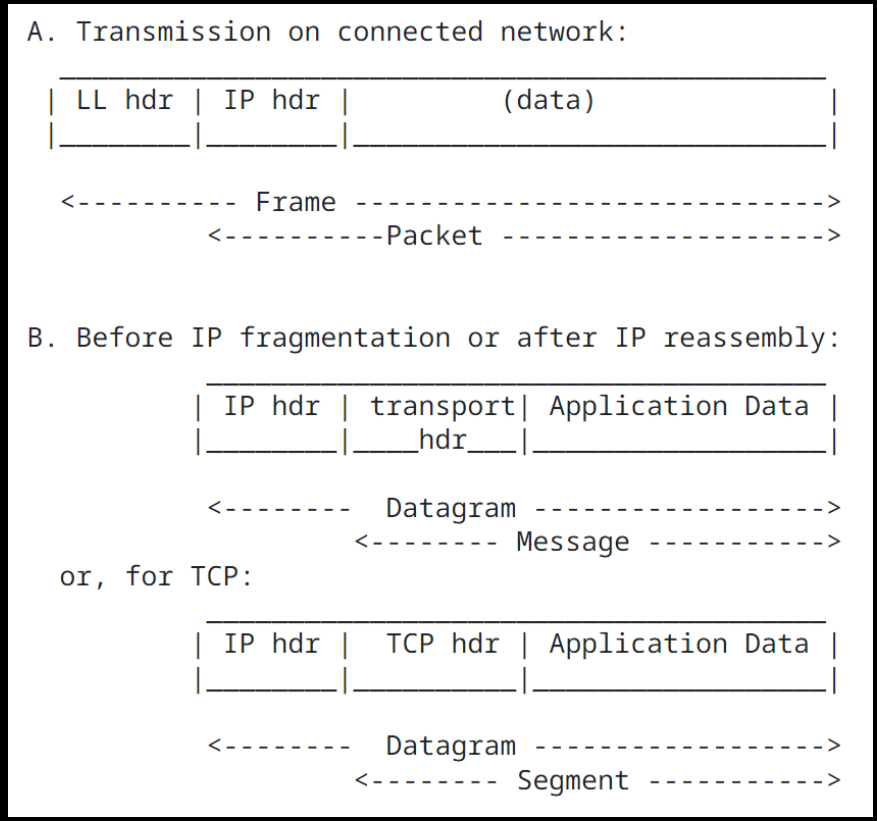
Data Transmission

- Frame - A frame is the unit of transmission in a link layer protocol, and consists of a link-layer header followed by a packet.

- Packet - A packet is the unit of data passed across the interface between the network layer and the link layer. It includes an IP header and data. A packet may be a complete IP datagram or a fragment of an IP datagram.

