

# Introduction to Software Development

WEEK 1 DAY 2

LED BY:

EMILY CROSE

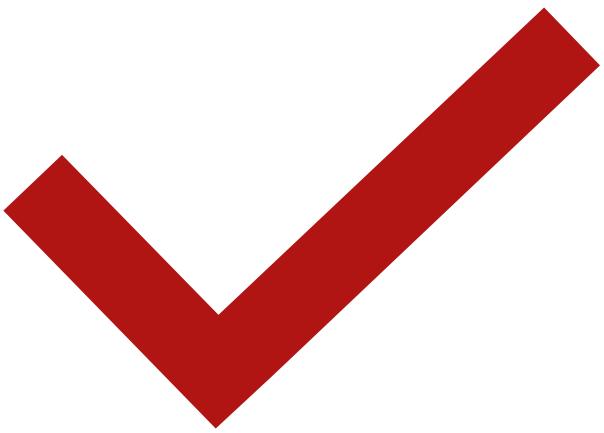
OAKLAND UNIVERSITY

# Contact info

[ecrose@oakland.edu](mailto:ecrose@oakland.edu)

# Admin Items

- ▶ Absences
  - ▶ Two allowed absences (with courtesy email to the instructor)
- ▶ Quiz at the end
  - ▶ YOU MUST TAKE THE QUIZ!

