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CPRE 489: Lab 9

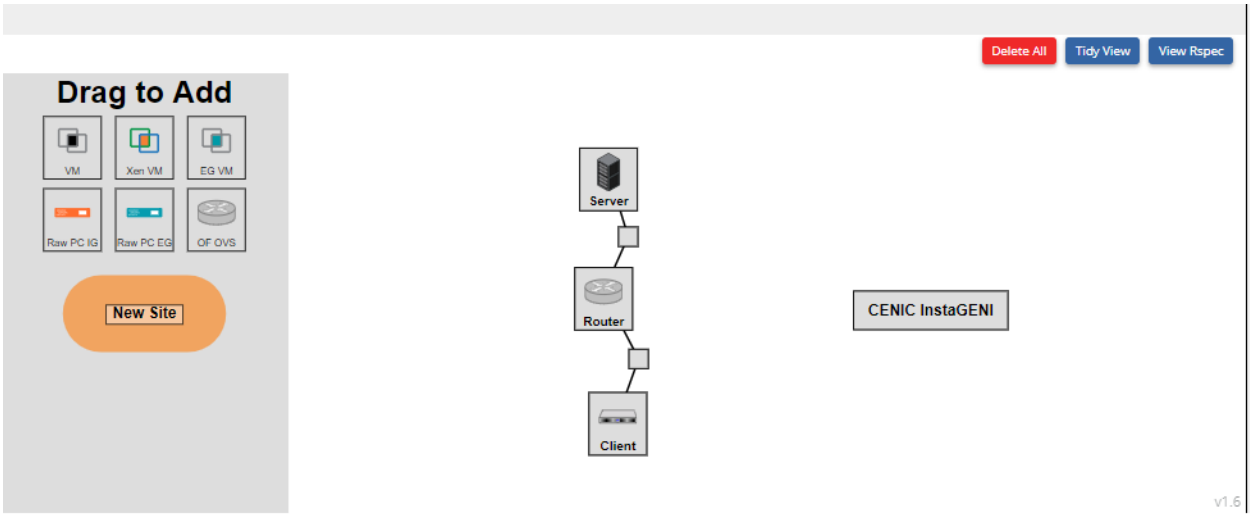
What I learned:

To start, I learned how to create a topology in GENI by hand, without having to use a pre-made setup. This helps me understand and make my own connections to perform whatever kind of test I would need to do. Another thing I learned was about TCP congestion avoidance algorithm, and how it is used to handle TCP traffic. There are many aspects to this algorithm such as the slow start threshold, congestion avoidance window, fast recovery, and fast response. These all come together to create a more consistent way to transmit packets quickly.

Another thing I learned (or already knew and had to struggle through) was creating a legible graph in excel. Whenever I imported the .dat file and tried to create graphs, they came out nasty. It definitely took some time and some google searching to find ways to make the graphs legible.

Exercise:

Screenshot of topology

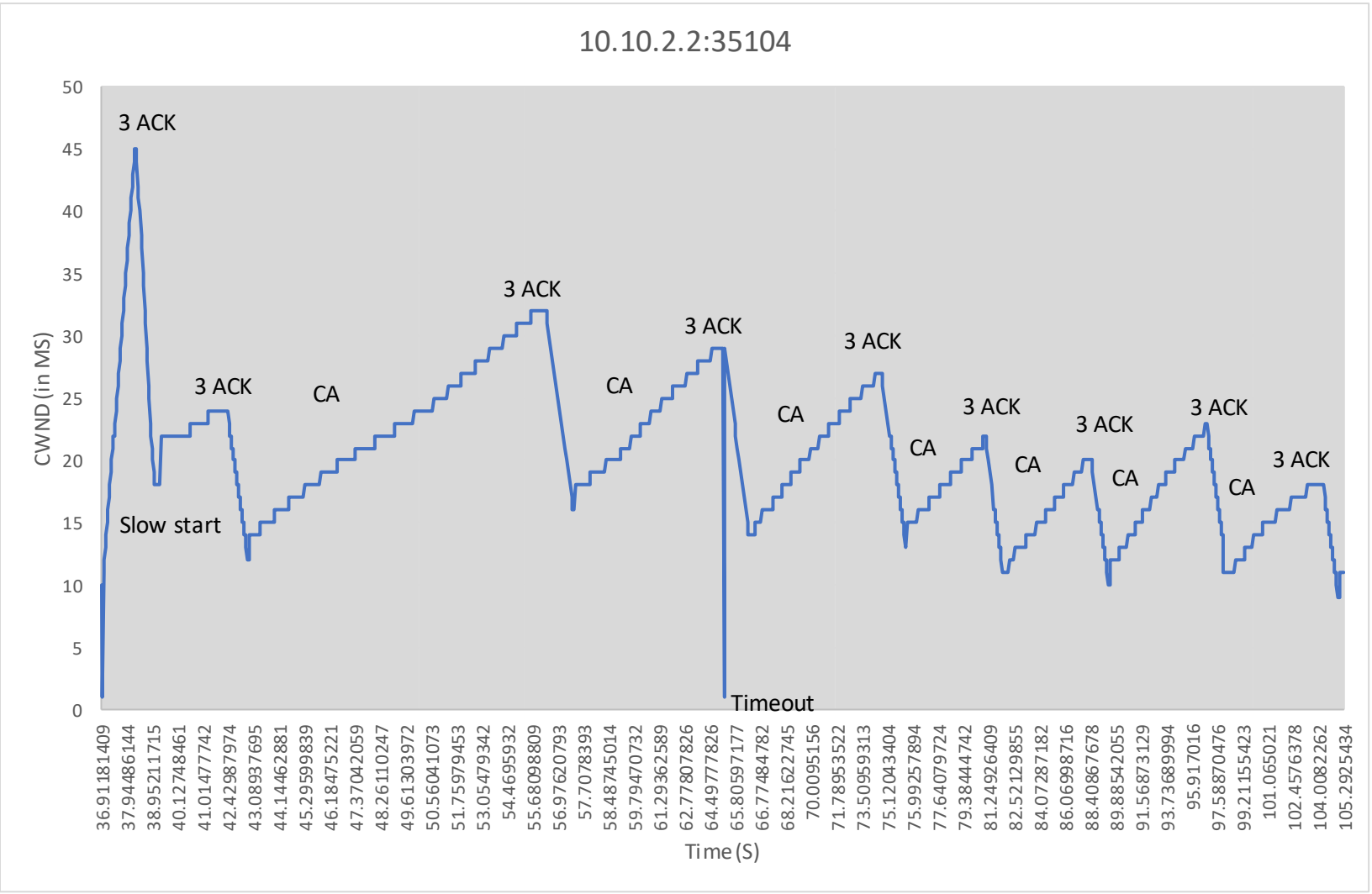


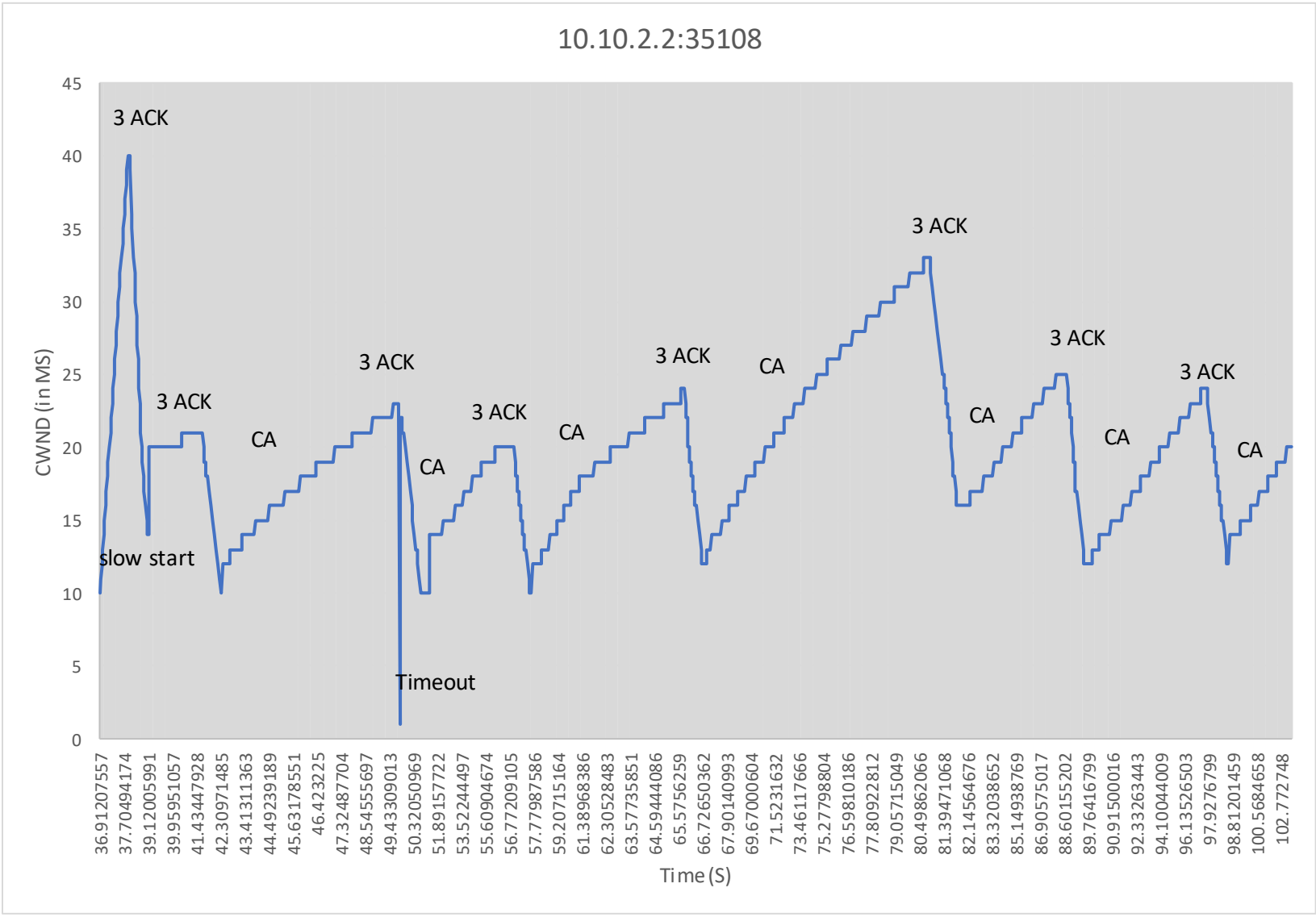
Screenshots of IPERF on PROBE output (I only included the last chunk of probe, otherwise it would take a few pages):

