



# Networking for Hackers!

Day12\_network.md



Recalling!

# LAST TIME TOPICS



# Topics

- Introduction to networking
- Classification of networks
- IP Address
- Mac Address
- OSI Model
- TCP and UDP protocols
- TCP/IP Model
- Networking tools





# Introduction to Networking

- A network consists of two or more entities or objects sharing resources and information.
- A computer network consists of two or more computing devices **connected to each other** to share resources and information.
- The network becomes a powerful tool when computers communicate and share resources with other computers on the same network or entirely distinct networks.



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- Computers on a network can act as a **client** or a **server**.

# Client computer

- A client is a computer that requests for resources.

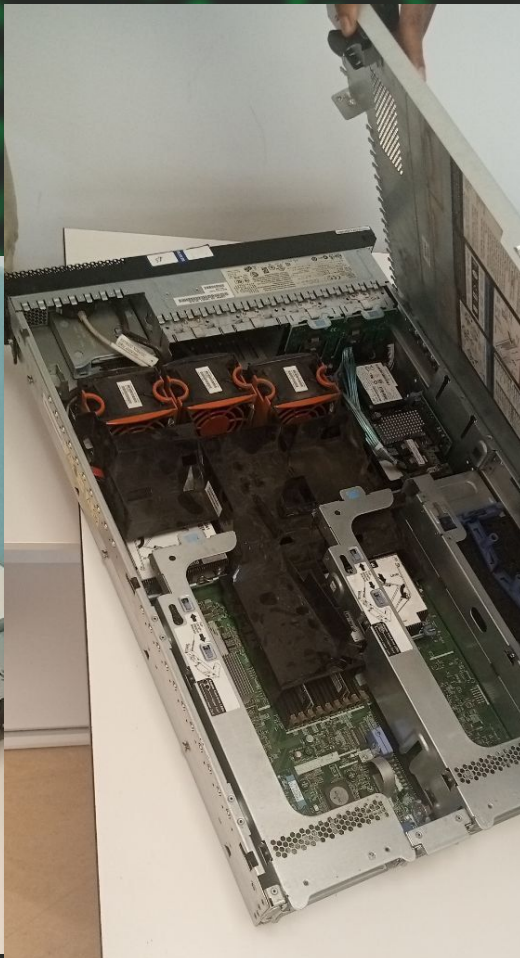
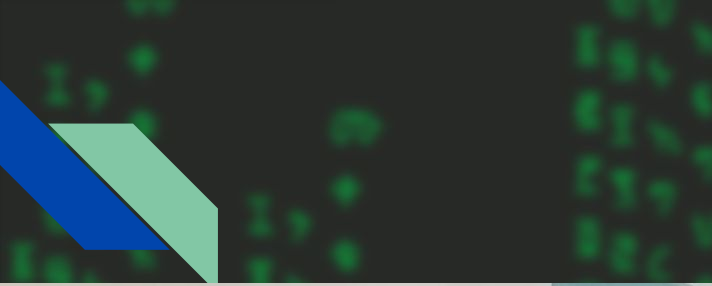




# Server computer

- A server is a computer that controls and provides access to resources.
- But have higher RAM,CPU and STORAGE





example







## Need of Networks

- Enhance communication.
- Share resources.
- Facilitate centralized management
- Internet



# Classification of Networks

1. Classification by network geography.
2. Classification by component roles.



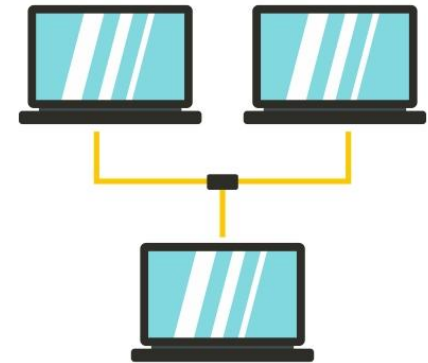
# Classification by Network Geography

- Networks are frequently classified according to the geographical boundaries spanned by the network itself.
- LAN, WAN, and MAN are the basic types of classification, of which LAN and WAN are frequently used



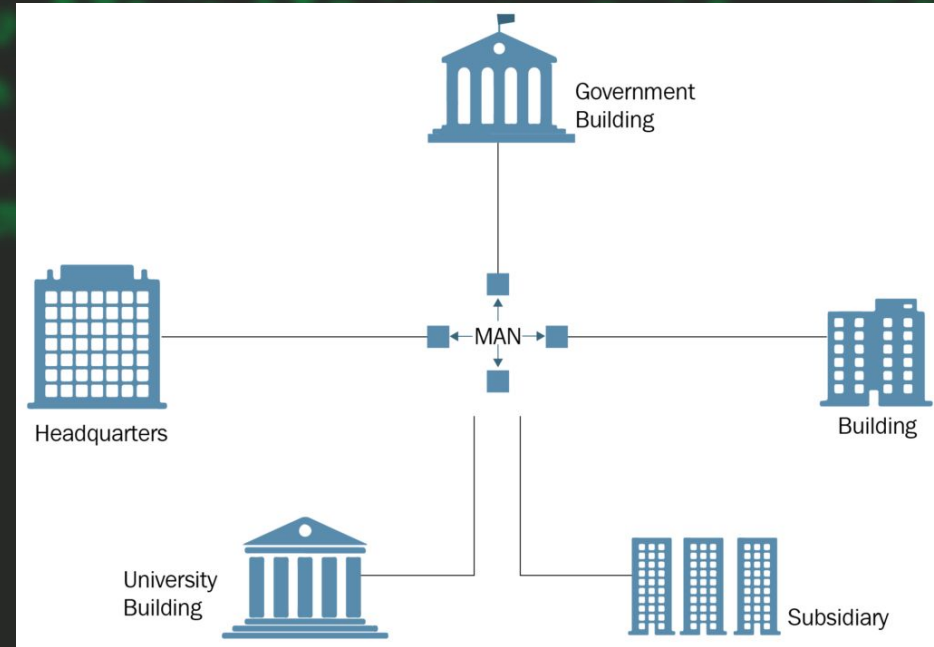
# Local area network (LAN)

- A LAN covers a relatively small area such as a classroom, school, or a single building.
- LANs are inexpensive to install and also provide higher speeds.



# Metropolitan area network (MAN)

- A MAN spans the distance of a typical metropolitan city.
- The cost of installation and operation is higher.
- MANs use high-speed connections such as fiber optics to achieve higher speeds



# Wide area network (WAN)

- WANs span a larger area than a single city.
- These use long distance telecommunication networks for connection, thereby increasing the cost.
- The Internet is a good example of a WAN.







# Classification by Component Roles

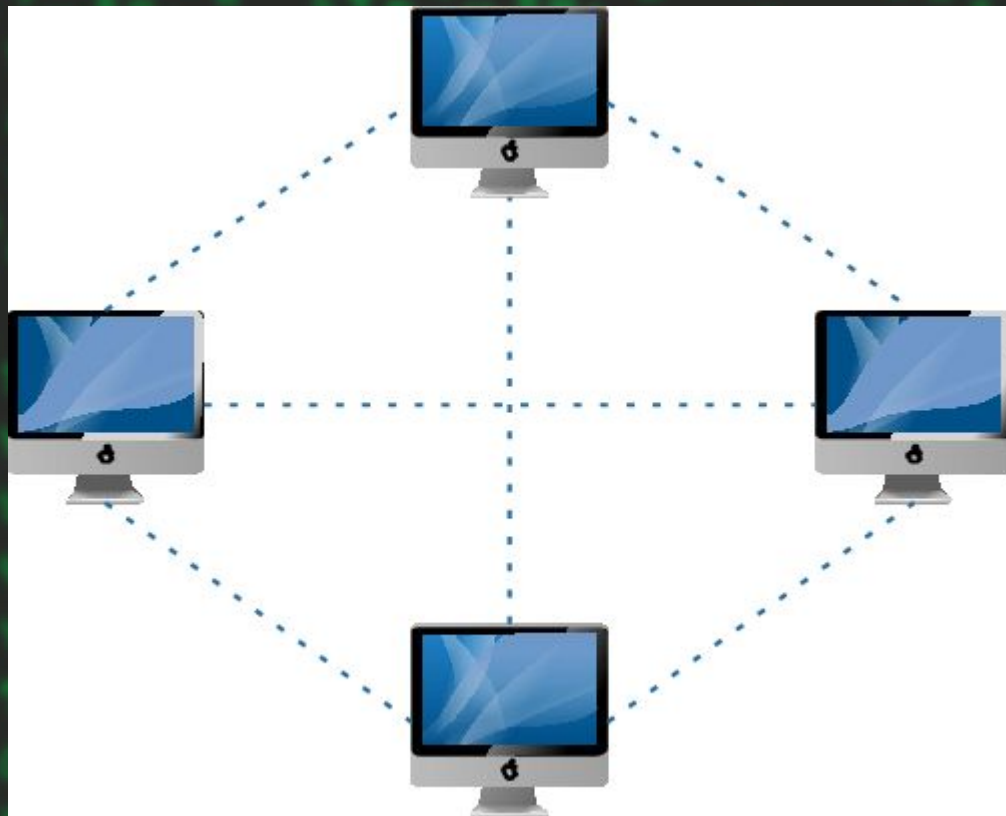
- Networks can also be classified according to the roles that the networked computers play in the network's operation.
- Peer-to-peer, server-based, and client-based are the types of roles into which networks are classified.



