Assignment 1 - Networks Lab

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1) TCP case:
Application layer : HTTP
Transport layer : TCP
Network layer : IP version 4

UDP case:
Application layer : -
Transport layer : UDP
Network layer : IP version 4

2) a) In all the cases, 2 SYN,ACK packets at the beginning, 1 TCP “ok” packet at the end, and 1 TCP ACK packets at the end are observed. Moreover, there was an ACK packet after each of the received packets.

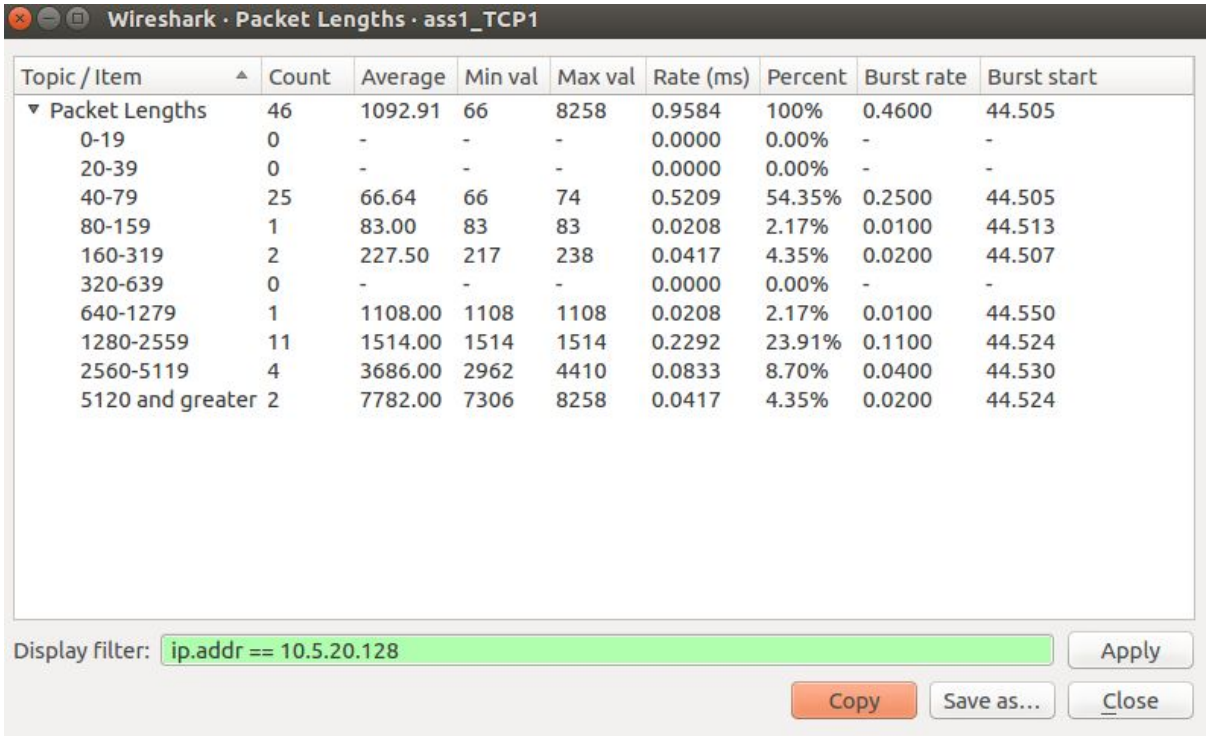
Pic 1 : 20 data packets
Pic 2 : 6087 data packets
Pic 3 : 231 data packets
Pic 4 : 1365 data packets
Pic 5 : 292 data packets

No, all the packets are of not same size and there were various sizes ranging from 60s to a few thousands. Generally, the ACK packets are of less size compared to the data packets.

