

Assignment 1 Report

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1. A brief discussion of how you have implemented the STP protocol. Provide a list of features that you have successfully implemented. In case you have not been able to get certain features of STP working, you should also mention that in your report.

- A three-way handshake (SYN, SYN+ACK, ACK) for the connection establishment.
- The four-segment connection termination (FIN, ACK, FIN, ACK).
- A single-timer for timeout operation
- Sequence numbers, cumulative acknowledgements, timers, buffers for implementing protocol.
- MSS&MWS
- PLD Module

2. A detailed diagram of your STP header and a quick explanation of all fields (similar to the diagrams that we have used in the lectures to understand TCP/UDP headers).

```
value = {'SYN':False, 'ACK':False, 'FIN':True, 'seq_num':message['seq_num'], 'ack_num':message['ack_num'], 'data':''}
```

The header includes:

- The type of the message, SYN, ACK, or FIN
- The sequence number and the cumulated acknowledgement number.
- The data itself.

3. For the standard version of the assignment, answer the following questions:

(a) Use the following parameter setting: pdrop = 0.1, MWS = 500 bytes, MSS = 50 bytes, seed = 300. Explain how you determine a suitable value for timeout. Note that you may need to experiment with different timeout values to answer this question. Justify your answer.

The timeout used in this section is 1.5ms. Too small timeout value will increase the transmission time greatly because of packet retransmission. Too large timeout value will be useless.

The result shows as follow:

Pdrop = 0.1:

```
Amount of data transferred: 2676 bytes
Number of data segments sent: 54
Number of packets dropped: 8
Number of retransmitted segments: 24
Number of duplicate acknowledgements: 24
```

Pdrop = 0.3:

```
Amount of data transferred: 4122 bytes
Number of data segments sent: 83
Number of packets dropped: 28
Number of retransmitted segments: 63
Number of duplicate acknowledgements: 63
```

As we can see in these pictures, the transmission time becomes much longer due to the retransmission of the dropped packet and wait for its acknowledgement.

The full packet sequences of all the experiments shows in the appendix section.

(b) Let $T_{current}$ represent the timeout value that you have chosen in part (a). Set $p_{drop} = 0.1$, $MWS = 500$ bytes, $MSS = 50$ bytes, $seed = 300$ and run three experiments with the following different timeout values:

i. $T_{current}$

ii. $4 \times T_{current}$

iii. $T_{current}/4$

and transfer the file test2.txt (available on the assignment webpage) using STP. Show a table that indicates how many STP packets were transmitted (this should include retransmissions) in total and how long the overall transfer took. Discuss the results.

The result shows as follow:

i: 1.5ms

```
Amount of data transferred: 2704 bytes
Number of data segments sent: 55
Number of packets dropped: 9
Number of retransmitted segments: 25
Number of duplicate acknowledgements: 25
```

ii:6.0ms

```
Amount of data transferred: 2704 bytes
Number of data segments sent: 55
Number of packets dropped: 9
Number of retransmitted segments: 25
Number of duplicate acknowledgements: 25
```

iii:0.4ms

```
Amount of data transferred: 2704 bytes
Number of data segments sent: 55
Number of packets dropped: 9
Number of retransmitted segments: 25
Number of duplicate acknowledgements: 25
```

There is a timeout value as a “sign”, when the timeout value used is above the sign, the time used increased linearly and slightly. In the current test, this case occurs.

If we decrease the timeout value until it below the “sign”, the time used will increase sharply.

Appendix

1. 3a pdrop=0.1

snd	5.013916015625	S	9792	0	0
rcv	5.013916015625	SA	8362	0	9793
snd	8.526611328125	A	9793	0	8363
snd	10.544921875	D	9793	50	8363
snd	11.0361328125	D	9843	50	8363
snd	11.0361328125	D	9893	50	8363
snd	11.534912109375	D	9943	50	8363
snd	11.534912109375	D	9993	50	8363
snd	12.0361328125	D	10043	50	8363
snd	12.0361328125	D	10093	50	8363
snd	12.0361328125	D	10143	50	8363
snd	12.5380859375	D	10193	50	8363
snd	12.5380859375	D	10243	50	8363
snd	12.5380859375	D	10293	50	8363
snd	12.5380859375	D	10343	50	8363
snd	13.03857421875	D	10393	50	8363
snd	13.03857421875	D	10443	50	8363
snd	13.03857421875	D	10493	50	8363
snd	13.540283203125	D	10543	50	8363
drop	13.540283203125	D	10593	50	8363
drop	13.540283203125	D	10643	50	8363
snd	13.540283203125	D	10693	50	8363
snd	13.540283203125	D	10743	50	8363
drop	14.041259765625	D	10793	50	8363
snd	14.041259765625	D	10843	50	8363
snd	14.041259765625	D	10893	50	8363
drop	14.041259765625	D	10943	50	8363
snd	14.041259765625	D	10993	50	8363
drop	14.041259765625	D	11043	50	8363
snd	14.542724609375	D	11093	50	8363
snd	14.542724609375	D	11143	50	8363
snd	14.542724609375	D	11193	50	8363
snd	15.044189453125	D	11243	50	8363
snd	15.044189453125	D	11293	50	8363
snd	15.044189453125	D	11343	43	8363
rcv	16.04638671875	A	8363	0	9843
rcv	16.04638671875	A	8363	0	9893
rcv	16.04638671875	A	8363	0	9943
rcv	16.04638671875	A	8363	0	9993
rcv	16.04638671875	A	8363	0	10043