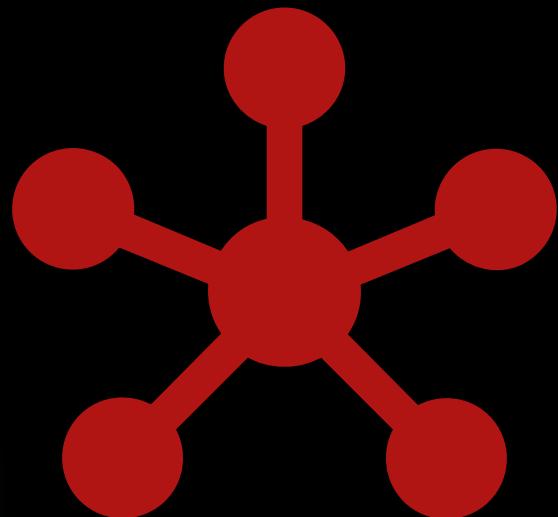


# Previous Session Recap



# Question or Clarifications?

# Networking

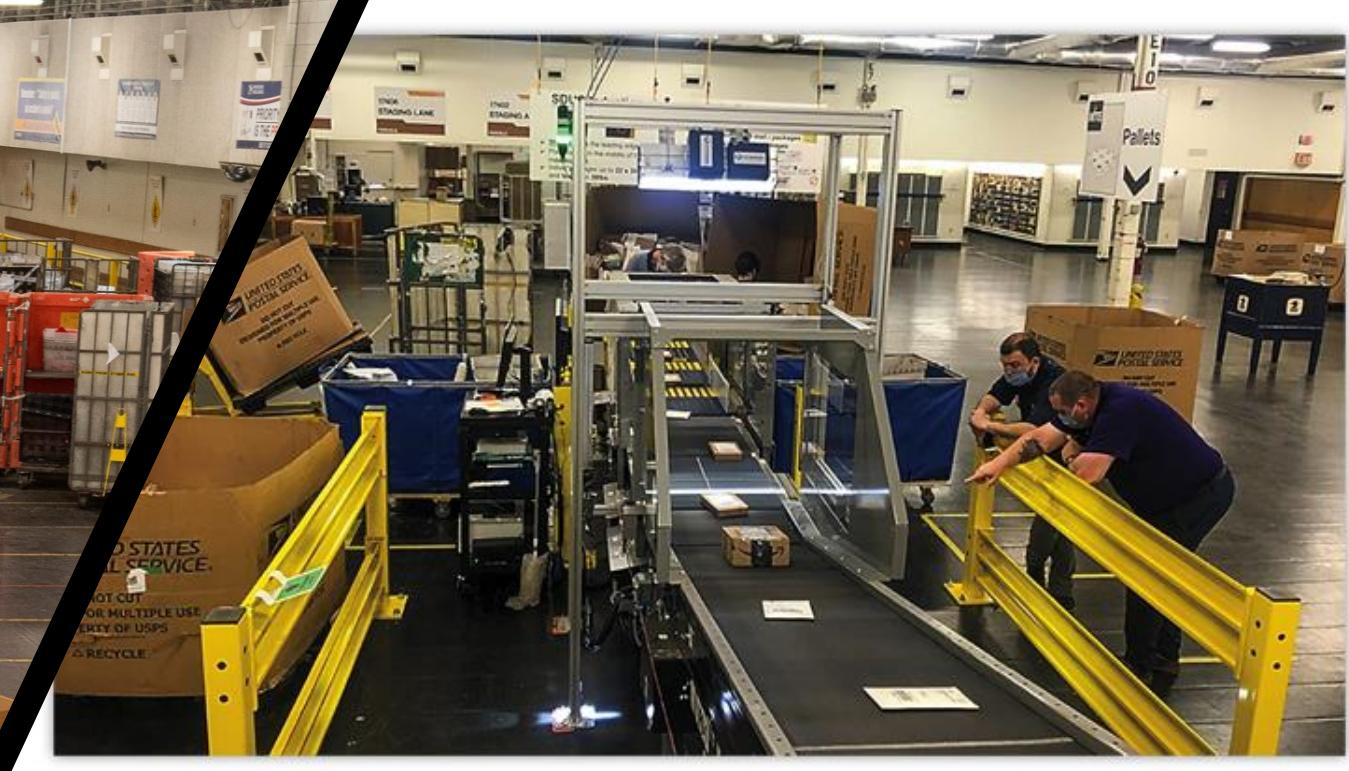




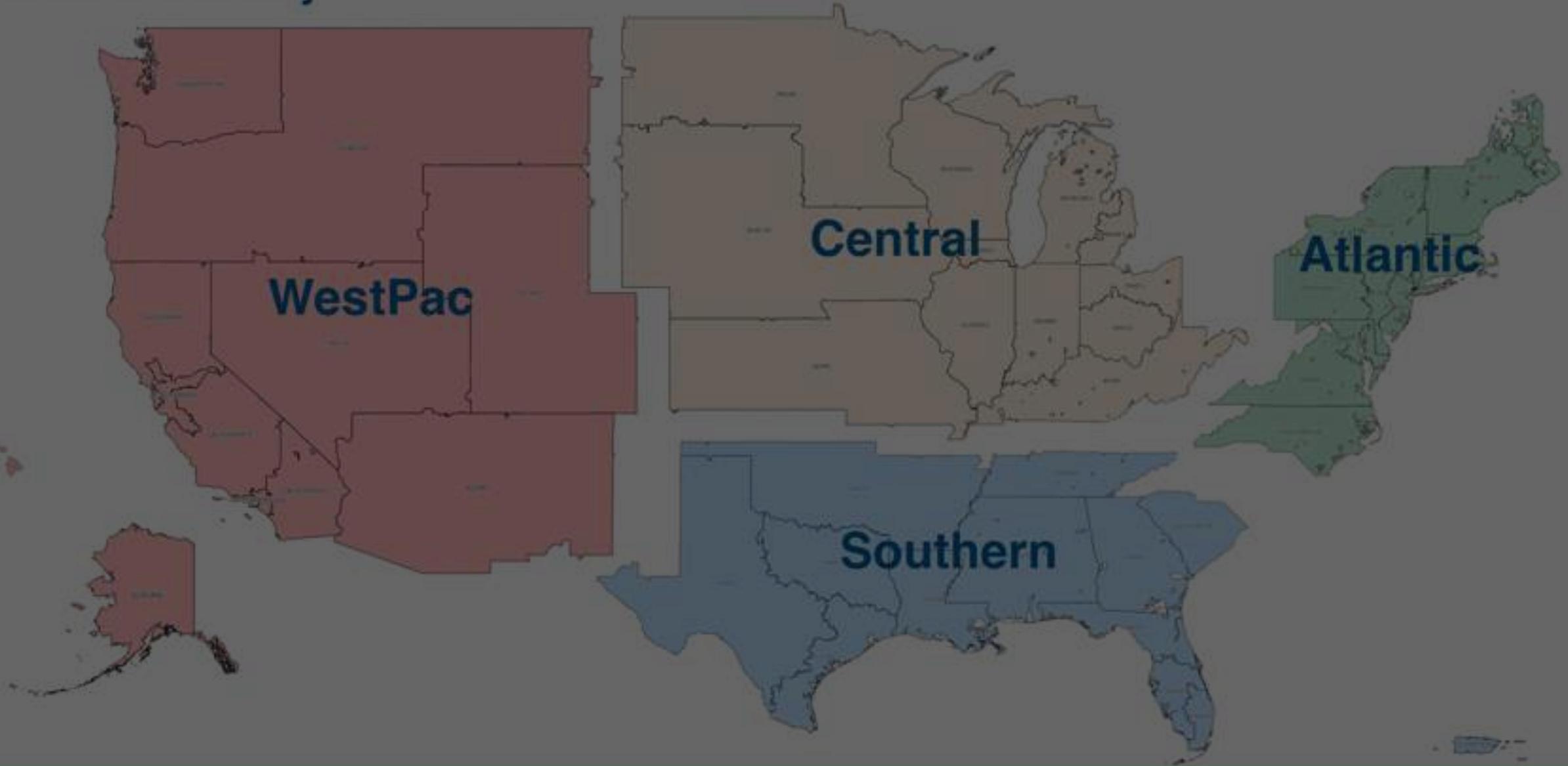
**UNITED STATES**  

---

**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

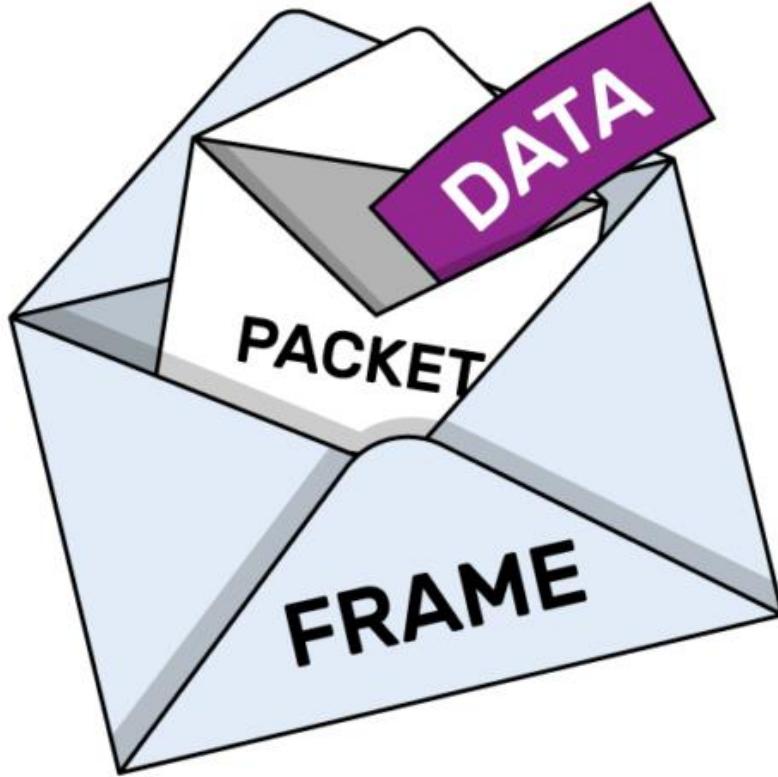


Source IP Address

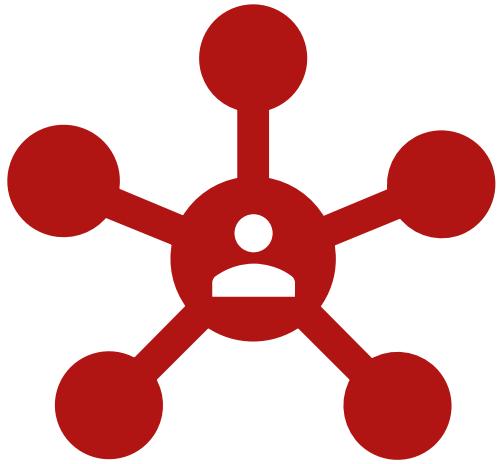


Destination IP Address

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

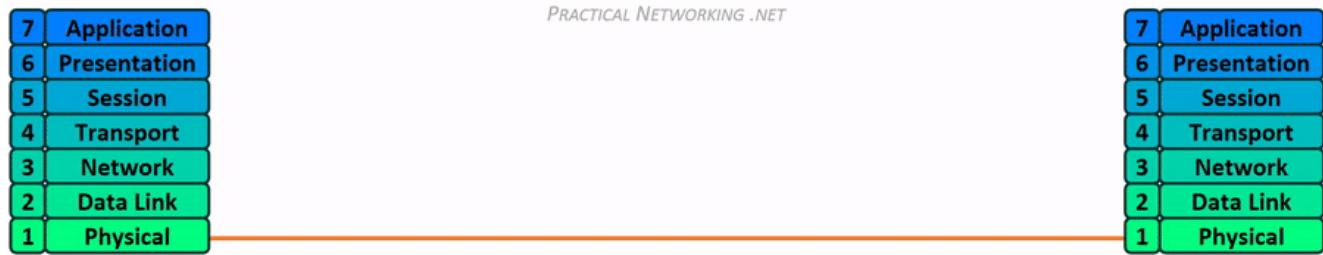
## Data Link

- 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

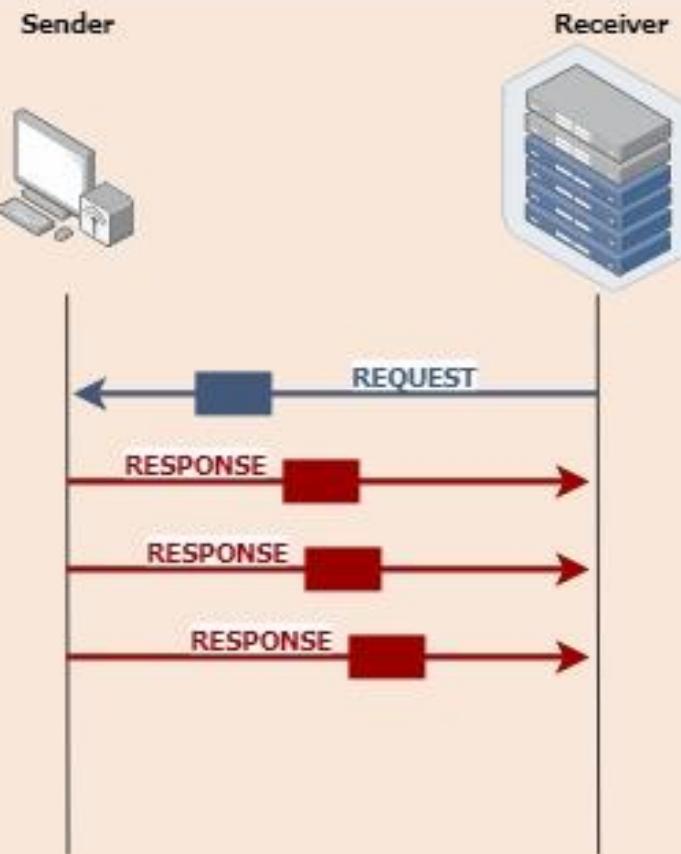


10 minute break

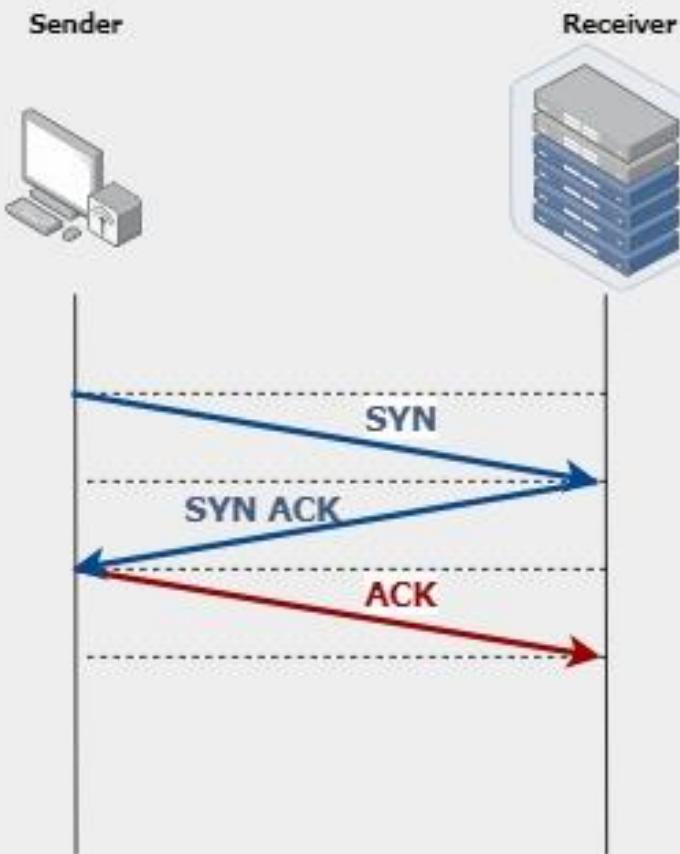
