CS 372 Lecture #2

Overview of Networking:

- Network protocols
- Service models
- Network structure
- Network edge ("fringe", "border")
  - end systems, links
  - applications

Note: Many of the lecture slides are based on presentations that accompany *Computer Networking: A Top Down Approach,* 6th edition, by Jim Kurose & Keith Ross, Addison-Wesley, 2013.

What is a protocol?

human protocols:

- "What time is it?"
- "The chair recognizes …"
- introductions

… specific messages sent

… specific actions taken when messages received, etc.

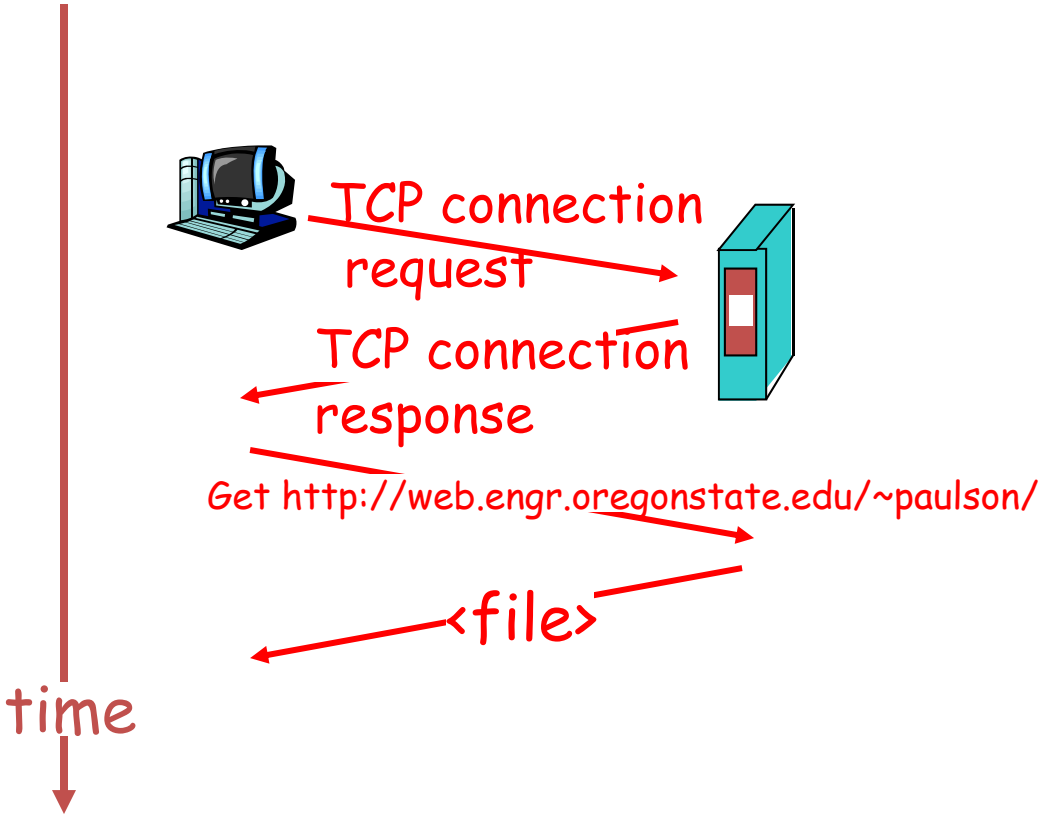
network protocols:

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

protocols *define*

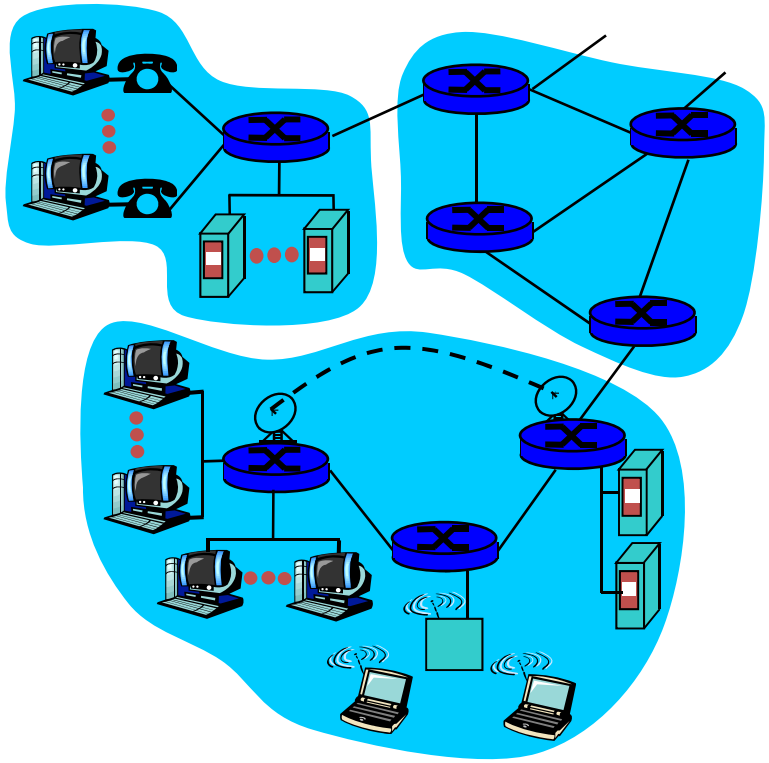
1. *format and order of messages sent and received among network entities*
2. *actions taken on message transmission and receipt*

