

Introduction to Software Development

WEEK 1 DAY 2

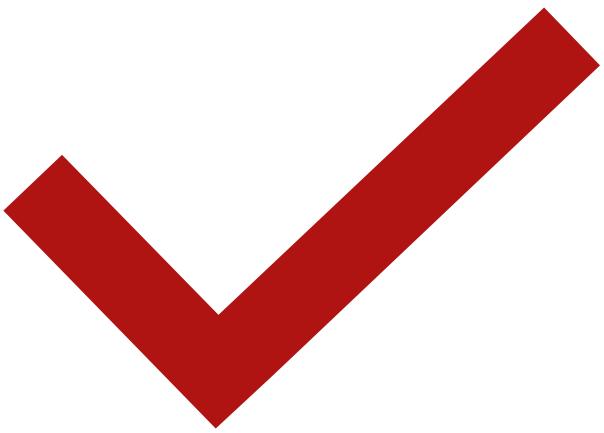
LED BY:

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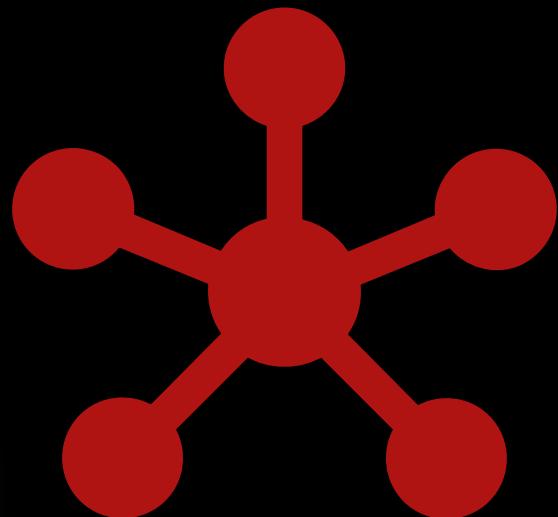


Previous Session Recap



Question or Clarifications?

