

Computer Networks

Introduction and Background

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Data → Communications → Networking

❑ **Data:** Information being shared, e.g. text, numbers, images, audio, video

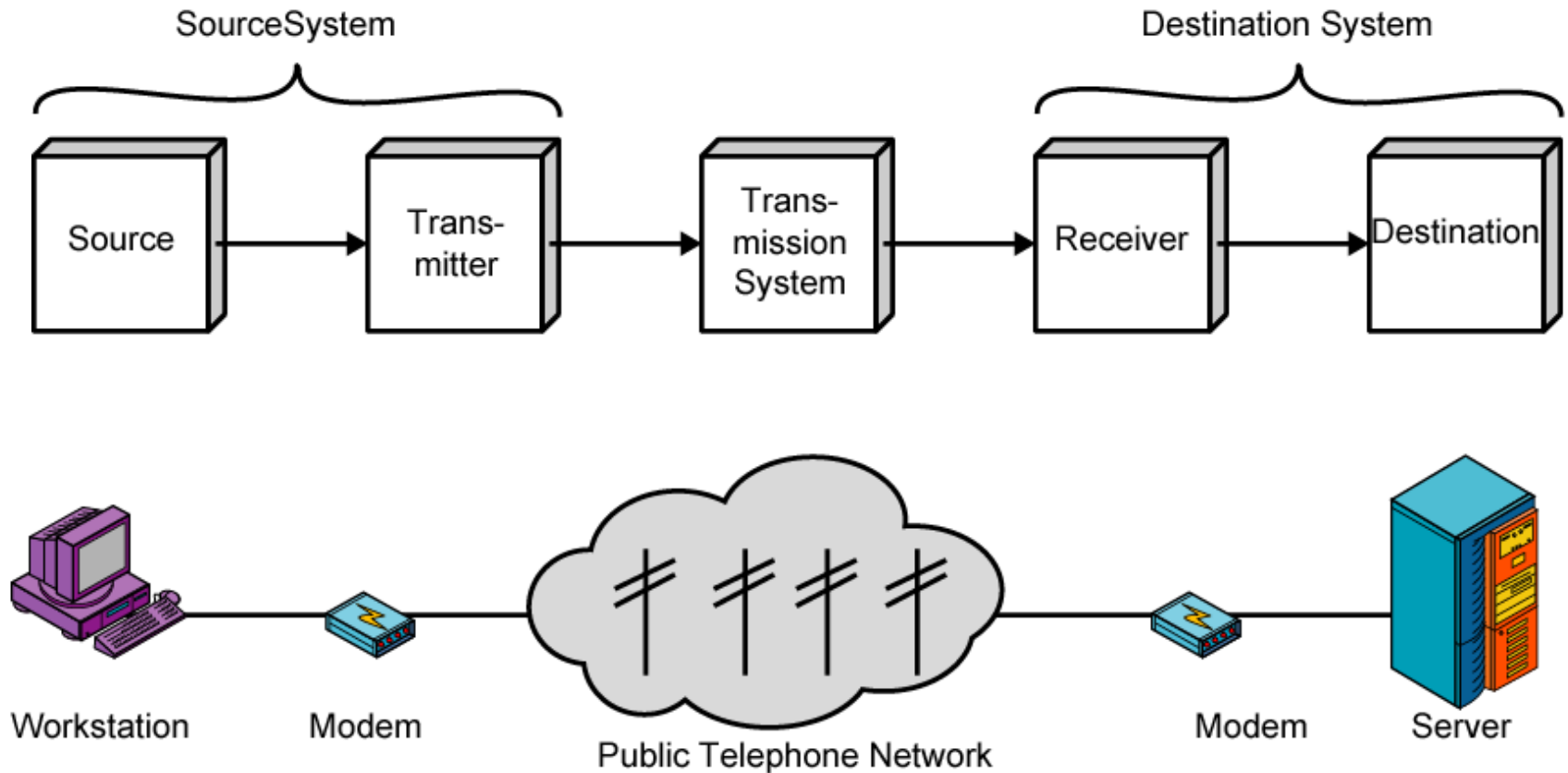
❑ **Communications:** Exchange of data between two or more devices via some transmission medium