# Peer-to-peer

- In a peer-to-peer network, all computers are considered equal.
- Each computer controls its own information and is capable of functioning as **either a client or a server** depending upon the requirement.
- Peer-to-peer networks are cheap and easy to install.
- They are popular as home networks and for use in small companies.
- Most operating systems come with built-in peer-to-peer networking capability.
- The maximum number of peers that can operate on a peer-to-peer network is ten.
- Each peer shares resources and allows others open access to them.

# Peer-to-peer



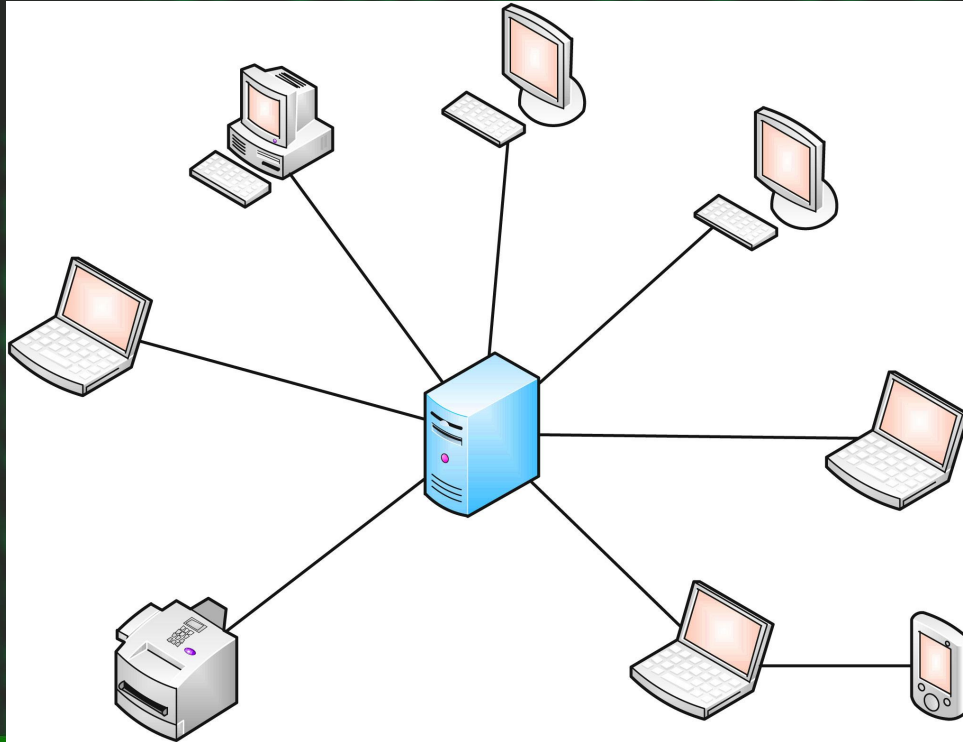




## Server based

- A server-based network offers **centralized** control and is designed for secure operations.
- In a server-based network, a dedicated server controls the network.
- A dedicated server is one that services the network by storing data, applications, resources, and also provides access to resources required by the client.

# Server-based



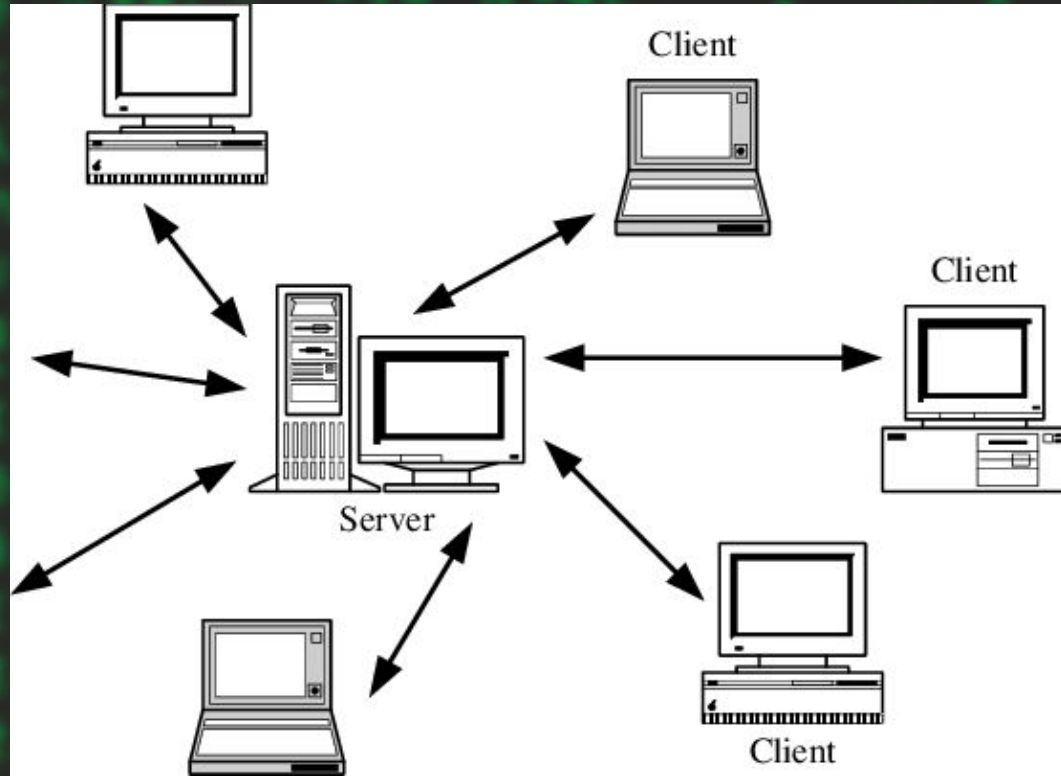


## Client-based

- Client-based network servers process requests from clients and return just the results.
- These networks take advantage of the powerful processing capabilities of both the client and the server.

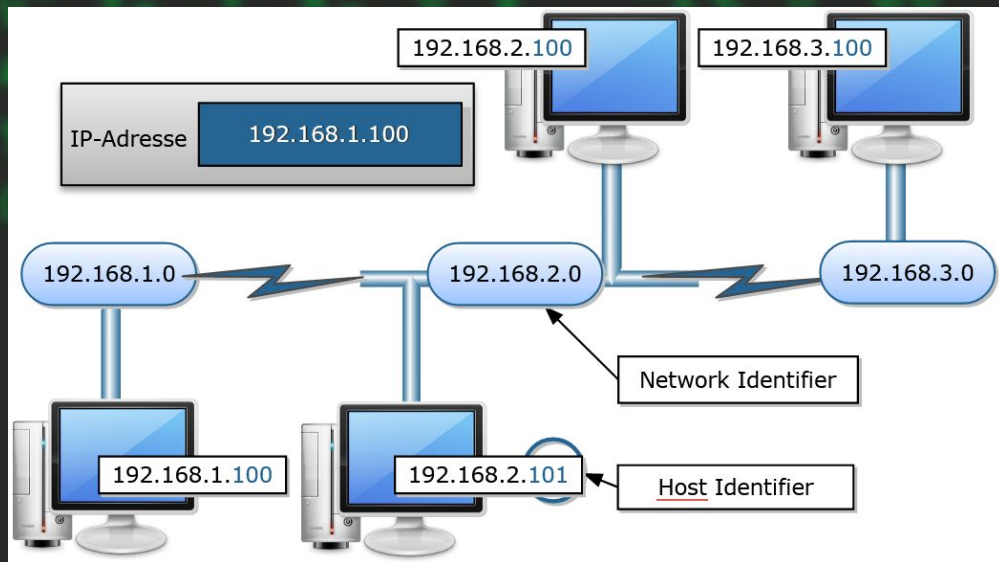


client-based



# IP /Internet Protocol/ address

- IP (Internet Protocol) is a Network Layer Protocol.
- A way to identify machines on a network
- A unique identifier