Some packet sizes for each of the pics in bytes are
Pic 1 : 74,66,217,8258,2962,4410 etc.
Pic 2 : 74,66,217,1514,7306,2962 etc.
Pic 3 : 74,66,217,83,5362,1514 etc.
Pic 4 : 74,66,217, 240,10202,1514,7306 etc
Pic 5 : 74,66,217,29962,1514,4410 etc

Details:

Pic1:



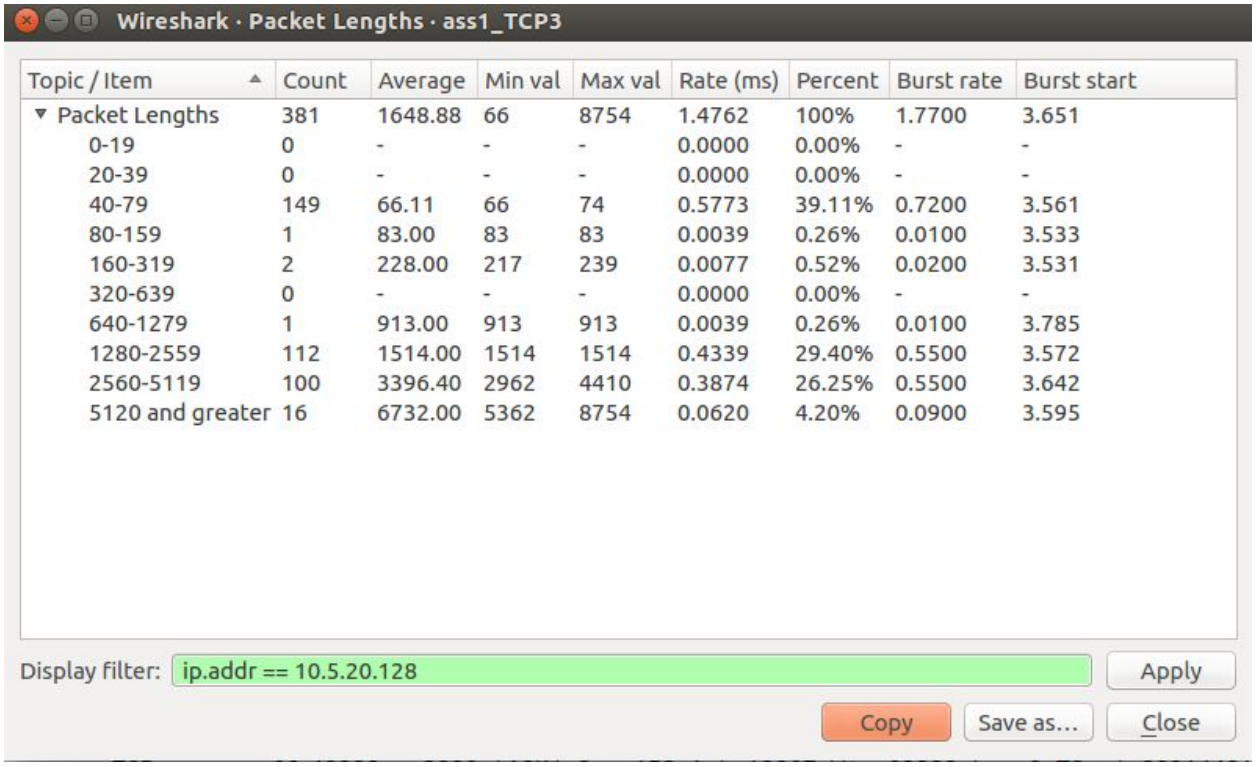
Pic2:

Topic / Item	Count	Average	Min val	Max val	Rate (ms)	Percent	Burst rate	Burst start
▼ Packet Lengths	10120	1699.42	66	8754	0.9060	100%	1.9200	190.491
0-19	0	-	-	-	0.0000	0.00%	-	-
20-39	0	-	-	-	0.0000	0.00%	-	-
40-79	3973	66.39	66	78	0.3557	39.26%	0.7700	190.542
80-159	60	89.15	83	94	0.0054	0.59%	0.3200	190.503
160-319	1	217.00	217	217	0.0001	0.01%	0.0100	180.178
320-639	0	-	-	-	0.0000	0.00%	-	-
640-1279	0	-	-	-	0.0000	0.00%	-	-
1280-2559	3323	1514.00	1514	1514	0.2975	32.84%	0.6000	190.487
2560-5119	2005	3423.29	2584	4410	0.1795	19.81%	0.5200	189.711
5120 and greater	758	6641.22	5858	8754	0.0679	7.49%	0.2100	190.898

Display filter: ip.addr == 10.5.20.128 Apply

Copy Save as... Close

Pic3:



Pic4:

Wireshark · Packet Lengths · ass1_TCP4

Topic / Item	Count	Average	Min val	Max val	Rate (ms)	Percent	Burst rate	Burst start
▼ Packet Lengths	2310	1805.75	66	10202	0.9581	100%	1.8700	6.897
0-19	0	-	-	-	0.0000	0.00%	-	-
20-39	0	-	-	-	0.0000	0.00%	-	-
40-79	913	66.04	66	78	0.3787	39.52%	0.7400	6.880
80-159	32	85.91	83	86	0.0133	1.39%	0.3100	7.125
160-319	2	228.50	217	240	0.0008	0.09%	0.0200	5.792
320-639	0	-	-	-	0.0000	0.00%	-	-
640-1279	0	-	-	-	0.0000	0.00%	-	-
1280-2559	689	1514.00	1514	1514	0.2858	29.83%	0.6000	6.915
2560-5119	454	3433.18	2962	4410	0.1883	19.65%	0.4600	6.926
5120 and greater	220	6845.27	5858	10202	0.0913	9.52%	0.2300	7.501

Display filter: ip.addr == 10.5.20.128 Apply

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Pic5:

Wireshark · Packet Lengths · ass1_TCP5

Topic / Item	Count	Average	Min val	Max val	Rate (ms)	Percent	Burst rate	Burst start
▼ Packet Lengths	482	1802.03	66	8754	1.2881	100%	1.6300	3.346
0-19	0	-	-	-	0.0000	0.00%	-	-
20-39	0	-	-	-	0.0000	0.00%	-	-
40-79	189	66.08	66	74	0.5051	39.21%	0.6800	3.315
80-159	1	83.00	83	83	0.0027	0.21%	0.0100	3.301
160-319	1	217.00	217	217	0.0027	0.21%	0.0100	3.296
320-639	0	-	-	-	0.0000	0.00%	-	-
640-1279	0	-	-	-	0.0000	0.00%	-	-
1280-2559	158	1514.00	1514	1514	0.4222	32.78%	0.5400	3.336
2560-5119	90	3360.21	2601	4410	0.2405	18.67%	0.3300	3.360
5120 and greater	43	7306.00	5858	8754	0.1149	8.92%	0.1800	3.566

