CSCI 446 Introduction to Computer Networks

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Topic

The Architecture of Computer Network

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A Closer Look at Network Structure:

network edge:

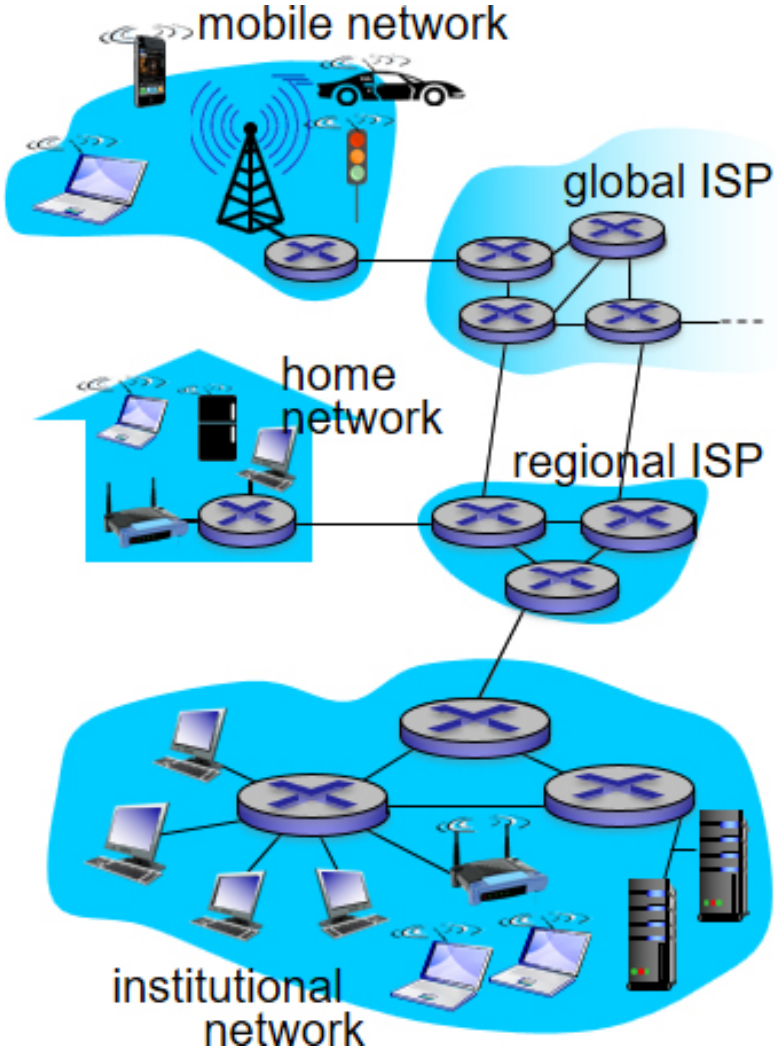
- hosts: clients and servers
- servers often in data centers

access networks, physical media*:* wired, wireless communication links

network core:

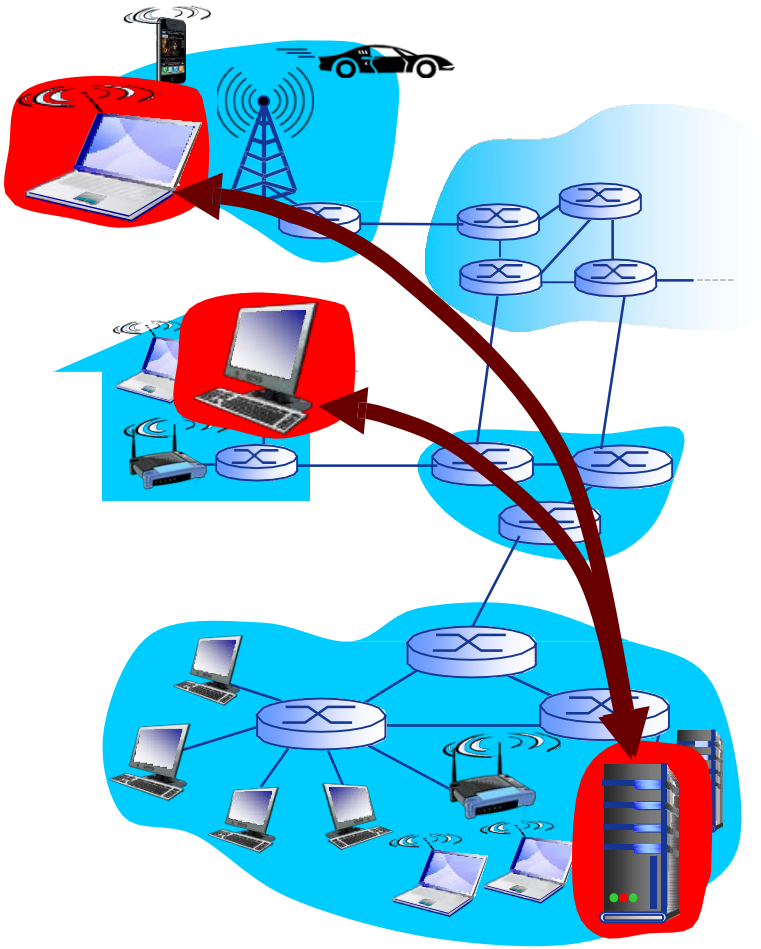
interconnected routers

network of networks



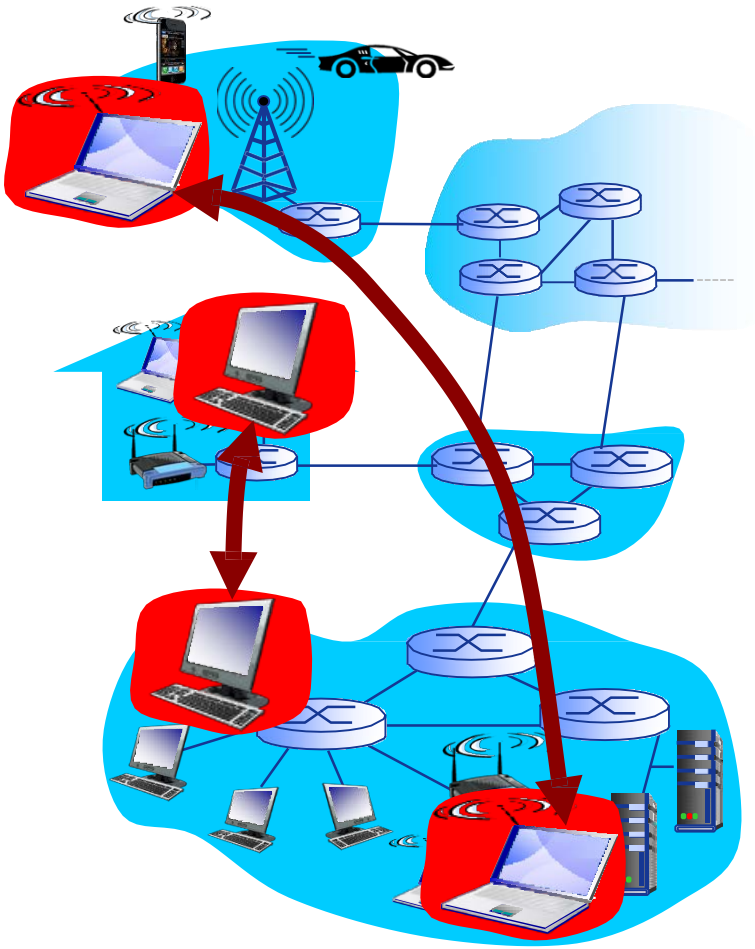
The Edge of the Network

- Host(End System):
  - Locates at the “edge”
  - Runs application software
    - E.g.: Web, email
- The client/server application model
  - Client sends request and receives server responses.
  - E.g.: Web application, file transfer in FTP



The Edge of the Network

- The client/server application model
  - Client sends request and receives server responses.
  - E.g.: Web application, file transfer in FTP
- The peer-peer (P2P) application model:
  - No (or not only dependent on) dedicated servers
  - Communication takes place directly between peer entities
  - Such as: Gnutella, BT, Skype, Messenger.



