

Chapter I

Introduction

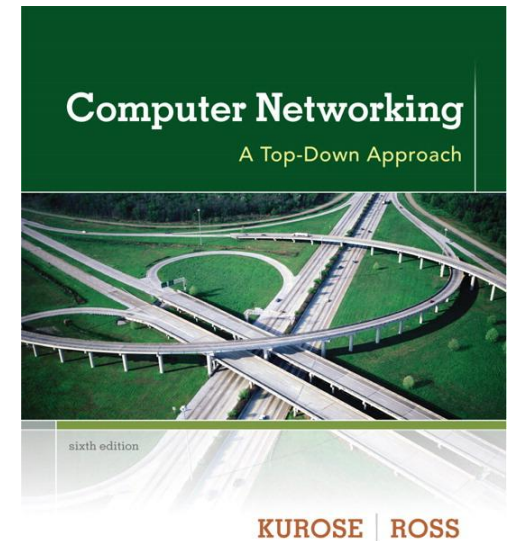
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*Computer
Networking: A
Top Down
Approach*
6th edition
Jim Kurose, Keith Ross
Addison-Wesley
March 2012

Chapter 1: introduction

our goal:

- get “feel” and terminology
- more depth, detail *later* in course
- approach:
 - use Internet as example

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

Chapter 1: roadmap

1.1 *what is the Internet?*

1.2 network edge

- end systems, access networks, links

1.3 network core

- packet switching, circuit switching, network structure

1.4 delay, loss, throughput in networks

1.5 protocol layers, service models

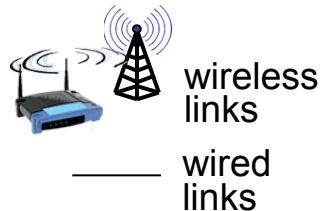
1.6 networks under attack: security

1.7 history

What's the Internet: "nuts and bolts" view



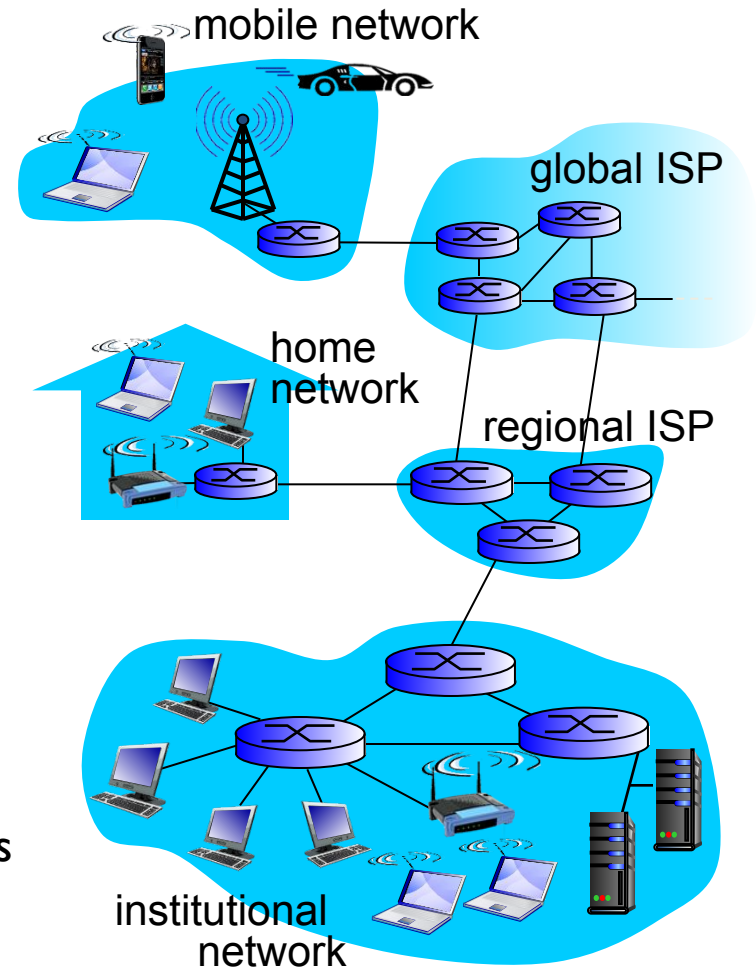
- millions of connected computing devices:
 - *hosts* = *end systems*
 - running *network apps*