Example computer network protocol



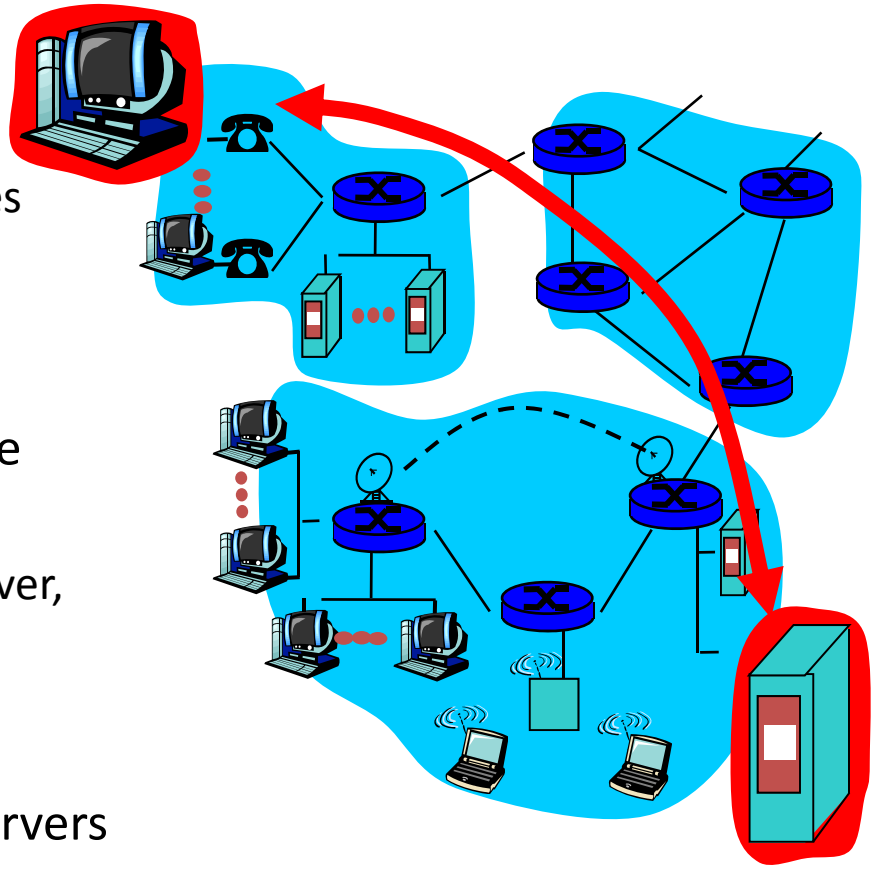
A closer look at network structure:

- network edge:
  - hosts and applications
  - clients and servers
- network core:
  - interconnected routers
  - network of networks
- physical media:
  - communication links



The network edge: service models

- end systems (hosts):
  - individual computers that initiate requests or provide services
    - e.g. personal computers, cellphones
    - e.g. server computers
- client/server model
  - client host requests/receives service from a server that is “always on”
    - e.g. Web browser (client), Web server, email client/server
- peer-to-peer model (P2P)
  - minimal (or no) use of dedicated servers
  - e.g. Skype, BitTorrent



The network edge: connection-oriented service

- Goal: data transfer between end systems
- TCP service [RFC 793]
  - TCP - Transmission Control Protocol
    - Internet's connection-oriented service
  - *handshake:* prepare for transfer
    - Hello, hello back (human protocol)
    - set up "state" in two communicating hosts
  - *reliable, in-order, byte-stream* data transfer
    - acknowledgements and retransmissions
  - *flow control:*
    - sender won't overwhelm receiver
  - *congestion control:*
    - senders "slow down sending rate" when network is congested

The network edge: connectionless service

- Goal: data transfer between end systems
  - same as connection-oriented
- UDP service [RFC 768]:
  - UDP – User Data Protocol
    - Internet's connectionless service
    - "light-weight", fast
  - no handshake
  - "unreliable" (best effort) data transfer
  - no flow control
  - no congestion control

The network edge:

Applications that use TCP:

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

Applications that use UDP:

- streaming media
- Teleconferencing
- DNS (Domain Name Service)
- Internet telephony

Summary Lecture #2

- Definitions:
  - protocol, network edge, network core
- Network service models
  - Client/Server, Peer-to-Peer (P2P)
- Network edge service types
  - Connection-oriented, connectionless