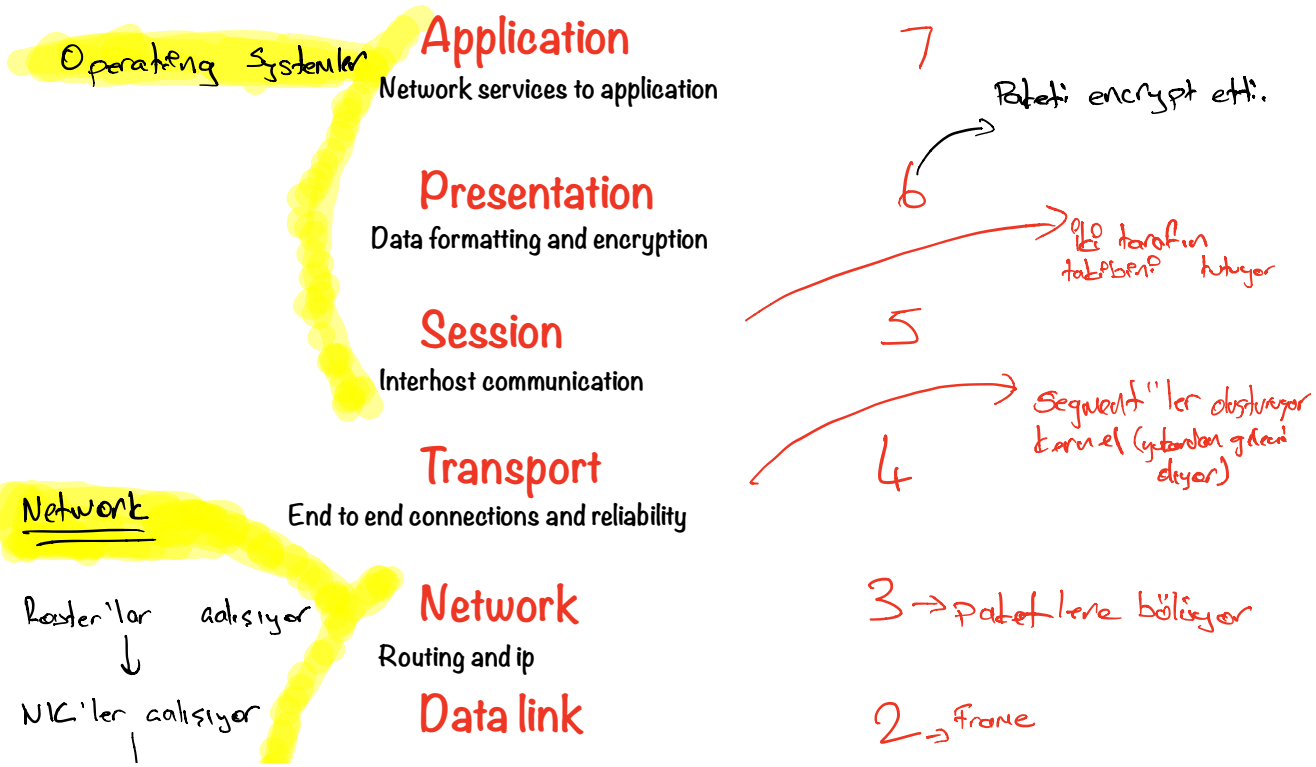
The OSI Reference Model

OSI stands for Open System Interconnection. The OSI model defines how data is transferred from one computer to another computer regardless of operating system or vendor of the hardware.

* If two computer connected with LAN and transfer data using NIC (Network Interface Card).

If both systems are different like MAC and Windows here comes the role of OSI model.



↓

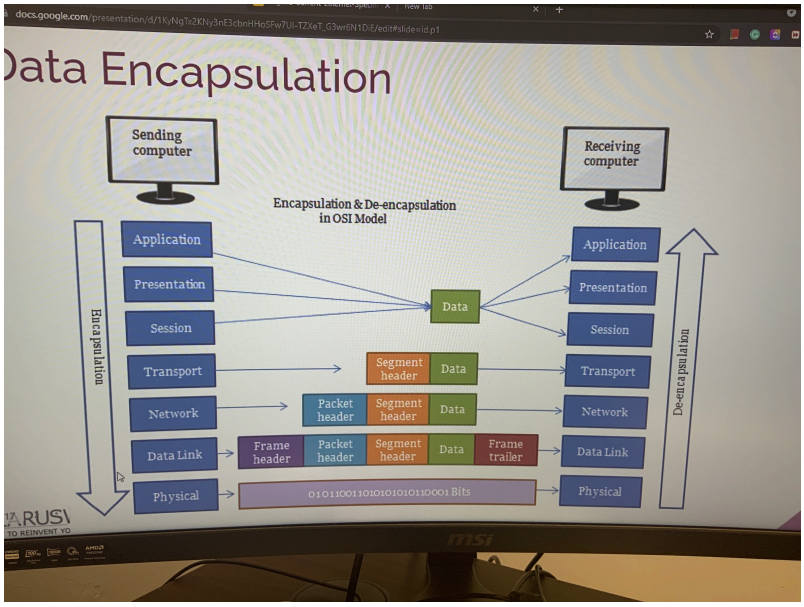
Digital sinyal → Analog sistem çeviriyor.