# TCP VS. UDP

# Stateful vs. Stateless Networking

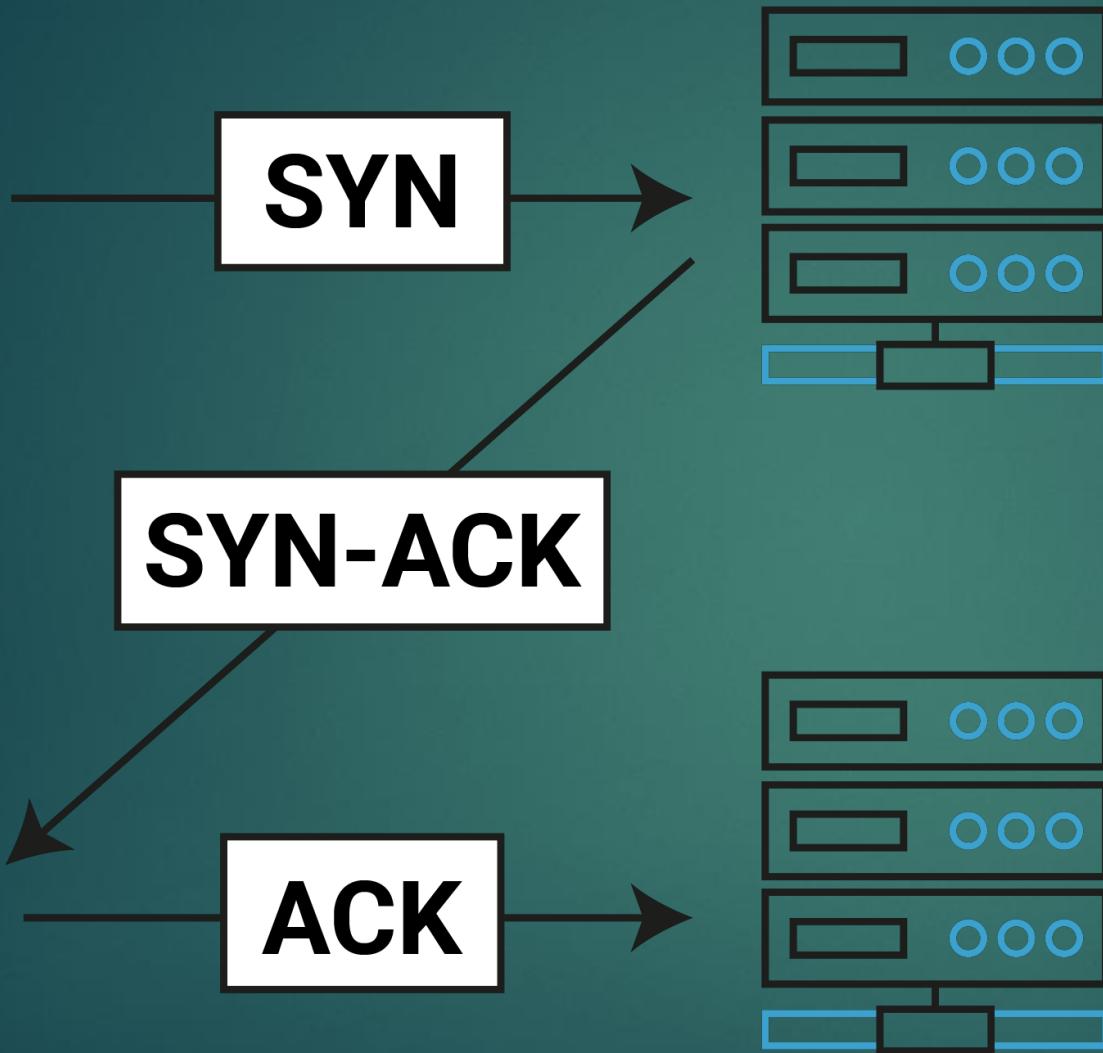
## UDP



## TCP



# TCP Handling



# TCP 3-Way Handshake

# Explain TCP In A Gif



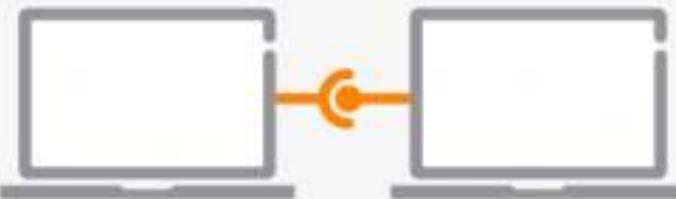
Delivery fulfilled.

# UDP Handling

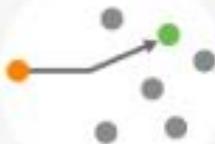
# Explain UDP In A Gif



## TCP

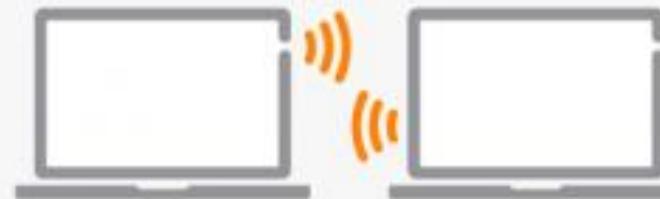


- Slower but more reliable transfers
- Typical Applications:
  - File Transfer Protocol (FTP)
  - Web Browsing
  - Email

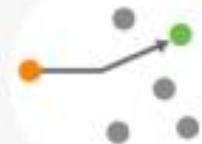


unicast

## UDP



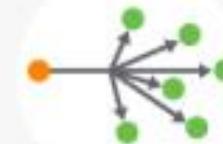
- Faster but not guaranteed transfers ("best effort")
- Typical Applications:
  - Live Streaming
  - Online Games
  - VoIP



