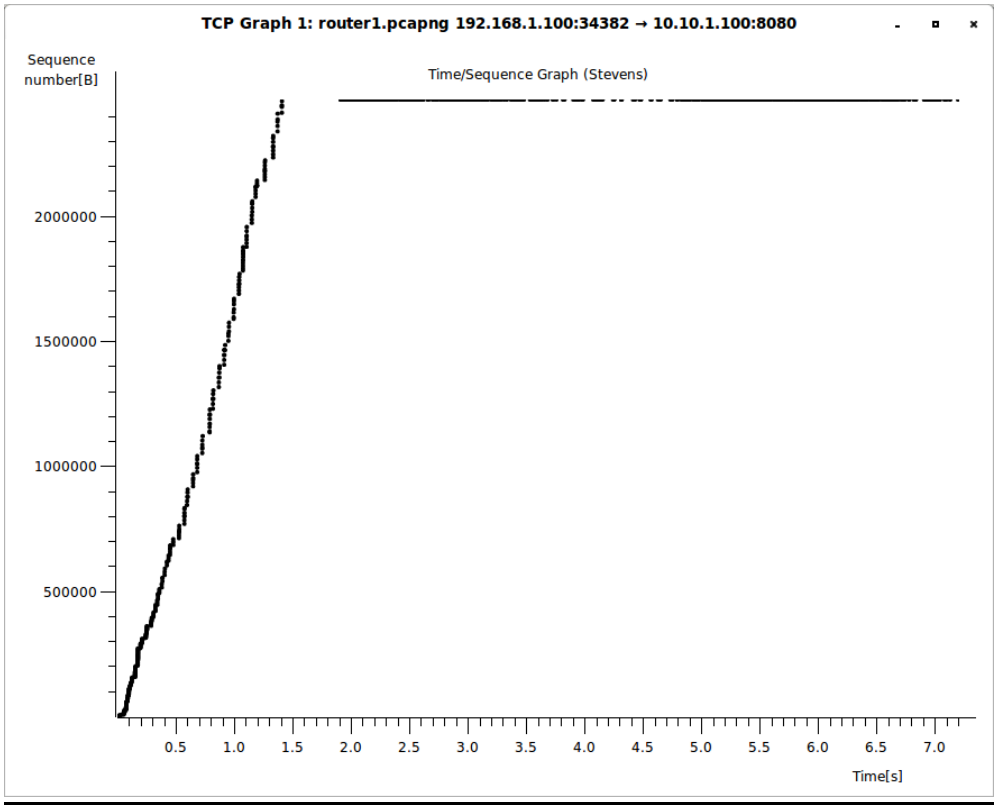
1. No Loss (see Conversation screenshot) :
   Number of transmitted packets at host a: 1172
   Number of received packets at host a: 2211
   Number of transmitted packets at host b: 2211
   Number of received packets at host b: 1172