MAC and LLC

Physical

Media, signal and binary Transmission

Digital paketi → analog sisteme çeviriyor → gönderiyor



Switch L2

Router L3

Broadcast domain =

Session Layer 5 = data transfer "session"
Responsible opening and closing communications.

Transport layer 4 = Responsible end-to end communication.
Takes data from upper to lower layer "Segments"
Responsible flow control and error control.

Network Layer 3 = Data transfer between two different networks.
Takes data from upper layer and breaks into packets.

Data link layer 2 = Data transfer between two devices on the same network
Takes data from upper layer and breaks into frames.
Responsible flow control and error control.

Physical Layer 1 = Includes physical equipment: cables-repeaters-modems-transceivers-media converts -hubs
Data is converted into bit streams like digital signal to analog signals.

Data Encapsulation

>Two nodes communicate they must use the same protocol.
> Getting data ready for transfer

Ethernet Basics

> IEEE protocol 802.3
> Uses data link and Physical layer

Collision Domain

> Network where packet collisions can occur
> Collision occurs when shared network segment send packets.
> The colliding packets must be discarded and sent again.
> Occurs often in a hub .

Broadcast Domain

> Broadcast domain collects of network devices that receive broadcast traffic from each other.

CSMA/CD

> Detect collisions and to re-transmit frames

Broadband/Baseband

Baseband
> Uses digital signals and single channel
>Short distance

Broadband
> Uses analog signals
> Multiple transmissions are possible
> Long distance

MAC Addresses

48 bit = 6bytes or 12 digits hardware number

1.Unicast
> Only one sender and only one receiver

2.Multicast
> A group of receivers

3. Broadcast
> All devices on the network are recipients
> MAC address is: FF:FF:FF:FF:FF:FF

Ethernet Frames
>Network Access Layer is called and Ethernet frame
>The Ethernet frame structure is defined in the IEEE 802.3

Common Network Connectivity Devices

→ Network Interface Card (NIC)

→ NIC is Layer 2, because the information it uses for communication

Hub

→ It does not have segmentation capability.
→ repeaters
→ Physical layer devices. ✱✱
→ Sometimes called multiport repeaters.

Bridge

→ Connects two different LAN operating on the same protocol.
→ Traffic pass through only opposite side.
→ data link layer ✱✱

Common Network Connectivity Devices

Switch

→ Data link layer (OSI)
→ Each port separate collision domain and can run full duplex.
→ learning - Forwarding - Filtering - flooding

Router

→ Layer 3 (Network) te calışır.

Intrusion detection system (IDS) ✗

→ It just monitor networks and tells you problems.

Intrusion prevention systems (IPS) ✗✗

→ IPS can work real time to stop threats.

Load Balancer

→ Load balancer send incoming packets to multiple machines hidden behind one IP address.

Domain Name Server (DNS)

→ We use to find the IP addresses of hostnames

Proxy Server

→ Operates by Application layer.

→ Basically client-machine requests by forwarding them to other servers.

IP Terminology

→ Bit = 1 or 0

Nibble = Nibble is 4 bits.

Byte = A byte is 8 bits.

Octet = 8 bit binary number

Network Address = 192.168.10.0

IP Address = A Logical Address

Broadcast Address = 10. 255. 255. 255 which broadcast to all subnets and hosts on network 10.0.0.0

Network Addressing

→ 172. 16. 30. 20 → 172. 16 is network address

30. 20 is host address

Class A addresses

→ Class A → 10. 224. 0. 1 → 10 is network address

network. host. host. host

1 – 126 Class A → 126 tane network. ip var.

→ 127. 0. 0. 1 → local host.

Class B addresses

→ 172. 16. 30. 20 → 172. 16 → network address

30. 20 → host address

network. network. host. host

128 – 191 10 000000 → basla.

16. 384 network create edilir.

Class C addresses

→ 192. 168. 30. 20 → 192. 168. 30 → network address

20 → host address

network. network. network. host → 11000000

192 – 223

Class D and E addresses

→ 224-239 arası

→ 240-255

→ Class d addresses are not assigned any devices on a network. (special purpose - video and audio - streaming)

→ Class e is special than class d. Class e is reserved for future use.

TCP/IP

TCP/IP/DoD

Mail delivery, File Transfer	Application
host-to-host	Transport
Routing yapıyor IP-ICMP-ARP	Internet
Paketin kabloya aktarma yapıyor.	Network Interface

OSI

- Application
- Presentation
- Session
- Transport
- Network
- Data link
- Physical

Application Layer Protocols

Telnet (TCP 23)

→ Remote client machine to access another machine.

SSH (TCP 22)

→ Secure connection. bilgisayara bağlanır

hersey? yapıyoruz.