unicast



multicast



broadcast

# Discussion: TCP Apps & UDP Apps

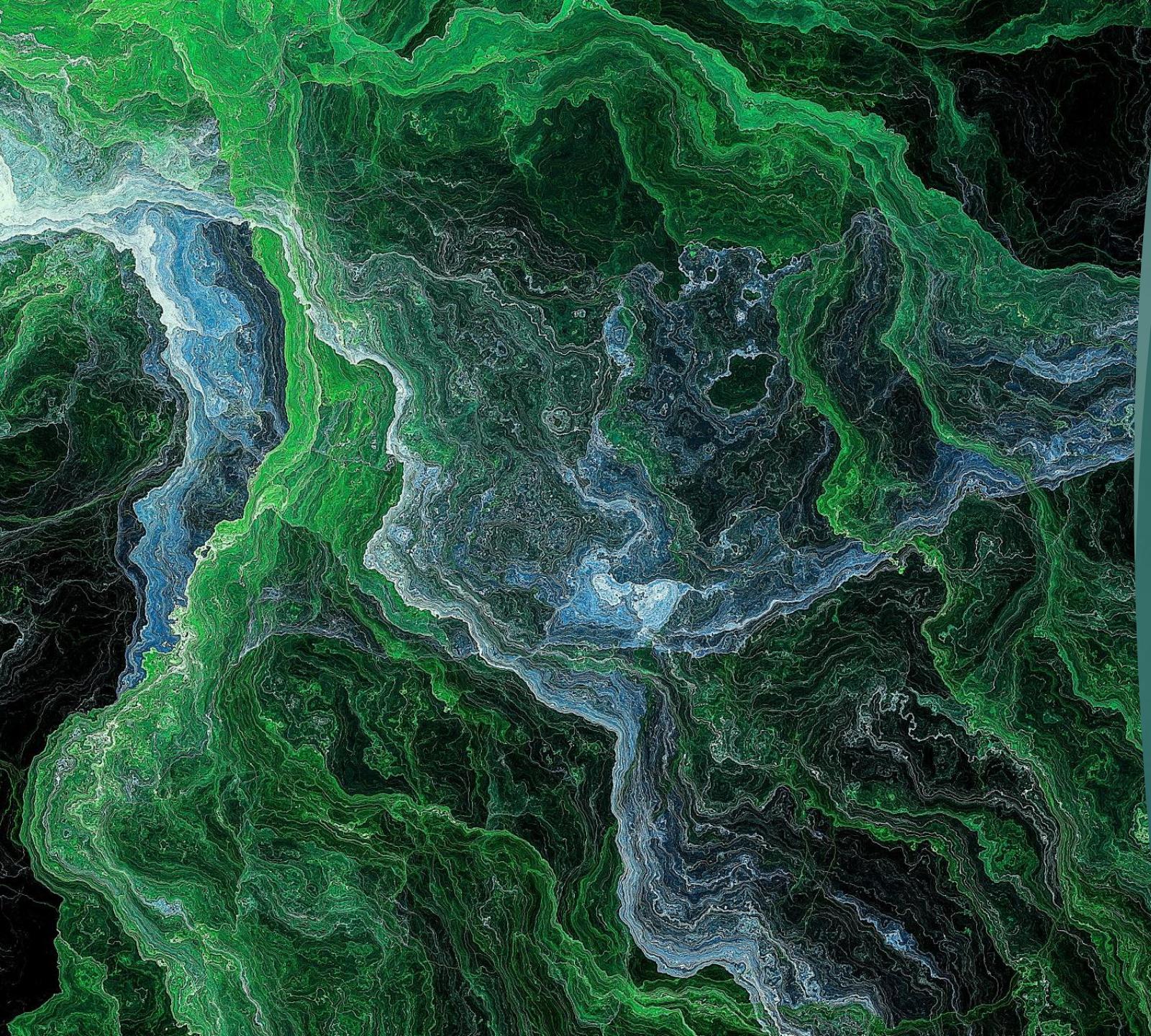
- ▶ Moodle
  - ▶ TCP or UDP?
- ▶ VoIP
  - ▶ TCP or UDP?
- ▶ YouTube
  - ▶ TCP or UDP?
- ▶ SWIFT Money Transfers
  - ▶ TCP or UDP?

# 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 deep valleys to bright green for higher elevations, with black lines indicating the exact 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

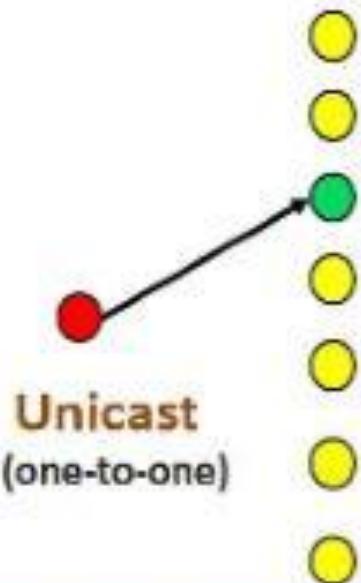
HOST LAYER



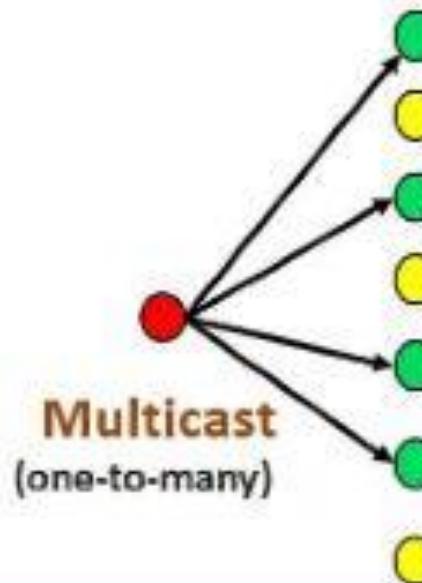
# Layer 7

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

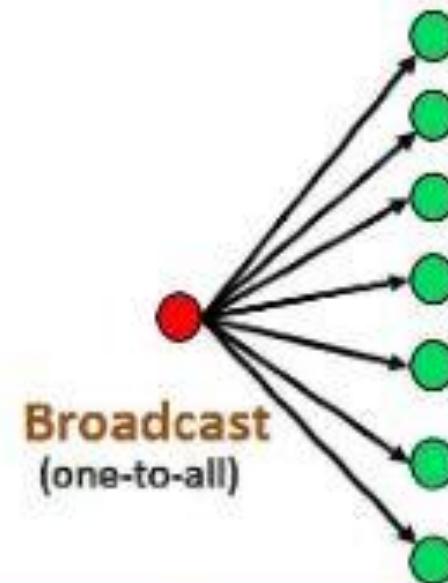
# What is **Unicast Multicast Broadcast**



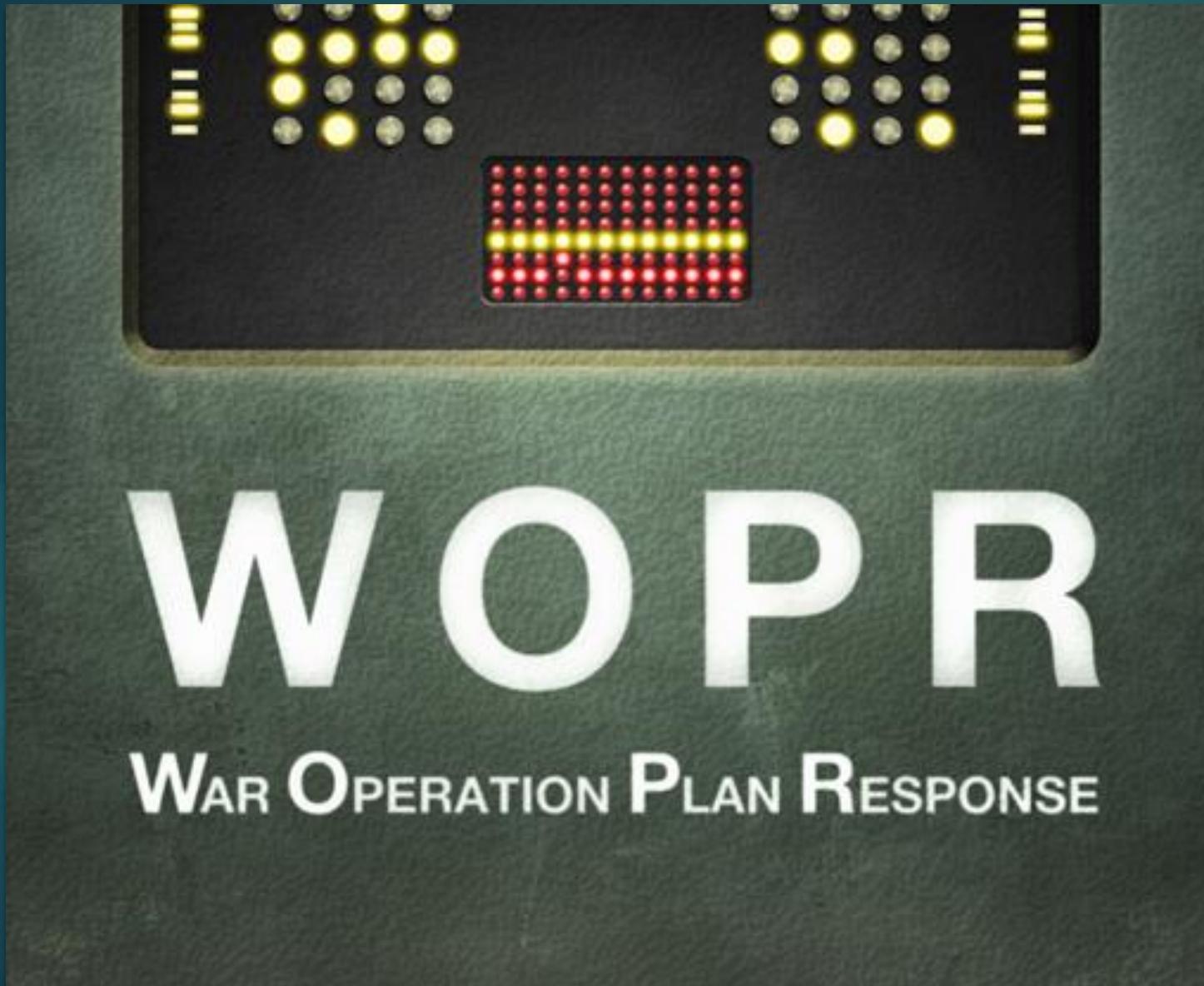
**Unicast**  
(one-to-one)