- Transmits signals in a reliable and efficient and efficient manner
- Focuses on individual links
- Key objectives: **Delivery**, **Accuracy** and **Timeliness**

❑ **Networking:** Communications across a set of links

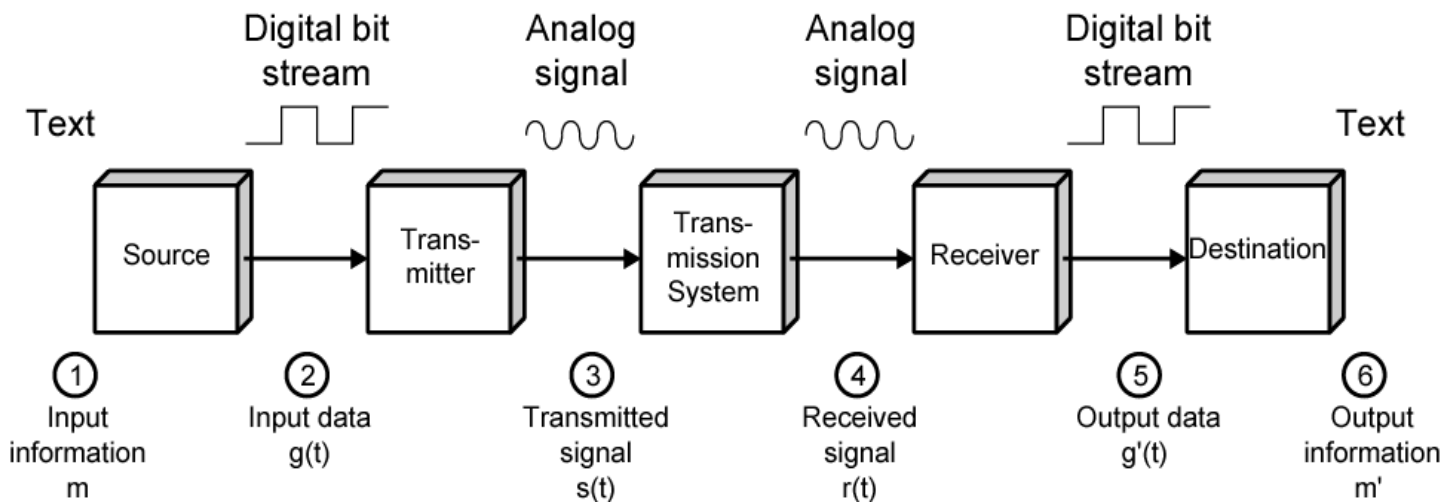
- Wide Area Networks (WAN)
 - Local Area Networks (LAN)
 - Metropolitan Area Networks (MAN)
 - The Internet
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Simplified Communications Model



Simplified Communications Model

- **Source:** Device that generates data to be transmitted.
- **Transmitter:** Converts data from source into transmittable signals.
- **Transmission system:** Carries data from source to the destination.
- **Receiver:** Converts received signal into data.
- **Destination:** Takes and uses incoming data.



Transmission Line

- ❑ Transmission line is the key part of communications system
 - ❑ Link between the transmitter and the receiver
 - Wired transmission: Fiber Optic Transmission
 - Wireless Transmission
 - ❑ Needs to provide required **capacity**, with acceptable **reliability** at minimum **cost**
 - ❑ **Example:** Want to transfer 50 GB of data from A to B
 - **Bluetooth:** 1Mbps data transfer → 400000 seconds
 - **WiFi:** 54Mbps data transfer → 7407 seconds
 - **LAN Cable:** 1Gbps data transfer → 400 seconds
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Local Area Networks

- ❑ Small coverage area, e.g. building, campus
 - ❑ Owned and operated by organization owning end-devices
 - ❑ Higher data rate compared to WANs
 - ❑ Example technologies: Ethernet, Wireless LAN
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Wide Area Networks

- ❑ Span a large geographical area
 - ❑ Carries data of multiple organizations
 - ❑ Technologies used:
 - Circuit Switching
 - Packet Switching
 - Frame Relay
 - Asynchronous Transfer Mode (ATM)
 - ❑ Metropolitan Area Network (MAN):
 - Middle ground between LAN and WAN
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The Internet