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



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



“Fun” internet appliances



IP picture frame
<http://www.ceiva.com/>



Web-enabled toaster +
weather forecaster



Tweet-a-watt:
monitor energy use



Internet
refrigerator



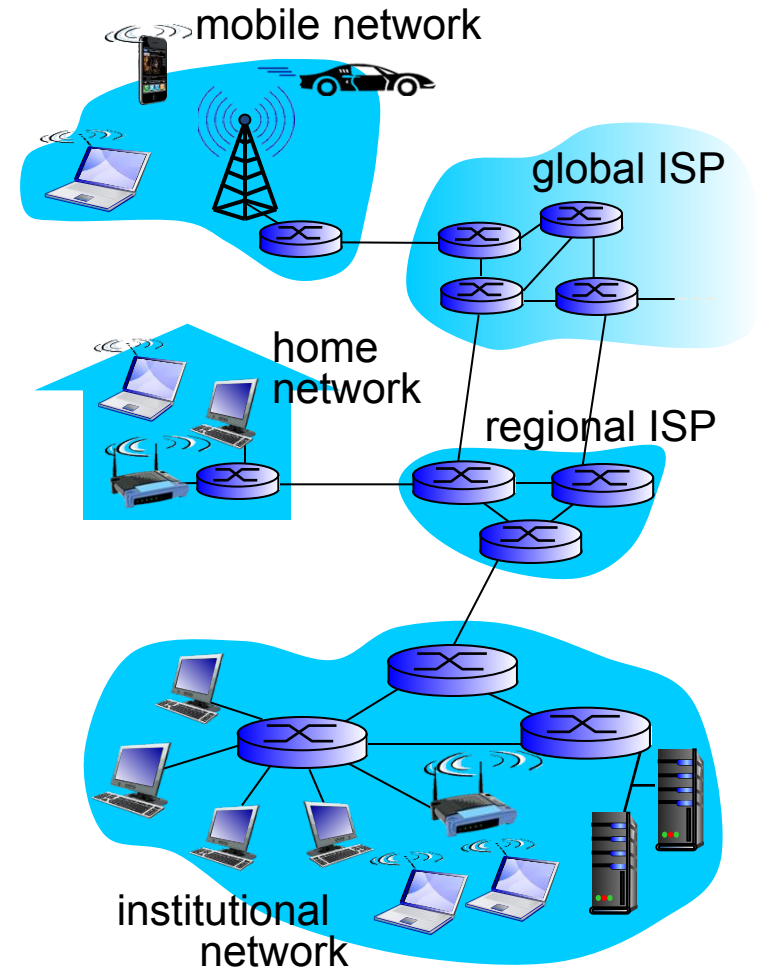
Slingbox: watch,
control cable TV remotely



Internet phones

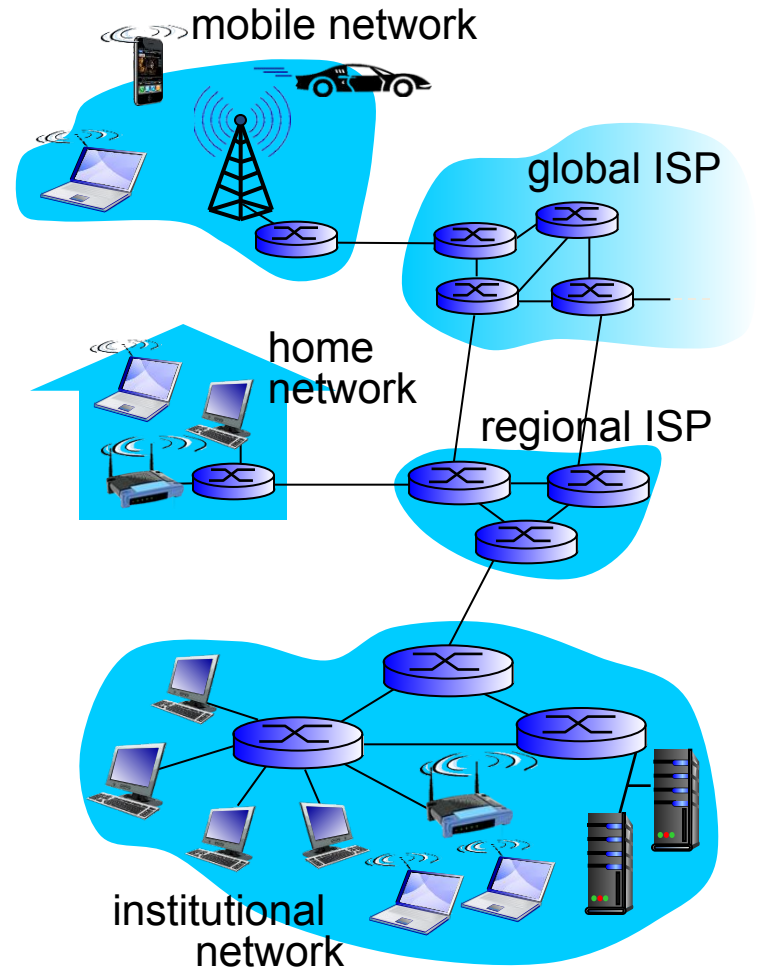
What's the Internet: “nuts and bolts” view

