



CCNA 200-301

Lesson 1

1. What is Networking?
2. OSI model
3. TCP/IP model



What is Networking ?

A Computer Network is a set of network components that use the common communication protocols.

Network components:

- ❖ Host devices: Computers, Mobile phones, Laptops
- ❖ Servers: That gives services to end users (mail server, DNS server, NTP server, Web server)
- ❖ NIC (Network Interface Card): it is used for connecting devices to network. Wired NIC, Wireless NIC
- ❖ Communication Links: DSL, COAX, UTP, Fiber Optic, Wireless-radio signals.
- ❖ Network devices: Switches, Routers, Modems, Firewalls,
- ❖ Network Protocol: Telnet, SNMP, NTP, SMTP, RIP, OSPF etc...

Host Devices



Servers



Network Interface Card (NIC)



Communication links or Media

ETHERNET CABLE



FIBER OPTIC



Network Devices

SWITCH (C2960)



ROUTER (CASR1001)



Protocol

*Set of rules

For Example:

RIP, EIGRP, OSPF, DHCP, HTTP, TELNET, SSH, NTP, STP, FTP, BGP, etc..

Note: Duration of the course you will learn most of them.

OSI Model (Open System Interconnection)

In the beginning, the development of networks was chaotic. Each vendor had its own proprietary solution. The bad part was that one vendor's solution was not compatible with another vendor's solution. If engineers want to build network from three vendor's computers, they had to create three different network according to each vendor's solution.

It increased complexity and more troubleshooting time. As a result, in the late 1970s OSI model was created by ISO (International Standardization Organization). After creation of OSI model there was only one reference model for creating network. This decreased the complexity of network approach.

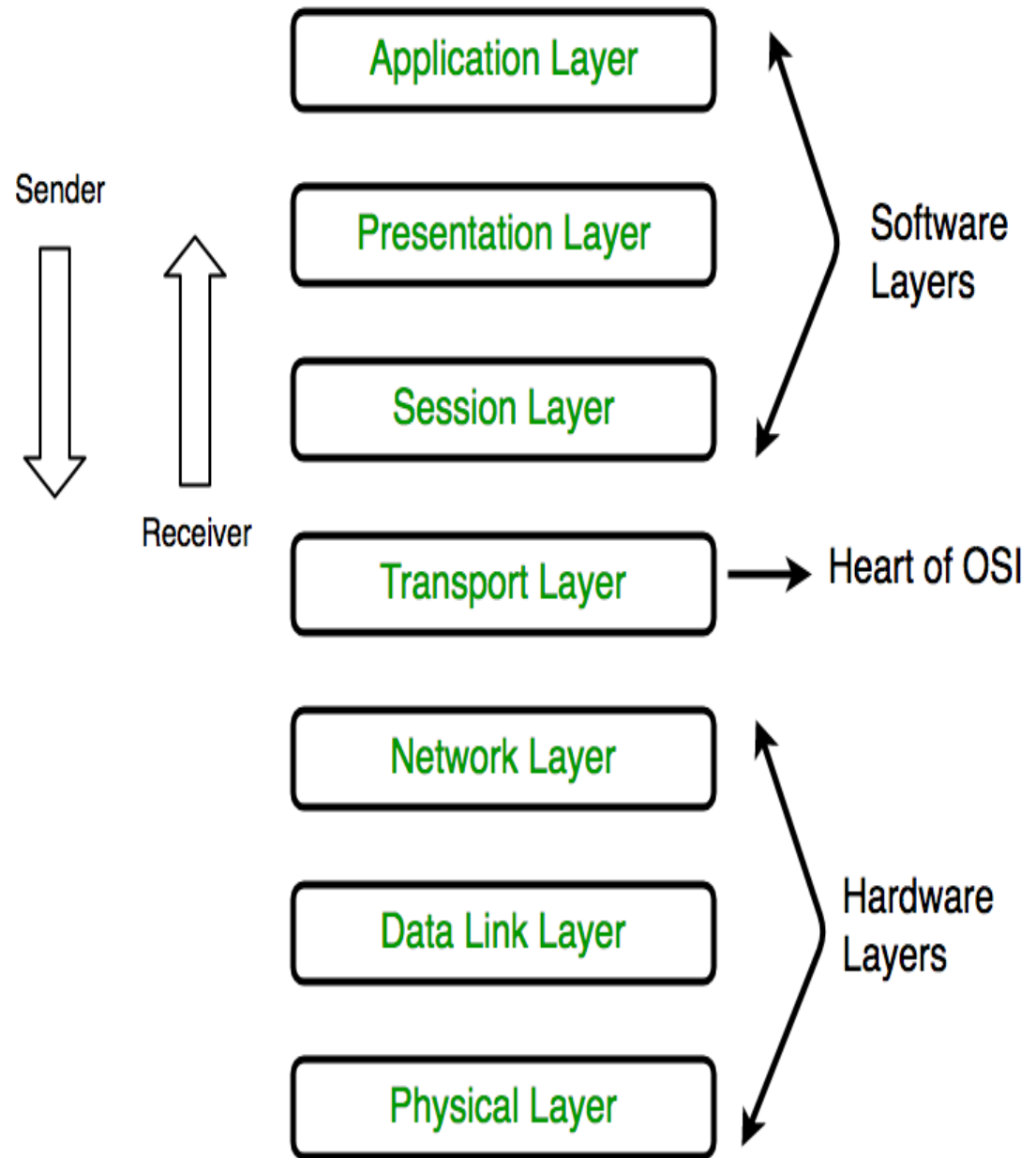
OSI model has layered architecture with seven layers.

