TNE10006/TNE60006: Networks and Switching

Network Protocols and the Physical Layer

Outline

- Network Protocols

- The TCP/IP Layered Architecture Model

- Data Encapsulation

- Reference Models

- The Physical Layer

Network Protocols

- Defines how communications take place between two devices

- How the message is formatted or structured

- Rules of Communication

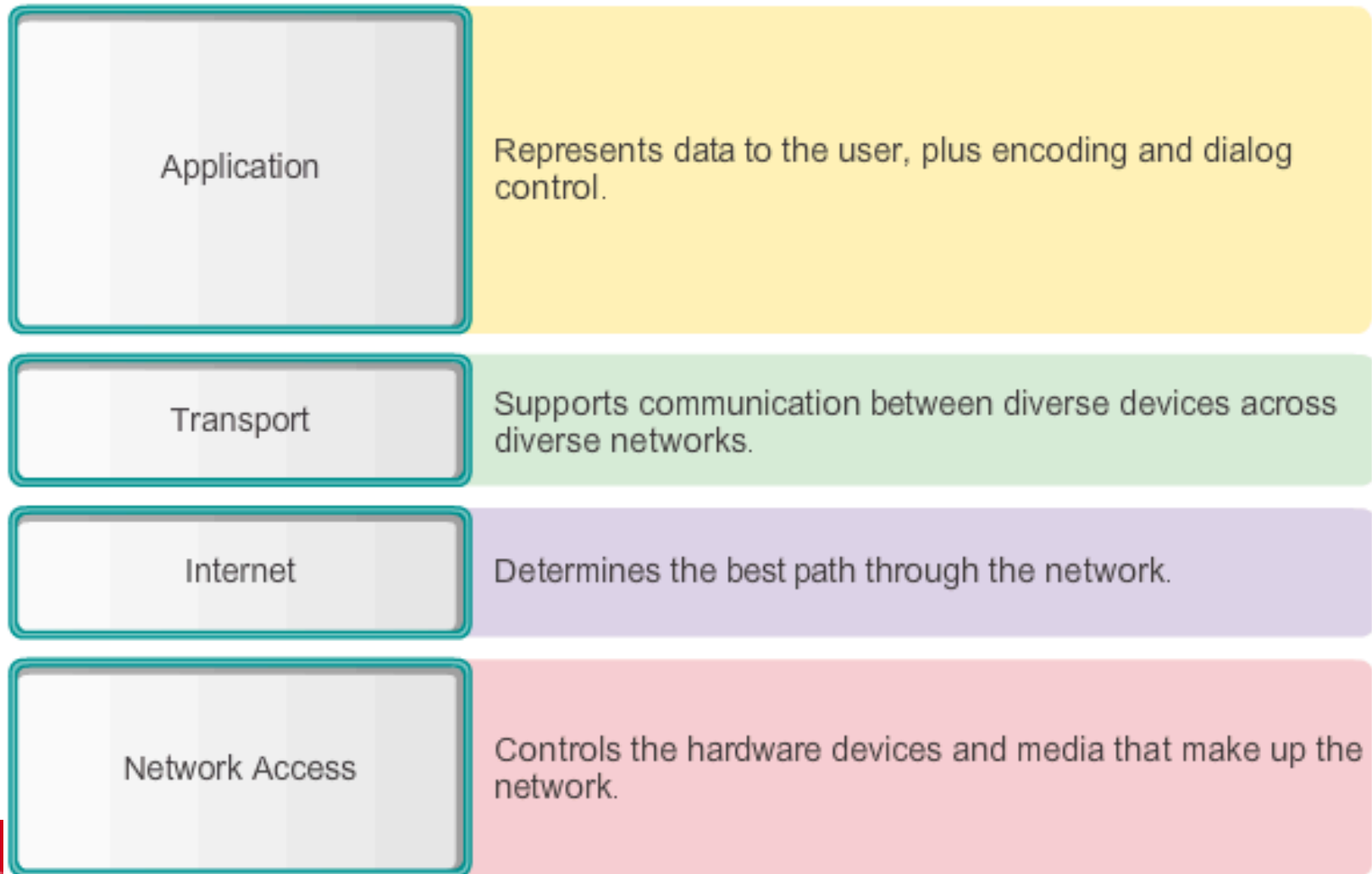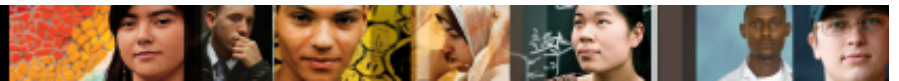- Message Formatting and Encapsulation
  - Headers
  - Data

