Introduction

COMPSCI 453 Computer Networks

Professor Jim Kurose

College of Information and Computer Sciences
University of Massachusetts

- Overview. What is the Internet? What is a protocol?
- Network edge
- Network core
- Performance: loss, delay, throughput
- Class textbook: Computer Networking: A Top-Down Approach (8th ed.) J.F. Kurose, K.W. Ross Pearson, 2020

http://gaia.cs.umass.edu/kurose_ross



- Layering, encapsulation, service models
- Security
- History

Protocol "layers" and reference models

Networks are complex, with many "pieces":

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

Question: is there any hope of organizing structure of network?

and/or our discussion of networks?

Example: organization of air travel

end-to-end transfer of person plus baggage

ticket (purchase)

baggage (check)

gates (load)

runway takeoff

airplane routing

ticket (complain)

baggage (claim)

gates (unload)

runway landing

airplane routing

airplane routing

How would you define/discuss the system of airline travel?

a series of steps, involving many services

Example: organization of air travel

ticket (purchase)	ticketing service	ticket (complain)	
baggage (check)	baggage service	baggage (claim)	
gates (load)	gate service	gates (unload)	
runway takeoff	runway service	runway landing	
airplane routing	routing service	airplane routing	

layers: each layer implements a service

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

Why layering?

Approach to designing/discussing complex systems:

- explicit structure allows identification, relationship of system's pieces
 - layered reference model for discussion
- modularization eases maintenance, updating of system
 - change in layer's service *implementation*: transparent to rest of system
 - e.g., change in gate procedure doesn't affect rest of system

Layered Internet protocol stack

- application: supporting network applications
 - HTTP, IMAP, SMTP, DNS
- transport: process-process data transfer
 - TCP, UDP
- network: routing of datagrams from source to destination
 - IP, routing protocols
- link: data transfer between neighboring network elements
 - Ethernet, 802.11 (WiFi), PPP
- physical: bits "on the wire"

application transport network link physical

application

transport

network

link

physical

Application exchanges messages to implement some application service using *services* of transport layer

H_t M

Transport-layer protocol transfers M (e.g., reliably) from one *process* to another, using services of network layer

- transport-layer protocol encapsulates application-layer message, M, with transport layer-layer header H_t to create a transport-layer segment
 - H_t used by transport layer protocol to implement its service

application

transport

network

link

physical





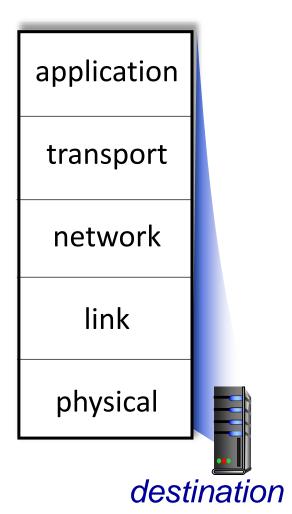
application transport network link physical

