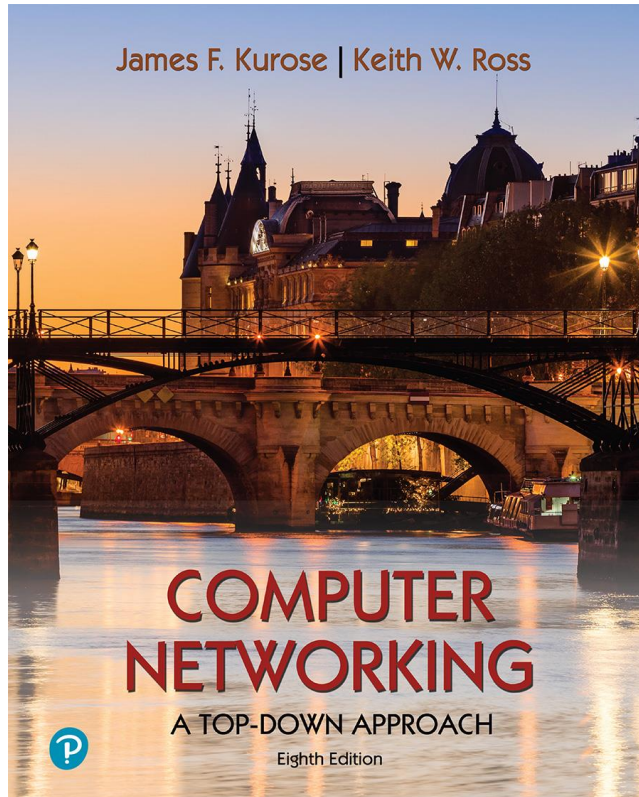


# Chapter 1

## Introduction



### *Computer Networking: A Top-Down Approach*

8<sup>th</sup> edition

Jim Kurose, Keith Ross

Pearson, 2020

# Chapter 1: introduction

## *Chapter goal:*

- Get “feel,” “big picture,” introduction to terminology
  - more depth, detail *later* in course
- Approach:
  - use Internet as example

## *Overview/roadmap:*

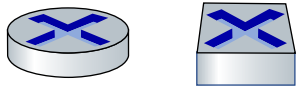
- What *is* the Internet?
- What *is* a protocol?
- **Network edge:** hosts, access network, physical media
- **Network core:** packet/circuit switching, internet structure
- **Performance:** loss, delay, throughput
- Security
- Protocol layers, service models

# The Internet: a “nuts and bolts” view



Billions of connected computing *devices*:

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



*Packet switches*: forward packets (chunks of data)

- *routers, switches*

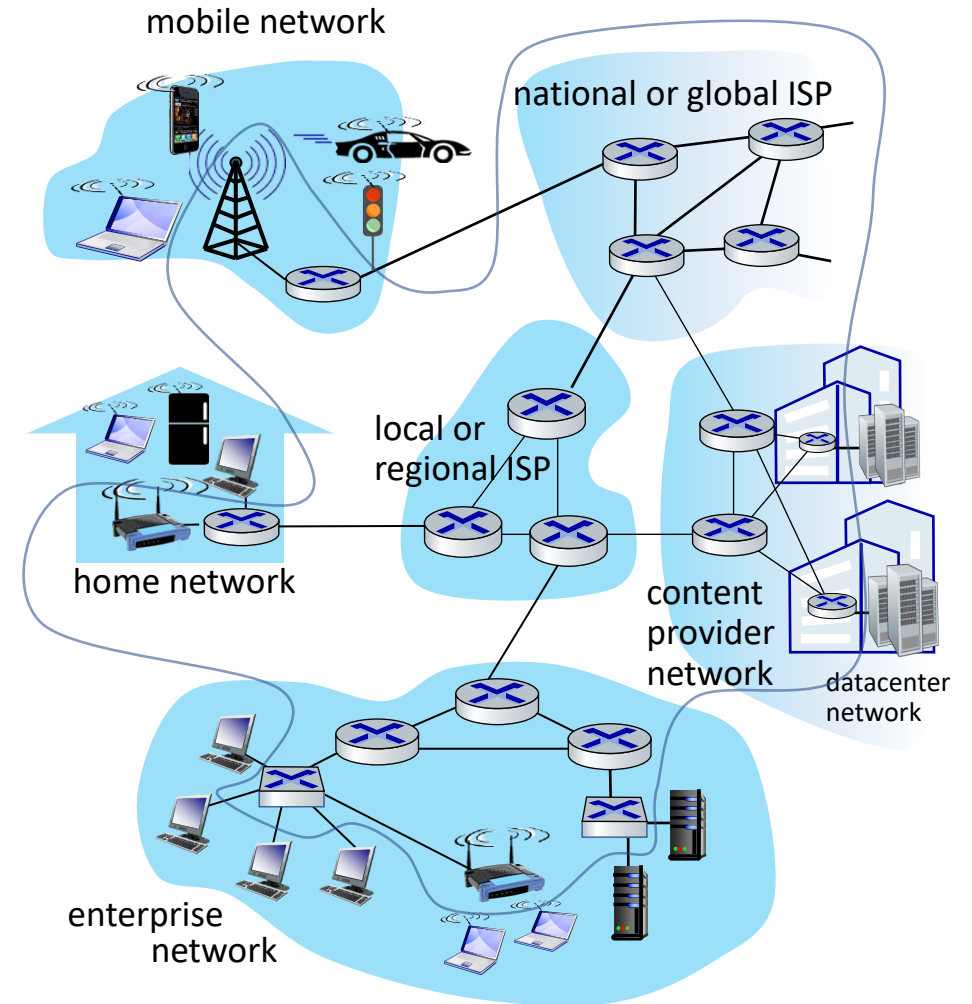
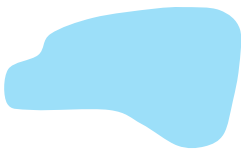
*Communication links*

