Network Core, Forwarding, Routing, and Packet Switching

Network Core

The **network core** refers to the mesh of interconnected routers and high-speed links that form the backbone of the Internet. It is responsible for transporting data across large distances efficiently.

- Provides connectivity between millions of end systems.
- Built on high-capacity fiber optics and advanced switching technology.
- Ensures reliability, scalability, and efficiency.

Analogy

Think of the network core like a city's central highway system. It connects all the smaller roads (access networks) and ensures traffic (data) can flow across long distances.

Forwarding

Forwarding is the process of moving a packet from a router's input interface to the appropriate output interface.

- Happens at the scale of nanoseconds or microseconds.
- Based on information stored in the **forwarding table**.
- Implemented in hardware (e.g., ASICs) for speed.

Key Point

Forwarding is a *local operation* — it only concerns where to send the packet next.

Routing

Routing is the process of determining the complete path a packet takes from source to destination.

- Routing algorithms compute paths across the entire network.
- Examples: Dijkstra's Algorithm (link-state), Bellman-Ford (distance-vector).
- Runs in the control plane of routers.

Difference from Forwarding

- **Routing:** The *planning stage* (finding the path).
- **Forwarding:** The *execution stage* (moving packets).

Packet Switching

Packet switching is the method of breaking data into small chunks called packets and transmitting them independently through the network.

Characteristics

- Each packet carries its own destination address.
- Packets may take different routes to reach the destination.
- Increases efficiency by sharing network resources.

Types

- **Datagram Networks:** No predefined path; each packet is routed independently.
- **Virtual-Circuit Networks:** A logical path is established before transmission.

Key Point

Packet switching makes the Internet scalable and robust, unlike circuit switching which dedicates a fixed path for the entire duration of communication.