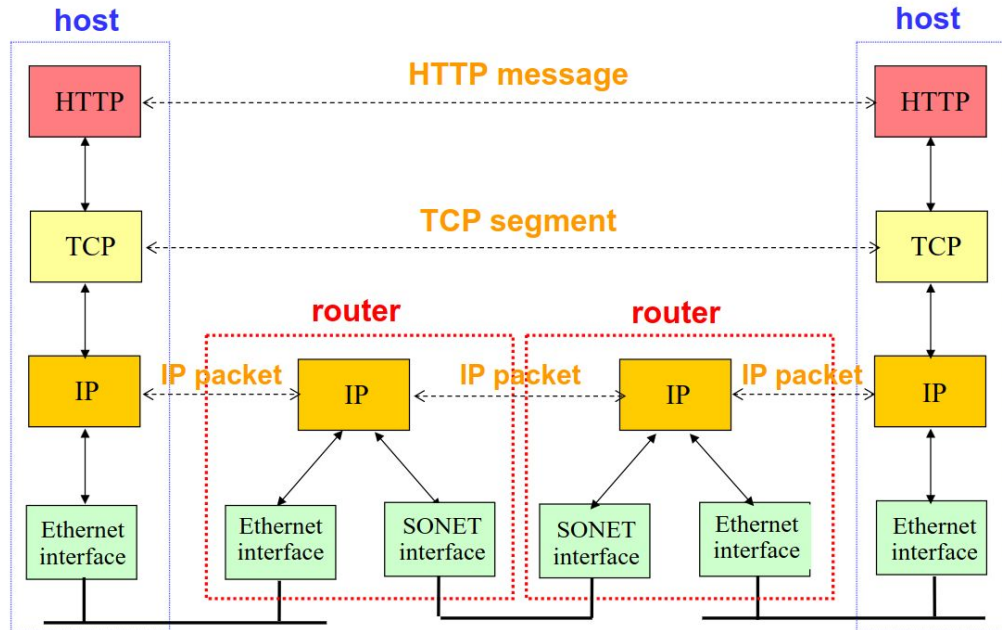


Midterm Review

COS 461 - Precept 5

What have we learned?

Network Organized into Layers



1. Physical Layer

Encoding bits on physical medium

- Examples: Voltages on an ethernet cable or PSK on a wireless link
- We haven't talked about this much
- Repeaters

2. Link Layer

Encoding chunks of data (“frames”) and transmitting them on the physical link

- Need to detect/avoid collisions (CSMA/CD)
- Check delivery (ACKs)
- Error correction (CRC)
- Host naming: MAC Addresses
- Identification protocols: DHCP and ARP
- Forwarding: Exact match
- Switches

3. Network Layer

End-to-end *unreliable* message delivery between hosts not physically connected

- Packet switching versus circuit switching
- Router design
- Naming: IP addresses
 - Subnets
 - Hierarchical addressing
- CIDR
- Error Correction: IP Checksum
- Forwarding: Longest Prefix Match
- Router Queuing, VOQ, Bufferbloat
- Routing algorithms: Distance-Vector, Link-state
- Middleboxes

4. Transport Layer

End-to-end *reliable* byte streams connecting *processes* on two different machines

- TCP
 - Logical connections established with SYN/SYN-ACK
 - Congestion Control: AIMD, Timeouts versus 3-ACKs, Phase plots, Non-loss-based CC
 - Error correction: Hamming Codes, Matrix-based Parity, etc.
 - Used for most network traffic, where receiving message bit-perfect is necessary
 - Example: Transactions for an online bank
- UDP
 - Unreliable, unacknowledged delivery of *Datagrams*
 - No congestion control by default, WebRTC uses GCC
 - Useful for streaming data, where speed matters more than correctness
 - Example: Video conferencing

Application Layer

Program-specific behavior using the transport layer's reliable byte stream

- Examples: HTTP, SMTP, SSH, FTP
- We haven't talked much about this

What should you study?

- All material from Lectures 1-10, Precepts 1-4, Assignments 1-2 is fair game
- Algorithms/Protocols
 - Work through examples, understand the mechanics
 - Understand strengths, weaknesses, and tradeoffs
 - Reason about changes to protocols and their effects
- Layer behavior
 - What happens at which layer
 - What abstraction does each layer provide?
 - What algorithms do each layer's protocols use to provide this abstraction?
- Topics from your assignments
 - Sockets, bufferbloat, reasoning about performance