COMPUTER NETWORKs – 1

What do you understand by networks!

All the internet is connected by wires. In a continent all the computers were connected by using wires. Tunnels are made in seas to create tunnels across continents. In 1990's foundation of internet was laid down to connect all the computers via internet. Even in our home, the internet that we receive from the towers are connected by wires.

IETF – Internet Engineering Task Force owns the internet. It governs the internet.

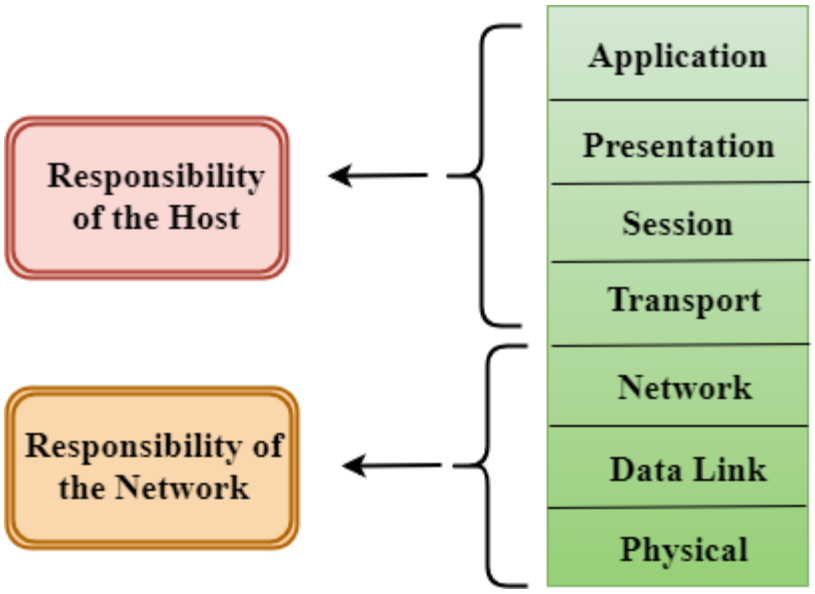
Network is how one person is connected to another person via internet.

IETF → OSI Model (***Open System Interconnection***) ➔not in use, as it is a theoretical model

➔ TCP / IP Model ➔ this is implemented and in use now.

Models means, rules or regulations about specification of the wires, it's bandwidth, and for routers, ethernet cables we use. In the starting process there are many processes, but IETF decided for one model (TCP / IP model).

OSI Model:



P*lease*

D*o*

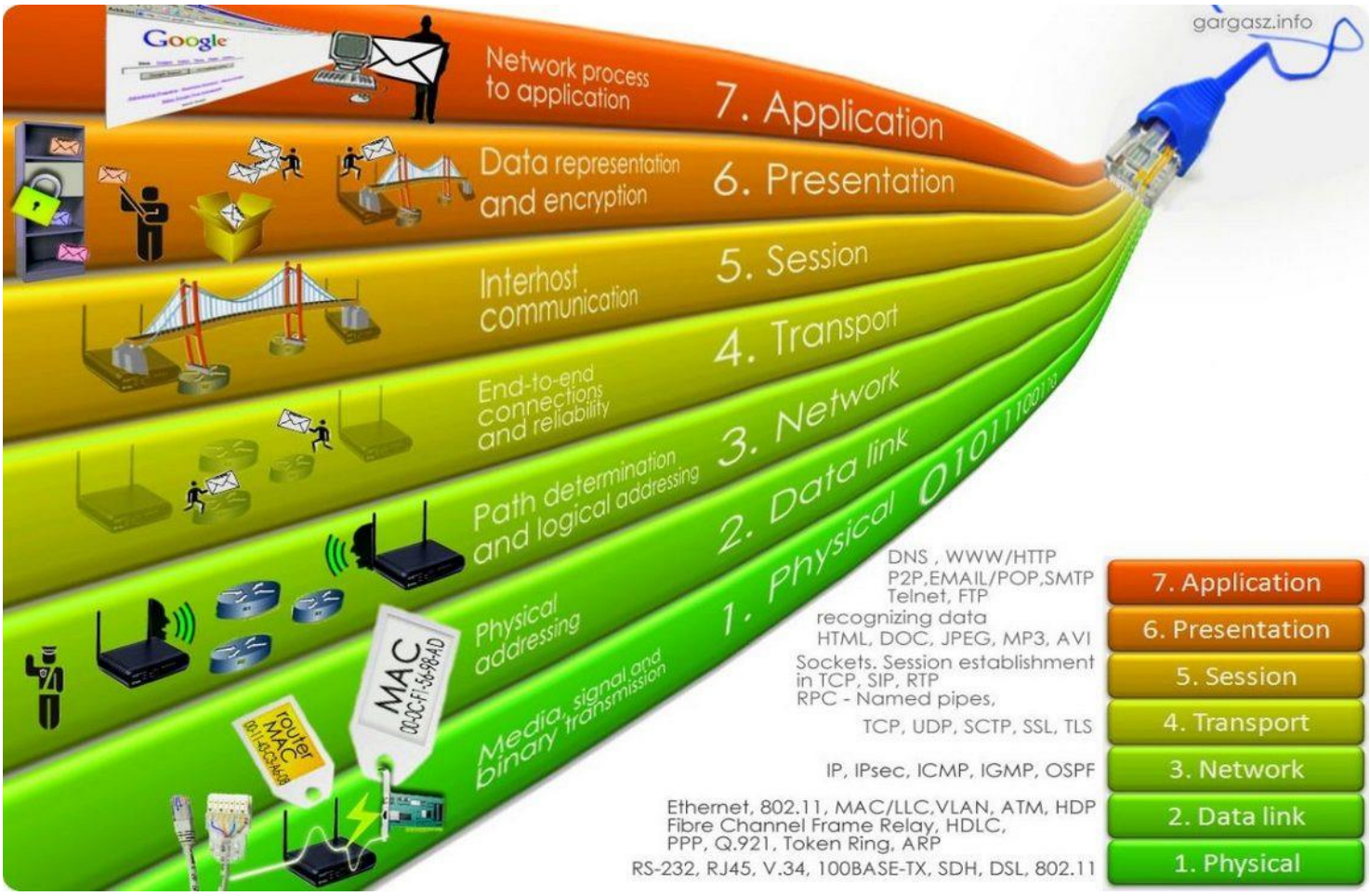
N*ot*

T*hrow*

S*andwich*

P*izza*

A*way*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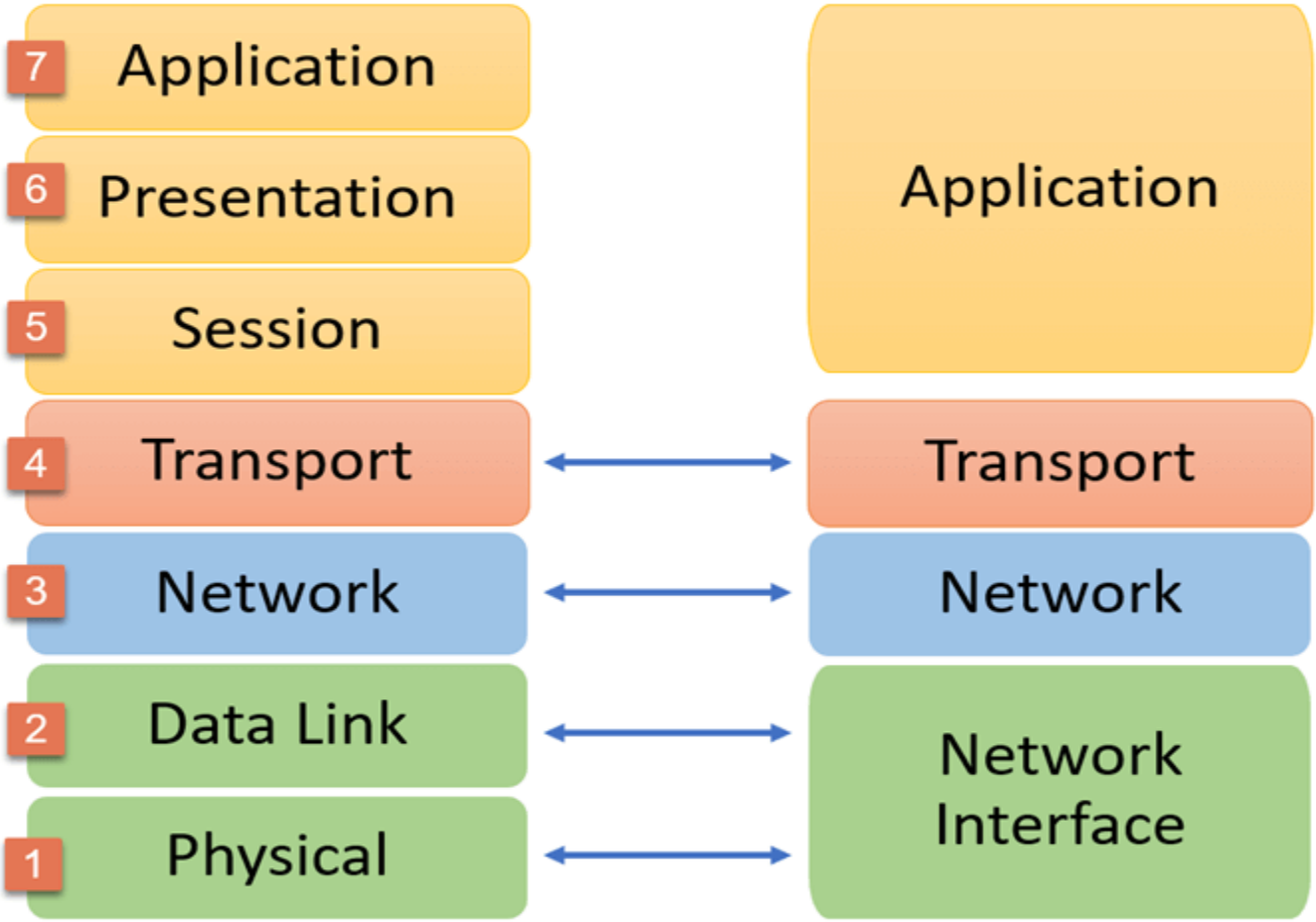
Network process to application
7. Application
Data representation and encryption
6. Presentation
Interhost communication
5. Session
End-to-end connections and reliability
4. Transport
Path determination and logical addressing
3. Network
Physical addressing
2. Data link
Media, signal and binary transmission
1. Physical
MAC
router MAC
DNS , WWW/HTTP
P2P,EMAIL/POP,SMTP
Telnet, FTP
recognizing data
HTML, DOC, JPEG, MP3, AVI
Sockets. Session establishment
in TCP, SIP, RTP
RPC - Named pipes,
TCP, UDP, SCTP, SSL, TLS
IP, IPsec, ICMP, IGMP, OSPF
Ethernet, 802.11, MAC/LLC,VLAN, ATM, HDP
Fibre Channel Frame Relay, HDLC,
PPP, Q.921, Token Ring, ARP
RS-232, RJ45, V.34, 100BASE-TX, SDH, DSL, 802.11
7. Application
6. Presentation
5. Session
4. Transport
3. Network
2. Data link
1. Physical


7 Application
6 Presentation
5 Session
4 Transport
3 Network
2 Data Link
1 Physical
Application
Transport
Network
Network Interface

Differences between OSI Model & TCP/IP Model:

OSI Model	TCP/IP model
It is developed by ISO (International Standard Organization)	It is developed by ARPANET (Advanced Research Project Agency Network).
OSI model provides a clear distinction between interfaces, services, and protocols.	TCP/IP doesn't have any clear distinguishing points between services, interfaces, and protocols.
OSI refers to Open Systems Interconnection.	TCP refers to Transmission Control Protocol.
OSI uses the network layer to define routing standards and protocols.	TCP/IP uses only the Internet layer.
OSI follows a vertical approach.	TCP/IP follows a horizontal approach.
OSI model use two separate layers physical and data link to define the functionality of the bottom layers.	TCP/IP uses only one layer (link).
OSI layers have seven layers.	TCP/IP has four layers.
OSI model, the transport layer is only connection-oriented.	A layer of the TCP/IP model is both connection-oriented and connectionless.
In the OSI model, the data link layer and physical are separate layers.	In TCP, physical and data link are both combined as a single host-to-network layer.
Session and presentation layers are not a part of the TCP model.	There is no session and presentation layer in TCP model.
It is defined after the advent of the Internet.	It is defined before the advent of the internet.
The minimum size of the OSI header is 5 bytes.	Minimum header size is 20 bytes.

OSI Model:

Physical Layer

The lowest layer of the OSI Model is concerned with electrically or optically transmitting raw unstructured data bits across the network from the physical layer of the sending device to the physical layer of the receiving device. It can include specifications such as voltages, pin layout, cabling, and radio frequencies. At the physical layer, one might find "physical" resources such as network hubs, cabling, repeaters, network adapters or modems. Cat6 is made of copper and is faster than Cat5. They are twisted so that the speed is increased and noise is reduced.

Data Link Layer

At the data link layer, directly connected nodes are used to perform node-to-node data transfer where data is packaged into frames. The data link layer also corrects errors that may have occurred at the physical layer. The ethernet cables are used to connect switches. The interne provides gets all the data via physical layer. There is a device called switch having incoming port and outgoing port so that it can connect multiple computers. Ethernet is the wires used to connect.

In this we have error check. Data can be corrupted so to make sure that such things don't happen, this layer will do **error check.** It is done via **check-some** mechanisms. If data is corrupted, data link layer will reject it. The speed of ethernet cable has increased since the time it was invented.

Network Layer

The network layer is responsible for receiving frames from the data link layer, and delivering them to their intended destinations among based on the addresses contained inside the frame. The network layer finds the destination by using logical addresses, such as IP (internet protocol). At this layer, routers are a crucial component used to quite literally route information where it needs to go between networks. To travel within network, network layer comes into play.

IP Addresses

A computer connected to internet has an IP address. It is actually an 8-bit number. All the 8-bits are separated by '**.**'

Ex: 162.5.1.8 ➔ each number is an 8-bit number. The max IP address is 255.255.255.255

We can have 2^{32} = **4294967296** IP addresses. Not just computers, but phone, smart watch, tables and many more devices are being used by internet so the number of IP addresses available are not sufficient. Previously these addresses were to be sufficient, but now the number is not sufficient. To resolve the limitation of IPV4, another paradigm IPV6 was invented. In IPV6, instead of 8-bit, there were 16-bit long. So, 16 * 8 = 128-bit long addresses. They are denoted in HEXA decimal formats. Hexa decimal has a base 16 i.e.,

0 1 2 3 4 5 6 7 8 9 a b c d e f

They are separated using **":"**. With this, we have 2^{128} = $\mathbf{3.40282367 \times 10^{38}}$

Routers:

Router transfers data to different devices. To transfer data in the shortest way using the algorithm of Dijkstra and Flooding.

Transport Layer

The transport layer manages the delivery and error checking of data packets. It regulates the size, sequencing, and ultimately the transfer of data between systems and hosts. One of the most common examples of the transport layer is TCP or the Transmission Control Protocol and the other is UDP or the User Datagram Protocol.

TCP – Transmission Control Protocol	UDP – User Datagram Protocol
Reliable, order is maintained.	Un-reliable, is not maintained
3-way handshake protocol. In this the server 1 will send request to server 2 and once serve 2 accepts the request, the server 1 acknowledges it.	It is fast. Ex of UDP is zoom.

MAC Addresses:

Every computer has a unique address called MAC address which is called media access control. in the motherboard there is a network card in all the devices connected to internet. The size of MAC address is 48-bits.

The only reason we use IP address instead of MAC address even though it is unique is because MAC addresses is a hardware number which can be changed and hence there is not guarantee that MAC address could be unique.