# USAGE of IP's

- Used to connect to another computer or network.
- Allows transfers of files and e-mail
- Identify a device





# IP types

- Based On IP versions
  - IPv4
  - IPv6



## IPv4 ( Internet protocol version 4)

- An IPv4 address is a 32-bit sequence of 1s and 0s.
- To make the IP address **easier to use**, the address is usually written as four decimal numbers separated by periods.
- This way of writing the address is called the **dotted decimal** format.
- IP generated by DHCP or Manually



# IP structure

- IP addresses consist of four sections

192	168	123	12
1	2	3	4

- Each section is 8 bits long

192	.	168	.	123	.	12
00101110		10100111		11101111		00011100

- Each section can range from 0 to 255





# Which one is a valid IP address?

1. 192.127.32.2
2. 192.259.22.1
3. 10.1.1.1
4. 192,168,1,1

...

- When you connect to some network an IP address will be generated and given.
- Every IP address has two parts:
  - Network: to identify the network( የእናንተ,የጎረቤት)
  - Host: identify the user(ሰልክ,PC)

192	.	168	.	123	.	12
Network		Network		Network		HOST

- The first(1) host address is called GATEWAY ADDRESS.



## Private and Public IP addresses.

- Any HOST have 2 different IP's
- Public IP:
  - is an ip address that is given to the host on the WAN network
- Private IP:
  - is ip that is given to the host on LAN network.
  - Internet and intranet?





...

- There are 5 classes of private IP address A B C D and E
- CLASS A: Governments
- CLASS B: medium Companies
- CLASS C: small companies
- CLASS D: MultiCasting(streaming)
- CLASS E: Future Use (IETF research)

# CLASS A

- Have 24bit of space for HOSTS

10 . 3 . 2 . 1  
00101110 10100111 11101111 00011100  
Network HOST HOST HOST

Address Class	High-Order Bits	First Octet Address Range	Number of Bits in the Network Address	Number of Networks	Number of Hosts per Network
Class A	0	0-127	8	126	16,777,216

## CLASS B

- Have 16bit of space for HOSTS

172	.	30	.	21	.	1
00101110		10100111		11101111		00011100
Network		Network		HOST		HOST

Address Class	High-Order Bits	First Octet Address Range	Number of Bits in the Network Address	Number of Networks	Number of Hosts per Network
Class B	10	128-191	16	16,384	65,536





## CLASS C

- Have 8bit of space for HOSTS and 24-bit of network

192	.	168	.	21	.	1
00101110		10100111		11101111		00011100
Network		Network		Network		HOST

Address Class	High-Order Bits	First Octet Address Range	Number of Bits in the Network Address	Number of Networks	Number of Hosts per Network
Class C	110	192-223	24	2,097,152	254



## CLASS C

- It is Used on Our Home,school and Office Network.
- As we saw the host changes on the last 8 bit only so devices in same network have same starting numbers.

192.168.1.1

192.168.1.11

192.168.1.3

192.168.1.9

192.168.1.32



# Reserved IP Addresses

- Certain host addresses are reserved and cannot be assigned to devices on a network.
  - a. Addresses beginning 127 are reserved for loopback and internal testing
  - b. An IP address that has binary 0s in all host bit positions is reserved for the network address.
  - c. An IP address that has binary 1 or 255s in all host bit positions is reserved for the broadcast address





# Examples of Reserved addresses

- 0.0.0.0
- 127.0.0.0
- 128.0.0.0
- 191.255.0.0
- 192.0.0.0
- 223.255.255.0



## IPv6 ( Internet Protocol Version 6)

- IPv6 is a 128-bit alphanumeric long value that identifies an endpoint devices in IPv6 network.
- **Format of an IPv6 address:**
  - FE80:CD00:0000:0CDE:1257:0000:211E:729C
    - ALPHANumeric
    - Separated by colon(:)
    - IP generated automatically.
- The main difference is the IP-space(host holding) IPv4 holds 32-bit ip address but IPv6 holds 128-bit ip Addresses.

# To know your computer ip address

## On windows:



```
C:\Windows\system32\cmd.exe

Connection-specific DNS Suffix . : 
Unknown adapter Local Area Connection 2:

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

Wireless LAN adapter Local Area Connection* 1:

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

Wireless LAN adapter Local Area Connection* 2:

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

Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix . : 
IPv4 Address. . . . . : 192.168.1.3
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.1.1

Ethernet adapter Bluetooth Network Connection:

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

C:\Users\Nathan Hailu>
```

ipconfig



...