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



*Networks*

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



# “Fun” Internet-connected devices



Amazon Echo



Internet refrigerator



IP picture frame



Pacemaker & Monitor



Tweet-a-watt:  
monitor energy use



Security Camera



Slingbox: remote  
control cable TV



Web-enabled toaster +  
weather forecaster



AR devices

Internet phones



sensorized,  
bed  
mattress

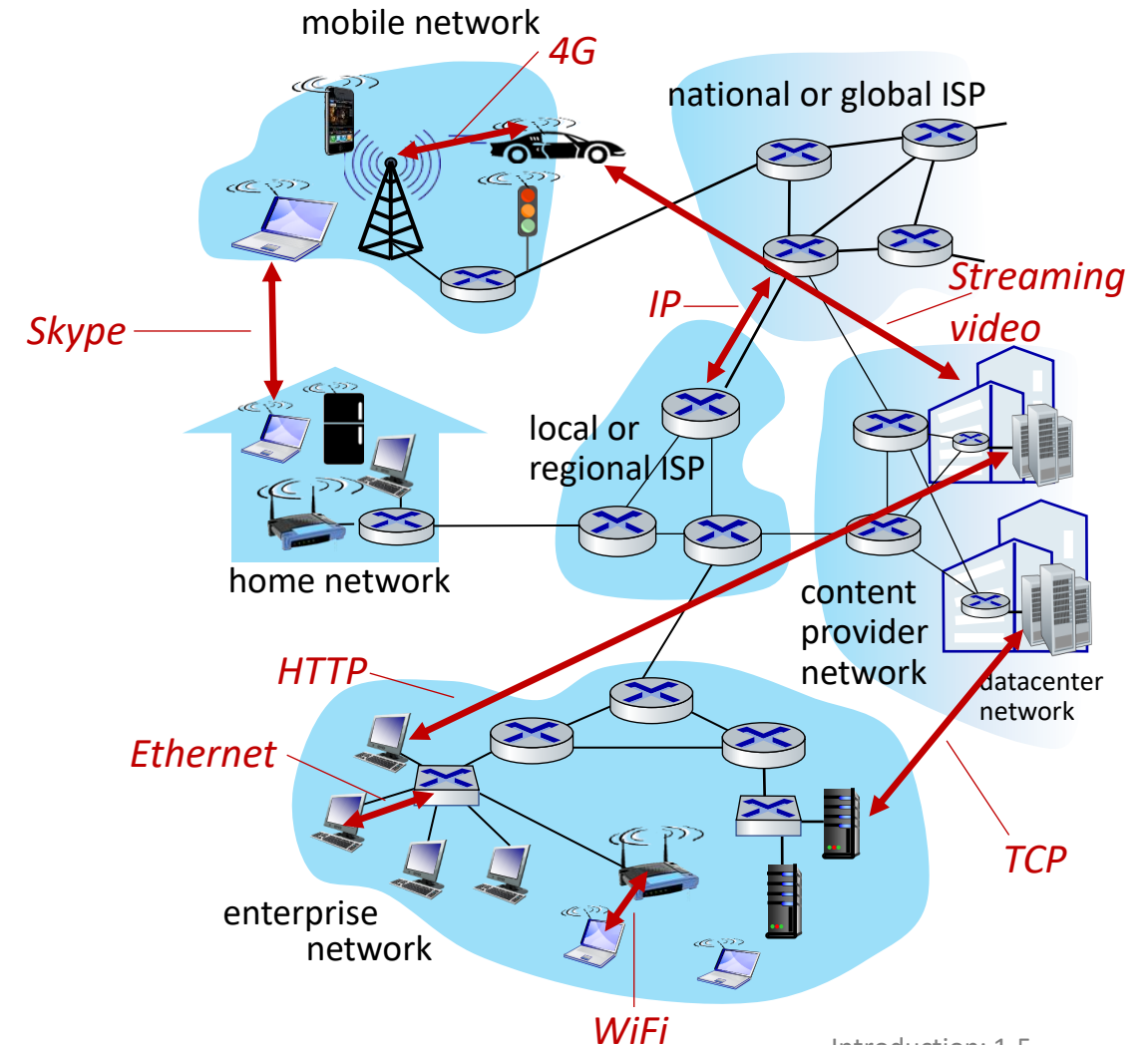


Fitbit

*Others?*

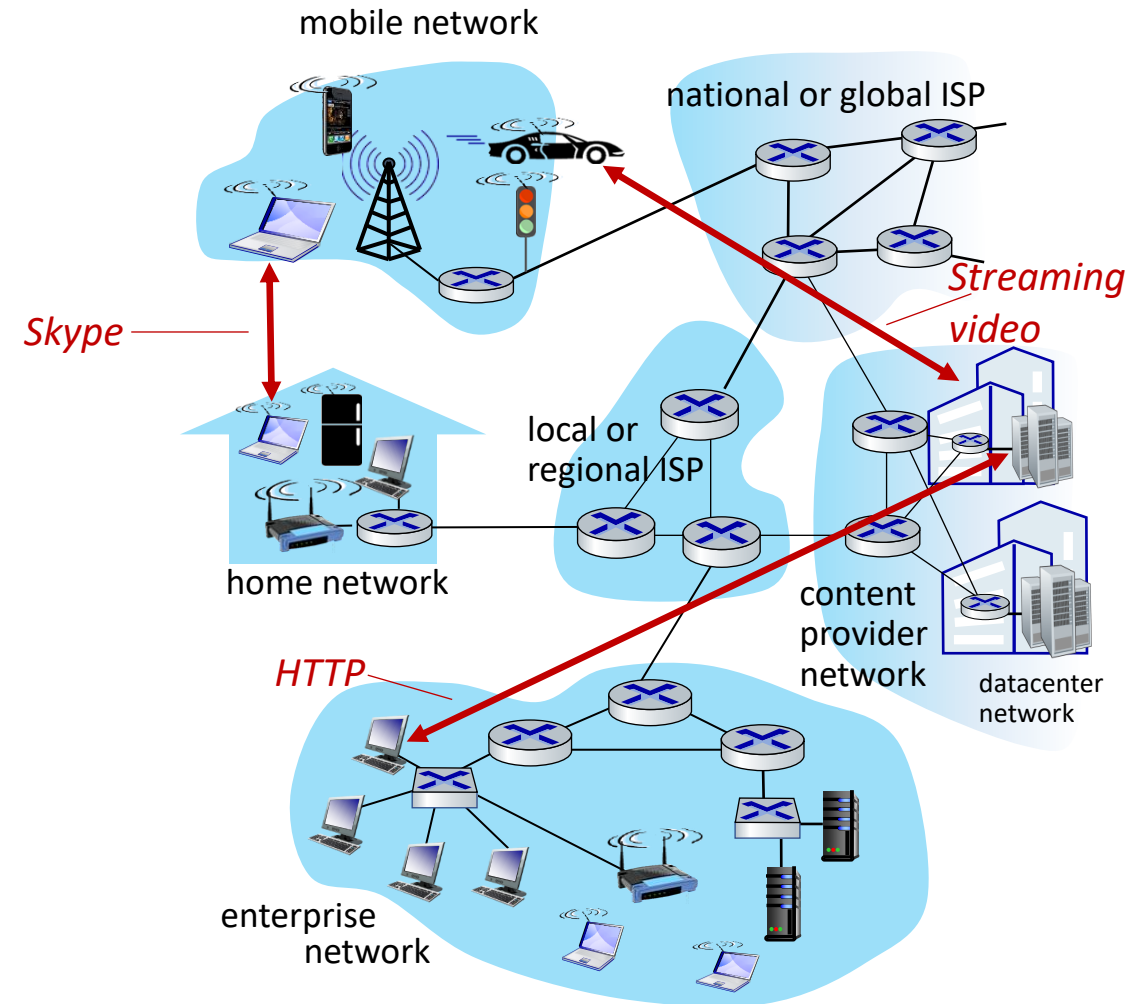
# The Internet: a “nuts and bolts” view

- *Internet: “network of networks”*
  - Interconnected ISPs
- *protocols are everywhere*
  - control sending, receiving of messages
  - e.g., HTTP (Web), streaming video, Skype, TCP, IP, WiFi, 4G, Ethernet
- *Internet standards*
  - RFC: Request for Comments
  - IETF: Internet Engineering Task Force



# The Internet: a “service” view

- *Infrastructure* that provides services to applications:
  - Web, streaming video, multimedia teleconferencing, email, games, e-commerce, social media, inter-connected appliances, ...
- provides *programming interface* to distributed applications:
  - “hooks” allowing sending/receiving apps to “connect” to, use Internet transport service
  - provides service options, analogous to postal service





