# CS144
# An Introduction to Computer Networks

## What the Internet is

## *The TCP and UDP Service Models*


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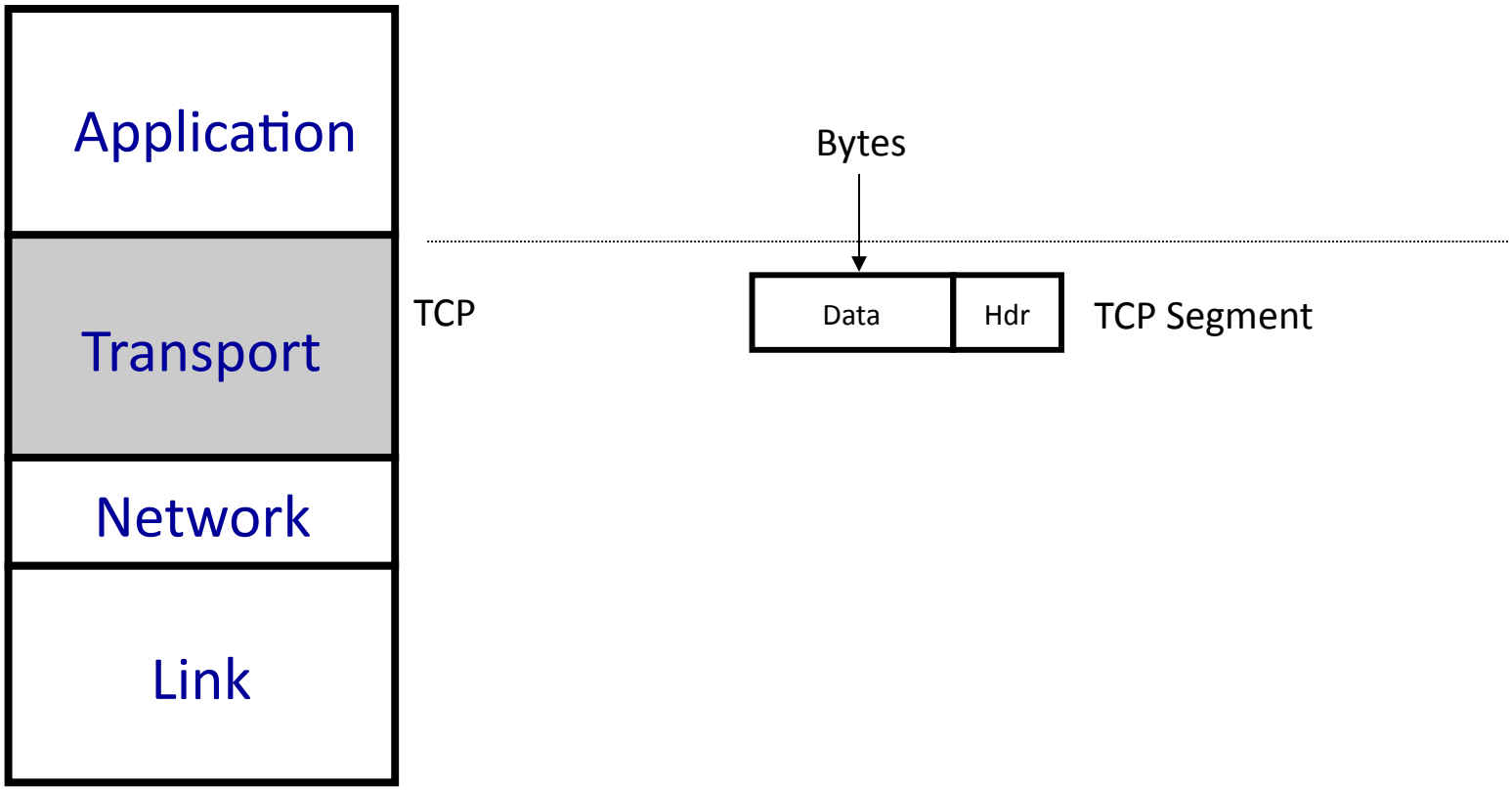
# Outline