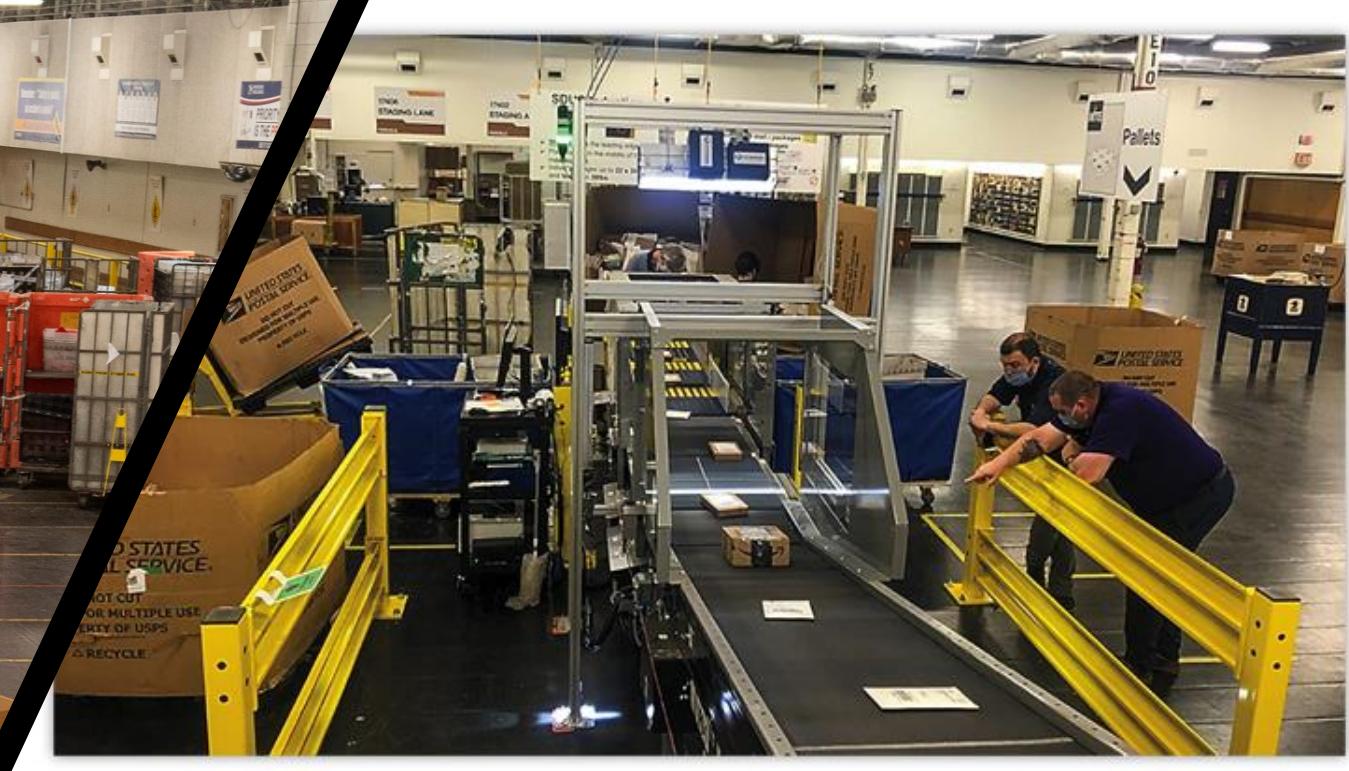
Networking



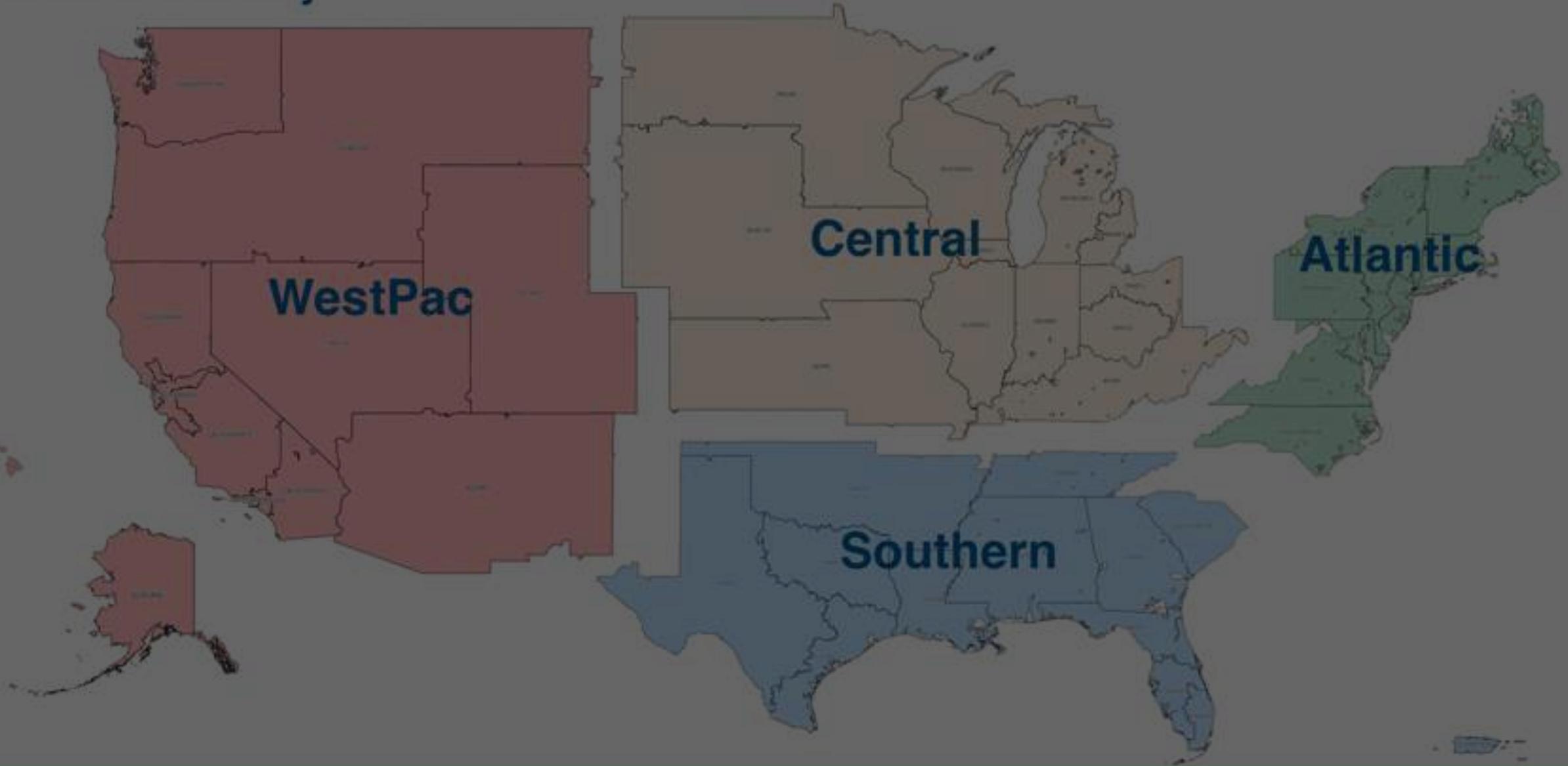


UNITED STATES

POSTAL SERVICE®



Retail & Delivery



Your name
Your SPO#
Luther College
700 College Drive
Decorah, Iowa 52101-1045

Return Address

Address

Recipient's Full Name
Business Name
Street Address
City State Zip Code
Country

Stamp

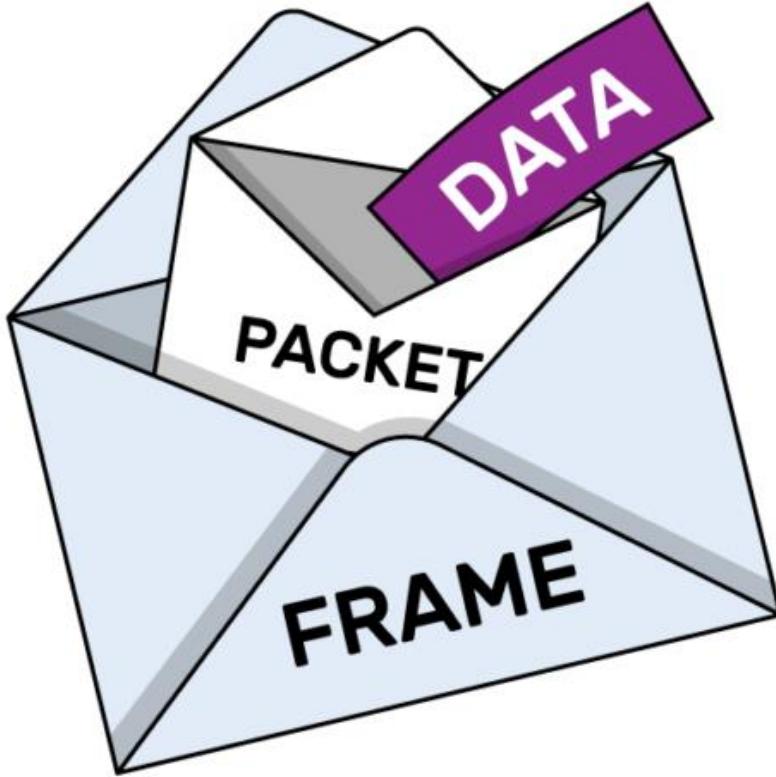


Source IP Address

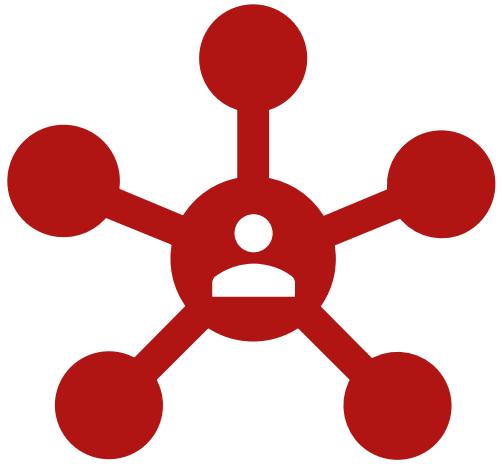


Destination IP Address

Data



Packets



What Does
Your Home
Network Look
Like?

7 Layers of the OSI Model

Application

- End User layer
- HTTP, FTP, IRC, SSH, DNS

Presentation

- Syntax layer
- SSL, SSH, IMAP, FTP, MPEG, JPEG

Session

- Synch & send to port
- API's, Sockets, WinSock

Transport

- End-to-end connections
- TCP, UDP

Network

- Packets
- IP, ICMP, IPSec, IGMP

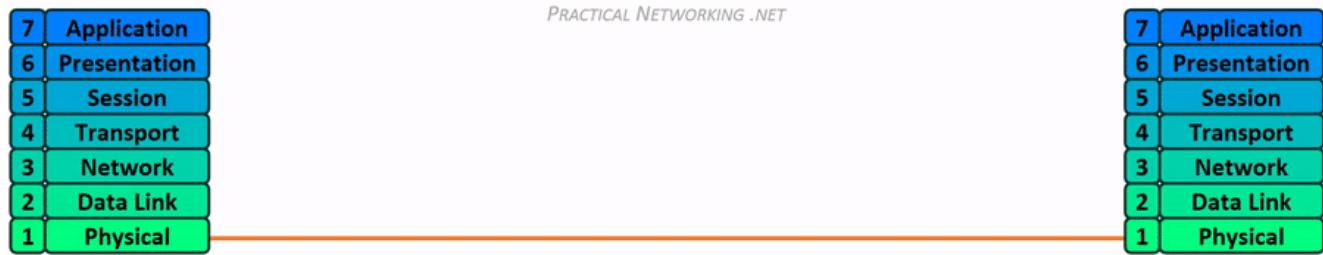
Data Link

- Frames
- Ethernet, PPP, Switch, Bridge

Physical

- Physical structure
- Coax, Fiber, Wireless, Hubs, Repeaters

Network Transmission



Layer 1 - Physical

MEDIA LAYER

Networking Hardware

- ▶ Purpose
 - ▶ Provides a physical medium for transporting raw information
- ▶ Wireless Antenna
- ▶ Cat5 (Ethernet) Cables
- ▶ Coaxial Cables
- ▶ Fiber Optic Cables
- ▶ Network Hubs
- ▶ Network Repeaters

Layer 2 - Data Link

MEDIA LAYER

Layer 2

- ▶ Purpose
 - ▶ Provides error-free transfer of data frames from one node to another via the physical layer
- ▶ Physical
 - ▶ Network Switch
 - ▶ Network Bridge
- ▶ Logical
 - ▶ “Frames”



Layer 3 - Network

MEDIA LAYER

Layer 3

- ▶ Purpose
 - ▶ Controls the operations of the subnet.
 - ▶ Decides which physical path data will take
- ▶ Physical
 - ▶ Router
- ▶ Logical (Protocols)
 - ▶ IP
 - ▶ ICMP
 - ▶ IPSec
 - ▶ IGMP



Layer 4 - Transport

HOST LAYER

Layer 4

- ▶ Purpose
 - ▶ Ensures that messages are delivered in sequence without losses, errors or duplications
- ▶ Logical
 - ▶ TCP
 - ▶ UDP