# What's a protocol?

## *Human protocols:*

- “what’s the time?”
- “I have a question”
- introductions

... specific messages sent

... specific actions taken  
when message received,  
or other events

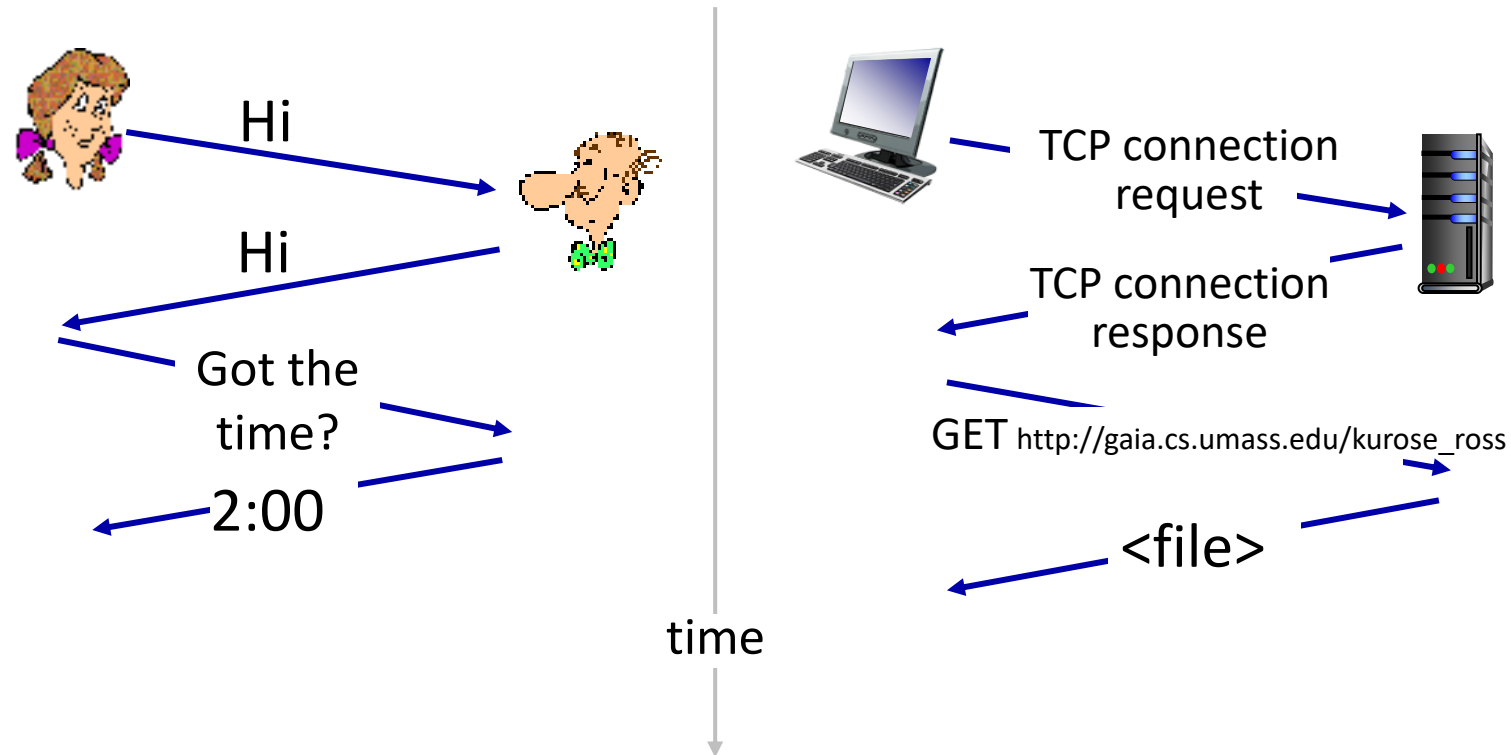
## *Network protocols:*

- computers (devices) rather than humans