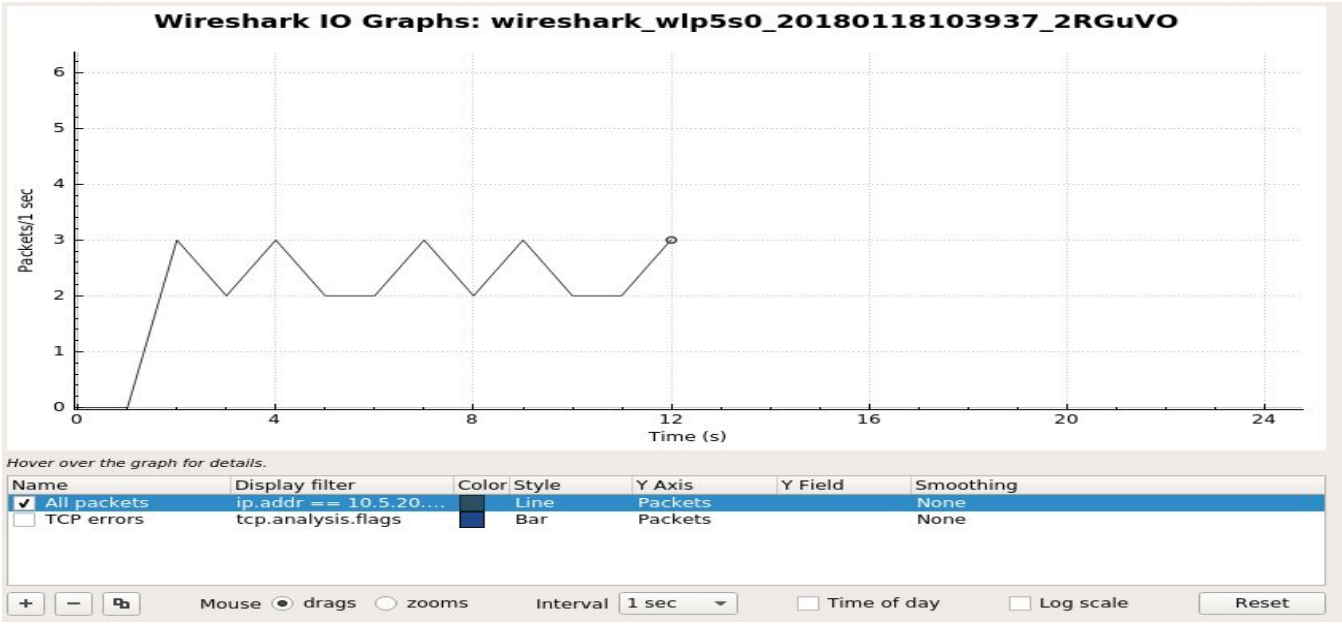
Display filter: ip.addr == 10.5.20.128 Apply

Copy Save as... Close

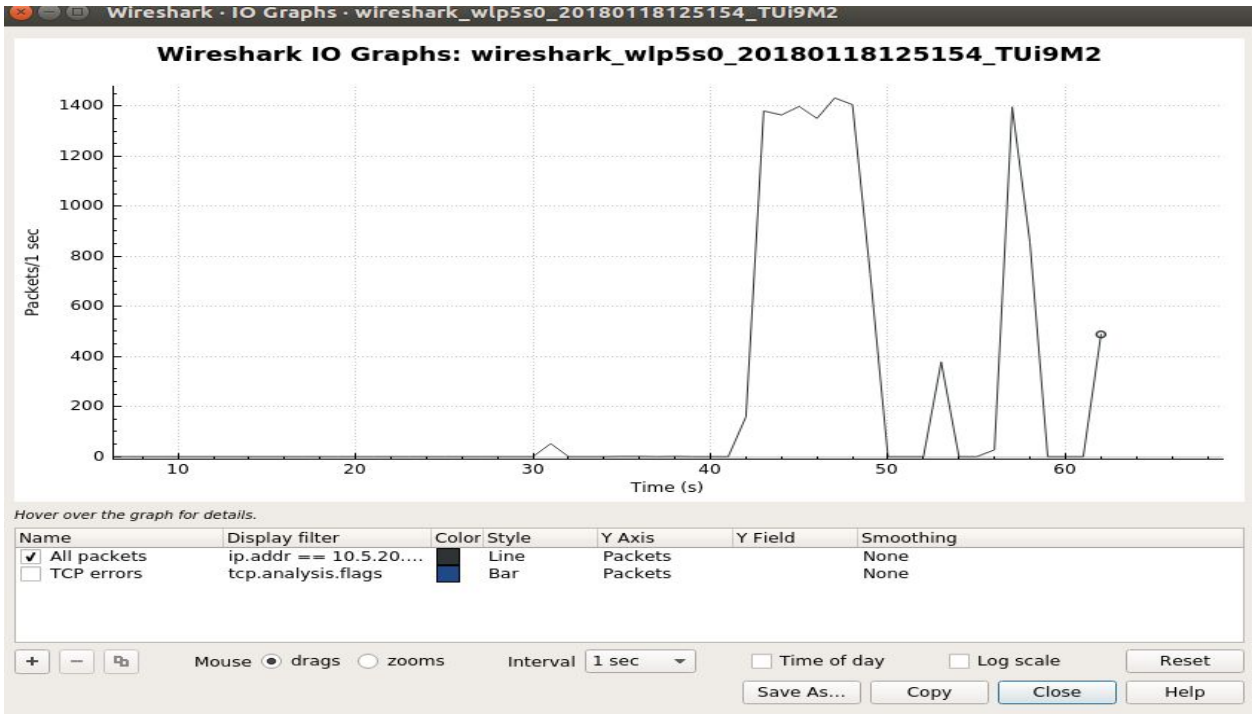
b) All UDP packets are of same size - 1512 bytes length per packet.

