A blue and white triangle

AI-generated content may be incorrect.**NETWORK LAYER (LAYER 3) OVERVIEW**

To accomplish end-to-end communications across network boundaries, network layer protocols perform four basic operations:

* **Addressing:** Assigning unique IP addresses to end devices for network identification.
* **Encapsulation (Đóng gói):** Packaging transport layer data into IP packets with source and destination IP addresses. (Performed by the sender.)
* **Routing:** Directing packets across networks via routers, which determine the optimal path (hops).
* **De-encapsulation:** Removing the IP header at the destination device to deliver the transport layer data. (Performed by the receiver.)

A diagram of a layer

AI-generated content may be incorrect.**A. IP Encapsulation**

- Network Layer’s Role: At the network layer, the internet Protocol (IP) takes data segments from the transport layer (like TCP or UDP segments) and adds an IP header. This process creates an IP packet.

**- IP Header:**

* The IP header contains essential routing information, most notably the source and destination IP addresses.
* This information allows routers to determine the optimal path for the packet to travel across the network.
* Other information contained in the header, includes information regarding Time To Live(TTL), and protocol type.

- **Packet Formation:**

* The combination of the transport layer segment and the IP header forms an IP packet (or datagram).
* This packet is the basic unit of data transmission in an IP network.

- **Routing:**

* IP encapsulation enables routers to read the destination IP address in the header and forward the packet accordingly.
* This process is essential for delivering data across different networks and the internet.

**B. Characteristics of IP**

- Connectionless (Không kết nối): No pre-established connection (Không thiết lập kết nối trước khi gửi dữ liệu).

- Best-Effort (Gửi nỗ lực tối đa): Delivery not guaranteed (Không đảm bảo việc gửi thành công).

- Packet Switching (Chuyển mạch gói): Data broken into packets.

- Logical Addressing (Địa chỉ Logic): Uses IP addresses.

- Routing (Định tuyến): Determines packet path.

- Fragmentation (Phân mảnh): Breaks large packets into smaller ones.

**C. Connectionless service**

- A connectionless service transfers data without establishing a connection between sender and receiver before transmission.

- Key Characteristics:

* **No Connection Setup**: Data can be sent immediately without checking if the receiver is available.
* **Data Packets**: Packets are called **datagrams** and are sent without a specific order.
* **Receiver Address**: Each packet contains only the address of the receiver.
* **Examples**: Protocols like **UDP** and **Internet Protocol** (IP) are common connectionless services.
* **Reliability**: Not considered reliable; the receiver may request retransmission if packets are lost.

- **Data Handling**: The receiver may receive packets out of order and must rearrange them into a complete data file

**D. Best-effort**

- No Guarantees:

* The IP protocol makes no promises about whether data packets will arrive at their destination.
* It also doesn't guarantee the order in which packets will arrive, or that they won't be corrupted.

- Focus on efficiency:

* This approach prioritizes speed and efficiency over absolute reliability.
* By avoiding the overhead of error-checking and retransmission, the network can handle a large volume of traffic.

- “Do What You Can”: Essentially, "best-effort" means the network will do its best to deliver packets, but it won't take extra steps to ensure perfect delivery.

**In Simple Terms:**

Imagine sending a letter through the regular postal service. They'll do their best to deliver it, but they don't guarantee it will arrive on time or at all. If you need guaranteed delivery, you'd use a service with tracking and confirmation. That's similar to how IP and TCP work together. IP provides the "regular mail" service, and TCP provides the "guaranteed delivery" service.