Sender
4085 SE Pine Street
Ocala, Florida 34471

Recipient
1400 Main Street
Canton, Ohio 44203

https://www.youtube.com/watch?v=T8XeD

The TCP/IP Layered Architecture Model

TCP/IP Model

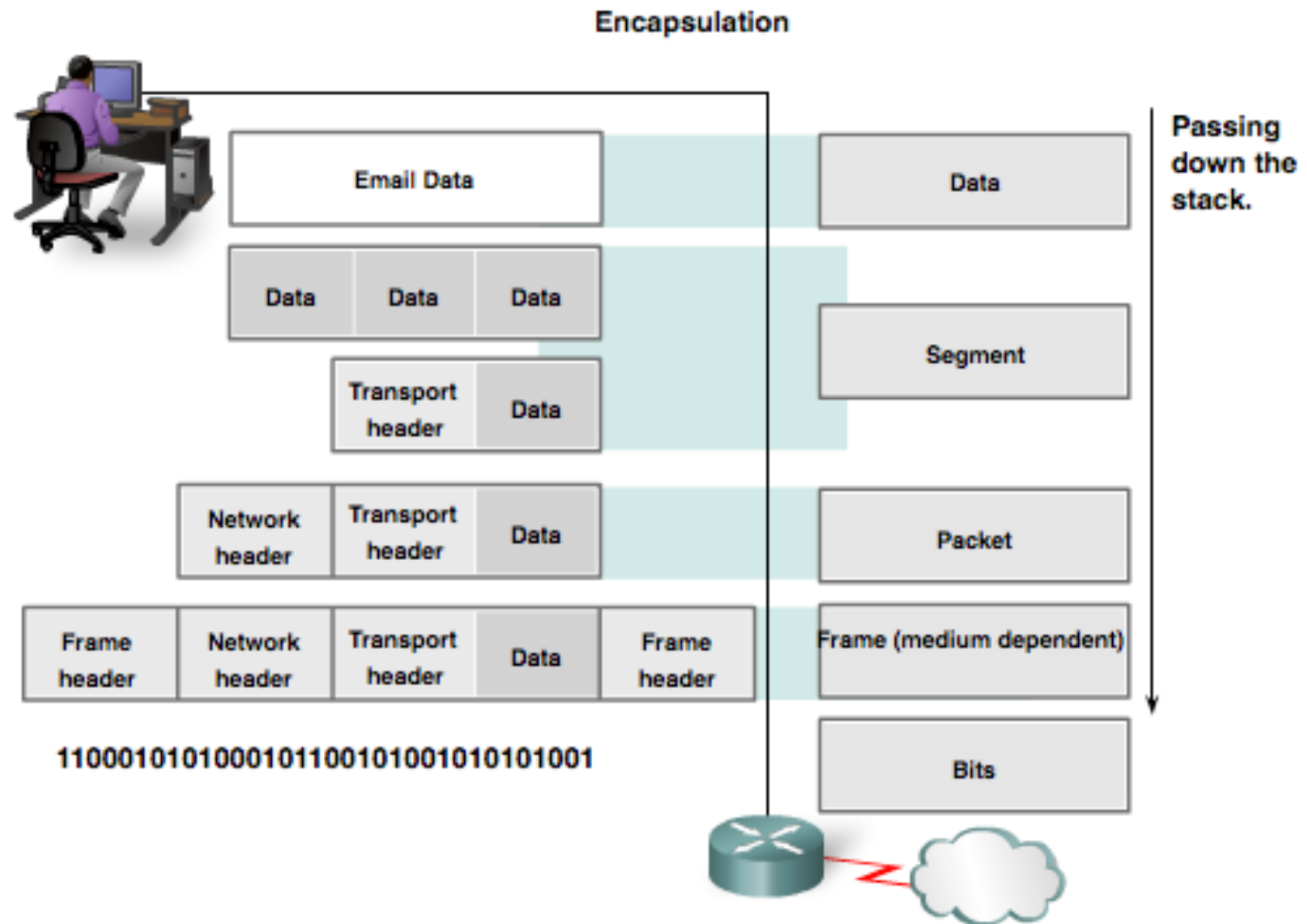|	
Application	Represents data to the user, plus encoding and dialog control.
Transport	Supports communication between diverse devices across diverse networks.
Internet	Determines the best path through the network.
Network Access	Controls the hardware devices and media that make up the network.