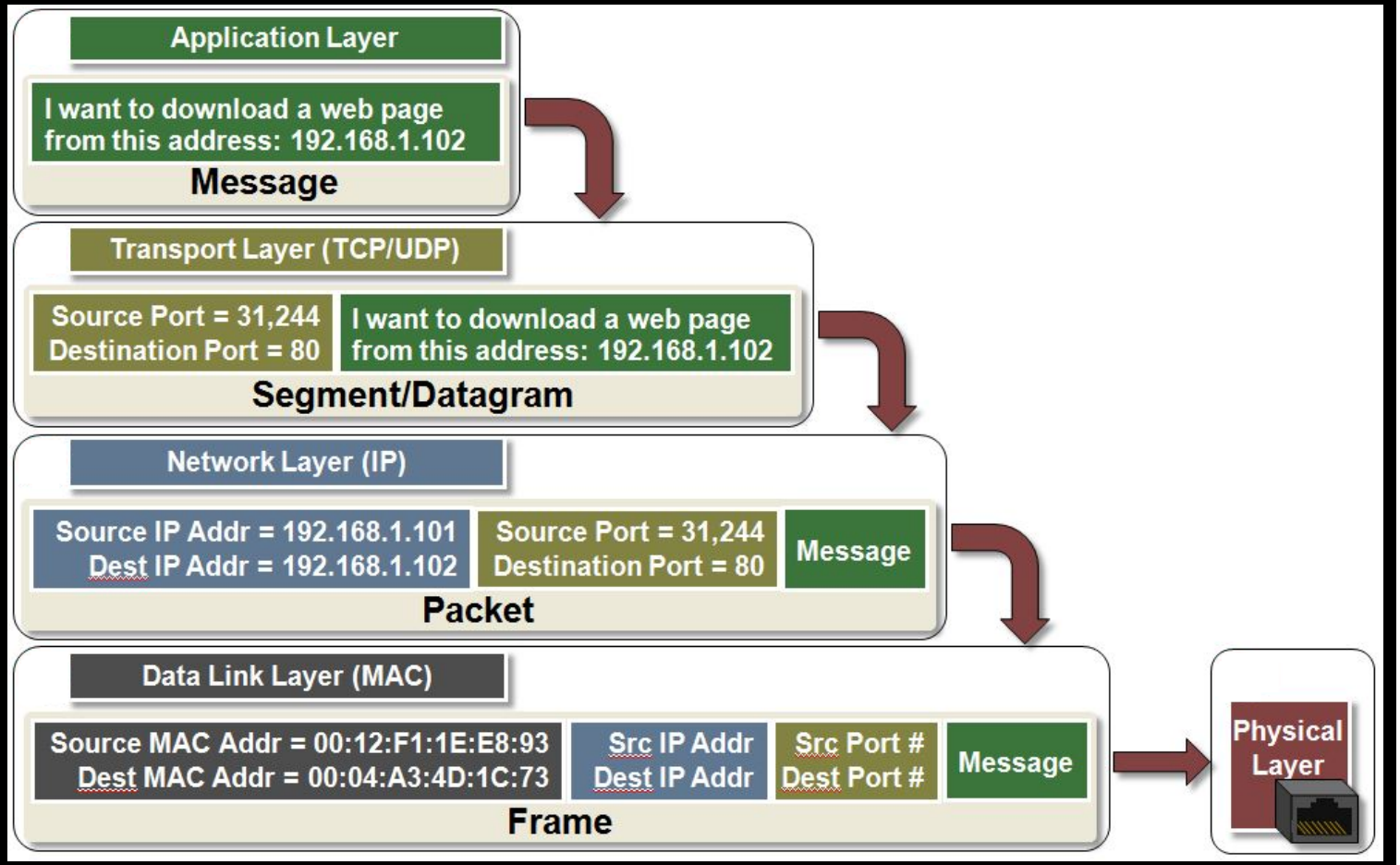
Data Transmission

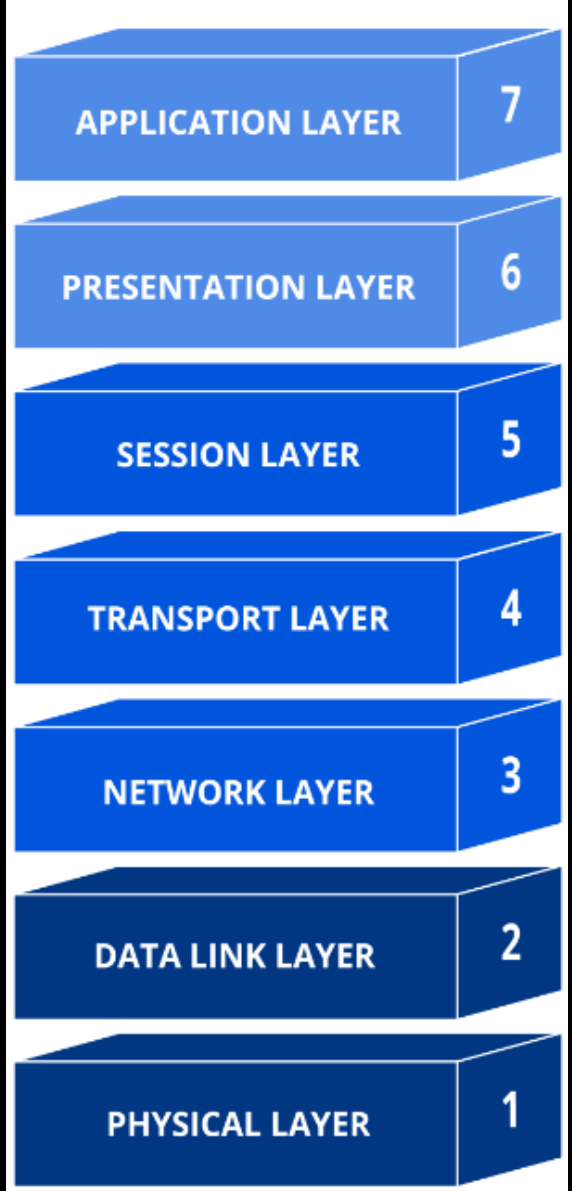
- IP datagram – The unit of end-to-end transmission in the IP protocol. An IP datagram consists of an IP header followed by transport layer data, i.e., of an IP header followed by a message.



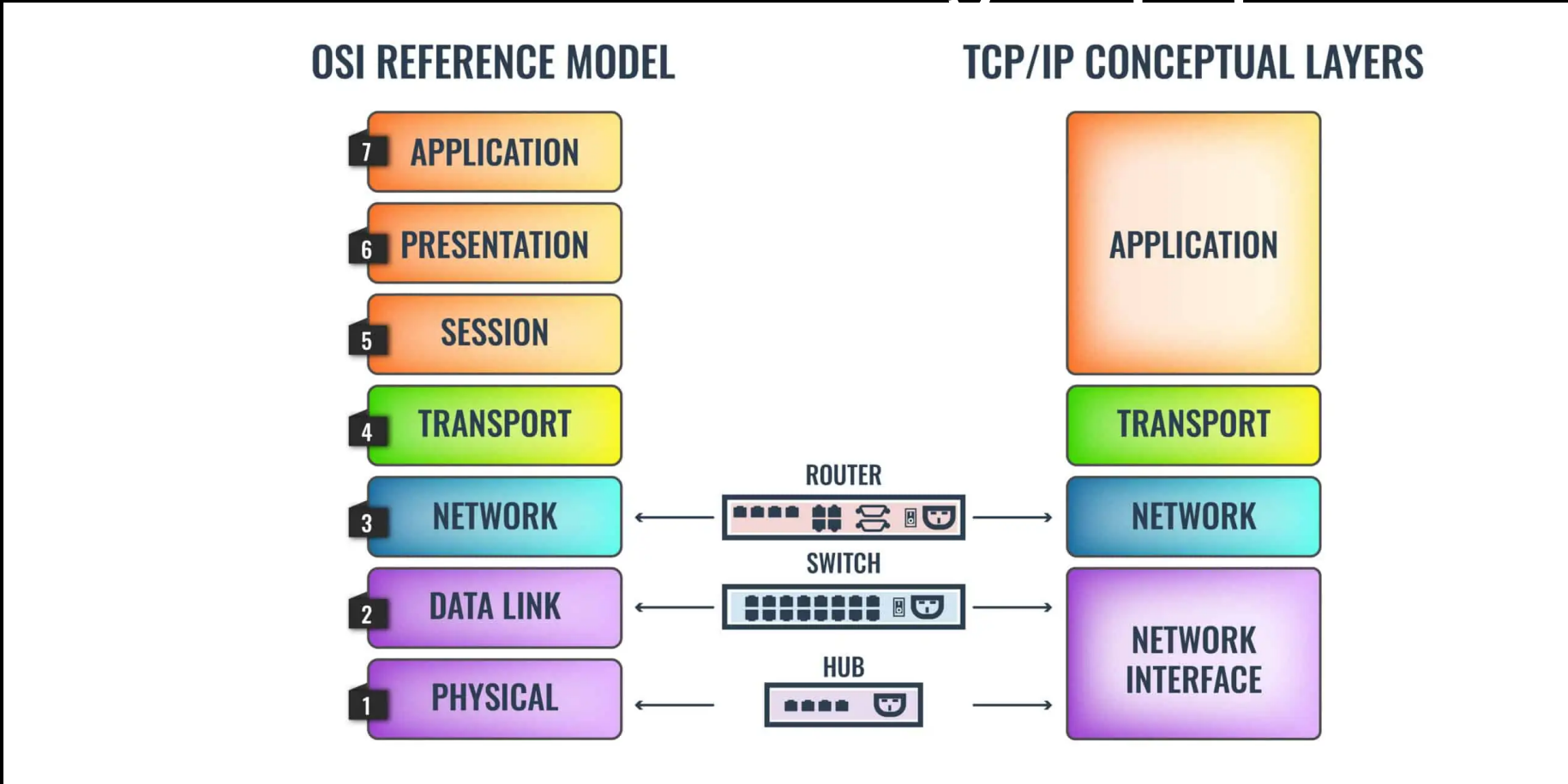
https://datatracker.ietf.org/doc/html/rfc1122#section-3