c) Throughput using Wireshark

UDP:



TCP CASE:



5 elevations in the graphs corresponds to 5 pictures transferred from server to client.

(d) The UDP throughput (amount of UDP data received per second) for following cases of UDP traffic generation rates (bandwidth)

(i) 64 Kbps

Data transfer = 80.4 k Bytes
Uplink throughput = 64.0 kbps
Downlink throughput = 64.3 kbps
Datagrams Sent = 58

(ii) 128 Kbps

Data transfer = 158 k Bytes
Uplink throughput = 128 kbps
Downlink throughput = 130 kbps
Datagrams Sent = 112

(iii) 256 Kbps

Data transfer = 314 k Bytes
Uplink throughput = 256.0 kbps
Downlink throughput = 256.0 kbps
Datagrams Sent = 221

(iv)512 Kbps

Data transfer = 627 k Bytes
Uplink throughput = 512 kbps
Downlink throughput = 520 kbps
Datagrams Sent = 439

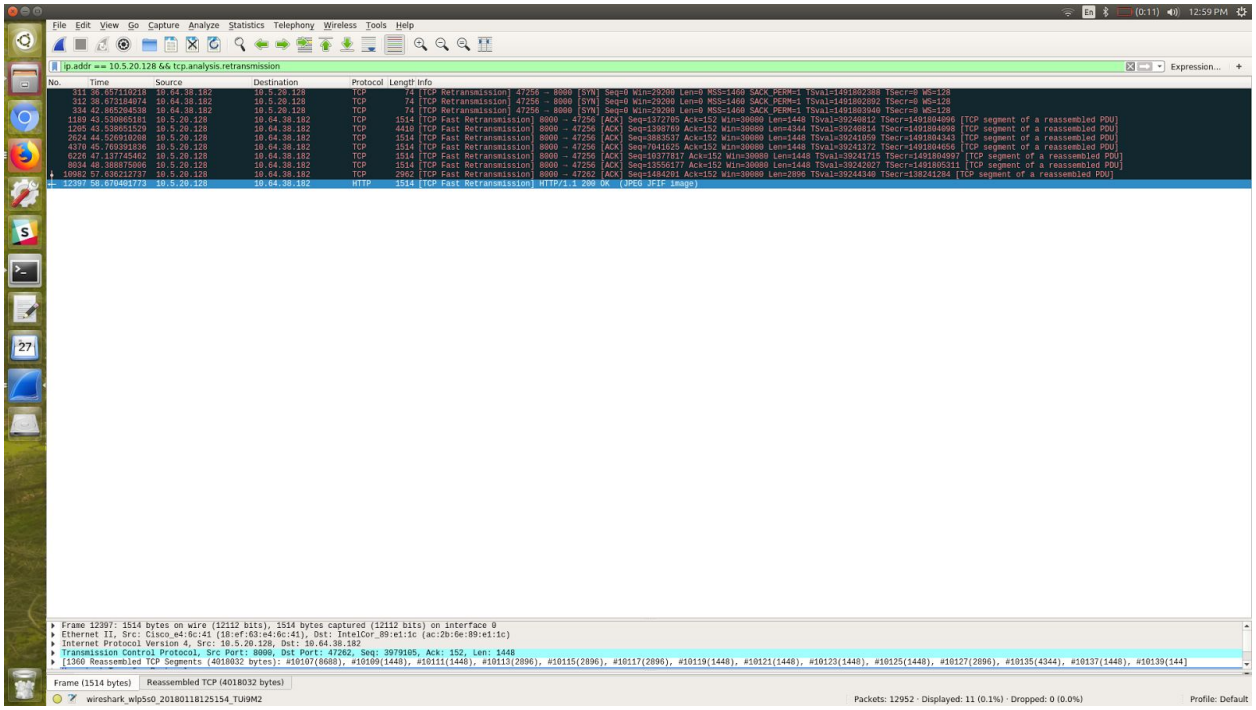
(v)1024 Kbps

Data transfer = 1.22 MB
Uplink throughput = 1.03Mbps
Downlink throughput = 1.03Mbps
Datagrams Sent = 874

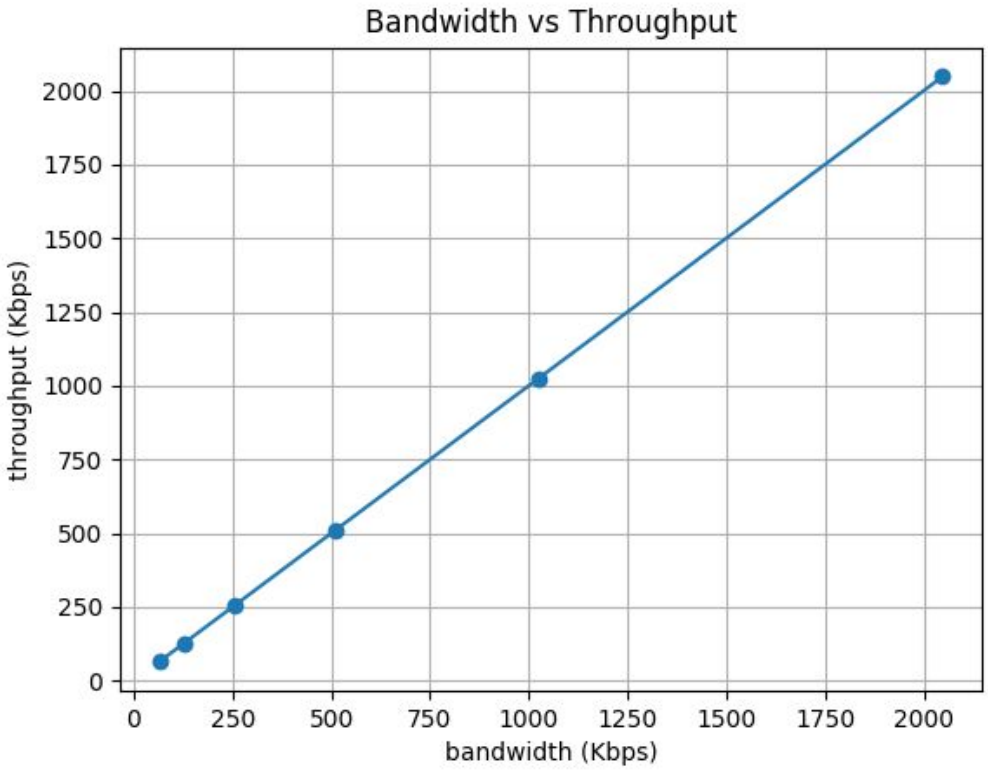
(vi) 2048 Kbps

Data transfer = 2.44 MB
Uplink throughput = 2.05 Mbps
Downlink throughput = 2.08Mbps
Datagrams Sent = 1745

