

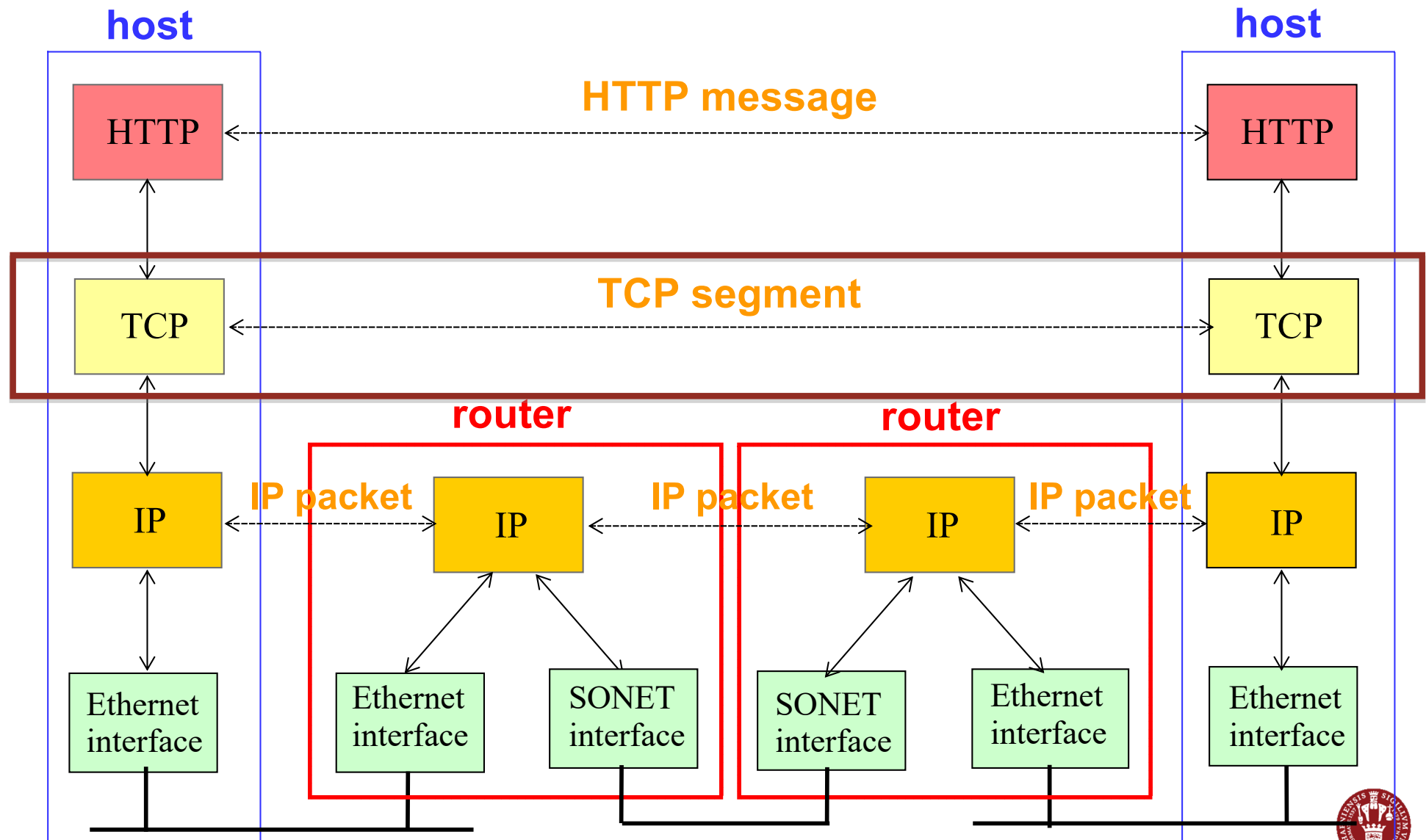


Transport Layer: UDP

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Based on slides compiled by Marcos Vaz Salles, adaptations by Vivek Shah