- all communication activity in Internet governed by protocols

*Protocols define the **format, order** of  
**messages 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:





# Chapter 1: roadmap

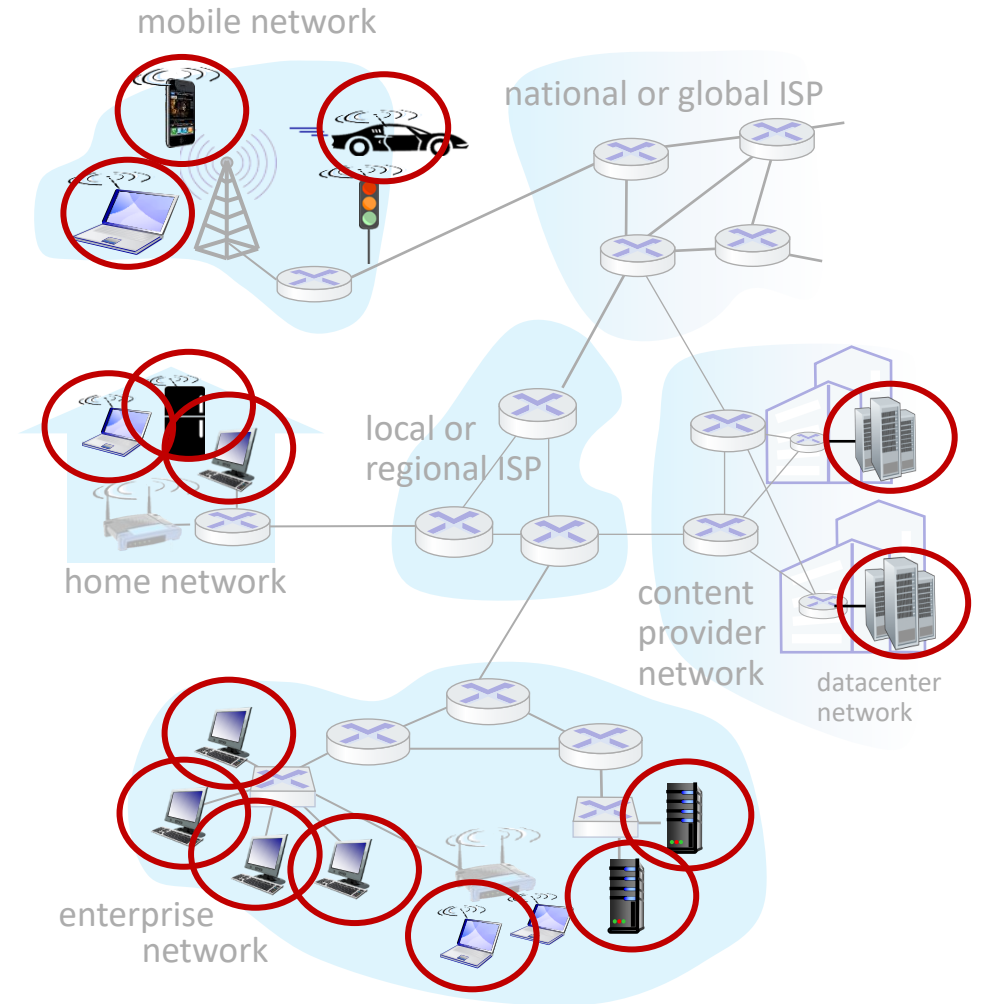
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- History