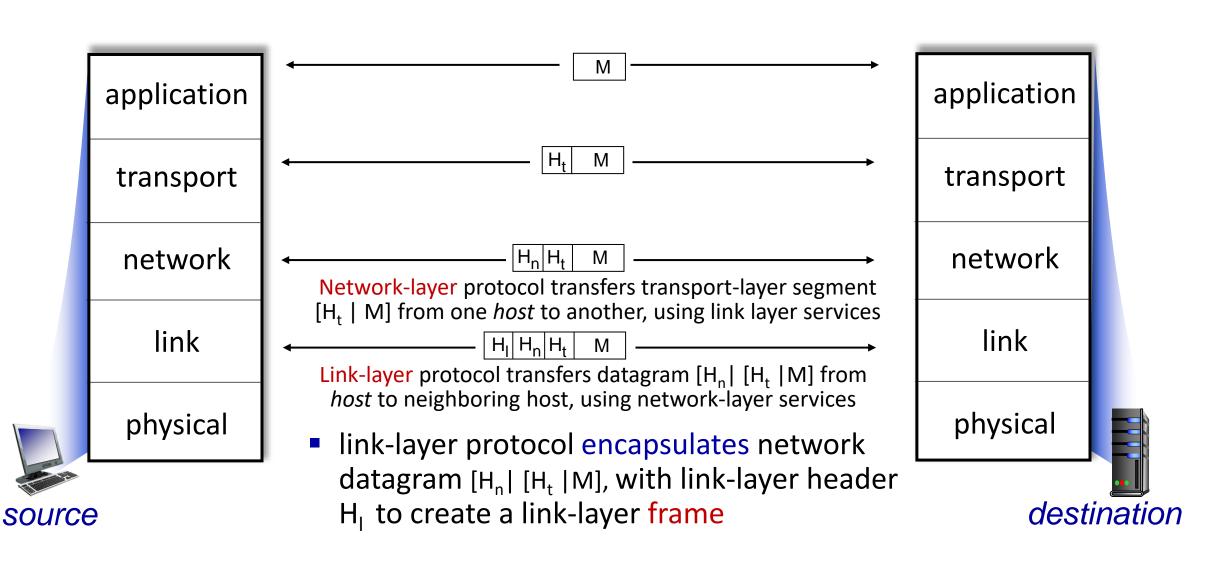
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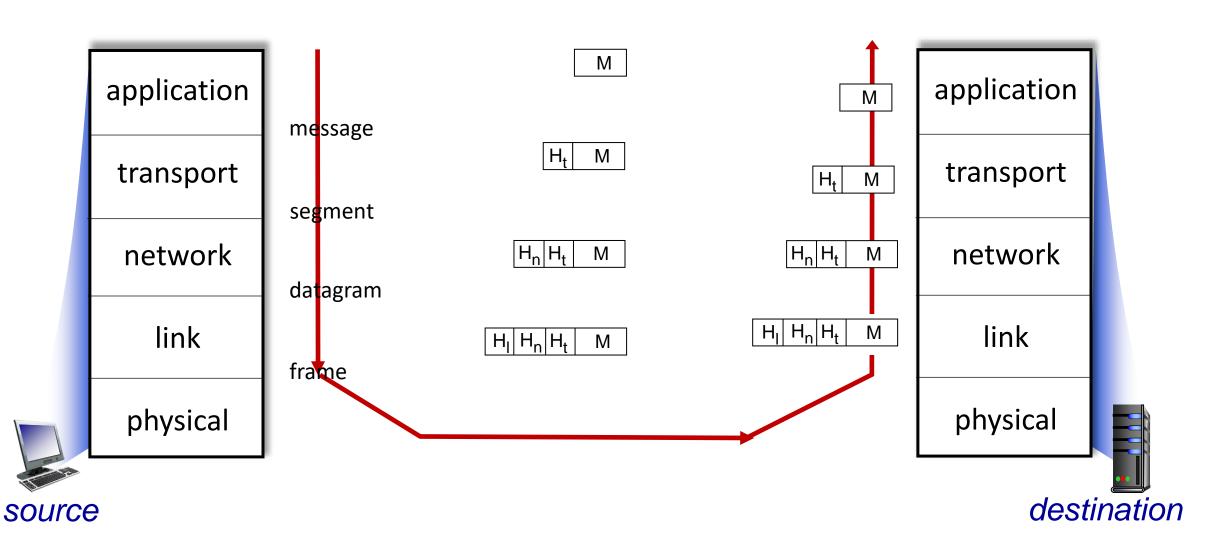
Transport-layer protocol transfers M (e.g., reliably) from one *process* to another, using services of network layer

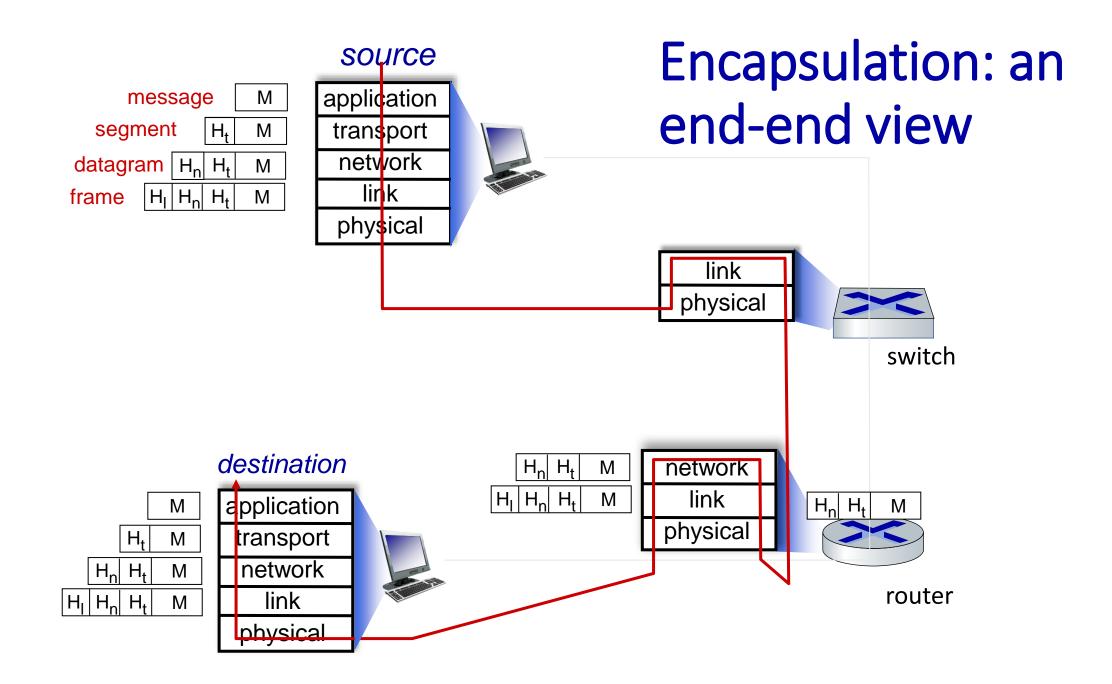
| H_n | H_t | M |
| Network-layer protocol transfers transport-layer segment [H_t | M] from one *host* to another, using link layer services

- network-layer protocol encapsulates transport-layer segment [H_t | M] with network layer-layer header H_n to create a network-layer datagram
 - H_n used by network layer protocol to implement its service









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