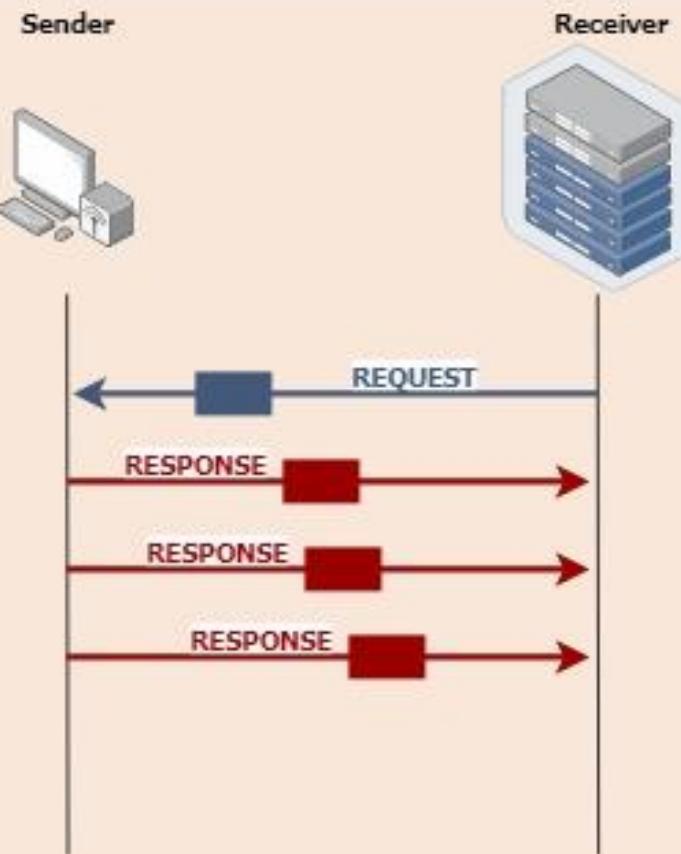


10 minute break

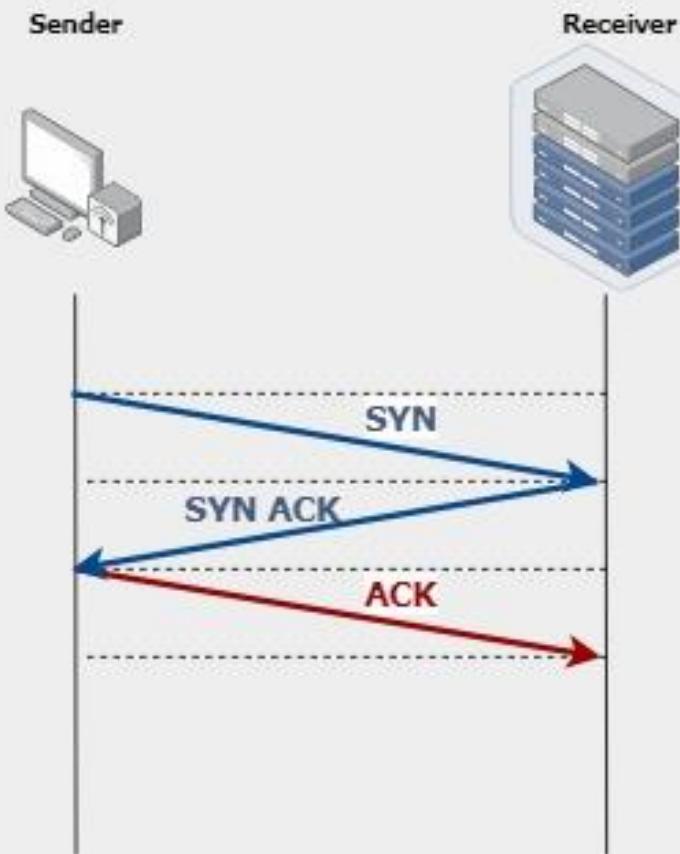
TCP VS. UDP

Stateful vs. Stateless Networking

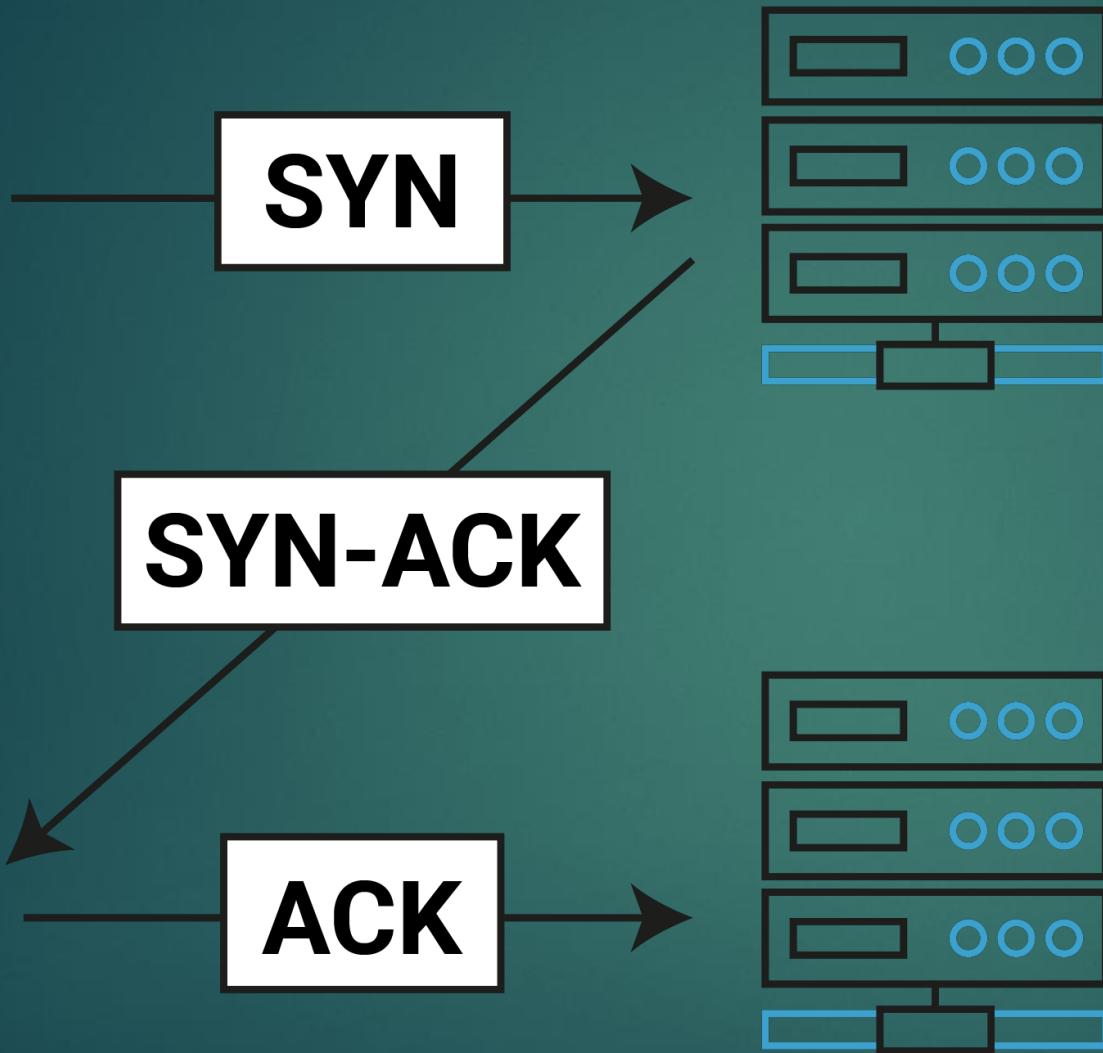
UDP



TCP



TCP Handling



TCP 3-Way Handshake

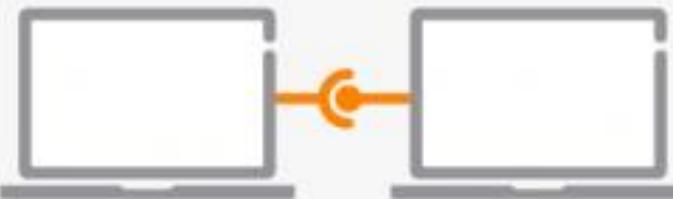
Explain TCP In A Gif



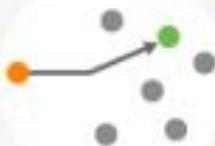
Delivery fulfilled.

UDP Handling

TCP

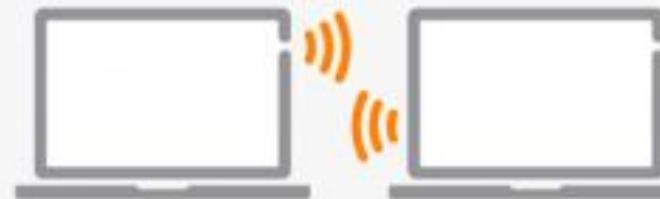


- Slower but more reliable transfers
- Typical Applications:
 - File Transfer Protocol (FTP)
 - Web Browsing
 - Email

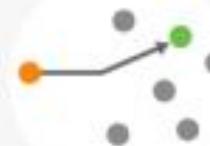


unicast

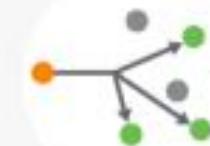
UDP



- Faster but not guaranteed transfers ("best effort")
- Typical Applications:
 - Live Streaming
 - Online Games
 - VoIP