# A closer look at Internet structure

## Network edge:

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



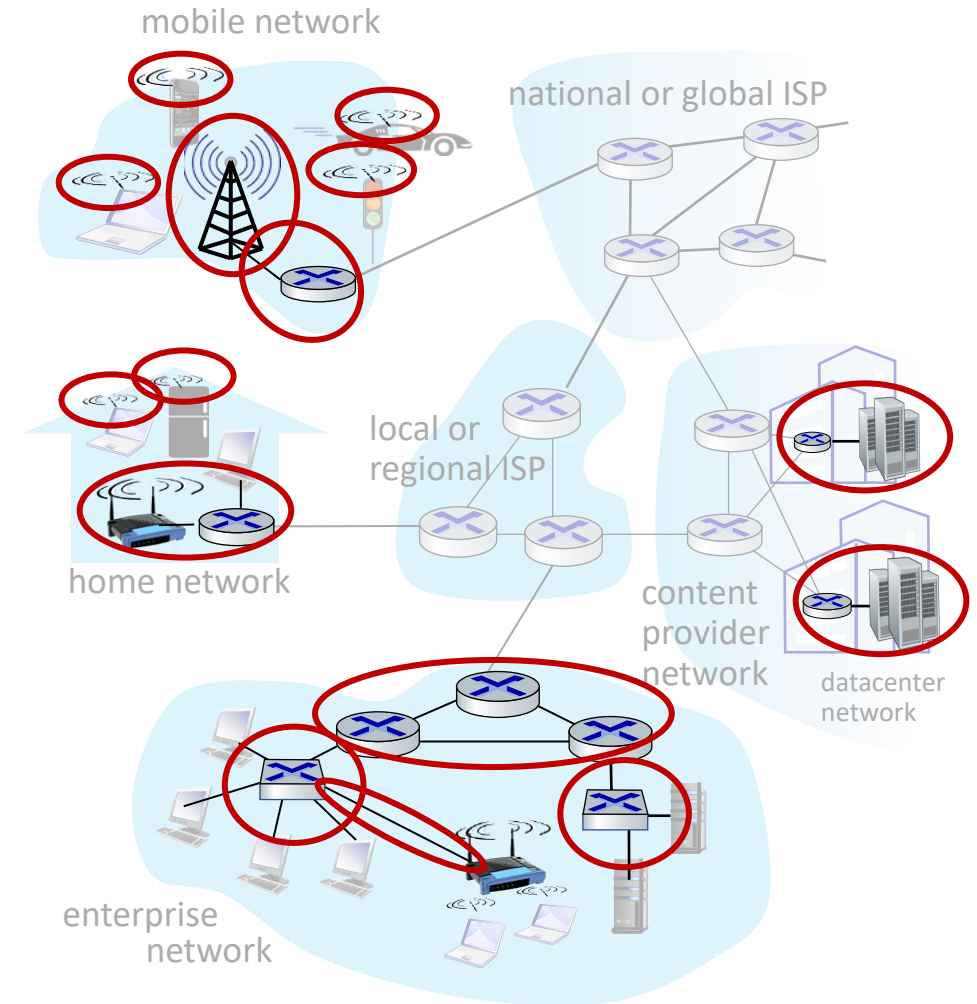
# A closer look at Internet structure

## Network edge:

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

## Access networks, physical media:

- wired, wireless communication links



# A closer look at Internet structure

## Network edge:

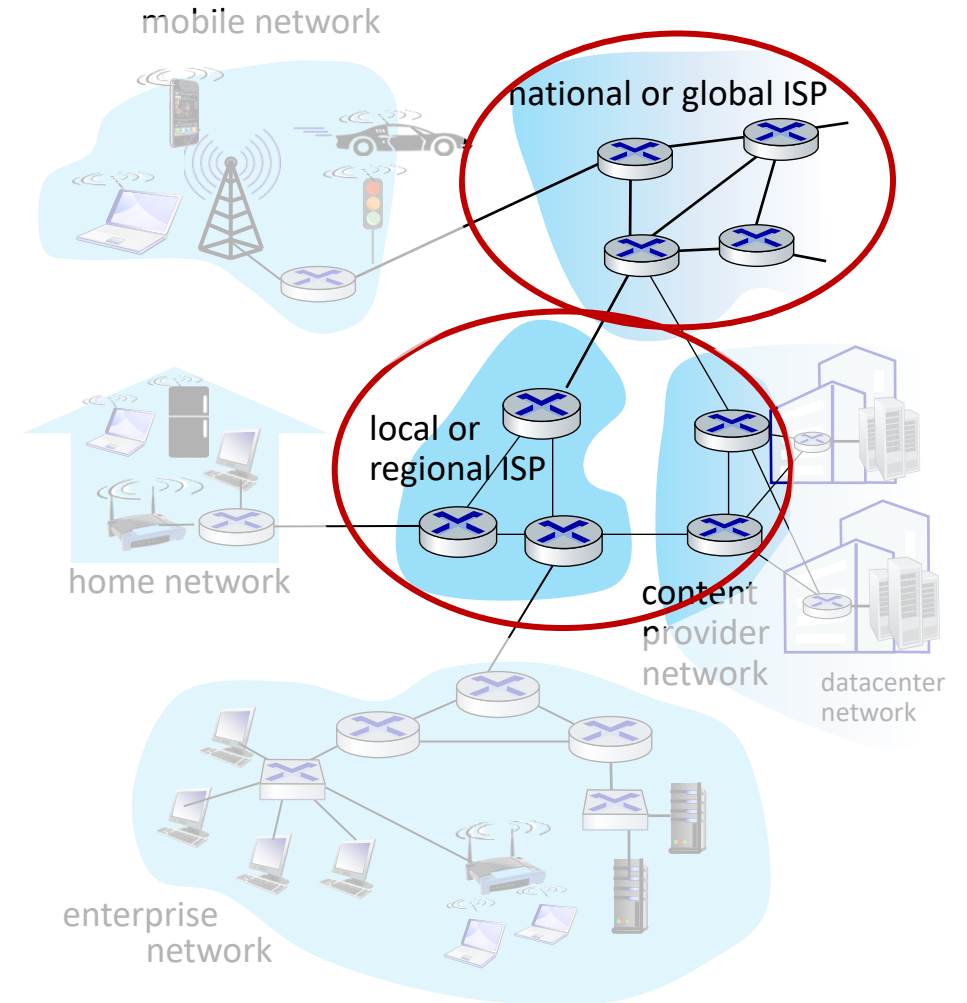