- *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*
 - hooks that allow 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”
 - introductions
- ... specific msgs sent
- ... specific actions taken when msgs received, or other events

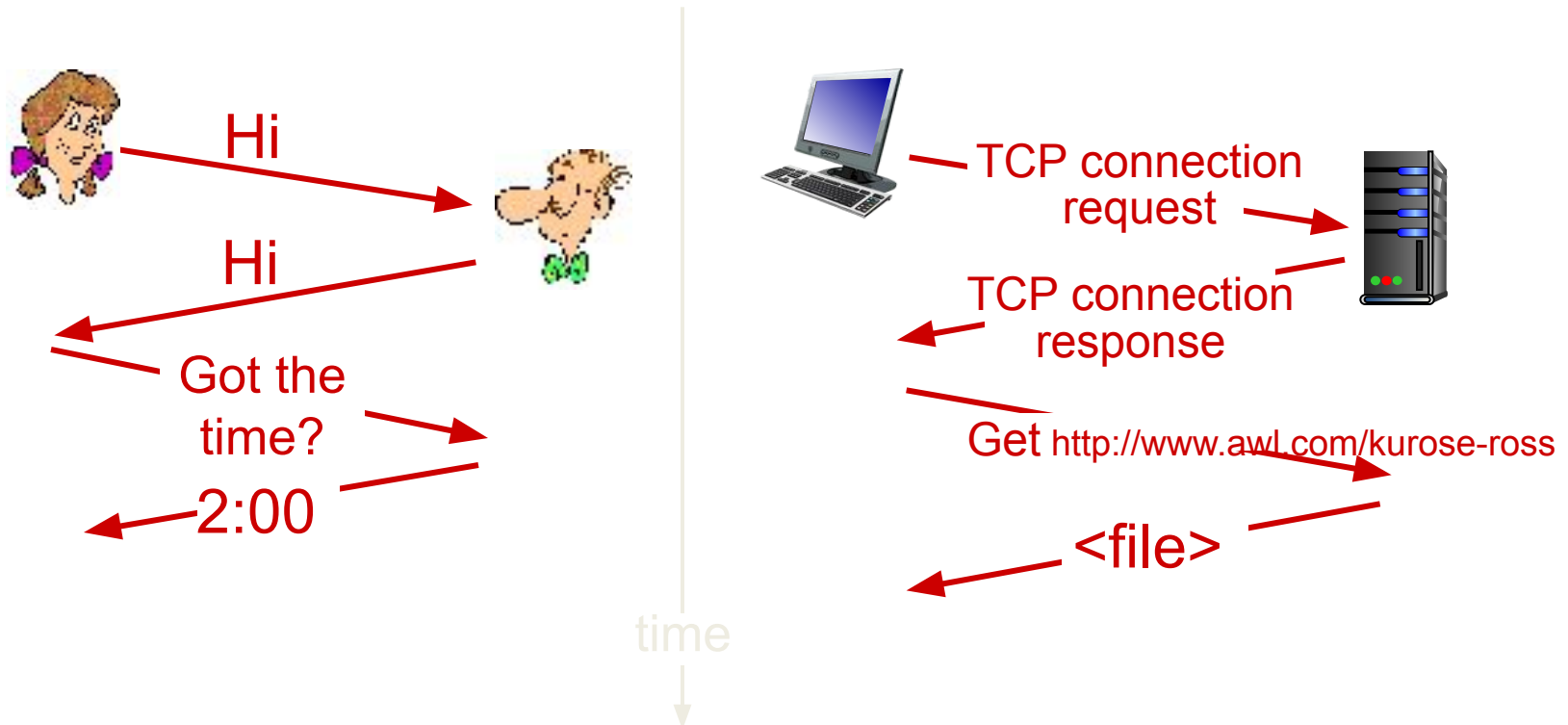
network protocols:

- 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?

