COMPUTER NETWORKS

Animesh Giri

Department of Computer Science & Engineering

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Transport Layer

Animesh Giri

Department of Computer Science & Engineering

3.1 transport-layer services

3.2 multiplexing and demultiplexing

3.3 connectionless transport: UDP

3.4 principles of reliable data transfer

3.5 connection-oriented transport: TCP
- segment structure
- reliable data transfer
- flow control
- connection management

3.6 principles of congestion control

3.7 TCP congestion control

In this segment

- Transport layer goals

- Transport layer services

- Transport services & protocols

- Transport vs Network layer

- Transport layer actions

- Internet transport layer protocols

Transport Layer - Goals

- Understand principles behind transport layer services:

  - Multiplexing, demultiplexing

  - Reliable data transfer

  - Flow control

  - Congestion control

- learn about Internet transport layer protocols:

  - UDP: connectionless transport

  - TCP: connection-oriented reliable transport

  - TCP congestion control

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Transport Layer Services

Animesh Giri

Department of Computer Science & Engineering

Transport Services & protocols

- provide *logical communication* between app processes running on different hosts

- transport protocols run in end systems
  - **send side:** breaks app messages into *segments*, passes to network layer
  - **rcv side:** reassembles segments into messages, passes to app layer

- more than one transport protocol available to apps
  - Internet: TCP and UDP

Transport vs. Network Layer
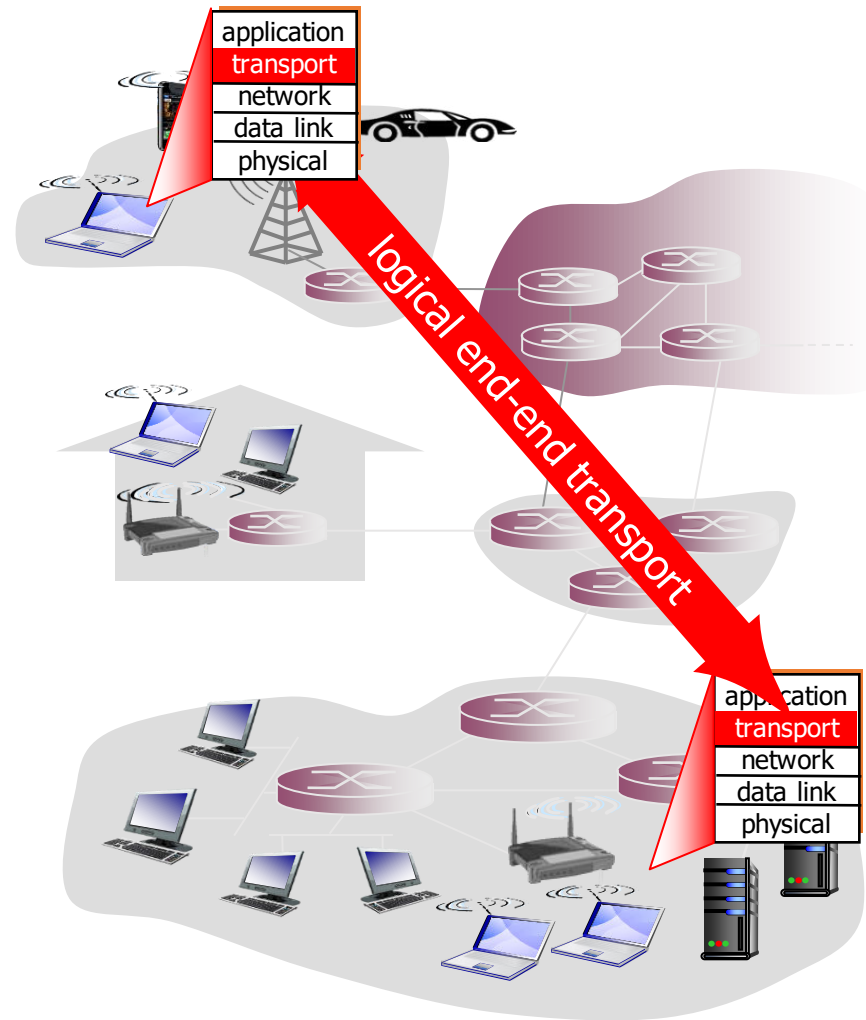
- *Network layer:* logical communication between hosts

- *Transport layer:* logical communication between processes

  - relies on, enhances, network layer services

household analogy:

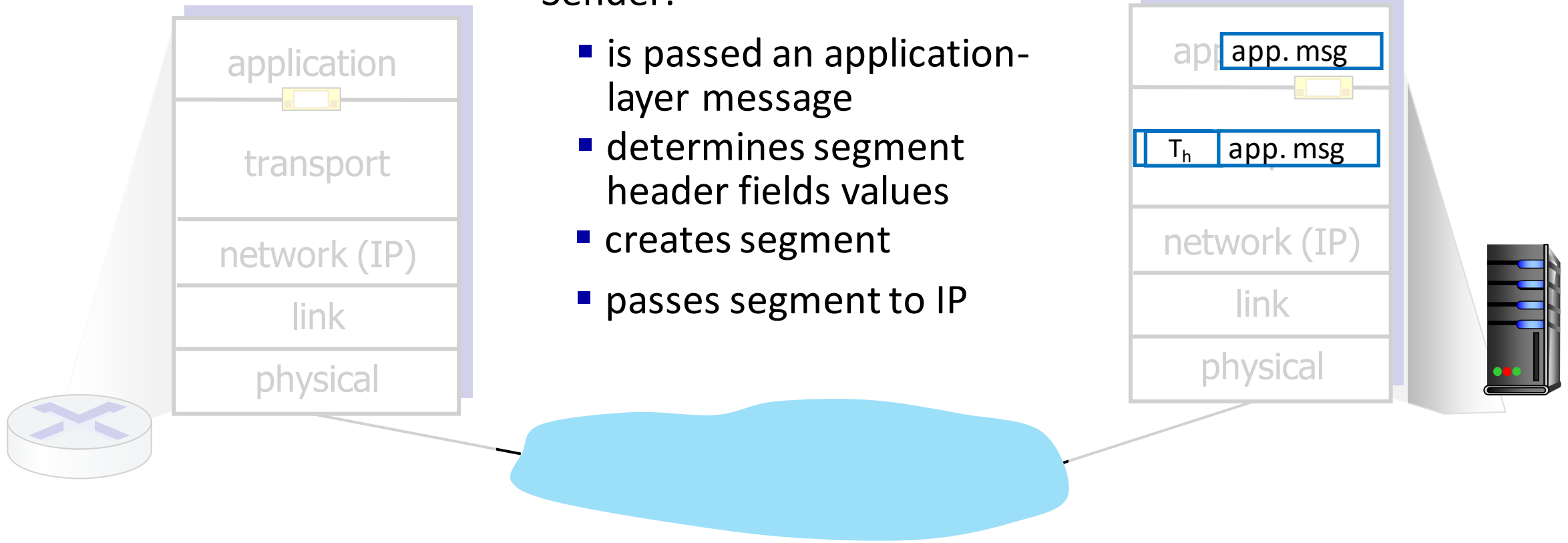12 kids in Ann's house sending letters to 12 kids in Bill's house:

- hosts = houses
- processes = kids
- app messages = letters in envelopes
- transport protocol = Ann and Bill who demux to in-house siblings
- network-layer protocol = postal service

Sender:

- is passed an application-layer message
- determines segment header fields values
- creates segment
- passes segment to IP