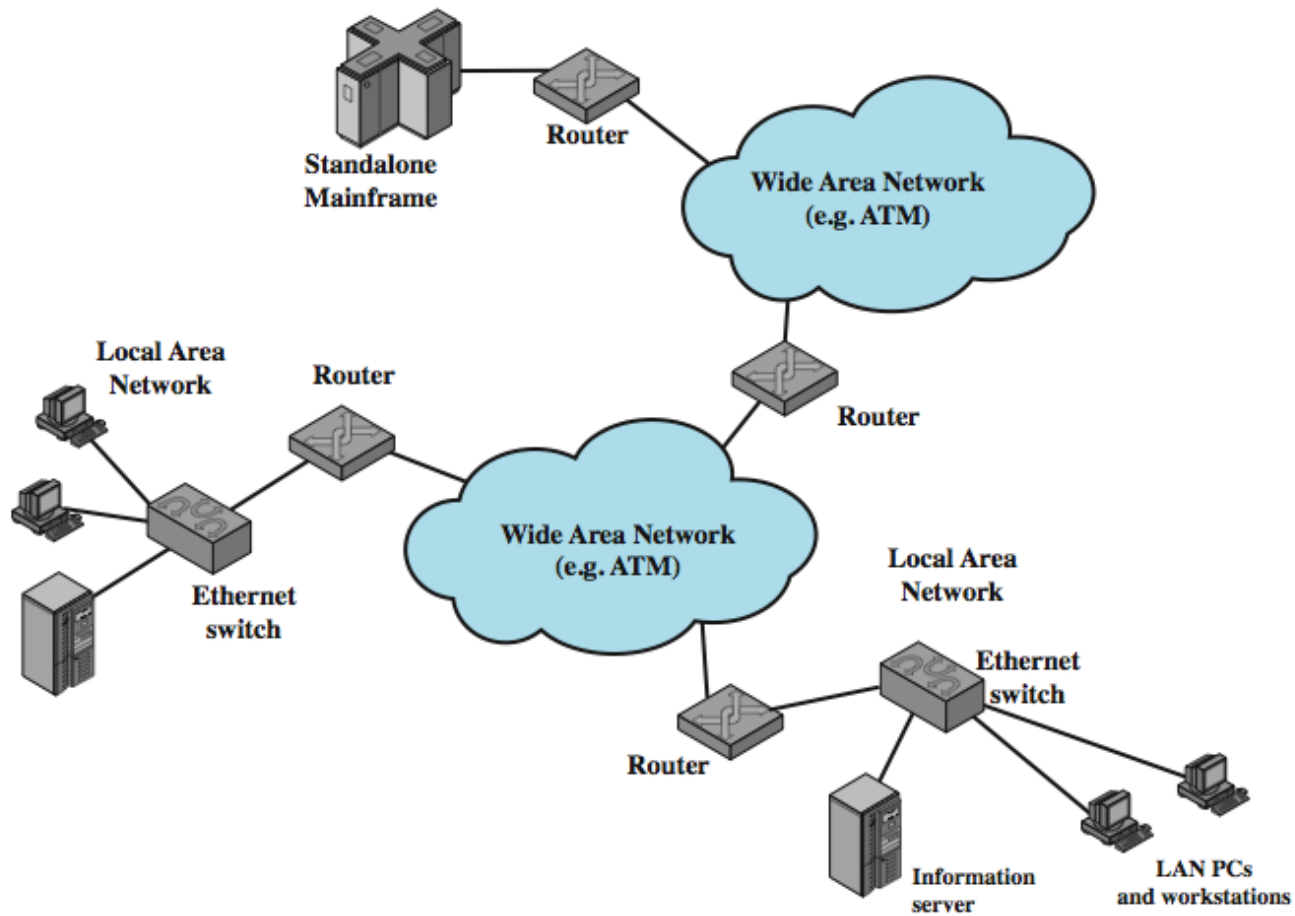
❑ Origins

- Evolved from US Department of Defense research network, APRANET in 1969
- Standardization of the Internet suite of protocols: TCP/IP

❑ What is The Internet?

