COMPUTER NETWORKS

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Computer Networks and the Internet

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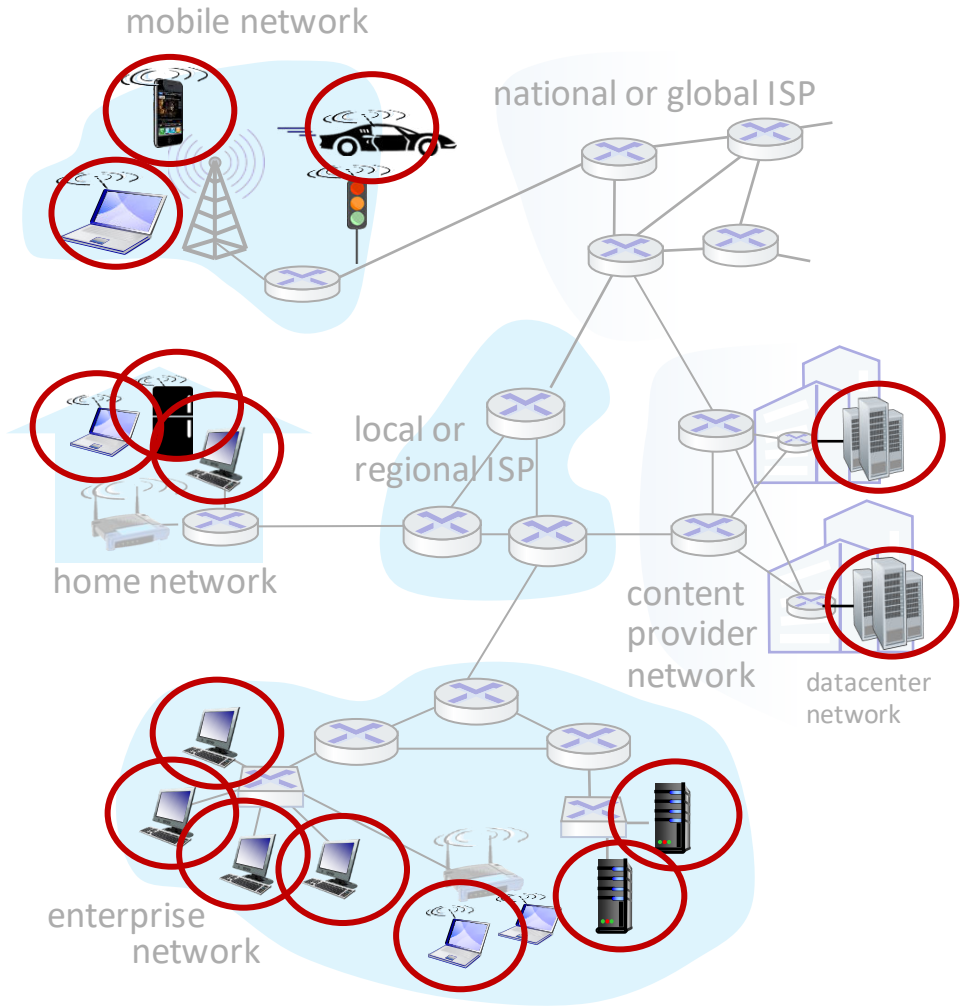
Network Edge: A closer look at network structure

Network edge:

- Hosts: clients & servers
- Servers in data centers



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Network Edge: A closer look at network structure