Data Transmission





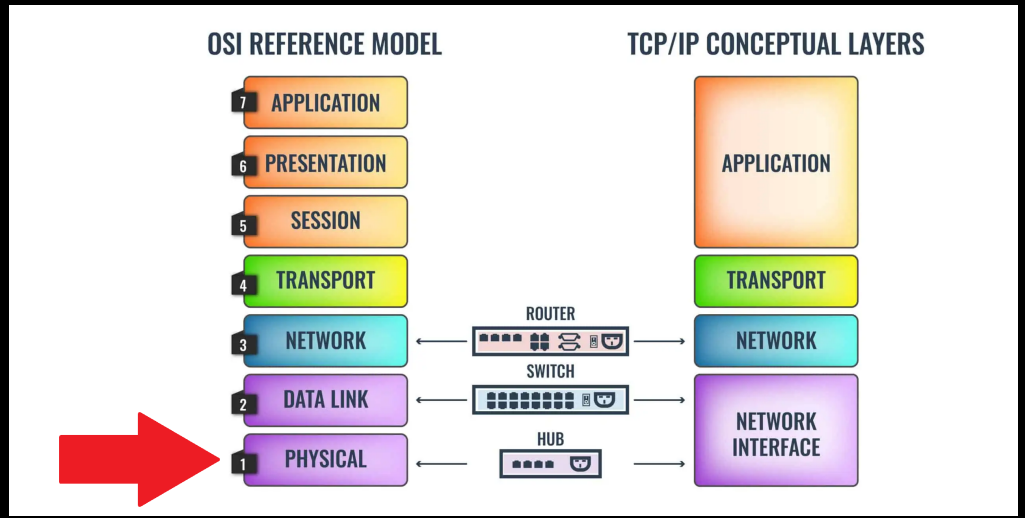
Common Networking Equipment

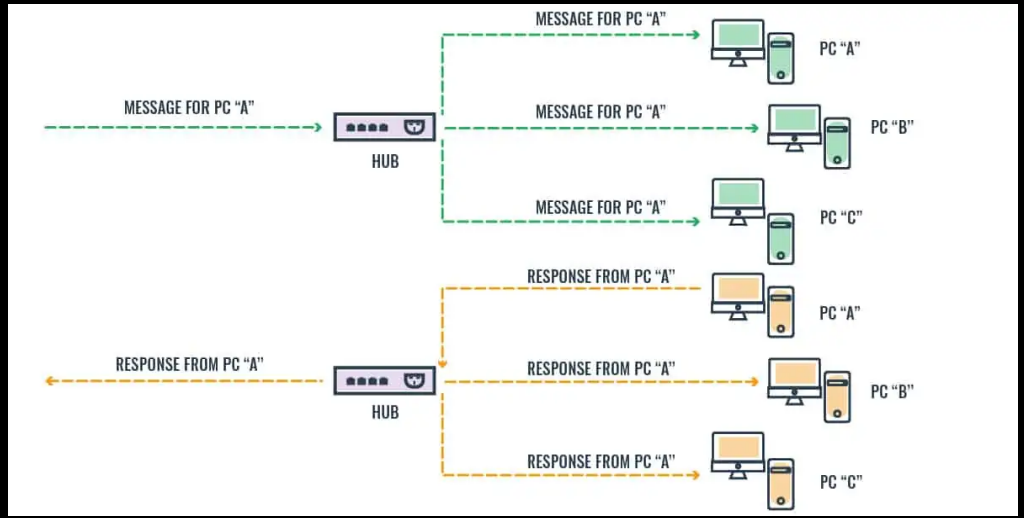


https://www.comparitech.com/net-admin/hub-vs-switch-vs-router/

Common Networking Equipment

- Hub – Physically connects parts of a network(s). This is a VERY low level hardware solution that creates a lot of network traffic! These are less common today, but they are cheap!

