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Project 2 Report

First, a two-way connection is formed between the client and server, such that the client is sending packets to the server on one port, and the server is able to send packets back on another. Then, the client sends its first message (signal: SYN), establishing contact with the server. The server acknowledges that contact has been made by replying with a SYN-ACK signal. The client then sends back ACK and the payload can then be sent.

From there, the client begins sending the main message. It does this by entering a nested while loop, in which it traces through the entire length of the test string, sending it to the server in 4 character increments. At first the window is set to 1 and increases until it gets to 4, this mirrors additive increase and the idea of the congestion control window. Once the window is 4 characters long, 4 bytes can be sent from the client to the server. Each byte is compared individually and the window slides 1 character at a time.

As it progresses through the test string, it checks for warning messages from the server, which are generated when the sequence number last received by the server matches what should come next in the sequence. The client also performs similar checks to make sure that it is receiving the proper acknowledgement numbers from the server, ensuring that no packets have been lost.

The server appends these 4 character strings that it receives from the server to a string called finalMsg. When the server detects the end of the string, the “FIN” signal, it breaks the connection with the client and prints the string finalMsg, which is identical to the test string.

Demos

First part is open connection and establish three-way handshake

Server side:

```
(base) Ethans-MacBook-Pro-2:Project 2 ethanpearlstone$ python server.py
Path establishment... Received: SYN, Flag Number: 1
Path establishment... Sending: SYN-ACK, Flag Number: 2
Path establishment... Received: ACK, Flag Number: 3
Ready to receive payload.
```

Client side:

```
(base) Ethans-MacBook-Pro-2:Project 2 ethanpearlstone$ python client.py
Path establishment... Sending: SYN, Flag Number: 1
Path establishment... Recveived: SYN-ACK, Flag Number: 2
Path establishment... Sending: ACK, Flag Number: 3
```

Second Part implementing flow control

Server side:

```
Received: I, Sequence Number: 0
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 0

Received: I , Sequence Number: 1
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 1

Received: I l, Sequence Number: 2
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 2

Received: I lo, Sequence Number: 3
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 3

Received:  lov, Sequence Number: 4
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 4

Received: love, Sequence Number: 5
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 5

Received: ove , Sequence Number: 6
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 6

Received: ve F, Sequence Number: 7
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 7

Received: e Fo, Sequence Number: 8
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 8

Received:  For, Sequence Number: 9
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 9
```

...skip to end of transmission:

```
Received: ty., Sequence Number: 47
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 47

Received: y., Sequence Number: 48
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 48

Received: ., Sequence Number: 49
Preparing Acknowledgement message number
Sending: ACK, Acknowledgement Number: 49

Received FIN flag. Sending FYN-ACK.
I love Fordham University in the New York City.
```

Client side:

```
Sending: I, Sequence Number: 0
Received: ACK, Acknowledgement Number: 0

Correct Acknowledgement Number received
Sending: I , Sequence Number: 1
Received: ACK, Acknowledgement Number: 1

Correct Acknowledgement Number received
Sending: I l, Sequence Number: 2
Received: ACK, Acknowledgement Number: 2

Correct Acknowledgement Number received
Sending: I lo, Sequence Number: 3
Received: ACK, Acknowledgement Number: 3

Correct Acknowledgement Number received
Sending:  lov, Sequence Number: 4
Received: ACK, Acknowledgement Number: 4

Correct Acknowledgement Number received
Sending: love, Sequence Number: 5
Received: ACK, Acknowledgement Number: 5

Correct Acknowledgement Number received
Sending: ove , Sequence Number: 6
Received: ACK, Acknowledgement Number: 6

Correct Acknowledgement Number received
Sending: ve F, Sequence Number: 7
Received: ACK, Acknowledgement Number: 7
```

...skip to end of transmission:

```
Correct Acknowledgement Number received
Sending: y., Sequence Number: 48
Received: ACK, Acknowledgement Number: 48

Correct Acknowledgement Number received
Sending: ., Sequence Number: 49
Received: ACK, Acknowledgement Number: 49

Correct Acknowledgement Number received
End of message, sending FIN flag
Recieved FIN-ACK from server, closing connection
I love Fordham University in the New York City.
```

Conclusion:

This lab was a lot of fun to experiment with and fully understand the concept of flow control and sliding window. Through bug corrections and trial and error my partner and I managed to complete all tasks.