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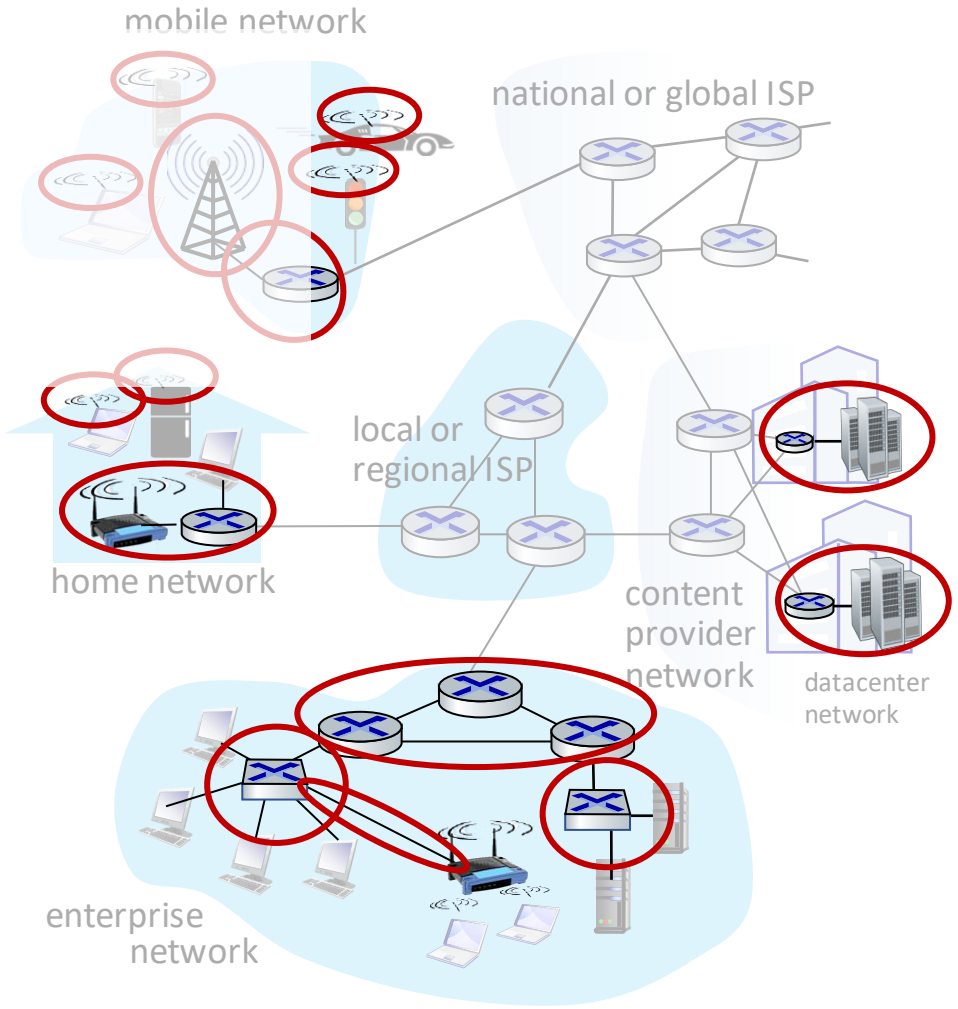
- Servers in data centers

Access networks, physical media:

- wired, wireless communication links



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Network Edge: A closer look at network structure