application

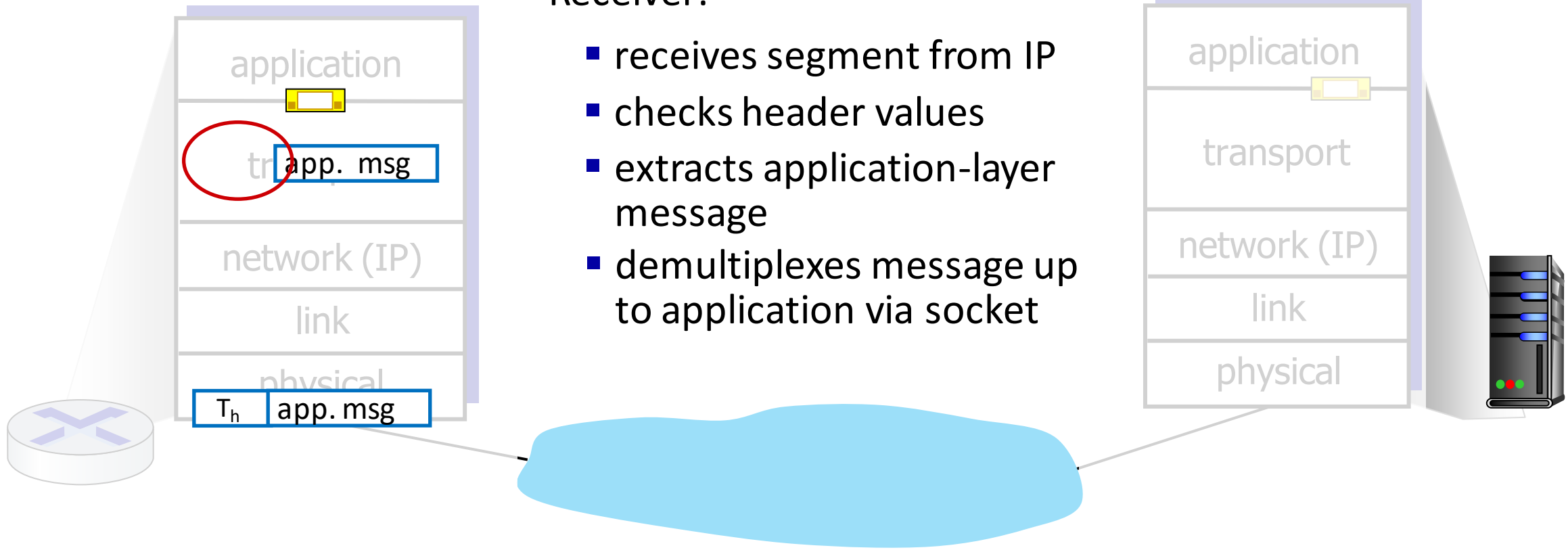transport

network (IP)

link

physical

app. msg

T_h | app. msg

app.

network (IP)

link

physical

Receiver:

- receives segment from IP
- checks header values
- extracts application-layer message
- demultiplexes message up to application via socket

application

transport app. msg

network (IP)

link

physical

T$_h$ app. msg

application

transport

network (IP)

link

physical

Internet Transport-layer protocols

- **TCP:** Transmission Control Protocol
  - reliable, connection oriented
  - in-order delivery
  - congestion control
  - flow control
  - connection setup

- **UDP:** User Datagram Protocol
  - unreliable, connectionless
  - unordered delivery
  - no-frills extension of "best-effort" IP

- services not available:
  - delay guarantees
  - bandwidth guarantees
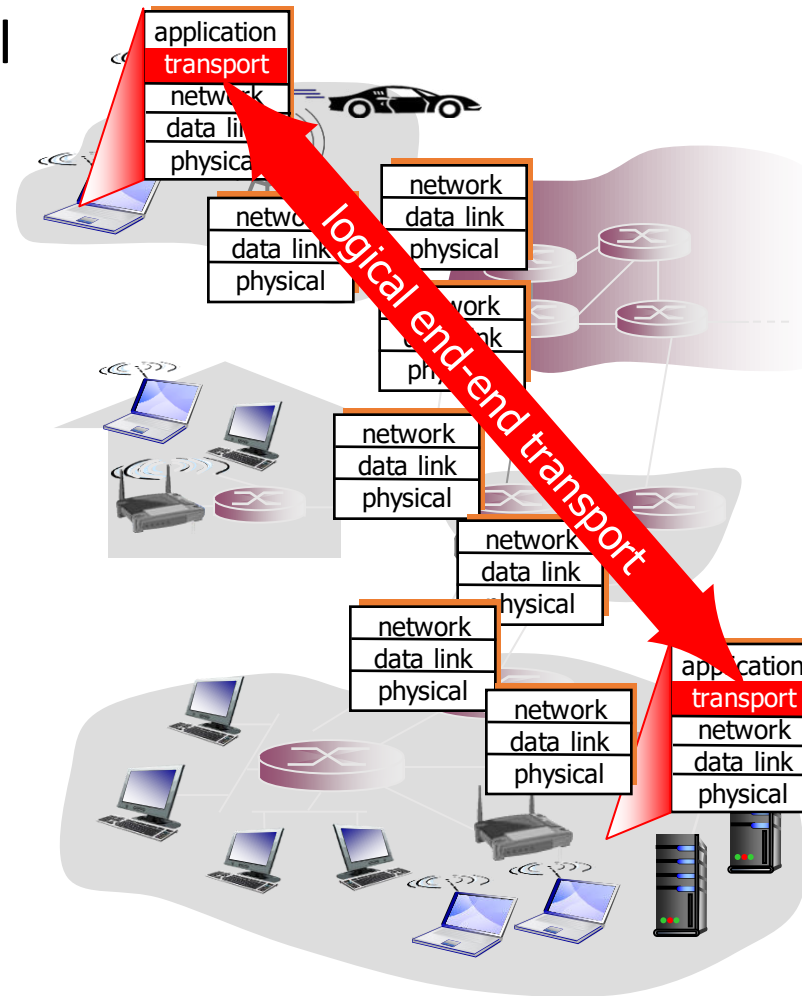
THANK YOU

Animesh Giri

Department of Computer Science & Engineering

animeshgiri@pes.edu

+91 80 6618 6603