unicast



multicast



broadcast

Explain UDP In A Gif



Discussion: TCP Apps & UDP Apps

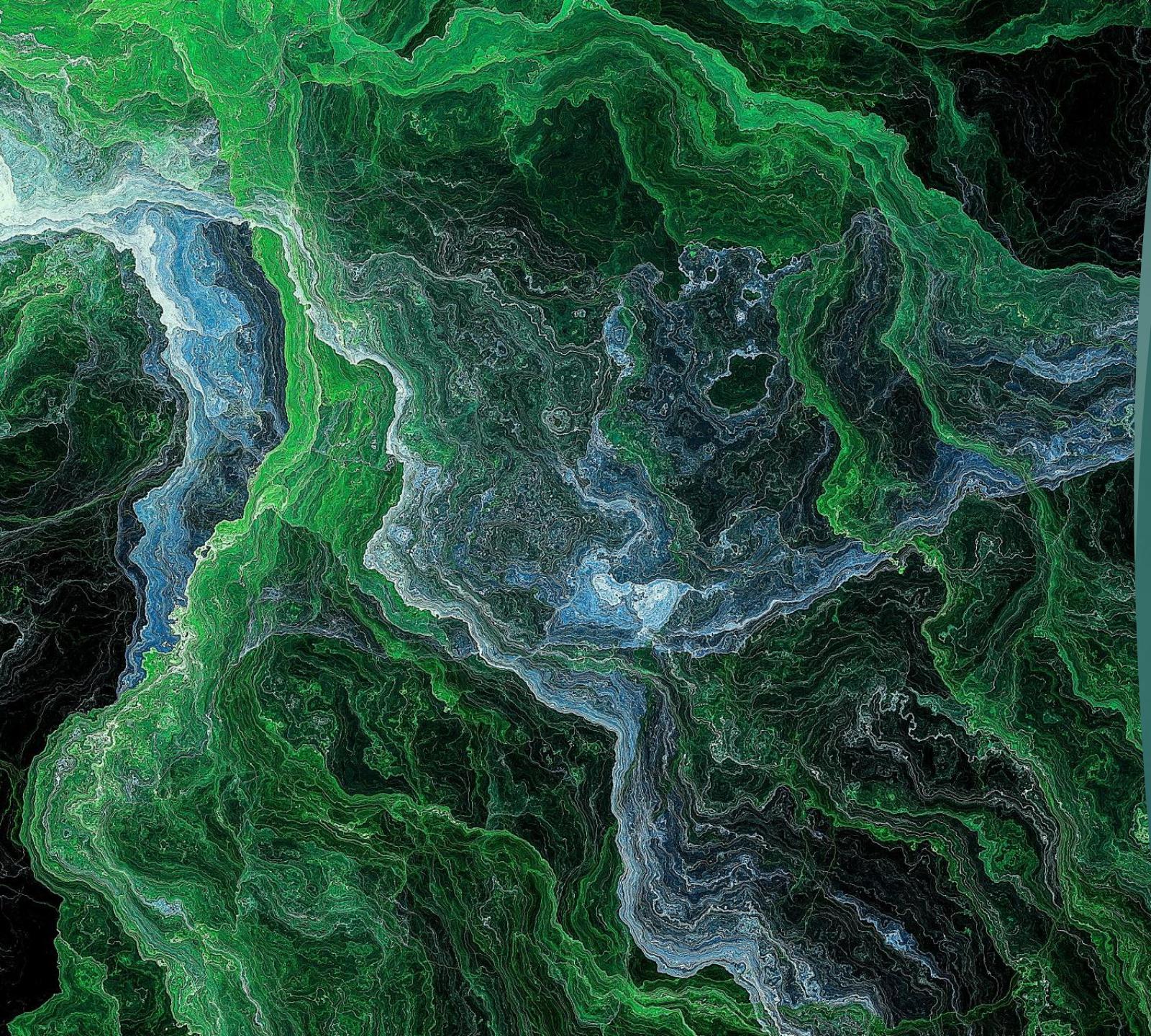
- ▶ Moodle
 - ▶ TCP or UDP?
- ▶ VoIP
 - ▶ TCP or UDP?
- ▶ YouTube
 - ▶ TCP or UDP?
- ▶ SWIFT Money Transfers
 - ▶ TCP or UDP?

Layer 5 – Session

HOST LAYER

Layer 5

- ▶ Purpose
 - ▶ Allows the establishment of sessions between processes
- ▶ Protocols
 - ▶ RPC
 - ▶ SQL
 - ▶ NFS
 - ▶ Netbios

A detailed topographic map with numerous contour lines, showing elevation changes across a landscape. The colors range from dark blue for lower elevations to bright green for higher elevations, with black lines indicating the specific contour levels.

Layer 6 – Presentation

HOST LAYER

Layer 6

- ▶ Purpose
 - ▶ Formats data bound for the application layer (layer 7)
- ▶ Protocols
 - ▶ JPG
 - ▶ ASCII
 - ▶ ANSI
 - ▶ GIF
 - ▶ WEBP

Layer 7 – Application

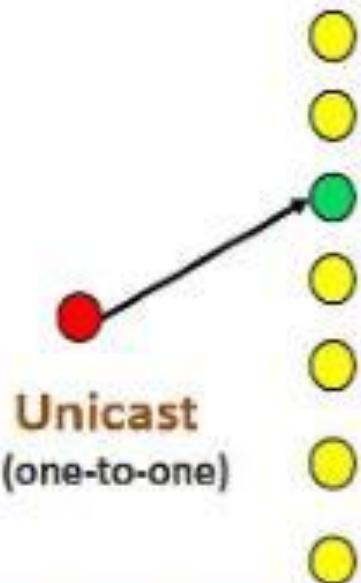
HOST LAYER



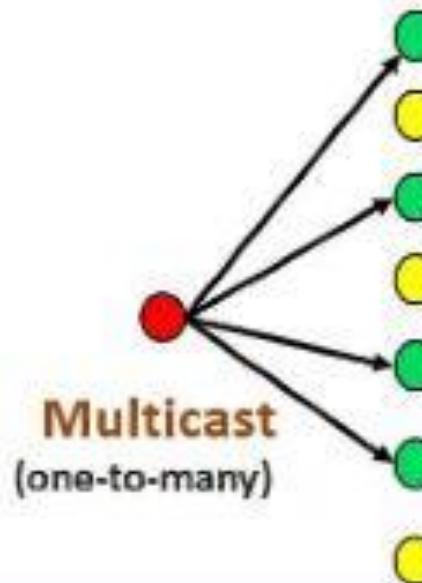
Layer 7

- ▶ Purpose
 - ▶ Interface layers for users to access network resources
- ▶ Protocols
 - ▶ SMTP
 - ▶ HTTP
 - ▶ Wiki
 - ▶ Microsoft Word

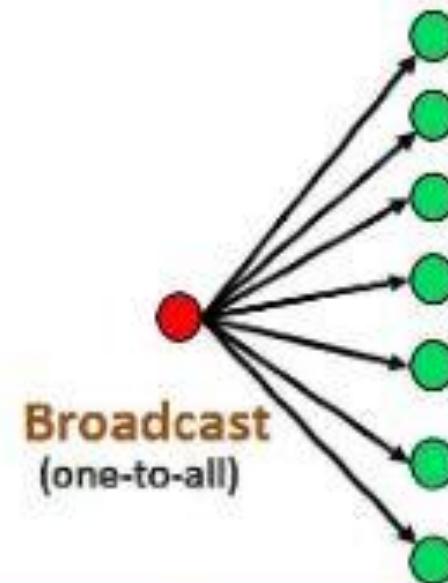
What is **Unicast Multicast Broadcast**



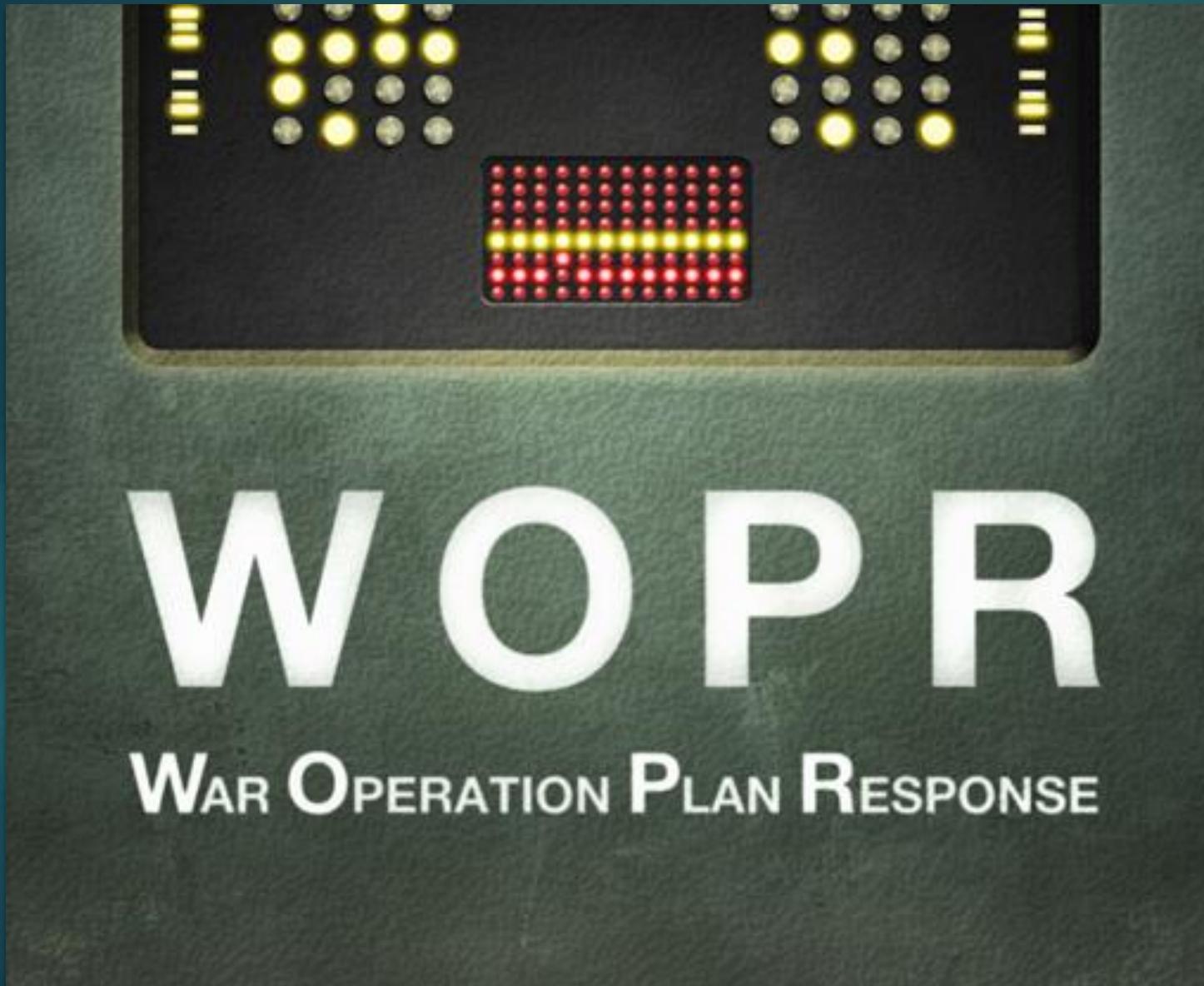
Unicast
(one-to-one)