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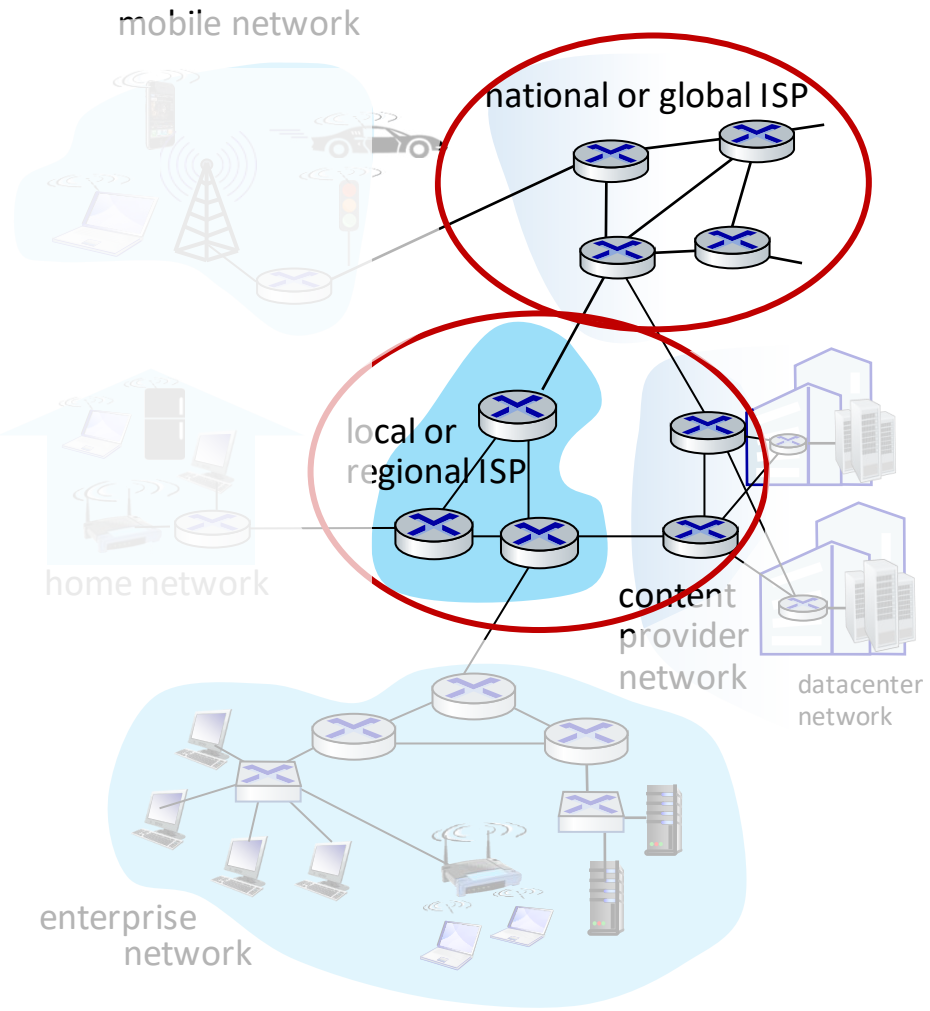
Network core:

- interconnected routers
- network of networks



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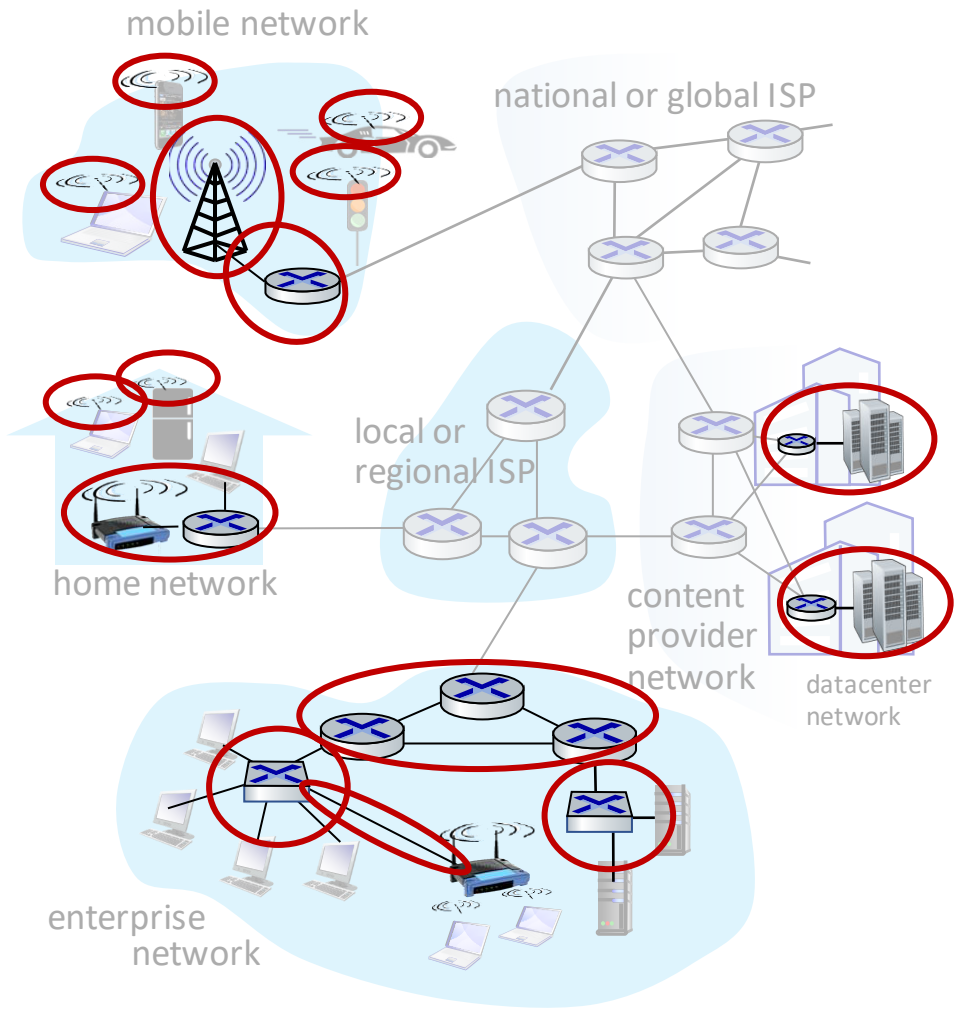
Network Edge: Access networks and Physical media