- Interconnection of networks
 - Although network technologies differ, any computer can communicate with any other computer
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The Internet



The Internet: a “nuts and bolts” view



Billions of connected computing **devices**:

- **hosts** = end systems
- running **network apps** at Internet's “edge”



Switches/routers: forward packets (chunks of data)

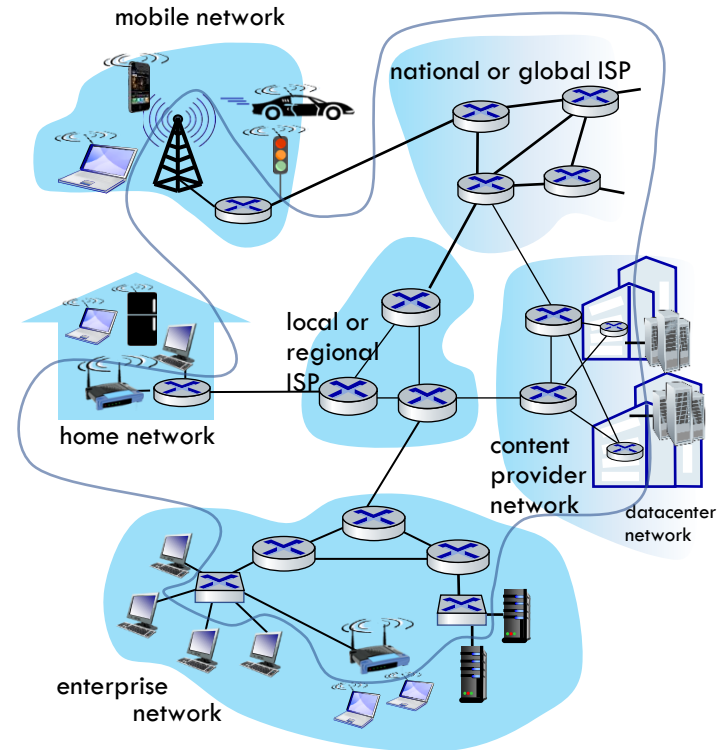


Communication links

- fiber, copper, radio, satellite
- transmission rate: **bandwidth**

Networks

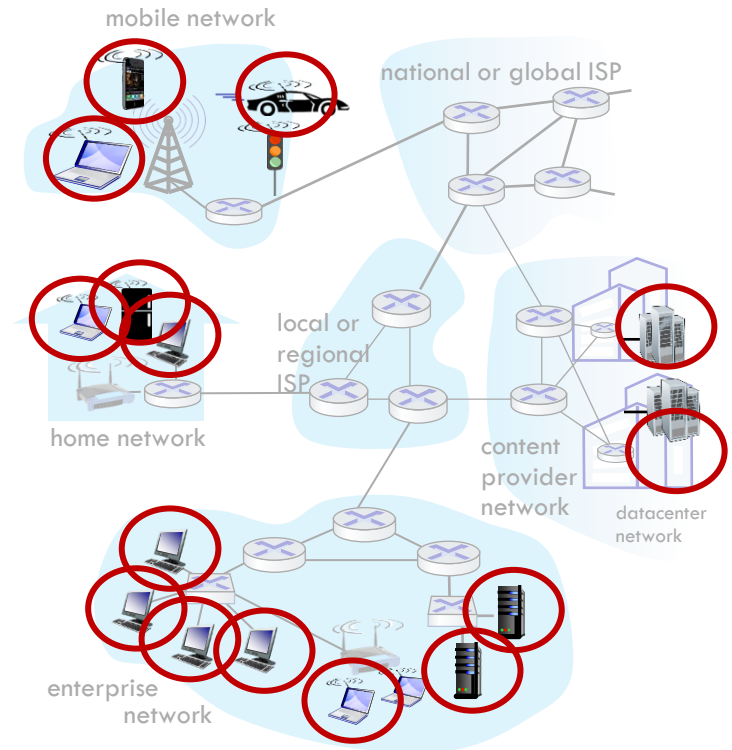
- collection of devices, routers, links: managed by an organization



Network Edge and Network Core

Network edge:

- ❑ End systems/hosts: data producers and consumers
- ❑ Clients and servers
- ❑ Servers often in data centers
- ❑ Access networks, physical media: wired, wireless communication links



