Computer Networks

Lecture 1: Introduction

Dr. Hossam Mahmoud Moftah

Assistant professor – Faculty of computers and information – Beni Suef University

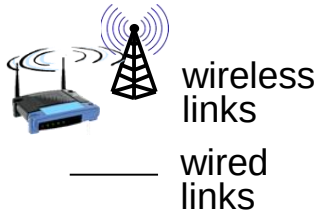
Chapter 1: introduction

overview:

- what's the Internet?
- what's a protocol?
- network edge; hosts, access net, physical media
- network core: packet/circuit switching, Internet structure
- performance: loss, delay, throughput
- security
- protocol layers, service models
- history

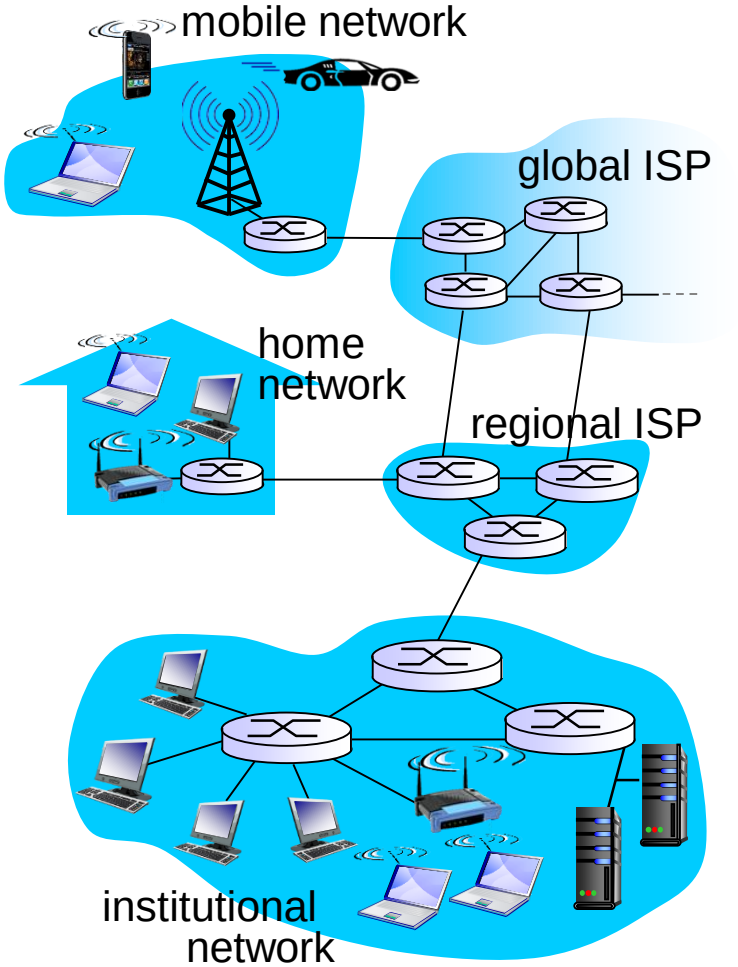
What's the Internet:

- millions of connected computing devices:
  - *hosts* = *end systems*
  - running *network apps*



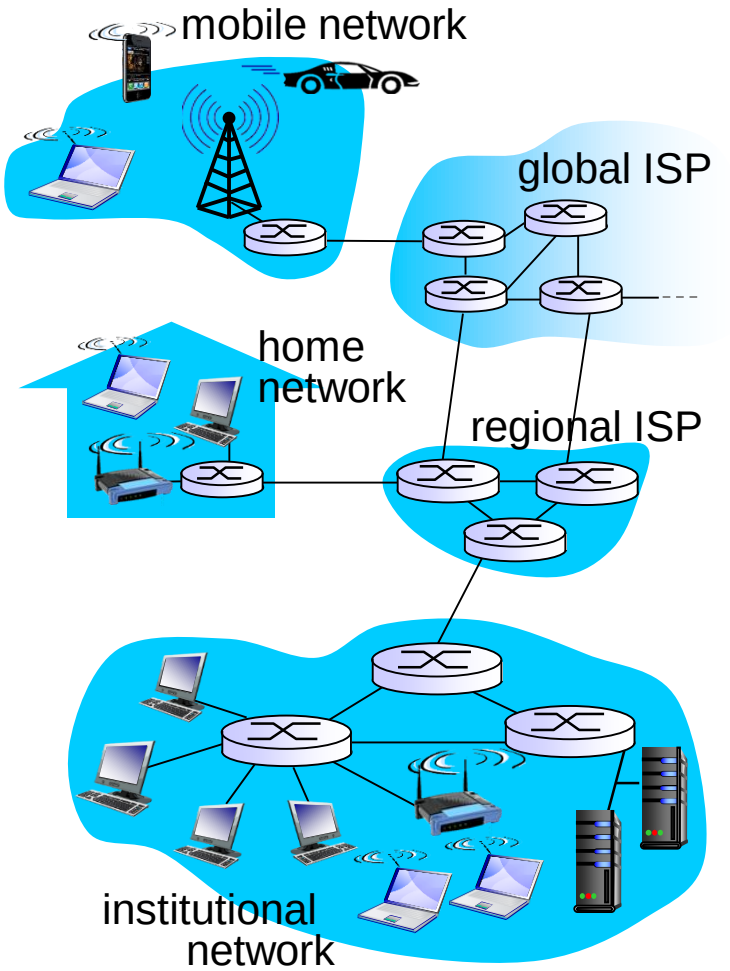
- *communication links*
  - fiber, copper, radio, satellite
  - transmission rate: *bandwidth*