Benefits of Using a Layered Model

- Assists in Protocol design

- Open standard – fosters competition

- Changes made in one layer do not affect other layers

- Common standard language

- Allows Protocols and technologies to evolve
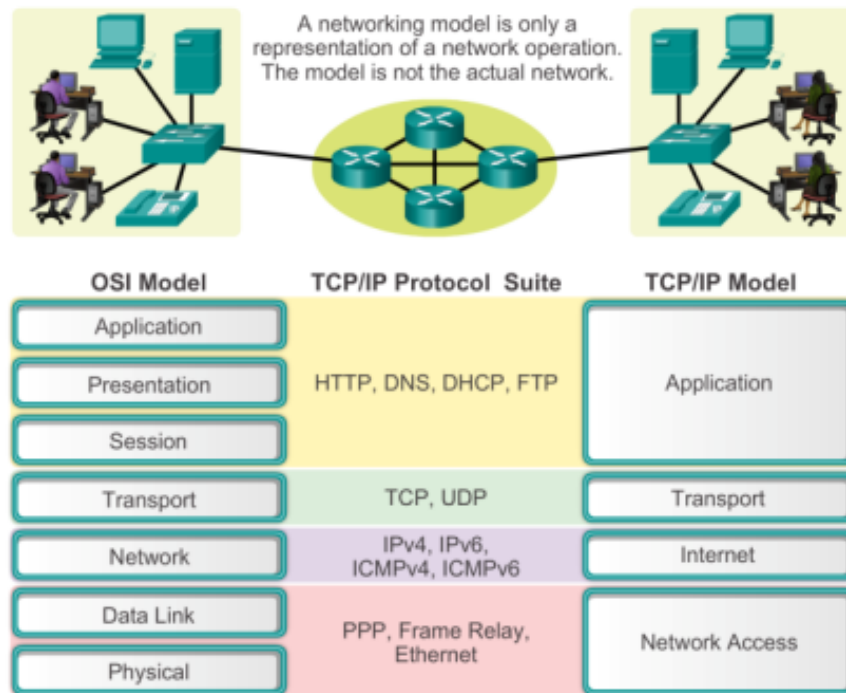
Data Encapsulation
Protocol Data Units (PDUs)

- Data

- Segment

- Packet

- Frame

- Bits

Encapsulation

| Email Data | | | | | Data | **Passing down the stack.** |

| Data | Data | Data | | | Segment |

| Transport header | Data | | | | |

| Network header | Transport header | Data | | | Packet |

| Frame header | Network header | Transport header | Data | Frame header | Frame (medium dependent) |

1100010101000101100101001010101001

Bits

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Reference Models
What is a Reference Model

A networking model is only a representation of a network operation. The model is not the actual network.

OSI Model	TCP/IP Protocol Suite	TCP/IP Model
Application	HTTP, DNS, DHCP, FTP	Application
Presentation		
Session		
Transport	TCP, UDP	Transport
Network	IPv4, IPv6, ICMPv4, ICMPv6	Internet
Data Link	PPP, Frame Relay, Ethernet	Network Access
Physical		

