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Chapter 1.3 - Network Core
Packet switching, circuit switching, and network structure

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What is the Network Core
A "mesh" of interconnected routers.

- **Packet switching** is when data packets are forwarded from one router to another across a path to the destination.

- Packets are broken in to L bits and transmitted with transmission rate R (also known as *link capacity* or *link bandwidth*).

- Thus, packet transmission delay = time to transmit L-bit packet into link = $\frac{L(bits)}{R(bits/sec)}$.

- i.e. It takes L/R seconds to transmit an L-bit packet into a link at R bps.

- **Store and forward** means that the *entire packet must arrive* at the router before it can be forwarded to the next link.

- If *arrival rate exceeds transmission rate*, then packets will wait in a *queue* to be transmitted.

- That means packets can be dropped (lost) if memory is full.

- **Routing** determines the route taken by packets to get from the source to destination.

- **Forwarding** moves packets from a router's input to the appropriate router output.

- **Circuit switching** is when network nodes *reserve* circuits through the network before sharing packets.

- Packet switching is simpler (requires less setup) and allows multiple users to use the network, but it is possible for data to be lost, so it is less reliable. There is still no solution found to prevent possible data lost from packet switching.

Internet Structure
Network of networks

- End systems connect to the internet via *access ISPs* (Internet Service Providers).

- Access ISPs must be *interconnected* so that any two hosts can exchange packets.

- It is very difficult to connect all ISPs together because there are so many of them (millions).

- Options:

    - Connect every ISP to every other ISP: $O(N^2)$ connections.
    - Connect ISPs to one global ISP. There will be competition for which ISP is the global one.

- Network structure on slide 1-40:

    - **Tier 1 Commercial ISPs** are at the *top* (*ex. Level 3, Sprint, AT&T*). They usually have *national* or *international* coverage.
    - **Content Provider Networks** are also at the *top*. They connect data centers to the internet (*ex. Google*).