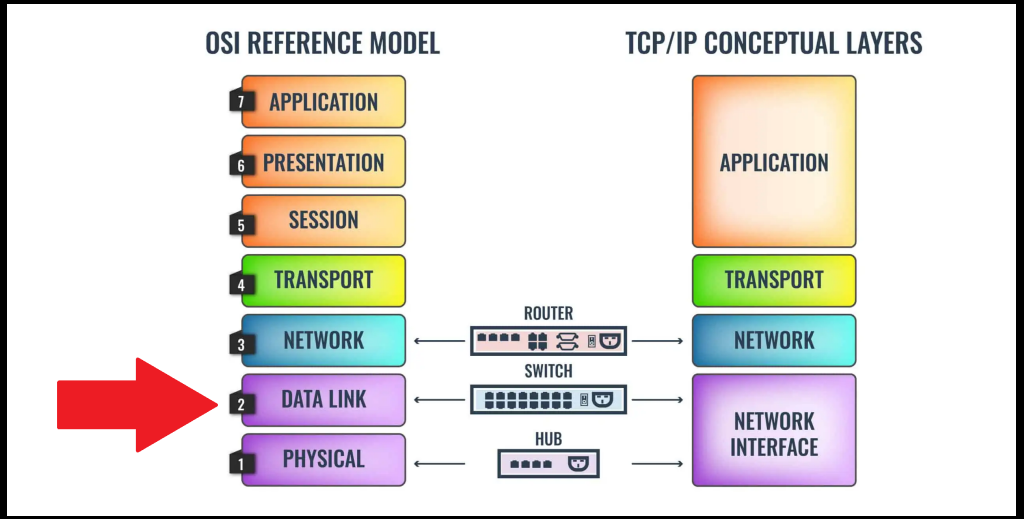


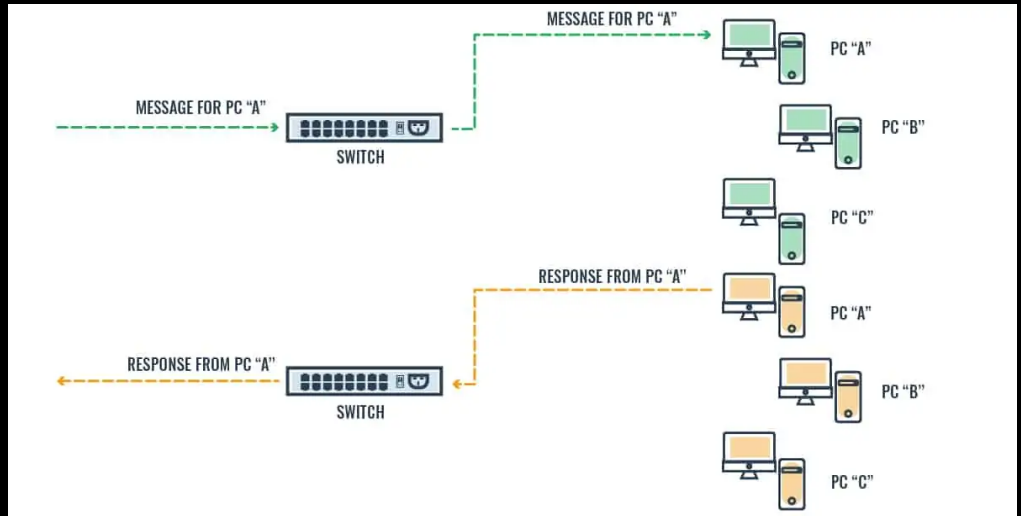


https://www.comparitech.com/net-admin/hub-vs-switch-vs-router/

Common Networking Equipment

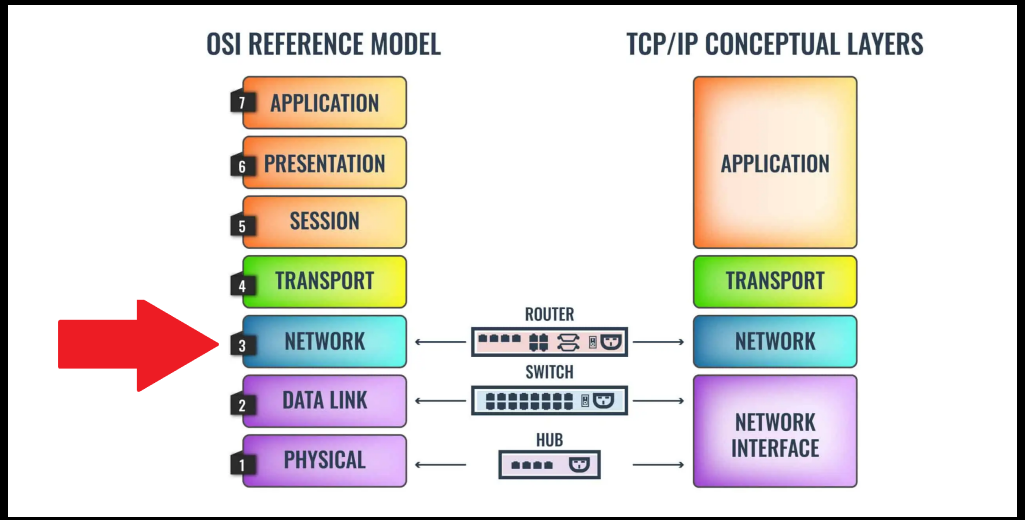
- Switch – Copies Data Frames on private networks at the Data Link layer. Uses “Hardware” MAC addresses.
  - Managed – Most common type of switch. Capable of some administrative tasks such as load balancing and reporting.
  - Unmanaged – “Workhorses”, generally no extra bells or whistles. Cheaper.

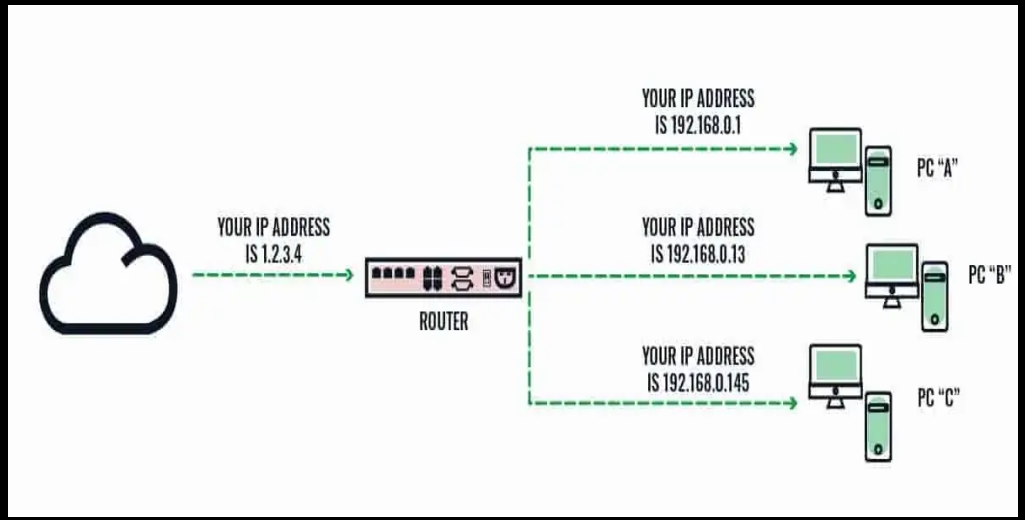




Common Networking Equipment

- Router – A device used for routing traffic on and between multiple networks. Commonly the internet.





Common Networking Equipment

- Firewall - A network security device that monitors incoming and outgoing network traffic and decides whether to allow or block specific traffic based on a defined set of security rules.

https://www.cisco.com/c/en/us/products/security/firewalls/what-is-a-firewall.html

Common Networking Equipment

- Intrusion Detection System (IDS) - A network security tool that monitors network traffic and devices for known malicious activity, suspicious activity or security policy violations.
- Intrusion Prevention System (IPS) - monitors network traffic for potential threats and automatically takes action to block them by alerting the security team, terminating dangerous connections, removing malicious content, or triggering other security devices.

https://www.ibm.com/topics/intrusion-detection-system
https://www.ibm.com/topics/intrusion-prevention-system

Common Networking Equipment

- Access Point - An access point connects to a wired router, switch, or hub via an Ethernet cable, and projects a WiFi signal to a designated area.

https://www.linksys.com/what-is-a-wifi-access-point.html

Common Networking Equipment

- Consumer Grade Equipment – Often you may have a device provided by your ISP that is referred to as the “router” or “modem” . This piece of equipment is generally multiple network appliances combined in a single housing.