- *Packet switches:* forward packets (chunks of data)
  - *routers* and *switches*



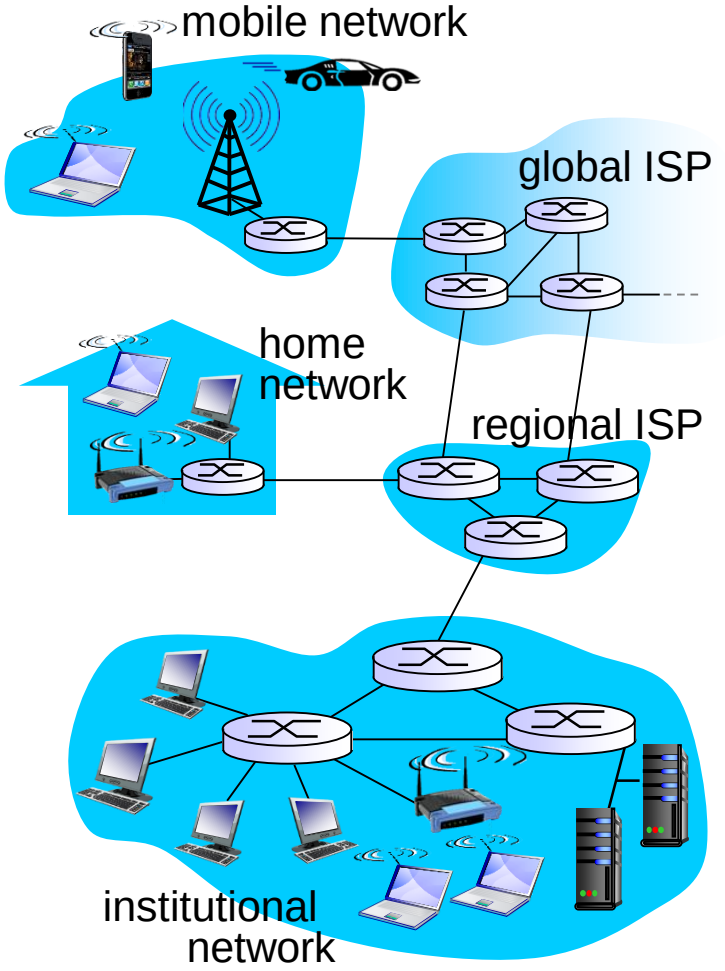
What's the Internet:

- *Internet:* "network of networks"
  - Interconnected ISPs
- *protocols* control sending, receiving of msgs
  - e.g., TCP, IP, HTTP, Skype, 802.11
- *Internet standards*
  - RFC: Request for comments
  - IETF: Internet Engineering Task Force



What's the Internet: a service view

- *Infrastructure that provides services to applications:*
  - Web, VoIP, email, games, e-commerce, social nets, …
- *provides programming interface to apps*
  - allows sending and receiving app programs to "connect" to Internet
  - provides service options, analogous to postal service



What's a protocol?

human protocols:

- "what's the time?"
- "I have a question"