OSI model


Seven layers architecture.
Each layer is a package of protocols.

P = Physical
D = Data Link
N = Network
T = Transport
S = Session
P = Presentation
A = Application

“People Do Need To See Pamela Anderson”



OSI Model – Application Layer

- ❖ Applications, protocols and services that is related to end users.
- ❖ It doesn't define computer applications → 
- ❖ It defines protocols: HTTP, FTP, SMTP, Telnet, SSH, etc.
- ❖ It is used by Network Applications (Computer Applications by used Internet)
- ❖ Network Applications do not reside in Application Layer but uses Application Layer Protocols
- ❖ Application Layer is called Software Layer.

OSI Model-Presentation Layer

In the presentation Layer :

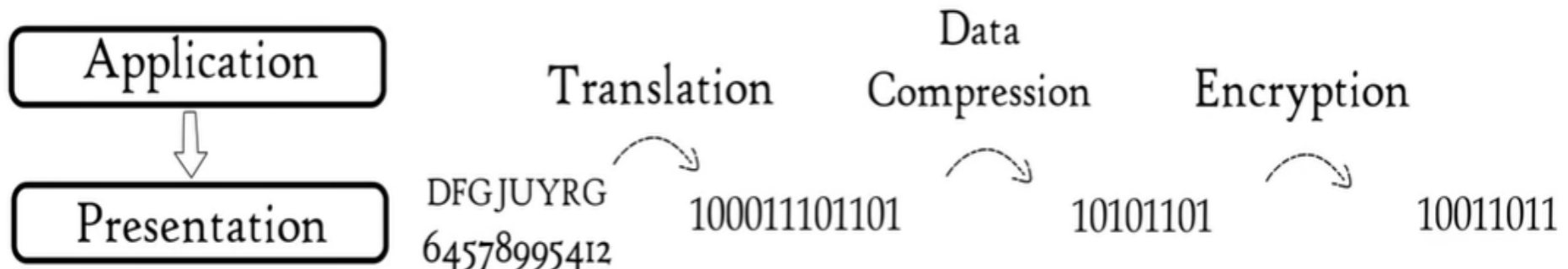
Data is formatted, converted, encrypted, decrypted, compressed, decompressed, and sent or presented to user.

Data is form of characters or numbers.

Characters or numbers are converted to machine understandable binary format – this is called translation.

The size of data is reduced – this is called to compression. As a result, fast transfer of data happens.

Data is encrypted and decrypted (SSL is used)– this is called encryption/decryption.



OSI model – Session Layer

1) Setting up sessions

- ❖ Check user credentials
- ❖ Assign number to session to identify it
- ❖ Negotiate Services needed to the session

2) Maintaining sessions

- ❖ Transfer data
- ❖ Reestablish a disconnected session

3) Tearing down sessions

- ❖ Because of mutual agreements
- ❖ Because of there is any intervention

Briefly, Session Layer is responsible connection of two communication end devices.