Q: How to connect end systems to edge router?

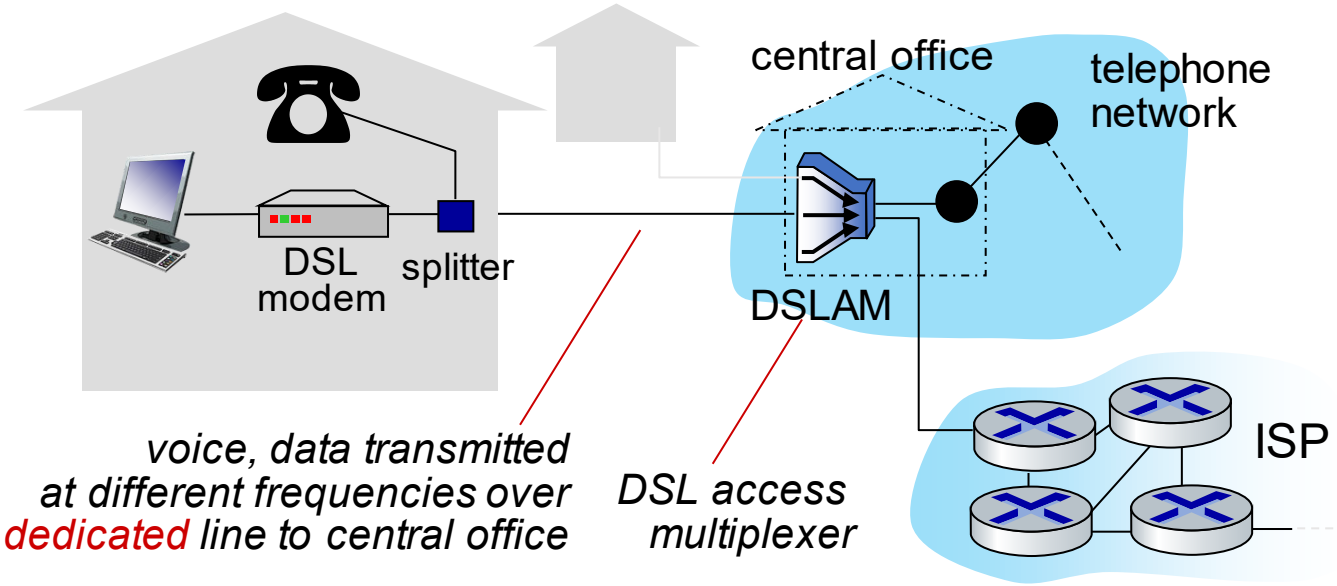
- Residential access networks
- Institutional access networks (school, company)
- Mobile access networks (WiFi, 4G/5G)

What to look for:

- Transmission rate (bits per second) of access network?
- Shared or dedicated access among users?