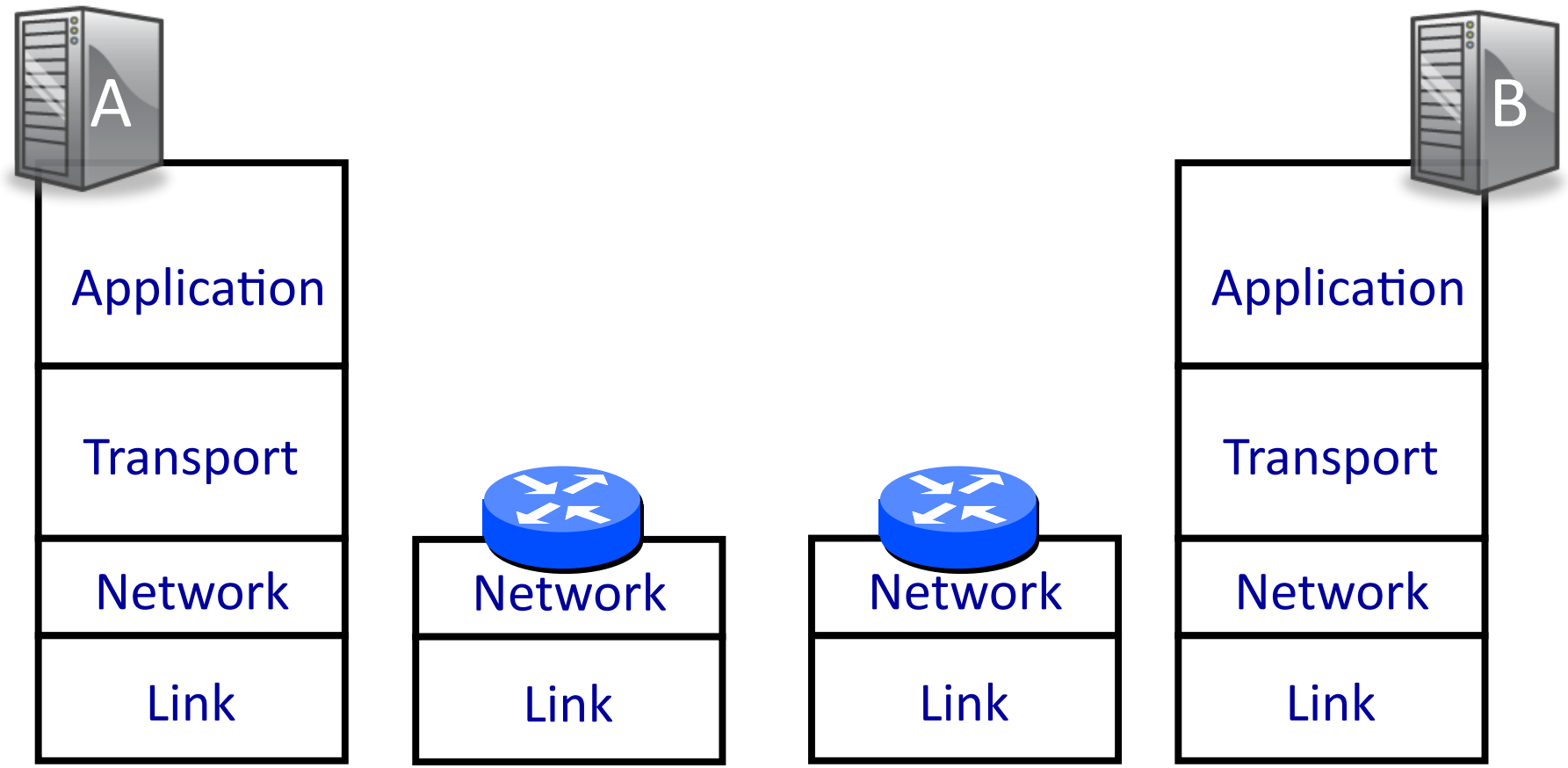
TCP Service Model

UDP Service Model

# Transmission Control Protocol (TCP)



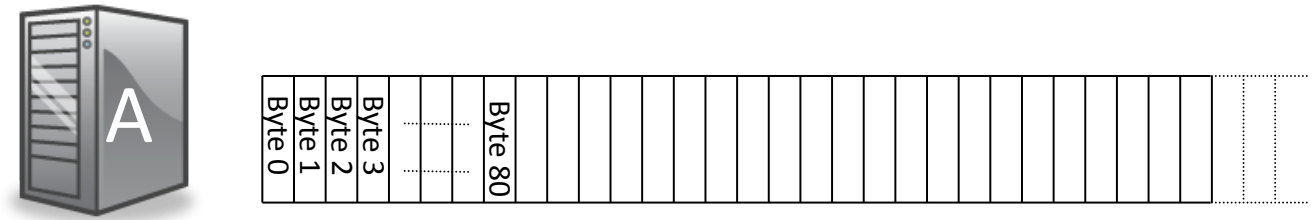
# Peer layers communicate

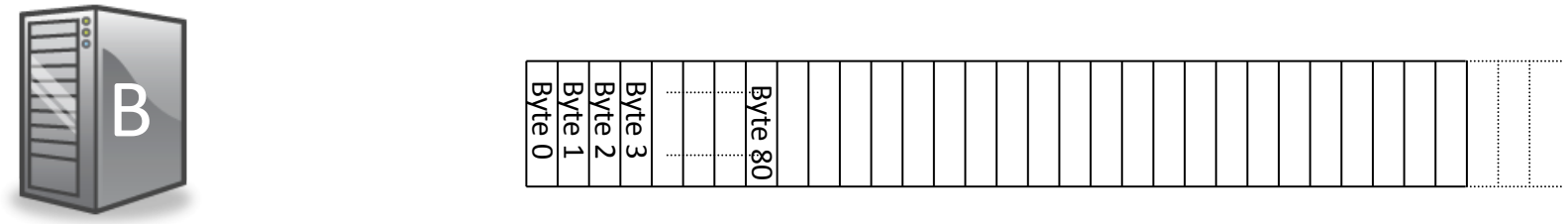


# The TCP Service Model

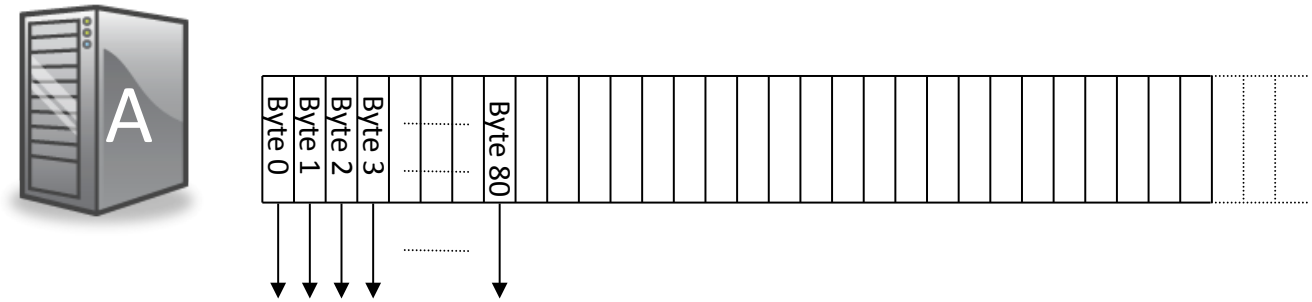
| Property | Behavior |
|---|---|
| ***Stream of bytes*** | Byte delivery service. |
| ***Connection oriented*** | 3-way handshake for connection setup. |
| ***Reliable delivery*** | 1. Acknowledgments indicate delivery.<br>2. Checksums detect corrupted data.<br>3. Sequence numbers detect missing data.<br>4. Flow-control prevents overrunning receiver. |
| ***In-sequence*** | Data delivered to application in sequence transmitted. |
| ***(Congestion Control*** | Controls network congestion.) |