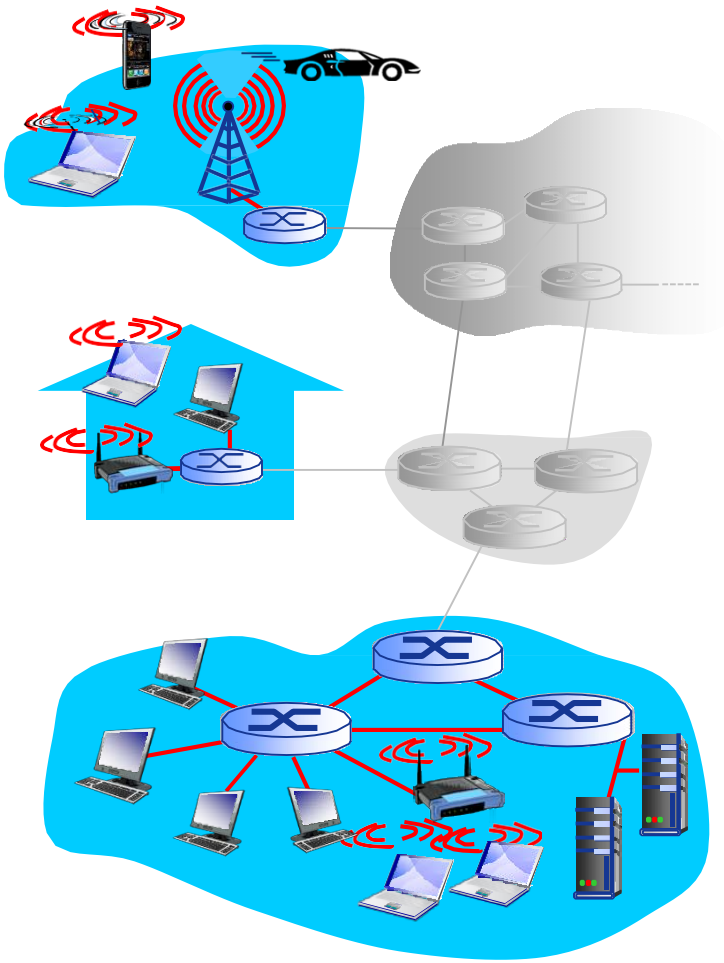
Access Networks and Physical Media

Q: How to connect end systems to edge router?

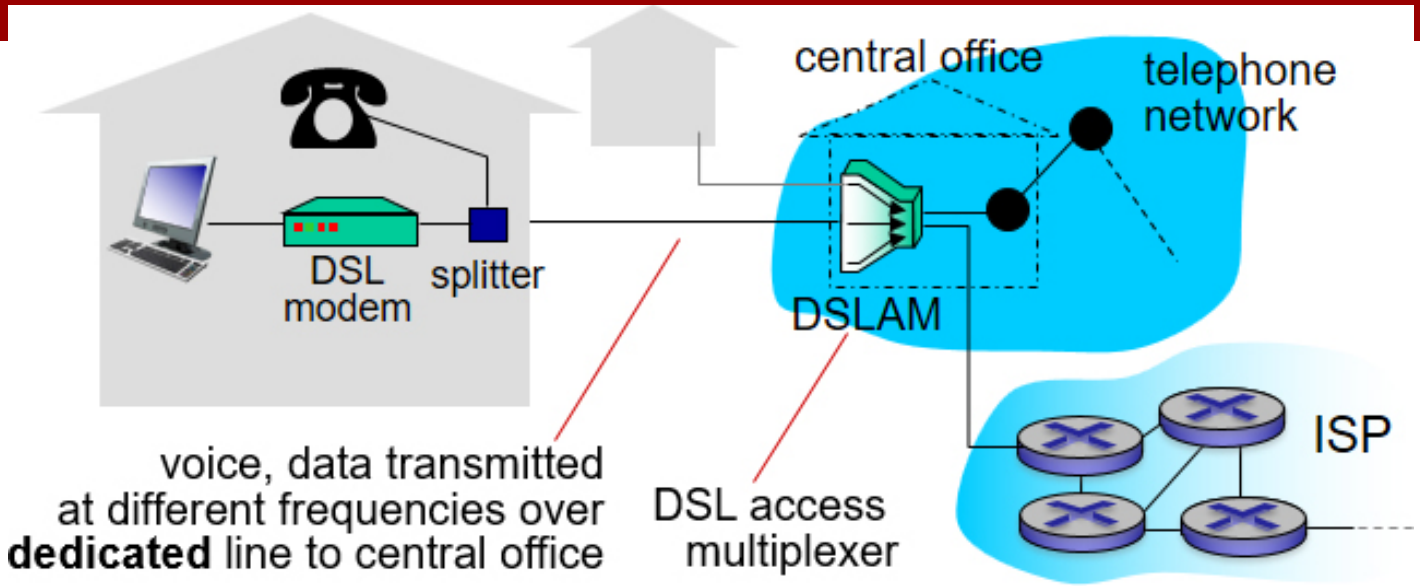
- residential access nets
- institutional access networks (school, company)
- mobile access networks

Users keep in mind:

- bandwidth (bits per second) of access network?
- shared or dedicated?