… specific msgs sent

… specific actions taken when msgs received, or other events

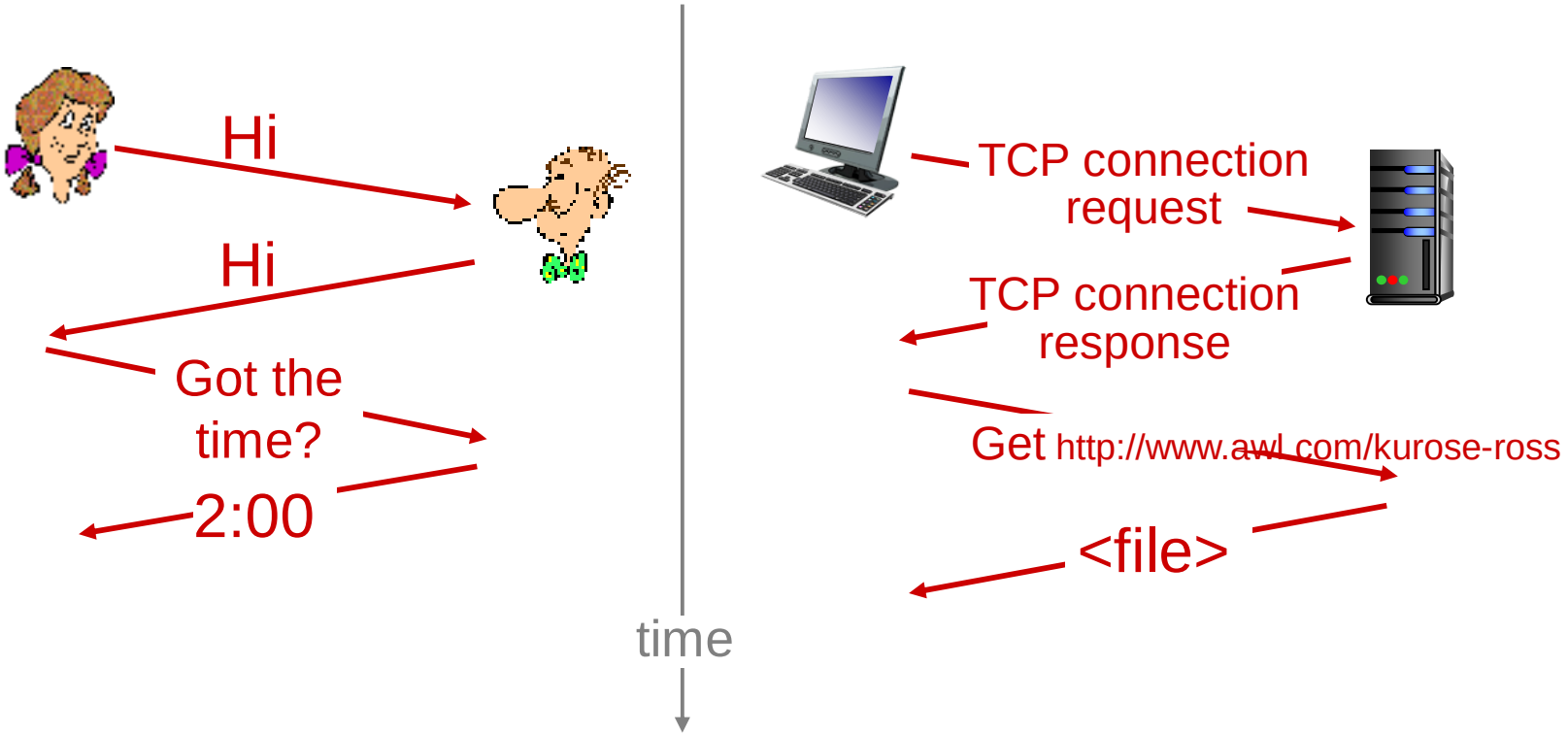
network protocols:

- machines rather than humans
- all communication activity in Internet governed by protocols

protocols define format, order of msgs sent and received among network entities, and actions taken on msg transmission, receipt

What's a protocol?

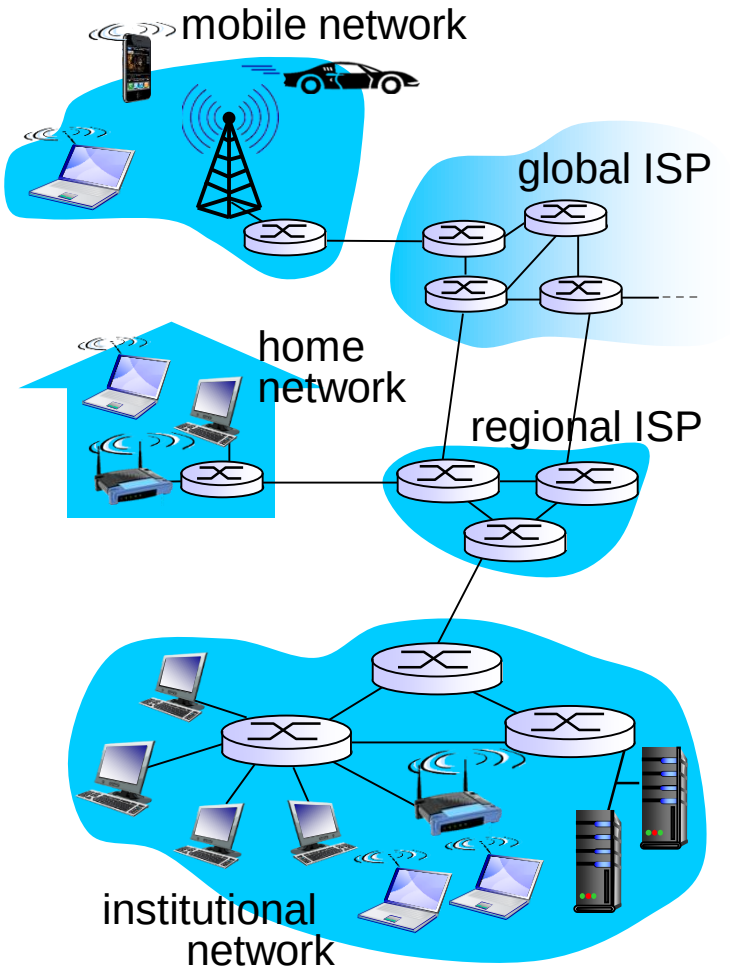
a human protocol and a computer network protocol:



Q: other human protocols?