Protocols: NFS, PAP, SQL, NetBIOS

OSI model-Transport Layer

- ❖ Transport Layer controls the reliability of communication using Segmentation, Flow Control, and Error Control.

- ❖ Uses two most common protocols: TCP/UDP

 - TCP-Transmission Control Protocol

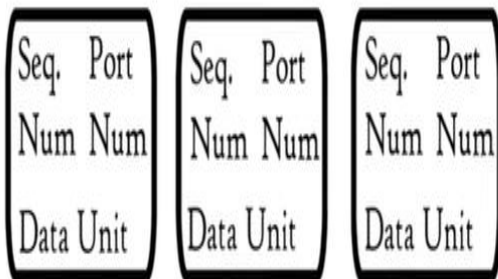
 - UDP-User Datagram Protocol

- ❖ Data is a form of **Segments**

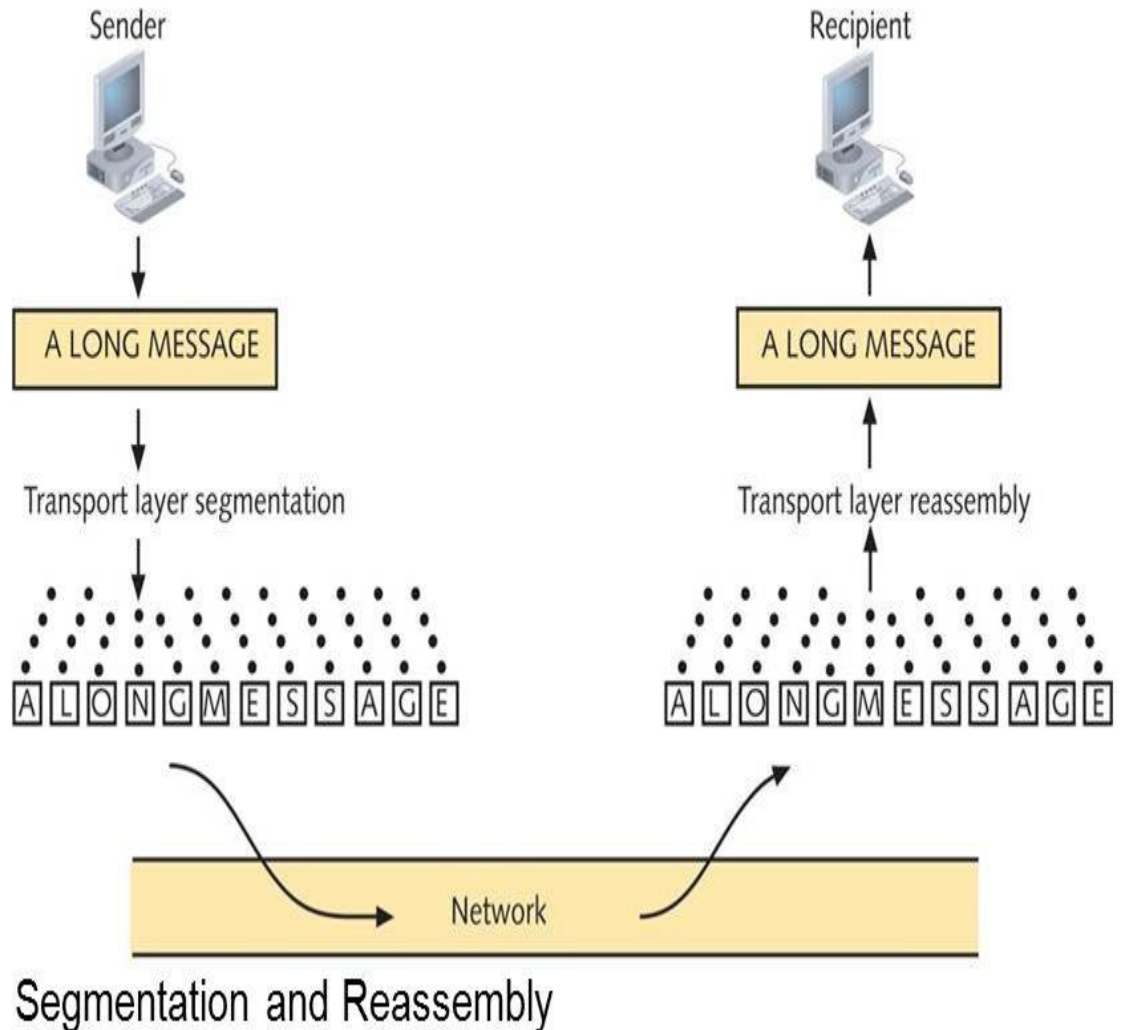
Segmentation

Data is divided into small parts that is called segment, each segment has sequence number and port number and data unit.

