CS 372 Lecture #6

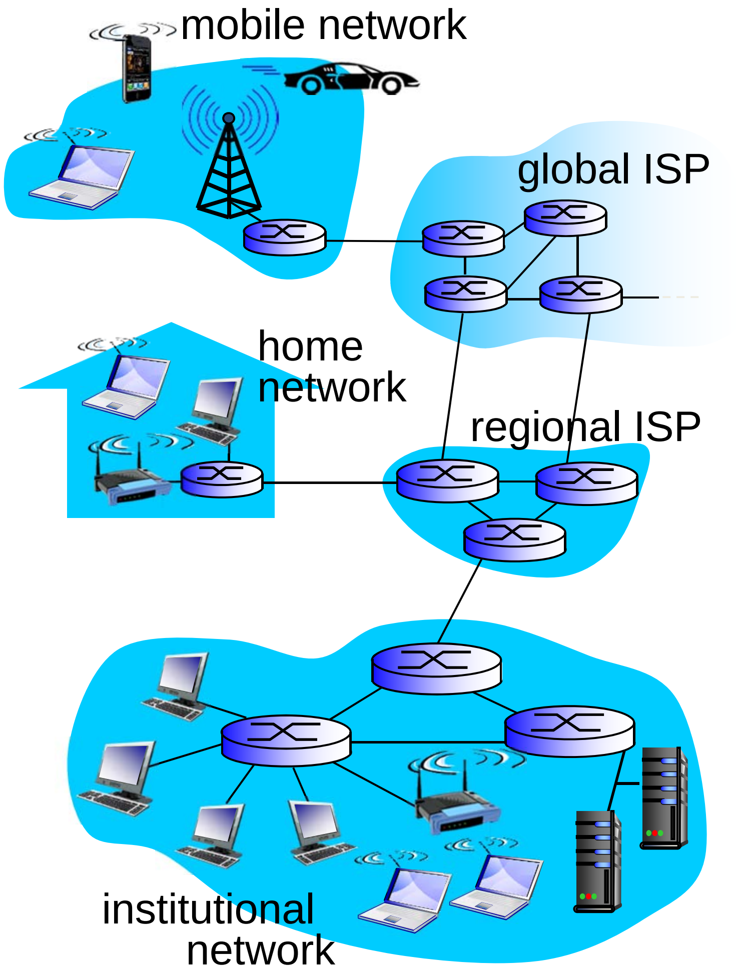
Overview of Networking:

- introduction to protocols

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.

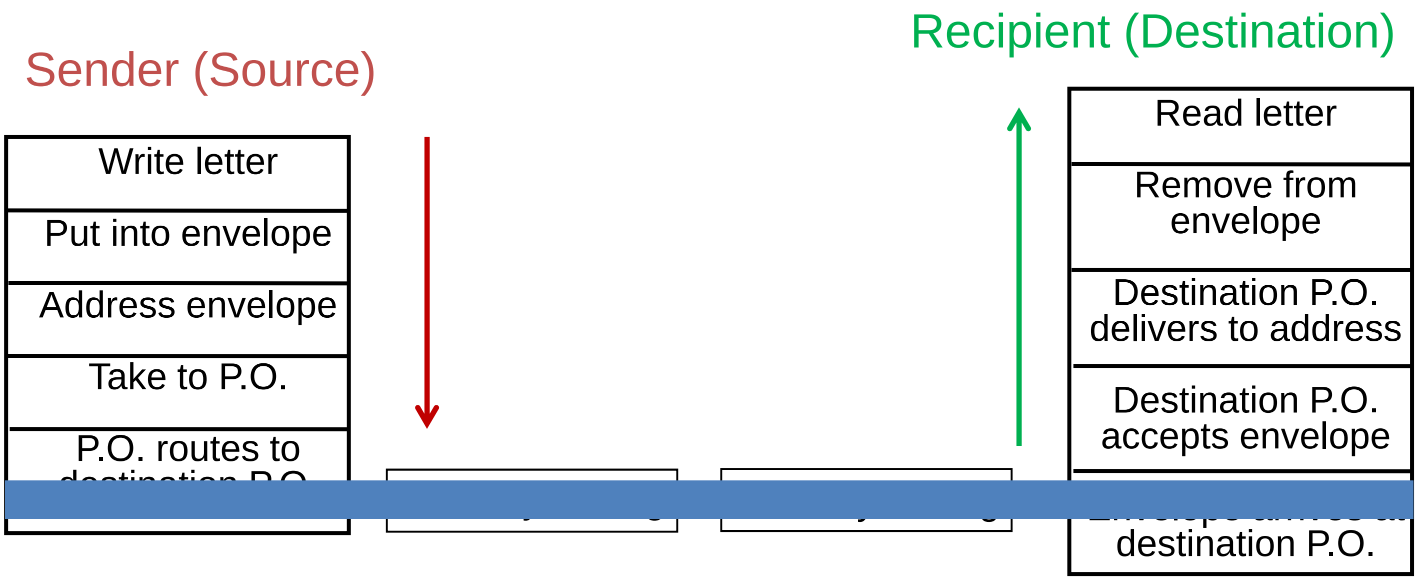
Networks are complicated!