**Multicast**  
(one-to-many)



**Broadcast**  
(one-to-all)

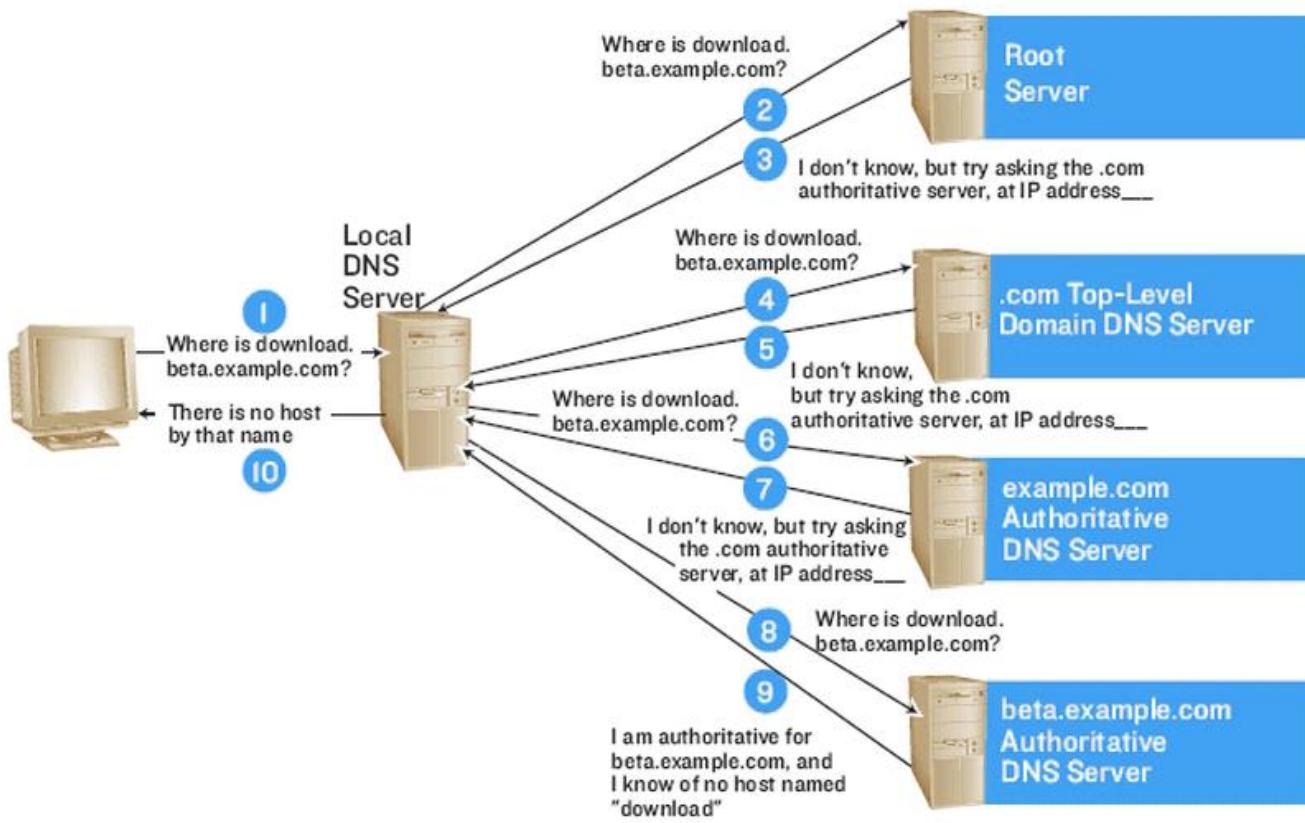


Shall We  
Play A  
Game?

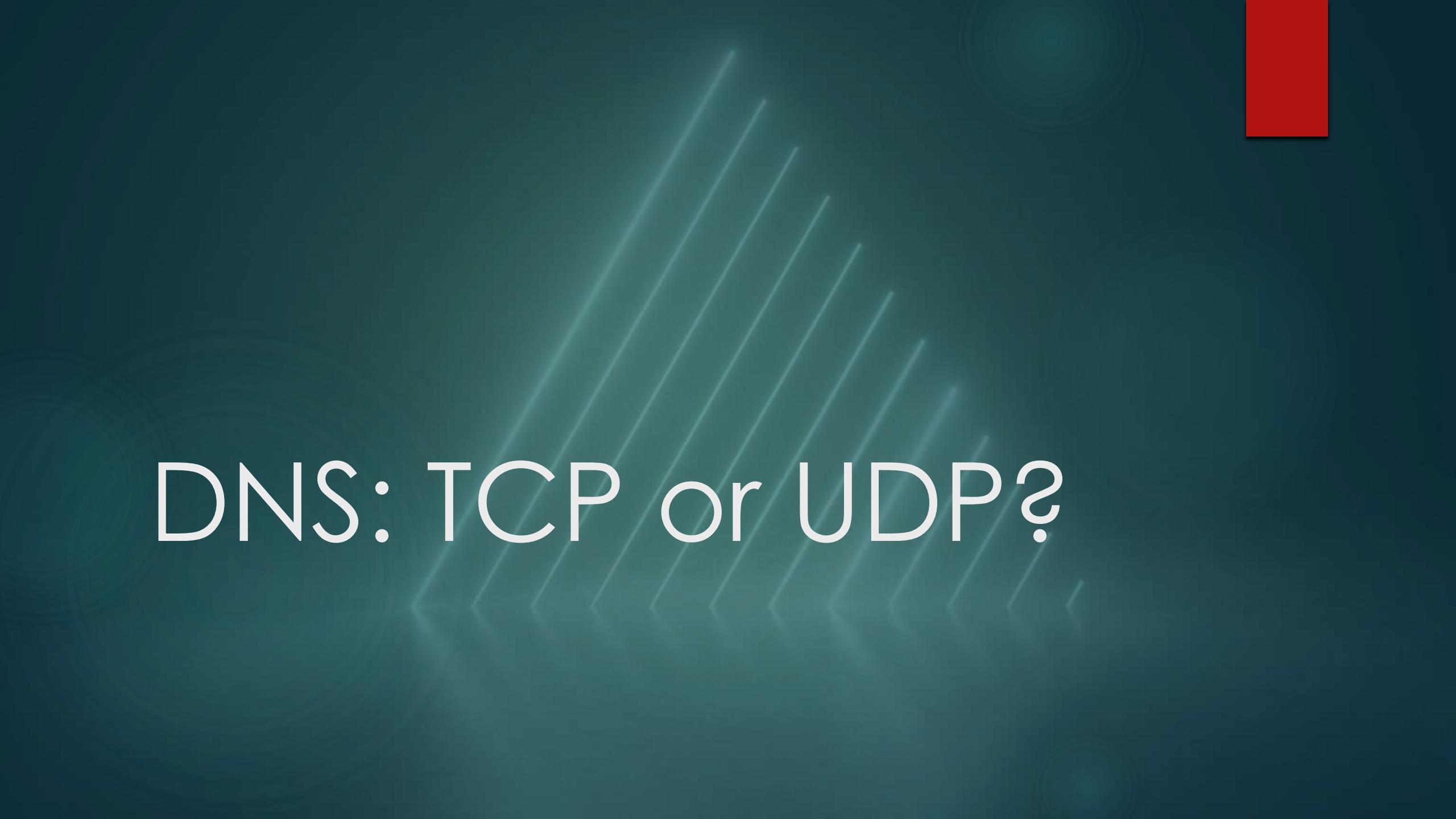
[HTTPS://STATIC-LABS.TRYHACKME.CLOUD/SITES/OSI-MODEL-GAME/](https://static-labs.tryhackme.cloud/sites/osi-model-game/)