Segments



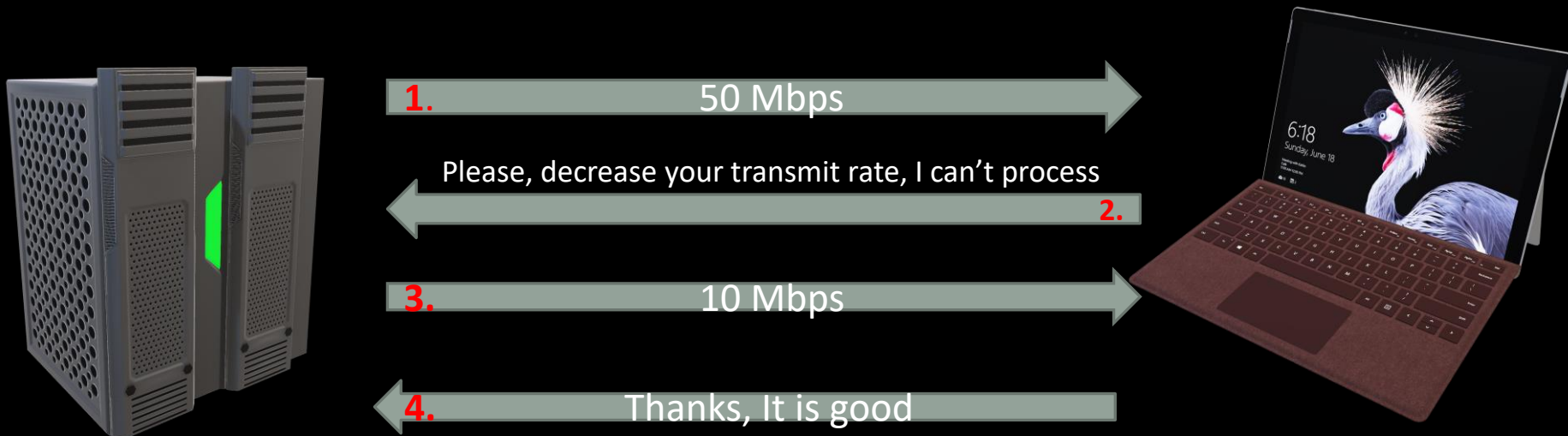
Transport Layer



Transport Layer Flow Control

In Flow Control Transport Layer controls the amount of data being transmitted.

Let's suppose that notebook has 10 Mb and server has 100 Mb NIC.



Transport Layer Error Control

Error Control:



OSI model-Network Layer

Segments in Network Layer are form of Packets. Network Layer has three main functions.

- ❖ Logical addressing

- ❖ Routing

- ❖ Path determination

IP addressing is done in Network Layer and called Logical Addressing. Each device in the network has to have unique address.

Routing is the transfer of IP packet from source to destination.

Path determination is done by the help of routing protocols (RIP, EIGRP, OSPF, IS-IS, BGP) and happens in the Network Layer.

Network Layer Protocols: IPv4, IPv6, ICMP.

OSI model-Data Link Layer

Data Link Layer has two sublayer:

- ❖ MAC (Media Access Control) sublayer

It concerns about physical addressing of network devices

- ❖ LLC (Logical Link Control) sublayer

Prepares frames for transmission.

OSI model-Physical Layer

Physical Layer cares about how data is presented in physical Links. Data in the Physical Layer is converted to binary digits like 0101011101.