- hosts
- routers
- links of various media types
- applications
- protocols
- other hardware, software



Layering of functionality

Post Office example



Sender (Source)

Write letter

Put into envelope

Address envelope

Take to P.O.

P.O. routes to destination P.O.

Recipient (Destination)

Read letter

Remove from envelope

Destination P.O. delivers to address

Destination P.O. accepts envelope

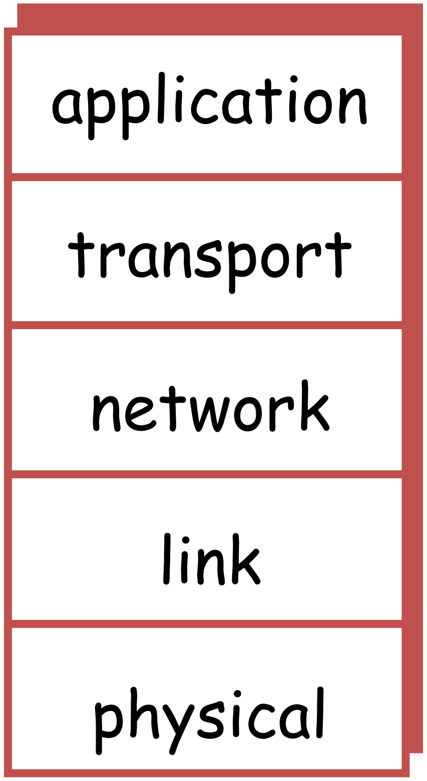
Envelope arrives at destination P.O.

Layers: each layer implements a service

- via its own internal-layer actions
- relying on services provided by layer above/below

Internet protocol stack

- application: supporting network applications
  - e.g. FTP, SMTP, HTTP
- transport: process-process data transfer
  - e.g. TCP, UDP
- network: routing of datagrams from source to destination
  - e.g. IP, routing protocols
- link: data transfer between neighboring network elements
  - e.g. PPP, Ethernet
- physical: carries actual signals between devices
  - e.g. cable, wireless