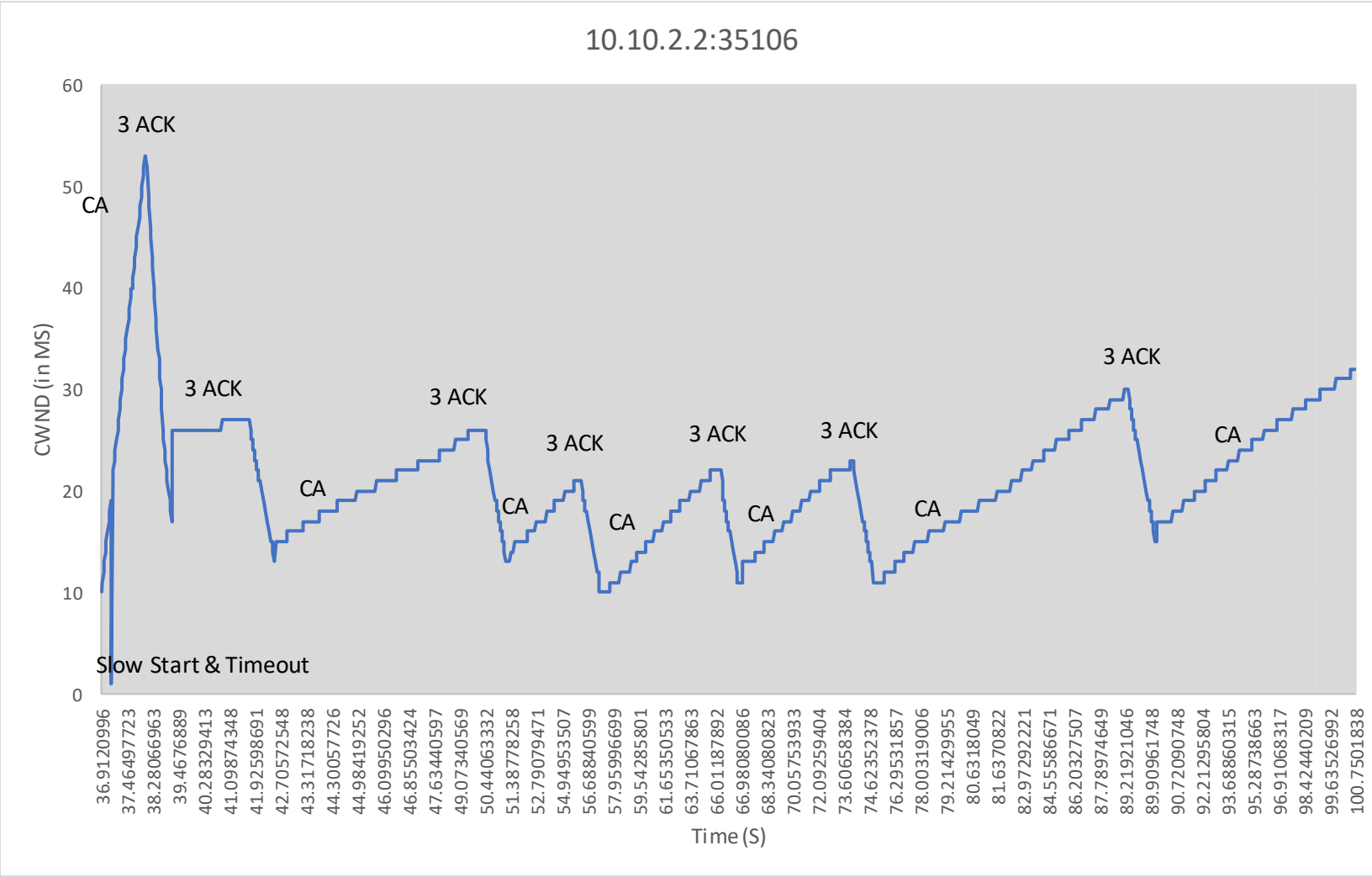
```
walls594@client:~$ iperf -t 60 -c server -P 3
------------------------------------------------------------
Client connecting to server, TCP port 5001
TCP window size: 85.0 KByte (default)
------------------------------------------------------------
[  4] local 10.10.2.2 port 35106 connected with 10.10.1.1 port 5001
[  5] local 10.10.2.2 port 35108 connected with 10.10.1.1 port 5001
[  3] local 10.10.2.2 port 35104 connected with 10.10.1.1 port 5001
[ ID] Interval       Transfer     Bandwidth
[  4]  0.0-63.9 sec  2.75 MBytes   361 Kbits/sec
[  5]  0.0-67.0 sec  2.75 MBytes   344 Kbits/sec
[  3]  0.0-68.4 sec  2.88 MBytes   352 Kbits/sec
[SUM]  0.0-68.4 sec  8.38 MBytes  1.03 Mbits/sec
walls594@client:~$
```

```
103.487422586 10.10.2.2:35108 10.10.1.1:5001 32 0xe352100c 0xe3519eec 20 15 232832 804107 29312
103.499586331 10.10.2.2:35104 10.10.1.1:5001 32 0x438695c6 0x43862ff6 18 13 273152 817144 29312
103.596718353 10.10.2.2:35108 10.10.1.1:5001 32 0xe3521b5c 0xe351aa3c 20 15 232832 806536 29312
103.717373527 10.10.2.2:35108 10.10.1.1:5001 32 0xe35226ac 0xe351b58c 20 15 232832 808714 29312
103.729613083 10.10.2.2:35104 10.10.1.1:5001 32 0x43869b6e 0x4386359e 18 13 273152 817950 29312
103.778155415 10.10.2.2:35104 10.10.1.1:5001 32 0x4386a116 0x43863b46 18 13 273152 818653 29312
103.826598076 10.10.2.2:35108 10.10.1.1:5001 32 0xe35231fc 0xe351c0dc 20 15 232832 810534 29312
103.875040433 10.10.2.2:35108 10.10.1.1:5001 32 0xe3523d4c 0xe351cc2c 20 15 232832 813682 29312
103.923496142 10.10.2.2:35108 10.10.1.1:5001 32 0xe352489c 0xe351d77c 20 15 232832 816457 29312
103.984031465 10.10.2.2:35104 10.10.1.1:5001 32 0x4386a6be 0x438640ee 18 13 273152 820804 29312
103.996170265 10.10.2.2:35104 10.10.1.1:5001 32 0x4386ac66 0x43864696 18 13 273152 821118 29312
104.008226215 10.10.2.2:35104 10.10.1.1:5001 32 0x4386b20e 0x43864c3e 18 13 273152 821457 29312
104.032261793 10.10.2.2:35104 10.10.1.1:5001 32 0x4386b7b6 0x438651e6 18 13 273152 821732 29312
104.044510362 10.10.2.2:35104 10.10.1.1:5001 32 0x4386bd5e 0x4386578e 18 13 273152 823460 29312
104.056592815 10.10.2.2:35104 10.10.1.1:5001 32 0x4386c306 0x43865d36 18 13 273152 824987 29312
104.068771797 10.10.2.2:35104 10.10.1.1:5001 32 0x4386c8ae 0x438662de 18 13 273152 826299 29312
104.105052187 10.10.2.2:35104 10.10.1.1:5001 44 0x4386ce56 0x43866886 18 13 273152 827468 29312
104.117109538 10.10.2.2:35104 10.10.1.1:5001 44 0x4386d3fe 0x43866886 18 13 273152 828485 29312
104.177926507 10.10.2.2:35104 10.10.1.1:5001 44 0x4386d9a6 0x43866886 18 13 273152 829358 29312
104.262608270 10.10.2.2:35104 10.10.1.1:5001 44 0x4386d9a6 0x43866886 17 9 273152 830193 29312
104.274647562 10.10.2.2:35104 10.10.1.1:5001 44 0x4386d9a6 0x43866886 16 9 273152 830893 29312