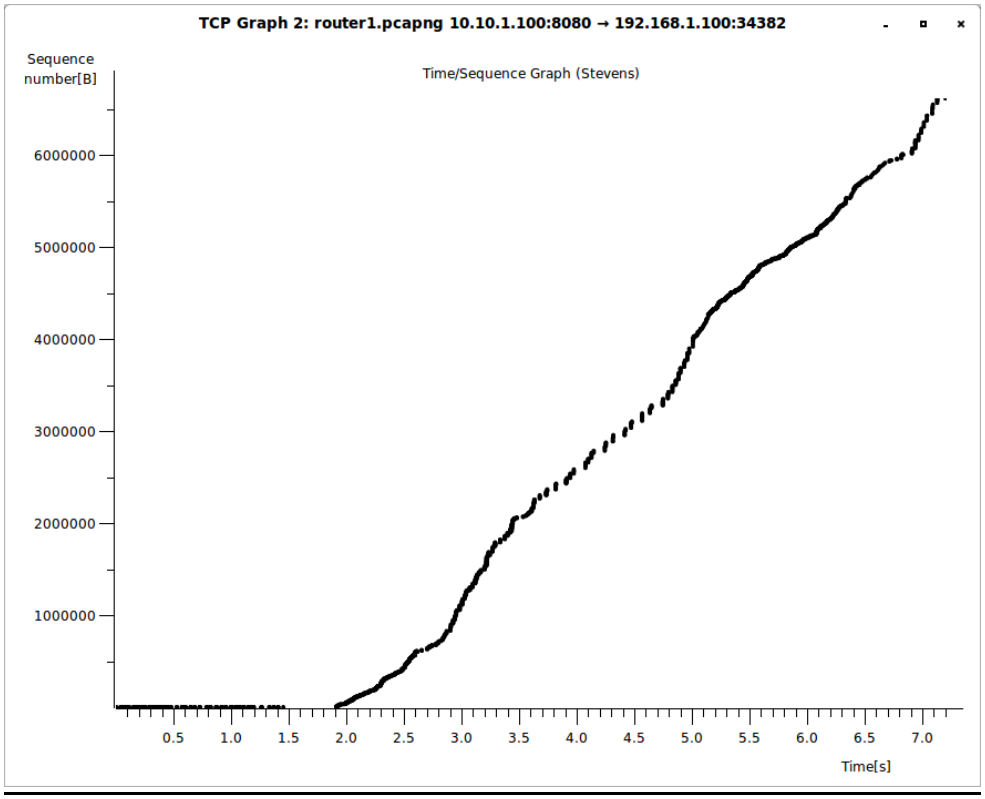
2. With 20% Loss (See Conversation and Retransmitted Packets screenshots):
   Number of transmitted packets at host a: 1937
   Number of received packets at host a: 4181
   Number of transmitted packets at host b: 4181
   Number of received packets at host b: 1937
   Total number of retransmitted packets: 156
   Number of retransmitted packets at host a: 147
   Number of retransmitted packets at host b: 9

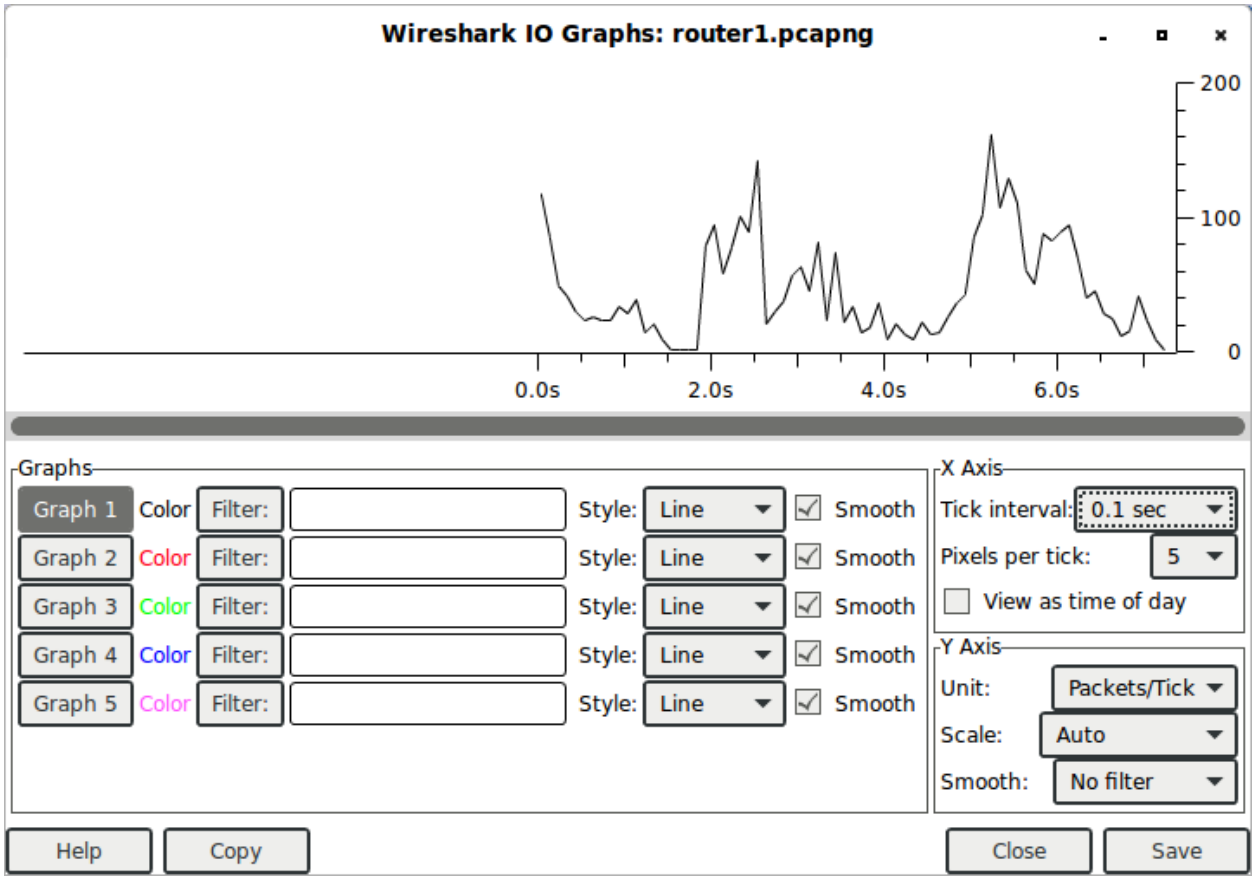
3. When there was no loss at the router, the lines in the TCP Stream Graphs from Host A to Host B and from Host B to Host A were both mostly solid and without gaps. They also both increased at about a linear rate. This indicates that everything is fine and there weren't many losses so TCP didn't need to adjust the rate at which it was sending packets. The line of Graph 2 (Host B to Host A) only begins increasing after the line of Graph 1 (Host A to Host B) stop increasing, which shows how Host B only sends to the unzipped file back to Host A after it fully receives the zipped file.
   From the IO Graph, we see that the packets/tick only decreased to close to 0 a few times.