# Name Resolution

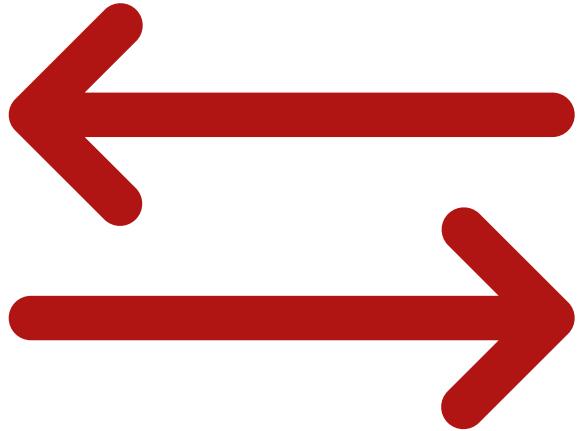
# HOW DNS WORKS



DNS



# DNS: TCP or UDP?



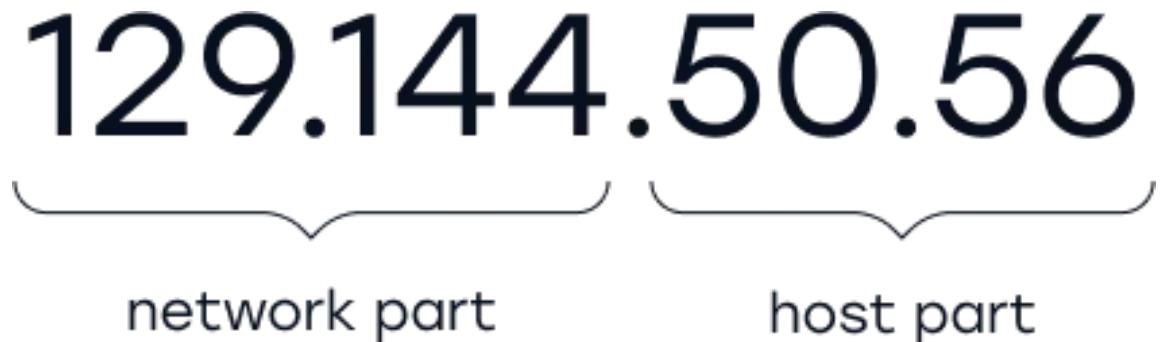
Problem: How  
Do We Move  
Information?