Protocol Model

- A model that describes an actual implementation

Reference Model
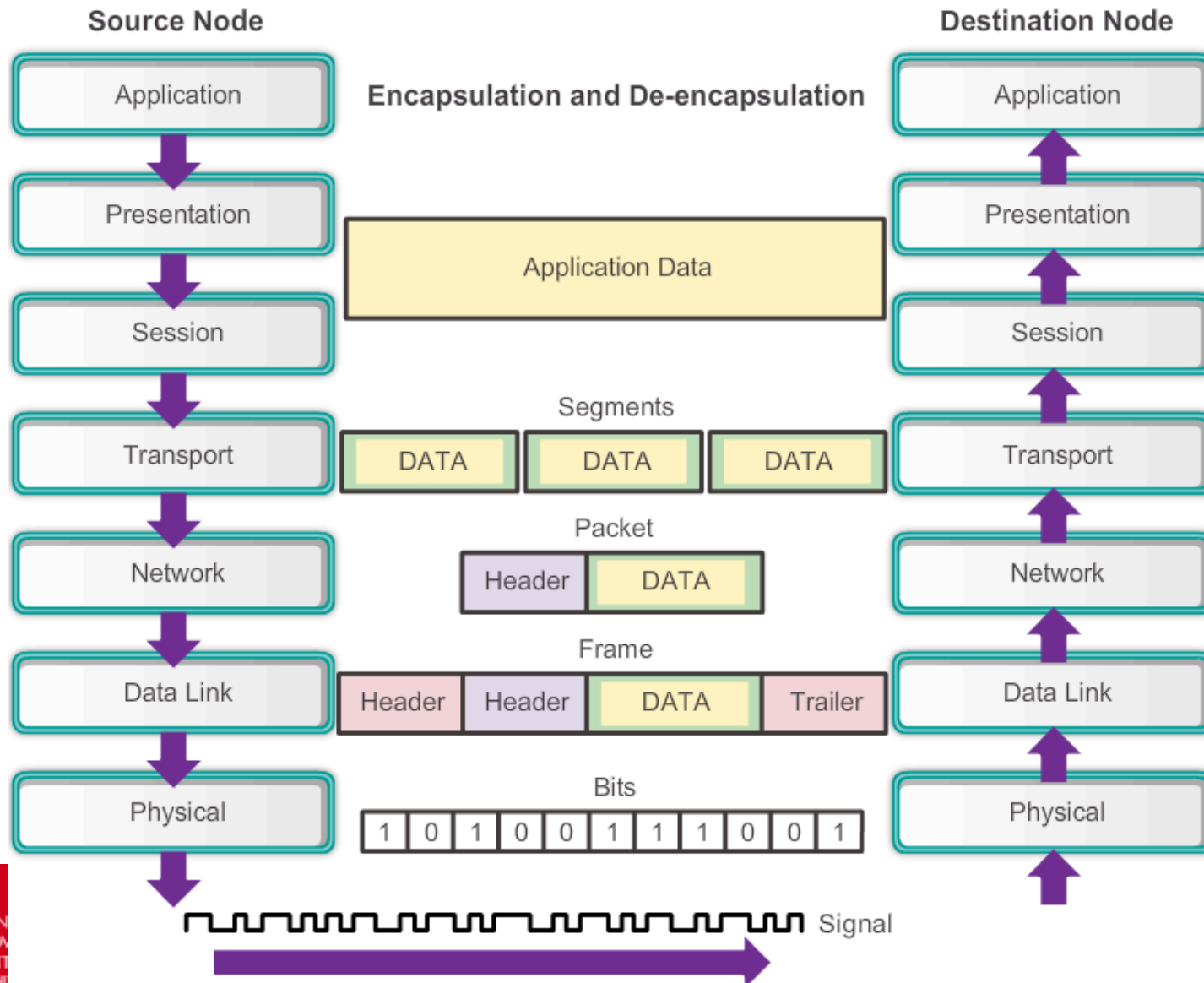
- Used to describe generic networking processes

Comparing the OSI and TCP/IP Models

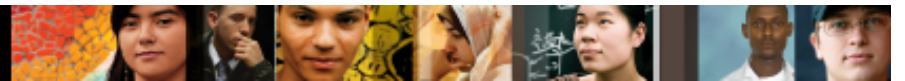| OSI Model	TCP/IP Model
7. Application	Application
6. Presentation	
5. Session	
4. Transport	Transport
3. Network	Internet
2. Data Link	Network Access
1. Physical	

The Physical Layer

Source Node ... **Destination Node**

Encapsulation and De-encapsulation

Source Node		Destination Node
Application	Application Data	Application
Presentation		Presentation
Session		Session
Transport	Segments: DATA DATA DATA	Transport
Network	Packet: Header DATA	Network
Data Link	Frame: Header Header DATA Trailer	Data Link
Physical	Bits: 1 0 1 0 0 1 1 1 0 0 1	Physical

Signal

General Purpose

Sending

- Accepts a frame from the Data Link Layer

- Transmits as binary bits over media between devices

Receiving

- Receives a signal over a common media

- Converts back into a sequence of bits

- Passes to the Data Link Layer as a frame for processing

Bandwidth

Unit of Bandwidth	Abbreviation	Equivalence
Bits per second	bps	1 bps = fundamental unit of bandwidth
Kilobits per second	kbps	1 kbps = 1,000 bps = 10^3 bps
Megabits per second	Mbps	1 Mbps = 1,000,000 bps = 10^6 bps
Gigabits per second	Gbps	1 Gbps = 1,000,000,000 bps = 10^9 bps
Terabits per second	Tbps	1 Tbps = 1,000,000,000,000 bps = 10^{12} bps

