

# **EECS 489 – FA 21**

## **Discussion 6**

# Assignment-2

Assignment 2 is out. Due date: **10/22 2021, 11:59 PM**

Much harder than A-1. (~1,000 loc)

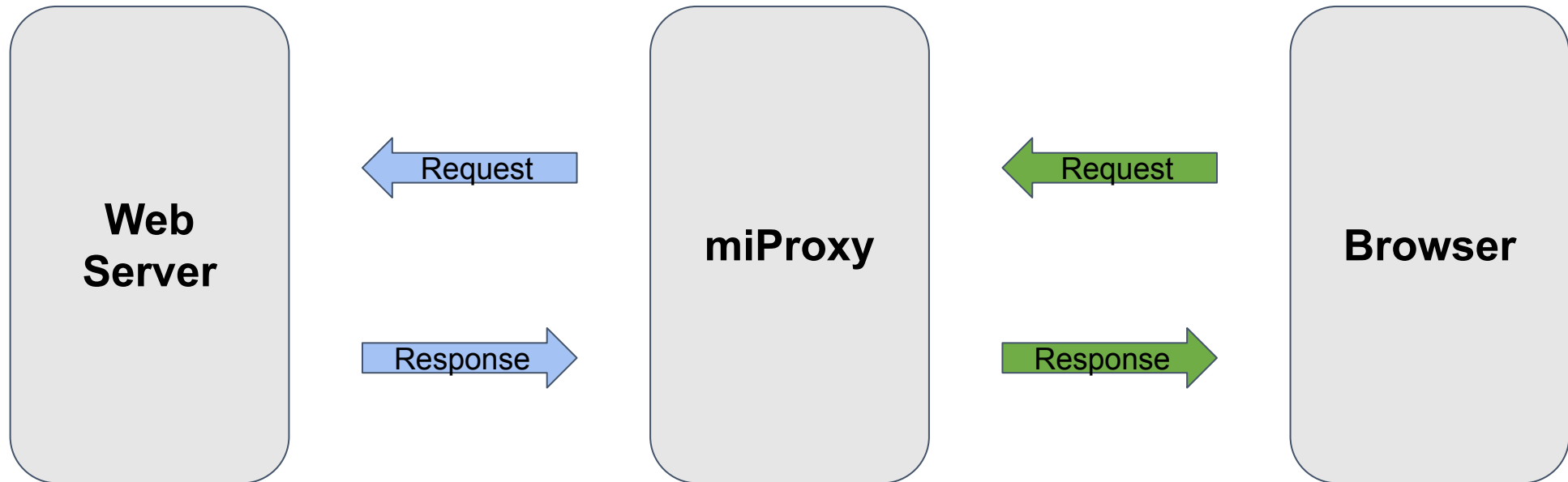
## START EARLY!

Hosted in GitHub under <https://github.com/eecs489>

Please make sure you are in the correct GitHub team and have access to your repo.

The Autograder will be available soon.

# Assignment-2 Overview



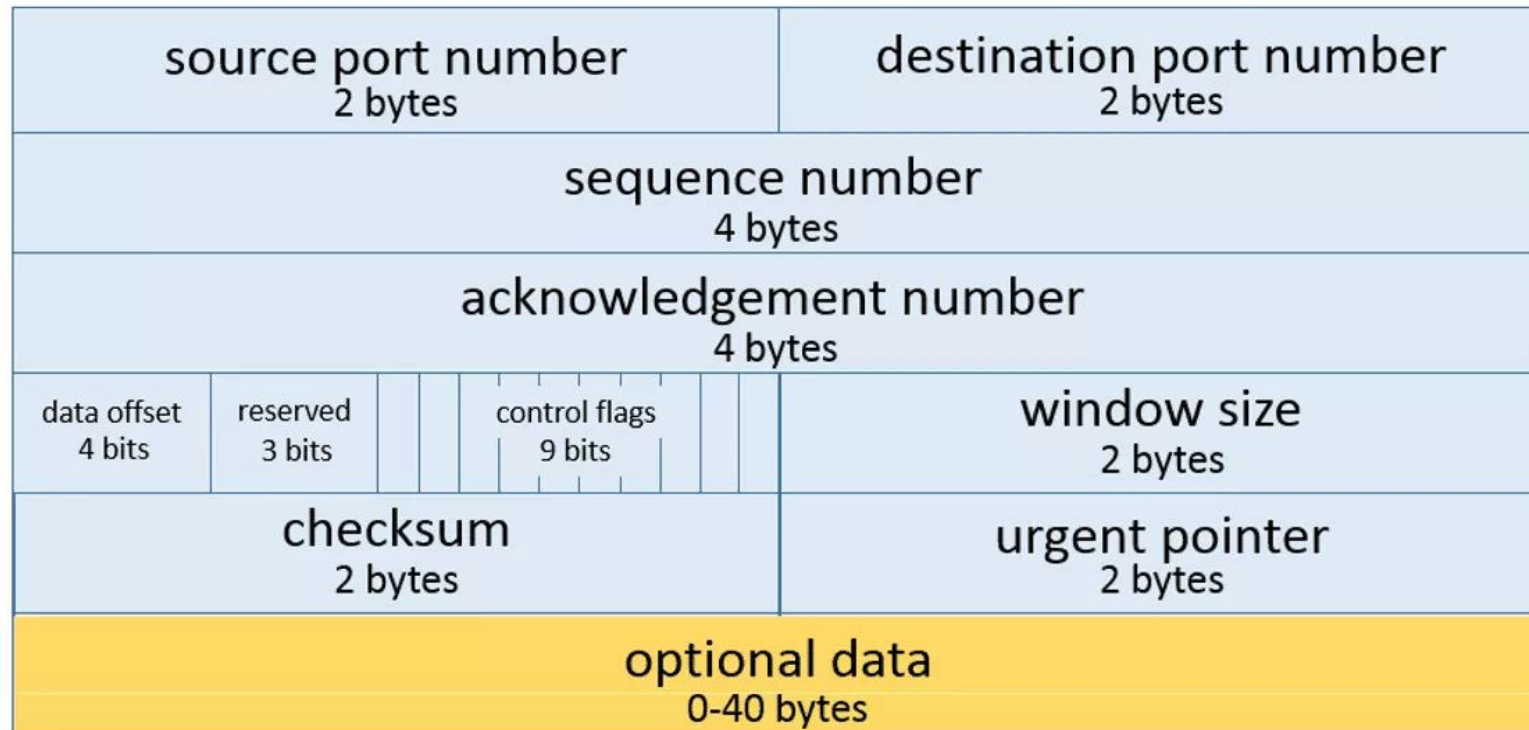
- The proxy only forwards messages between the browser and the web server
- Doesn't care what are forwarded
  - Don't make any assumption on what are forwarded

# Assignment-2 Overview

**A quick demo**

# TCP: Transmission Control Protocol

## Transmission Control Protocol (TCP) Header 20-60 bytes



# Q1 TCP File Transfer I

Consider transferring an enormous file of  $L$  bytes from host A to host B.  
What is the maximum value of  $L$  such that we don't run out of TCP sequence numbers?

- *Note: TCP sequence number is 4 bytes in the header*

$2^{32}$  Bytes

Given  $L = 2^{32}$  bytes, find how long it takes to transmit the file Assume:

- MSS (max segment size) = 1460 Bytes
- MTU (max transmission unit) = 1500 Bytes
- 128 Mbps link from A to B
- Ignore flow and congestion control, assume A sends as fast as possible contiguously.

$$(2^{32} / 1460 * 1500) / (128 * 10^6 / 8) = 276 \text{ s}$$

amount of data / bandwidth

# Q2 TCP Segment Metadata

Host A (sender) and B (receiver) are communicating over a TCP connection.

Assume the following events happen in order:

- B has received the first 127 bytes of the flow from A, this consumes seq num 0-126
- A then sends two segments, S1 (80 bytes of data), S2 (40 bytes of data)
- S1 has sequence num 127, source port 30302, destination port 80
- B sends ACK1 and ACK2 to A when it receives the first / second segment respectively

**Assume S1 and S2 arrive in order**

Q: For S2, what are the sequence num, source port and destination port?

**Seq num: 207, Source port: 30302, Destination port: 80**

Q: For ACK1, what are the ack num, source port and destination port?

**Ack num: 207, Source port: 80, Destination port: 30302**

**Now assume S1 and S2 come out of order**

Q: For ACK1, what are the ack num, source port and destination port?

**Ack num: 127, Source port: 80, Destination port: 30302**

# Q3 TCP CWND

Consider sending a large file over a lossless TCP connection

Assume:

- TCP uses AIMD for congestion control with slow start
- ssthres = 16 MSS
- Approximately constant RTT
- CWND starts at 1 MSS

Q: How long does it take for CWND to increase from 1 MSS to 20 MSS?

**CWND: 1 2 4 8 16 17 18 19 20; 8 RTT**

Q: What is the average throughput (in terms of MSS and RTT) of the above process?

**$(1+2+4+8+16+17+18+19) / 8 = 85 \text{ MSS} / 8 \text{ RTT}$**



# Thanks

Have a good one!