Network Edge: Access Networks - Digital Subscriber Line (DSL)



- 24-52 Mbps – downstream transmission rate
- 3.5-16 Mbps – upstream transmission rate
- Asymmetric access

- use *existing* telephone line to central office DSLAM
  - **data** over DSL phone line goes to Internet
  - **voice** over DSL phone line goes to telephone net
- A high-speed downstream channel, in the 50 kHz to 1 MHz band
- A medium-speed upstream channel, in the 4 kHz to 50 kHz band
- An ordinary two-way telephone channel, in the 0 to 4 kHz band

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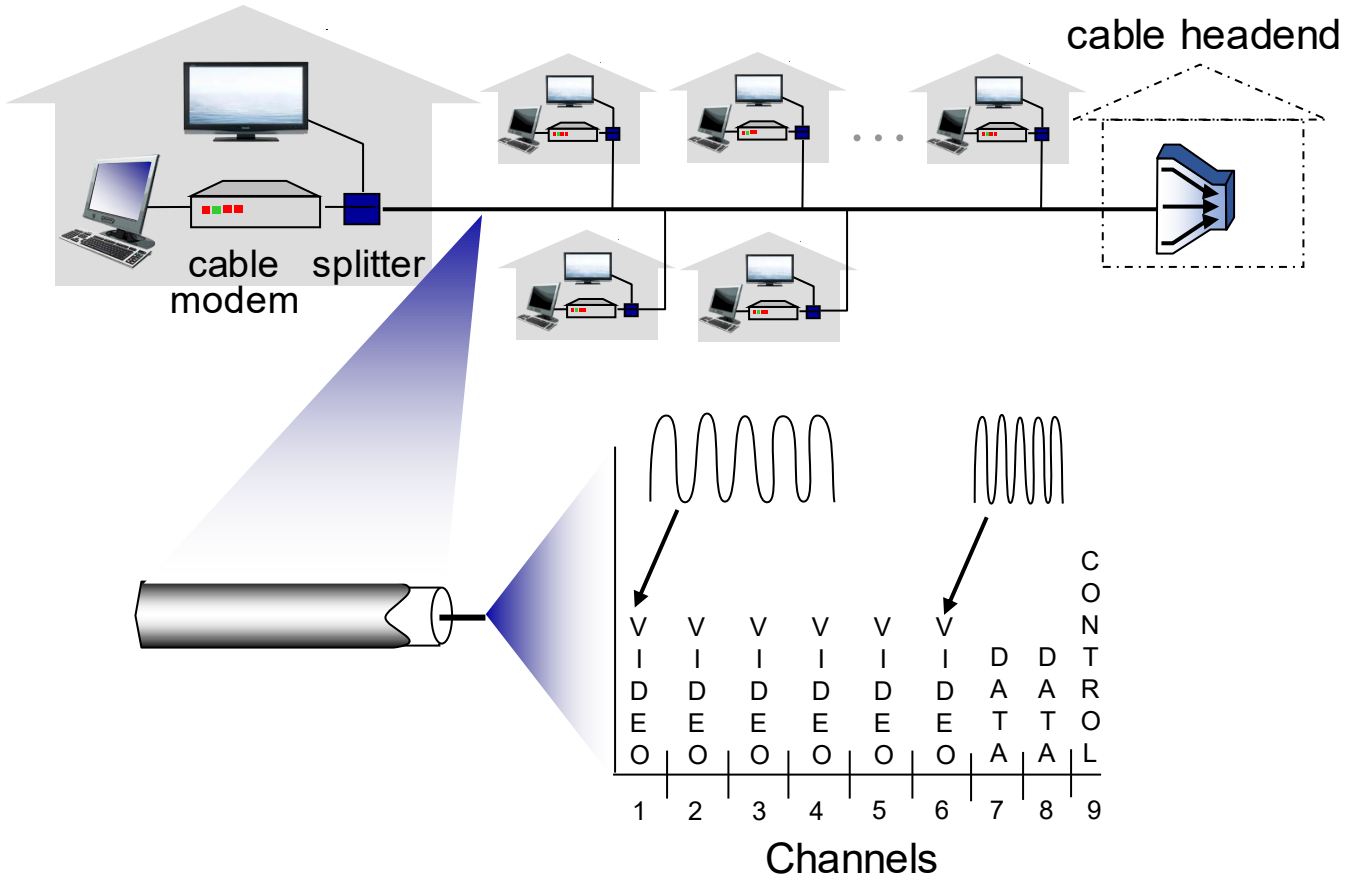
Network Edge: Access Networks: Cable-based access