On Linux

•

ifconfig

```
rexder@HunterMachine ~/test> ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1420
    inet 172.17.99.42 netmask 255.255.240.0 broadcast 172.17.111.255
    inet6 fe80::215:5dff:fe65:929d prefixlen 64 scopeid 0x20<link>
    ether 00:15:5d:65:92:9d txqueuelen 1000 (Ethernet)
    RX packets 1788 bytes 320789 (320.7 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 23 bytes 1714 (1.7 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

# MAC(Media Access Control) Address

- It is Given by A manufacturer of that network adapter.
- Network adapter is a hardware device that helps us to have connection ( our wifi adapter or our ethernet port)
- It is Alphanumeric, with 2 part
  - Organizational Unique Id
  - Universally Administered Address

## MAC Media Access Control Address



Organizational Unique Identifier   Universally Administered Address



# MAC(Media Access Control) Address

- Flat name space of 48 bits
  - Typically written in six octets in hex
  - E.g., 00-15-C5-49-04-A9 for my Ethernet
- Organizationally unique identifier
  - Assigned by IEEE Registration Authority
  - Determines the first 24 bits of the address
  - E.g., 00-15-C5 corresponds to “Dell Inc”
- Remainder of the MAC address
  - Allocated by the manufacturer
  - E.g., 49-04-A9 for my Ethernet card



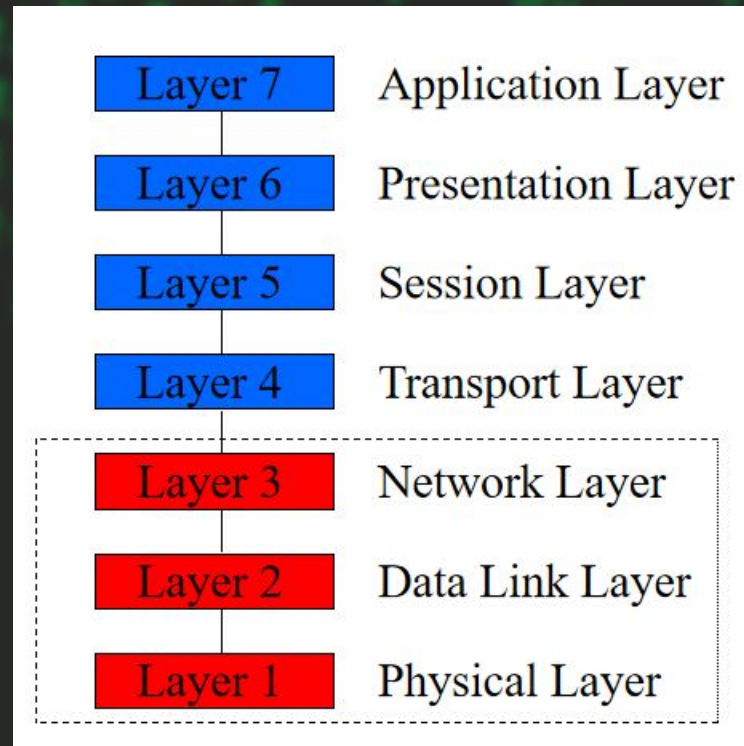


# OSI(Open Systems Interconnection) Reference model

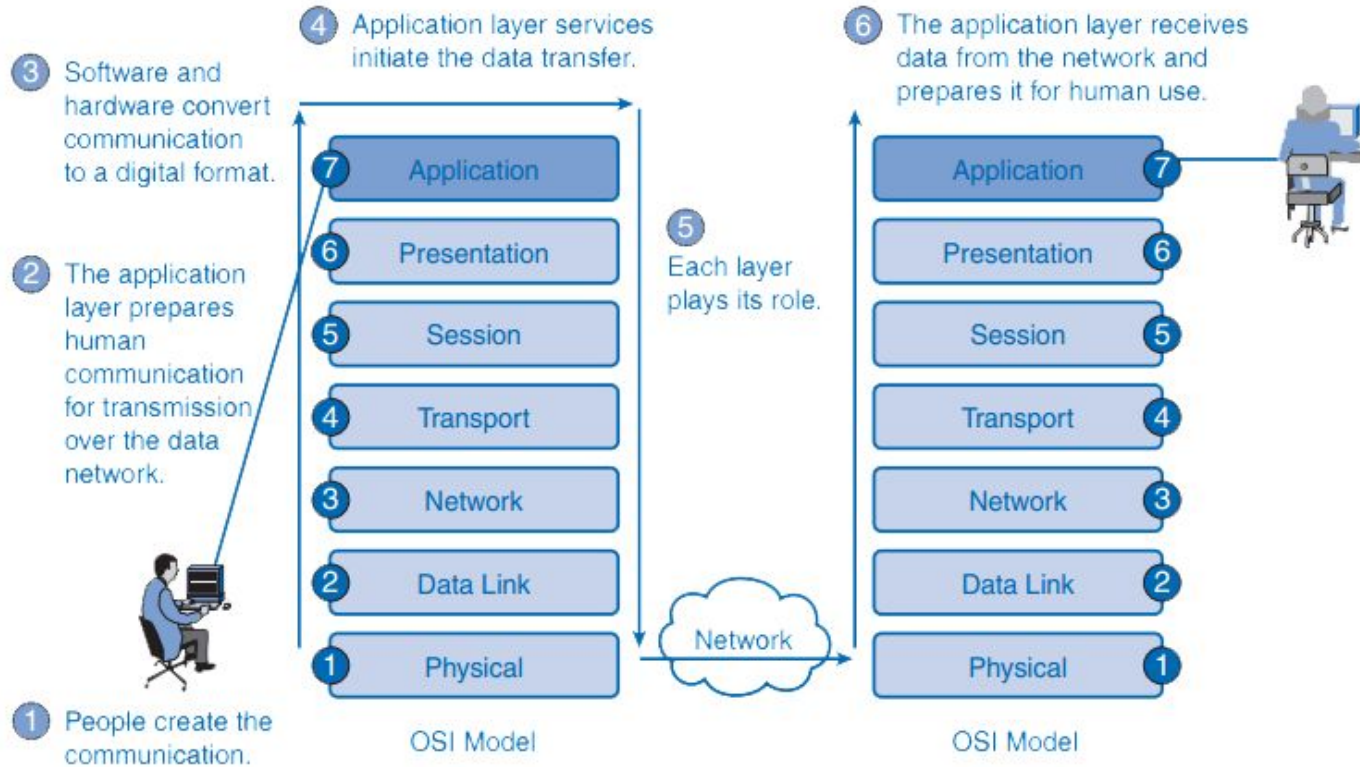