- hosts: clients and servers
- servers often in data centers

## Access networks, physical media:

- wired, wireless communication links

## Network core:

- interconnected routers
- network of networks



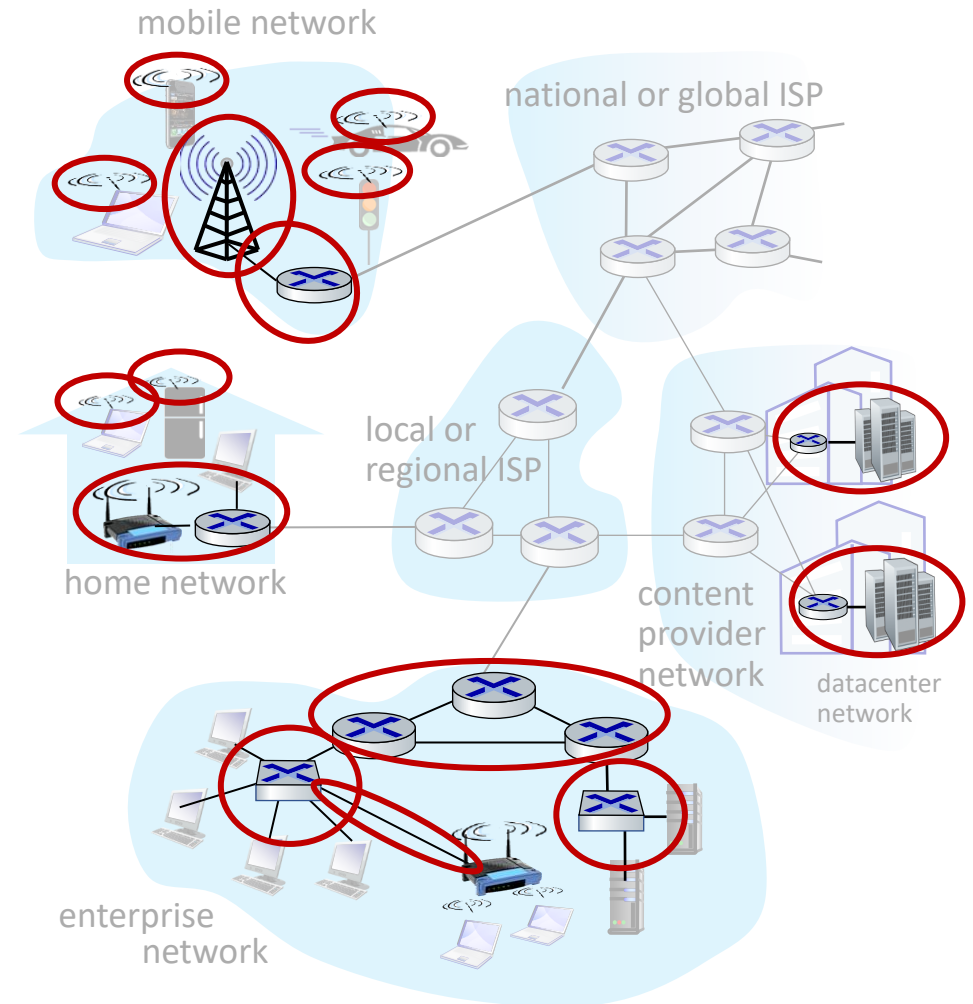
# Access networks and physical media

*Q: How to connect end systems to edge router?*

- residential access nets
- institutional access networks (school, company)
- mobile access networks (WiFi, 4G/5G)