Recap: Internet Layering Model



Source: Freedman



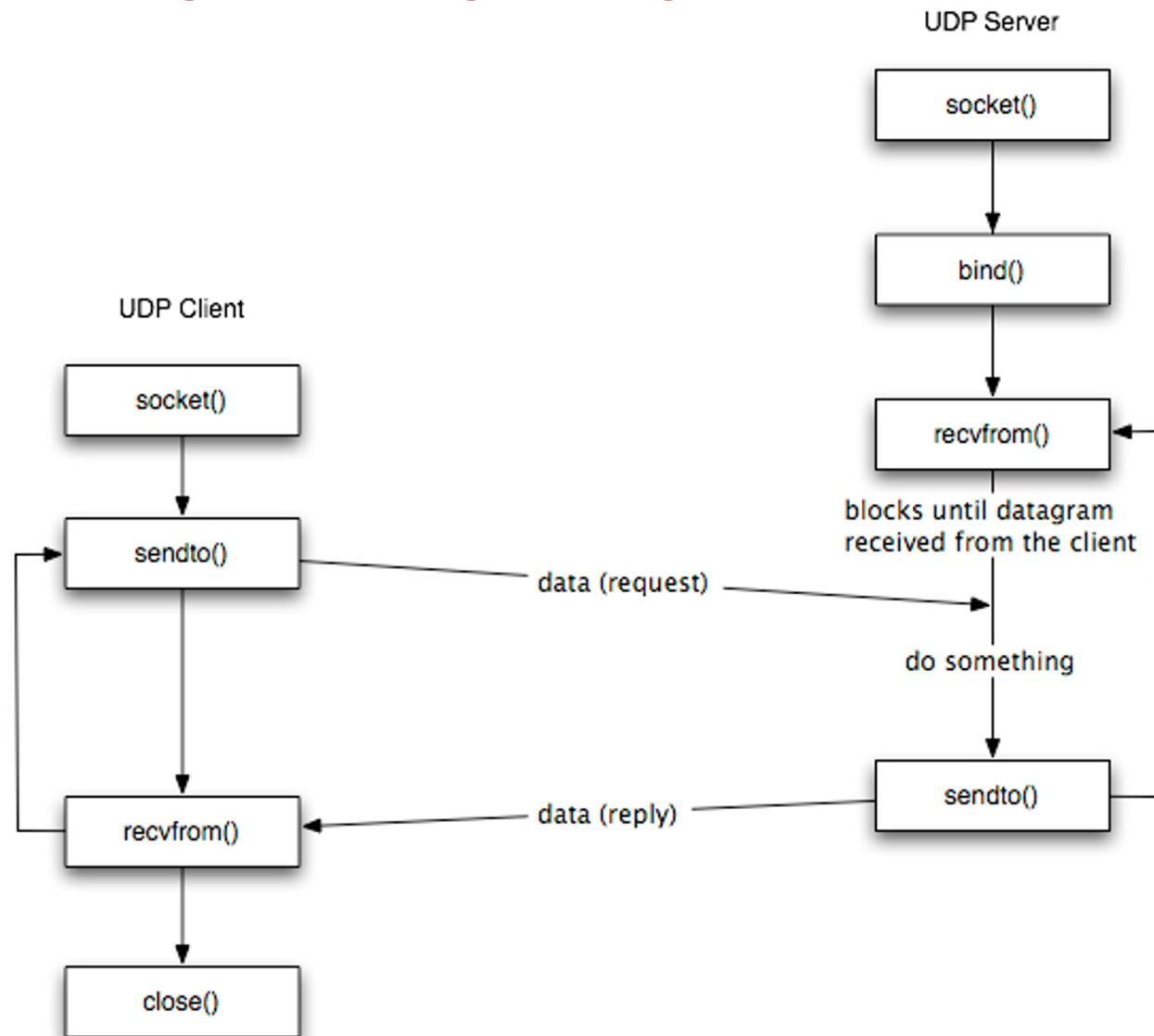
Transport Layer

- Logical Communication between processes
 - Sender divides messages into segments.
 - Receiver re-assembles messages into segments.
- Principles underlying transport-layer services
 - (De)multiplexing
 - Detecting corruption
 - Optional: Reliable delivery, Flow control, Congestion control
- Transport-layer protocols in the Internet
 - **User Datagram Protocol (UDP)**
 - Simple (unreliable) message delivery
 - **Transmission Control Protocol (TCP)**
 - Reliable bidirectional stream of bytes