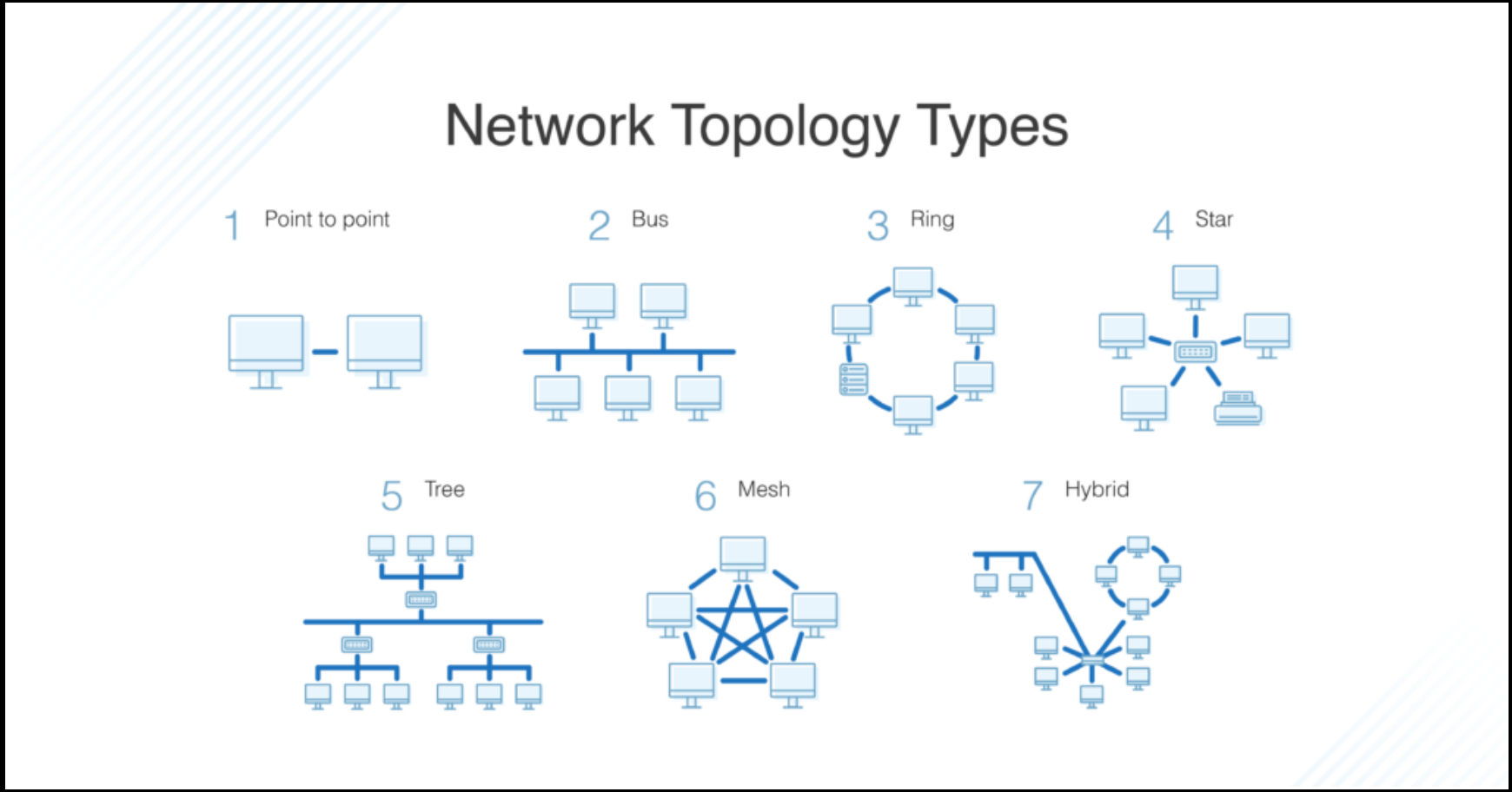
Common Network Topologies

- Physical – The actual connections (wires, cables, etc.) of how the network is arranged. Setup, maintenance, and provisioning tasks require insight into the physical network.

- Logical – higher-level idea of how the network is set up, including which nodes connect to each other and in which ways, as well as how data is transmitted through the network.

https://www.dnsstuff.com/what-is-network-topology

Common Network Topologies



https://www.dnsstuff.com/what-is-network-topology

Tiers of ISP

- Tier 1 ISP - Networks that are the backbone of the Internet. These ISPs build infrastructure such as the Atlantic Internet sea cables. They provide traffic to all other ISPs, not end users.
- Tier 2 ISP - Utilizes a combination of paid transit via Tier 1 ISPs and peering with other Tier 2 ISPs to deliver Internet traffic to end customers through Tier 3 ISPs. Tier 2 ISPs are typically regional or national providers.
- Tier 3 ISP - strictly purchases Internet transit. A Tier 3 provider is by definition primarily engaged in delivering Internet access to end customers. Tier 3 ISPs focus on local business and consumer market conditions.