Multicast
(one-to-many)



Broadcast
(one-to-all)

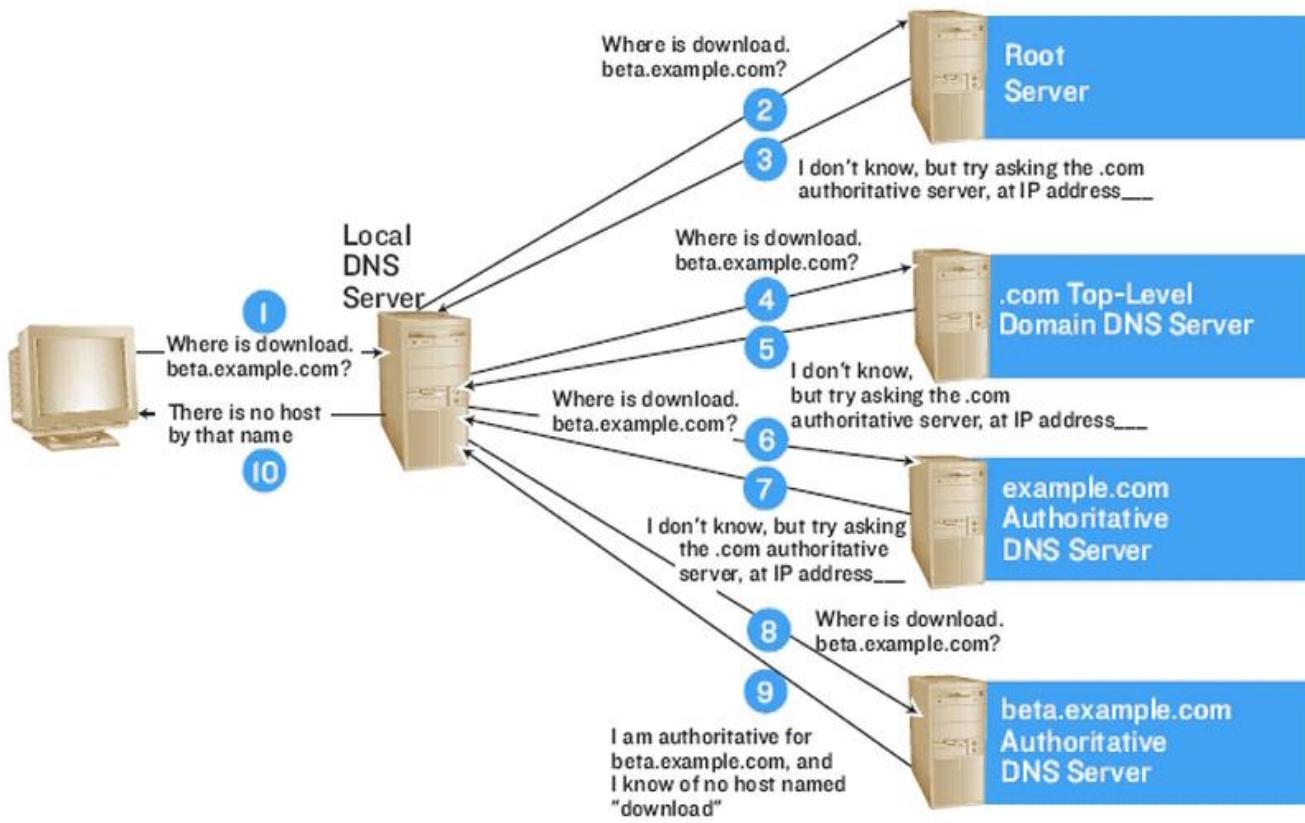


Shall We
Play A
Game?

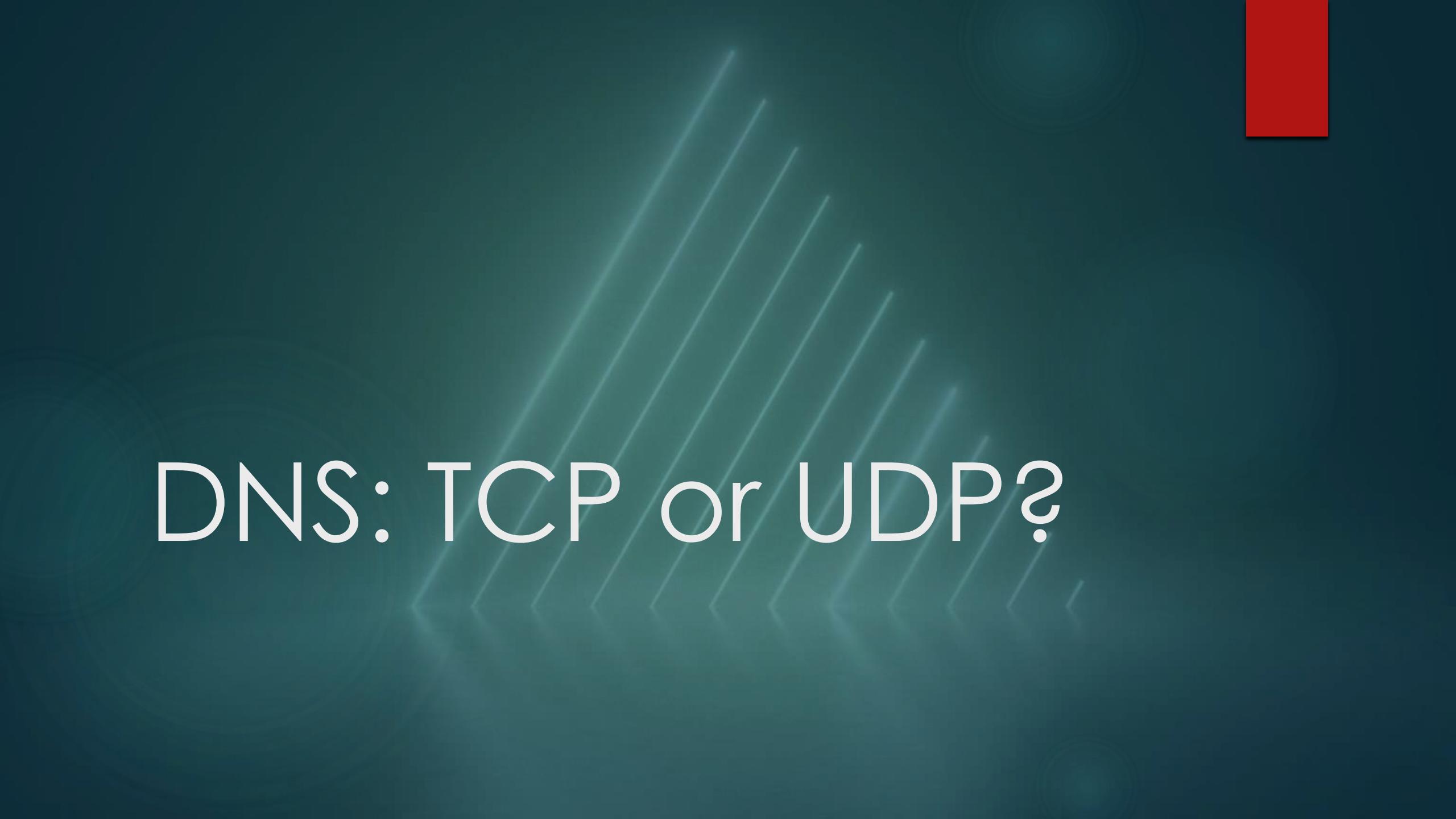
[HTTPS://STATIC-LABS.TRYHACKME.CLOUD/SITES/OSI-MODEL-GAME/](https://static-labs.tryhackme.cloud/sites/osi-model-game/)