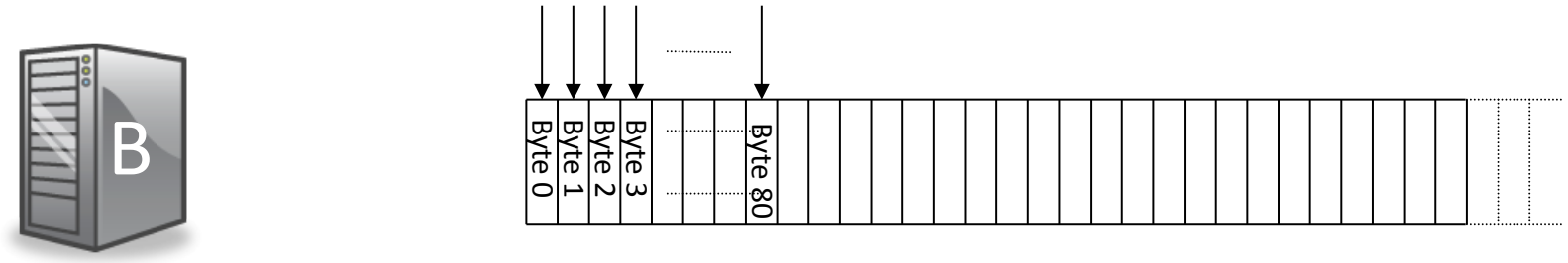
# TCP “stream of bytes” service



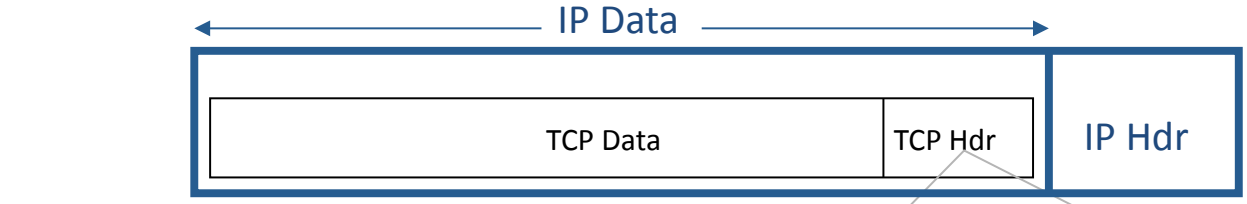



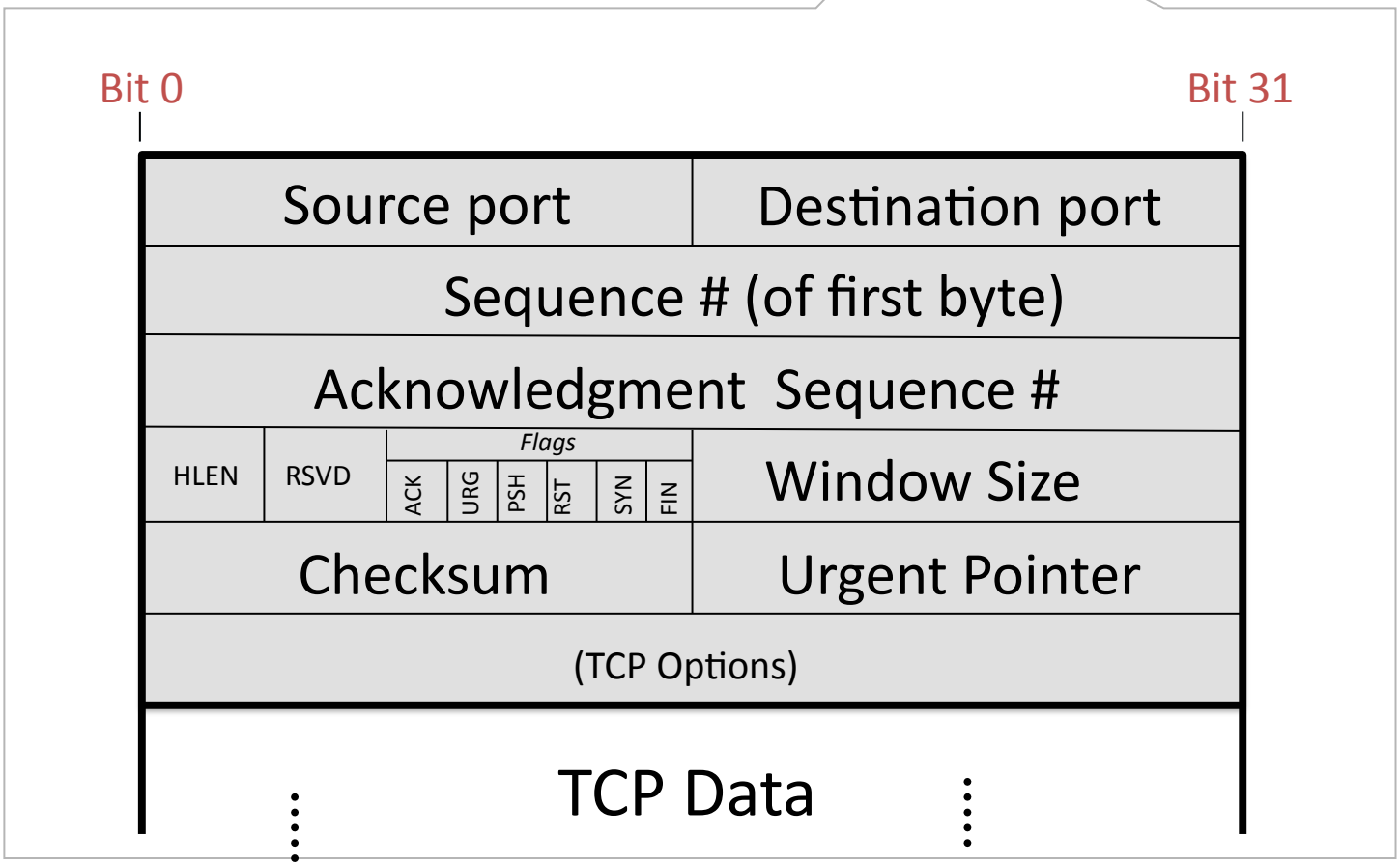
# …emulated using TCP “segments”