FTP(TCP_20-21)
→ File transfer protocol. Between only two machines.

SFTP(TCP,22)
→ Secure than FTP

TFTP(UDP-69)
→ dosya gönder al.

POP(TCP-110)
→ Post office protocol.

IMAP(TCP-143)
→ Mail filtreleme

RDP(TCP-3389)
→ Remote desktop protocol.
It allows you to connect another computer and run programs.

TLS/SSL(TCP 995/465)
→ Cripto güvenlik.

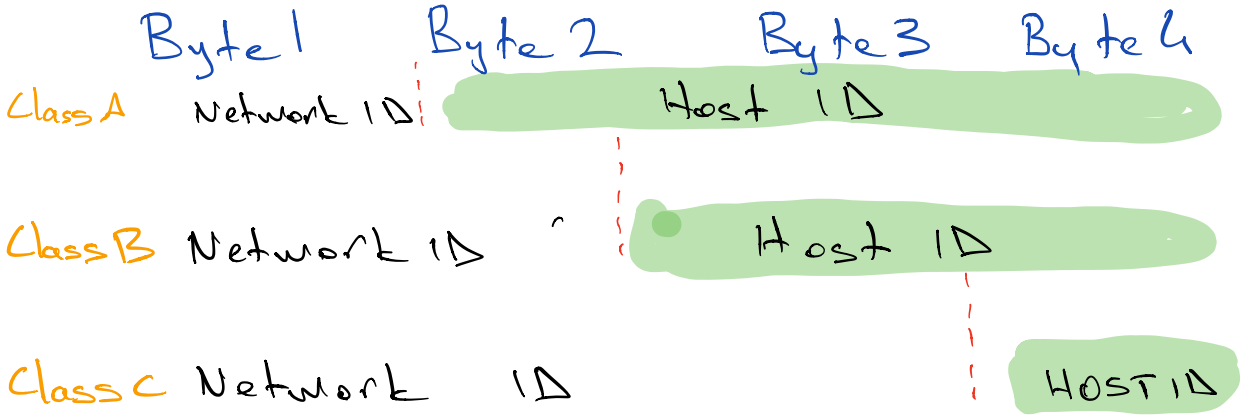
İnternette güvenlik sağlıyor.

Address Resolution Protocol (ARP)

→ IP address'i MAC address ile eşleştiriyor.

6/16/2021

Network Classification



Class D — Multicast Address

Class E — Reserved

Class A Addresses

→ Class A address first bit of the first byte be off or 0.

00000000 = 0

01111111 = 127

→ Class A address must be between 0 and 127.

→ Network 127.0.0.1 = Reserved for loopback tests.

Class B Addresses

→ First 2 bytes network. network. host. host

→ Class B should start binary digit 1 and 0

10000000 = 128

10111111 = 191

→ Class B 128 - 191

→ 172.16.0.1 to 172.16.255.254

Class C Addresses

→ First 3 bytes network. network. network. host

→ First 3 bits are 110

11000000 = 192

11011111 = 223

→ Class C range is 192 to 223

→ 192.168.100.1 to 192.168.100.254

Class D and E addresses

→ These addresses uses for special purpose, multicast applications

→ First bits of the first octet set to 1110.

11100000 = 224

11101111 = 239

→ It uses a 255.255.255.255

Class E addresses

→ The first bits of the first octet is 1111

11110000 = 240

11111111 = 255

Address Class	Reserved address space
Class A	10.0.0.0 to 10.255.255.255
Class B	172.16.0.0 to 172.31.255.255
Class C	192.168.0.0 to 192.168.255.255

IPv4 Address Types

→ Layer 2 Broadcasts = These sent all nodes on a LAN

→ Broadcasts (Layer 3) = These sent all nodes on a network.

→ Unicast = Send packets to single destination host.

→ Multicast = Packets send to many devices on different network.

Benefits of and uses for IPv6

→ 128 bits – more than 4 billion addresses.

Shortening IPv6 Address

Original = 2041:0000:140F:0000:0000:0000:875B:131B

Short = 2041:0000:140F::875B:131B

Original = 2001:0000:0000:0012:0000:0000:1234:56ab

Wrong = 2001::0012::1234:56ab

We don't know which one has more 0000.

Short = 2041:0000:140F::875B:131B

Shorter = 2041:0:140F::875B:131B

Original = 2001:0001:0002:0003:0004:0005:0006:0007

Short = 2001:1:2:3:4:5:6:7

Address Types

1. Unicast address

→ Packets are delivered to a single node.

1a. Global Unicast Address

→ The format 2000::/3 includes all addresses 2000 to 3FFF.

1b. link-local Address

→ local networks
→ The format FE80::/10

2. Multicast

→ Delivered to all hosts - one to many.
→ They always start for IPv6 with FF.

3. Anycast

→ The anycast packet is delivered to only one address.
→ This is also referred to as one-to-nearest addressing.

Subnetting and Introduction devices →