Name Resolution

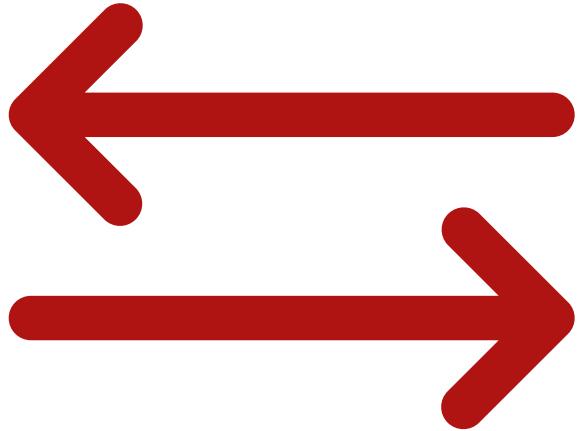
HOW DNS WORKS



DNS



DNS: TCP or UDP?



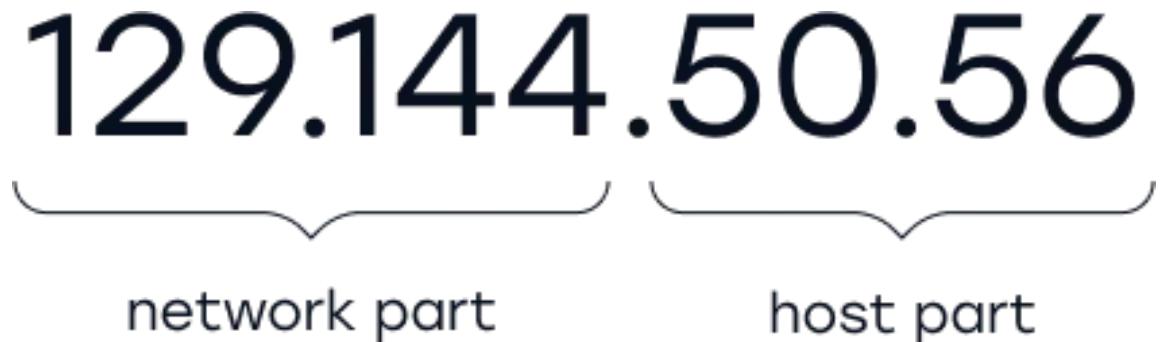
Problem: How
Do We Move
Information?

LANs and WANs

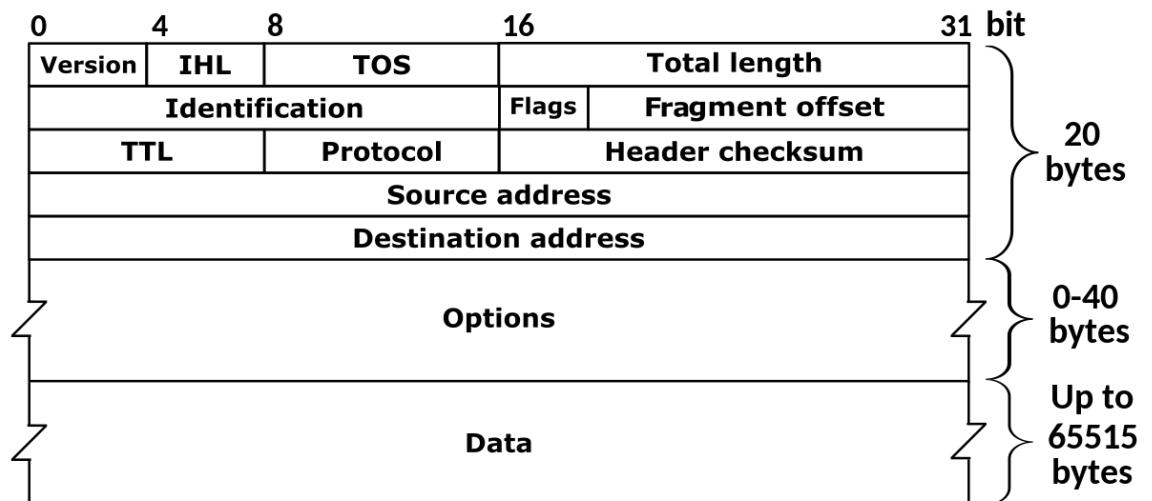


Network Operation

129.144.50.56



The IP address 129.144.50.56 is shown with a brace under the first three octets (129.144.50) labeled "network part" and a brace under the last octet (56) labeled "host part".