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



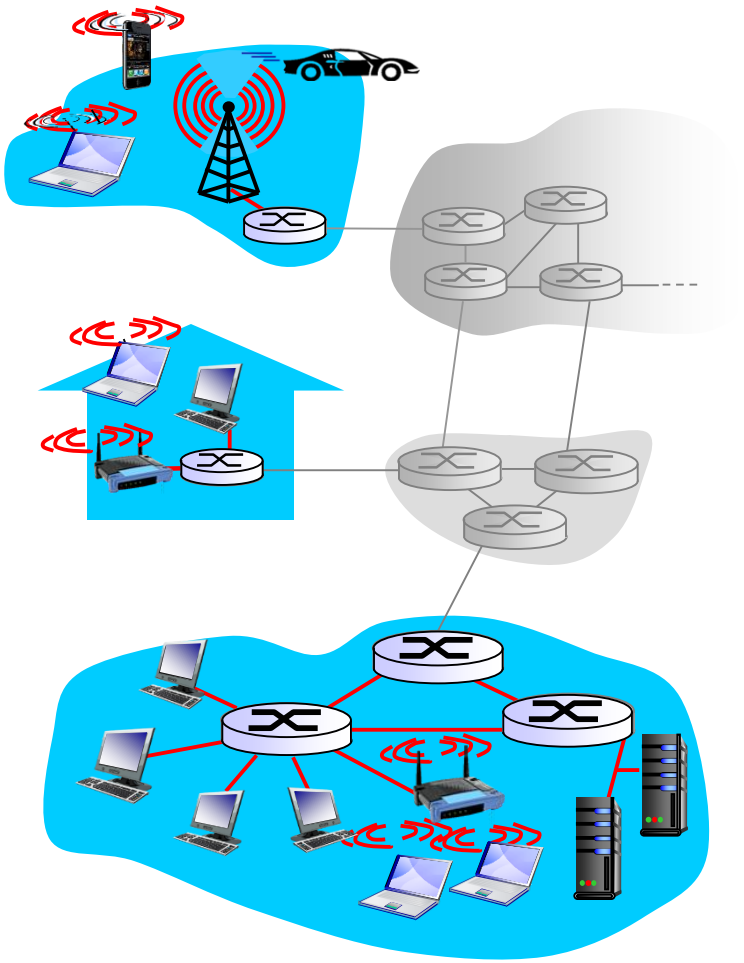
Access networks and physical media

Q: How to connect end systems to edge router?

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

keep in mind:

- bandwidth (bits per second) of access network?
- shared or dedicated?
- How sharing is done?



Access networks and physical media

shared vs. dedicated?

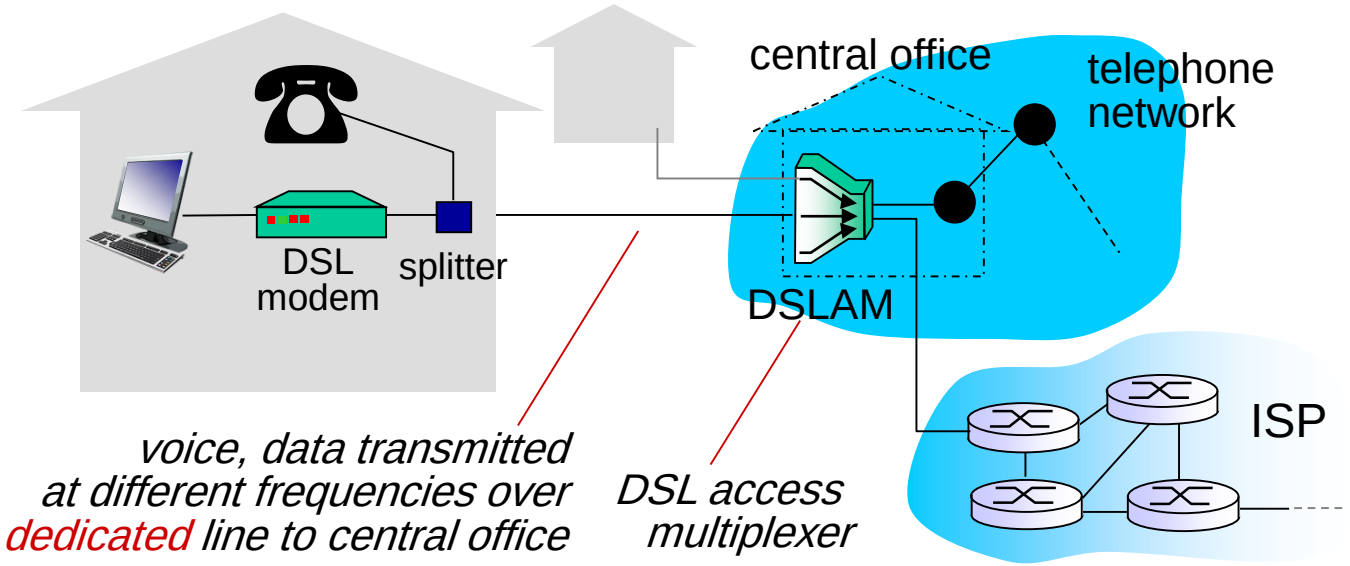
- **Sites Hosted on the Server:** With a shared hosting package, there are other sites that are hosted on the server along with your website. A dedicated hosting plan means that your website is the only site hosted on the server.
- **Bandwidth or Disk Space:** With shared hosting, the amount of disk space and bandwidth you are allotted is limited because there are others sharing the server. You will be charged if you surpass you allotted amount. With dedicated hosting, bandwidth and disk space are dedicated to you only so there is no sharing and no limitations on the amount of space available space.
- **Costs:** With shared hosting, server resources are shared among several users, so operating costs are divided up among the users making it cheaper. Because a dedicated server is dedicated solely to one user, it cost more.