104.286747053 10.10.2.2:35104 10.10.1.1:5001 44 0x4386df4e 0x43866886 16 9 273152 831497 29312
104.298735993 10.10.2.2:35104 10.10.1.1:5001 44 0x4386df4e 0x43866886 15 9 273152 832031 29312
104.335119553 10.10.2.2:35104 10.10.1.1:5001 44 0x4386e4f6 0x43866886 15 9 273152 832465 29312
104.565408385 10.10.2.2:35104 10.10.1.1:5001 44 0x4386e4f6 0x43866886 14 9 273152 832848 29312
104.601912614 10.10.2.2:35104 10.10.1.1:5001 44 0x4386ea9e 0x43866886 14 9 273152 833216 29312
104.783344309 10.10.2.2:35104 10.10.1.1:5001 44 0x4386ea9e 0x43866886 13 9 273152 832033 29312
104.795455065 10.10.2.2:35104 10.10.1.1:5001 44 0x4386f046 0x43866886 13 9 273152 827942 29312
104.807473080 10.10.2.2:35104 10.10.1.1:5001 44 0x4386f046 0x43866886 12 9 273152 824360 29312
104.831808178 10.10.2.2:35104 10.10.1.1:5001 44 0x4386f5ee 0x43866886 12 9 273152 821219 29312
104.844212221 10.10.2.2:35104 10.10.1.1:5001 44 0x4386f5ee 0x43866886 11 9 273152 818510 29312
104.856294343 10.10.2.2:35104 10.10.1.1:5001 44 0x4386fb96 0x43866886 11 9 273152 816158 29312
104.868431976 10.10.2.2:35104 10.10.1.1:5001 44 0x4386fb96 0x43866886 10 9 273152 814100 29312
104.905065030 10.10.2.2:35104 10.10.1.1:5001 44 0x4386fb96 0x43866886 9 9 273152 812295 29312
104.917071780 10.10.2.2:35104 10.10.1.1:5001 44 0x4387013e 0x43866886 9 9 273152 810758 29312
104.953365717 10.10.2.2:35104 10.10.1.1:5001 32 0x438706e6 0x43866886 9 9 273152 809408 29312
105.013921280 10.10.2.2:35104 10.10.1.1:5001 32 0x43871236 0x4386d9a6 11 9 244224 804732 29312
105.026097323 10.10.2.2:35104 10.10.1.1:5001 32 0x43871d86 0x4386df4e 11 9 273152 796548 29312
105.159418927 10.10.2.2:35104 10.10.1.1:5001 32 0x4387232e 0x4386e4f6 11 9 273152 787897 29312
105.292543440 10.10.2.2:35104 10.10.1.1:5001 32 0x438728d6 0x4386ea9e 11 9 273152 763661 29312
105.304532430 10.10.2.2:35104 10.10.1.1:5001 32 0x43872e7e 0x4386f046 11 9 273152
```

Graphs with annotations:




10.10.2.2:35108
CWND (in MS)
Time (S)
3 ACK
3 ACK
slow start
CA
3 ACK
CA
Timeout
3 ACK
CA
3 ACK
CA
3 ACK
CA
3 ACK
CA
3 ACK
CA




Slow Start vs. Congestion avoidance:

In slow start mode, the number of transmissions is exponential until it reaches the slow start threshold. Once this is reached, congestion avoidance starts, where the number of transmissions increases linearly. So basically, slow start sends packets slowly and then really ramps up, where as congestion avoidance sends them slowly to avoid going past the threshold.

When 3 duplicate ACKS are received:

When this happens, the slow start threshold is set to the current congestion avoidance window, and the current congestion avoidance window is reduced by half. Slow start and congestion avoidance then start again until the threshold is reached.