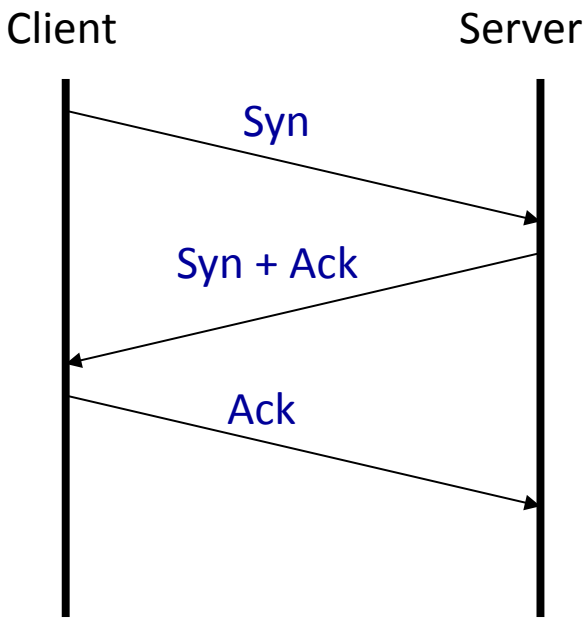



# The TCP Segment Format

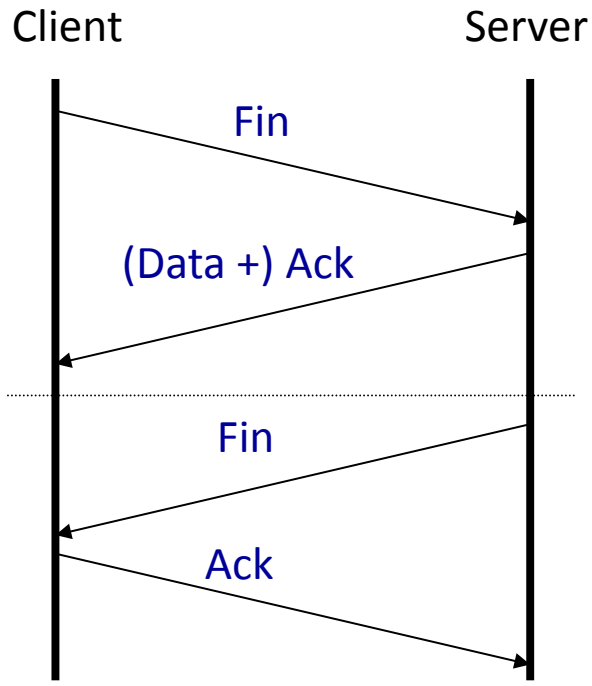


# Connection oriented: 3-way handshake

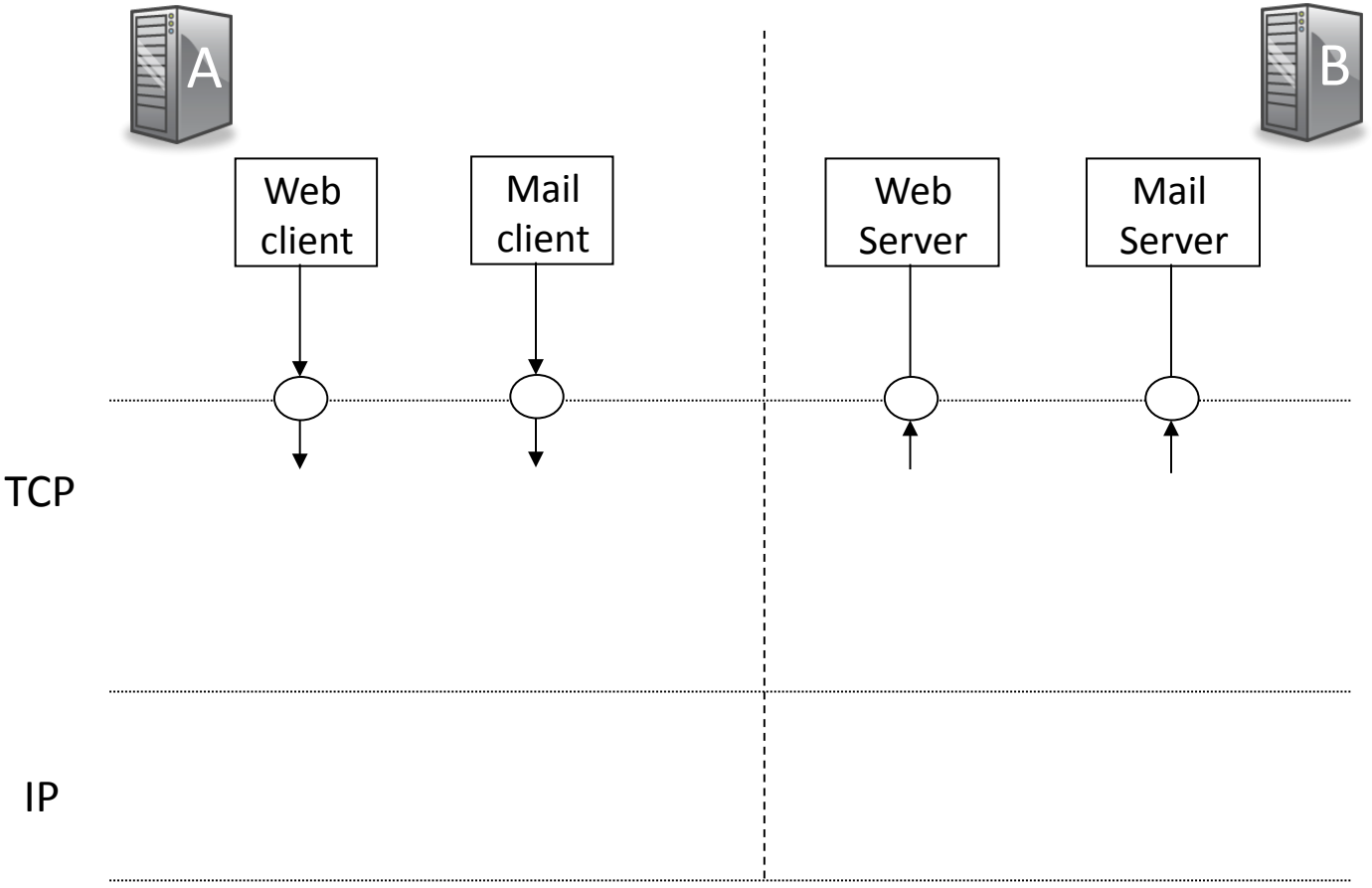



Connection Setup
3-way handshake

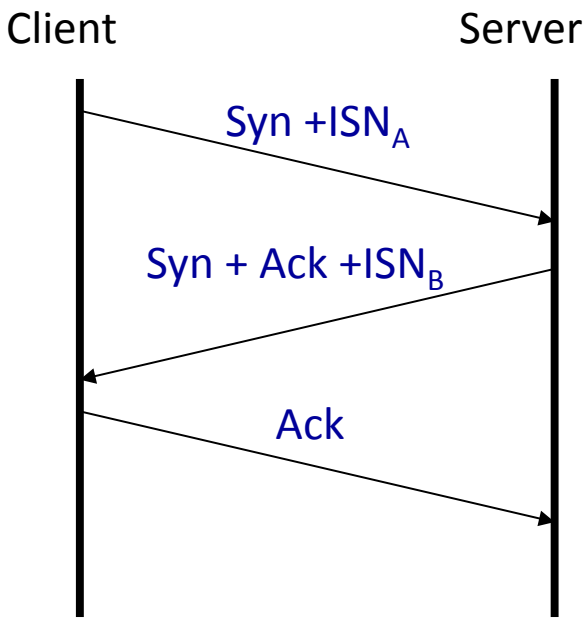