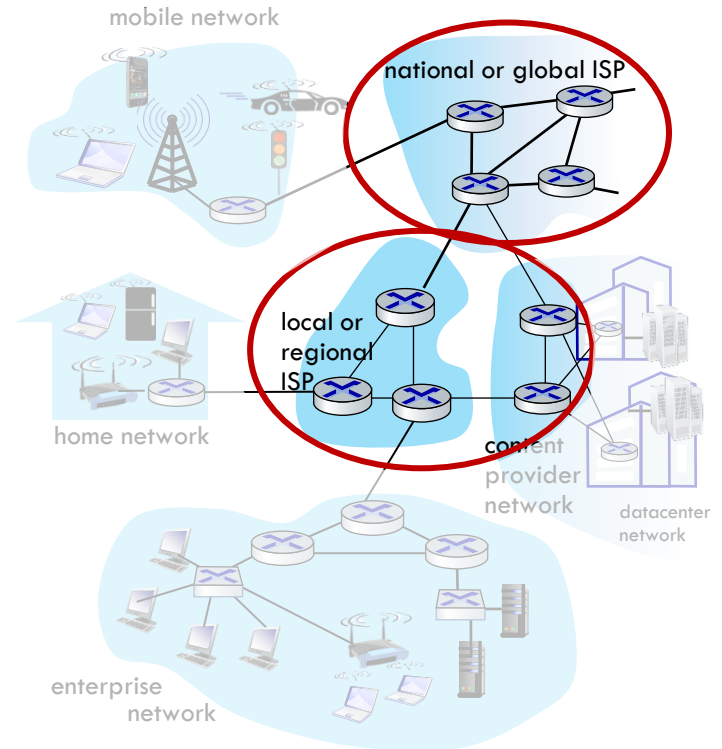
Network Edge and Network Core

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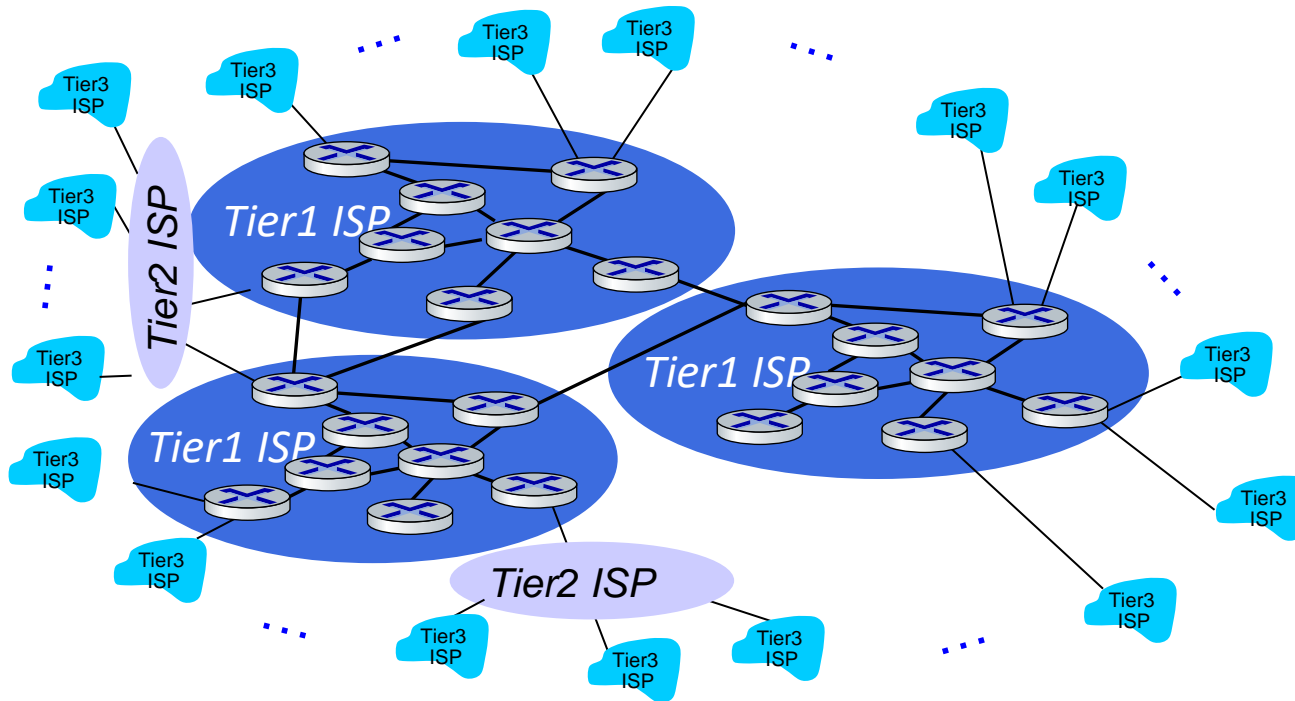
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Network core:

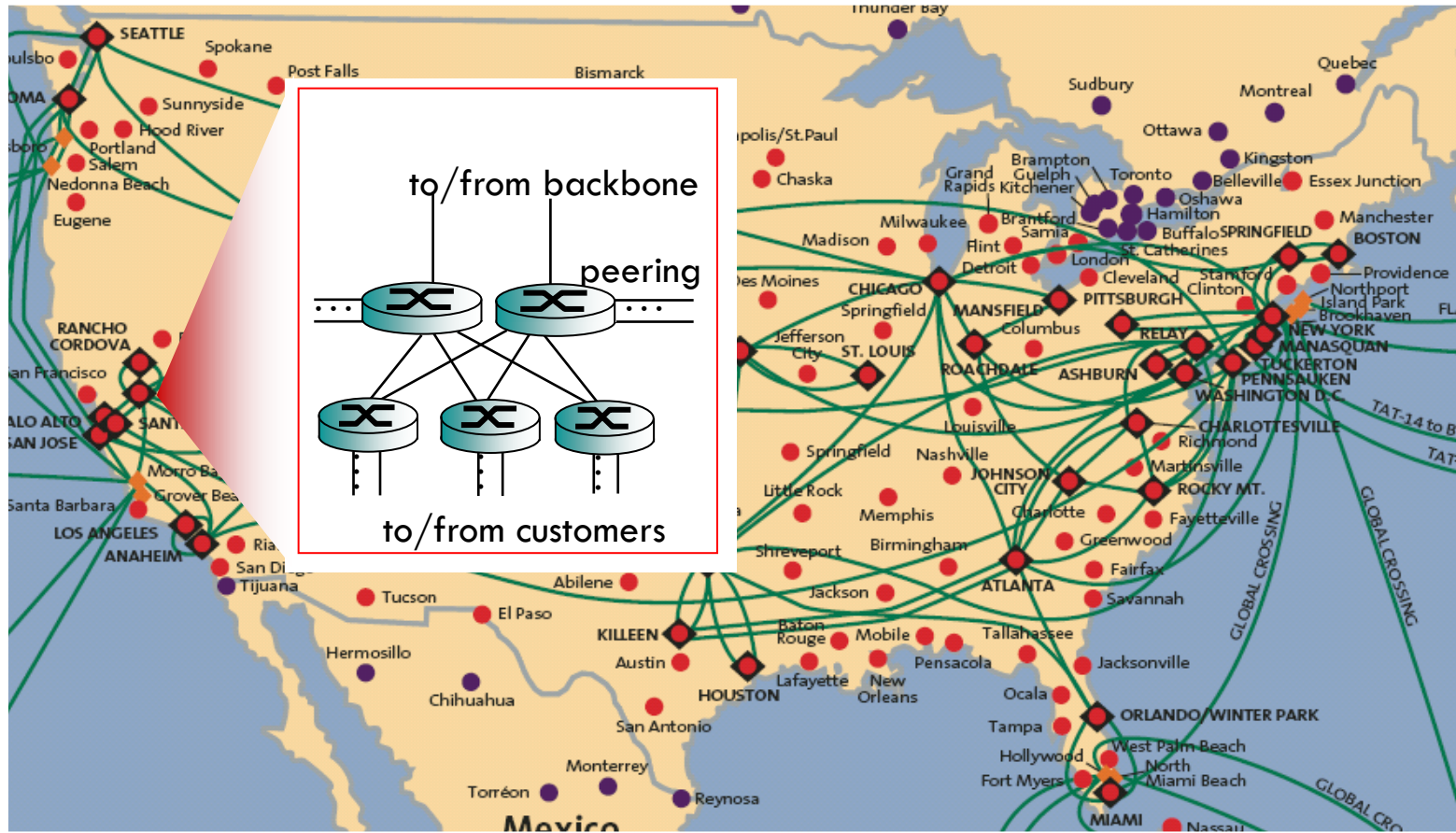
- ❑ Interconnected routers
- ❑ Forms the backbone of the Internet