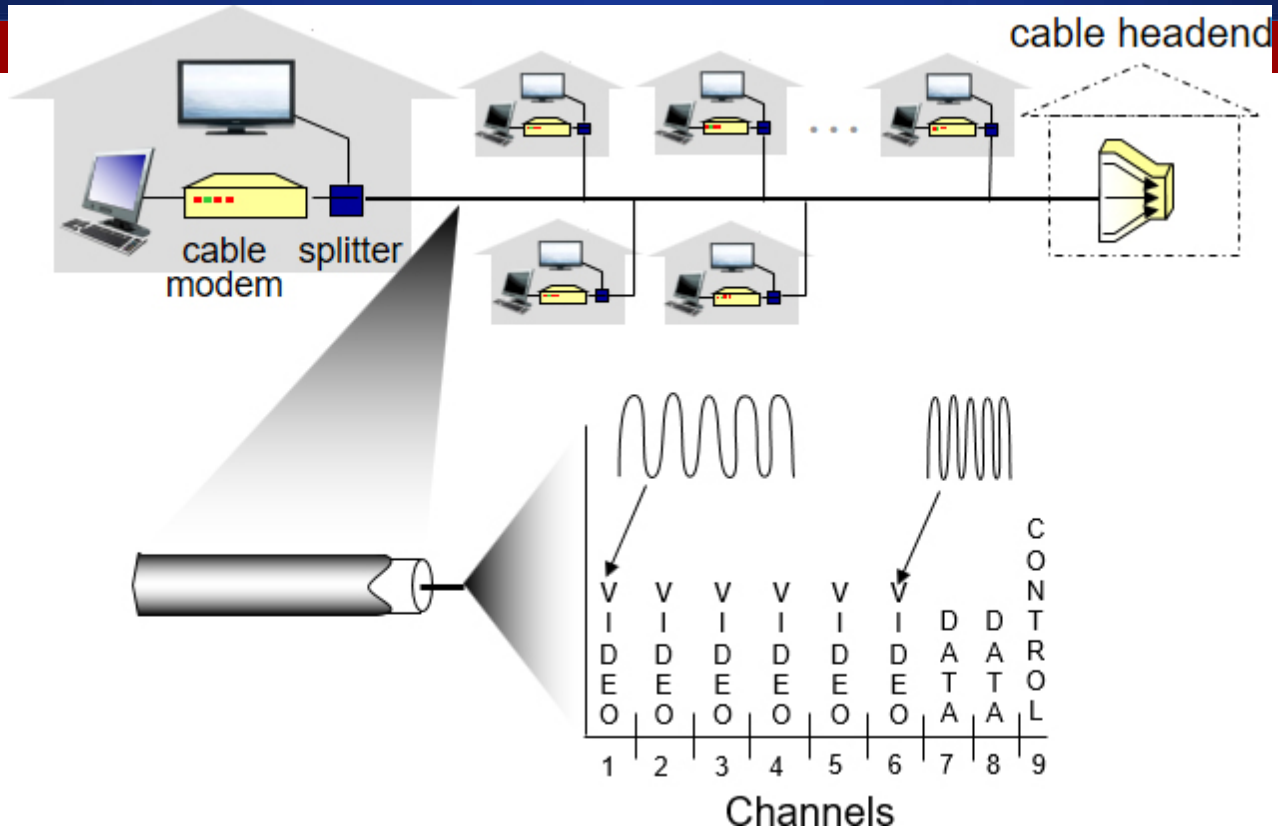


Access Network: Digital Subscriber Line (D S L)



- use **existing** telephone line to central office D S L A M
  data over D S L phone line goes to Internet
  voice over D S L phone line goes to telephone net
- < 2.5 M b p s upstream transmission rate (typically < 1 M b p s)
- < 24 M b p s downstream transmission rate (typically < 10 M b p s)