# LANs and WANs

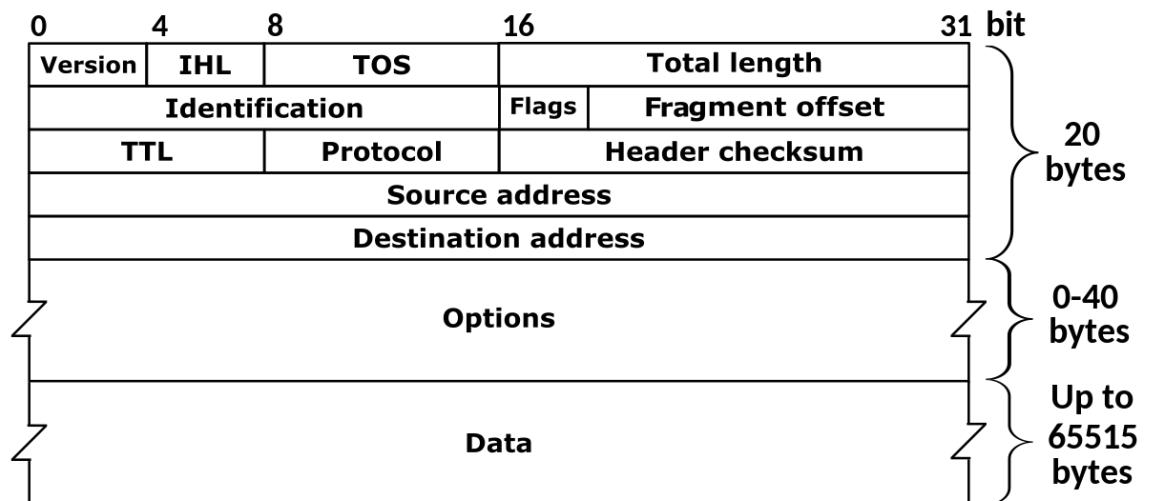


# Network Operation

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

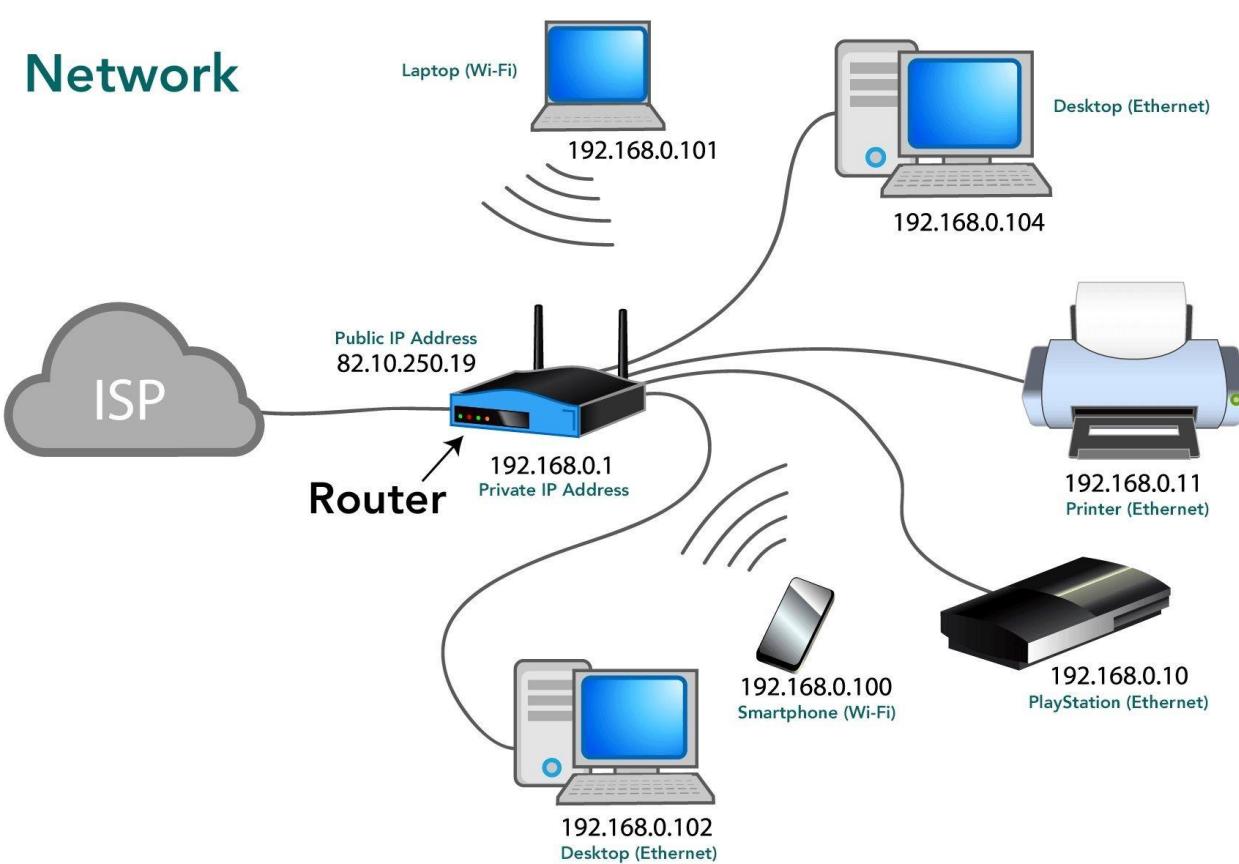
# Common Ports

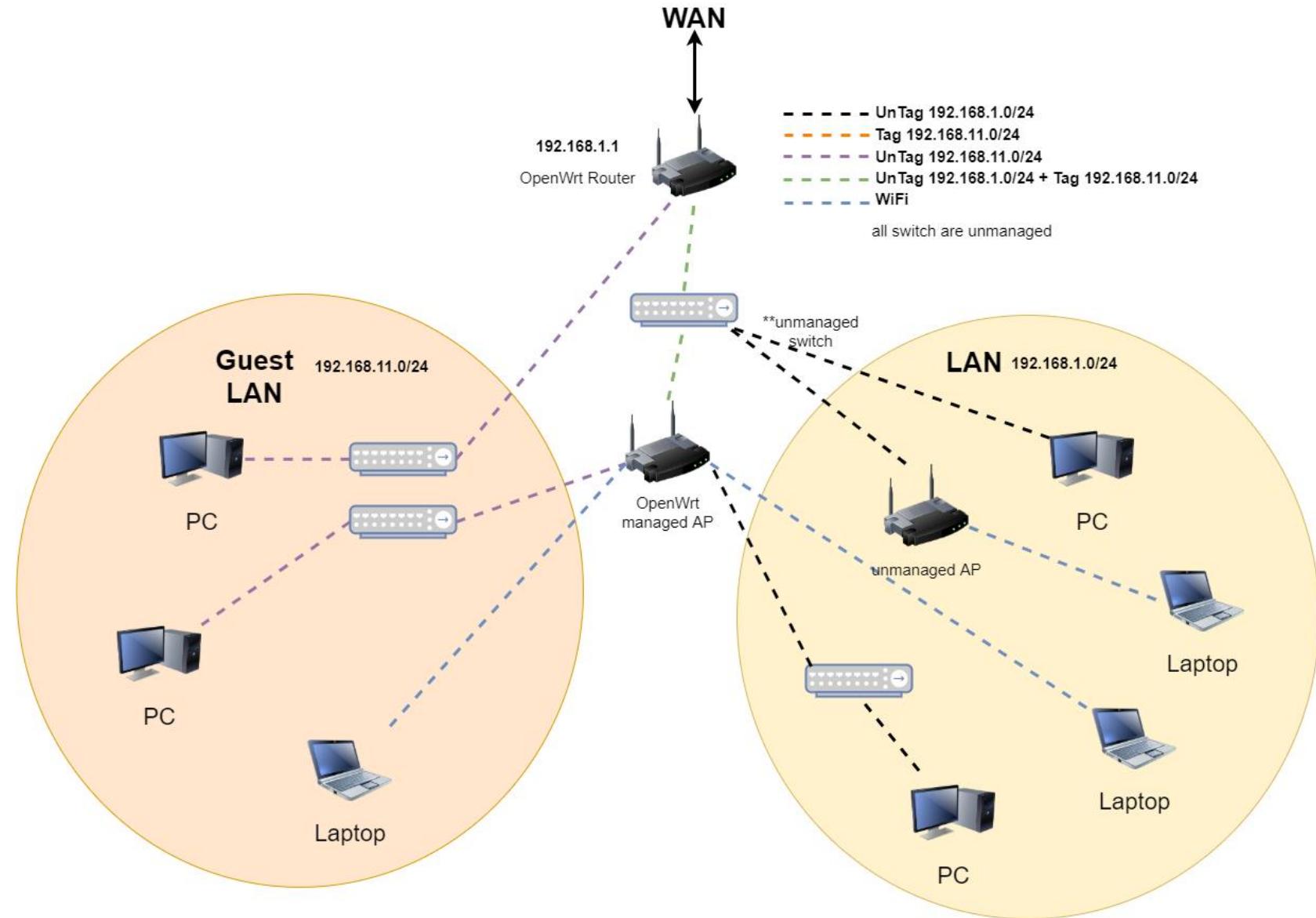
Port #	Application Layer Protocol	Type	Description
20	FTP	TCP	File Transfer Protocol - data
21	FTP	TCP	File Transfer Protocol - control
22	SSH	TCP/UDP	Secure Shell for secure login
23	Telnet	TCP	Unencrypted login
25	SMTP	TCP	Simple Mail Transfer Protocol
53	DNS	TCP/UDP	Domain Name Server
67/68	DHCP	UDP	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

