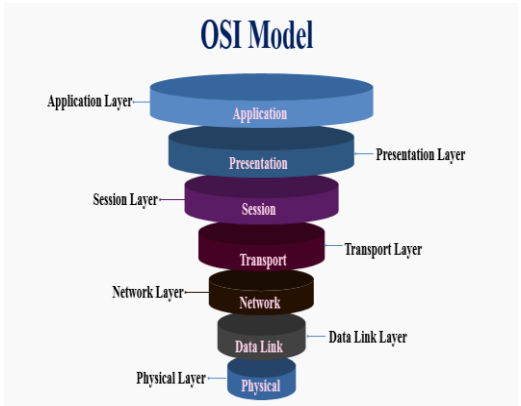
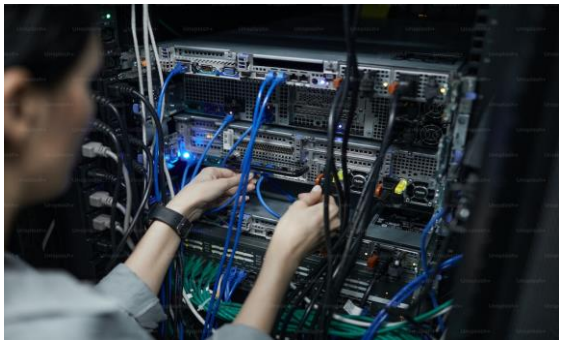
SH. A.
أكاديميـــة الشـــروق

Computer Networks (1)

First Semester 2023/2024





Computer Networks (1)

For fourth year
Electronics and Communication Engineering (ECE) Program
Computer and Control Engineering (CCE) Program
(2019 Regulation: ECE 462 and CCE 462)
(2013 Regulation: ECE 491 and CCE 491)

Dr. Mohamed A. Abdelhamed

Department of Communications and Computers Eng.

Higher Institute of Engineering, El-Shorouk Academy

Academic year 2023/2024

Contacts:

WhatsApp: +201002323525

E-mail: m.abdelhamed@sha.edu.eg & mohabdelhamed@yahoo.com

Course contents

Week No.	Start date of the week (Sunday)	Event/Task	Topics
1	1-10-2023		Network definition, Importance, Components and Topology types
2	**8-10-2023**		**Network Model (OSI model)**
3	15-10-2023		OSI model vs. TCP/IP Model (Application, Transport, Internet and Network Access Layers)
4	22-10-2023		- Typical Network Model and Components. - Classification of Network Devices. - TCP/IP (Physical Layer).
5	29-10-2023	**Written Quiz (1)- (Tuesday at 10:15 A.M)**	Physical Layers (Cables, Standards (Card Types) and Connectors.

Course contents

Week No.	Start date of the week (Sunday)	Event/Task	Topics
6	5-11-2023		- Physical Layer (Layer (1) Devices). - Data Link Layer (MAC Address and MAC Frame).
7	Saturday 11-11-2023	**M.T Exam**	------
8	19-11-2023		Layer (2) devices, switching modes, and switching operation.
9	26-11-2023		Internet (Network) Layer (Logical Address and Routing Operation) and IPv4 (Classifications, Shortage, Solution and Subnetting).
10	3-12-2023	**Online Quiz (2)- (Tuesday at 08:30 P.M)**	IPv4 (Subnetting), Troubleshooting End to End Data Delivery, IPv6

Course contents

Week No.	Start date of the week (Sunday)	Event/Task	Topics
11	10-12-2023		Internet Layer Protocols (Layer (3)) (ICMP, DHCP/APIPA, DNS)
12	17-12-2023		Internet Layer Protocols (Layer (3)) (ARP, Commands, Add IP and DNS manual), Transport layer
13	24-12-2023	End of the Semester (28-12-2023)	Oral / Practical Exam
Start of the Final Exam: Monday, 1-1-2024			
Mid-year vacation from 27-1-2024 to 9-2-2024			

Chapter (2)

Network Models (OSI and TCP/IP)

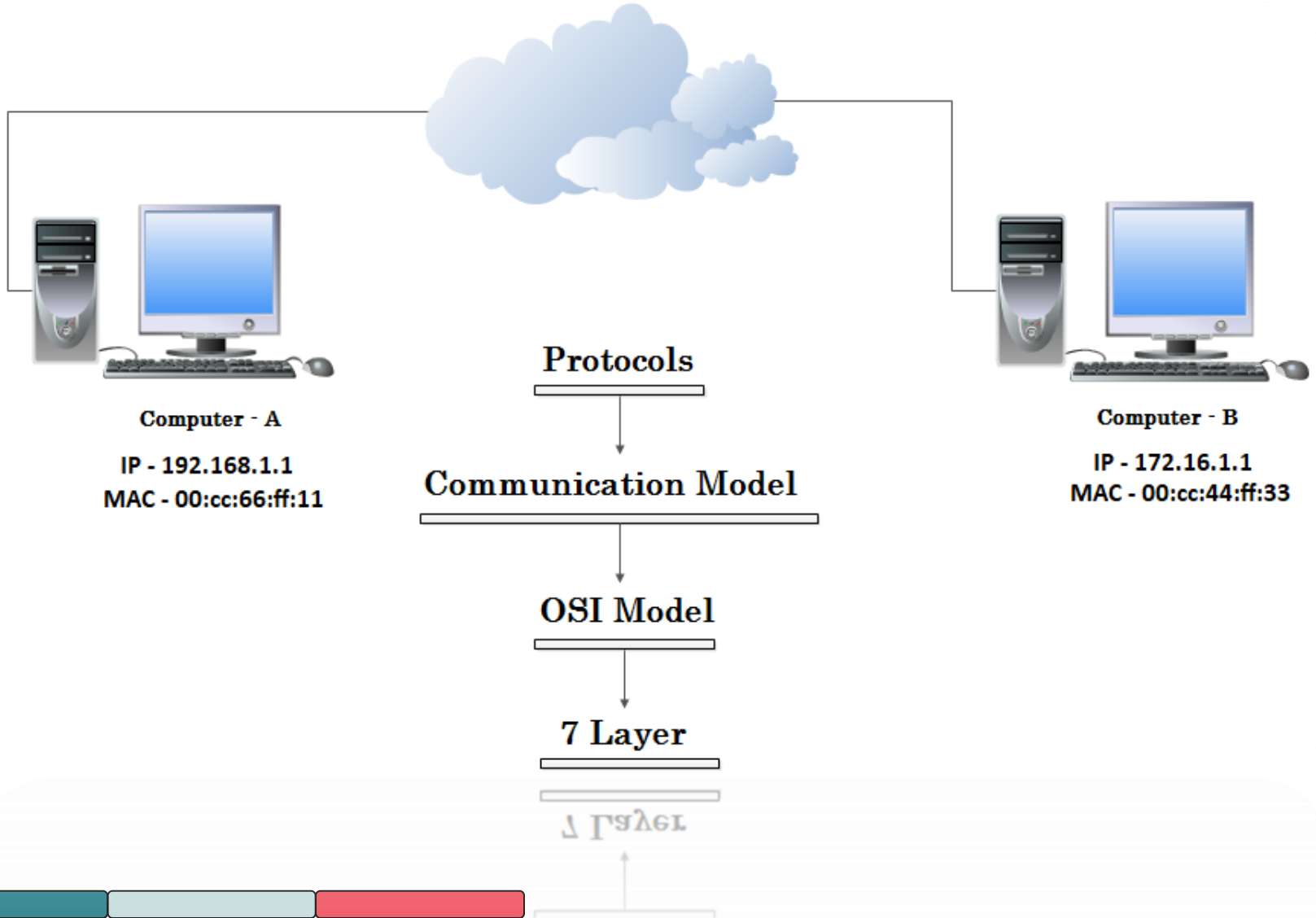
List of Contents

OSI vs. TCP/IP Network Models

- **Model:** It is a set of stages (layers) that data passes through to exit a device and be able to communicate with other devices.

- The Open Systems Interconnection (OSI) model is a conceptual model created by the International Organization for Standardization which enables diverse communication systems to communicate using standard protocols. In plain English, the OSI provides a standard for different computer systems to be able to communicate with each other

OSI vs. TCP/IP Network Models



OSI vs. TCP/IP Network Models (Cont.)

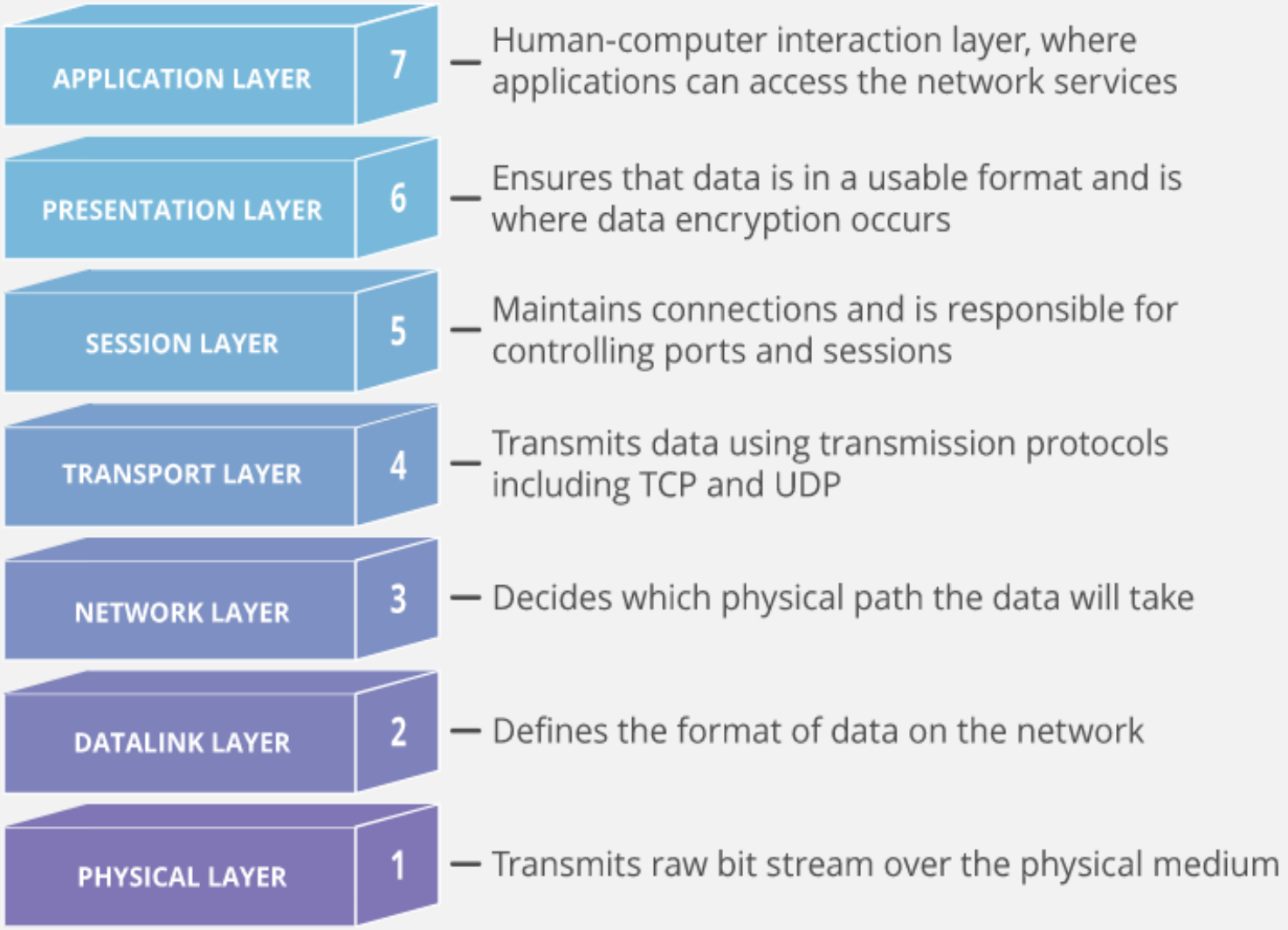
TCP/IP:

- Transmission Control Protocol / Internet Protocol.
- Is a set of communication protocols (rules) used to interconnect network devices on the internet. TCP/IP is also used as a communications protocols in a private computer network (an intranet or extranet).

OSI vs. TCP/IP Network Models (Cont.)

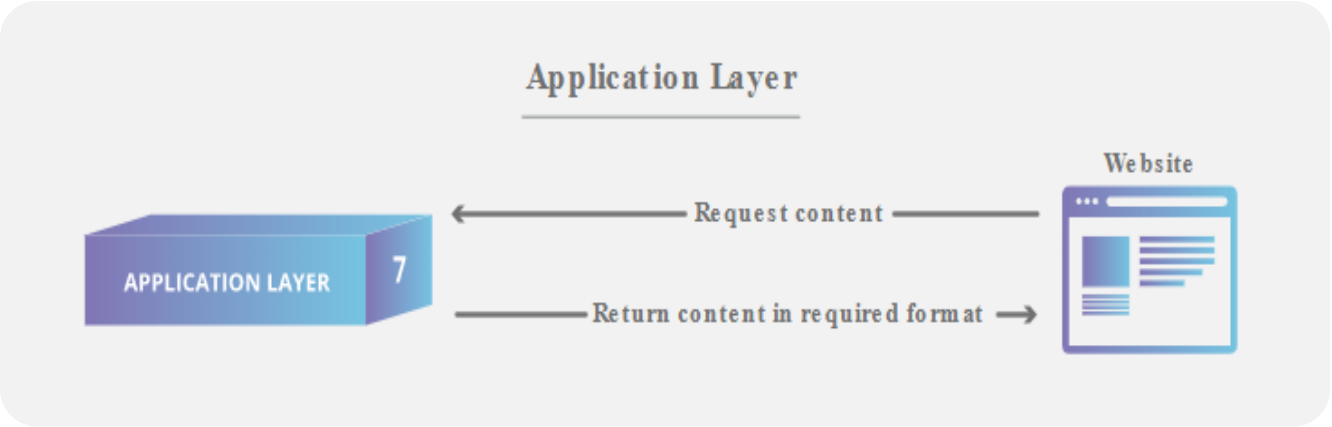
- The OSI model can be seen as a universal language for computer networking. It's based on the concept of splitting up a communication system into seven abstract layers, each one stacked upon the last.

OSI vs. TCP/IP Network Models (Cont.)

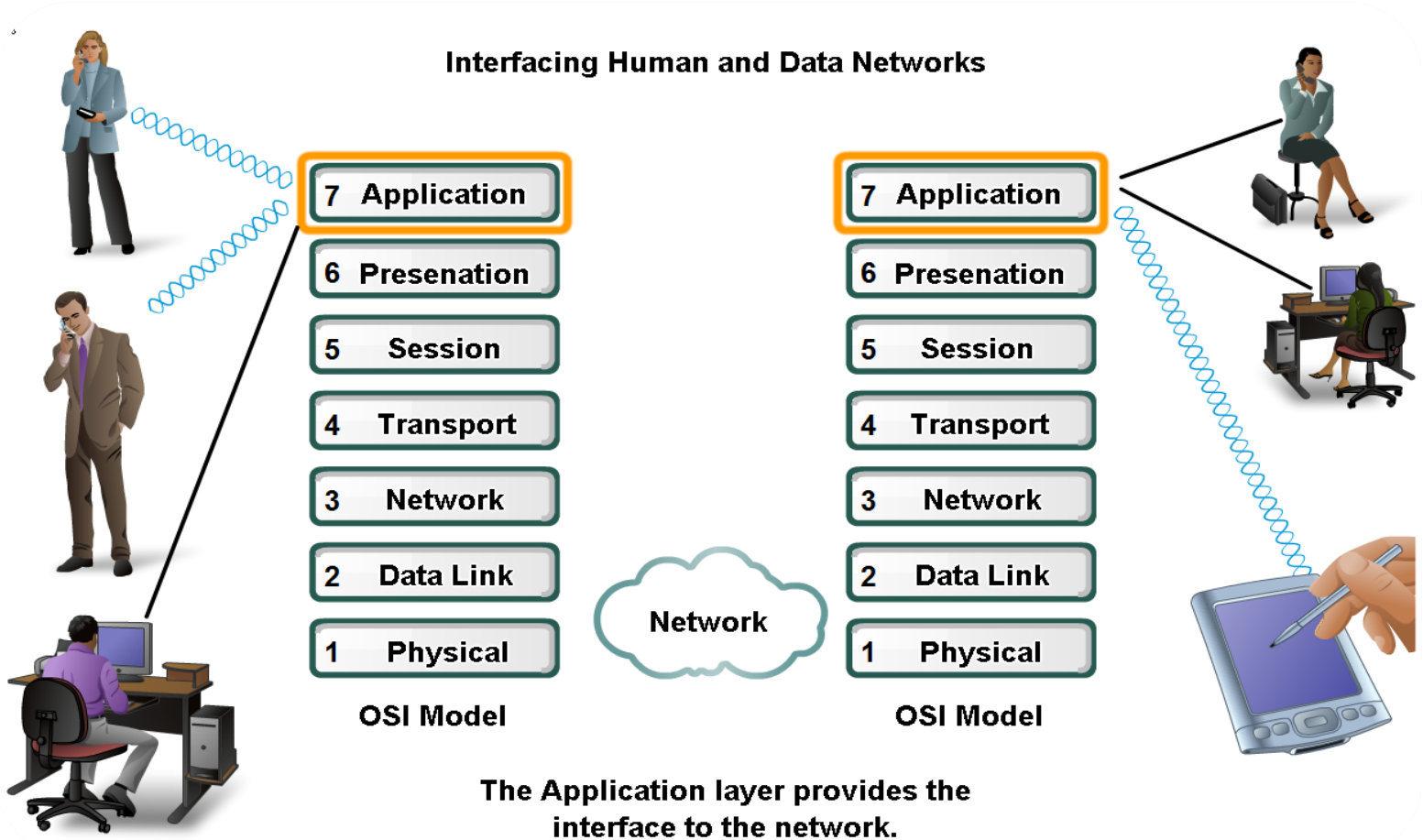


OSI vs. TCP/IP Network Models (Cont.)

- The seven abstraction layers of the OSI model can be defined as follows, from top to bottom:
  - **7. The Application Layer; Data**
    - With this layer, the users can access the network by using interfaces and services like electronic mail, shared database management, file access/transfer and the other services



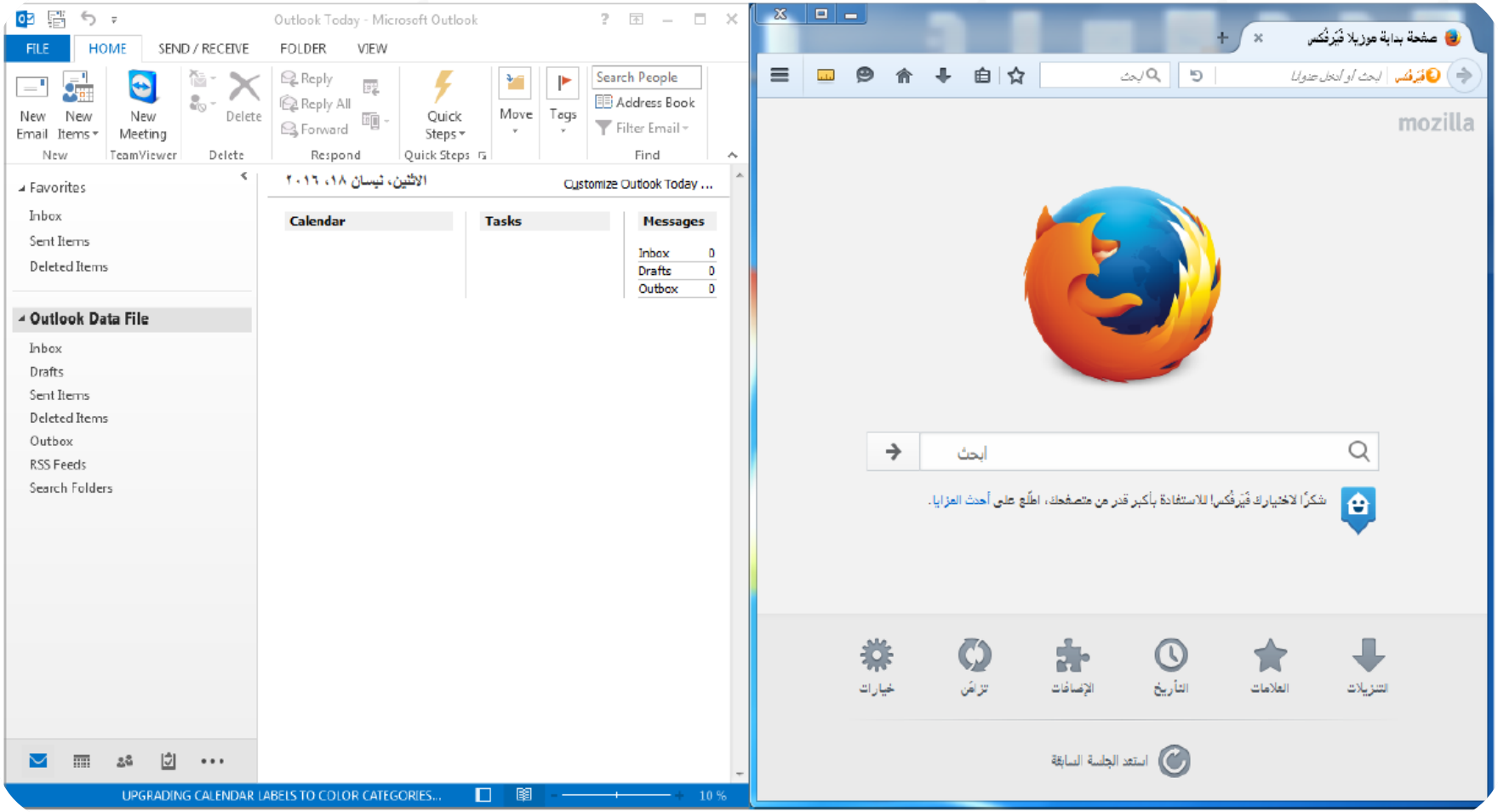
OSI vs. TCP/IP Network Models (Cont.)



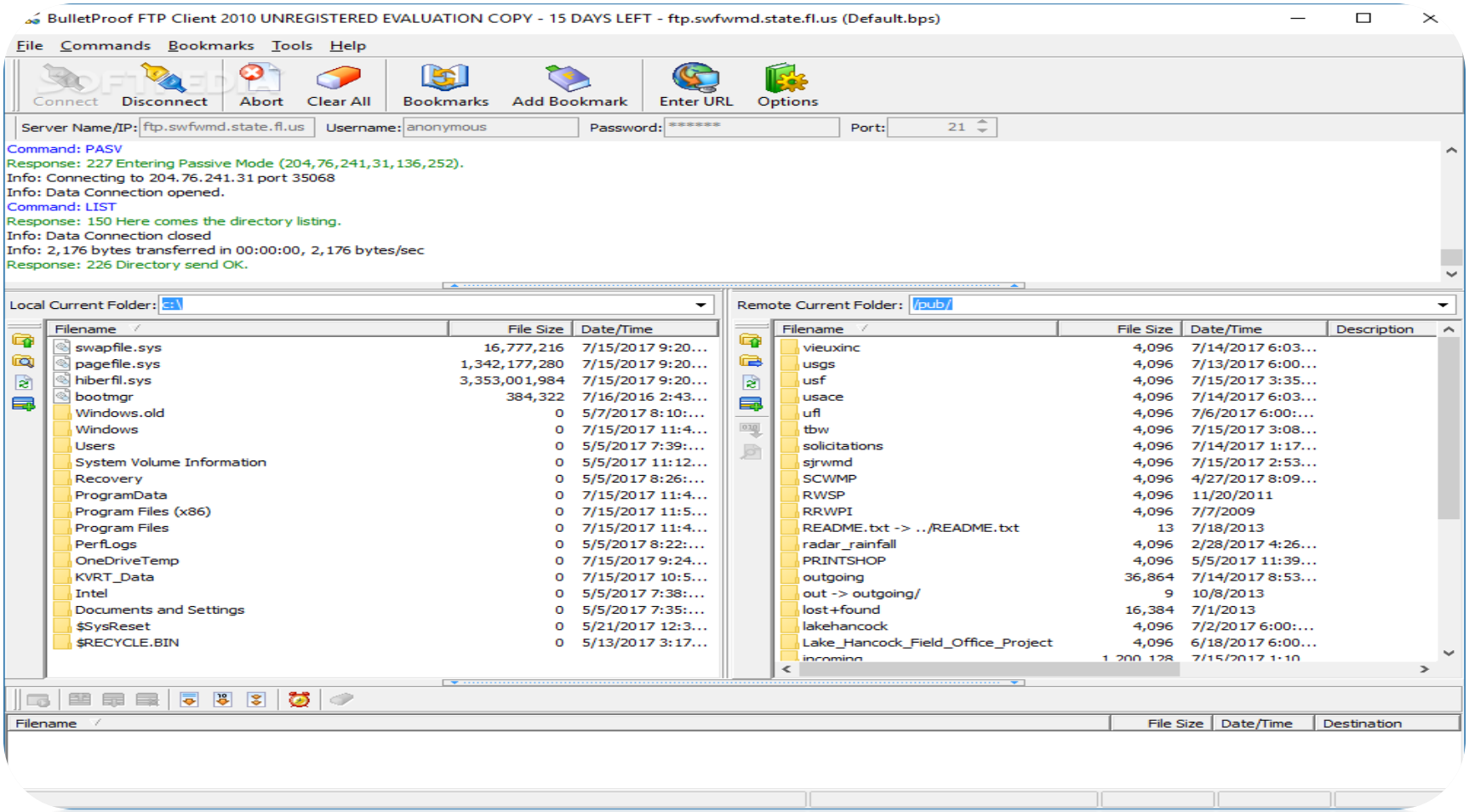
OSI vs. TCP/IP Network Models (Cont.)

- **7. The Application Layer; Data**
  - SNMP , DNS , FTP , LDAP , LMP , NTP , HTTPs , DHCP , Open VPN , SMTP , POP3 , IMAP , HTTP , WAP , SSH, Telnet , SIP , PKI , SOAP , rlogin , TLS / SSL , RDP, TFTP , NNTP , LTP, Ipfix , DNP, CoAP.

OSI vs. TCP/IP Network Models (Cont.)



OSI vs. TCP/IP Network Models (Cont.)



OSI vs. TCP/IP Network Models (Cont.)

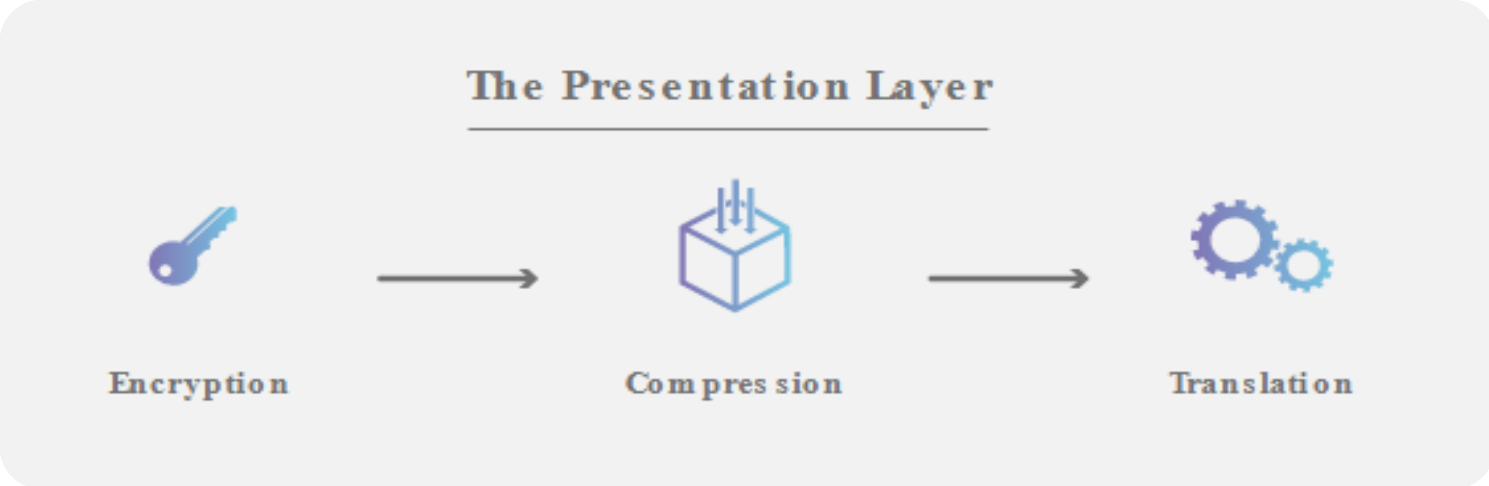
6. The Presentation Layer; Data

- Presentation layer focuses on the syntax and semantics of the transmitting information.

  - Present data.

  - Compression – decompression.

  - Encryption – decryption.



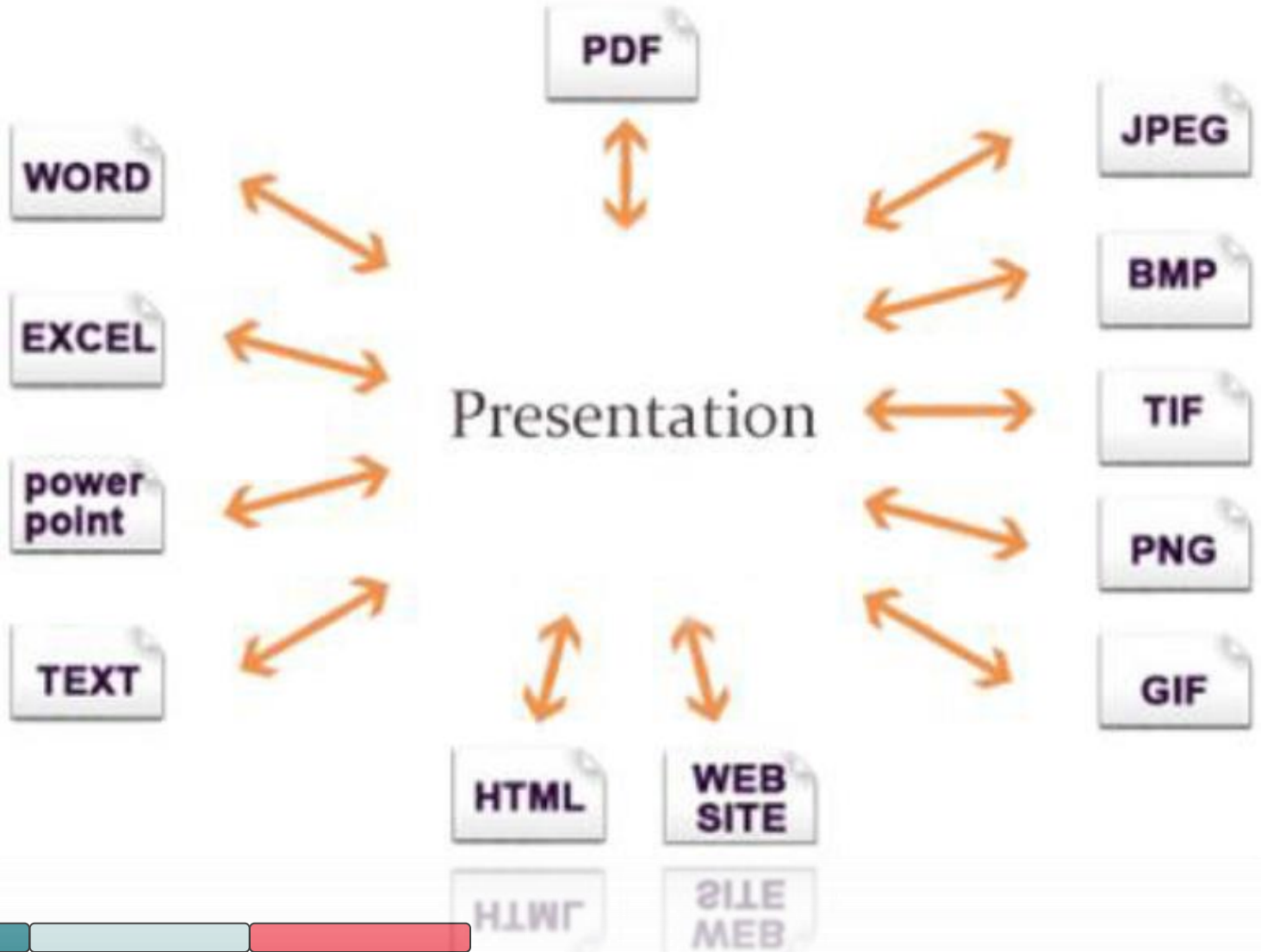
OSI vs. TCP/IP Network Models (Cont.)

- 6. The Presentation Layer; Data
  - JPEG , MPEG , ASCII , EBCDIC , HTML , AFP , PAD , NDR , RDP , PAD , AVI .
  - Example:

Send ---- Image.jpeg through

HTTPs www.facebook.com

OSI vs. TCP/IP Network Models (Cont.)



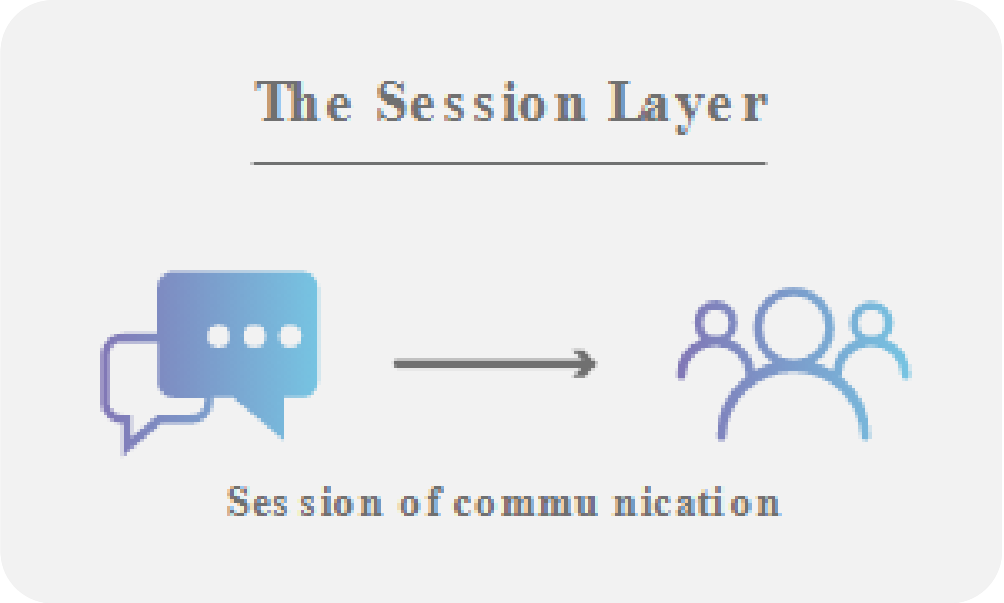
OSI vs. TCP/IP Network Models (Cont.)

5. Session Layer; Data

- This layer establishes the session between different machines to synchronize and maintain the interaction between them. The services provided by the session layer are dialog control, token management and synchronization.
- User logs in with a username & password.
- All data now has a special significance until that user logs off, or the session times out, or is terminated some other way.

OSI vs. TCP/IP Network Models (Cont.)

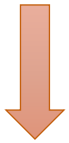
- SAP, RTP, NFS, SQL, RPC, NETBIOS NAM, NCP, SOCKETS, SMB, NETBEUI, 9P.
- Setup path.
- Mange path.
- end path.



OSI vs. TCP/IP Network Models (Cont.)

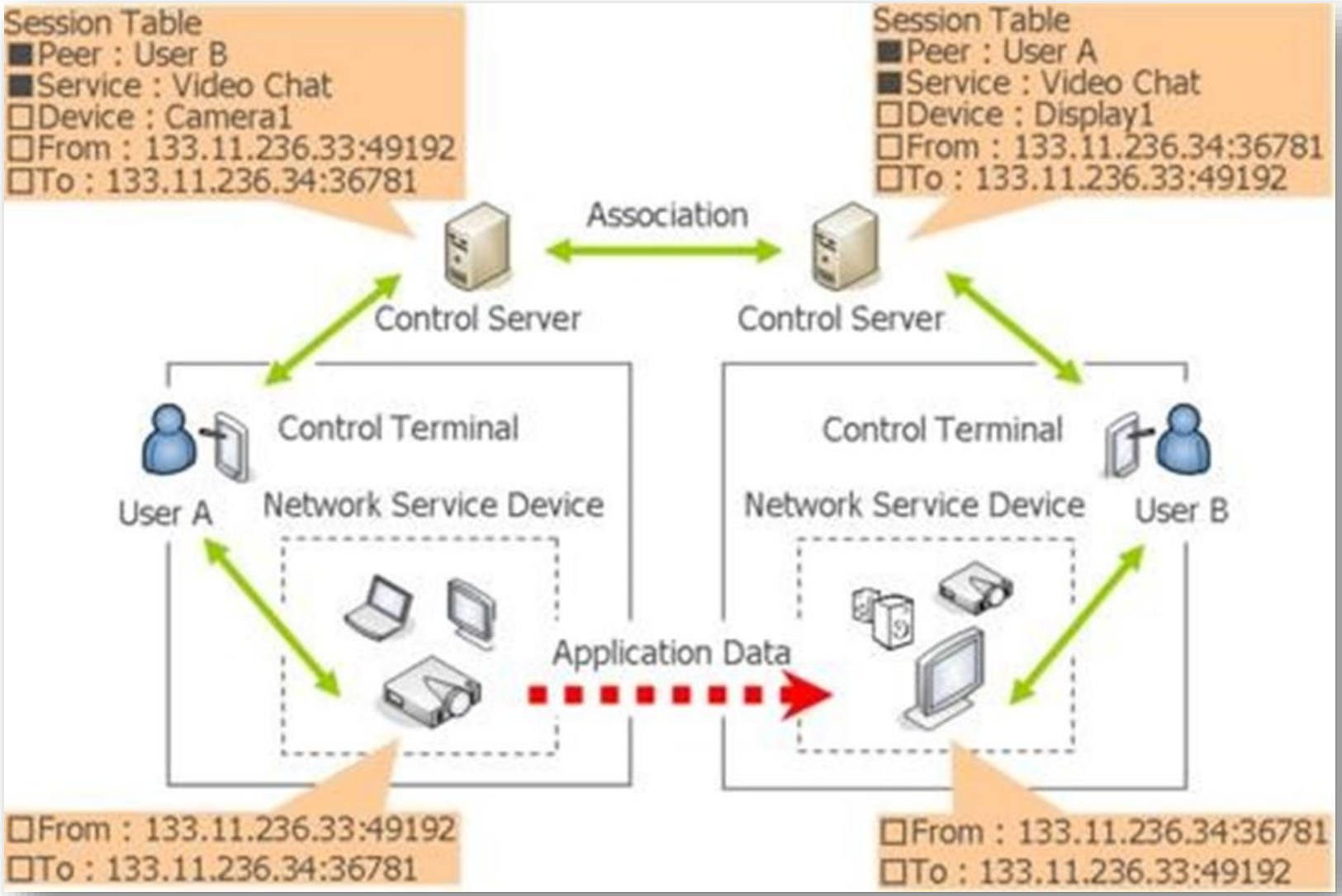
- Example:

  - HTTPs www.facebook.com - Port 443 : 5152
  - HTTPs www.google.com - Port 443 : 5153
  - HTTPs www.google.com - Port 443 : 5154
  - Data stream 01010101010101010101



4 - Transport Layer

OSI vs. TCP/IP Network Models (Cont.)



OSI vs. TCP/IP Network Models (Cont.)

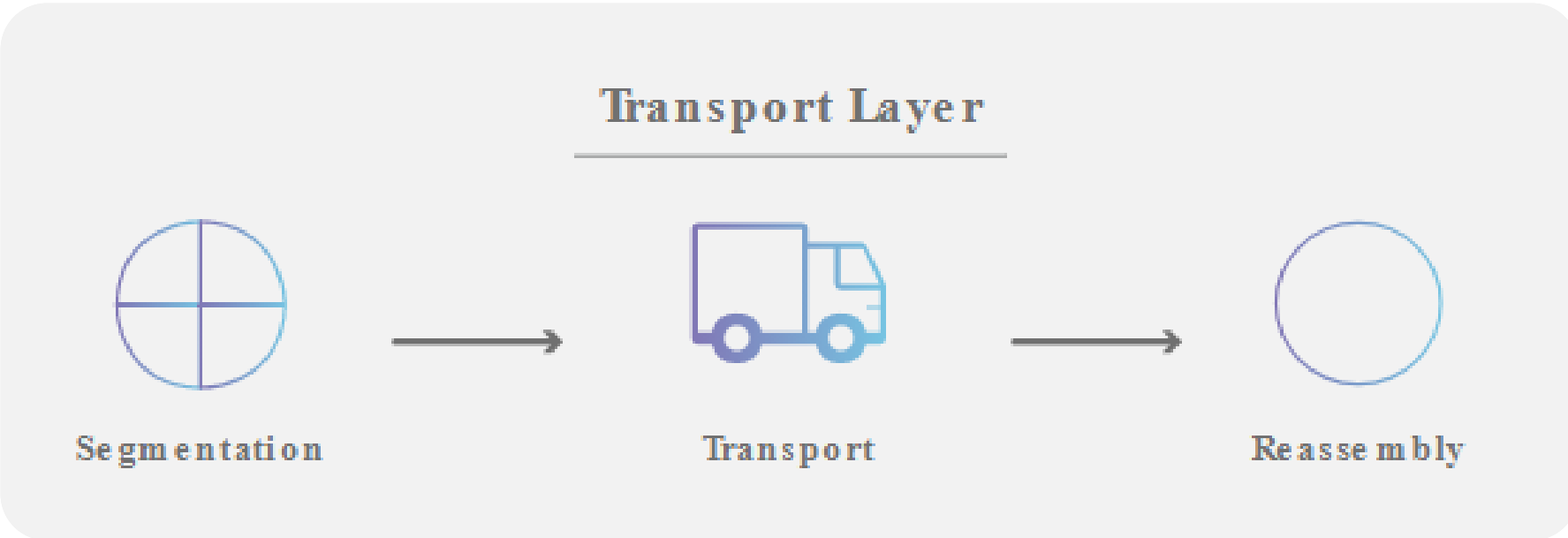
4. Transport Layer; Segment

- It accepts the data from its preceding layer in the form of independent packets and transmits it to the succeeding layer in proper order. The other function carried out by this layer are service point addressing, connection control, segmentation and reassembly, flow control and error control.
- **TCP or UDP (in TCP/IP)**

  - TCP - Transmission Control Protocol.

  - UDP - User Datagram Protocol.

OSI vs. TCP/IP Network Models (Cont.)

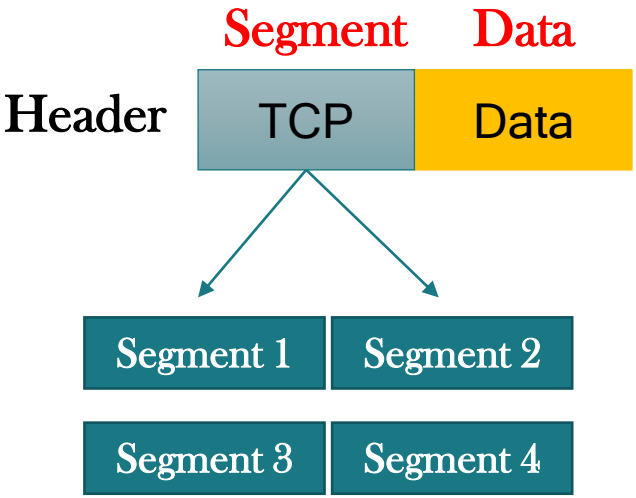


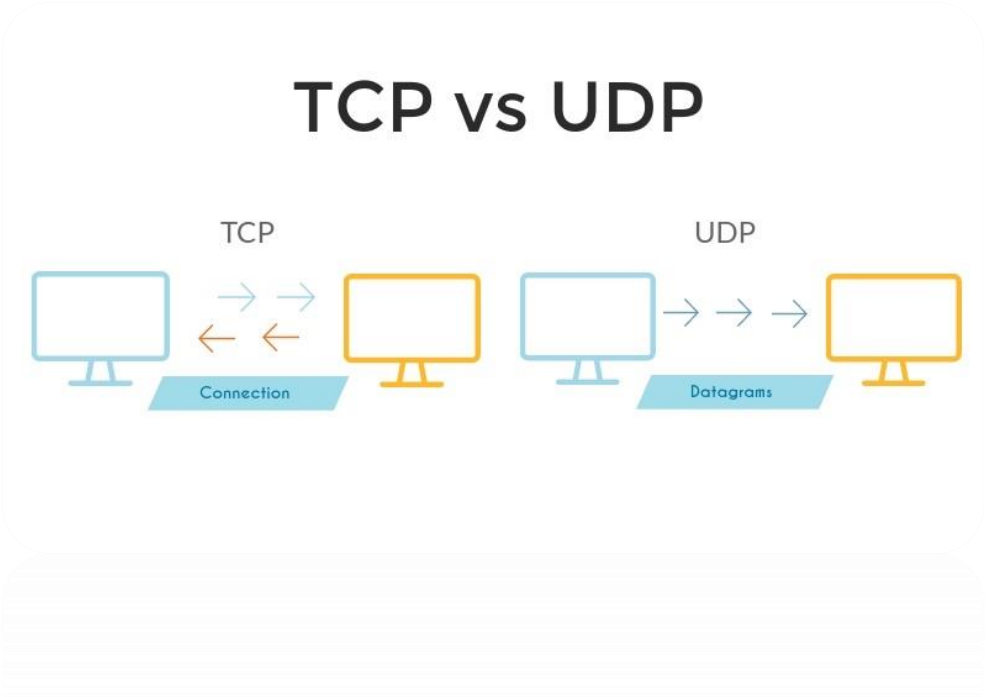
OSI vs. TCP/IP Network Models (Cont.)

- **4. Transport Layer; Segment**
  - Segmentation: dividing data into smaller parts.
  - Sequencing or Addressing: giving serial No. to data part (seq. No. --).
  - Error detection

OSI vs. TCP/IP Network Models (Cont.)

- 4. Transport Layer; Segment
  - Encapsulation





OSI vs. TCP/IP Network Models (Cont.)

- Compare TCP to UDP:

Item	TCP	UDP
Stands For	Transmission Control Protocol	User Datagram Protocol
Protocol	Connection Oriented	Connectionless
Security	Makes Checks For Errors And Reporting	Makes Error Checking But No Reporting
Data Sending	Slower	Faster
Header Size	20 Bytes	8 Bytes
Segments	Acknowledgement	No Acknowledgement
Typical Applications	- Email	- VoIP

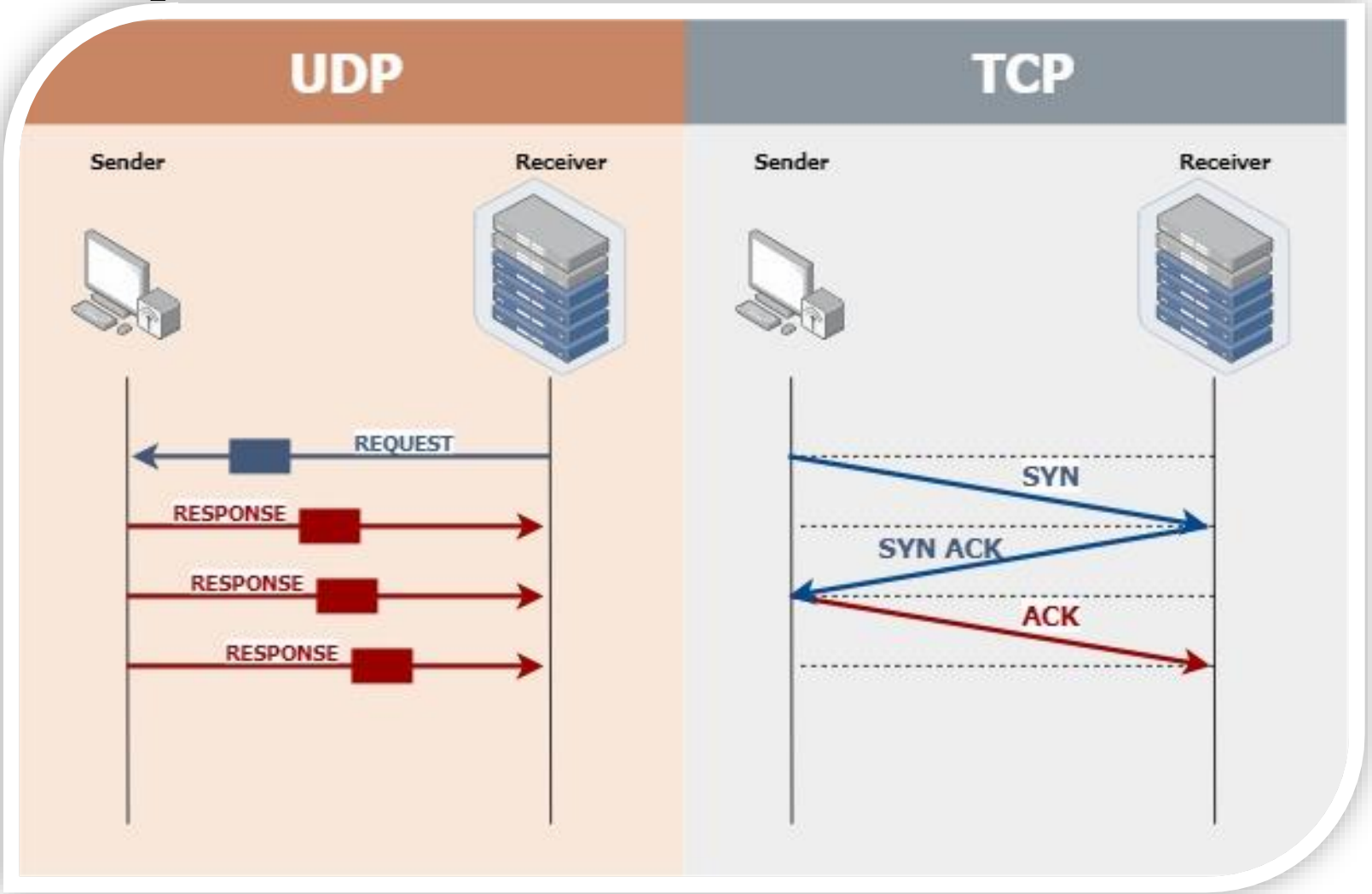
OSI vs. TCP/IP Network Models (Cont.)

- Compare TCP to UDP:

TCP	UDP
Sequenced	Unsequenced
Reliable	Unreliable
Connection-oriented	Connectionless
Virtual circuit	Low overhead
Acknowledgements	No acknowledgements
Windowing flow control	No windowing or flow control

OSI vs. TCP/IP Network Models (Cont.)

- Compare TCP to UDP:



OSI vs. TCP/IP Network Models (Cont.)

3. Network Layer; Packet

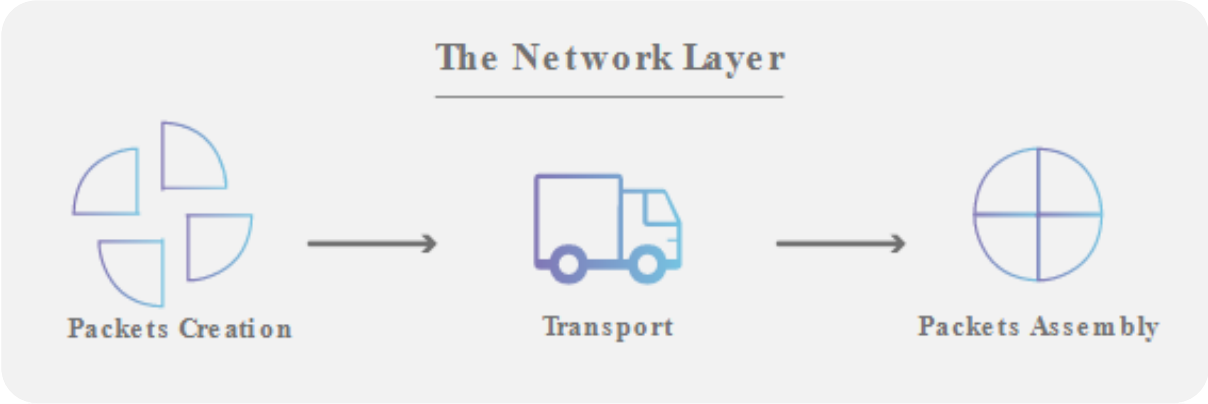
- Logical addressing and routing are the major operations performed by the network layer.

- Best way to move data.

- Router Device.

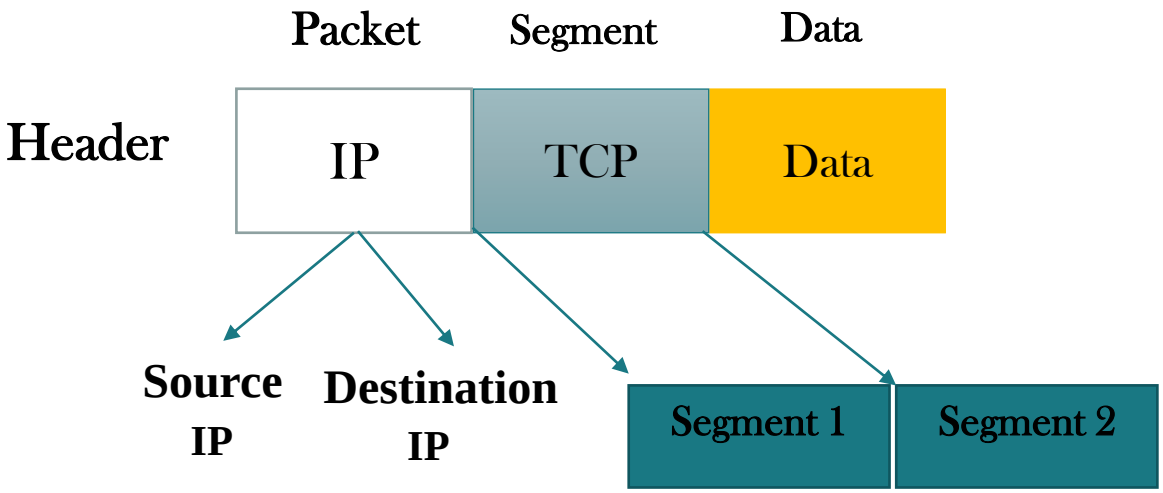
- IP Address.

- Packet.

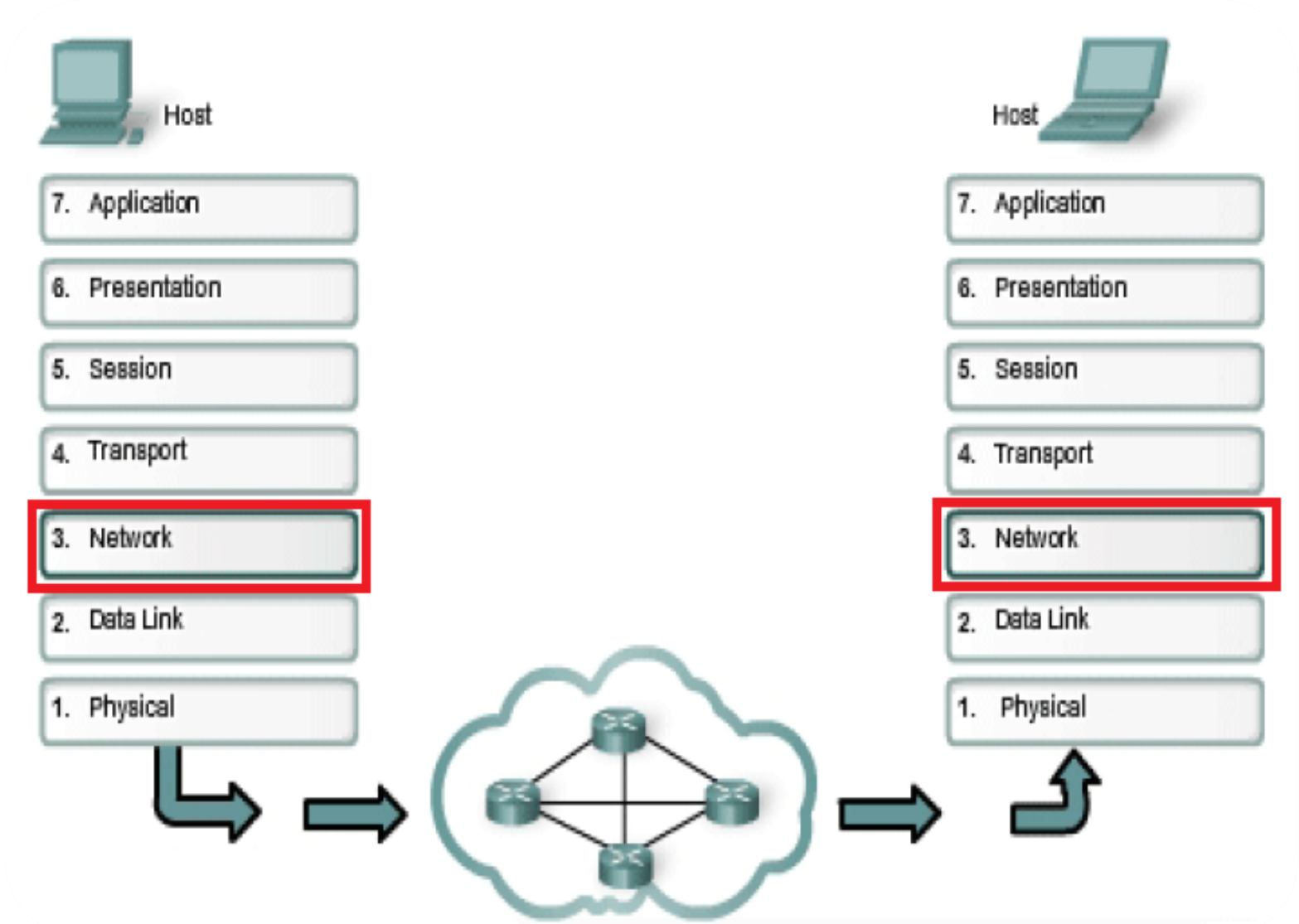


OSI vs. TCP/IP Network Models (Cont.)

- IPv4, IPv6 , IPx , ICMP , IPsec , IGMP , CLNP , EGP , EIGRP , IGRP , Ipx SCCP, GRE, OSPF, ARP, RIP, Routed-SMLT.
- **Encapsulation**



OSI vs. TCP/IP Network Models (Cont.)



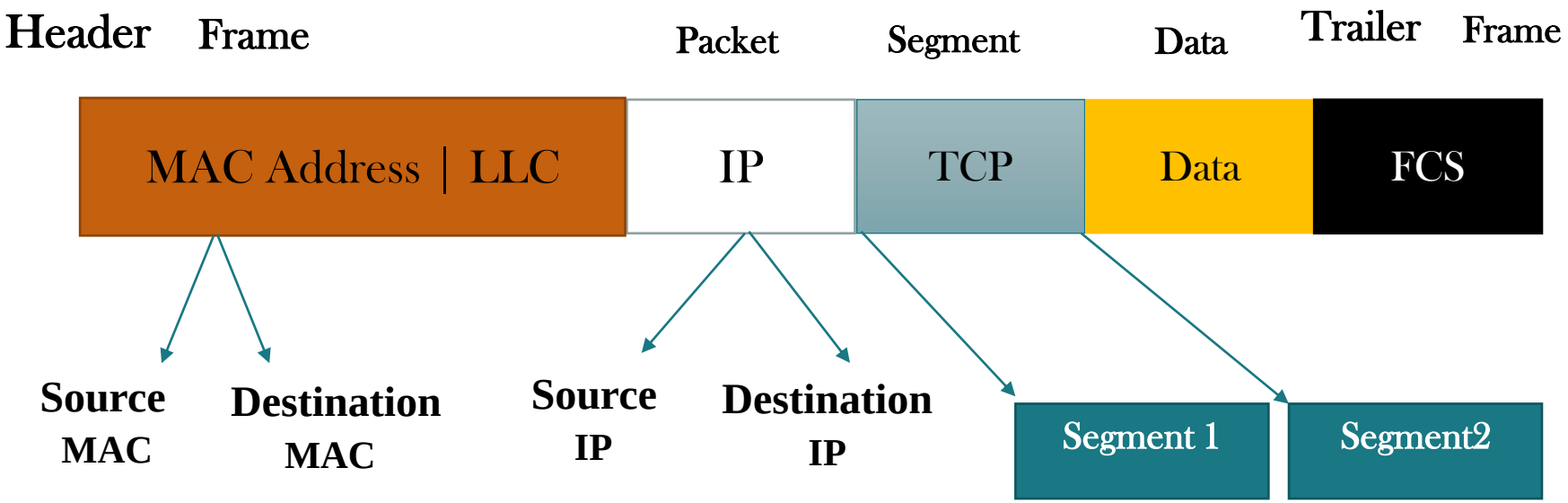
OSI vs. TCP/IP Network Models (Cont.)

2. Data Link Layer; Frame

- It is responsible for transforming the raw transmission service (Physical layer) into a reliable link.
- **Logical link control**
  - **LLC** : Frame network layer.
  - **LLC** : network layer protocol.
- **Media access control**
  - **MAC** : Address the frame
  - **MAC** : Make H and T

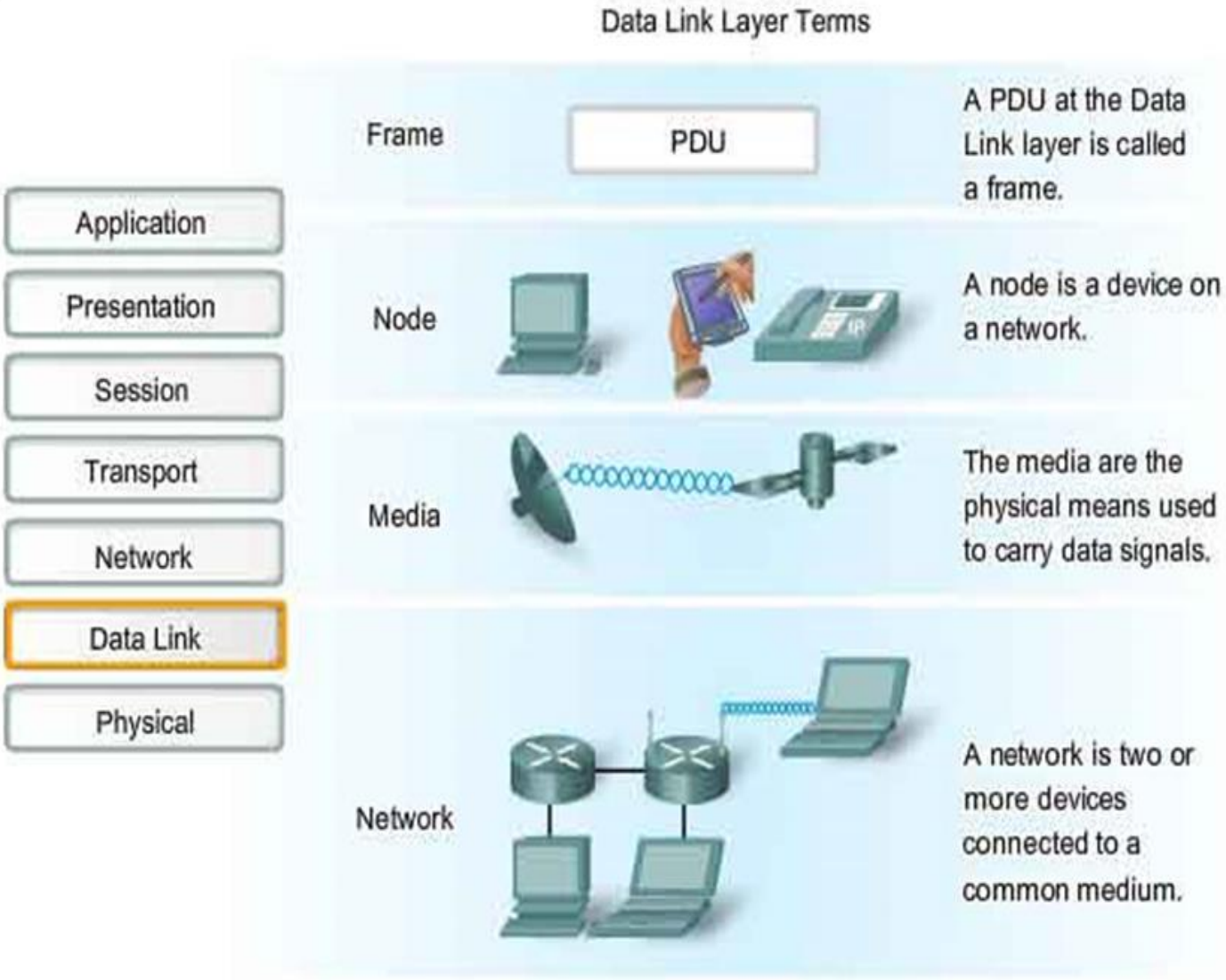
OSI vs. TCP/IP Network Models (Cont.)

- Encapsulation



FCS: Frame check sequence, Error detection.

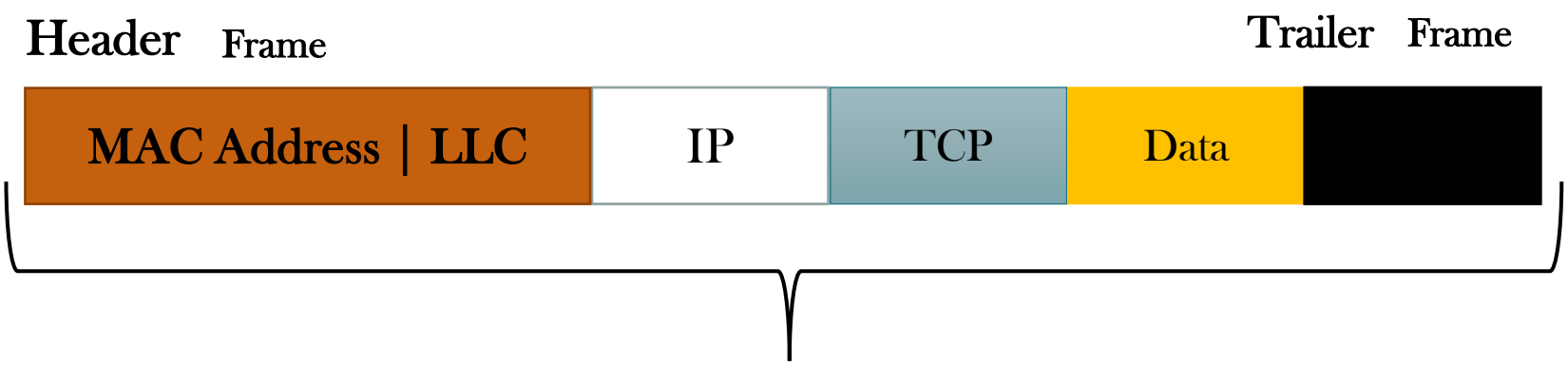
OSI vs. TCP/IP Network Models (Cont.)



OSI vs. TCP/IP Network Models (Cont.)

- **1. Physical Layer; Signal (Stream of bits)**
  - It transmits the individual bits over the transmission channel.
  - Network Interface Card – NIC.
  - Hub Device.
  - Send and receive bits.
  - Convert frame to bits.

OSI vs. TCP/IP Network Models (Cont.)



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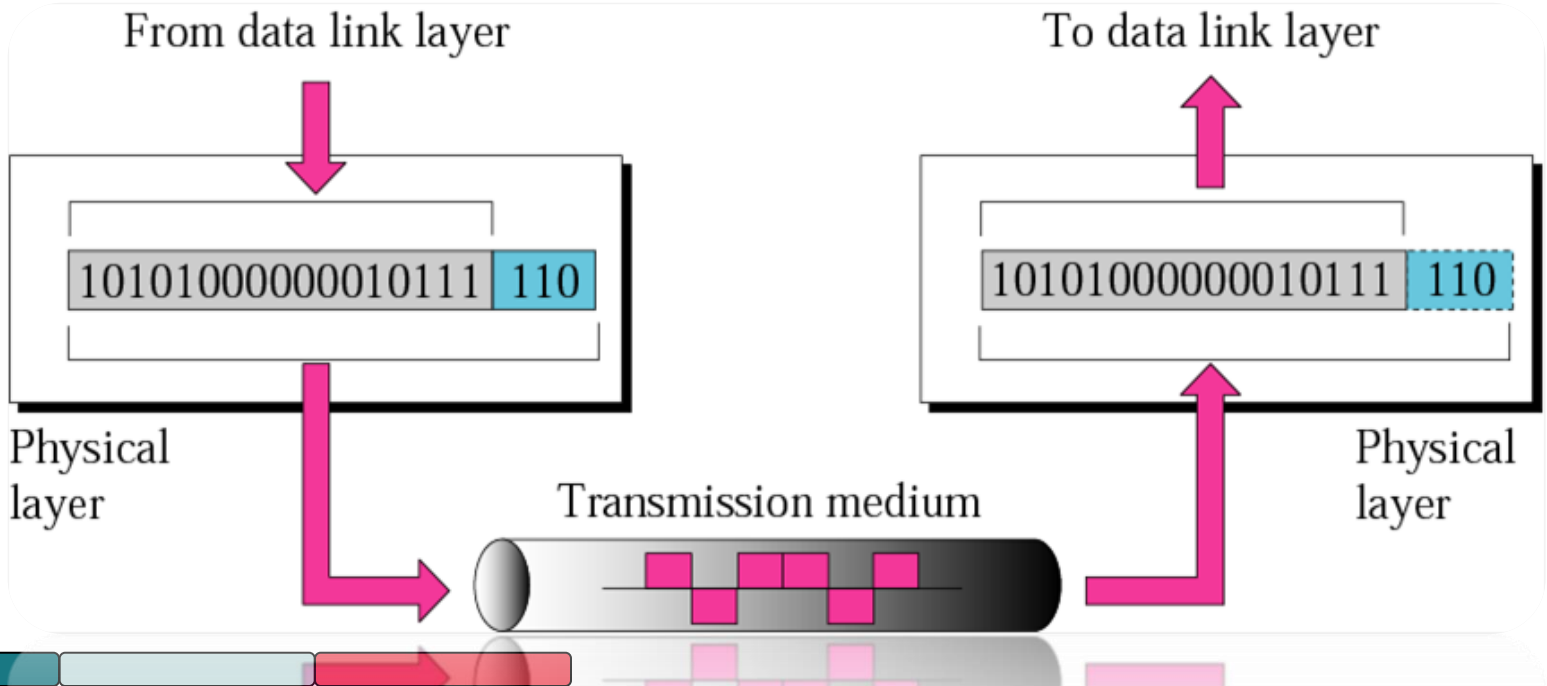

OSI vs. TCP/IP Network Models (Cont.)

OSI Vs TCP \ IP Network Model:

TCP/IP	OSI Model	Protocols
Application Layer	Application Layer	DNS - DHCP - FTP - HTTPS - LDAP - NTP - POP3 - RTP - RTSP - SSH - SIP - SMTP - Telnet - TFTP
	Presentation Layer	JPEG - MIDI - MPEG - PICT - TIFF
	Session Layer	NetBIOS - NFS - PAP - SCP - SQL - ZIP
Transport Layer	Transport Layer	TCP - UDP
Internet Layer	Network Layer	ICMP - IGMP - IPsec - IPv4 - IPv6 - IPX - RIP
Link Layer	Data Link Layer	ARP - ATM - CDP - FDDI - Frame Relay - HDLC - MPLS - PPP - STP - Token Ring
	Physical Layer	Bluetooth - Ethernet - DSL - ISDN - 802.11 - WiFi

Typical Network Components

- Next Lecture


SH. A.
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هندسة الاتصالات والحاسبات
Communications and Computers Engineering Dept .

Questions?

References

Required books:

[1] William Stallings, “Data and Computer Communications”, 10th edition, 2014

Recommended books:

[1] Forouzan B. A “Data Communications and Networking”, McGraw-Hill, 2nd Ed., 2005

Periodicals, Web sites, … etc.:

Cisco network guide (https://www.netacad.com/ar),
Huawei network guide (https://e.huawei.com/en/talent/#/),
EKB,
IEEE, … etc.

Course notes:

lecture notes after each lecture