NETWORK PORTS

Well-known Ports

0 - 1023

Registered Ports

1024 - 49151

Dynamic Ports

49152 - 65565

Network Ports

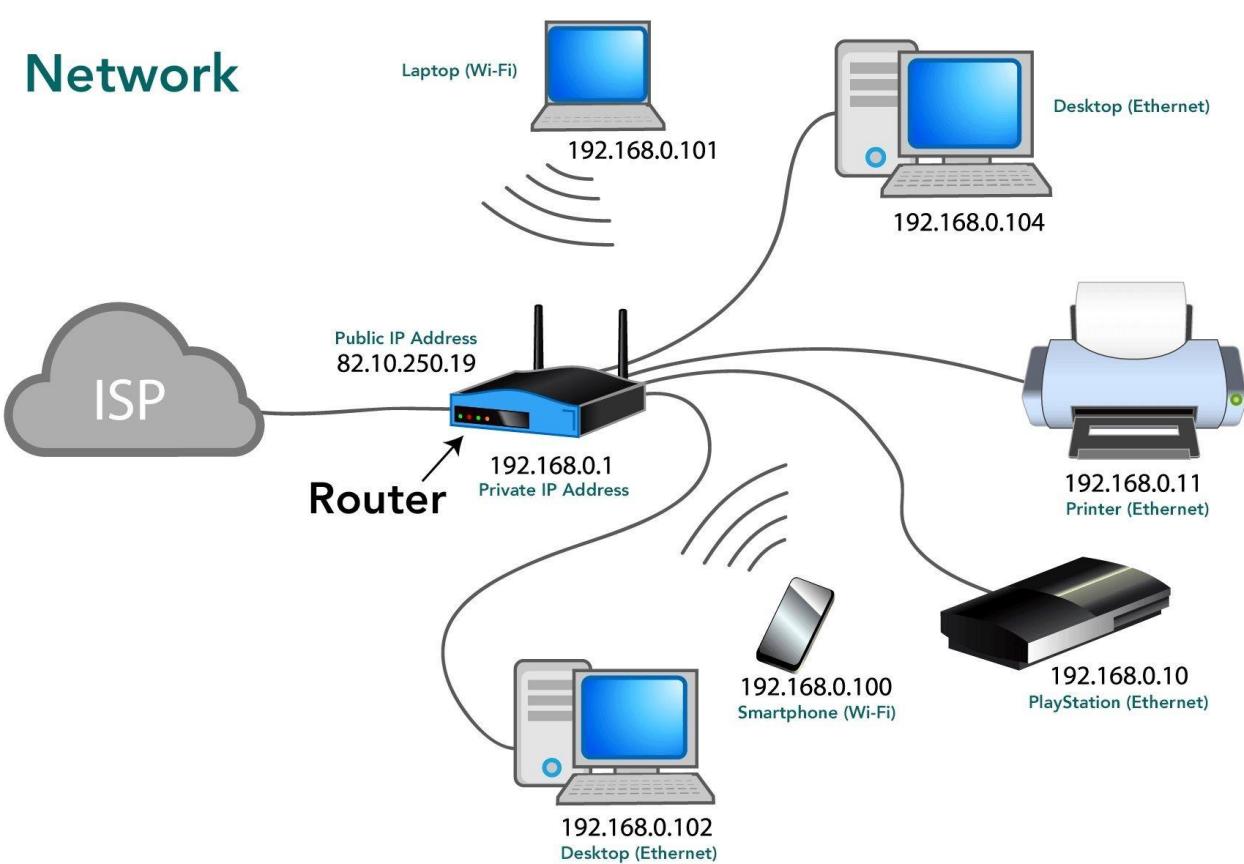
Common Ports

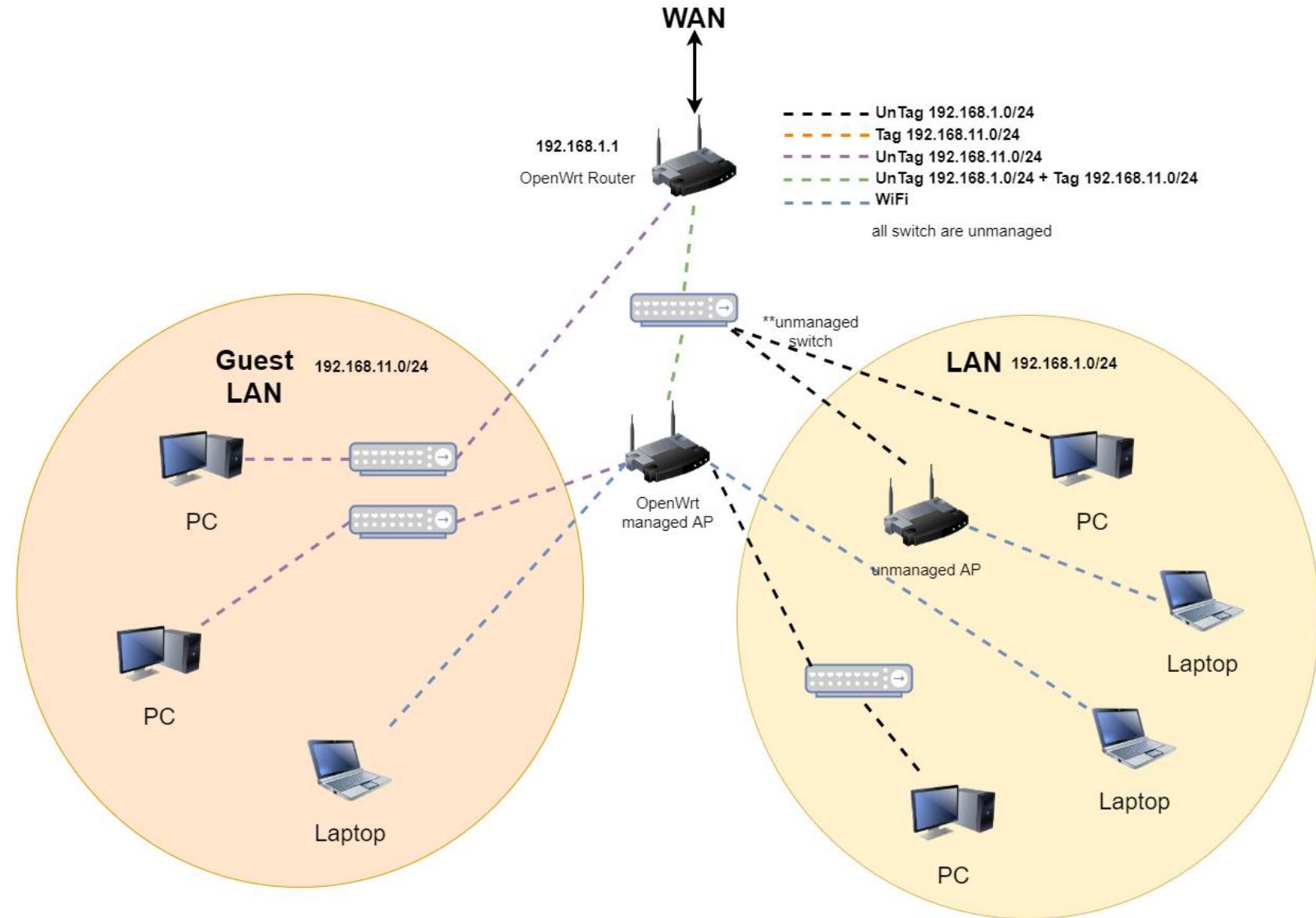
Port #	Application Layer Protocol	Type	Description
20	FTP	TCP	File Transfer Protocol - data
21	FTP	TCP	File Transfer Protocol - control
22	SSH	TCP/UDP	Secure Shell for secure login
23	Telnet	TCP	Unencrypted login
25	SMTP	TCP	Simple Mail Transfer Protocol
53	DNS	TCP/UDP	Domain Name Server
67/68	DHCP	UDP	Dynamic Host
80	HTTP	TCP	HyperText Transfer Protocol
123	NTP	UDP	Network Time Protocol
161,162	SNMP	TCP/UDP	Simple Network Management Protocol
389	LDAP	TCP/UDP	Lightweight Directory Authentication Protocol
443	HTTPS	TCP/UDP	HTTP with Secure Socket Layer

Local Area Network (LAN)

- ▶ Allows connection to other nearby network-connected systems
- ▶ You probably use some of these devices!
 - ▶ Amazon firestick
 - ▶ Google Chromecast
 - ▶ Apple TV
- ▶ More protective of local information?