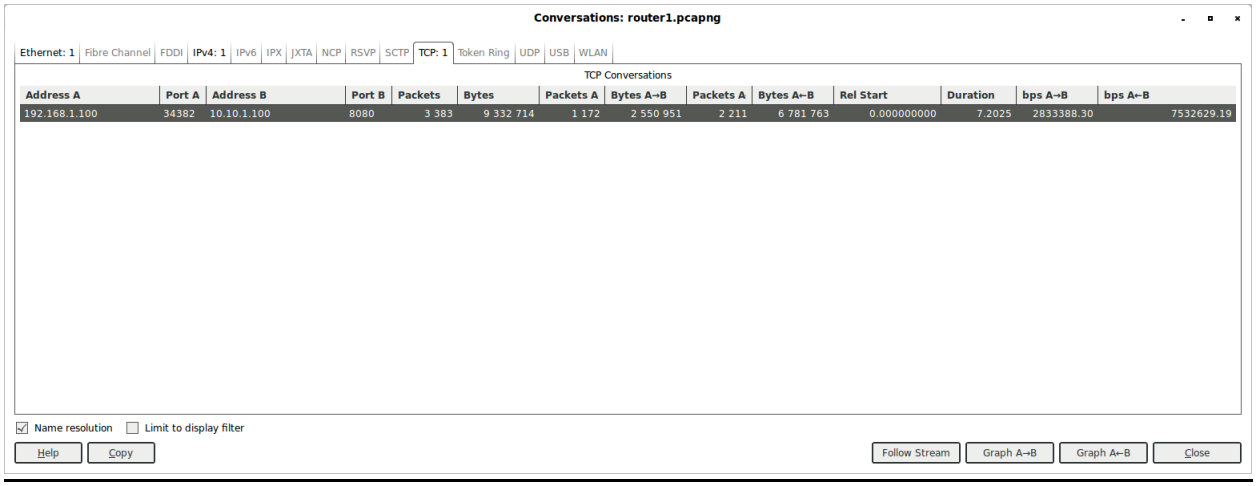
   There was a significant increase in the number of transmitted packets at both hosts when there was 20% loss at the router. This is because TCP is a reliable protocol, which means that it will make sure that every packet will get to the receiver. So if every 2 out of 10 packets are dropped at the router, the sender will have to retransmit many packets to ensure that all the data arrives intact.
   The line in the TCP Stream Graph from Host A to Host B in particular had many gaps in it and was not linear. This indicates that there were many losses and therefore many retransmissions. We can see this as the number of packets Host A retransmitted was 147 while the number of packets Host B retransmitted was 9. When the sender was waiting for a timeout to occur, there was a gap in the line as it would not send anything. From the changing slope of the line, we can see that TCP was changing the rate at which it was sending packets. Since many packets were being dropped, this could mean that the network is congested so TCP backed off as part of its congestion control mechanism.
   From the IO Graph, we see that the packets/tick was close to 0 for about 25 seconds.

