Homework Assignment: TCP/IP, OSI, and Encapsulation

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February 14, 2025

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
Session	Application	Manages communication sessions
Transport	Transport	Ensures reliable data transfer
Network	Internet	Routes packets across networks
Data Link	Network Access	Handles MAC addressing and framing
Physical	Network Access	Defines hardware transmission

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.
- **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.
- **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.
- **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.
- **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).

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

- **C) Network**

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

- **B) Data Link**

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.

- **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.

- **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.