Access networks and physical media

shared vs. dedicated?

- **Required Technical Skills:** With shared hosting, you will not require much technical skills as maintenance and security are managed by the shared hosting provider.
- **Server Performance and Response Time:** On shared hosting, with other sharing the same resources, allot of traffic can be generated which could drain resources such as bandwidth which could lead to slow response time and slow loading time.

Access net: digital subscriber line (DSL)

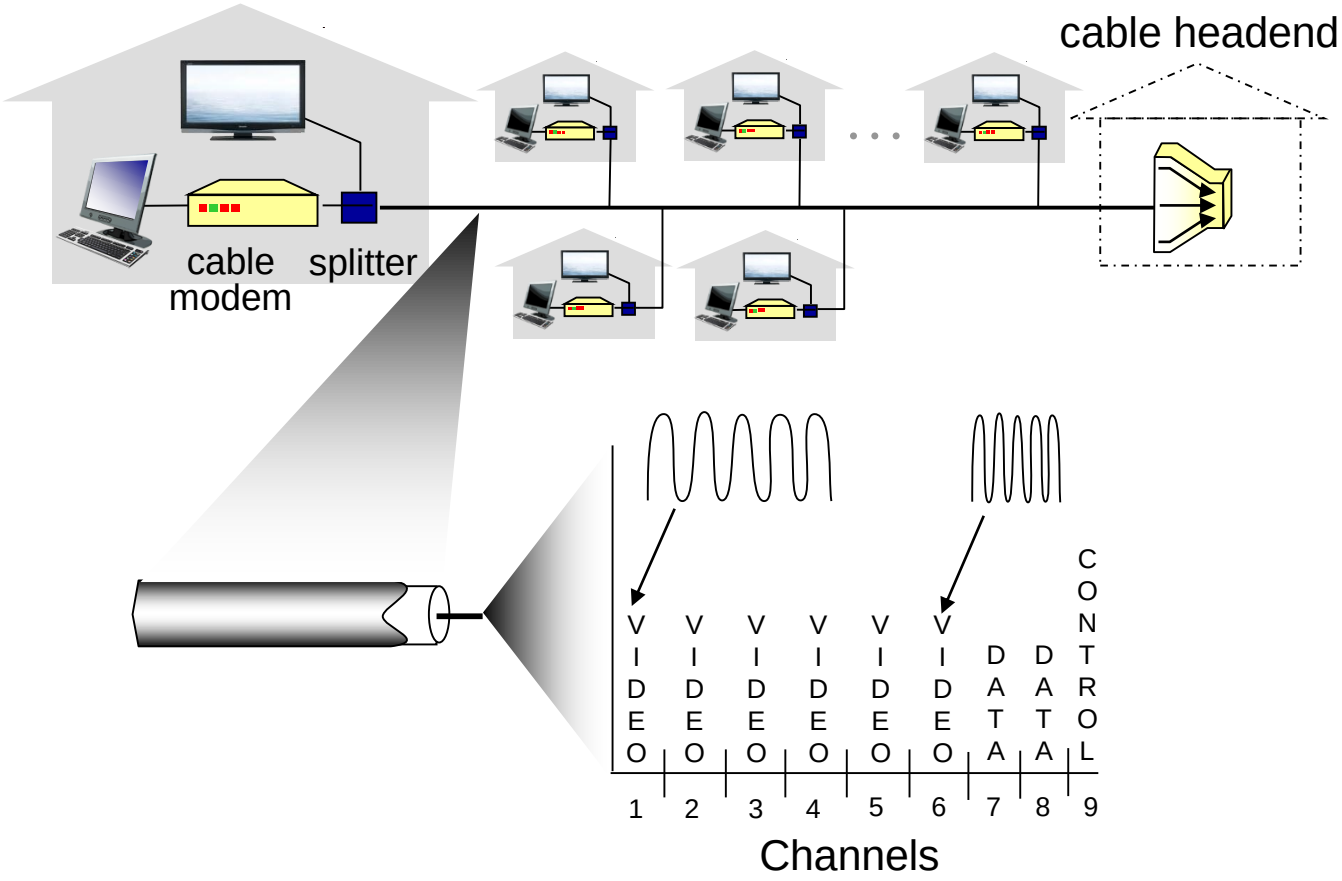


- use *existing* telephone line to central office DSLAM
  - data over DSL phone line goes to Internet
  - voice over DSL phone line goes to telephone net
- < 2.5 Mbps upstream transmission rate (typically < 1 Mbps)
- < 24 Mbps downstream transmission rate (typically < 10 Mbps)

Access net: digital subscriber line (DSL)