- OSI Reference Model - internationally standardised network architecture.
- Specified in ISO 7498.
- It is an idea model to show the way of network work
- Model has 7 layers.
- It shows How Data transfers between 2 hosts/servers

...

- Layers 1-4 relate to communications technology.
- Layers 5-7 relate to user applications.
- The sequence differ when sender and receiver use it



# The way data transfer







# Layer 7: Application Layer

- Level at which applications access network services.
  - Represents services that directly support software applications for file transfers, database access, and electronic mail, **BROWSERS** etc.
- Your data is DATA
  - PROTOCOLS: HTTP,FTP,SMTP

# Application Layer



Supplies network services to end-user applications and provides data to (and obtains data from) the Presentation layer

*Lifewire*

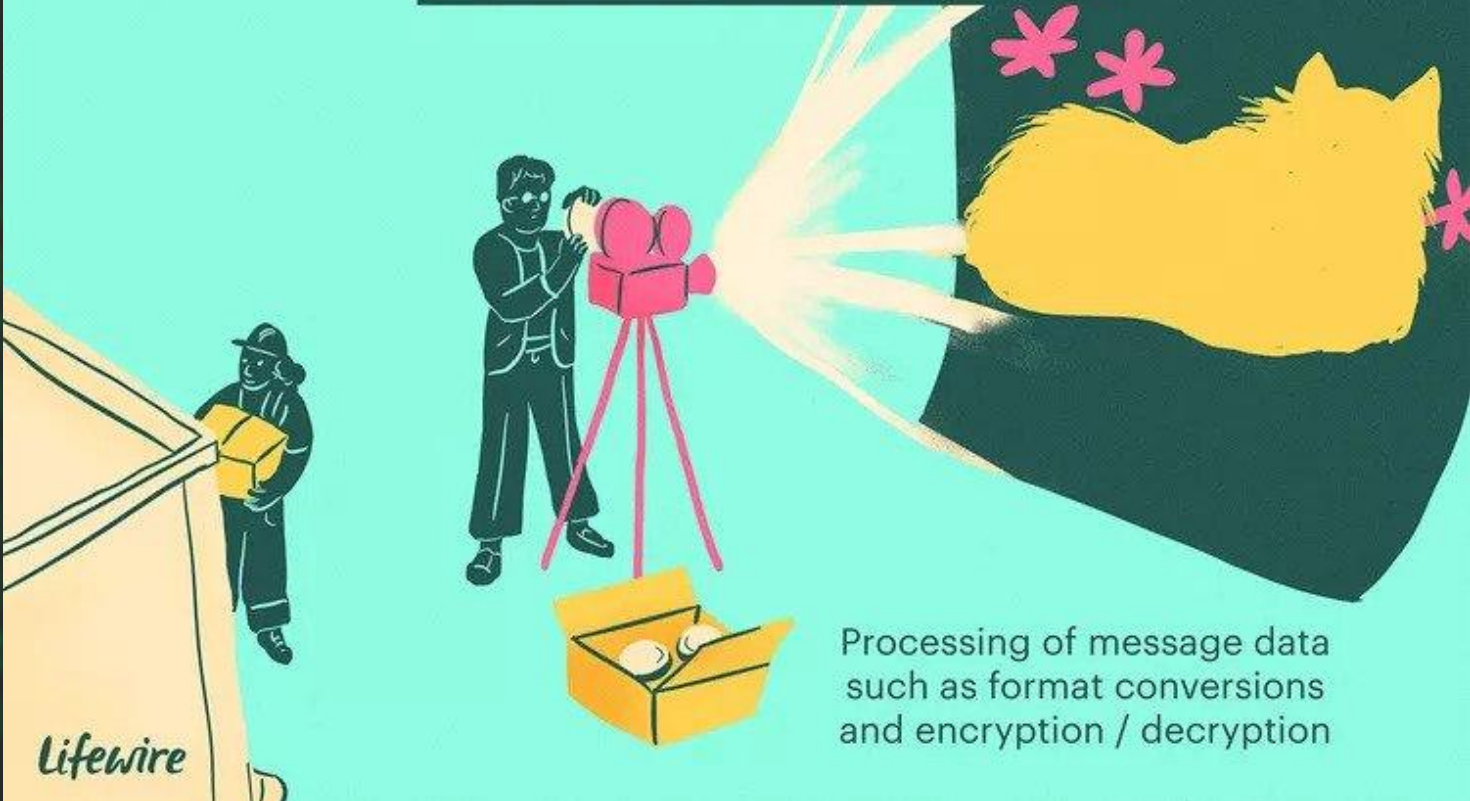


# Layer 6: Presentation Layer

- Related to representation of transmitted data
  - Translates different data representations from the Application layer into uniform standard format
- Providing services for secure efficient data transmission
  - e.g. data encryption, and data compression.
- Your data is DATA
- PROTOCOLS: SSL



# Presentation Layer





# Layer 5: Session Layer

- Allows two applications on different computers to establish, use, and end a session.
  - e.g. file transfer, remote login
- Establishes dialog control
  - Regulates which side transmits, plus when and how long it transmits.