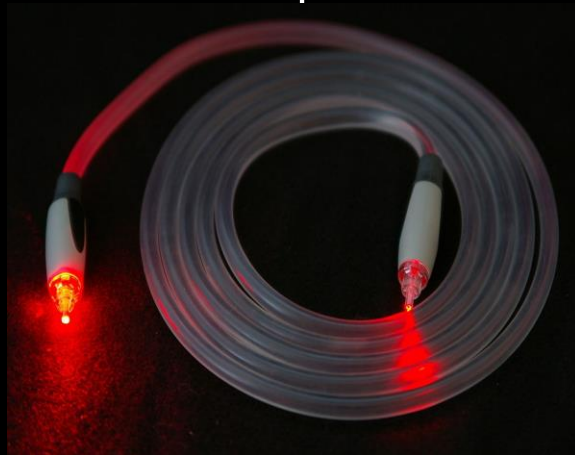
Physical Layer Component:

Ethernet cable



Data is sent the form of electrical signals

Fiber Optic



Data is sent the form of Light signals (pulses)

Radio Signals



Data is sent the form of Radio signals

For now, that is all about OSI model.

Let's relax for a while...



TCP/IP model

U.S. Defense of Department began new contract and attracted Universities as a volunteer. The purpose was to prepare second, less effort vendor-neutral model for computer networking. As a result, TCP/IP model was created.

Original TCP/IP model

Application
Transport
Internet
Link

Updated TCP/IP model

Application
Transport
Network
Data Link
Physical

TCP/IP vs OSI

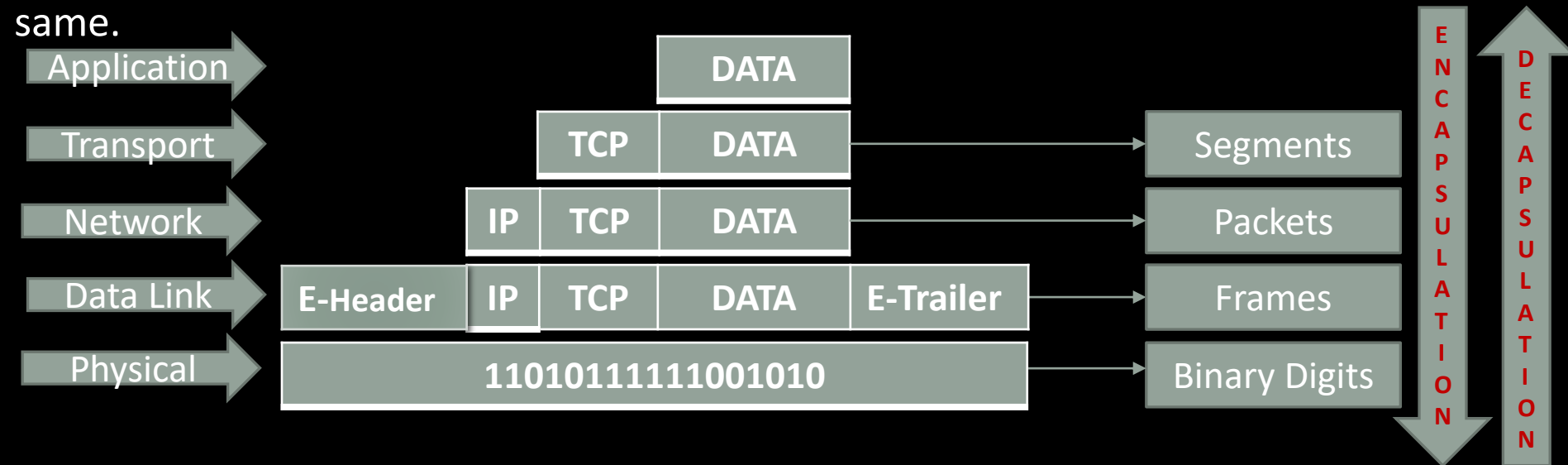
Application	Application
	Presentation
	Session
Transport	Transport
Network	Network
Data Link	Data Link
Physical	Physical