Source: Freedman



Socket Programming Using UDP



Source: Campbell



Socket Programming Using UDP

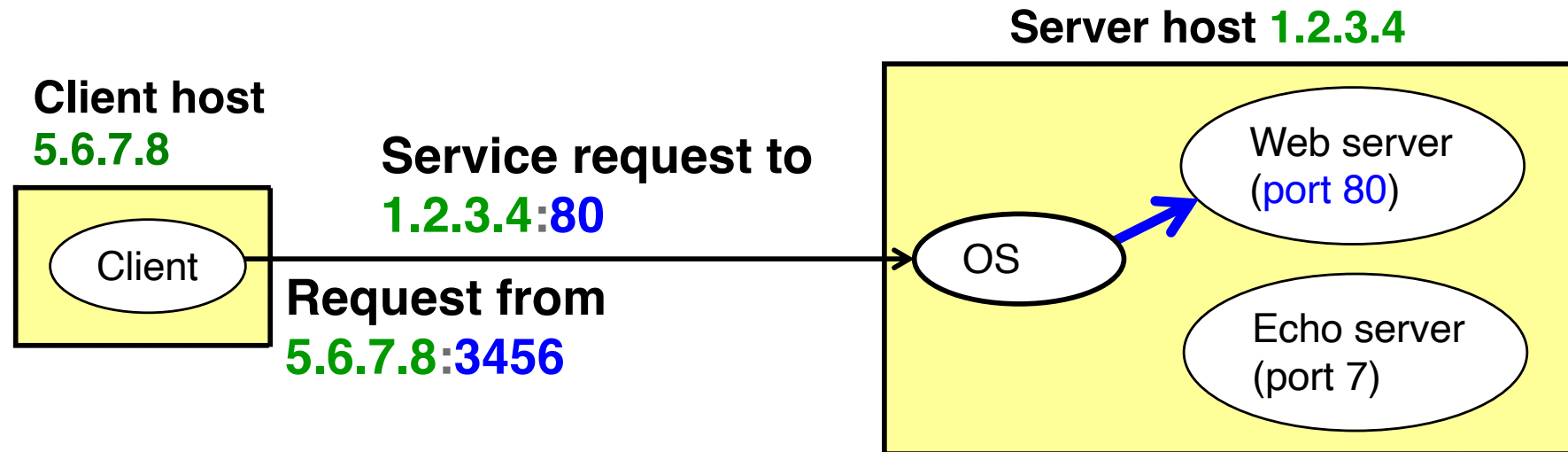
```
ssize_t recvfrom(int sockfd, void* buff,  
    size_t nbytes, int flags, struct sockaddr* from,  
    socklen_t *addrlen);
```

```
ssize_t sendto(int sockfd, const void *buff,  
    size_t nbytes, int flags,  
    const struct sockaddr *to, socklen_t addrlen);
```



Two Basic Transport Features

- **Demultiplexing:** port numbers



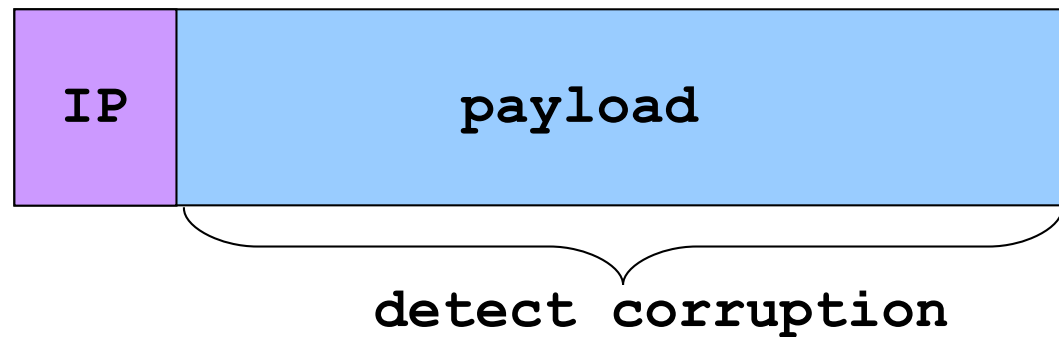
Demux table ("5 tuple")	Socket
<*, *, 1.2.3.4, 80, TCP>	5
<5.6.7.8, 3456, 1.2.3.4, 80, TCP>	6