rcv	16.04638671875	A	8363	0	10093
rcv	16.04638671875	A	8363	0	10143
rcv	16.04638671875	A	8363	0	10193
rcv	16.04638671875	A	8363	0	10243
rcv	16.04638671875	A	8363	0	10293
rcv	16.04638671875	A	8363	0	10343
rcv	16.04638671875	A	8363	0	10393
rcv	16.04638671875	A	8363	0	10443
rcv	16.04638671875	A	8363	0	10493
rcv	16.04638671875	A	8363	0	10543
rcv	16.04638671875	A	8363	0	10593
rcv	16.04638671875	A	8363	0	10593
rcv	16.04638671875	A	8363	0	10593
rcv	16.04638671875	A	8363	0	10593
rcv	16.04638671875	A	8363	0	10593
rcv	16.04638671875	A	8363	0	10593
rcv	16.04638671875	A	8363	0	10593
rcv	16.54833984375	A	8363	0	10593
rcv	16.54833984375	A	8363	0	10593
rcv	16.54833984375	A	8363	0	10593
rcv	16.54833984375	A	8363	0	10593
rcv	16.54833984375	A	8363	0	10593
snd	16.54833984375	D	10593	50	8363
snd	17.04931640625	D	10643	50	8363
drop	17.04931640625	D	10693	50	8363
snd	17.04931640625	D	10743	50	8363
drop	17.04931640625	D	10793	50	8363
snd	17.04931640625	D	10843	50	8363
snd	17.550537109375	D	10893	50	8363
snd	17.550537109375	D	10943	50	8363
snd	17.550537109375	D	10993	50	8363
snd	18.05224609375	D	11043	50	8363
snd	18.05224609375	D	11093	50	8363
snd	18.05224609375	D	11143	50	8363
snd	18.05224609375	D	11193	50	8363
snd	18.5537109375	D	11243	50	8363
snd	18.5537109375	D	11293	50	8363
snd	18.5537109375	D	11343	43	8363
rcv	19.054443359375	A	8363	0	10643
rcv	19.054443359375	A	8363	0	10693
rcv	19.054443359375	A	8363	0	10693
rcv	19.054443359375	A	8363	0	10693
rcv	19.054443359375	A	8363	0	10693
rcv	19.054443359375	A	8363	0	10693

rcv	19.054443359375	A	8363	0	10693
rcv	19.054443359375	A	8363	0	10693
rcv	19.054443359375	A	8363	0	10693
rcv	19.054443359375	A	8363	0	10693
rcv	19.054443359375	A	8363	0	10693
rcv	19.054443359375	A	8363	0	10693
rcv	19.054443359375	A	8363	0	10693
rcv	19.054443359375	A	8363	0	10693
snd	19.556396484375	D	10693	50	8363
snd	19.556396484375	D	10743	50	8363
snd	19.556396484375	D	10793	50	8363
snd	20.0576171875	D	10843	50	8363
snd	20.0576171875	D	10893	50	8363
snd	20.0576171875	D	10943	50	8363
snd	20.55859375	D	10993	50	8363
snd	20.55859375	D	11043	50	8363
drop	20.55859375	D	11093	50	8363
snd	20.55859375	D	11143	50	8363
snd	21.060302734375	D	11193	50	8363
snd	21.060302734375	D	11243	50	8363
snd	21.060302734375	D	11293	50	8363
snd	21.5615234375	D	11343	43	8363
rcv	21.5615234375	A	8363	0	10793
rcv	21.5615234375	A	8363	0	10793
rcv	21.5615234375	A	8363	0	10843
rcv	21.5615234375	A	8363	0	11386
snd	21.5615234375	F	11386	0	8363
rcv	22.6884765625	FA	8364	0	11387
snd	24.692626953125	A	11387	0	8365