https://www.thousandeyes.com/learning/techtorials/isp-tiers

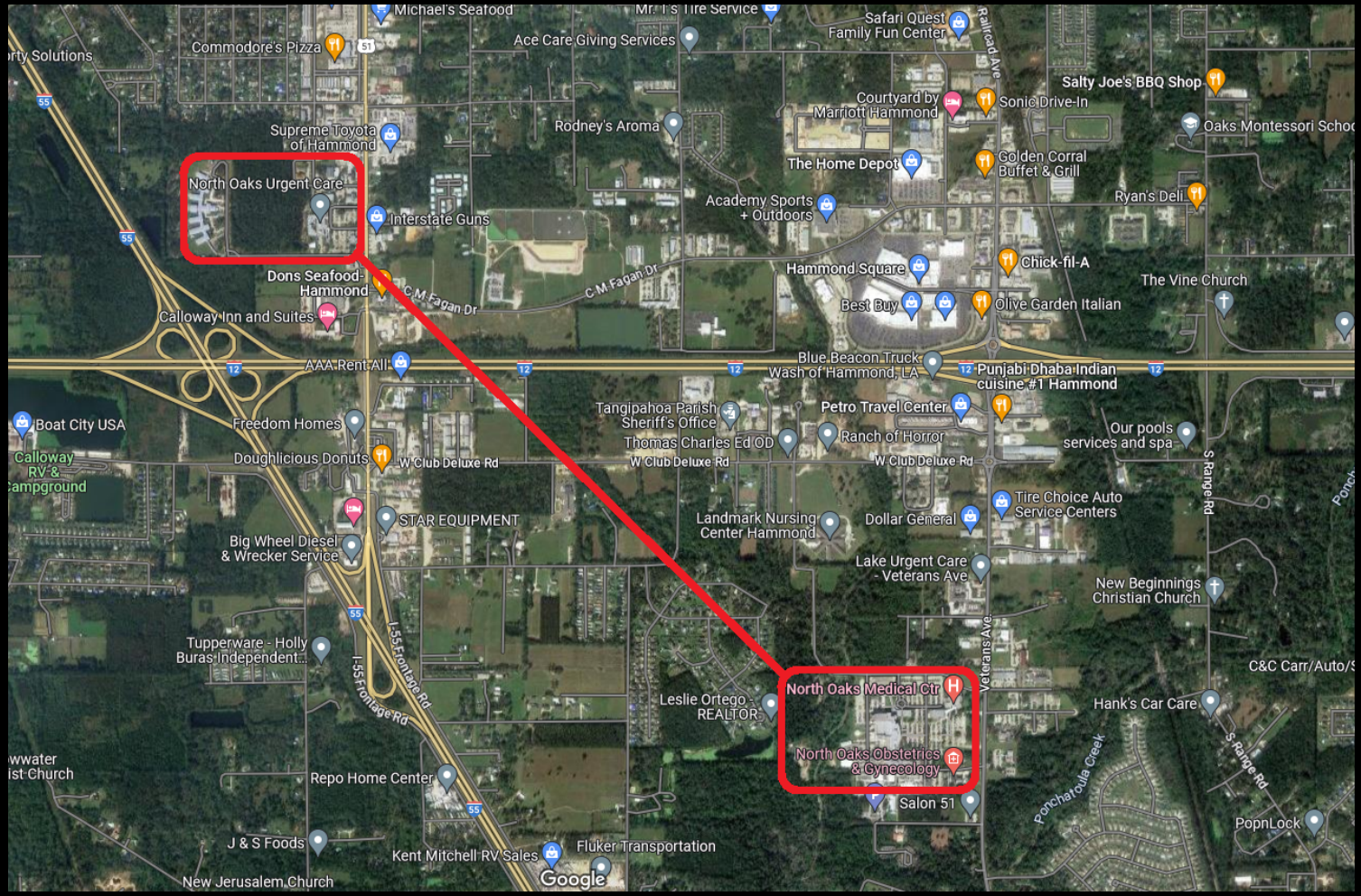
LAN VS WAN

- Local Area Network (LAN) - collection of wired and Wi-Fi connected devices in your home or office. This is your personal network. Your computer, phone, tablet, router, etc. make up your LAN.

- Wide Area Network (WAN) - exists over a large-scale geographical area. Your modem sends and receives information to and from the internet through its WAN port.

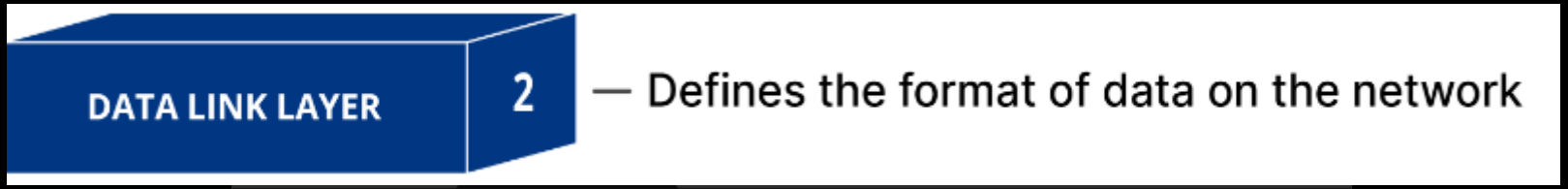
https://support.google.com/googlenest/answer/6274166

LAN VS WAN


North Oaks Urgent Care
North Oaks Medical Ctr
Michael's Seafood
Commodore's Pizza
Ace Care Giving Services
Safari Quest Family Fun Center
Salty Joe's BBQ Shop
Courtyard by Marriott Hammond
Sonic Drive-In
Supreme Toyota of Hammond
Rodney's Aroma
The Home Depot
Golden Corral Buffet & Grill
Academy Sports + Outdoors
Ryan's Deli
Interstate Guns
Hammond Square
Chick-fil-A
Dons Seafood-Hammond
C.M. Fagan Dr
Best Buy
Olive Garden Italian
The Vine Church
Calloway Inn and Suites
A'AA Rent All
Blue Beacon Truck Wash of Hammond, LA
Punjabi Dhaba Indian cuisine #1 Hammond
Boat City USA
Freedom Homes
Tangipahoa Parish Sheriff's Office
Petro Travel Center
Thomas Charles Ed OD
Ranch of Horror
Our pools services and spa
Calloway RV & Campground
Doughlicious Donuts
W Club Deluxe Rd
S Range Rd
STAR EQUIPMENT
Tire Choice Auto Service Centers
Landmark Nursing Center Hammond
Dollar General
Big Wheel Diesel & Wrecker Service
Lake Urgent Care - Veterans Ave
New Beginnings Christian Church
Tupperware - Holly Buras Independent...
I-55 Frontage Rd
Veterans Ave
C&C Carr/Auto/S
Leslie Ortego - REALTOR
Hank's Car Care
North Oaks Obstetrics & Gynecology
Repo Home Center
Salon 51
Poncheroula Creek
PopnLock
J & S Foods
Kent Mitchell RV Sales
Fluker Transportation
New Jerusalem Church
Google

MAC Addresses

“Hardware” Address of your networking devices. This address is “burned” onto a ROM chip that is soldered onto your network card.