Frequency division multiplexing (FDM): different channels transmitted in different frequency bands

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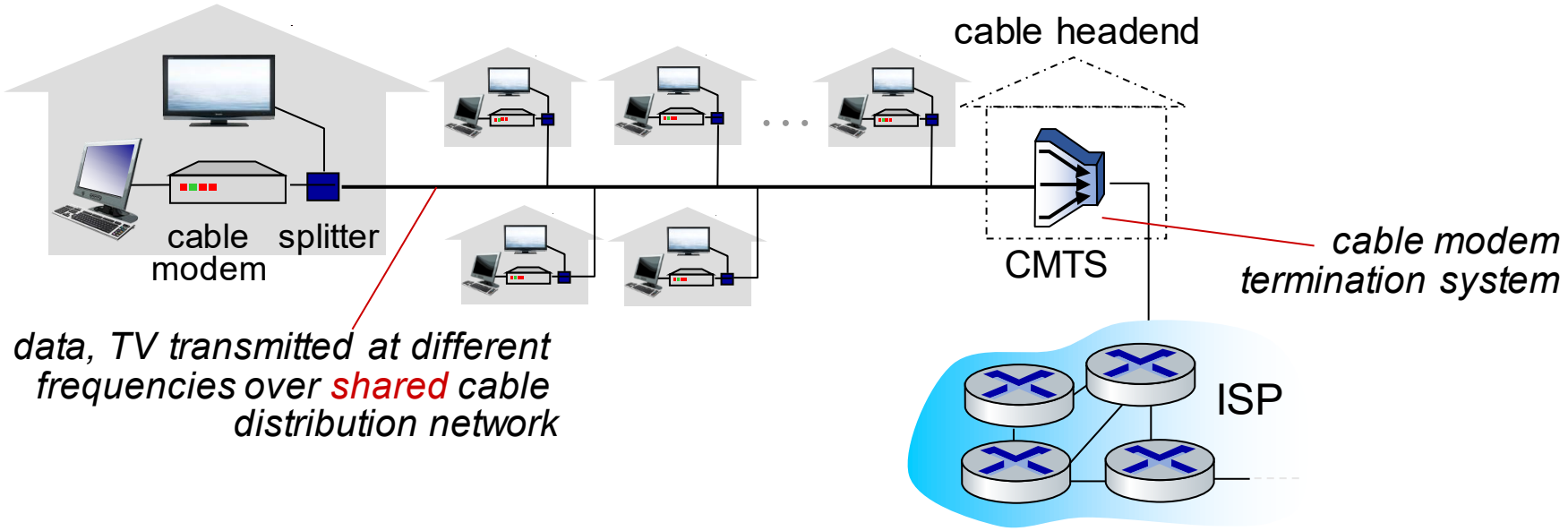
Network Edge: Access Networks: Cable-based access

