Homework Assignment: TCP/IP, OSI, and Encapsulation

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Part 1: TCP/IP vs. OSI Model Comparison (4 points)

1. Fill in the following table comparing the OSI model and the TCP/IP model:

Layer (OSI Model)	**Equivalent Layer (TCP/IP Model)**	**Main Function**
Application	Application	Handles user applications (e.g., web browsing)
Presentation	Application	Formats and encrypts data [1]
Session	Application	Manages communication sessions [1]
Transport	Transport	Ensures reliable data transfer [2]
Network	Internet	Routes packets across networks [2]
Data Link	Network Access	Handles MAC addressing and framing [3]
Physical	Network Access	Defines hardware transmission [3]

The information for this table was retrieved from the following image:

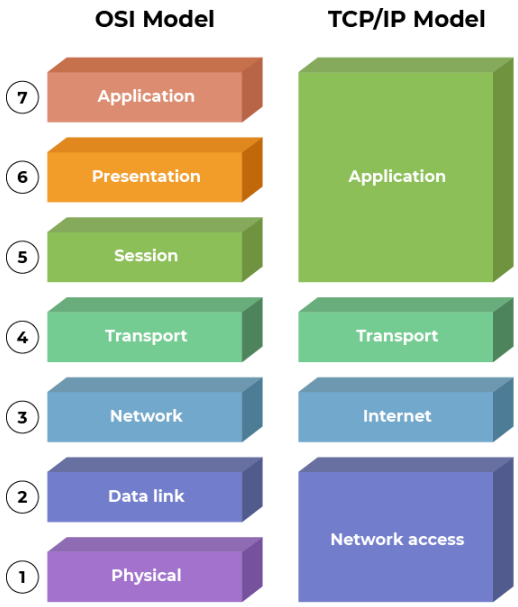

Figure 1: TCP/IP Model vs. OSI Model

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Part 2: Encapsulation Process (3 points)

3. Arrange the following terms in order of encapsulation (from application to physical layer):

The correct order of encapsulation is:

- **Data → TCP Segment → IP Packet → Frame → Bits**

Explanation of Each Step:

- **Data**: The original message or payload created at the Application layer [1].
- **TCP Segment**: At the Transport layer, the data is encapsulated into a TCP segment, which includes a header with information such as source

and destination ports, sequence numbers, and checksums for reliable communication [2].

- **IP Packet**: At the Network layer, the TCP segment is encapsulated into an IP packet, which adds a header containing source and destination IP addresses for routing across networks [2].
- **Frame**: At the Data Link layer, the IP packet is encapsulated into a frame, which includes a header with MAC addresses for local network delivery and a trailer for error checking [3].
- **Bits**: At the Physical layer, the frame is converted into bits (binary 1s and 0s) for transmission over the physical medium (e.g., Ethernet cables or wireless signals) [3].

4. When sending a message over the Internet, at which layer does IP addressing occur?

- **C) Network** [2]

5. In de-encapsulation, which layer removes MAC addresses before sending data to the Network layer?

- **B) Data Link** [3]

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Part 3: Practical Scenario (3 points)

6. Read the scenario below and answer the questions.

Scenario:

Alice is using a web browser to visit `www.example.com`. Her computer is connected to a router via Ethernet, and the website is hosted on a remote server.

Questions:

- **At which OSI layer does the HTTP request occur? Answer:** The HTTP request occurs at the Application layer. This is where web browsers and web servers interact using the HTTP protocol to request and deliver web pages [1].
- **Which protocol at the Transport layer will likely be used for this connection? Answer:** The protocol used at the Transport layer will likely be TCP. TCP is commonly used for web traffic because it provides reliable, ordered, and error-checked delivery of data between applications [2].

- **What happens to Alice's data at the Data Link layer before it is sent through Ethernet? Answer:** At the Data Link layer, Alice's data is encapsulated into frames. The Data Link layer adds a header containing the source and destination MAC addresses, which are used for frame forwarding within the Local Area Network (LAN). The frame also includes a trailer for error detection (e.g., a CRC checksum). Once the frame is ready, it is sent through the Ethernet interface for transmission over the physical network [3].

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References

References

[1] Improve, G. (2017a, August 30). *What is OSI Model*. GeeksforGeeks. https://www.geeksforgeeks.org/open-systems-interconnection-model-osi/

[2] Improve, G. (2017b, October 4). *TCP/IP model*. GeeksforGeeks. https://www.geeksforgeeks.org/tcp-ip-model/

[3] Rosenbaum, O. (2022, October 21). *How the Ethernet protocol works – A complete guide*. Freecodecamp.org. https://www.freecodecamp.org/news/the-complete-guide-to-the-ethernet-protocol/