Chapter 1: roadmap

1.1 what *is* the Internet?

1.2 network edge

- end systems, access networks, links

1.3 network core

- packet switching, circuit switching, network structure

1.4 delay, loss, throughput in networks

1.5 protocol layers, service models

1.6 networks under attack: security

1.7 history

The network edge:

- **end systems (hosts):**

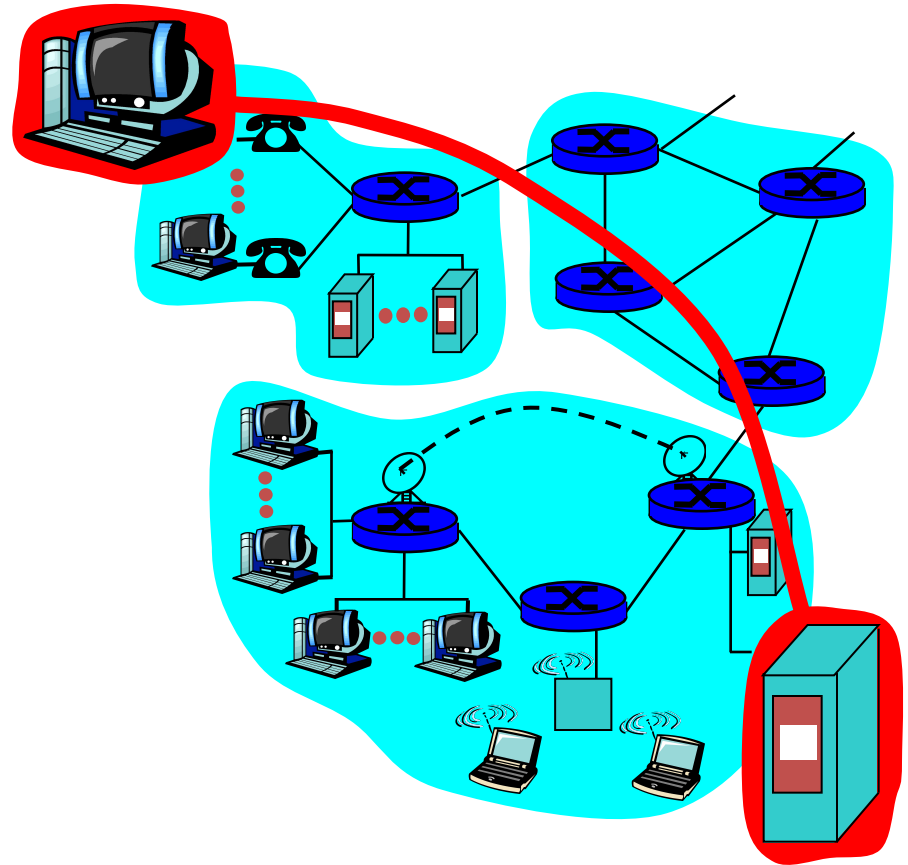
- run application programs
- e.g. Web, email
- at “edge of network”

- **client/server model**

- e.g. Web browser/server; email client/server
- Distributed applications

- **peer-peer model:**

- minimal (or no) use of dedicated servers
- e.g. Skype, BitTorrent



Network edge: connection-oriented service

- Goal: data transfer
between end systems
- *handshaking*: setup a connection for data transfer ahead of time
 - TCP - Transmission Control Protocol
 - Internet's connection-oriented service

TCP service [RFC 793]

- *reliable, in-order* byte-stream data transfer
 - loss: acknowledgements and retransmissions
- *flow control*:
 - sender won't overwhelm receiver
- *congestion control*:
 - senders "slow down sending rate" when network congested

Network edge: connectionless service

Goal: data transfer between end systems

- **UDP** - User Datagram Protocol [RFC 768]:
 - No handshaking - less work!
 - Less delay
 - Internet's connectionless service
 - unreliable data transfer
 - no flow control
 - no congestion control

TCP vs. UDP

App's using TCP:

- HTTP (Web), FTP (file transfer), Telnet (remote login), SMTP (email)

App's using UDP:

- streaming media, teleconferencing, DNS, Internet telephony, network games