No Loss

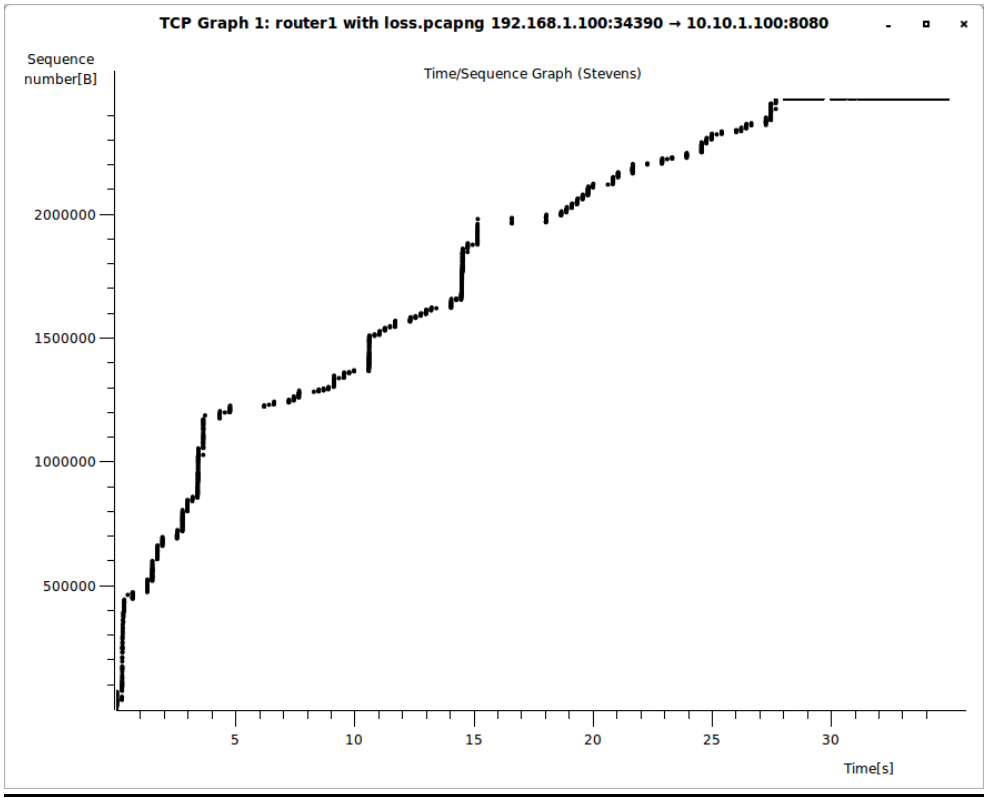

TCP Graph 1: router1.pcapng 192.168.1.100:34382 → 10.10.1.100:8080
Time/Sequence Graph (Stevens)
Sequence number[B]
2000000
1500000
1000000
500000
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
Time[s]