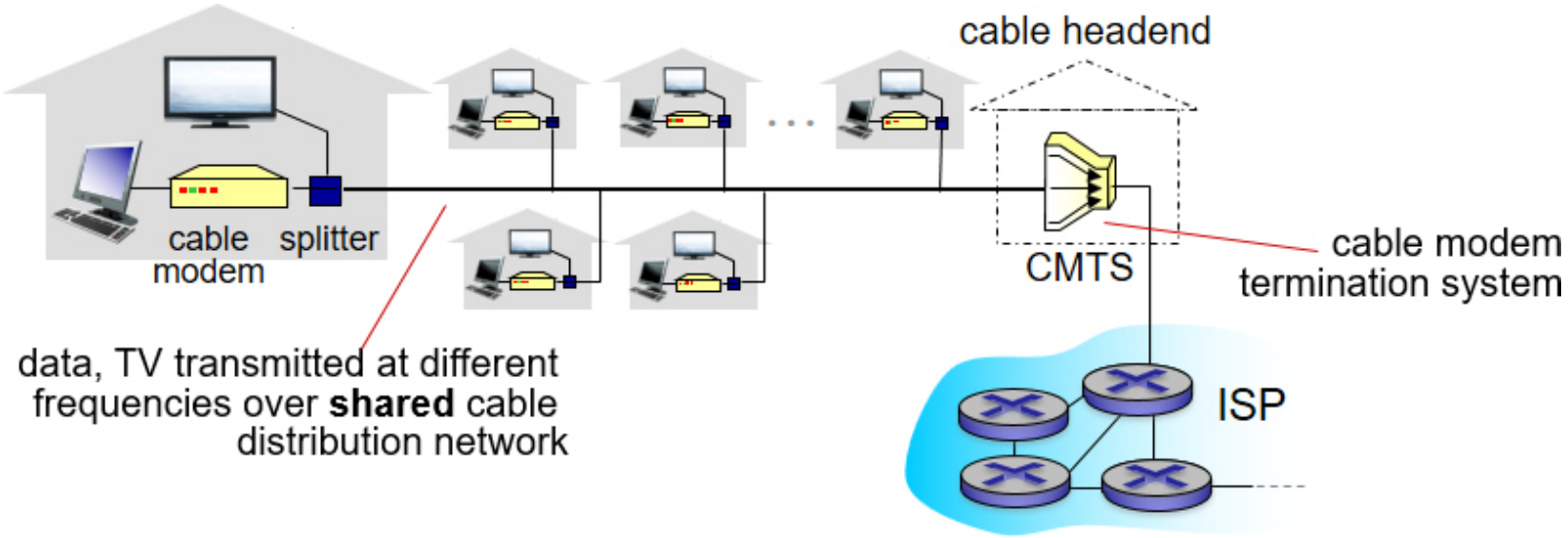
Access Network: Cable Network



frequency division multiplexing: different channels transmitted in different frequency bands

- e.g.: >50 kHz - 1 MHz used for down link
  4 kHz - 50 kHz used for up link
  0 kHz - 4 kHz used for traditional telephone

Access Network: Cable Network



HFC: hybrid fiber coax

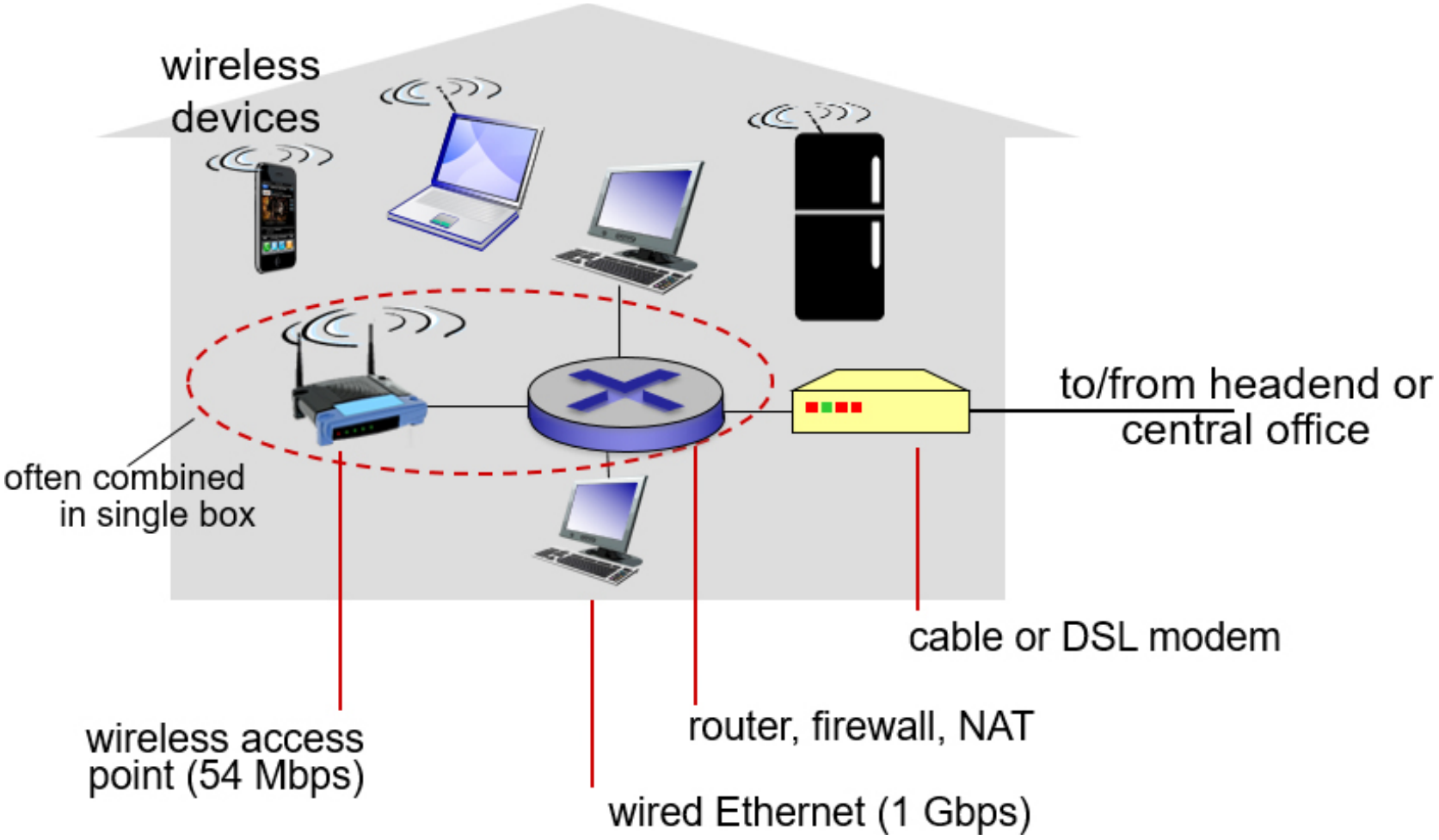
asymmetric: up to 30Mbps downstream transmission rate, 2 Mbps upstream transmission rate