- Performs token management and synchronization.
- Your data is DATA
- PROTOCOLS: RPC, NETBIOS

# Session Layer

Manages the sequence and flow of events

Built to support multiple types of connections

*Lifewire*





# Layer 4: Transport Layer

- Manages transmission packets
  - Repackages long messages when necessary into small packets for transmission [ sender ]
  - Reassembles packets in correct order to get the original message. [ receiver ]
- Handles error recognition and recovery.
  - Transport layer at receiving acknowledges packet delivery.
  - Resends missing packets
- Your data is SEGMENTS
- PROTOCOLS: TCP,UDP

# Transport Layer

Delivers data across  
network connections  
like TCP



*Lifewire*



Different transport protocols  
may support a range of optional  
capabilities including:



Error recovery



Flow Control



Support for  
re-transmission



# Layer 3: Network Layer

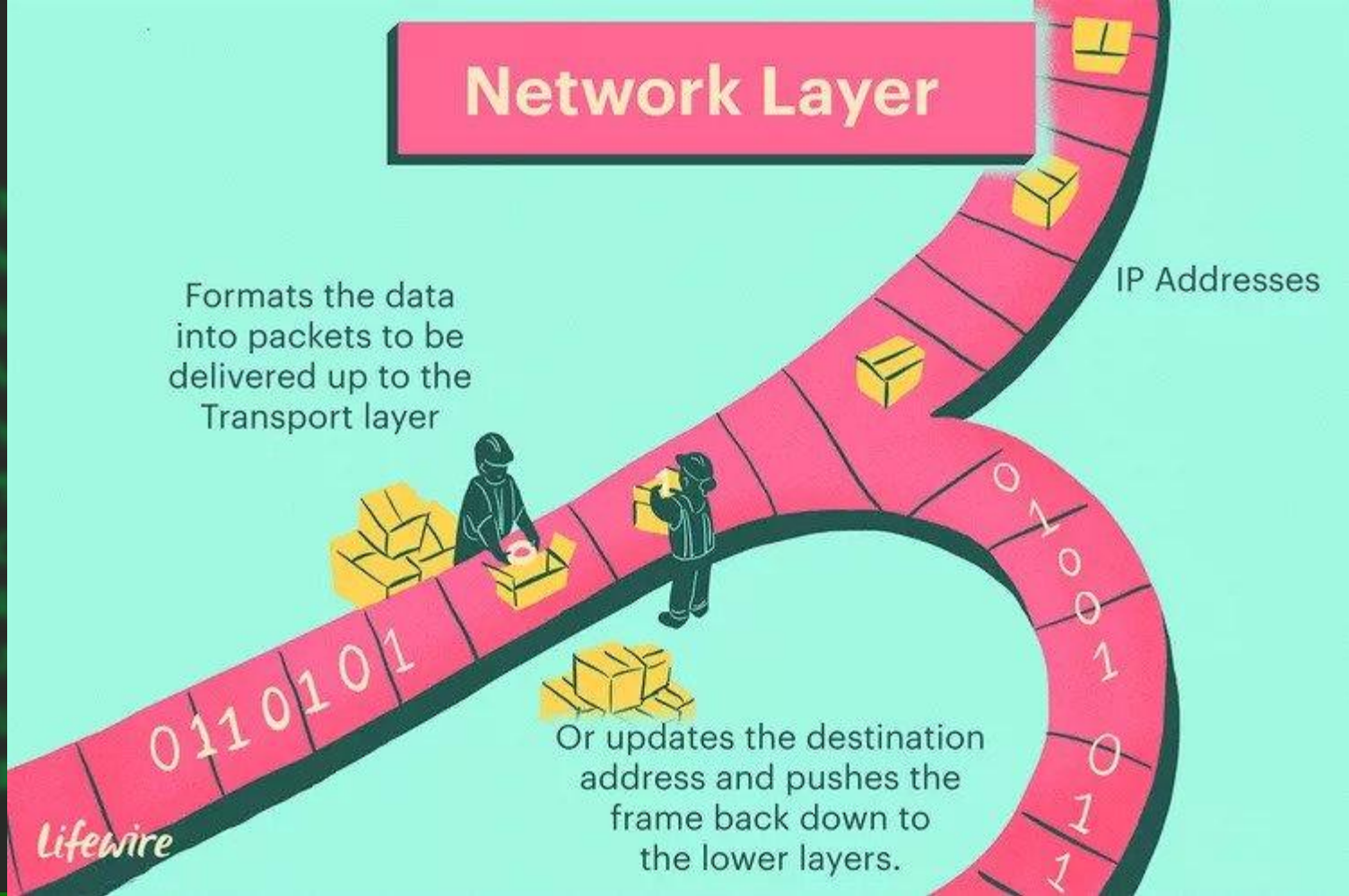
- Manages addressing/routing of data within the ip range
  - Addresses messages and translates logical addresses and names into physical addresses.
  - Determines the route from the source to the destination computer
  - Manages traffic problems, such as switching, routing, and controlling the congestion of data packets.
- Your data is PACKETS
- PROTOCOLS: ICMP, ARP, NAT, IP



# Network Layer

Formats the data into packets to be delivered up to the Transport layer

IP Addresses





