Measurements From A QUIC Deployment

The QUIC Transport Protocol: Design and Internet-Scale Deployment

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Google

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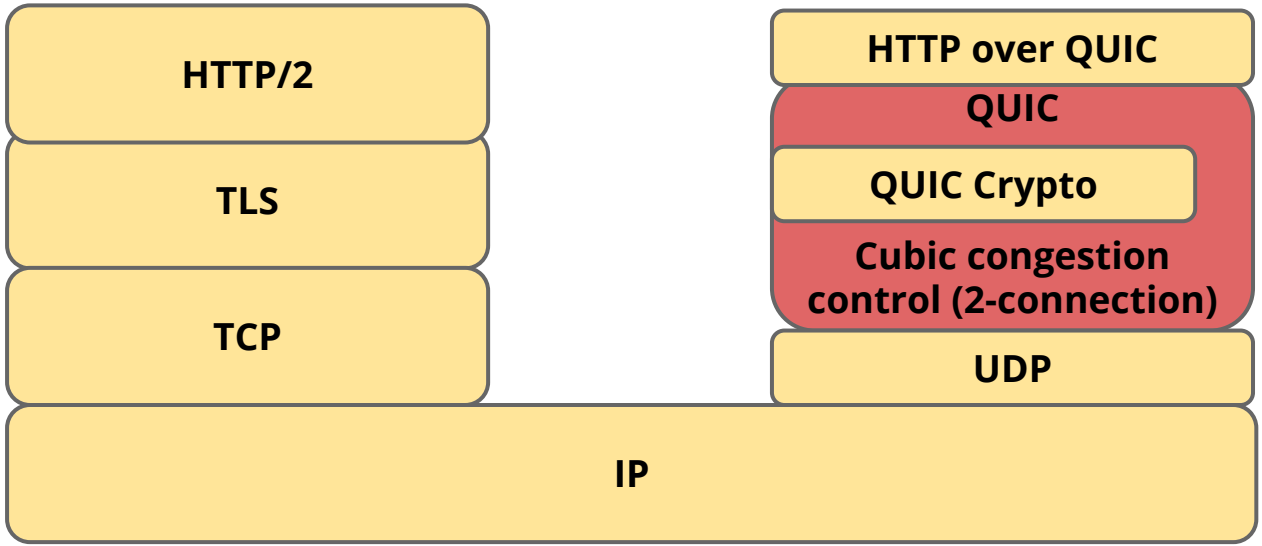
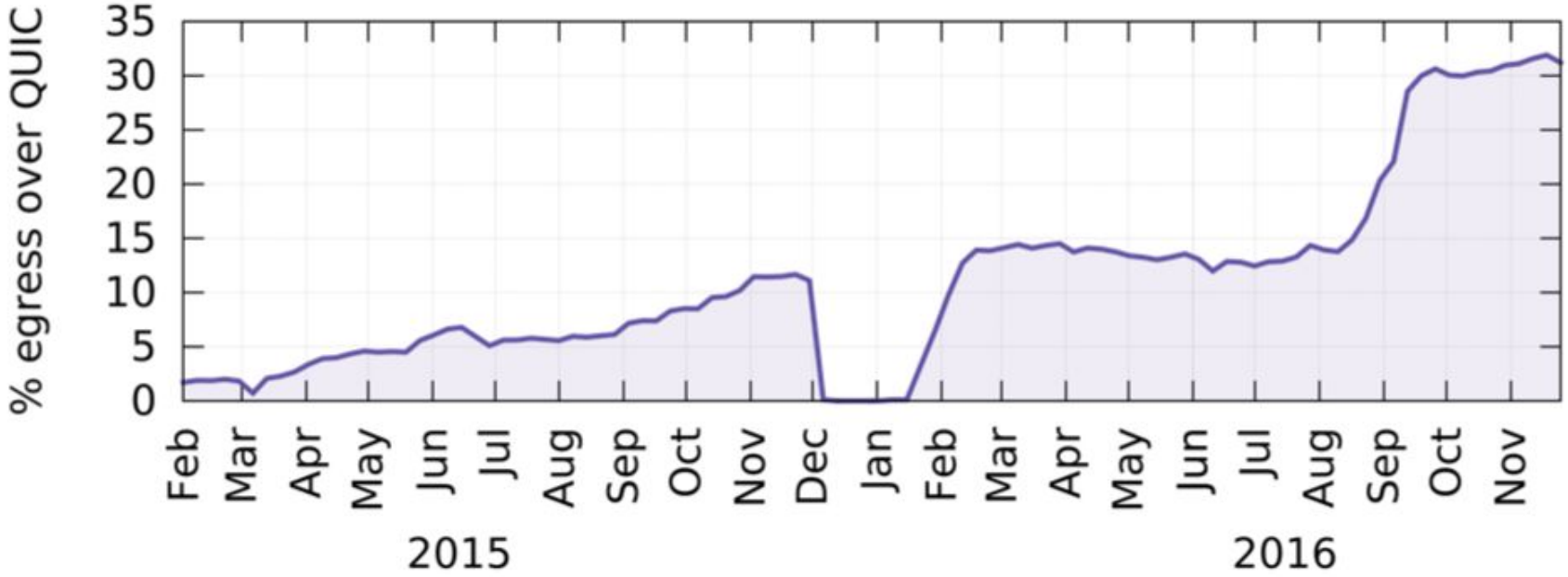
What are we talking about?




% egress over QUIC
35
30
25
20
15
10
5
0
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
2015
2016

		% latency reduction by percentile						
		Lower latency				Higher latency		
	Mean	1%	5%	10%	50%	90%	95%	99%
Search								
Desktop	8.0	0.4	1.3	1.4	1.5	5.8	10.3	16.7
Mobile	3.6	-0.6	-0.3	0.3	0.5	4.5	8.8	14.3
Video								
Desktop	8.0	1.2	3.1	3.3	4.6	8.4	9.0	10.6
Mobile	5.3	0.0	0.6	0.5	1.2	4.4	5.8	7.5

Table 1: Percent reduction in global Search and Video Latency for users in $QUIC_g$, at the mean and at specific percentiles. A 16.7% reduction at the 99th percentile indicates that the 99th percentile latency for $QUIC_g$ is 16.7% lower than the 99th percentile latency for TCP_g.

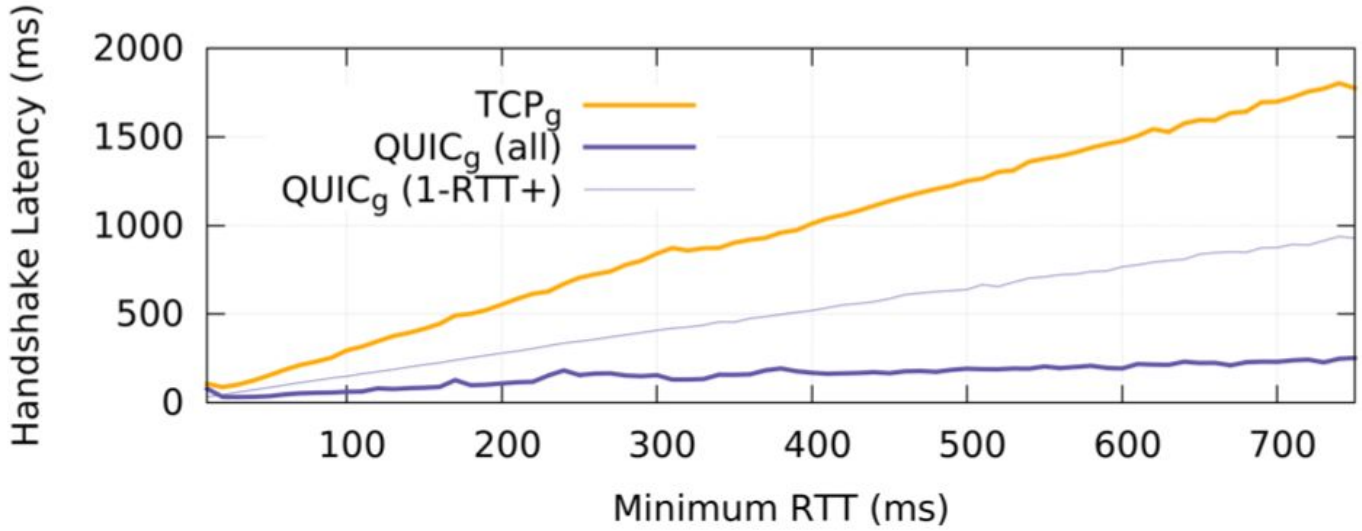
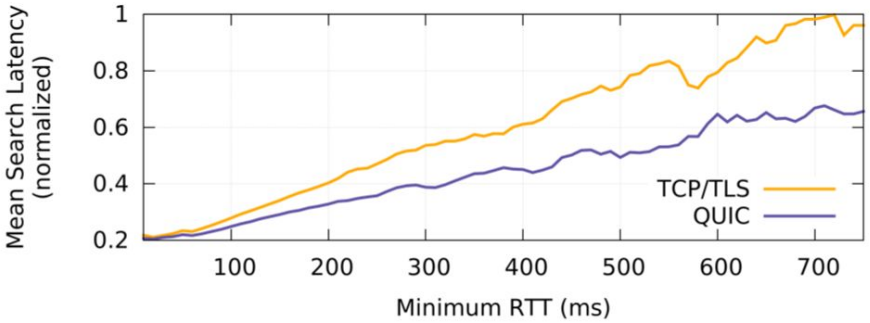
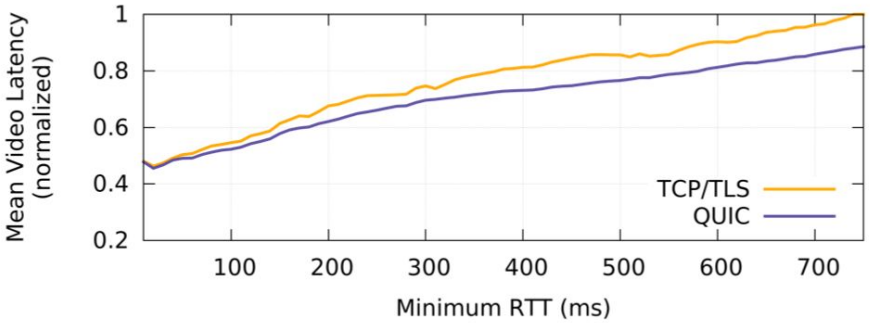


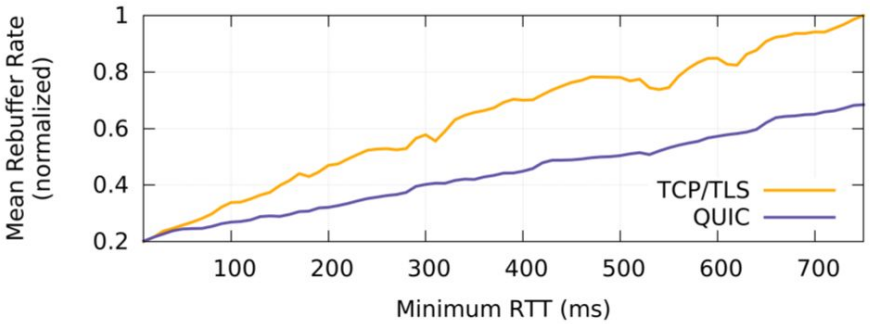
Figure 7: Comparison of handshake latency for $QUIC_g$ and TCP_g versus the minimum RTT of the connection. Solid lines indicate the mean handshake latency for all connections, including 0-RTT connections. The dashed line shows the handshake latency for only those $QUIC_g$ connections that did not achieve a 0-RTT handshake. Data shown is for Desktop connections, mobile connections look similar.

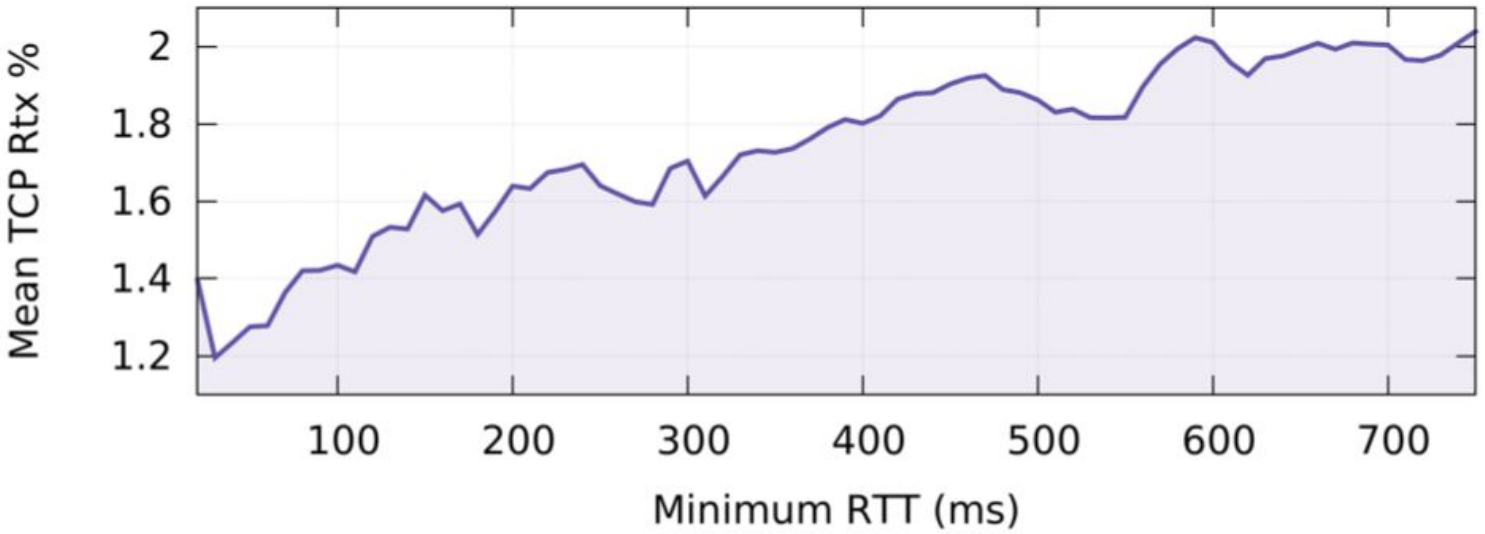
		% rebuffer rate reduction by percentile				
		Fewer rebuffers			More rebuffers	
	Mean	< 93%	93%	94 %	95%	99%
Desktop	18.0	*	100.0	70.4	60.0	18.5
Mobile	15.3	*	*	100.0	52.7	8.7

Table 2: Percent reduction in global Video Rebuffer Rate for users in $QUIC_g$ at the mean and at specific percentiles. An 18.5% reduction at the 99th percentile indicates that the 99th percentile rebuffer rate for $QUIC_g$ is 18.5% lower than the 99th percentile rate for TCP_g. An * indicates that neither $QUIC_g$ nor TCP_g have rebuffers at that percentile.


Mean Search Latency (normalized)
1
0.8
0.6
0.4
0.2
100
200
300
400
500
600
700
Minimum RTT (ms)
TCP/TLS
QUIC


Mean Video Latency (normalized)
1
0.8
0.6
0.4
0.2
100
200
300
400
500
600
700
Minimum RTT (ms)
TCP/TLS
QUIC


Mean Rebuffer Rate (normalized)
1
0.8
0.6
0.4
0.2
100
200
300
400
500
600
700
Minimum RTT (ms)
TCP/TLS
QUIC


Mean TCP Rtx %
2
1.8
1.6
1.4
1.2
100
200
300
400
500
600
700
Minimum RTT (ms)

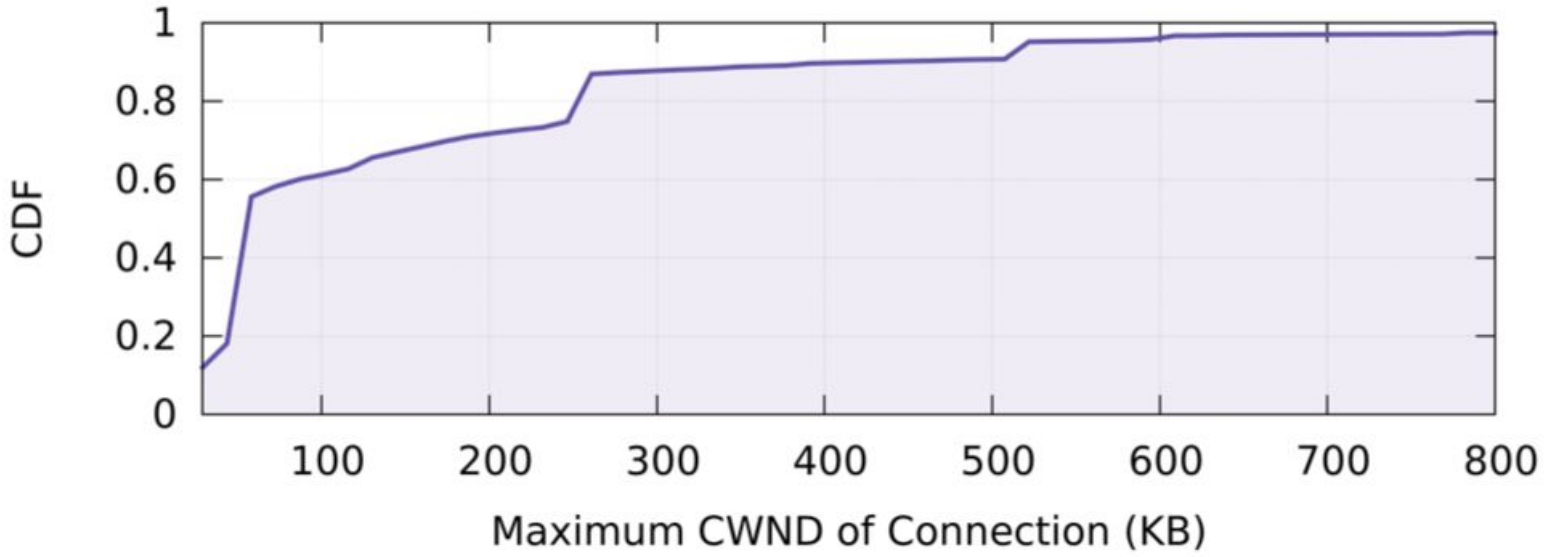


Figure 11: CDF of TCP connections where the server's maximum congestion window was limited by the client's maximum receive window. Data presented is for video playbacks from one week in March 2016.

			% Reduction in Search Latency		% Reduction in Rebuffer Rate	
Country	Mean Min RTT (ms)	Mean TCP Rtx %	Desktop	Mobile	Desktop	Mobile
South Korea	38	1	1.3	1.1	0.0	10.1
USA	50	2	3.4	2.0	4.1	12.9
India	188	8	13.2	5.5	22.1	20.2