Source: Freedman



Two Basic Transport Features

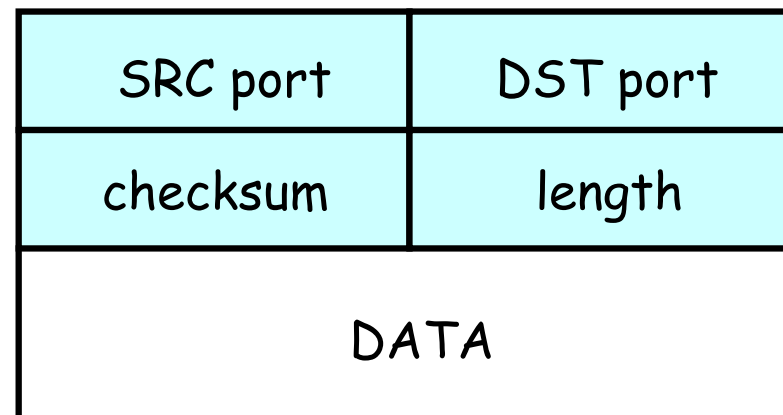
- **Error detection:** checksums



- Optional for IPv4
 - 16-bit one's complement of the sum of a pseudo header of information from the IP header, the UDP header, and the data

User Datagram Protocol (UDP)

- Datagram messaging service
 - Demultiplexing of messages: port numbers
 - Detecting corrupted messages: checksum
- Lightweight communication between processes
 - Send messages to and receive them from a socket
- Avoid overhead and delays of ordered, reliable delivery



Source: Freedman



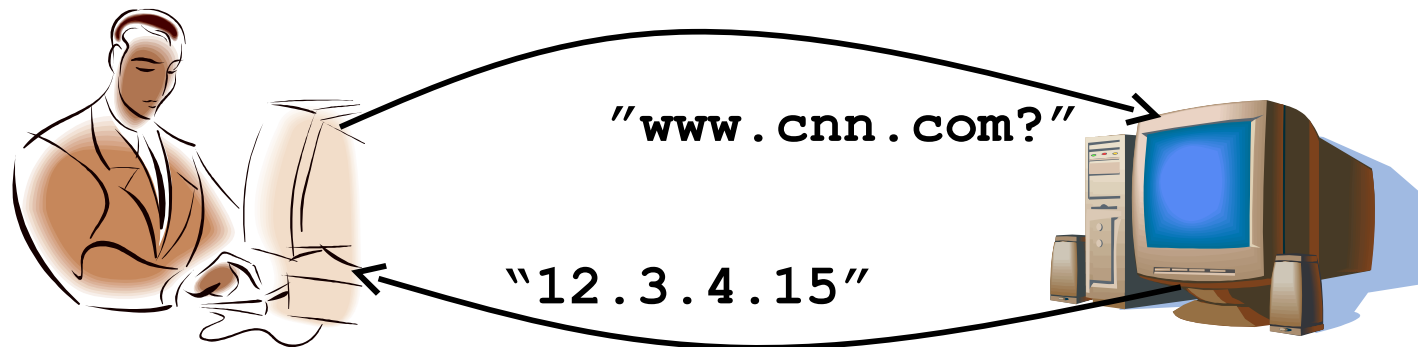
Why Would Anyone Use UDP?

- Fine control over what data is sent and when
 - As soon as app process writes into socket
 - ... UDP will package data and send packet
- No delay for connection establishment
 - UDP blasts away without any formal preliminaries
 - ... avoids introducing unnecessary delays
- No connection state (no buffers, sequence #'s, etc.)
 - Can scale to more active clients at once
- Small packet header overhead (header only 8B long)



Popular Applications That Use UDP

- Simple query protocols like DNS
 - Overhead of connection establishment is overkill
 - Easier to have the application retransmit if needed



- Multimedia streaming (VoIP, video conferencing, ...)
 - Retransmitting lost/corrupted packets is not worthwhile
 - By time packet is retransmitted, it's too late

Source: Freedman



Summary

- UDP
 - basic multiplexing, checksums
- QUIC (now named HTTP/3) gives (some) TCP guaranteed over UDP



What's next ? Reliable Data Transfer & TCP