application

transport

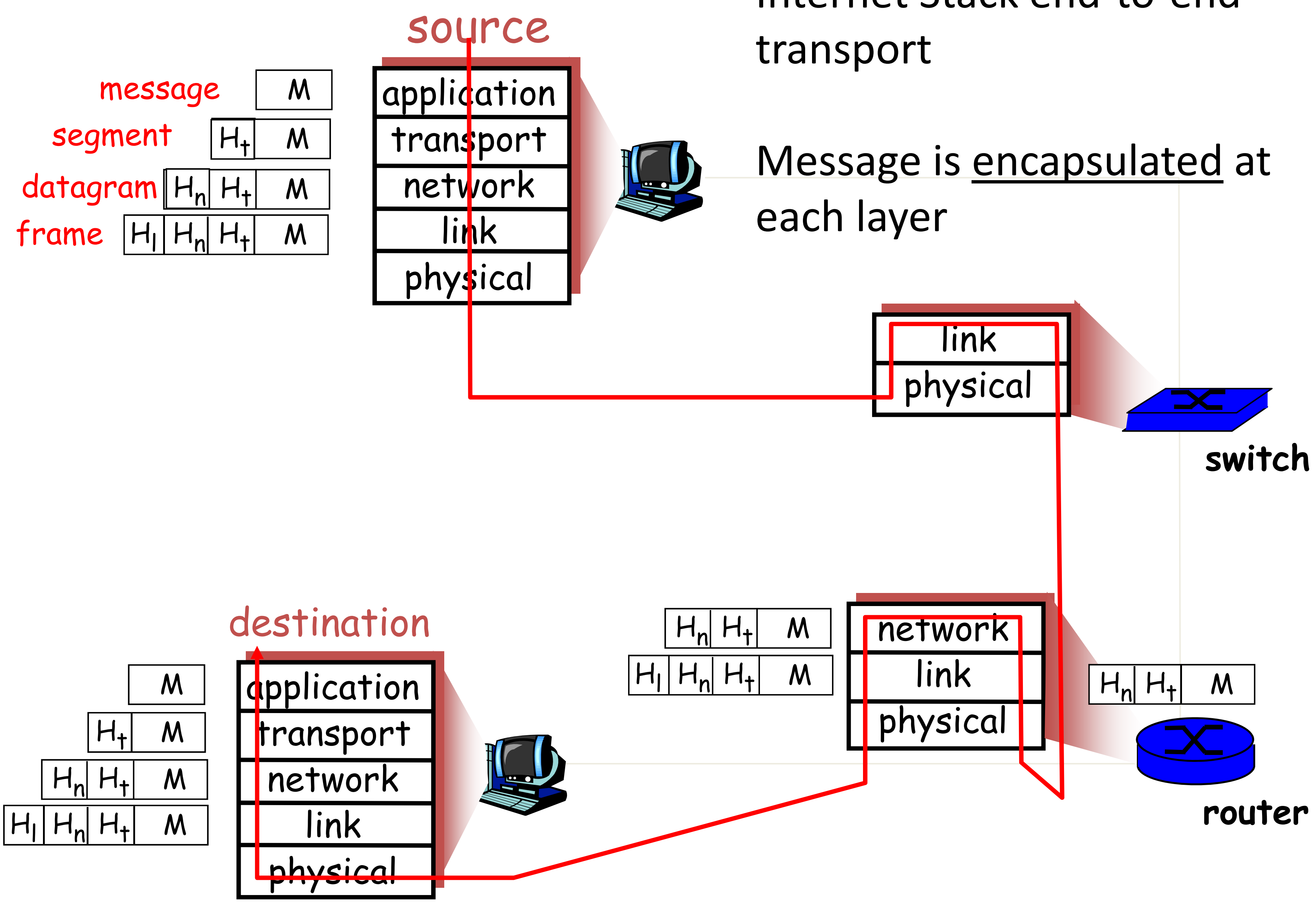
network

link

physical

Internet Stack end-to-end transport

Message is encapsulated at each layer



Why layering?

Dealing with complex systems:

- explicit structure allows identification and relationship of complex system’s pieces
  - layered reference model for discussion
- modularization eases maintenance and updating of complex system
  - change of implementation of layer’s service is transparent to rest of system
    - e.g., change in “deliver to address” procedure doesn’t affect the rest of the system

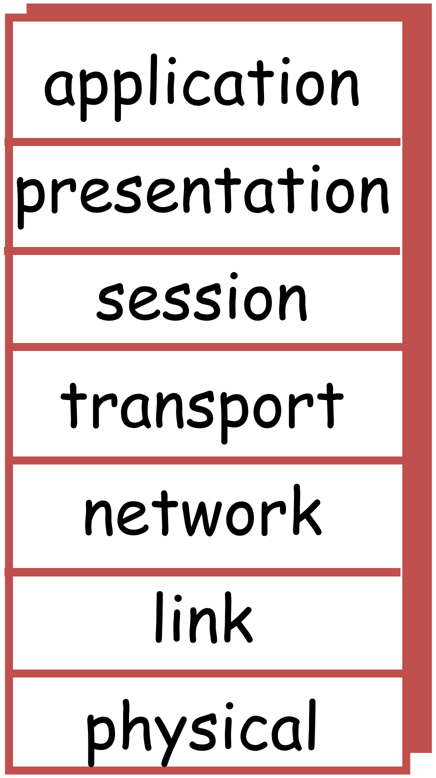
Constraints

1. The software for each layer depends only on the services of the software provided by neighboring layers (well-defined interfaces)
2. The software at layer *n* at the destination receives exactly the same protocol message sent by layer *n* at the sender (consistency)

- These constraints mean that protocols within a protocol stack can be
  - tested independently
  - modified/replaced independently