# Layer 2: Data Link Layer

- Packages raw bits from the Physical layer into frames (logical, structured packets for data). [ receiver ]
- Provides **reliable transmission of frames**
  - It waits for an acknowledgment from the receiving computer.
  - Retransmits frames for which acknowledgement not received
- Your data is FRAMES
- PROTOCOLS: PPP,NDP,CDP

# Data Link Layer

Destination  
Address

Source  
Address

Other  
Header

Logical Link  
Control

011010

Frame  
Footer

Media Access  
Control

*Lifewire*



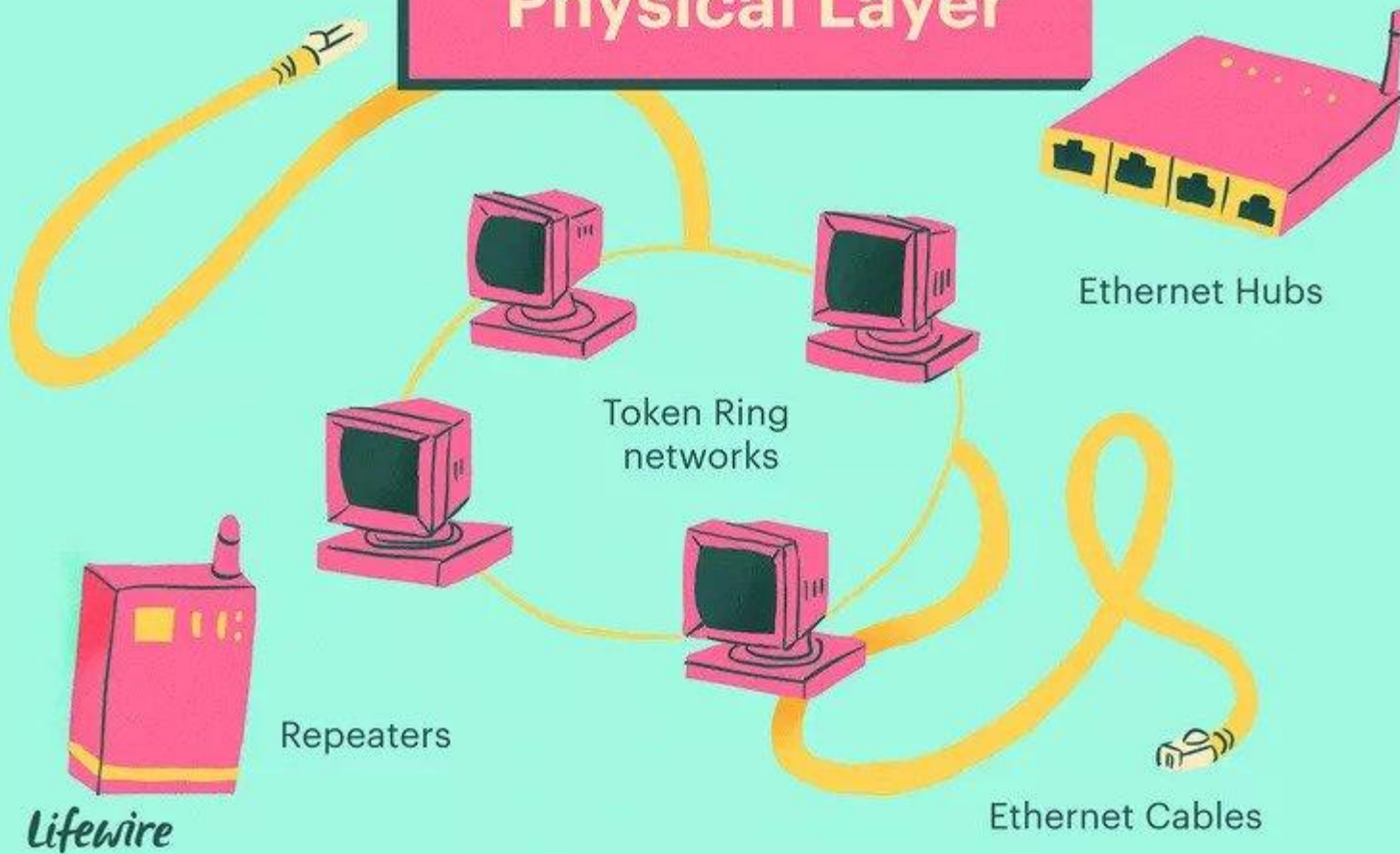




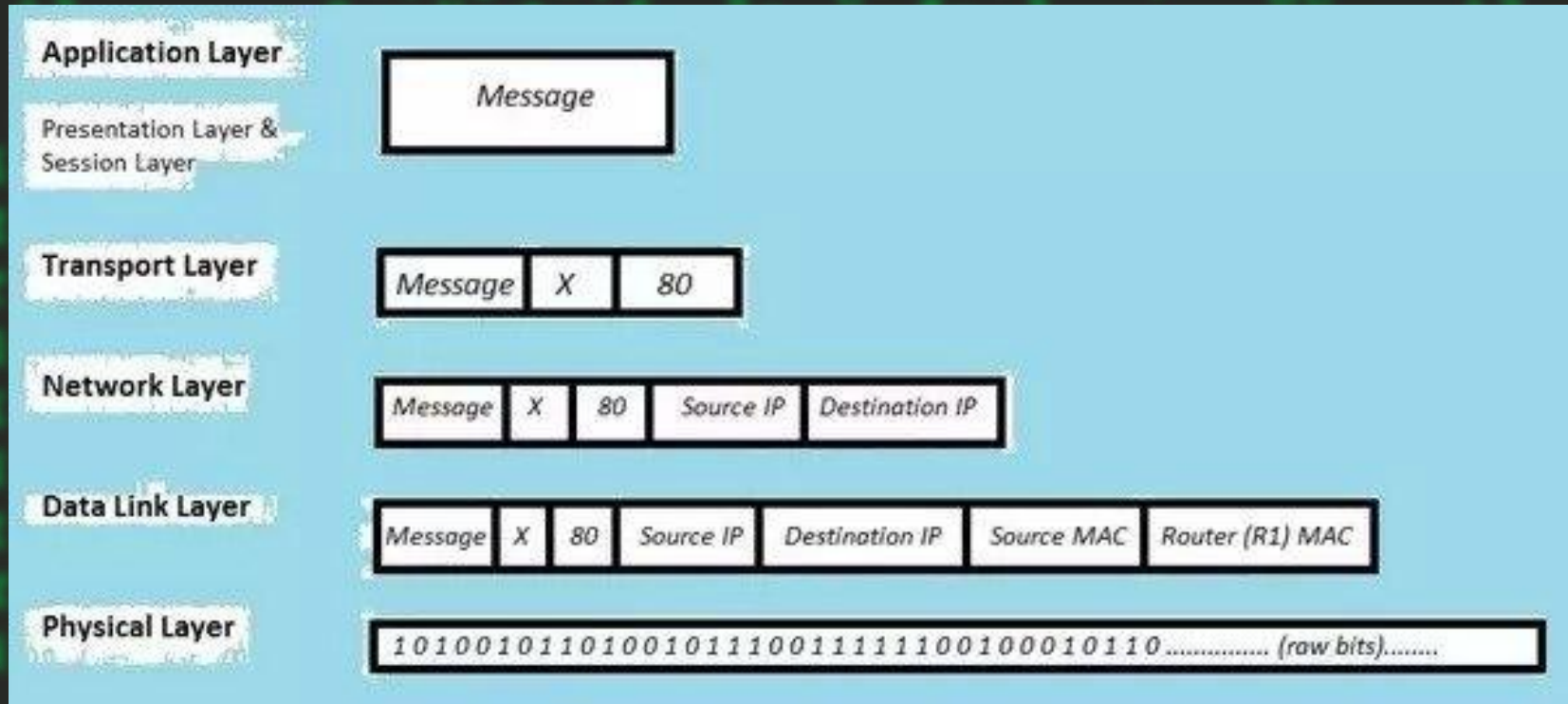
# Layer 1: Physical Layer

- Transmits bits from one computer to another
- Regulates the transmission of a stream of bits over a **physical medium.**
- Defines how the cable is attached to the network adapter and what transmission technique is used to send data over the cable. Deals with issues like
  - The definition of 0 and 1, e.g. **how many volts represents** a 1, and how long a bit lasts?
  - How many pins a connector has, and what the function of each pin is?
- Your data is Bits
- PROTOCOLS/DEVICES: RS-449

# Physical Layer



# Summary







# TCP and UDP

## What Is TCP (Transmission Control Protocol)?

- Reliable
- Connection-Oriented protocol
  - Means it establishes a connection between the receiver and sender.
    - It uses 3 way HandShake ( more on Network Hacking )
- Used on emails, Chat, watching online videos, simple browsing.



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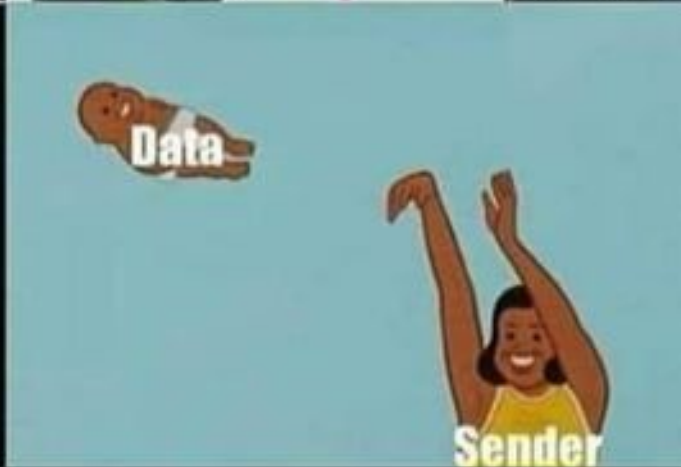