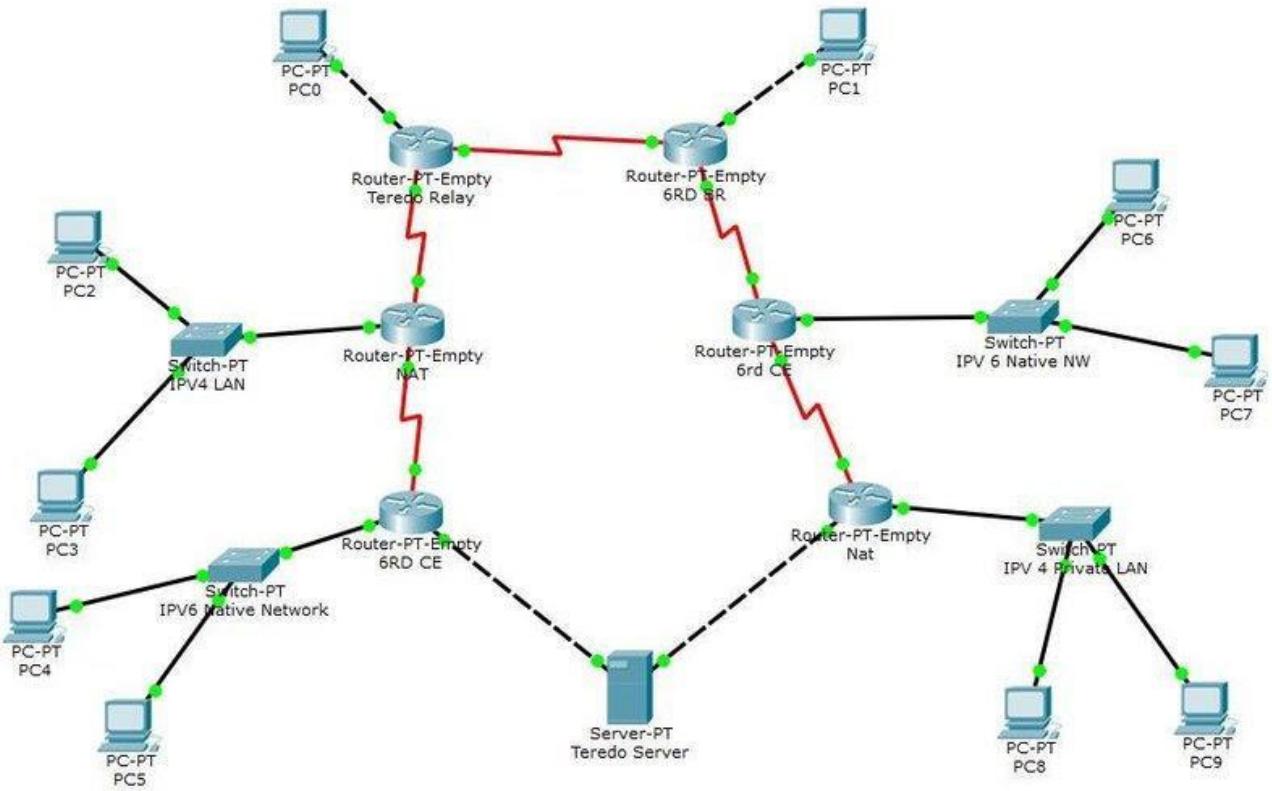


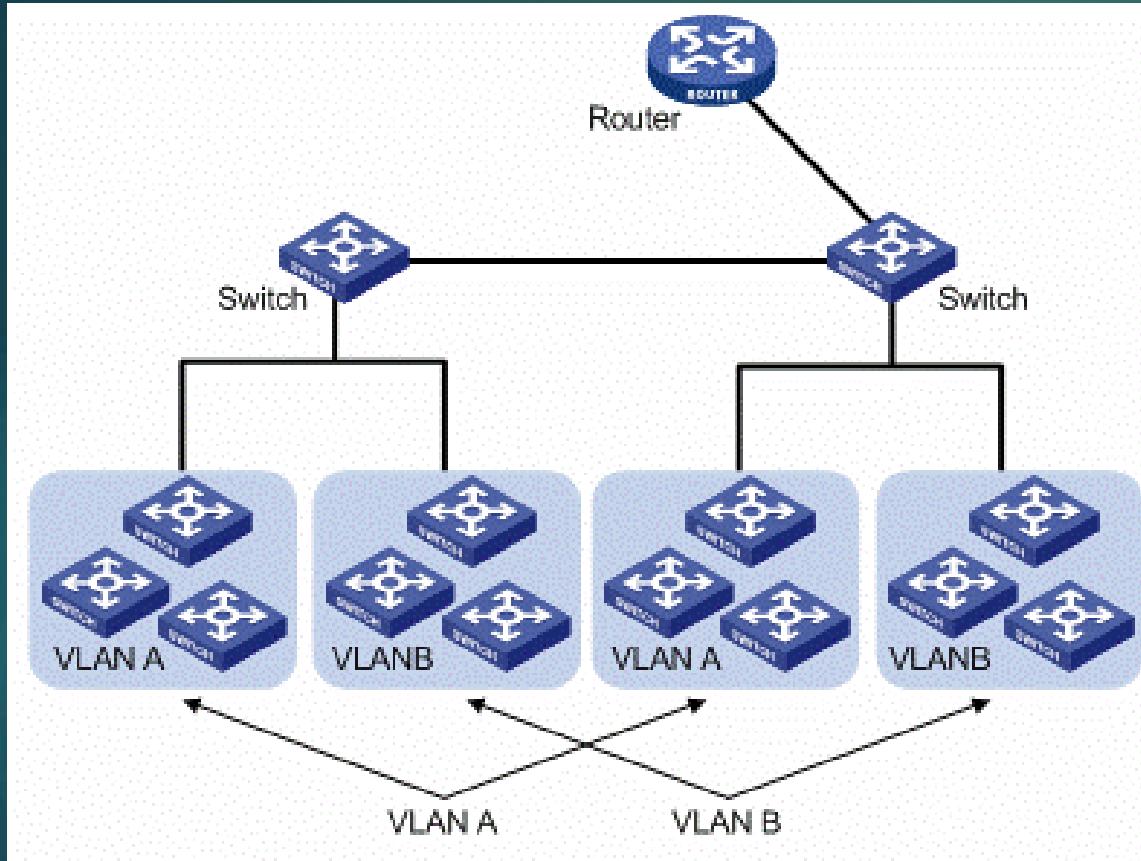


# Wide Area Network (WAN)

- ▶ 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

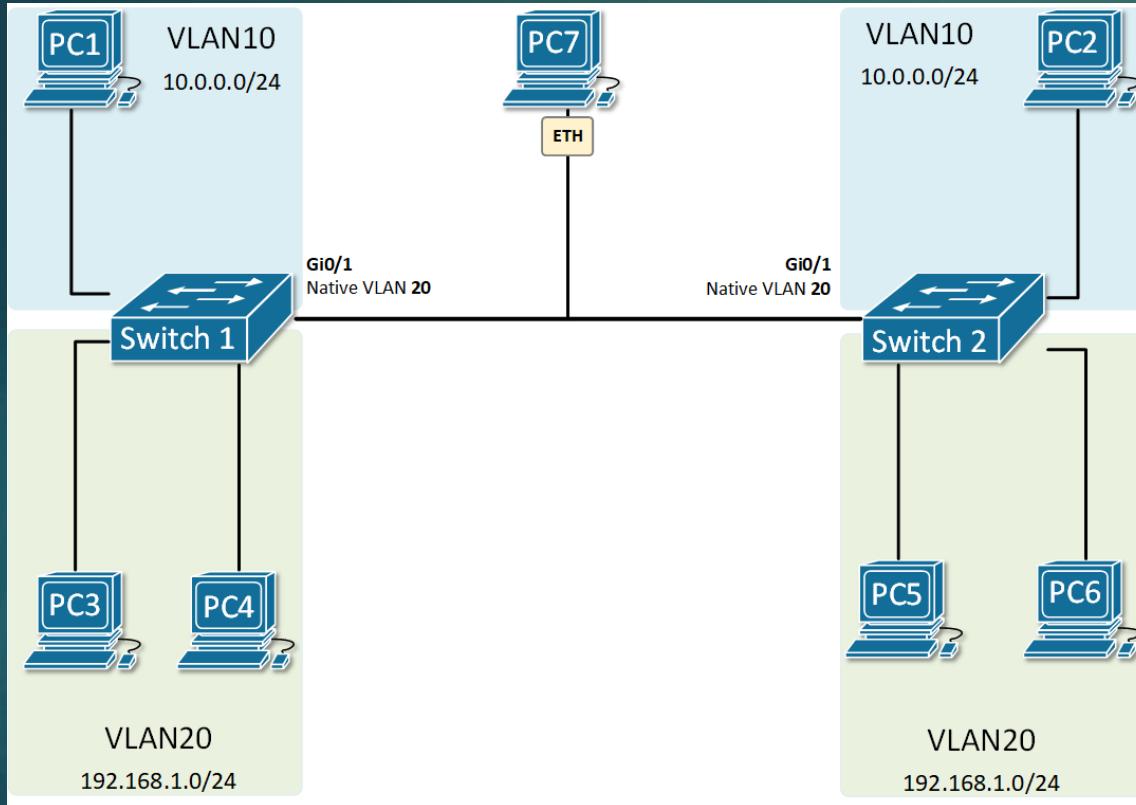
# Complex Network Topology





# LANs and VLANs

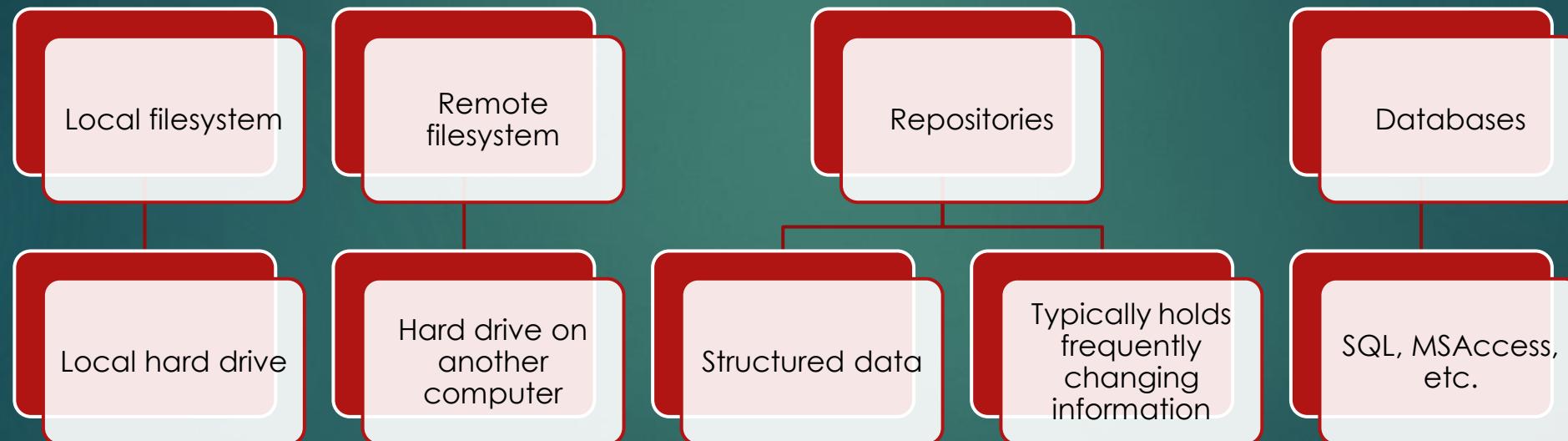
# Trunk Native VLAN



# How Do Apps Access Information?

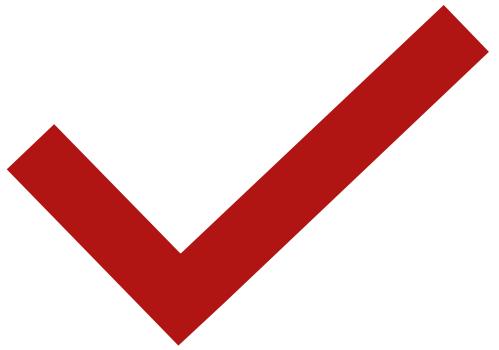


# Local & Remote Information





Software Underpins  
All Of This!



# Day 2 Recap



# Question or Clarifications?

# Day 3 Preview

# Instructor Contact Info

- ▶ [ecrose@oakland.edu](mailto:ecrose@oakland.edu)