Basic Network Topology

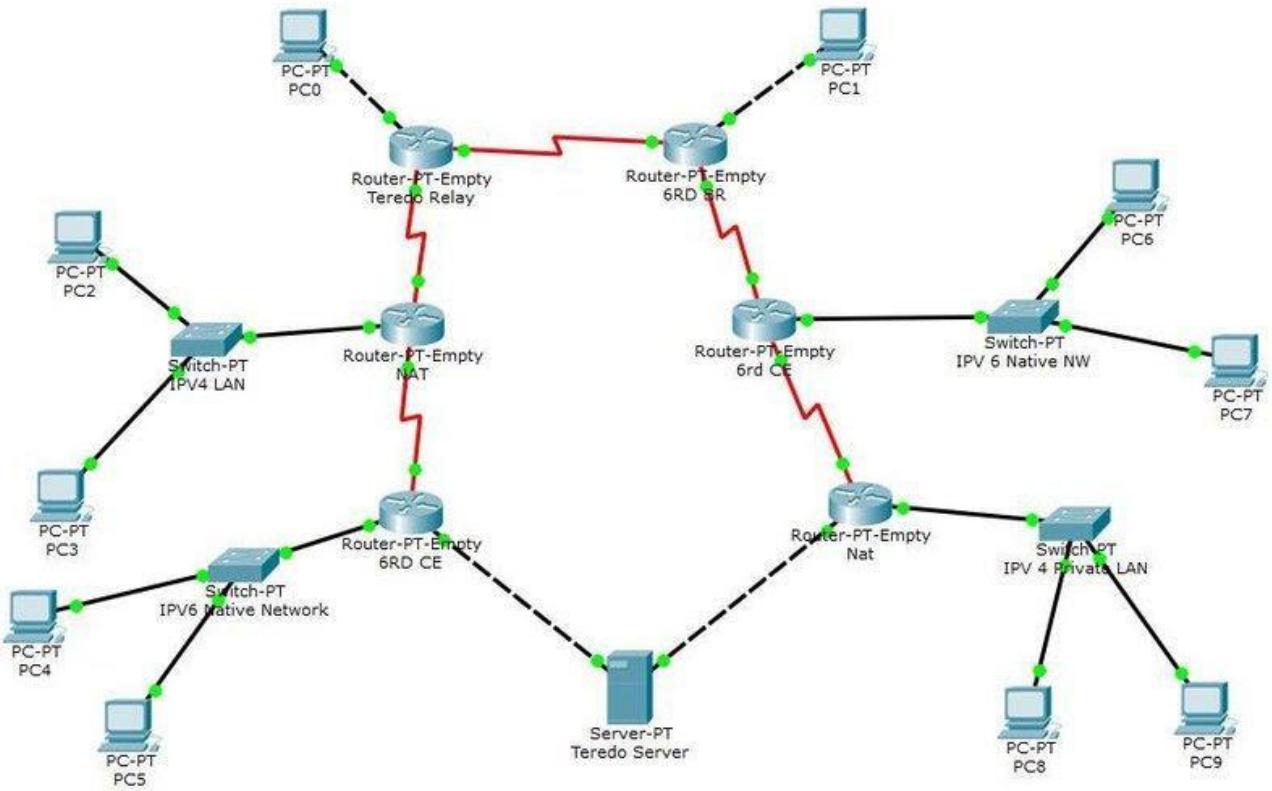


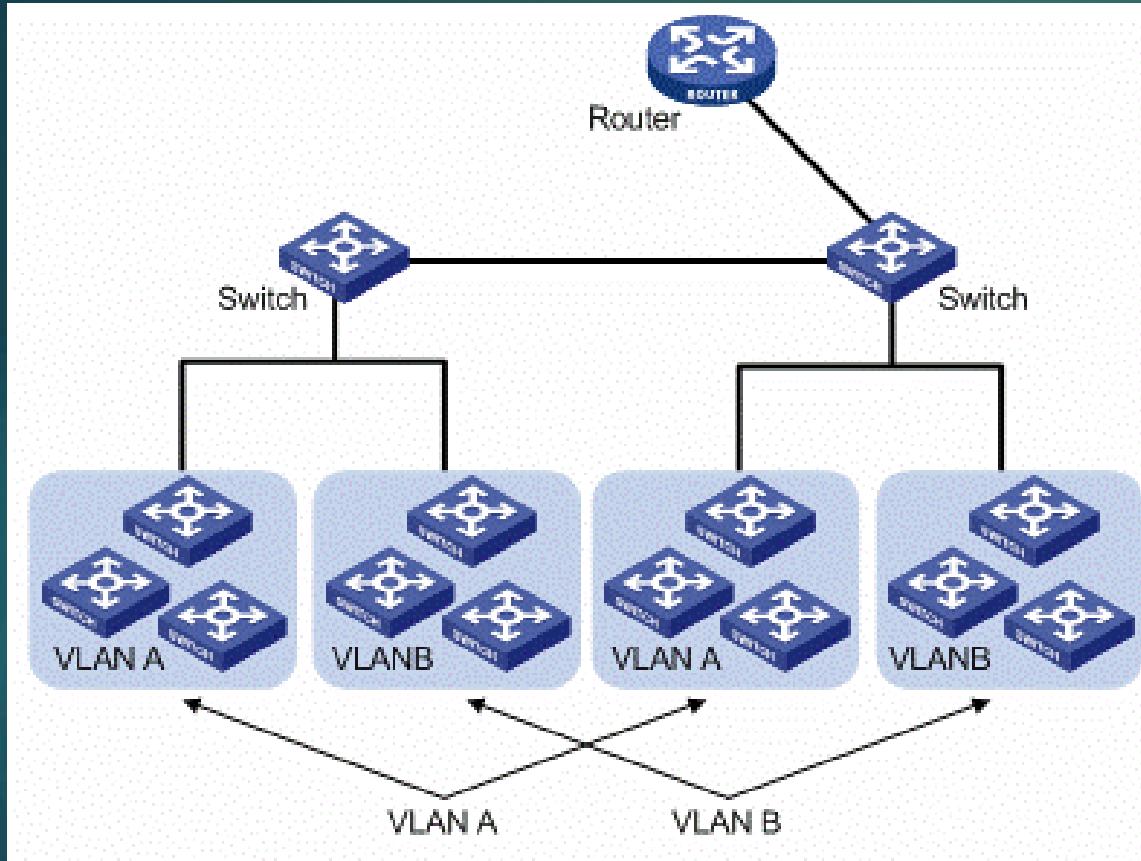


Wide Area Network (WAN)

- ▶ Allows connection to remote hosts
 - ▶ Typically used to connect multiple geographic locations together
 - ▶ Think offices, homes, customers, etc.
- ▶ Websites
- ▶ Remote backups/repositories
- ▶ VPNs enable access to remote LANs

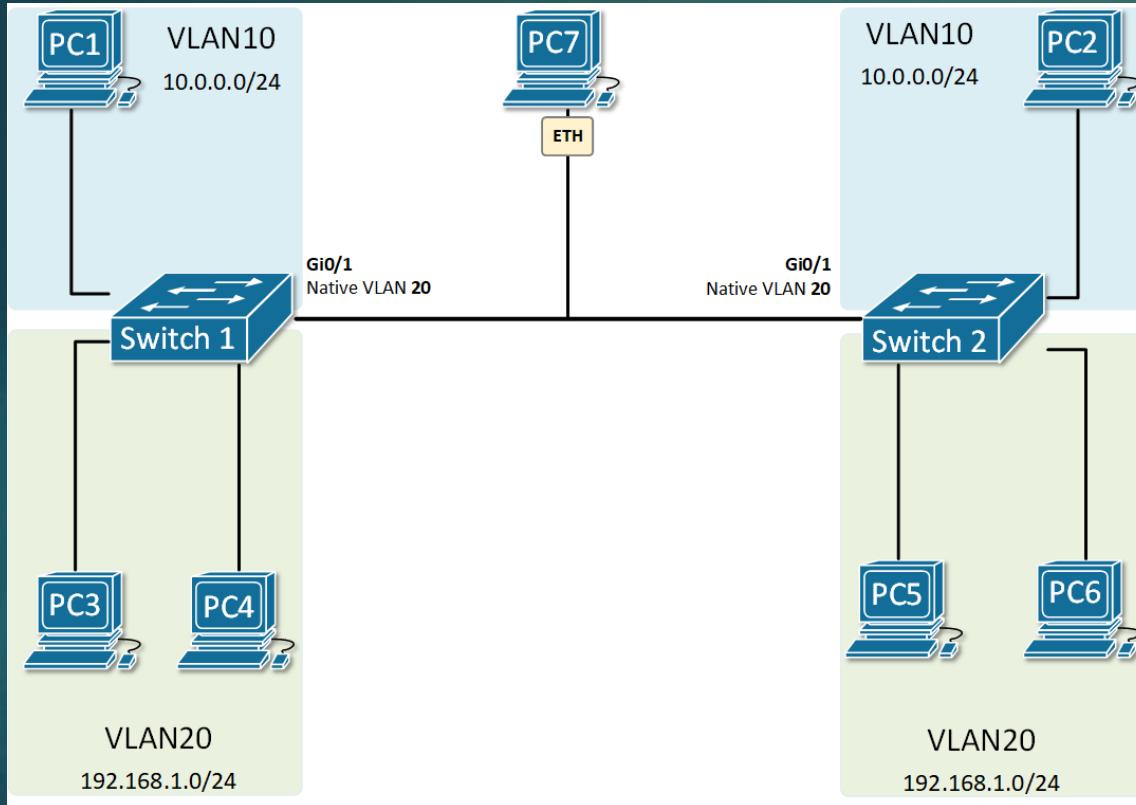
Complex Network Topology





LANs and VLANs

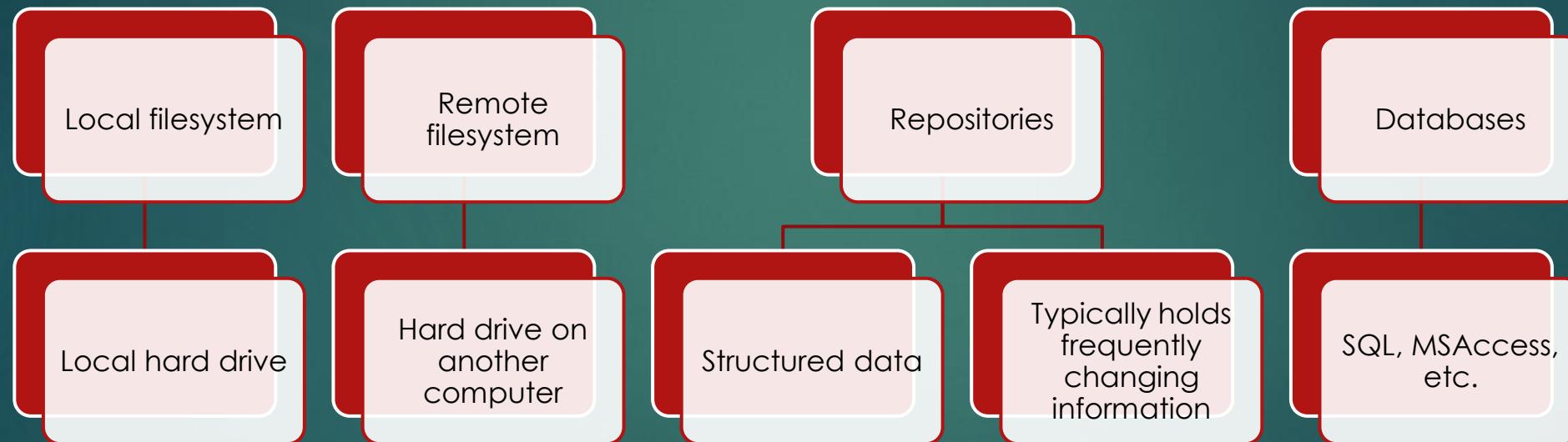
Trunk Native VLAN



How Do Apps Access Information?

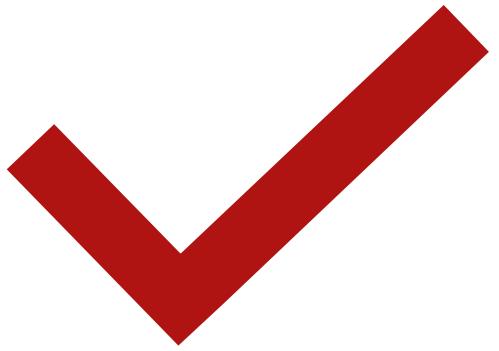


Local & Remote Information





Software Underpins
All Of This!



Day 2 Recap



Question or Clarifications?

Day 3 Preview

Instructor Contact Info

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