## What is UDP(User Datagram Protocol)?

- Connectionless
- less reliable, but faster and more straightforward.
- It's often used in situations where higher speeds are crucial, like in streaming or gaming.

**TCP**



**UDP**





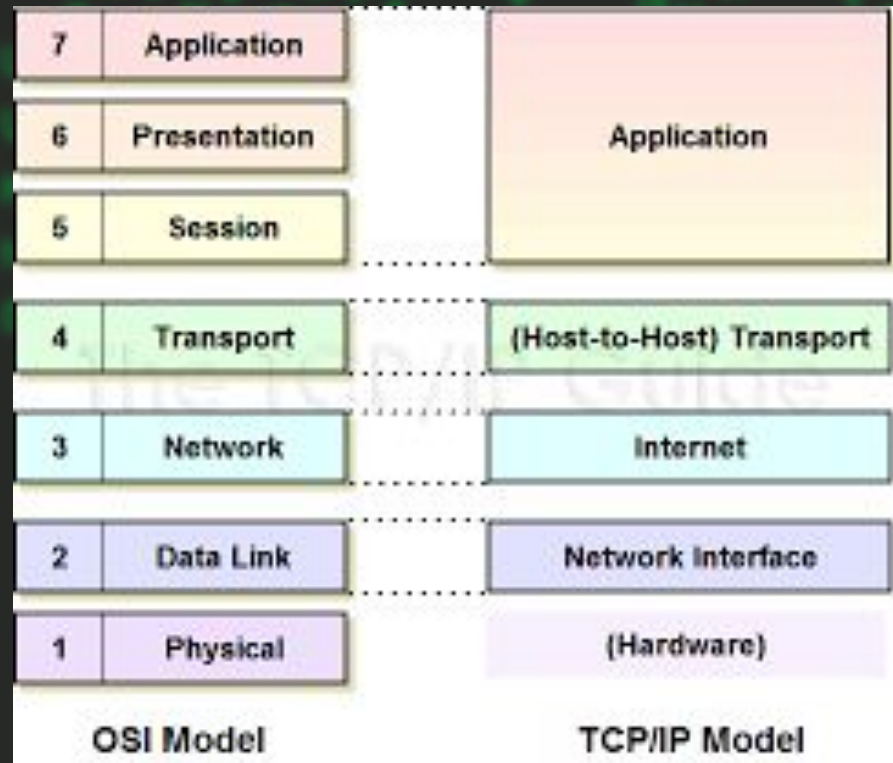


## TCP/IP model

- It is A reference model like the OSI model
- TCP/IP is the new and most used Model at this time.
- This model have 5 layers

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- Application, Presentation and session layers are combined together and called APPLICATION



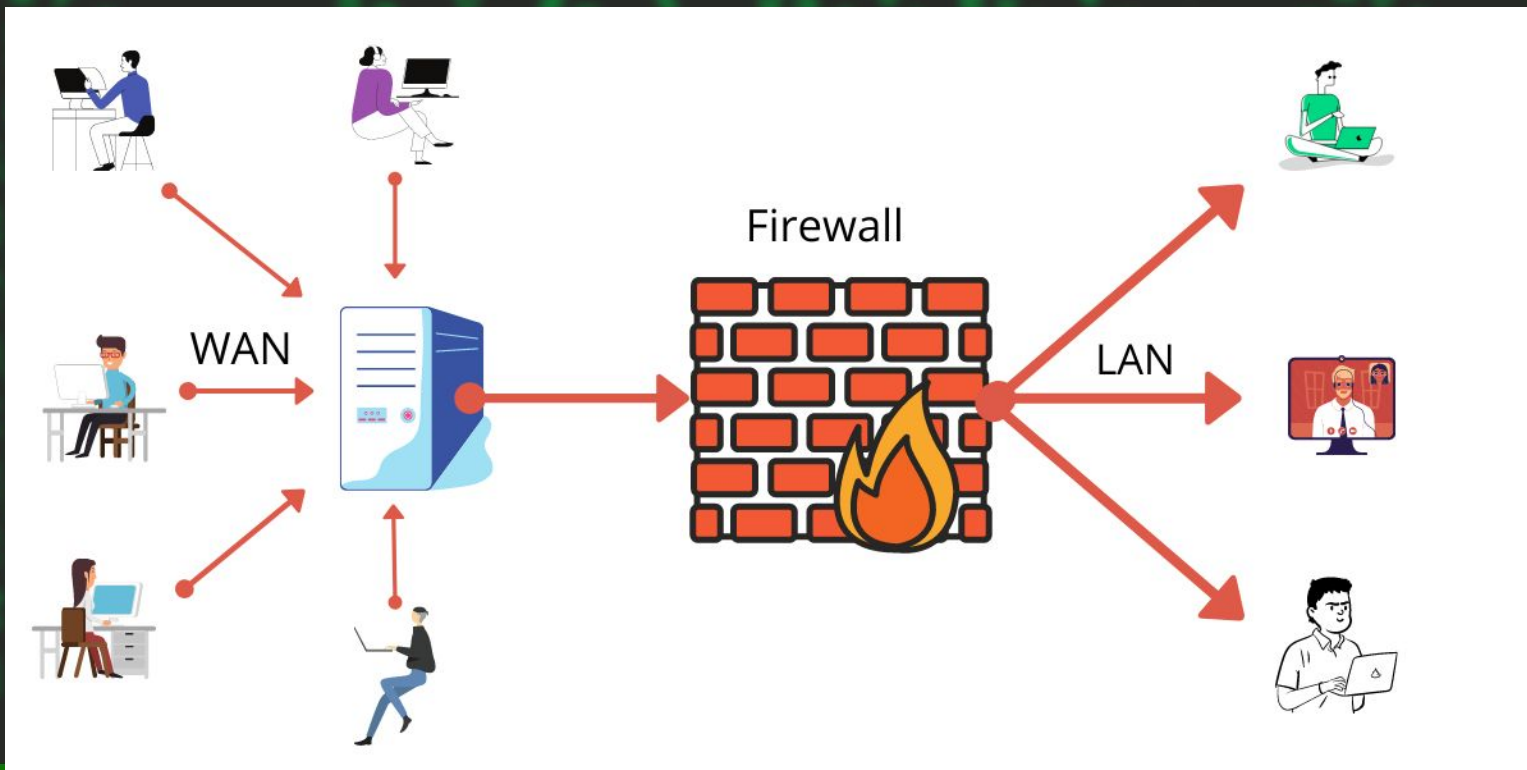


# Firewall

- A firewall is 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.
- It is Just A collection of rules to allow and deny network traffics
- Ex: You can't directly access some host directly from other Network.



# Firewall



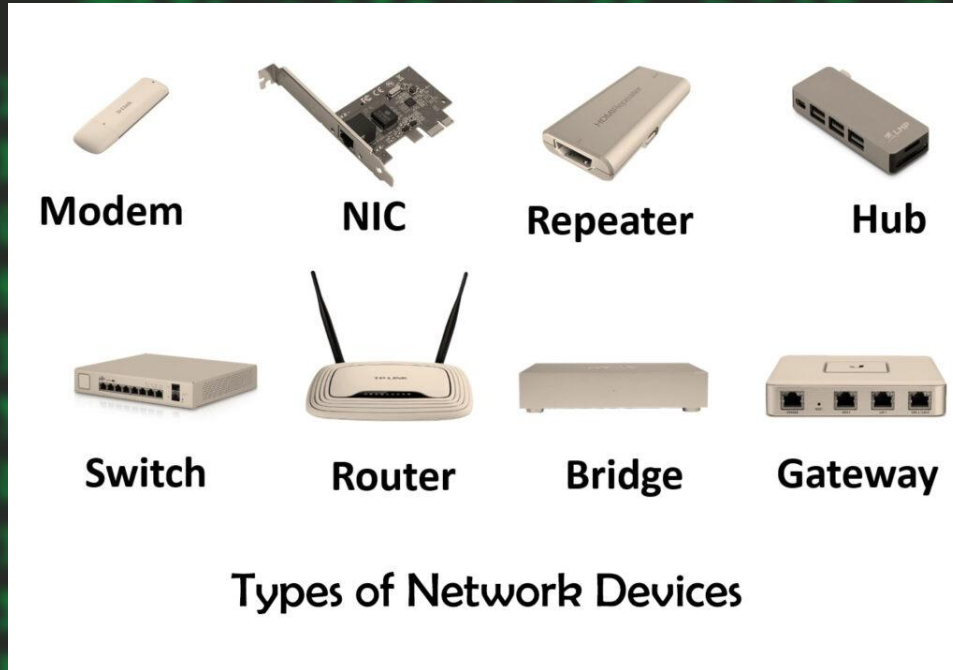
# Firewall hardwares



**But every OS have firewall Built-in**

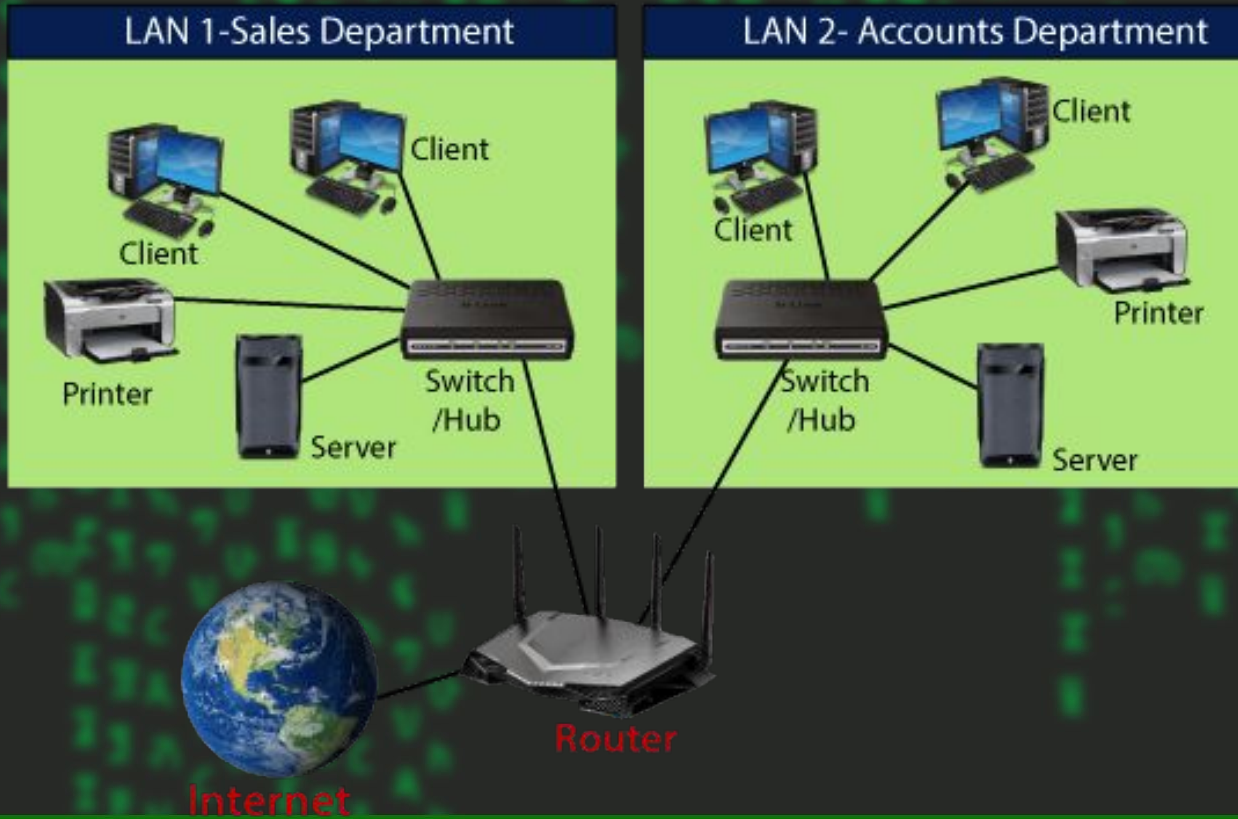
# Networking tools

ON Networking there are many hardware devices.

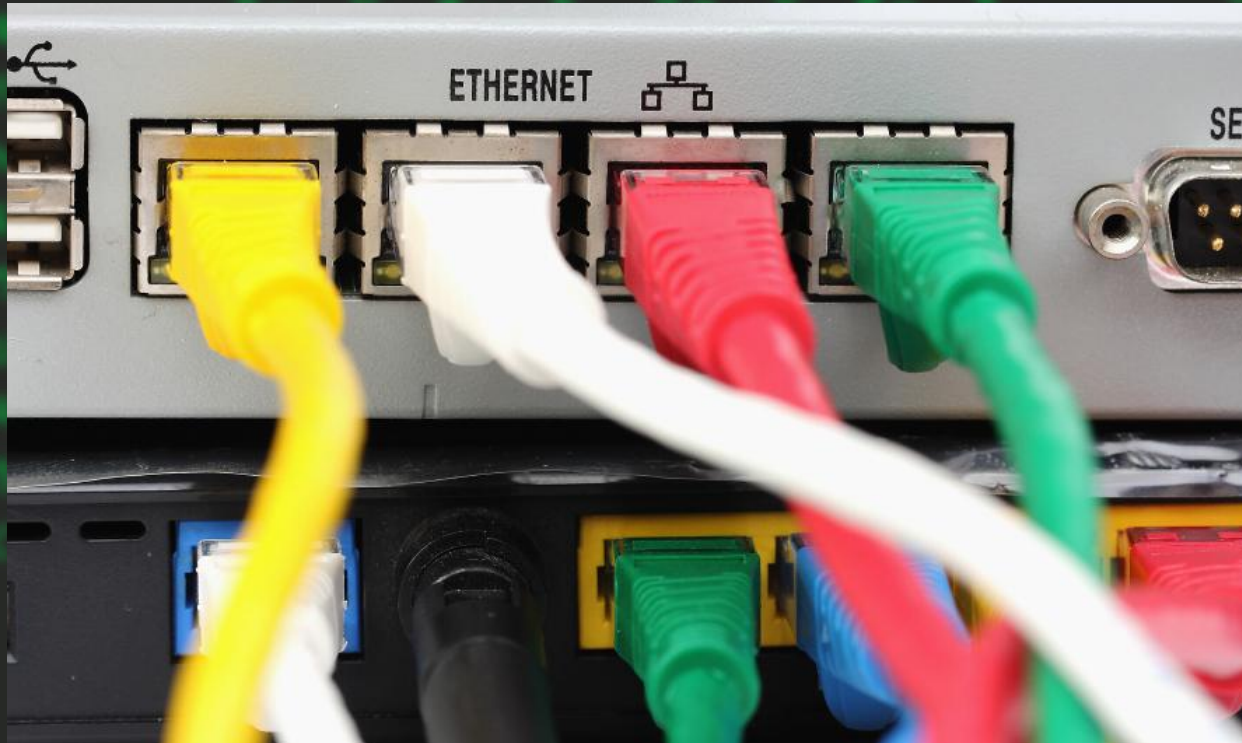




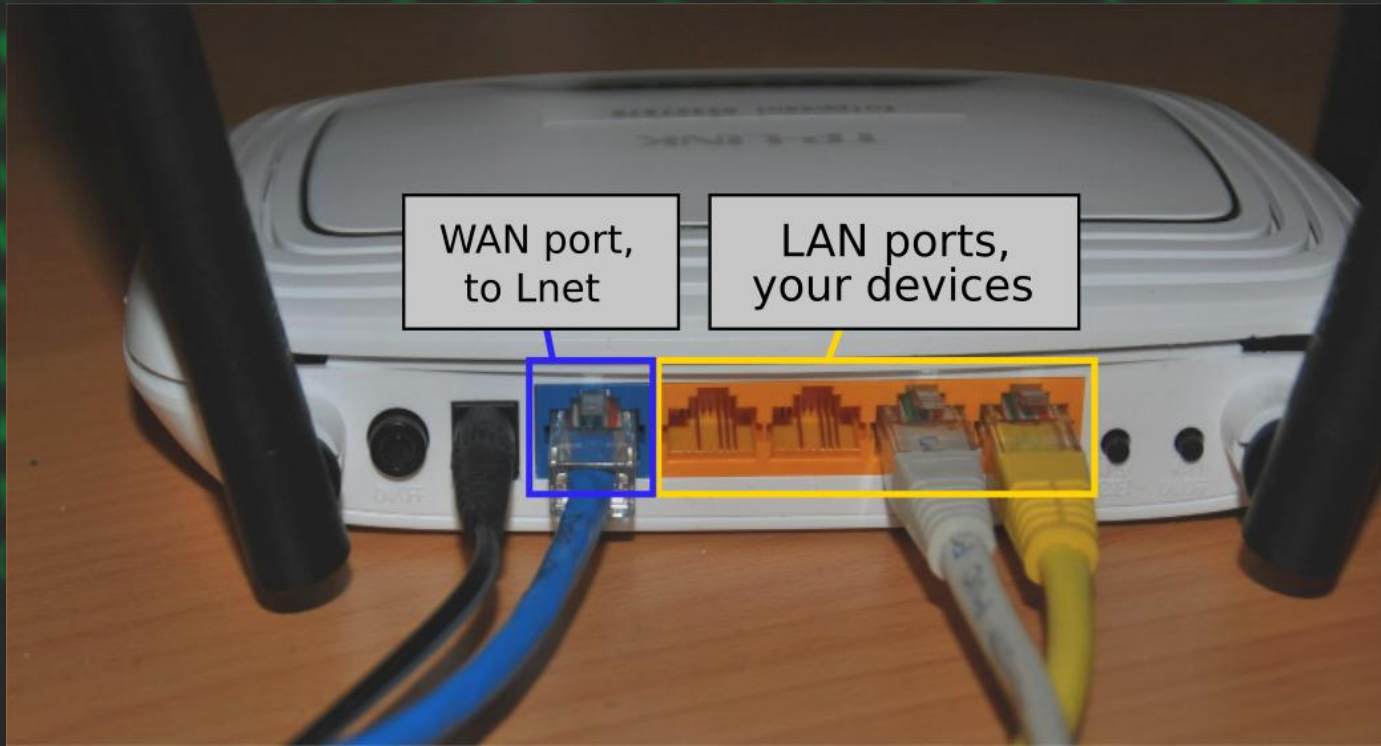
# Switches/Hub and Routers



# The switches



# Modern wifi routers





# Repeater

- Helps To boost/amplify the speed of the internet, in long route



# Bridge

Used to Connect different LANs





# CLASS IS OVER

- 1) Do note
- 2) Read it again
- 3) ASK
- 4) Prepare Your Kali linux/Parrot machine