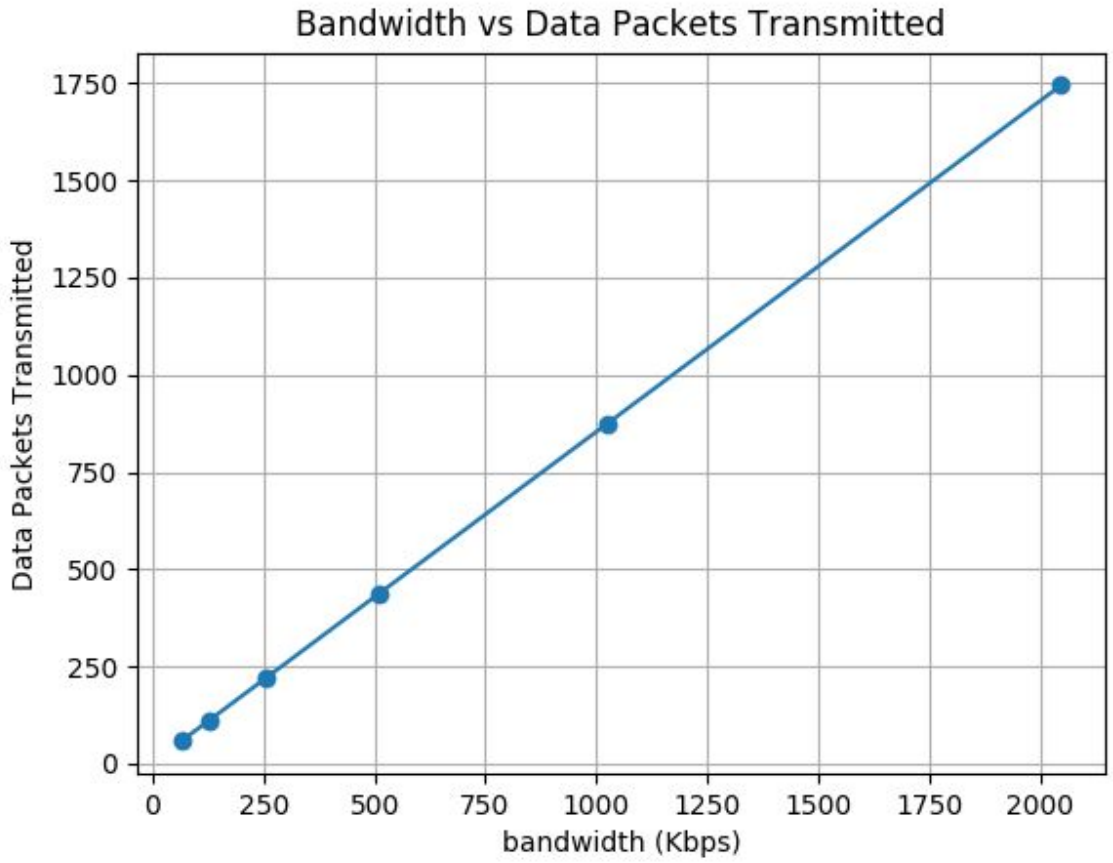
3)