ISO/OSI reference model

- presentation: allow applications to interpret meaning of data, e.g., encryption, compression, machine-specific conventions
- *session:* synchronization, checkpointing, recovery of data exchange
- Internet stack “missing” these layers
  - these services, *if needed,* must be implemented in the application layer of the Internet protocol stack



application

presentation

session

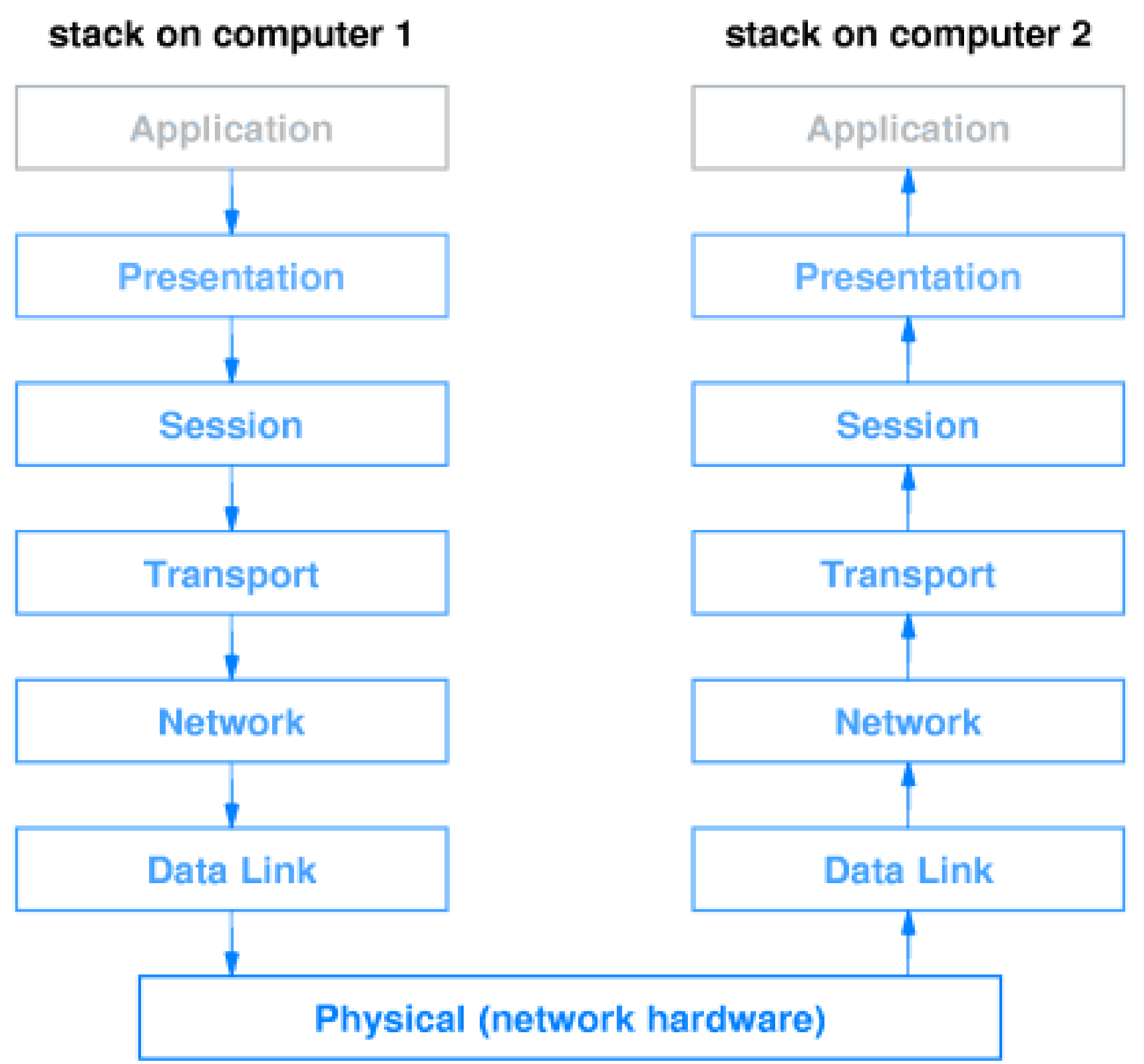
transport

network

link

physical

ISO model end-to-end transport



Summary Lecture #6

- Definitions:
  - protocol
  - encapsulation
- Internet protocol stack
- ISO layering model