- In telecommunications generally, a transmission from an information server toward an end user is referred to as downstream and a transmission toward the server is referred to as upstream.
- In DSL, downstream data rates are higher since the kind of information that needs to get to the user (including still and video images and sound) requires a higher data rate.
- User responses back to the computer on the upstream path can be smaller since they are usually text-only.

Access net: cable network



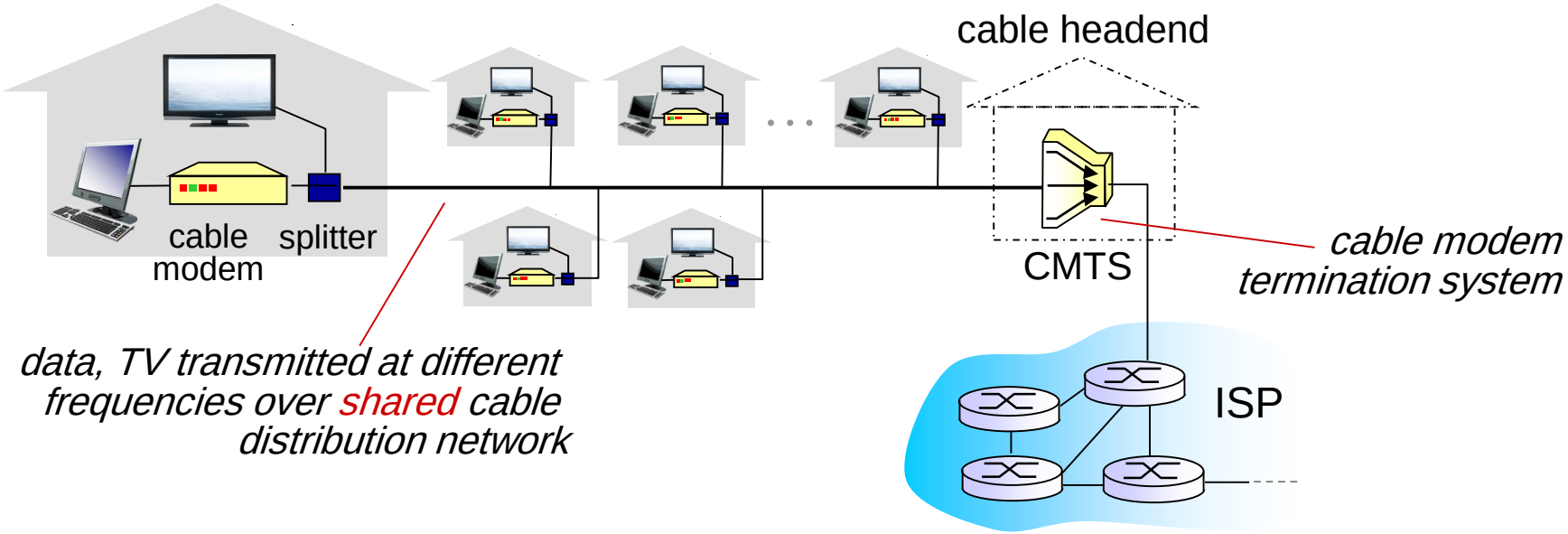
frequency division multiplexing: different channels transmitted in different frequency bands

Access net: cable network

frequency division multiplexing (FDM) is a technique by which the total bandwidth available in a communication medium is divided into a series of non-overlapping frequency sub-bands, each of which is used to carry a separate signal.