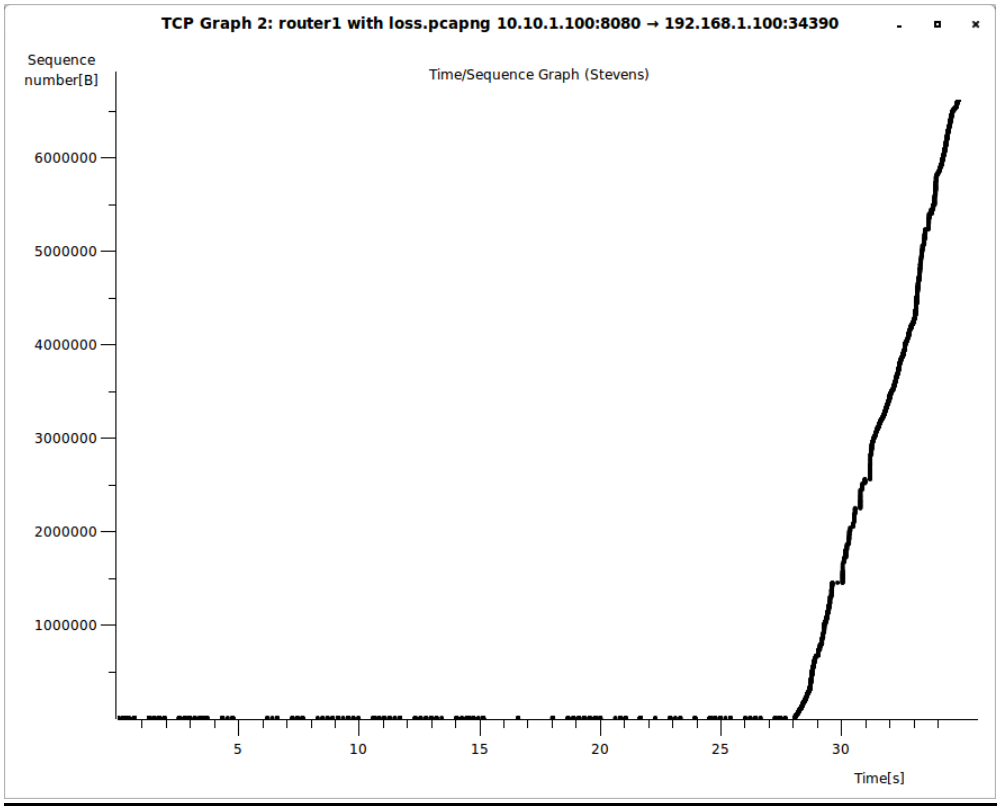

TCP Graph 2: router1.pcapng 10.10.1.100:8080 → 192.168.1.100:34382
Time/Sequence Graph (Stevens)
Sequence number[B]
6000000
5000000
4000000
3000000
2000000
1000000
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
Time[s]