Connection Close/Teardown
2 x 2-way handshake

# TCP: Port Demultiplexing

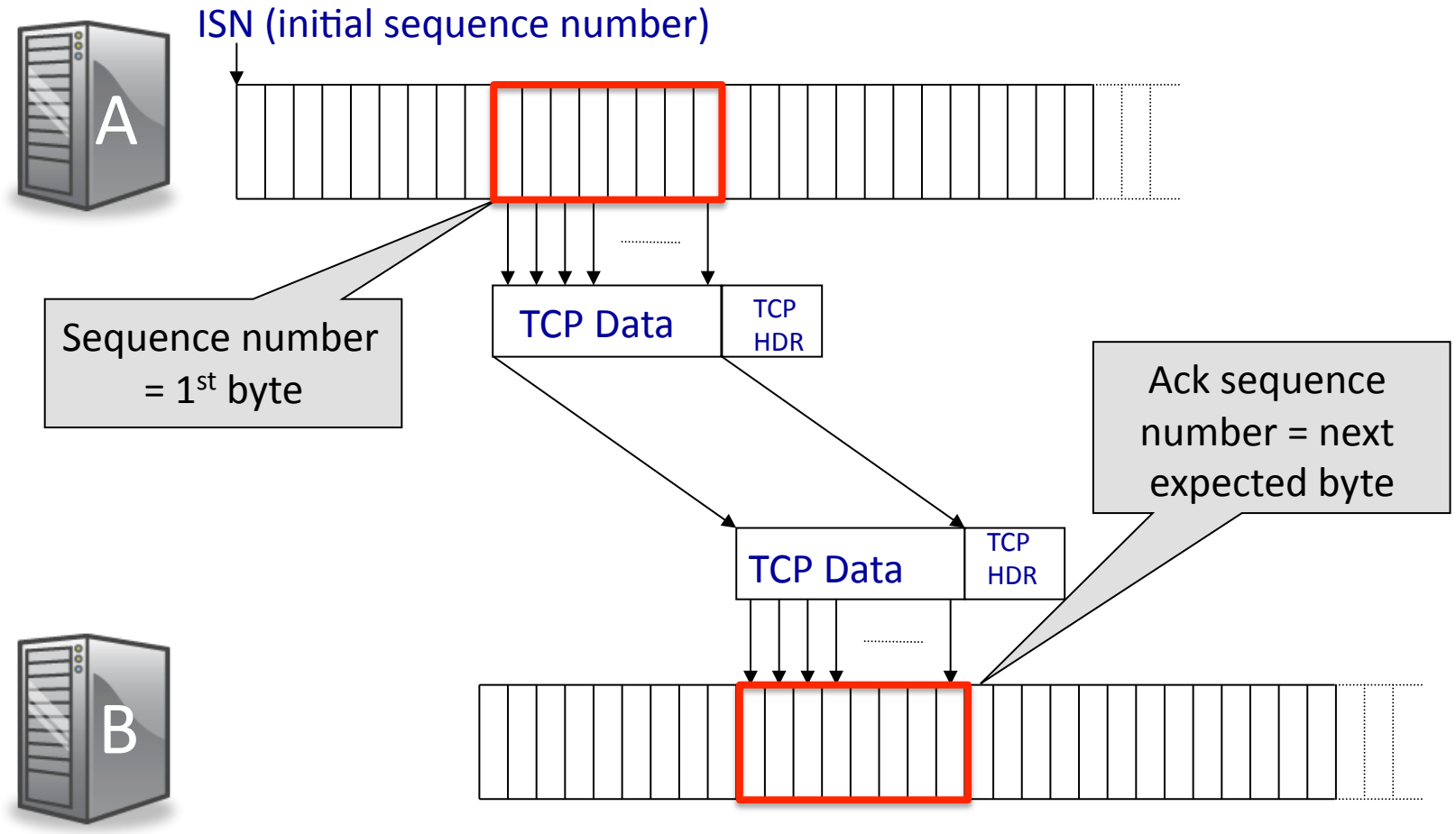


# Initial Sequence Numbers




Connection Setup
3-way handshake

# Sequence Numbers



# TCP Sliding Window

We will learn about several features of TCP in later lectures:

- Window-based flow control
- Congestion control
- Retransmission and timeouts

# Outline

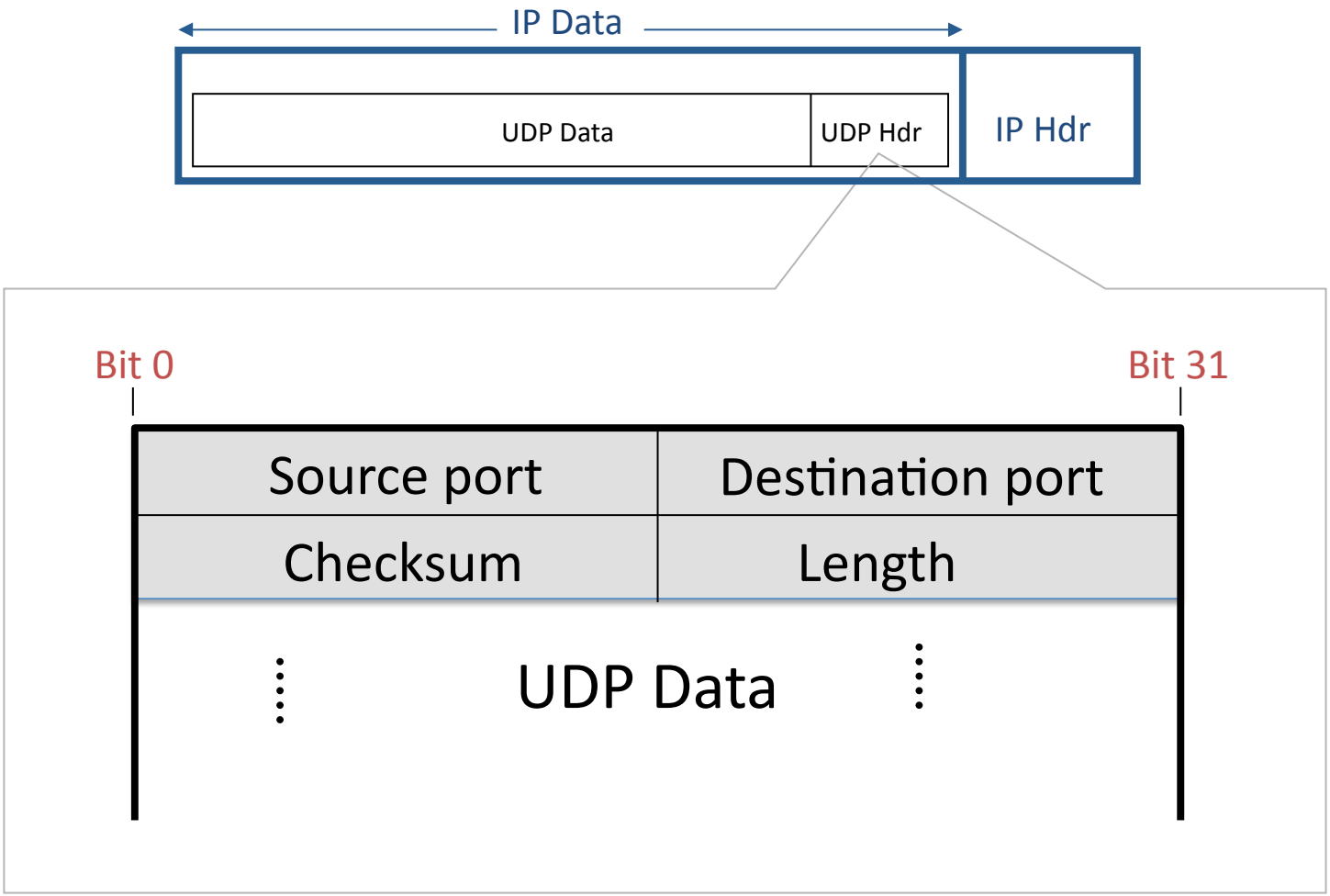
TCP Service Model

**UDP Service Model**

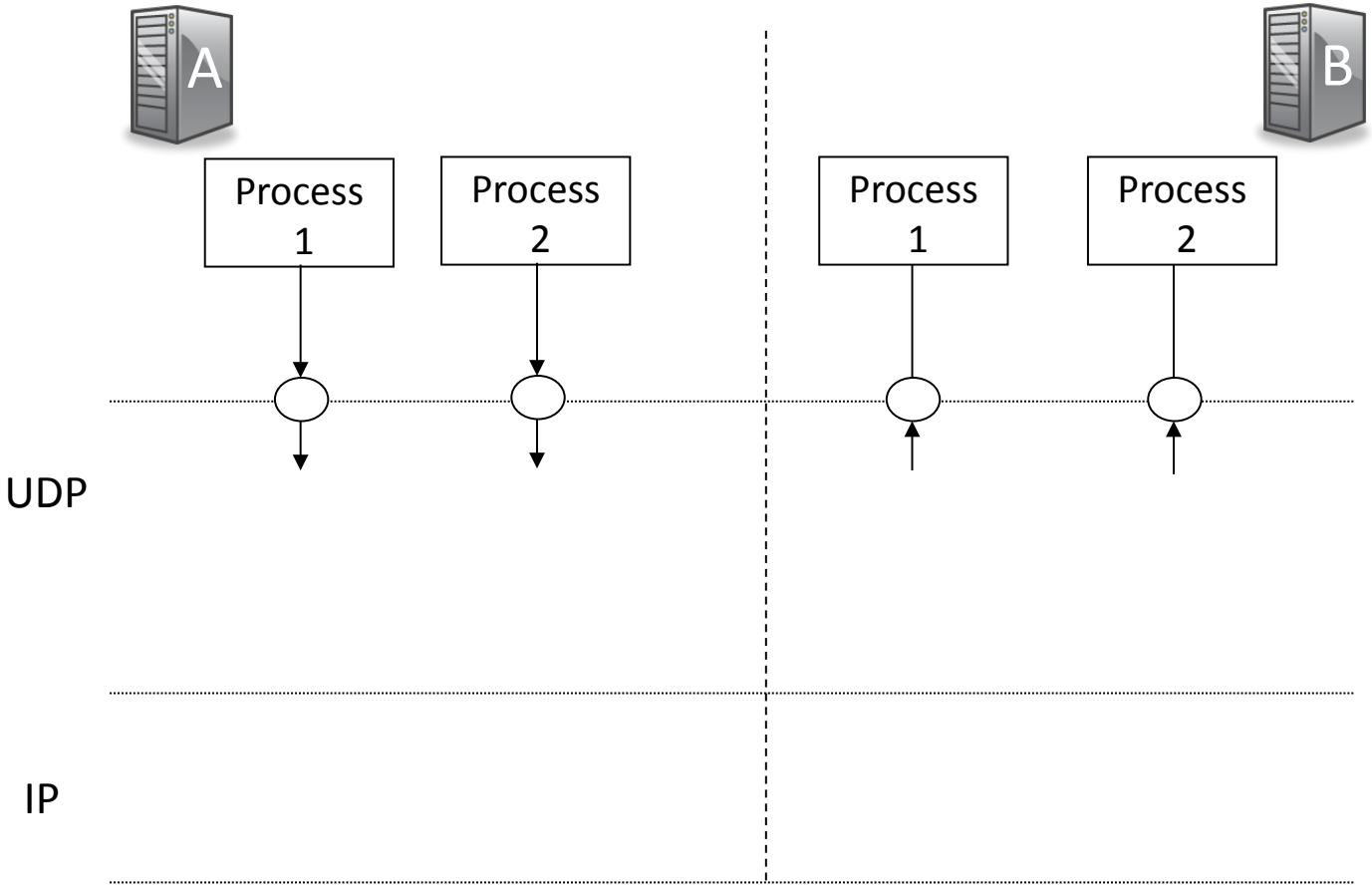
# User Datagram Protocol (UDP)

| Property | Behavior |
|---|---|
| ***Connectionless Datagram Service*** | No connection established.<br>Packets may show up in any order. |
| ***Self contained datagrams*** | |
| ***Unreliable delivery*** | 1. No acknowledgments.<br>2. Checksum covers header, not data.<br>3. No mechanism to detect missing or mis-sequenced data.<br>4. No flow control. |

# The UDP Datagram Format



# UDP: Port Demultiplexing



# Summary

TCP provides in-order, reliable delivery of a stream of bytes between application processes.

UDP provides a simpler, datagram delivery service between application processes.

# <The End>