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Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : attlocal.net
   Description . . . . . . . . . . . : Killer(R) Wi-Fi 6E AX1675w 160MHz Wireless Network Adapter (210D2W)
   Physical Address. . . . . . . . . : 00-91-9E-43-3B-E5
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   IPv6 Address. . . . . . . . . . . : 2600:1700:35c2:afbf:96ff:eb3f:ade8:f727(Preferred)
   Temporary IPv6 Address. . . . . . : 2600:1700:35c2:afbf:8915:ba02:2642:d86c(Preferred)
   Link-local IPv6 Address . . . . . : fe80::dddf:ce41:e091:c3eb%16(Preferred)
   IPv4 Address. . . . . . . . . . . : 10.0.0.120(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : Sunday, July 9, 2023 7:26:07 PM
   Lease Expires . . . . . . . . . . : Monday, July 10, 2023 7:26:06 PM
   Default Gateway . . . . . . . . . : fe80::3223:3ff:fe10:f148%16
                                       10.0.0.1
   DHCP Server . . . . . . . . . . . : 10.0.0.1
   DHCPv6 IAID . . . . . . . . . . . : 134255006
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2A-A2-C5-7D-CC-96-E5-62-3C-AA
   DNS Servers . . . . . . . . . . . : 2600:1700:35c2:afbf:3223:3ff:fe10:f148
                                       10.0.0.1
   NetBIOS over Tcpip. . . . . . . . : Enabled
   Connection-specific DNS Suffix Search List :
                                       attlocal.net
                                       attlocal.net