network of cable, fiber attaches homes to ISP router

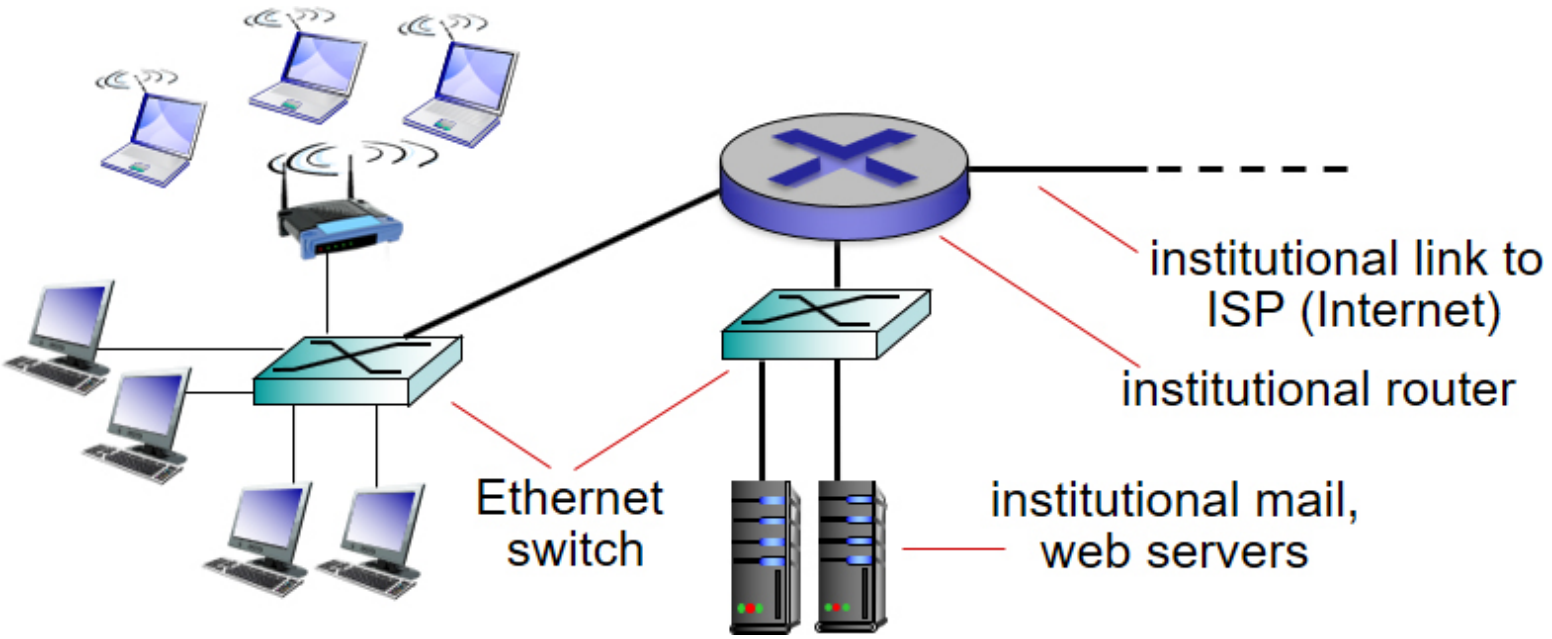
homes **share access network** to cable headend