Amount of data transferred: 2679 bytes

Number of data segments sent: 54

Number of packets dropped: 8

Number of retransmitted segments: 24

Number of duplicate acknowledgements: 24

2. 3a pdrop=0.3

snd	4.9814453125	S	9792	0	0
rcv	4.9814453125	SA	2403	0	9793
snd	8.991943359375	A	9793	0	2404
snd	10.49658203125	D	9793	50	2404
snd	10.998779296875	D	9843	50	2404
snd	10.998779296875	D	9893	50	2404
snd	10.998779296875	D	9943	50	2404

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[illegible]

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rcv	22.13134765625	A	2404	0	10693
rcv	22.13134765625	A	2404	0	10693
rcv	22.13134765625	A	2404	0	10693
rcv	22.13134765625	A	2404	0	10693
rcv	22.13134765625	A	2404	0	10693
rcv	22.13134765625	A	2404	0	10693
drop	22.13134765625	D	10693	50	2404
snd	22.13134765625	D	10743	50	2404
snd	22.13134765625	D	10793	50	2404
snd	23.125	D	10843	50	2404
snd	23.125	D	10893	50	2404
snd	23.125	D	10943	50	2404
snd	23.125	D	10993	50	2404
snd	23.125	D	11043	50	2404
snd	23.125	D	11093	50	2404
snd	24.126953125	D	11143	50	2404
snd	24.126953125	D	11193	50	2404
snd	24.126953125	D	11243	50	2404
snd	24.126953125	D	11293	50	2404
snd	24.126953125	D	11343	43	2404
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
rcv	25.148193359375	A	2404	0	10693
snd	26.152099609375	D	10693	50	2404
snd	26.152099609375	D	10743	50	2404
snd	26.152099609375	D	10793	50	2404
drop	26.152099609375	D	10843	50	2404
drop	26.152099609375	D	10893	50	2404
drop	26.152099609375	D	10943	50	2404
snd	26.152099609375	D	10993	50	2404
snd	27.140625	D	11043	50	2404
snd	27.140625	D	11093	50	2404
snd	27.140625	D	11143	50	2404
snd	27.140625	D	11193	50	2404

snd	27.140625	D	11243	50	2404
snd	27.140625	D	11293	50	2404
snd	28.1396484375	D	11343	43	2404
rcv	28.1396484375	A	2404	0	10743
rcv	28.1396484375	A	2404	0	11386
snd	28.1396484375	F	11386	0	2404
rcv	29.140380859375	FA	2405	0	11387
snd	30.14599609375	A	11387	0	2406

Amount of data transferred: 4122 bytes

Number of data segments sent: 83

Number of packets dropped: 28

Number of retransmitted segments: 63

Number of duplicate acknowledgements: 63

3. 3b timeout=1.5

snd	5.0302734375	S	9792	0	0
rcv	6.028564453125	SA	6851	0	9793
snd	9.02490234375	A	9793	0	6852
snd	11.0302734375	D	9793	50	6852
snd	11.0302734375	D	9843	50	6852
snd	11.0302734375	D	9893	50	6852
snd	12.033203125	D	9943	50	6852
snd	12.033203125	D	9993	50	6852
snd	12.033203125	D	10043	50	6852
snd	12.033203125	D	10093	50	6852
snd	13.0361328125	D	10143	50	6852
snd	13.0361328125	D	10193	50	6852
snd	13.0361328125	D	10243	50	6852
snd	13.0361328125	D	10293	50	6852
snd	14.038818359375	D	10343	50	6852
snd	14.038818359375	D	10393	50	6852
snd	14.038818359375	D	10443	50	6852
snd	14.038818359375	D	10493	50	6852
snd	15.0419921875	D	10543	50	6852
drop	15.0419921875	D	10593	50	6852
drop	15.0419921875	D	10643	50	6852
snd	15.0419921875	D	10693	50	6852
snd	16.0439453125	D	10743	50	6852
drop	16.0439453125	D	10793	50	6852
snd	16.0439453125	D	10843	50	6852
snd	16.0439453125	D	10893	50	6852
drop	16.0439453125	D	10943	50	6852
snd	16.0439453125	D	10993	50	6852