File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
ip.addr == 10.5.20.128 && tcp.analysis.retransmission
No. Time Source Destination Protocol Length Info
311 36.657119218 10.64.38.182 10.5.20.128 TCP 74 [TCP Retransmission] 47256 → 8000 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1491802388 TSecr=0 WS=128
312 36.673184074 10.64.38.182 10.5.20.128 TCP 74 [TCP Retransmission] 47256 → 8000 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1491802892 TSecr=0 WS=128
334 42.865204538 10.64.38.182 10.5.20.128 TCP 74 [TCP Retransmission] 47256 → 8000 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1491803940 TSecr=0 WS=128
1189 43.530865181 10.5.20.128 10.64.38.182 TCP 1514 [TCP Fast Retransmission] 8000 → 47256 [ACK] Seq=1372705 Ack=152 Win=30080 Len=1448 TSval=39240812 TSecr=1491804096 [TCP segment of a reassembled PDU]
1205 43.538051529 10.5.20.128 10.64.38.182 TCP 4410 [TCP Fast Retransmission] 8000 → 47256 [ACK] Seq=1398769 Ack=152 Win=30080 Len=4344 TSval=39240814 TSecr=1491804098 [TCP segment of a reassembled PDU]
2624 44.526910208 10.5.20.128 10.64.38.182 TCP 1514 [TCP Fast Retransmission] 8000 → 47256 [ACK] Seq=3883537 Ack=152 Win=30080 Len=1448 TSval=39241059 TSecr=1491804343 [TCP segment of a reassembled PDU]
4370 45.769391836 10.5.20.128 10.64.38.182 TCP 1514 [TCP Fast Retransmission] 8000 → 47256 [ACK] Seq=7041625 Ack=152 Win=30080 Len=1448 TSval=39241372 TSecr=1491804656 [TCP segment of a reassembled PDU]
6226 47.137745462 10.5.20.128 10.64.38.182 TCP 1514 [TCP Fast Retransmission] 8000 → 47256 [ACK] Seq=10377617 Ack=152 Win=30080 Len=1448 TSval=39241715 TSecr=1491804997 [TCP segment of a reassembled PDU]
8034 48.388875006 10.5.20.128 10.64.38.182 TCP 1514 [TCP Fast Retransmission] 8000 → 47256 [ACK] Seq=13556177 Ack=152 Win=30080 Len=1448 TSval=39242027 TSecr=1491805311 [TCP segment of a reassembled PDU]
10962 57.630217737 10.5.20.128 10.64.38.182 TCP 2962 [TCP Fast Retransmission] 8000 → 47262 [ACK] Seq=1484201 Ack=152 Win=30080 Len=2896 TSval=39244340 TSecr=138241284 [TCP segment of a reassembled PDU]
12397 58.670401773 10.5.20.128 10.64.38.182 HTTP 1514 [TCP Fast Retransmission] HTTP/1.1 200 OK (JPEG JFIF image)
Frame 12397: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits) on interface 0
Ethernet II, Src: Cisco_e4:6c:41 (18:ef:63:e4:6c:41), Dst: IntelCor_89:e1:1c (ac:2b:6e:89:e1:1c)
Internet Protocol Version 4, Src: 10.5.20.128, Dst: 10.64.38.182
Transmission Control Protocol, Src Port: 8000, Dst Port: 47262, Seq: 3979105, Ack: 152, Len: 1448
[1360 Reassembled TCP Segments (4018032 bytes): #10107(8088), #10109(1448), #10111(1448), #10113(2896), #10115(2896), #10117(2896), #10119(1448), #10121(1448), #10123(1448), #10125(1448), #10127(2896), #10135(4344), #10137(1448), #10139(144]
Frame (1514 bytes)
Reassembled TCP (4018032 bytes)
wireshark_wlp5s0_20180118125154_TUi9M2
Packets: 12952 · Displayed: 11 (0.1%) · Dropped: 0 (0.0%)
Profile: Default

4)a)


Bandwidth vs Throughput
throughput (Kbps)
bandwidth (Kbps)
0
250
500
750
1000
1250
1500
1750
2000

b)



Observations:

- UDP uplink throughput is almost equal to the bandwidth specific using iperf. That means the data rate is almost equal to the uplink throughput. This shows the network is showing no latency at all. It can be observed that for very high data rate the uplink throughput reaches a limiting value. This limiting value is the network limitation.
- As bandwidth increases more number of packets were transferred in the same span of time. This can be observed by the increasing number of datagrams sent.