unlike DSL, which has dedicated access to central office

Access Network: Home Network



Enterprise Access Networks (Ethernet)



- typically used in companies, universities, etc.
- 10 Mbps, 100Mbps, 1Gbps, 10Gbps transmission rates
- today, end systems typically connect into Ethernet switch

Wireless Access Networks (1 of 2)

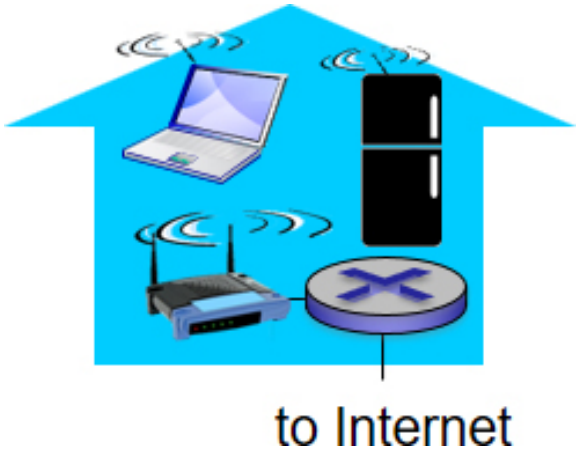
shared wireless access network connects end system to router

via base station aka “access point”

wireless L A Ns:

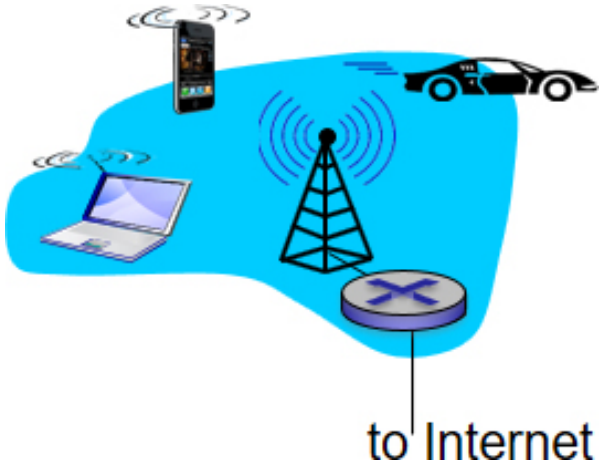
within building (100 ft.)

802.11b/g/n (WiFi): 11, 54, 450 Mbps transmission rate



Wireless Access Networks (2 of 2)

- **wide-area wireless access**
- **provided by telco (cellular) operator, 10's km**
- **between 1 and 10 Mbps**
- **3G, 4G: LTE**



The Core of Network

- Interconnected router network
- The key function of the network core: routing + forwarding