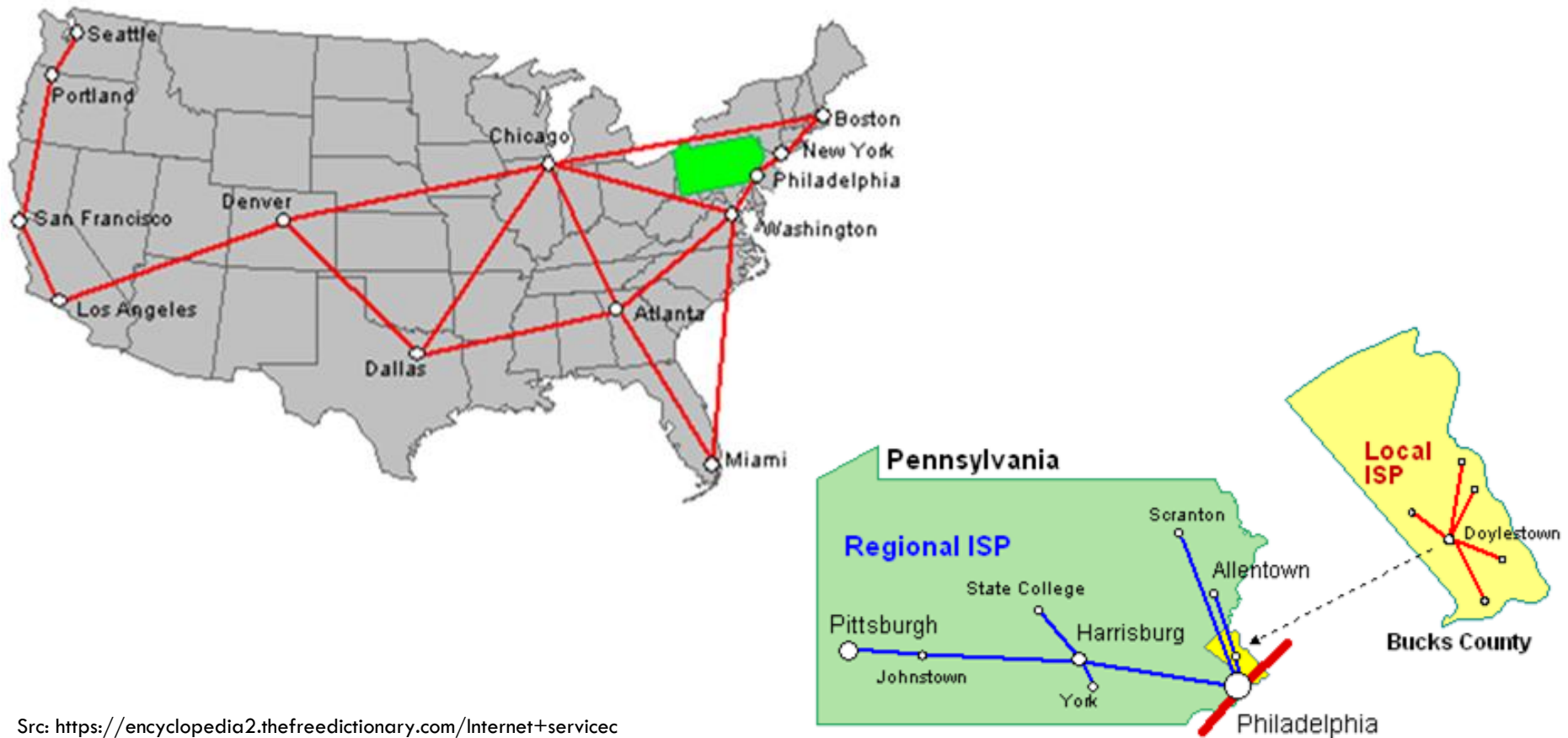
Internet structure: a “network of networks”



Tier-1 ISP: e.g., Sprint



Internet structure: a “network of networks”



Src: <https://encyclopedia2.thefreedictionary.com/Internet+service+provider>