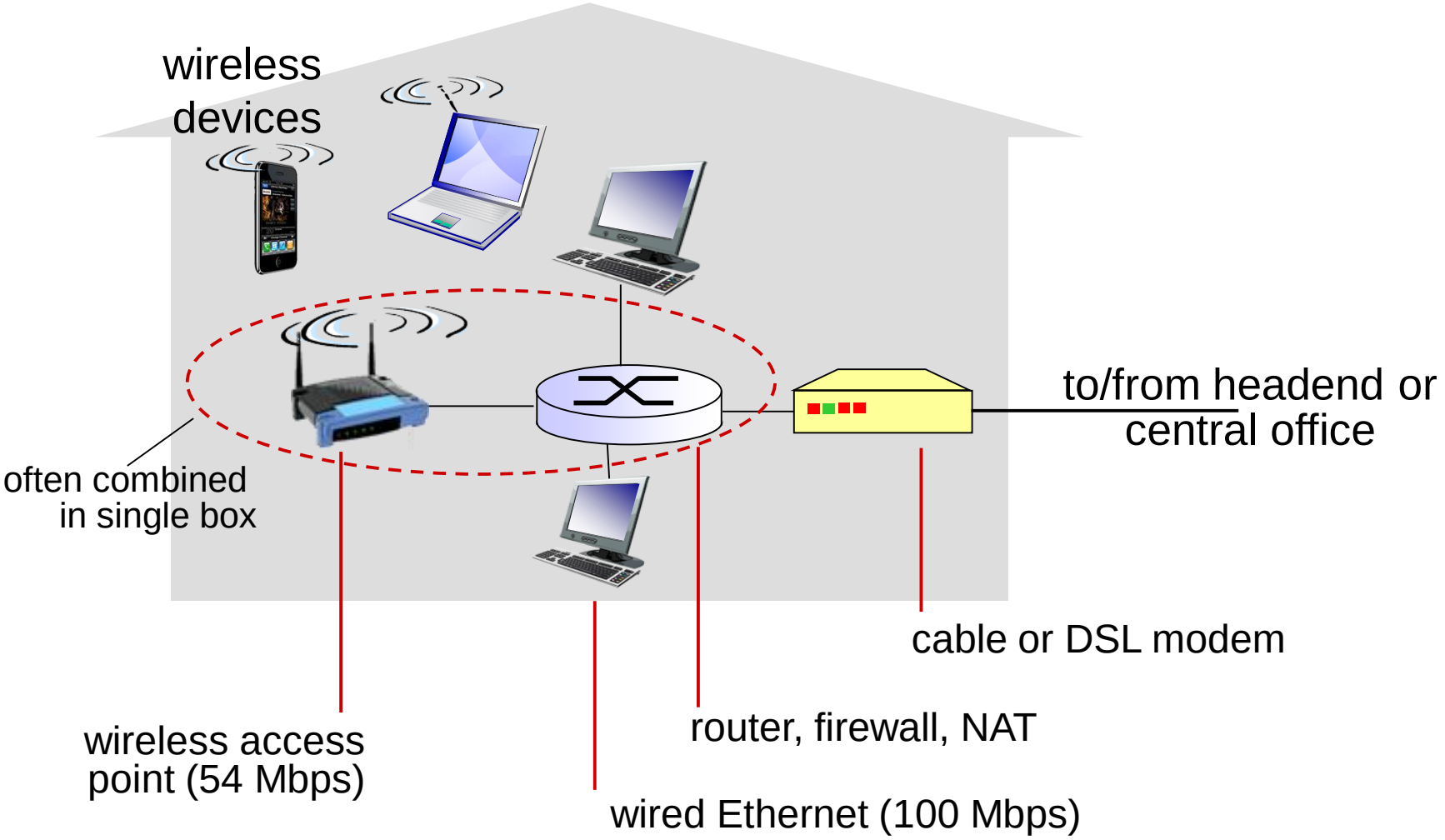
Example: radio and television broadcasting

Access net: cable network



- 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
- HFC: hybrid fiber coax (combines optical fiber and coaxial cable.)
  - asymmetric: up to 30Mbps downstream transmission rate, 2 Mbps upstream transmission rate