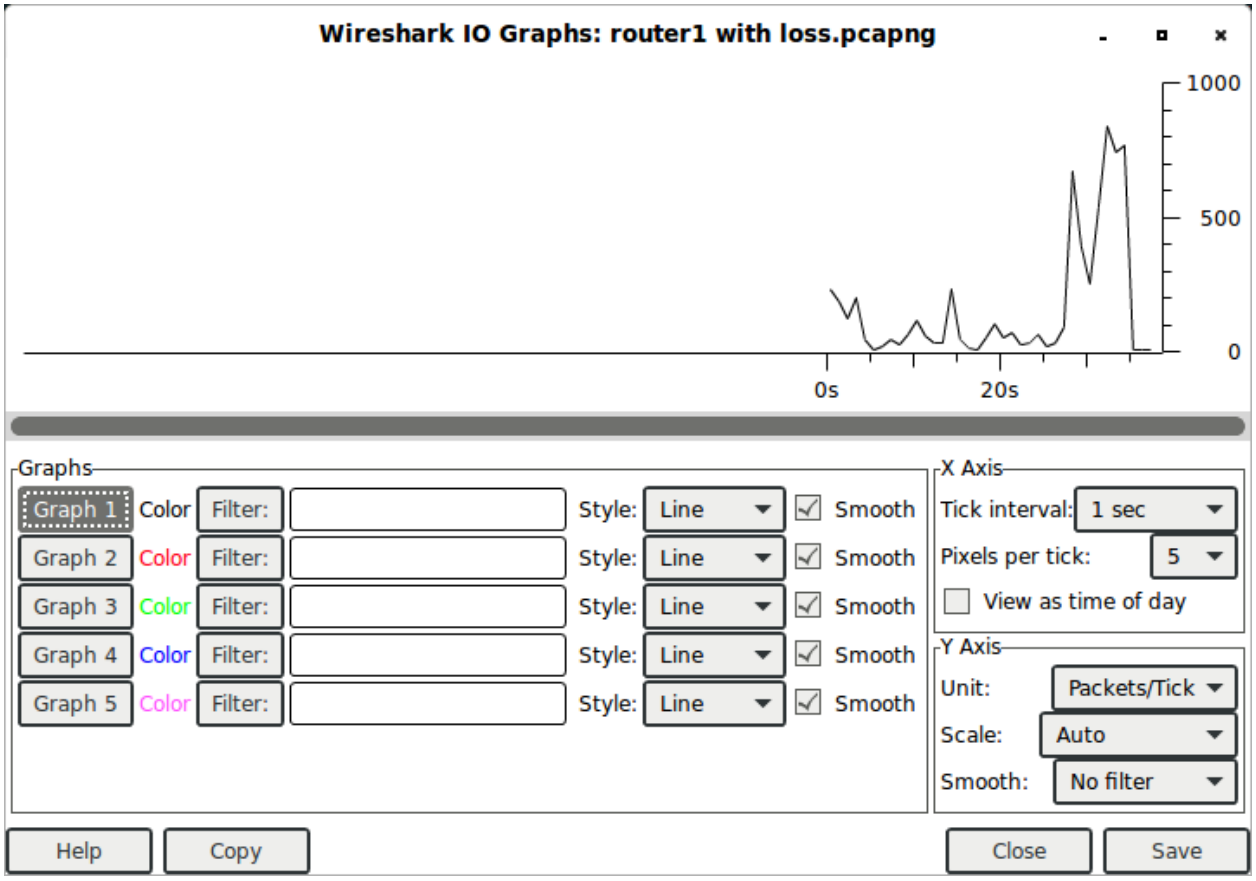

Wireshark IO Graphs: router1.pcapng
200
100
0
0.0s
2.0s
4.0s
6.0s
Graphs
Graph 1
Color
Filter:
Style:
Line
Smooth
Graph 2
Graph 3
Graph 4
Graph 5
X Axis
Tick interval:
0.1 sec
Pixels per tick:
5
View as time of day
Y Axis
Unit:
Packets/Tick
Scale:
Auto
Smooth:
No filter
Help
Copy
Close
Save