Ethernet adapter Bluetooth Network Connection:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
```

MAC Addresses

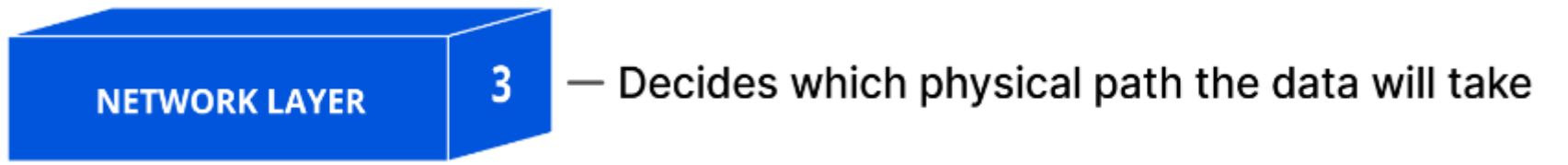
- Physical Address: 00-91-9E-43-3B-E5
- OUI – Organizationally Unique Identifier.
  First 3 bytes of MAC. Identifies the vendor. Set by Institute of Electrical and Electronics Engineers (IEEE) standard.
  - 00-91-9E
- Unique Identifier- last 3 bytes of MAC. Uniquely identify physical device.
  - 43-3B-E5

https://standards-oui.ieee.org/

https://www.wireshark.org/tools/oui-lookup.html

IP Address

- Assigned by a Dynamic Host Configuration Protocol (DHCP) Server.
- IPv4 – Older Standard that is still commonly used today and fairly easy for humans to memorize. Consists of 4 octets. Not enough IPs for all devices! 4,294,967,296
  - Octet – 8 bits (0-255 in decimal notation)



https://www.ciscopress.com/articles/article.asp?p=348253

IP Addresses

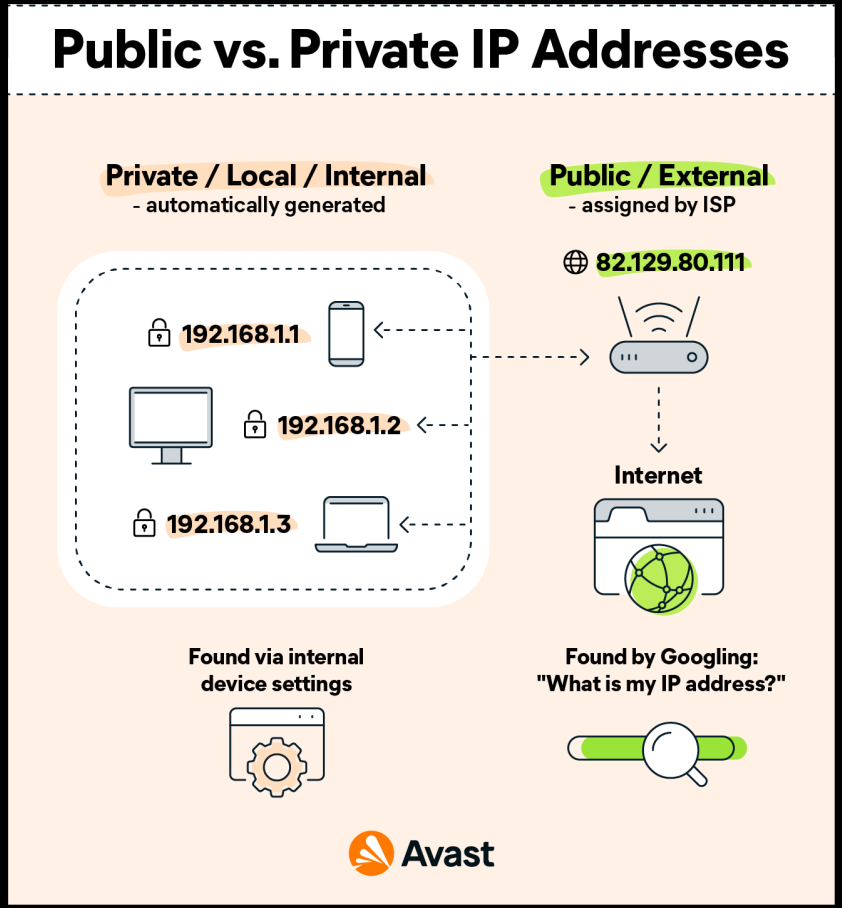
- Private Range - Address exists within specific private IP address ranges reserved by the Internet Assigned Numbers Authority (IANA) and should never appear on the internet.

- Class A: 10.0.0.0 — 10.255.255.255
- Class B: 172.16.0.0 — 172.31.255.255
- Class C: 192.168.0.0 — 192.168.255.255

- Public Range – Basically everything else.

https://www.avast.com/c-ip-address-public-vs-private

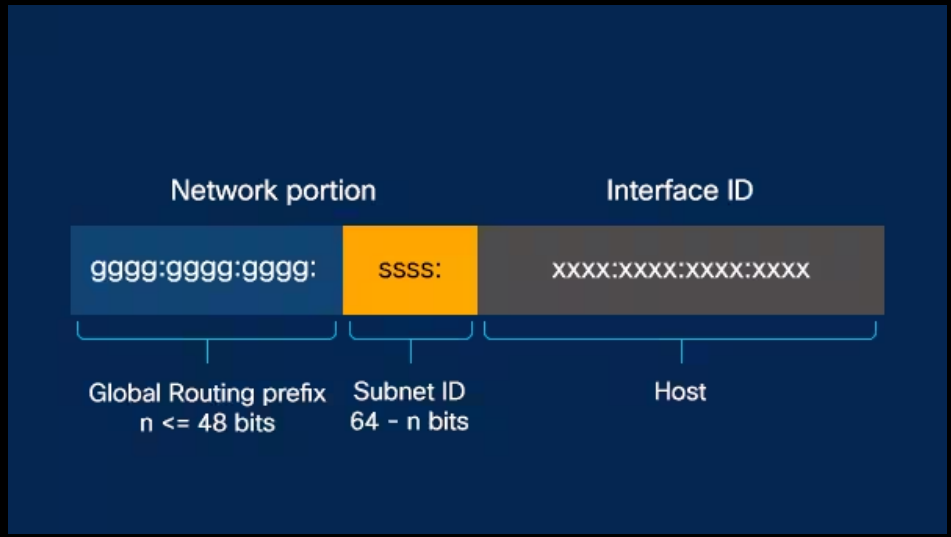
IP Addresses



https://www.avast.com/c-ip-address-public-vs-private

IP Addresses

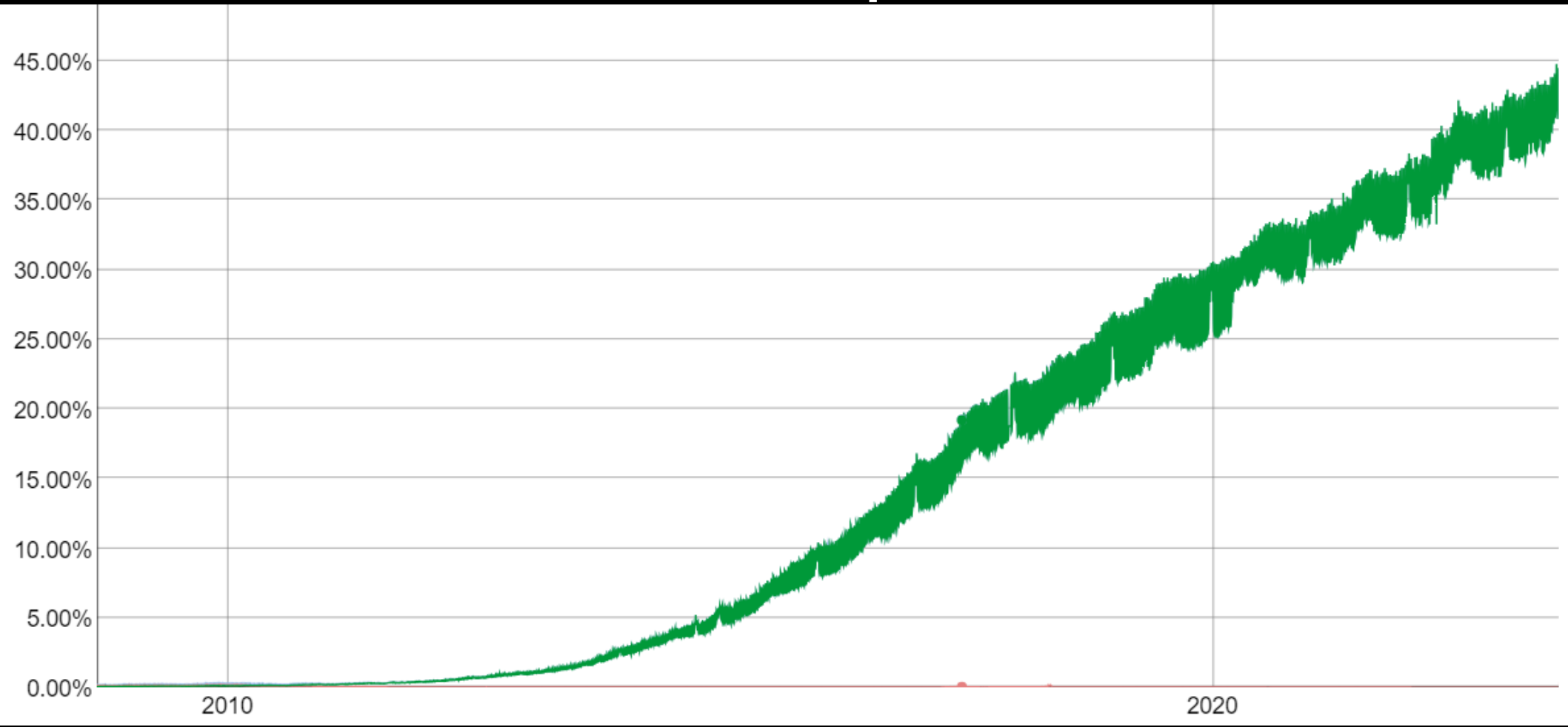
- IPv6 – The better solution! Less human readable. 340 undecillion unique addresses.
- Uses hexadecimal (base 16)



https://www.cisco.com/c/en/us/solutions/ipv6/overview.html

https://www.google.com/intl/en/ipv6/statistics.html

IPv6 Adoption



IP Addresses - Math

Decimal **Base 10**	192	168	28	9
Binary **base 2**	11000000	10101000	00011100	00001001
Hexadecimal **base 16**	C0	A8	1C	09

IP Addresses – Masks/CIDR Notation

Class A, B, and C networks have natural masks, or default subnet masks:

Class A: 255.0.0.0
Class B: 255.255.0.0
Class C: 255.255.255.0

CIDR Notation uses a “/” to represent which bits should not change. EX. 192.168.1.0/24

https://avinetworks.com/glossary/subnet-mask/