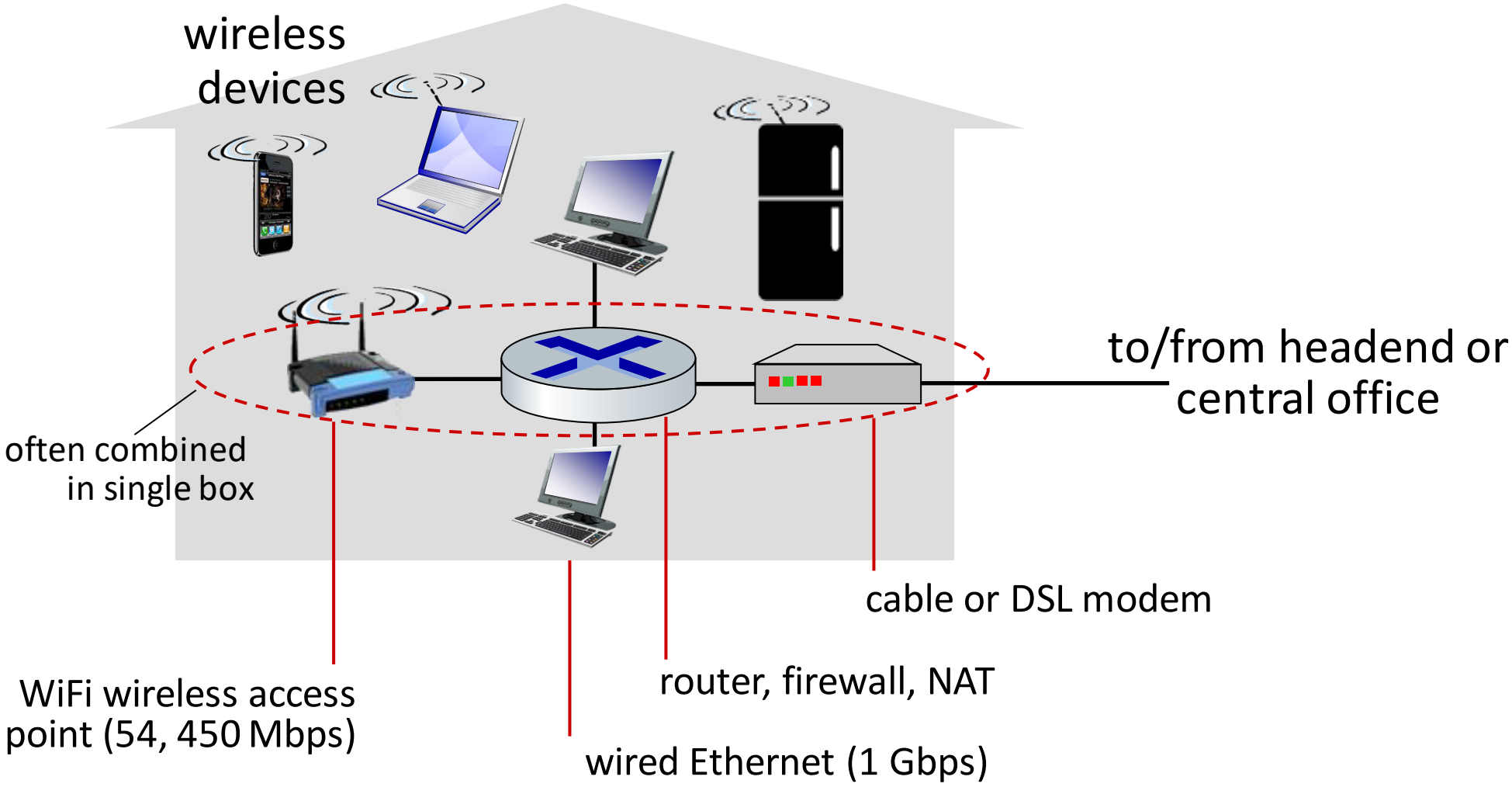


- HFC: hybrid fiber coax
  - Asymmetric:

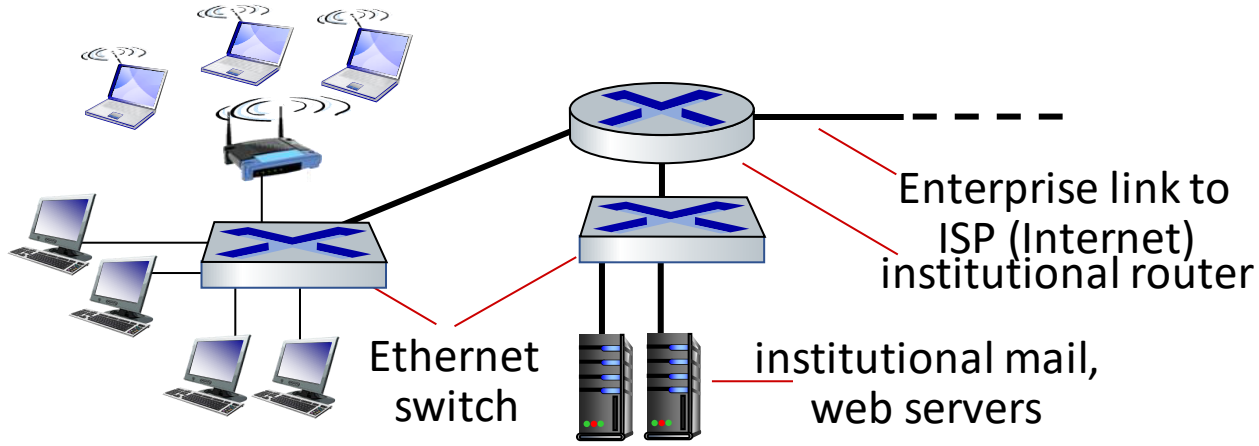
    up to 40 Mbps – 1.2 Gbs downstream transmission rate,

    30-100 Mbps upstream transmission rate
- Network of cable, fiber attaches homes to ISP router
  - homes *share access network* to cable headend

Network Edge: Access Networks – Home access



Network Edge: Access Networks – Enterprise networks



- companies, universities, etc.
- mix of wired, wireless link technologies, connecting a mix of switches and routers (we'll cover differences shortly)
  - Ethernet: wired access at 100Mbps, 1Gbps, 10Gbps
  - WiFi: wireless access points at 11, 54, 450 Mbps

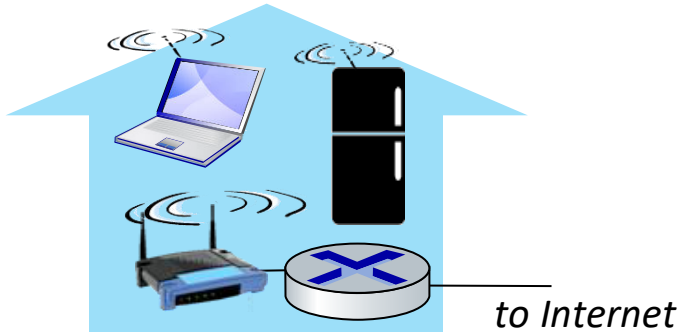
Network Edge: Wireless Access Networks

Shared *wireless* access network connects end system to router

- via base station aka “access point”

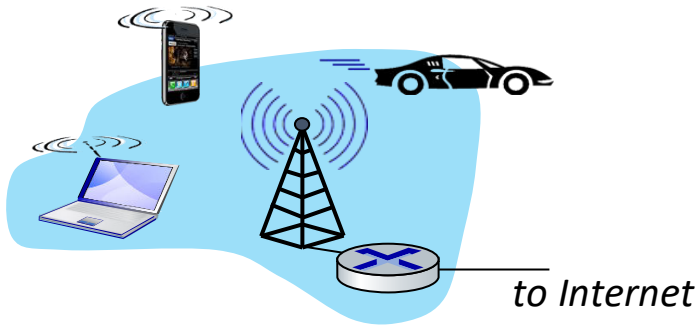
Wireless local area networks (WLANs)

- typically within or around building (~100 ft)
- 802.11b/g/n (WiFi): 11, 54, 450 Mbps transmission rate



Wide-area cellular access networks

- provided by mobile, cellular network operator (10’s km)
- 10’s Mbps
- 4G cellular networks (5G coming)



Queries

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Thank You
For Your Attention

THANK YOU

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