TCP/IP Encapsulation

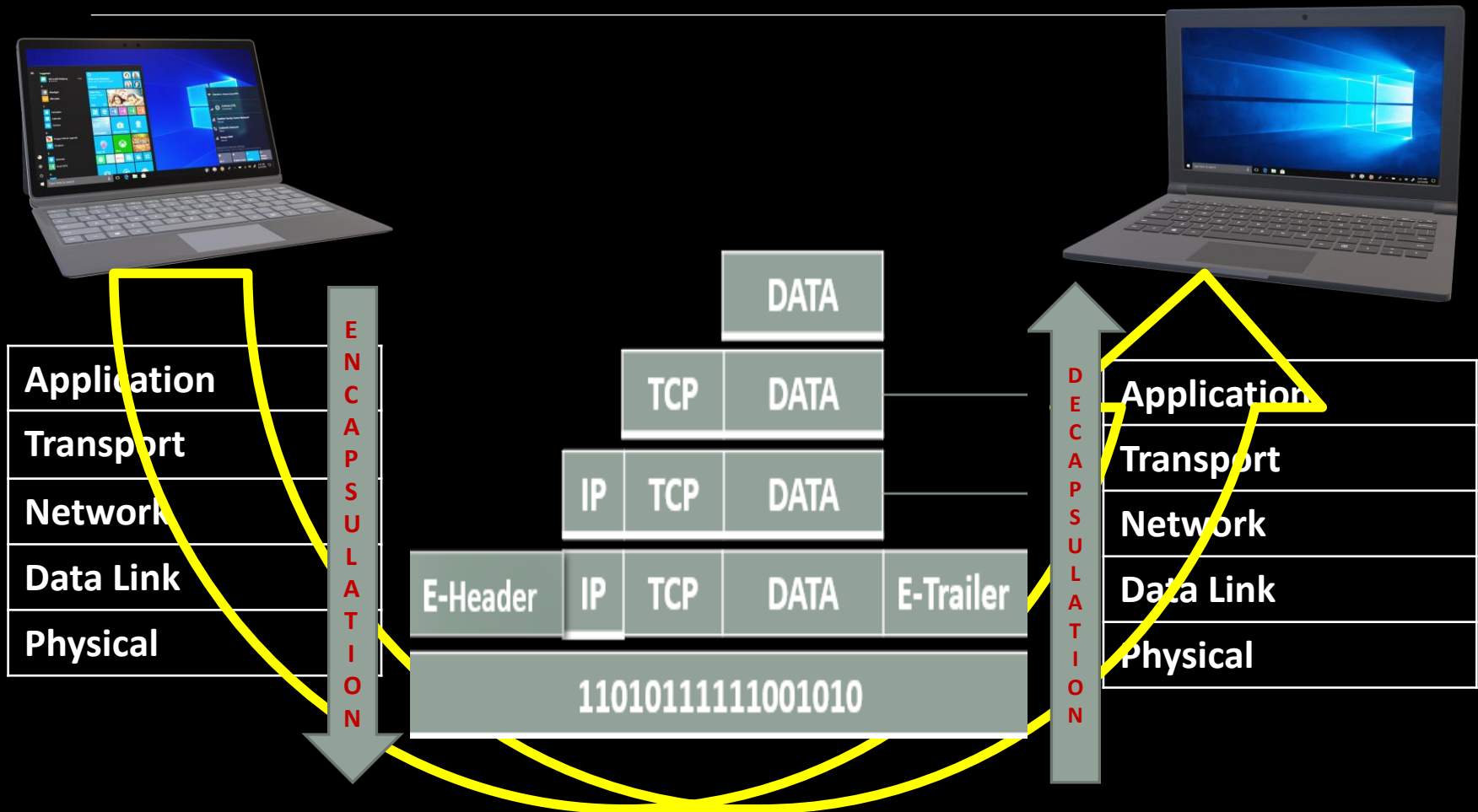
In TCP/IP model each layer has its own functions for networking process. Application Layer is the combination of three layers of original OSI model (Application, Presentation, and Sessions).

The Top-down approach to original user data is called encapsulation and vice-versa is called de-encapsulation.

In the application layer the data is called original user data. Let's suppose we have the same.



TCP/IP De-Encapsulation



Headers Content

- ❖ Transport Layer header has source and Destination Port Number according to Application Layer Protocols.
- ❖ Network Layer header has source and destination IP address.
- ❖ Data Link Layer has a header and trailer. Header contains of source and destination MAC addresses. Trailer has FCS (Frame Check Sequence) field that is responsible for error detection. FCS uses CRC algorithm for error detection.

Appendix for Lesson 1

TCP/UDP port numbers

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

That is all for
Lesson 1



The key is :



Learn



Repeat



Practice



You will be able to reach your goals.



GOOD LUCK !!!!!...