Fundamental Principles of the Physical Layer
Throughput
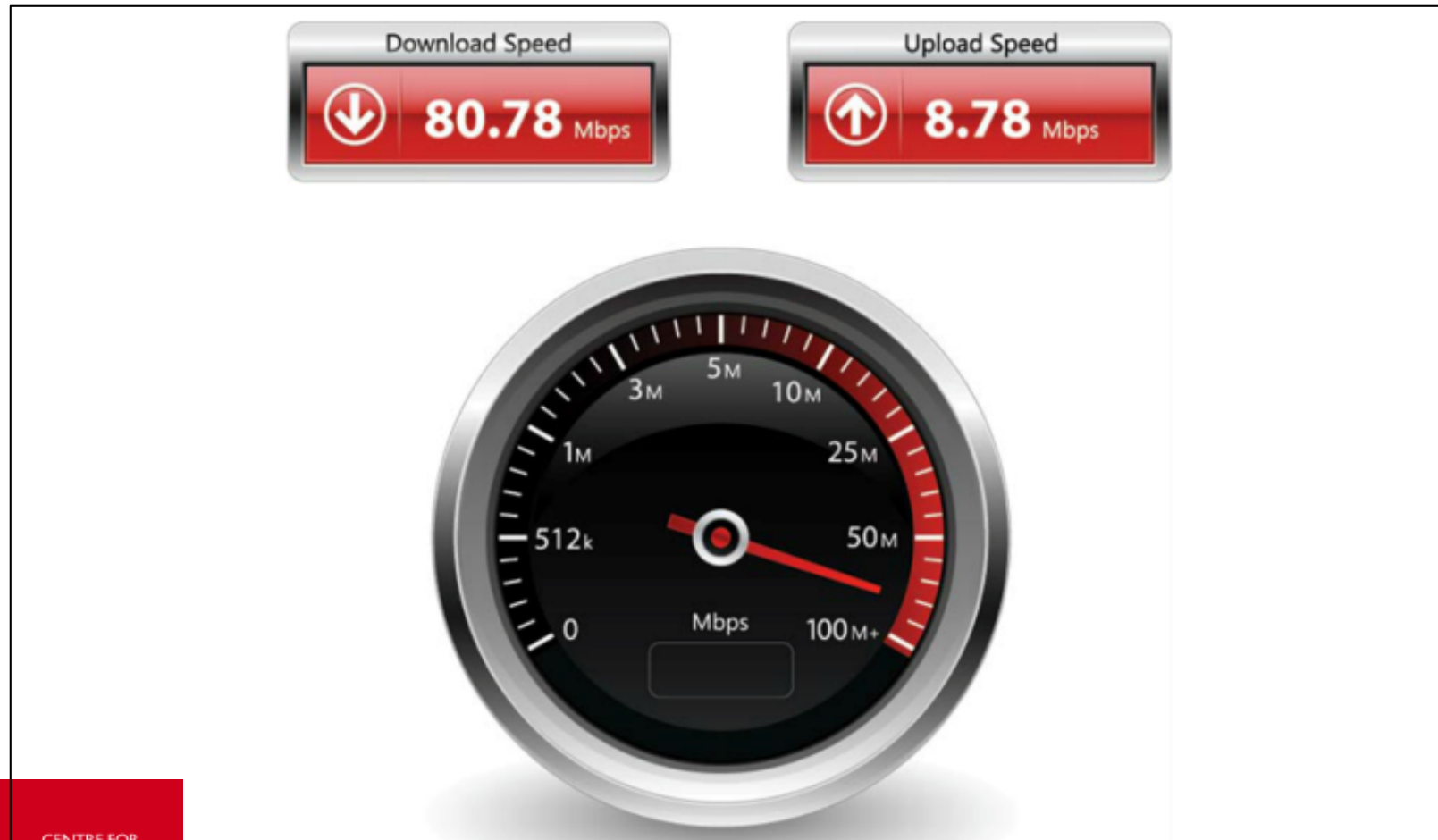
Summary

In this lecture, we covered:

- What is a Network Protocol

- The TCP/IP Layered Architecture

- The concept of Data Encapsulation

- The benefits and usages of a layered architecture model

- The purpose of a Network Reference Architecture Model

- Compared the OSI/ISO Reference Model with the TCP/IP Model

- The purpose and function of the Physical Layer

- The difference between Bandwidth and Throughput