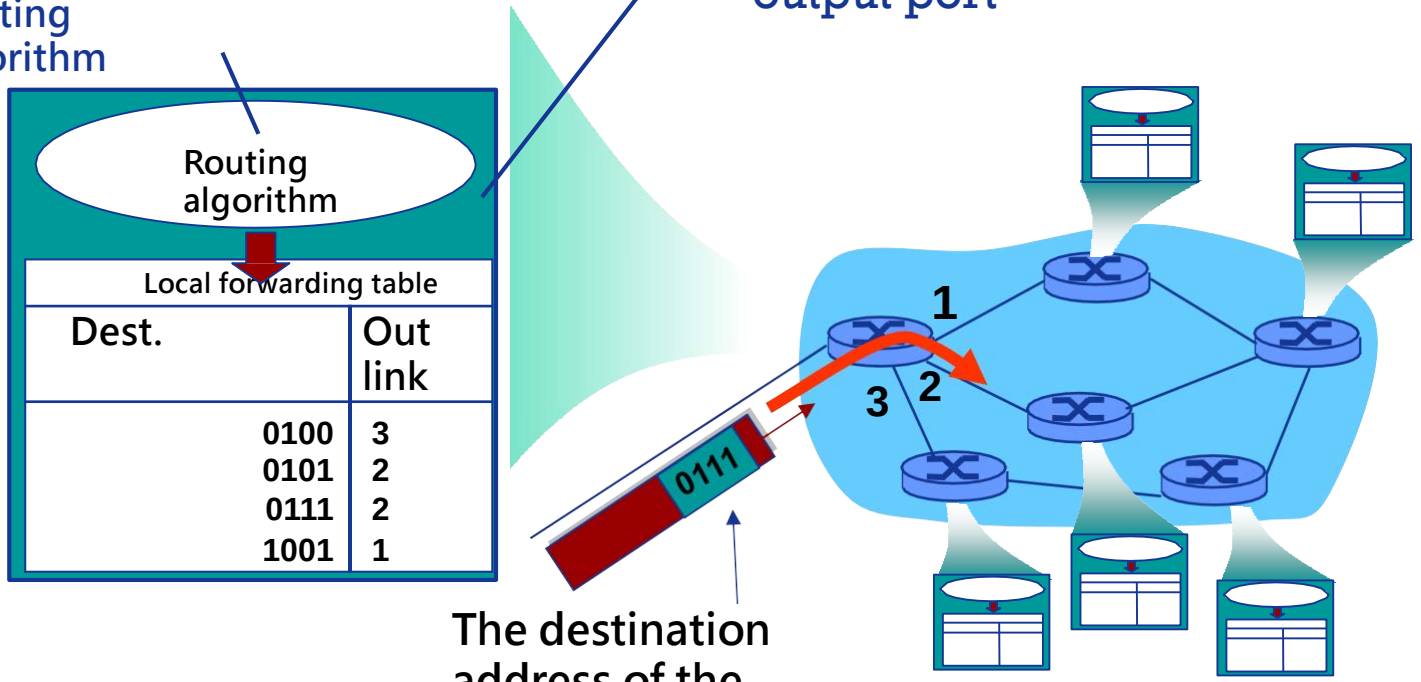
routing:

Determine the transmission path of packets from source to destination

- Routing algorithm

forwarding:

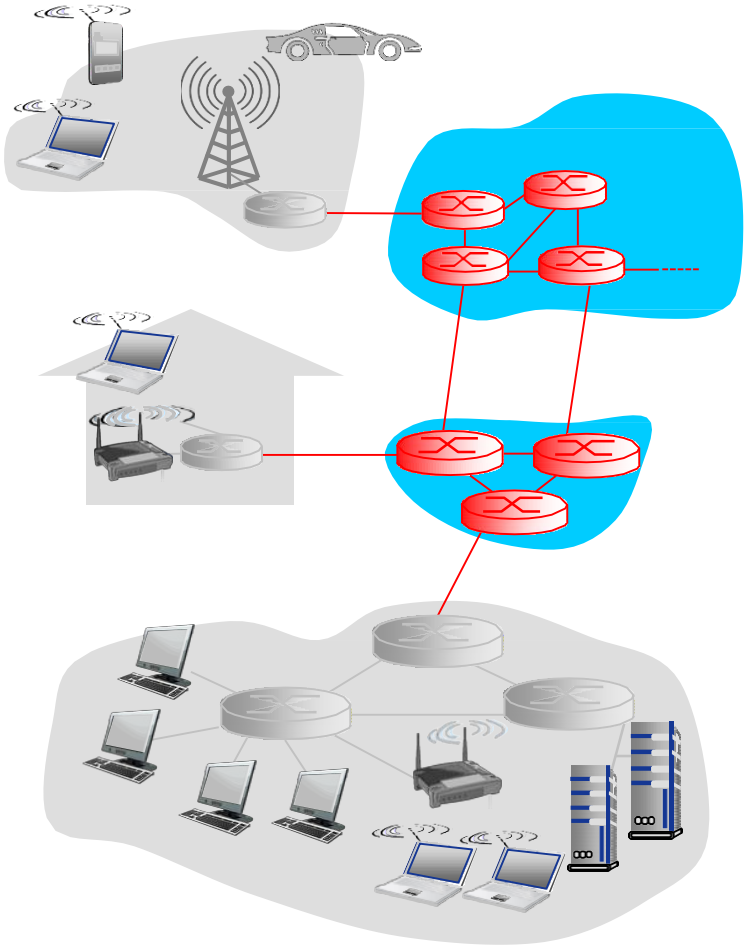
Switch packets from the input port of the router to the correct output port



The Core of Network

The fundamental problem of the core of the network:

- Q: How to realize data from the source host to the destination host through the network core?
- A: **Data exchange**



Thank you!