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rcv	23.06298828125	A	6852	0	11493
rcv	23.06298828125	A	6852	0	11543
rcv	23.06298828125	A	6852	0	11593
rcv	23.06298828125	A	6852	0	11643
rcv	23.06298828125	A	6852	0	11747
snd	23.06298828125	F	11747	0	6852
rcv	24.065185546875	FA	6853	0	11748
snd	27.07373046875	A	11748	0	6854

Amount of data transferred: 2704 bytes

Number of data segments sent: 55

Number of packets dropped: 9

Number of retransmitted segments: 25

Number of duplicate acknowledgements: 25

4. 3b timeout=0.4

snd	5.025146484375	S	9792	0	0
rcv	6.017333984375	SA	7174	0	9793
snd	7.02197265625	A	9793	0	7175
snd	10.026611328125	D	9793	50	7175
snd	10.026611328125	D	9843	50	7175
snd	11.0302734375	D	9893	50	7175
snd	11.0302734375	D	9943	50	7175
snd	11.0302734375	D	9993	50	7175
snd	11.0302734375	D	10043	50	7175
snd	11.0302734375	D	10093	50	7175
snd	12.031982421875	D	10143	50	7175
snd	12.031982421875	D	10193	50	7175
snd	12.031982421875	D	10243	50	7175
snd	12.031982421875	D	10293	50	7175
snd	12.031982421875	D	10343	50	7175
snd	13.03466796875	D	10393	50	7175
snd	13.03466796875	D	10443	50	7175
snd	13.03466796875	D	10493	50	7175
snd	13.03466796875	D	10543	50	7175
drop	13.03466796875	D	10593	50	7175
drop	13.03466796875	D	10643	50	7175
snd	13.03466796875	D	10693	50	7175
snd	14.052978515625	D	10743	50	7175
drop	14.052978515625	D	10793	50	7175
snd	14.052978515625	D	10843	50	7175
snd	14.052978515625	D	10893	50	7175
drop	14.052978515625	D	10943	50	7175
snd	14.052978515625	D	10993	50	7175

[illegible]

[illegible]

rcv	22.6123046875	A	7175	0	11493
rcv	22.6123046875	A	7175	0	11543
rcv	22.6123046875	A	7175	0	11593
rcv	22.6123046875	A	7175	0	11643
rcv	22.6123046875	A	7175	0	11747
snd	23.07470703125	F	11747	0	7175
rcv	23.07470703125	FA	7176	0	11748
snd	24.583984375	A	11748	0	7177

Amount of data transferred: 2704 bytes

Number of data segments sent: 55

Number of packets dropped: 9

Number of retransmitted segments: 25

Number of duplicate acknowledgements: 25

5. 3b timeout = 6.0

snd	5.984130859375	S	9792	0	0
rcv	5.984130859375	SA	2629	0	9793
snd	16.177001953125	A	9793	0	2630
snd	18.163818359375	D	9793	50	2630
snd	18.163818359375	D	9843	50	2630
snd	18.163818359375	D	9893	50	2630
snd	19.1669921875	D	9943	50	2630
snd	19.1669921875	D	9993	50	2630
snd	19.1669921875	D	10043	50	2630
snd	19.1669921875	D	10093	50	2630
snd	19.1669921875	D	10143	50	2630
snd	19.1669921875	D	10193	50	2630
snd	20.16943359375	D	10243	50	2630
snd	20.16943359375	D	10293	50	2630
snd	20.16943359375	D	10343	50	2630
snd	20.16943359375	D	10393	50	2630
snd	20.16943359375	D	10443	50	2630
snd	20.16943359375	D	10493	50	2630
snd	21.172119140625	D	10543	50	2630
drop	21.172119140625	D	10593	50	2630
drop	21.172119140625	D	10643	50	2630
snd	21.172119140625	D	10693	50	2630
snd	21.172119140625	D	10743	50	2630
drop	21.172119140625	D	10793	50	2630
snd	21.172119140625	D	10843	50	2630
snd	21.172119140625	D	10893	50	2630
drop	21.172119140625	D	10943	50	2630
snd	21.172119140625	D	10993	50	2630

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[illegible]

rcv	29.191650390625	A	2630	0	11493
rcv	29.191650390625	A	2630	0	11543
rcv	29.191650390625	A	2630	0	11593
rcv	29.191650390625	A	2630	0	11643
rcv	29.191650390625	A	2630	0	11747
snd	29.191650390625	F	11747	0	2630
rcv	29.191650390625	FA	2631	0	11748
snd	31.19677734375	A	11748	0	2632

Amount of data transferred: 2704 bytes

Number of data segments sent: 55

Number of packets dropped: 9

Number of retransmitted segments: 25

Number of duplicate acknowledgements: 25