Access net: home network



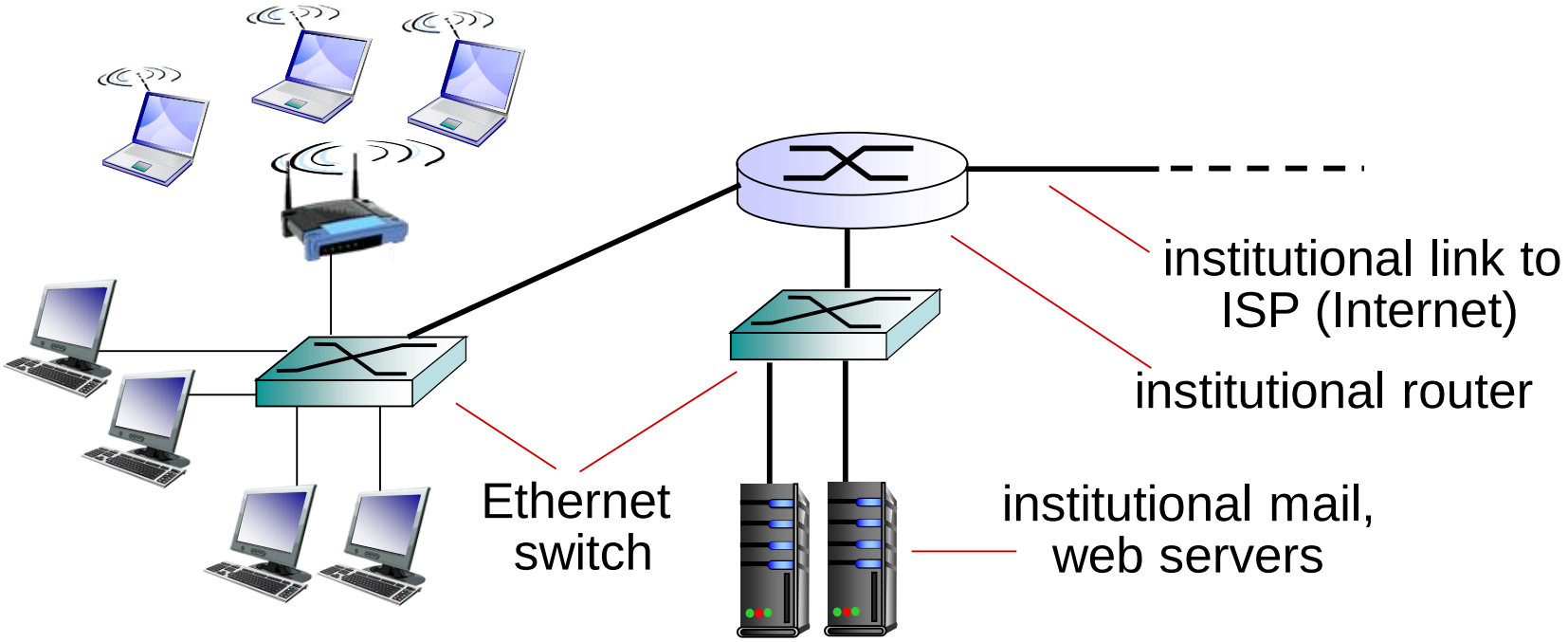
Access net: home network

- A digital subscriber line (DSL) modem is a device used to connect a computer or router to a telephone line which provides the digital subscriber line service for connectivity to the Internet, which is often called DSL broadband.

- A wireless Access Point (AP) is a device that allows wireless devices to connect to a wired network using Wi-Fi, or related standards. The AP usually connects to a router (via a wired network) as a standalone device, but it can also be an integral component of the router itself.

- A **router** is a device that forwards data packets along networks. A **router** is connected to at least two networks, commonly two LANs or WANs or a LAN and its ISP's network.

Enterprise access networks (Ethernet)



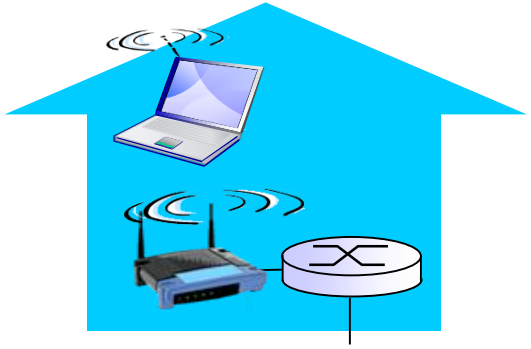
- Ethernet : a system for connecting a number of computer systems to form a local area network, with protocols to control the passing of information and to avoid simultaneous transmission by two or more systems.
- typically used in companies, universities, etc
- 10 Mbps, 100Mbps, 1Gbps, 10Gbps transmission rates
- today, end systems typically connect into Ethernet switch

Wireless access networks

- shared *wireless* access network connects end system to router
  - via base station aka "access point"

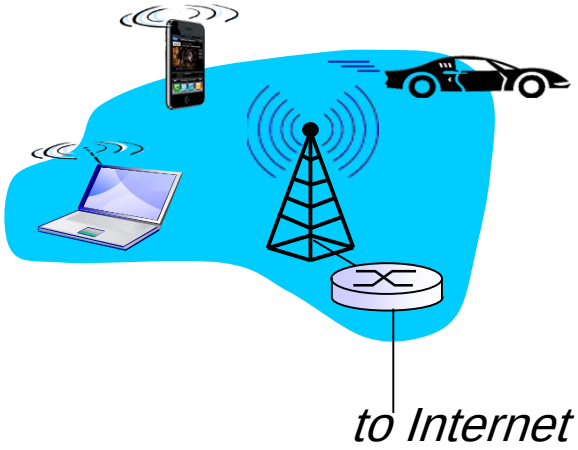
wireless LANs:

- within building (100 ft)
- 802.11b/g (WiFi): 11, 54 Mbps transmission rate



wide-area wireless access

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



The End