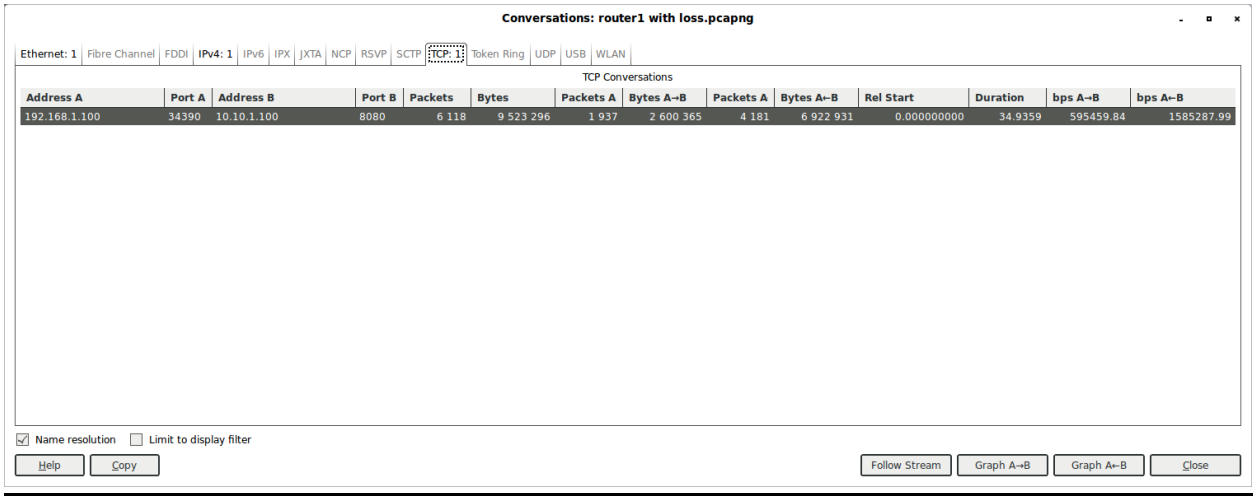
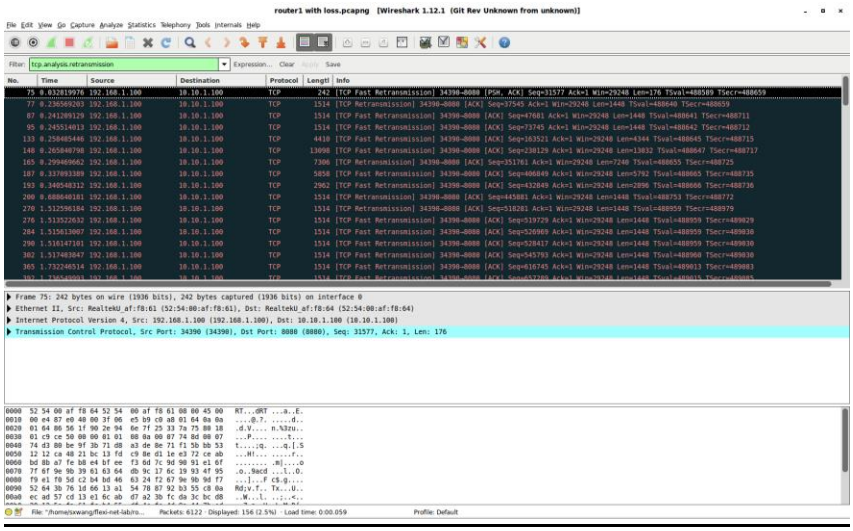
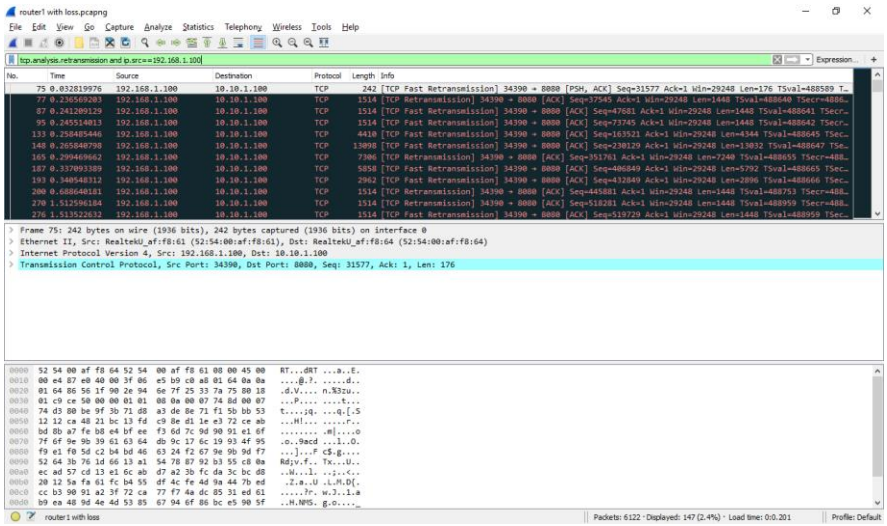
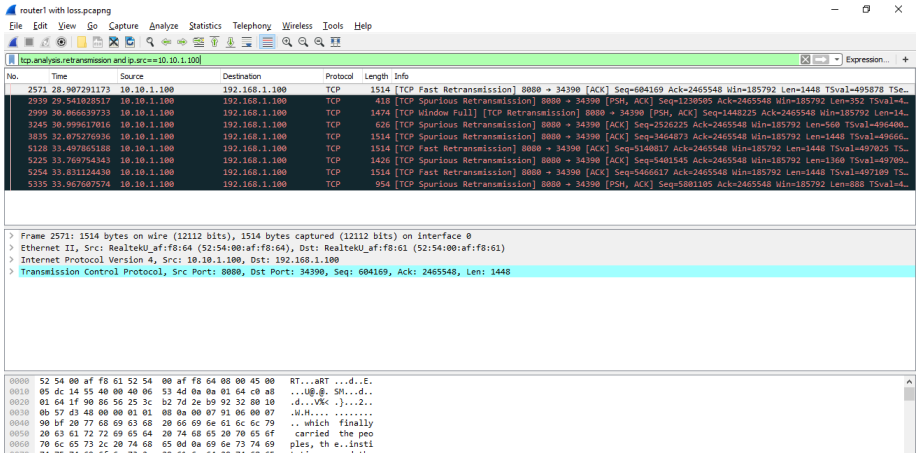