*What to look for:*

- transmission rate (bits per second) of access network?
- shared or dedicated access among users?



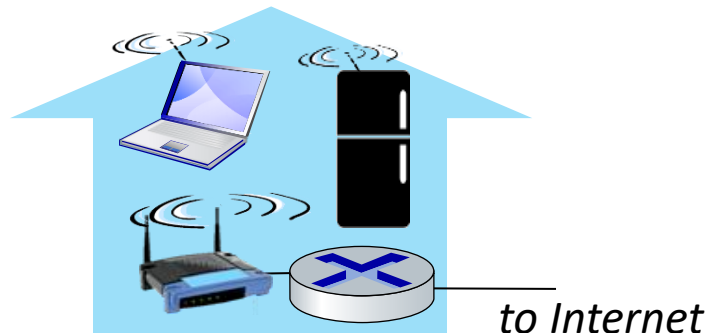
# Wireless access networks

Shared *wireless* access network connects end system to router

- via base station aka “access point”

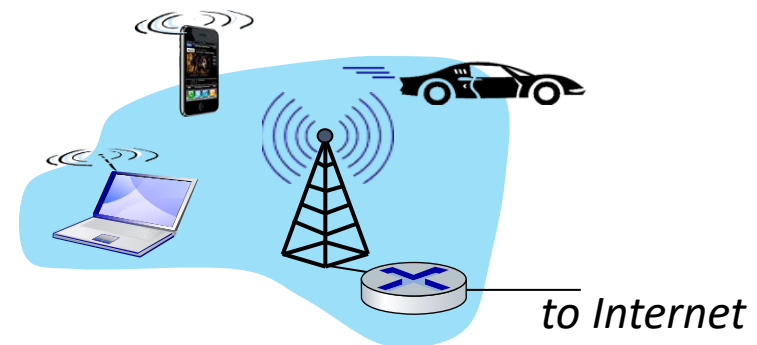
## Wireless local area networks (WLANs)

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

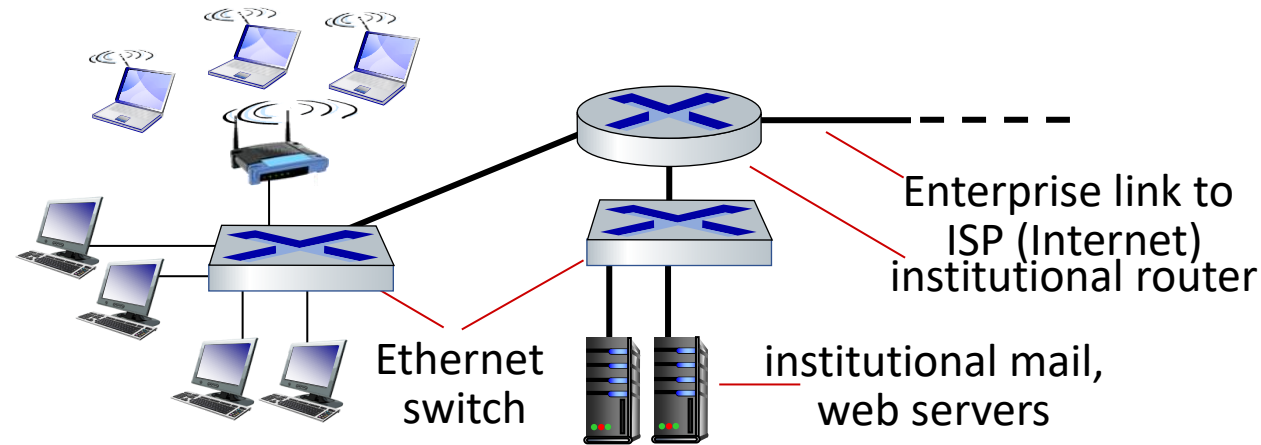


## Wide-area cellular access networks

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



# 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