Conversations: router1.pcapng
Ethernet: 1
Fibre Channel
FDDI
IPv4: 1
IPv6
IPX
JXTA
NCP
RSVP
SCTP
TCP: 1
Token Ring
UDP
USB
WLAN
TCP Conversations
Address A
Port A
Address B
Port B
Packets
Bytes
Packets A
Bytes A→B
Packets A
Bytes A←B
Rel Start
Duration
bps A→B
bps A←B
192.168.1.100
34382
10.10.1.100
8080
3 383
9 332 714
1 172
2 550 951
2 211
6 781 763
0.000000000
7.2025
2833388.30
7532629.19
Name resolution
Limit to display filter
Help
Copy
Follow Stream
Graph A→B
Graph A←B
Close

With Loss


TCP Graph 1: router1 with loss.pcapng 192.168.1.100:34390 → 10.10.1.100:8080
Sequence number[B]
Time/Sequence Graph (Stevens)
2000000
1500000
1000000
500000
5
10
15
20
25
30
Time[s]


TCP Graph 2: router1 with loss.pcapng 10.10.1.100:8080 → 192.168.1.100:34390
Sequence number[B]
Time/Sequence Graph (Stevens)
6000000
5000000
4000000
3000000
2000000
1000000
5
10
15
20
25
30
Time[s]


Wireshark IO Graphs: router1 with loss.pcapng
1000
500
0
0s
20s
Graphs
Graph 1
Color
Filter:
Style:
Line
Smooth
Graph 2
Graph 3
Graph 4
Graph 5
X Axis
Tick interval:
1 sec
Pixels per tick:
5
View as time of day
Y Axis
Unit:
Packets/Tick
Scale:
Auto
Smooth:
No filter
Help
Copy
Close
Save


Conversations: router1 with loss.pcapng
Ethernet: 1
Fibre Channel
FDDI
IPv4: 1
IPv6
IPX
JXTA
NCP
RSVP
SCTP
TCP: 1
Token Ring
UDP
USB
WLAN
TCP Conversations
Address A
Port A
Address B
Port B
Packets
Bytes
Packets A
Bytes A→B
Packets A
Bytes A←B
Rel Start
Duration
bps A→B
bps A←B
192.168.1.100
34390
10.10.1.100
8080
6 118
9 523 296
1 937
2 600 365
4 181
6 922 931
0.000000000
34.9359
595459.84
1585287.99
Name resolution
Limit to display filter
Help
Copy
Follow Stream
Graph A→B
Graph A←B
Close

Retransmitted packets in total, at Host A and at Host B: