## CSC 458/D58/2209 Course Project  Due Date: Sunday, November 25, 2018

RTT Estimation in Real World

# Dataset Statistics:

**Per-Packet Statistics:**

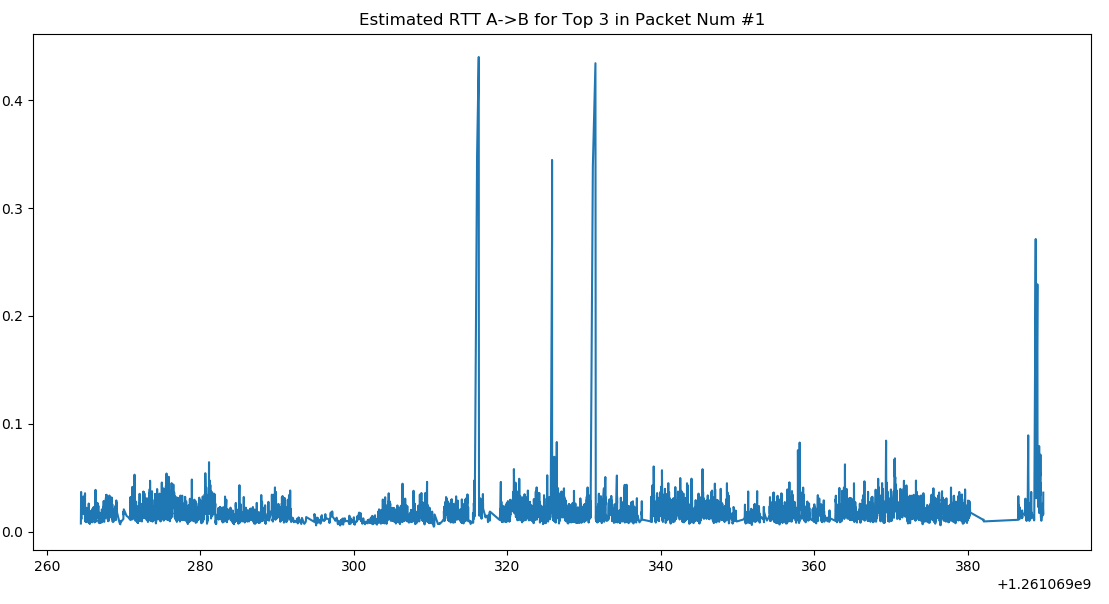
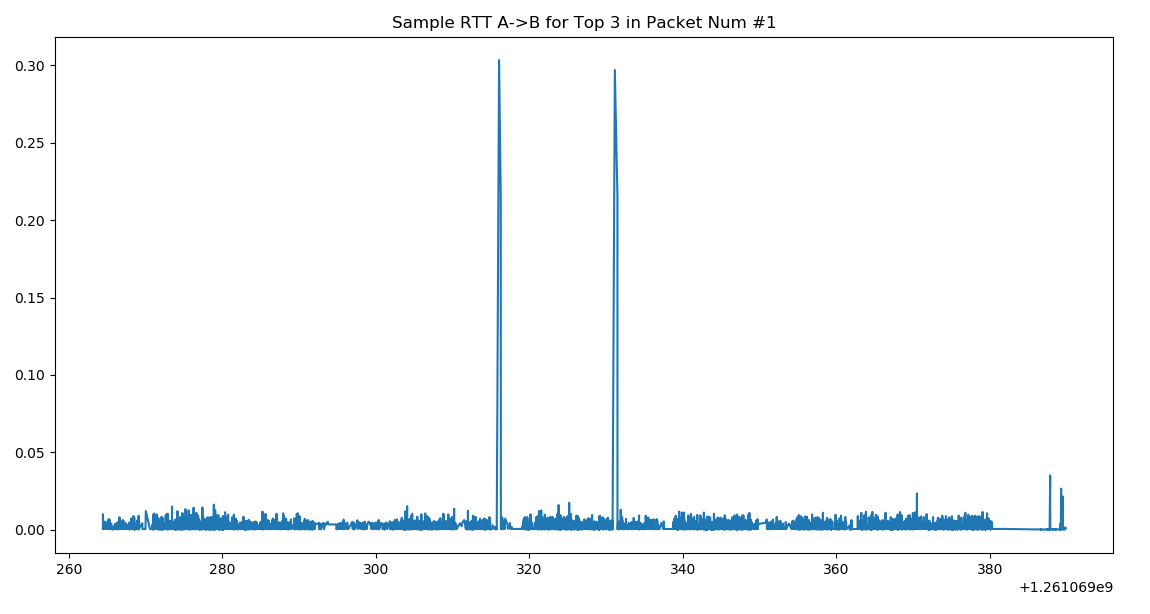
# RTT Estimation:

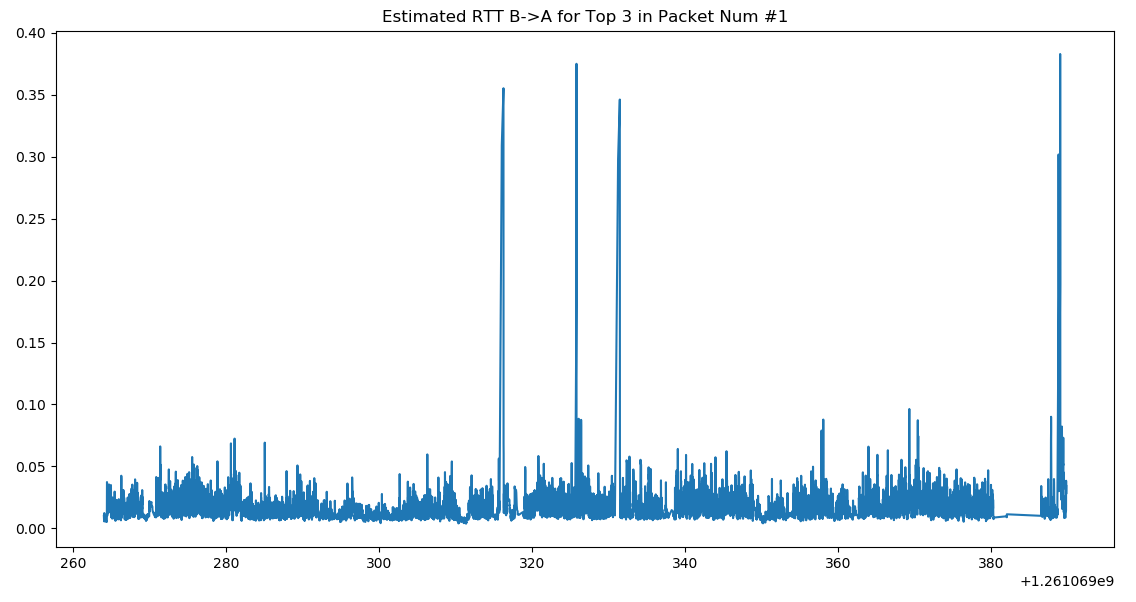
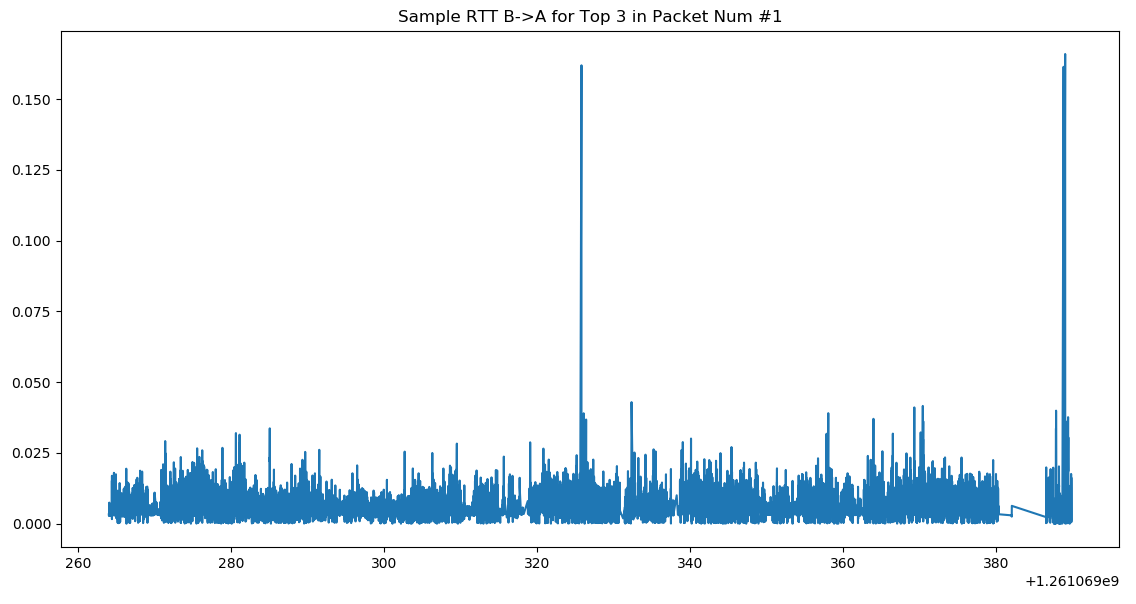
## *Implementation Notes:*

* For our RTT estimation, we saw that much of our sample RTTs fell below the 1s threshold specified in RFC6298 and so we decided to forego that requirement in order for our data to show some non-constant results.

## Top 3 TCP Flows in Terms of Packet Number:

**Flow #1 Charts:**

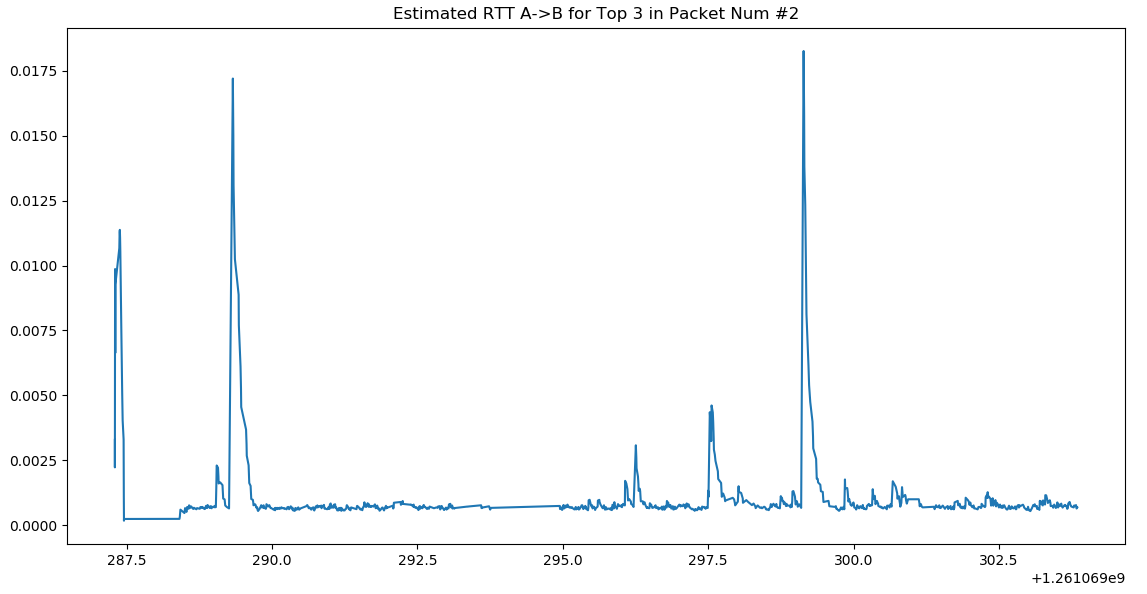
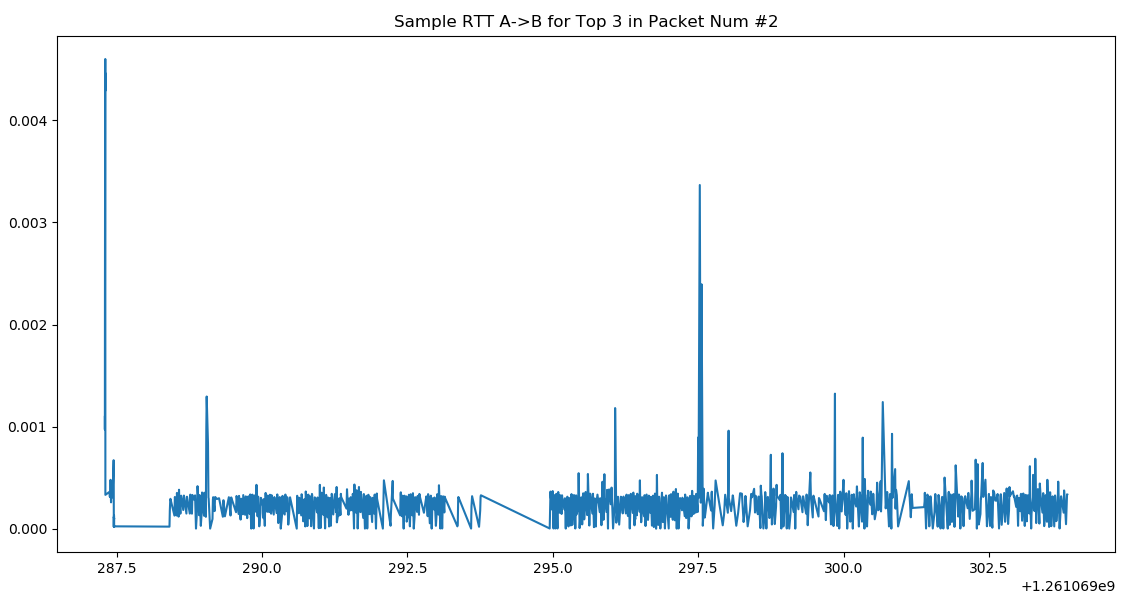


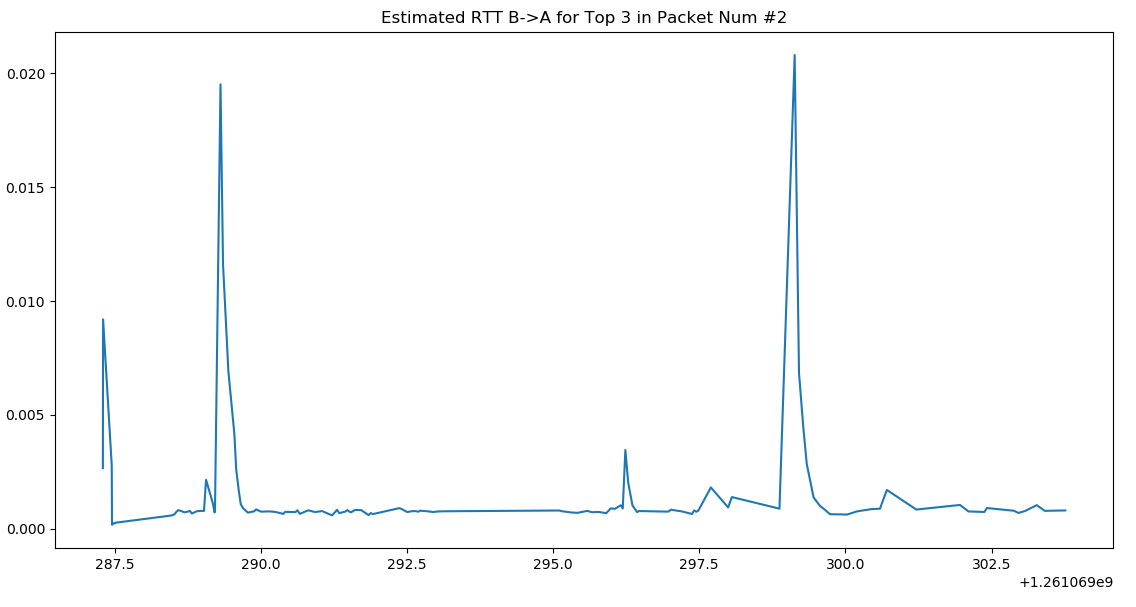
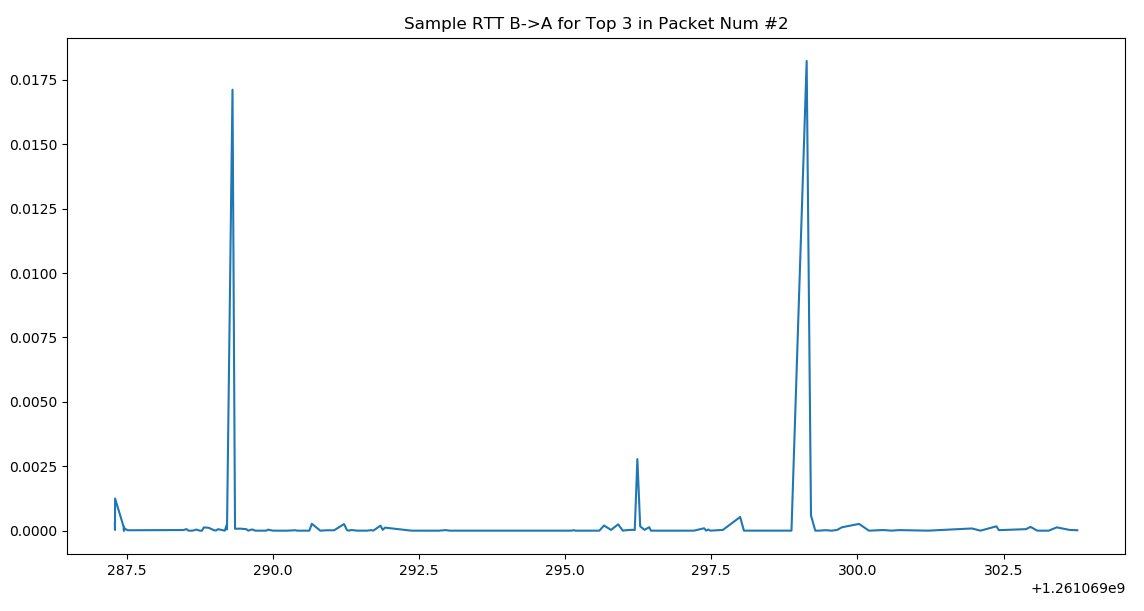


***Charts Analysis***

* In both directions of the flow, the appeared to be two to three main point of increased RTT in both the sample and estimated calculations. This would suggest some congestion at those points however given our inclusion of < 1s data, these variances could simply be small and expected variances in transfer rate
* Otherwise, the sample RTTs and estimated RTTs are relatively stable.

**Flow #2 Charts:**

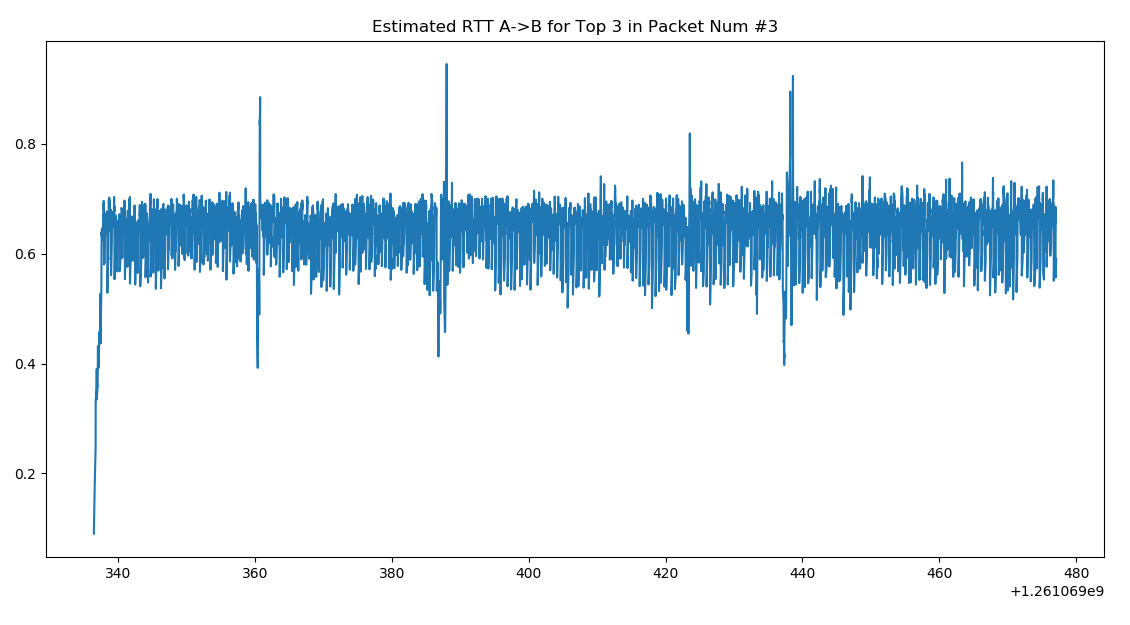
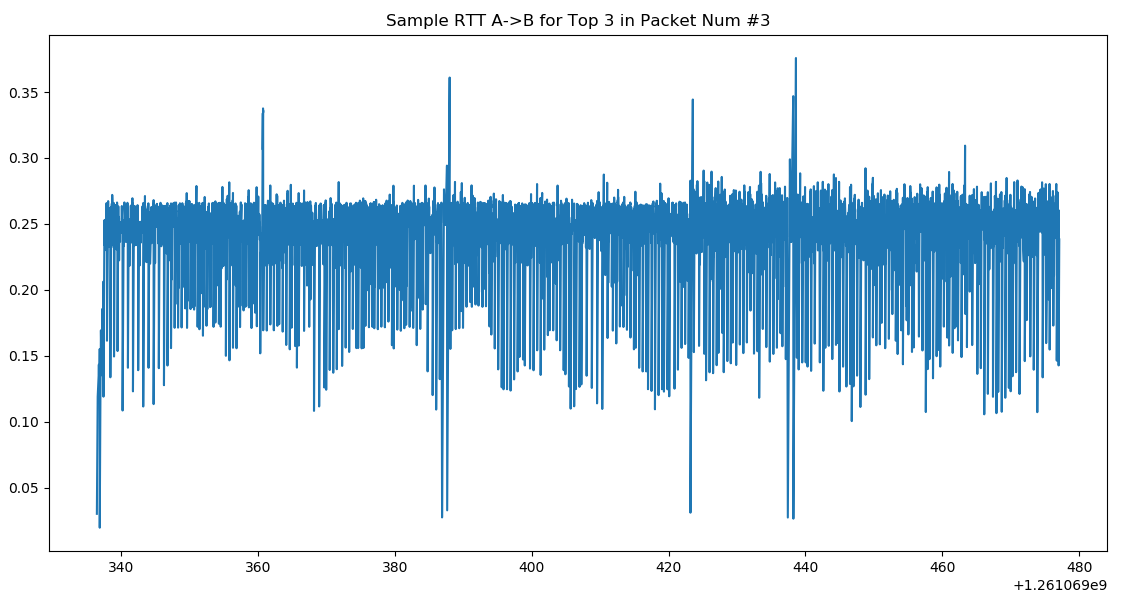


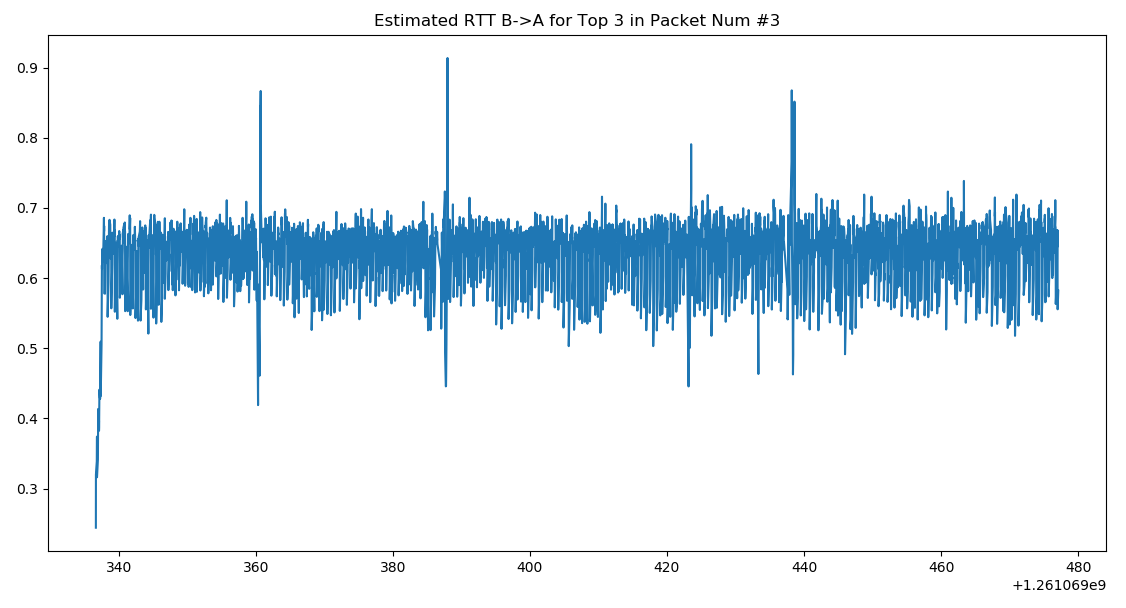
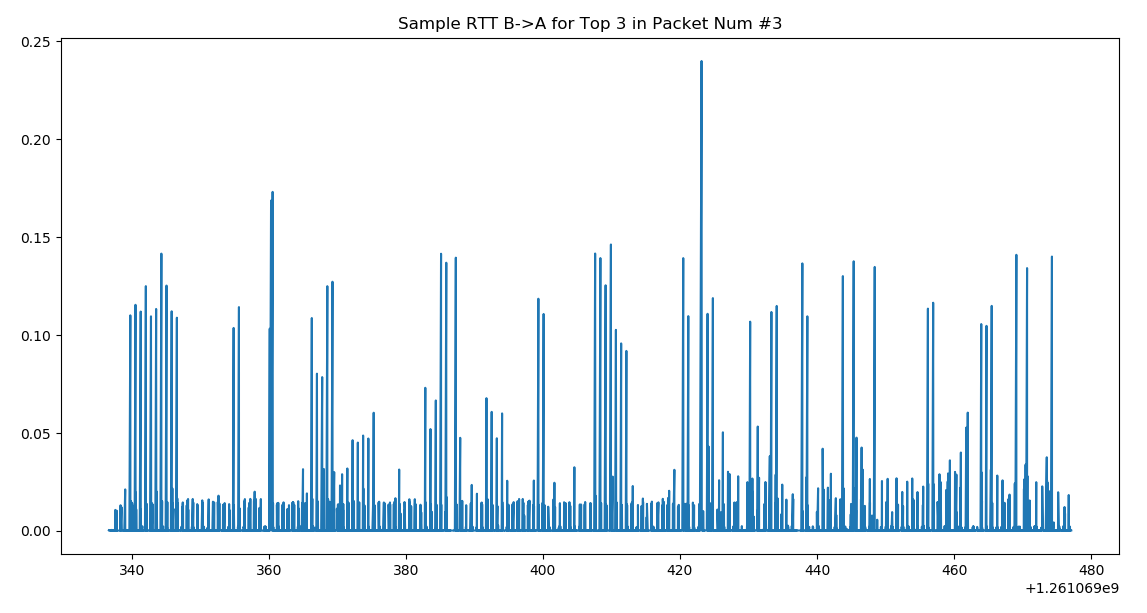


***Chart Analysis***

* This flow’s RTTs are once again fairly stable except for much clearer spikes than in flow #1
* This is likely because the actual RTT values in this flow are much lower compared to the former’s values. Again, this data could be attributed to normal variances in transfer rates or possibly some minor congestion

**Flow #3 Charts:**





***Chart Analysis:***

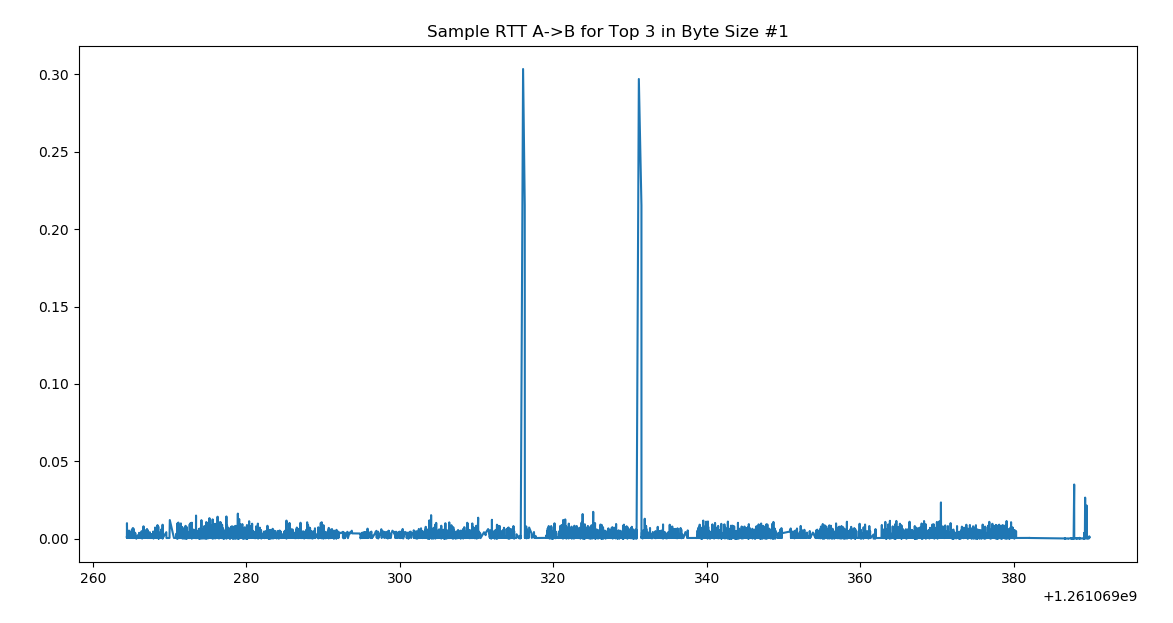
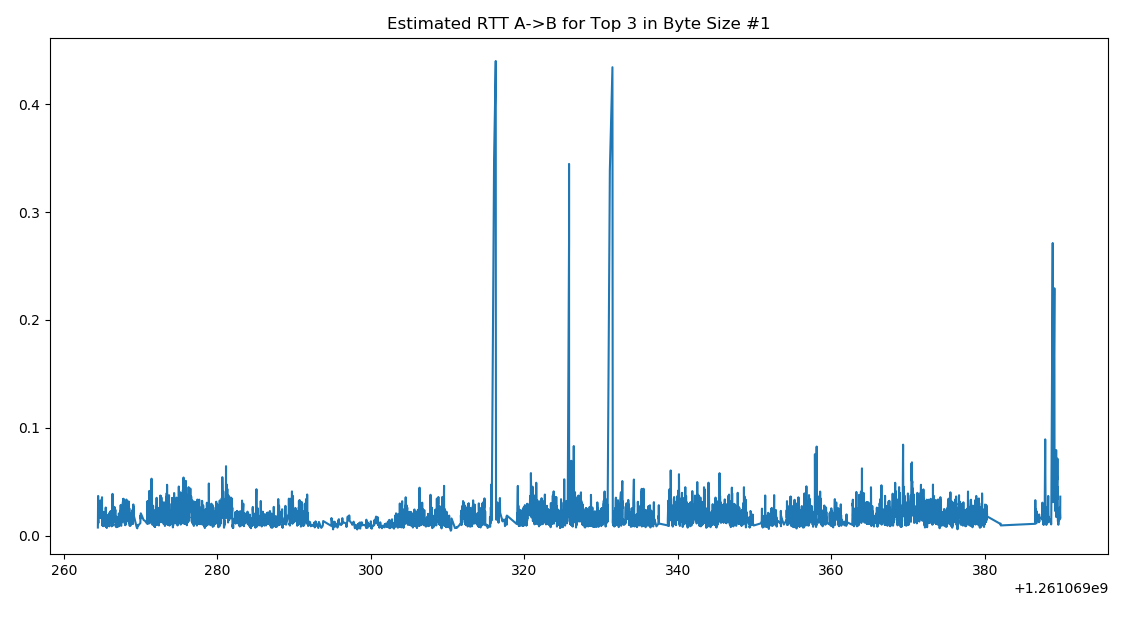
* This flow’s RTT values are much less stable than the others and also reach higher values.
* The A->B charts compared to B->A suggest that the RTT from A->B is generally slower than from B->A.
* And as previously, the more frequent spikes here can be indications of congestion or other transfer slow down issues.

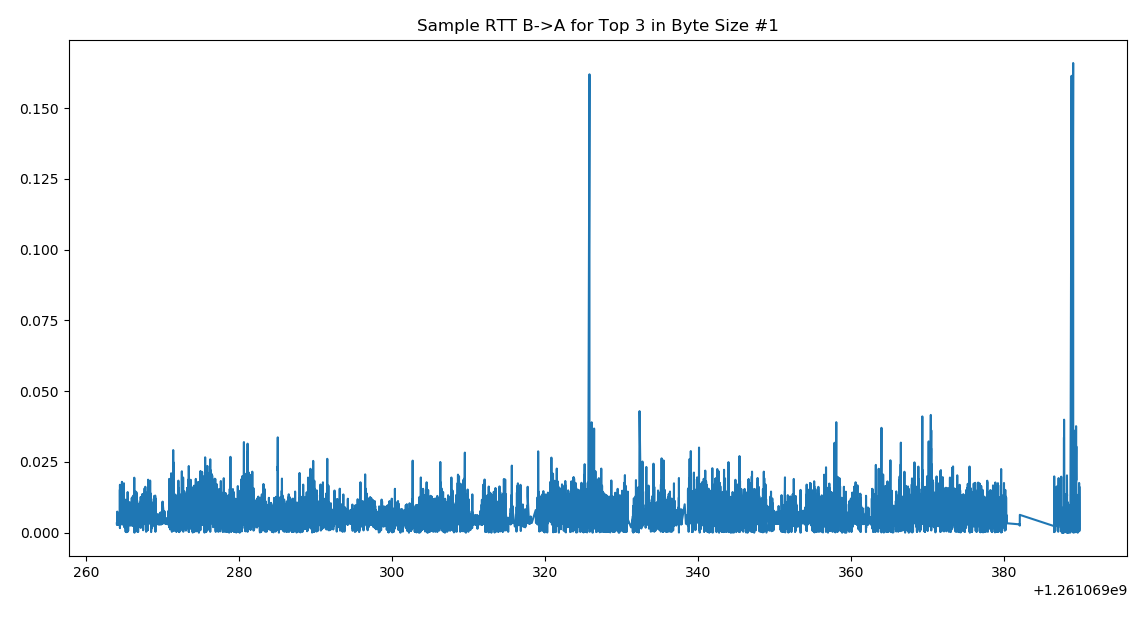
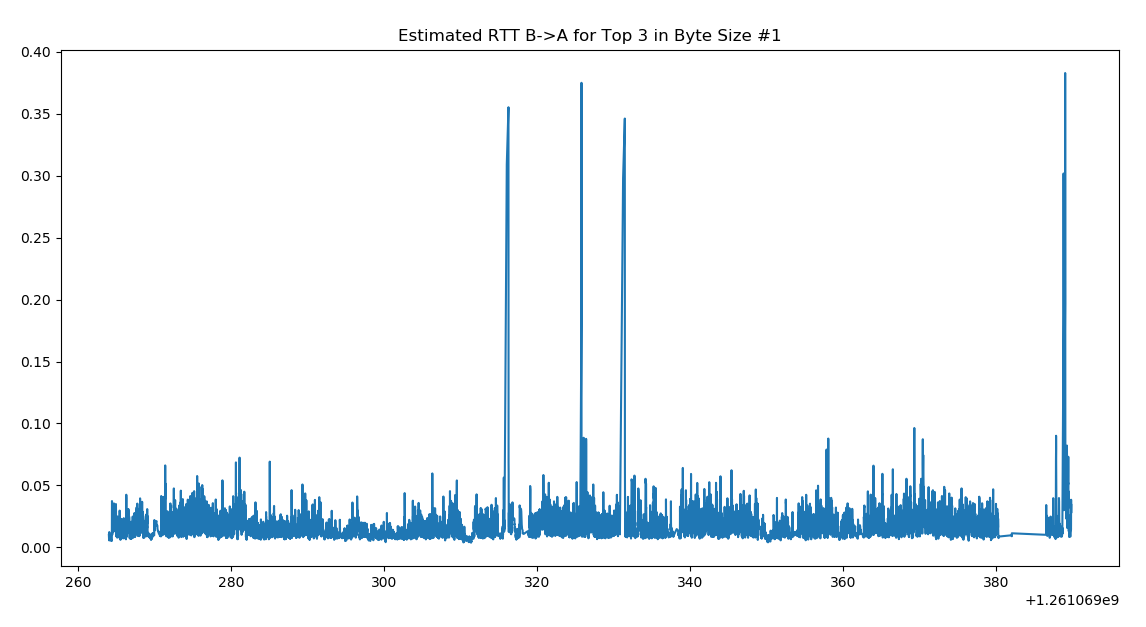
## Top 3 TCP Flows in Terms of Byte Size:

**Top Byte Size Flow Observations:**

* All three of the flows from the packet number ranking were the same and in the same order when it came to byte size. This is maybe not completely unexpected and we can see from this that there was no flows in our dataset with comparably larger packets.

**Flow #1 Charts:**

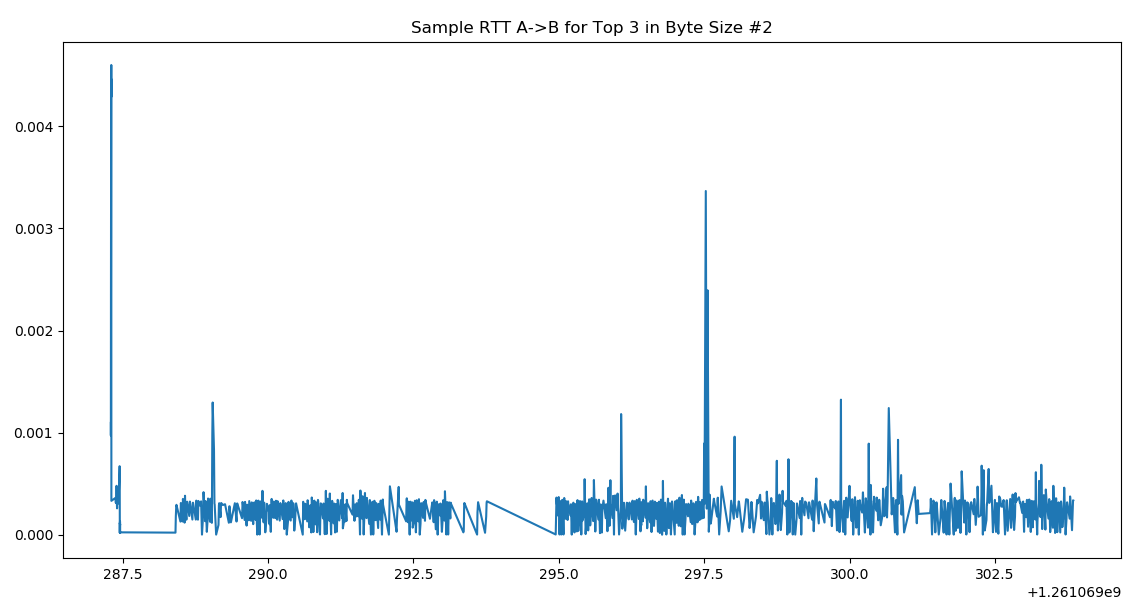
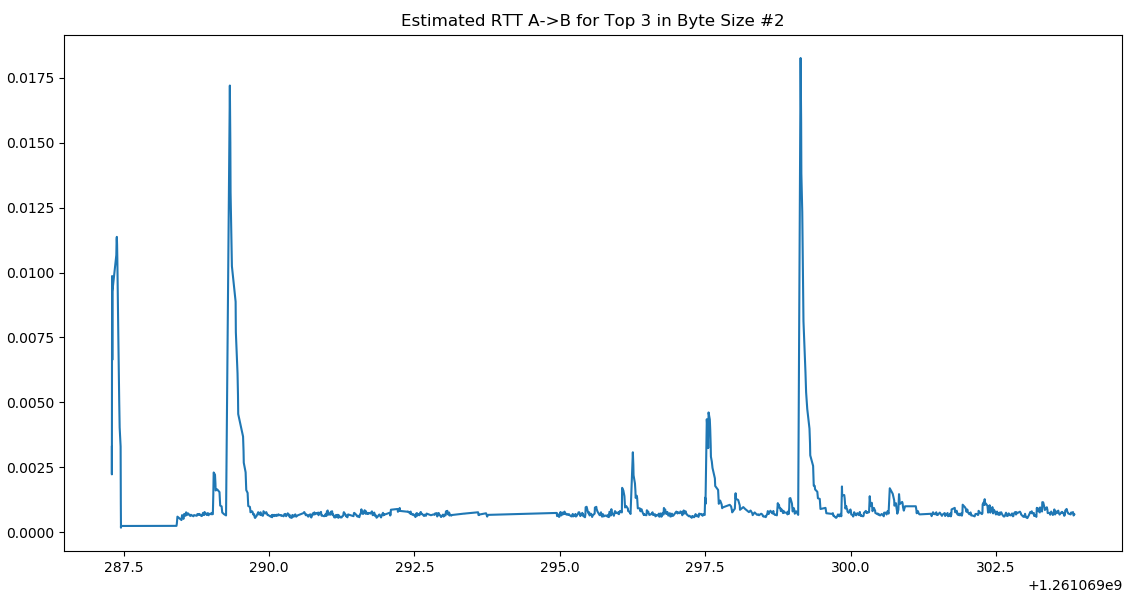
 

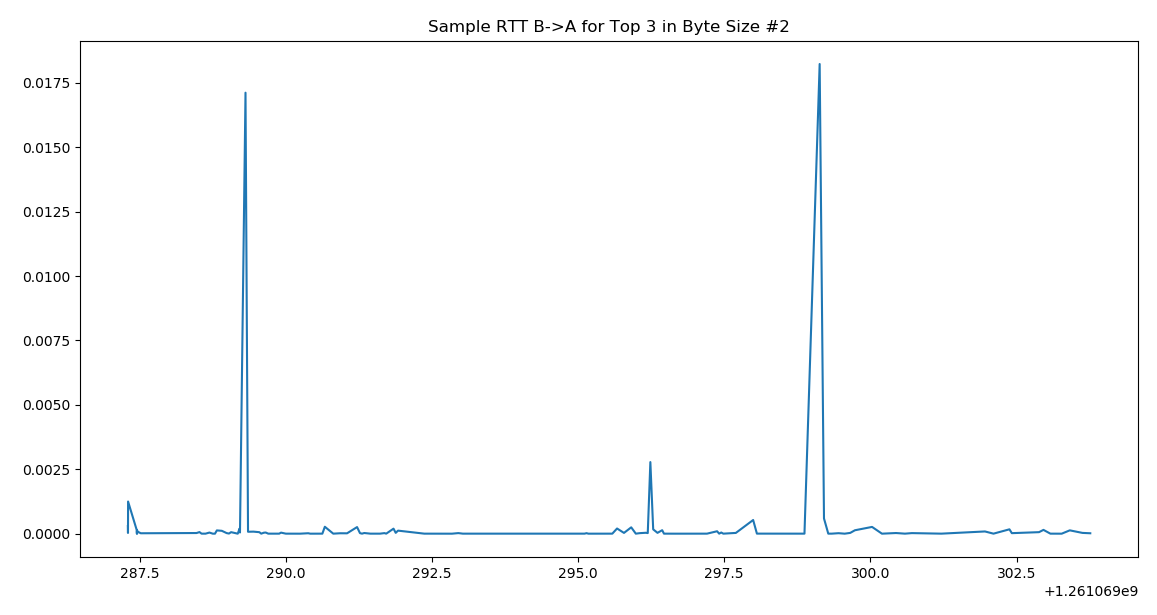
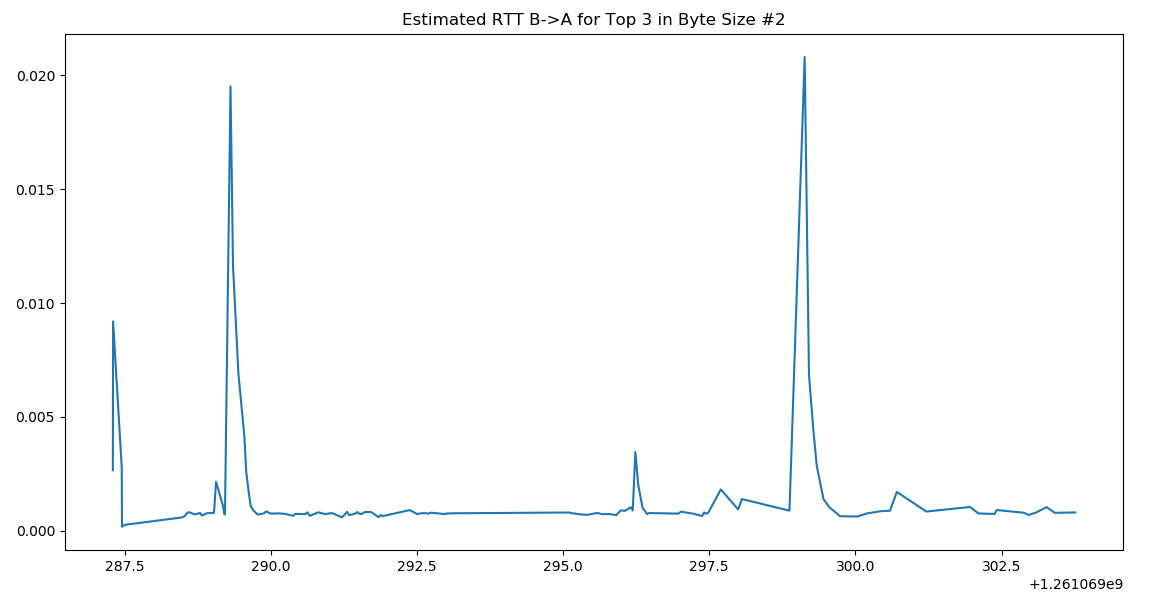
 

***Chart Analysis:***

* This flow is the same as #1 in “Top 3 in Term of Packet number” and as such the analysis is the same.

**Flow #2 Charts:**

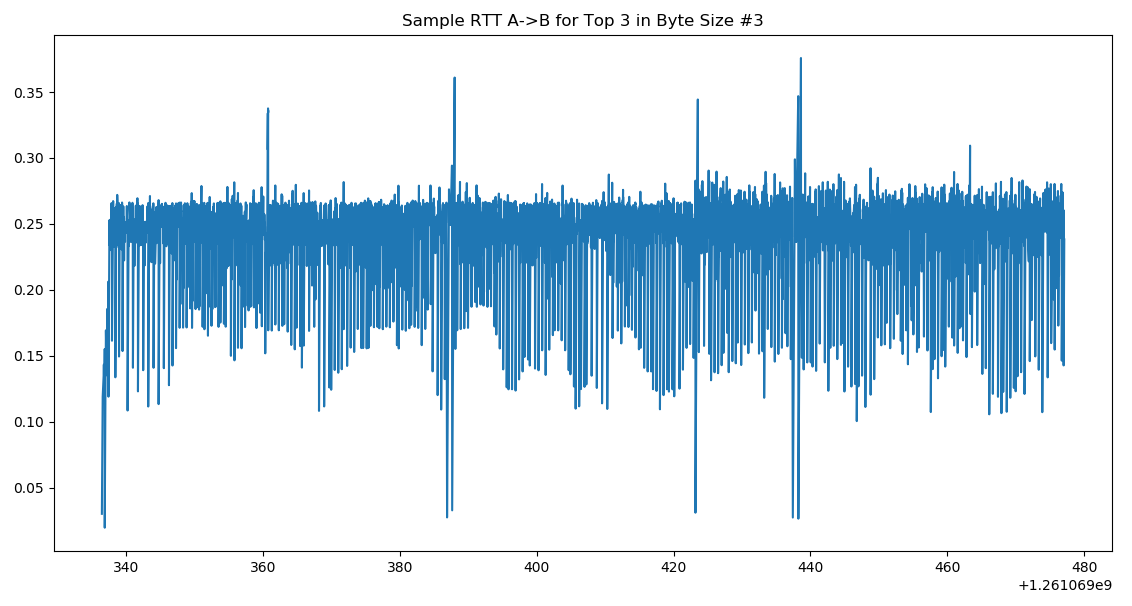
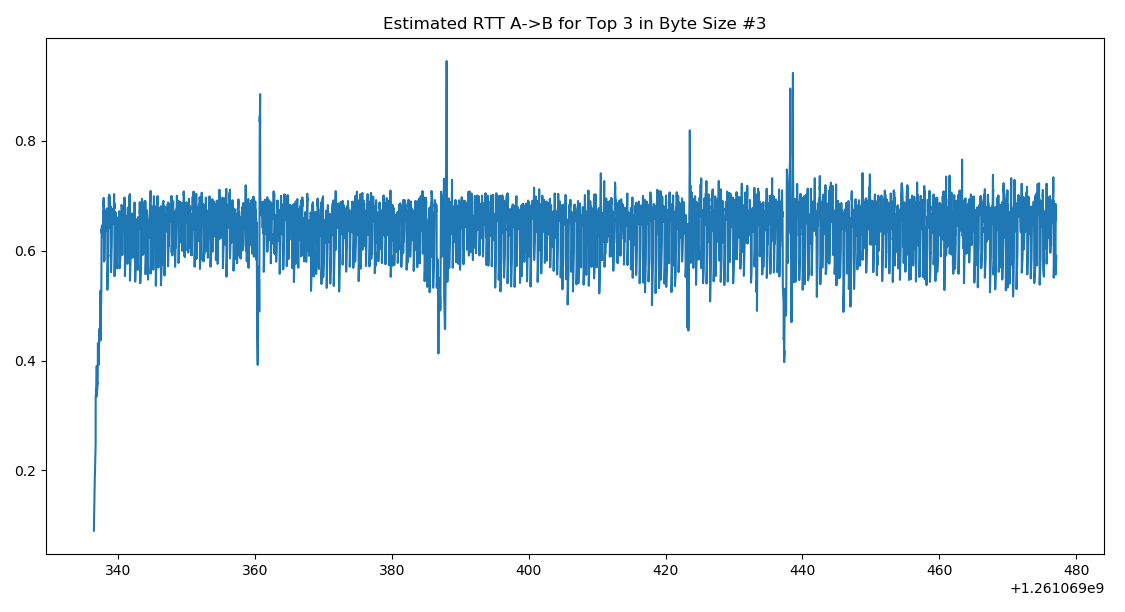
 

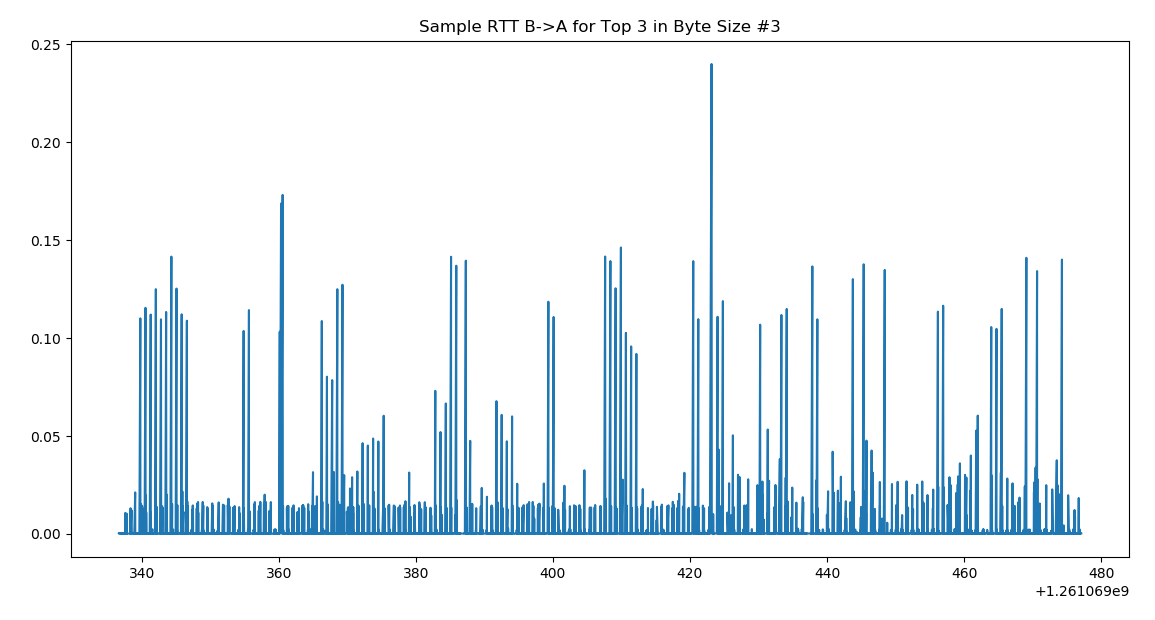
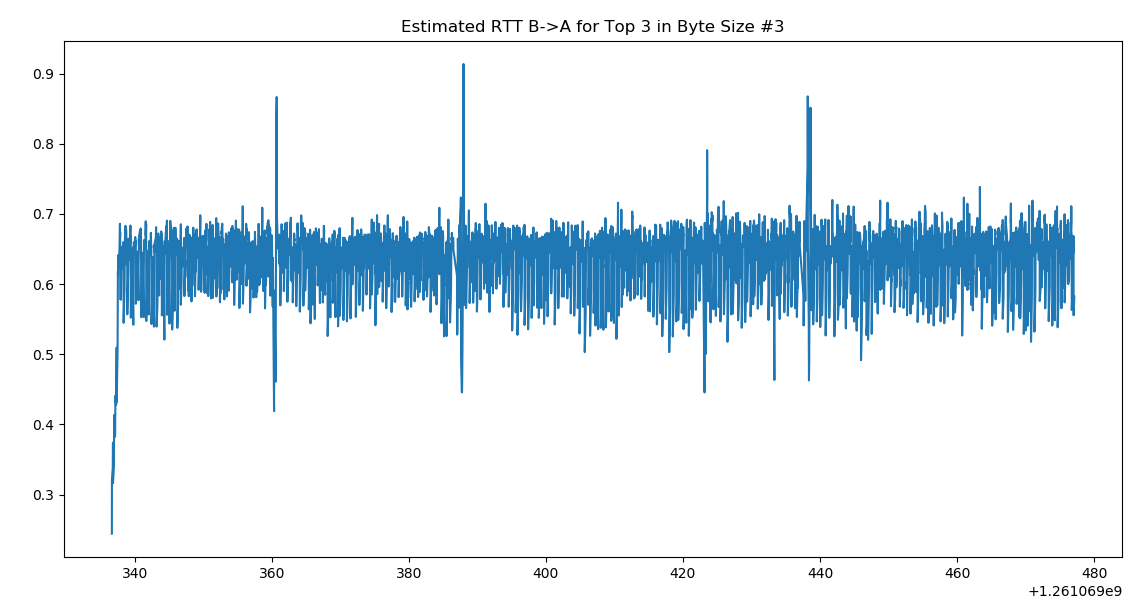
 

***Chart Analysis:***

* This flow is the same as #2 in “Top 3 in Term of Packet number” and as such the analysis is the same.

**Flow #3 Charts:**

***Chart Analysis:***

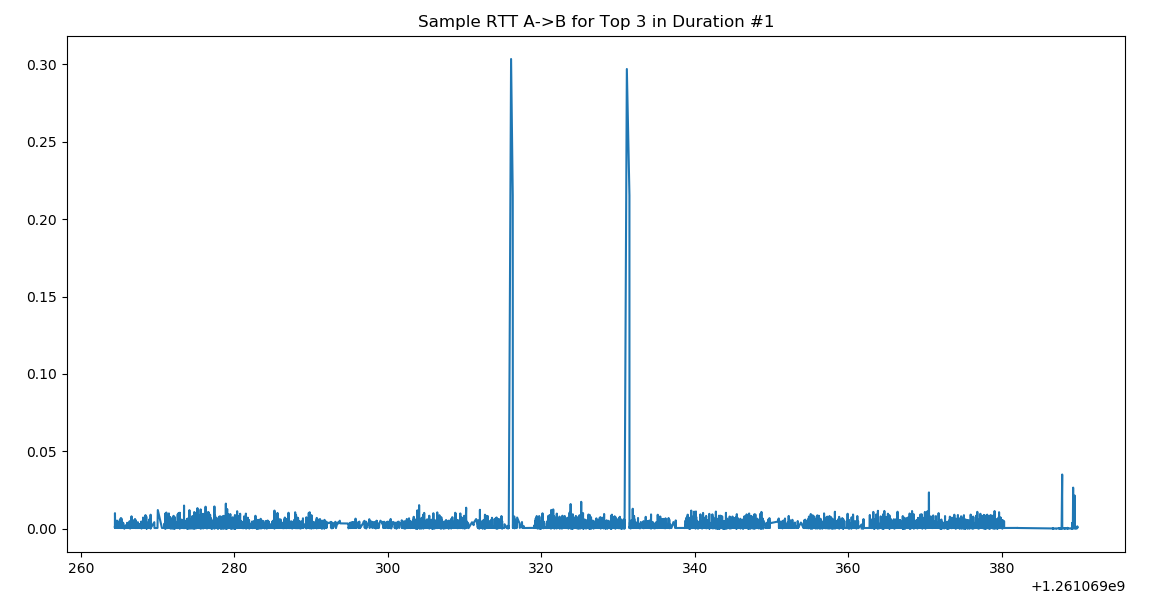
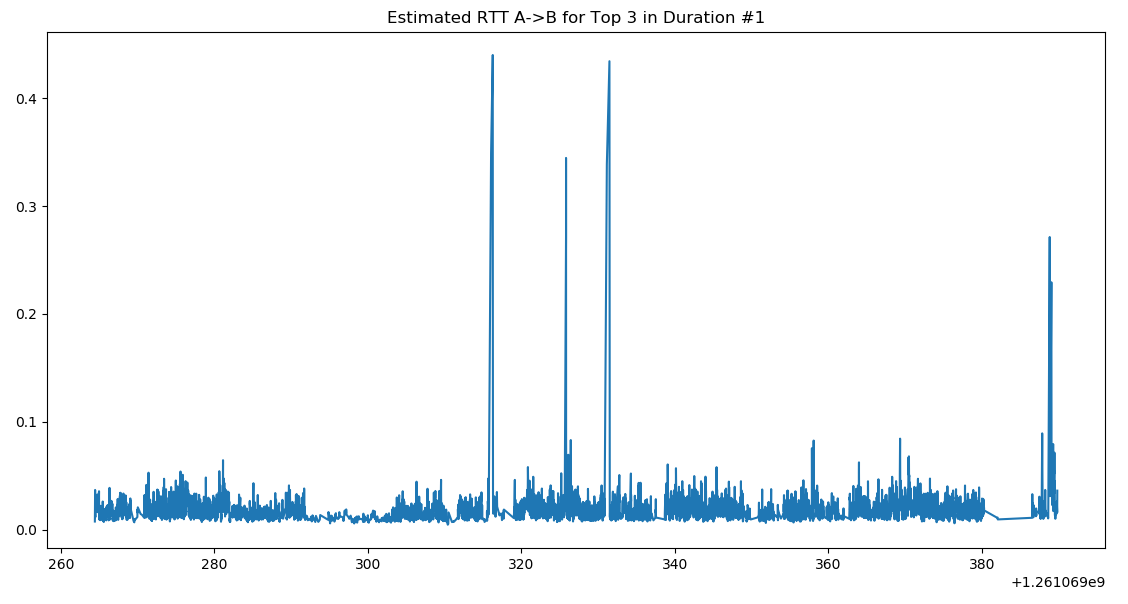
* This flow is the same as #3 in “Top 3 in Term of Packet number” and as such the analysis is the same.

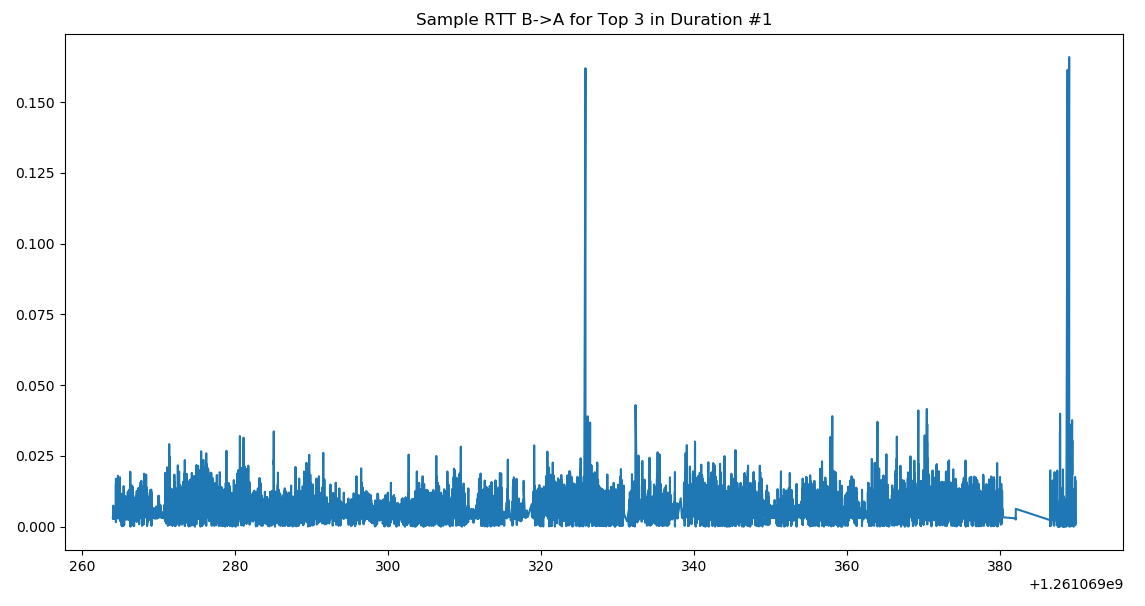
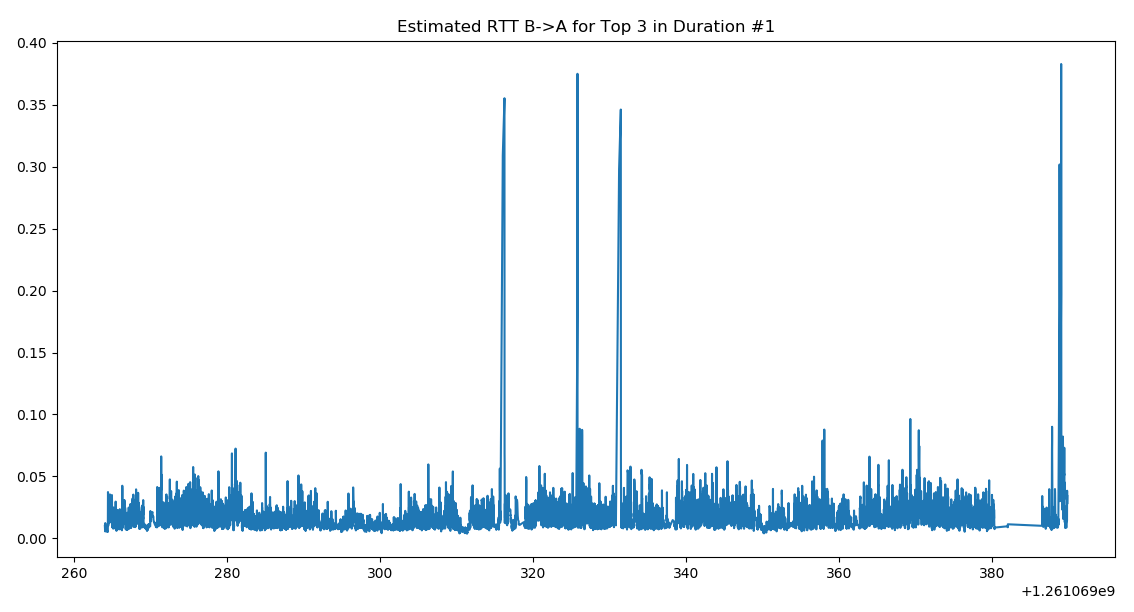
## Top 3 TCP Flows in Terms of Duration:

**Top Duration Flow Observations:**

* The top duration flows turned out the same way as both the top packet number and top byte size flows, and such the analysis for these ones will be, once again, the same.
* We can also observe from this that the top flows in our data have a correlation between all three attributes: packet number, byte size, and duration.

**Flow #1 Charts:**

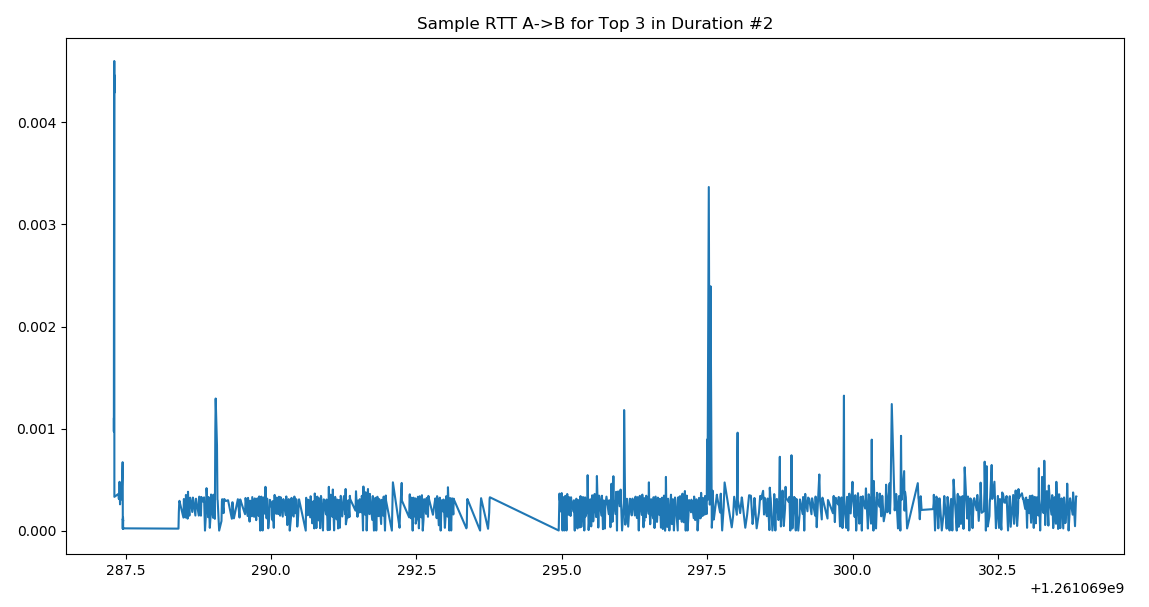
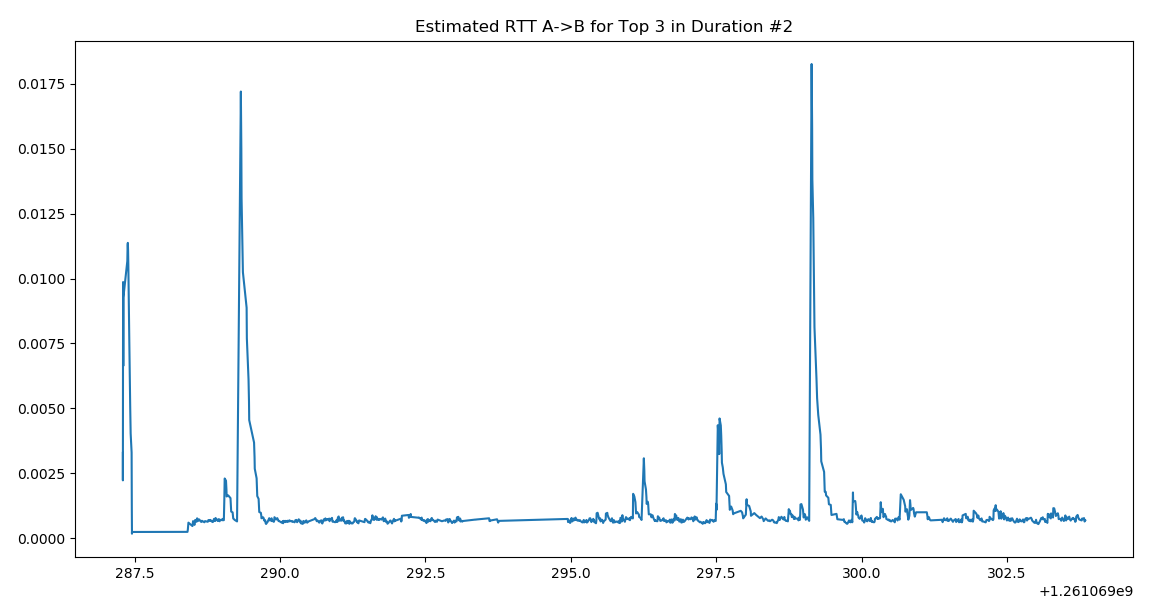
 

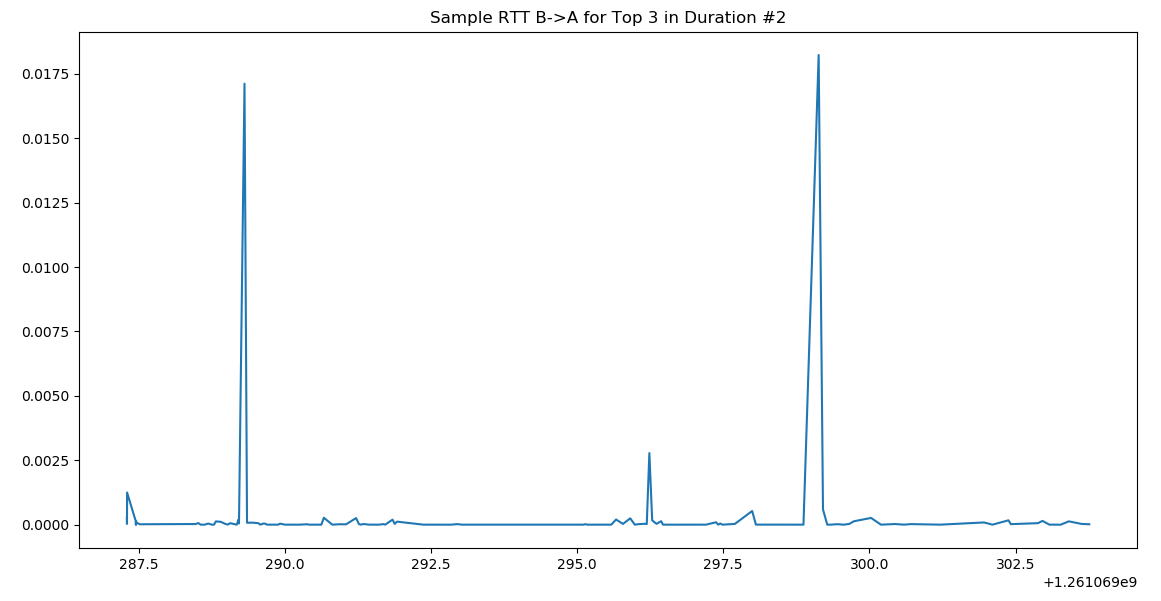
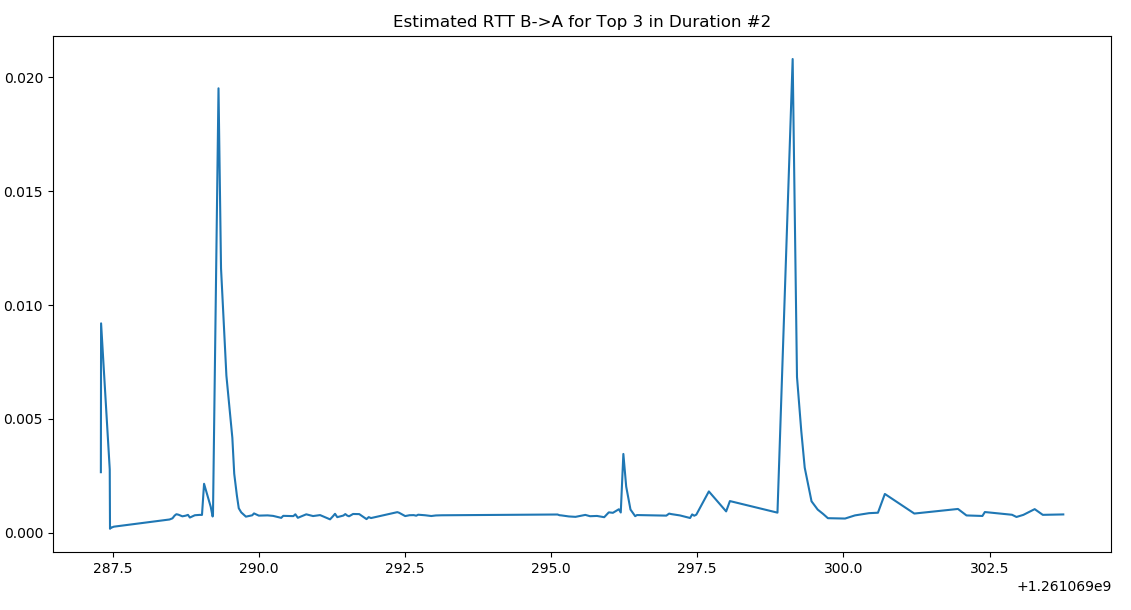
 

***Chart Analysis:***

* This flow is the same as #1 in “Top 3 in Term of Packet number” and as such the analysis is the same.

**Flow #2 Charts:**

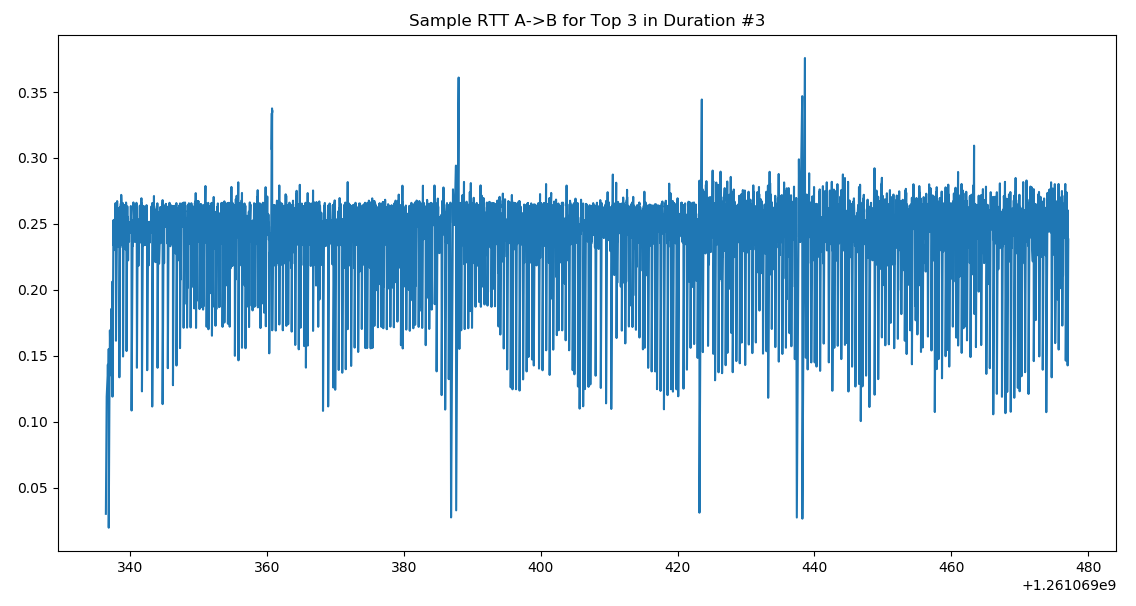
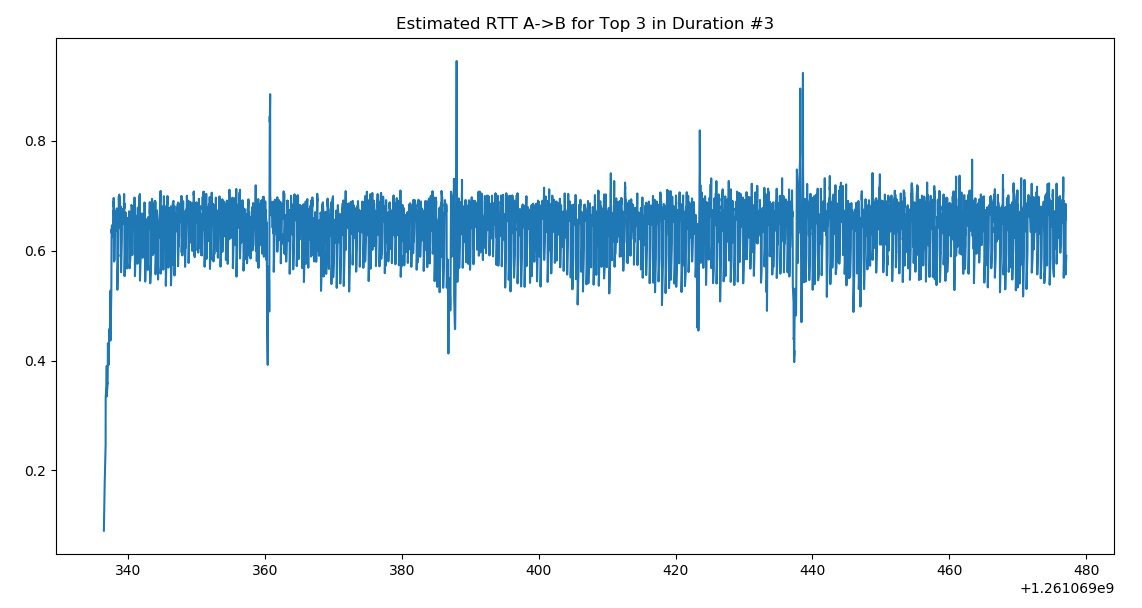
 

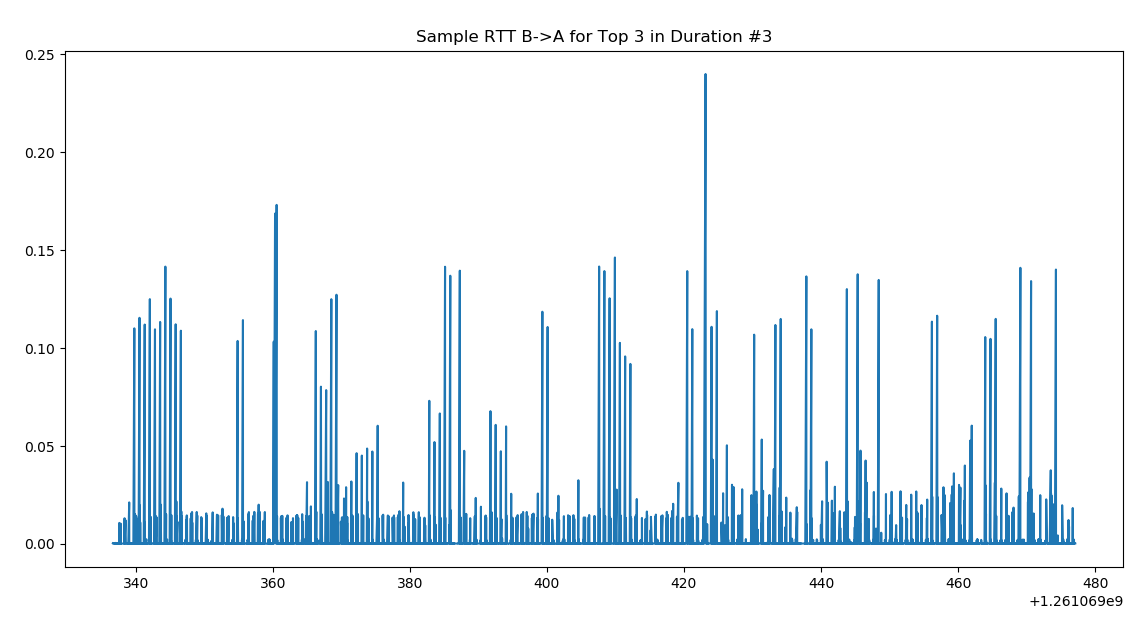
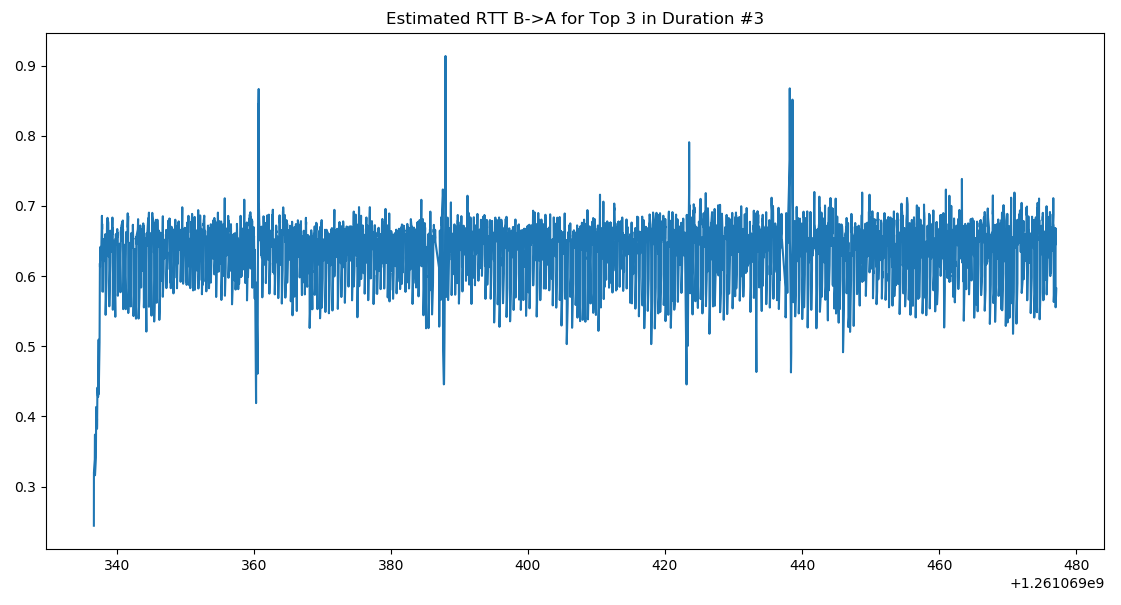
 

***Chart Analysis:***

* This flow is the same as #2 in “Top 3 in Term of Packet number” and as such the analysis is the same.

**Flow #3 Charts:**

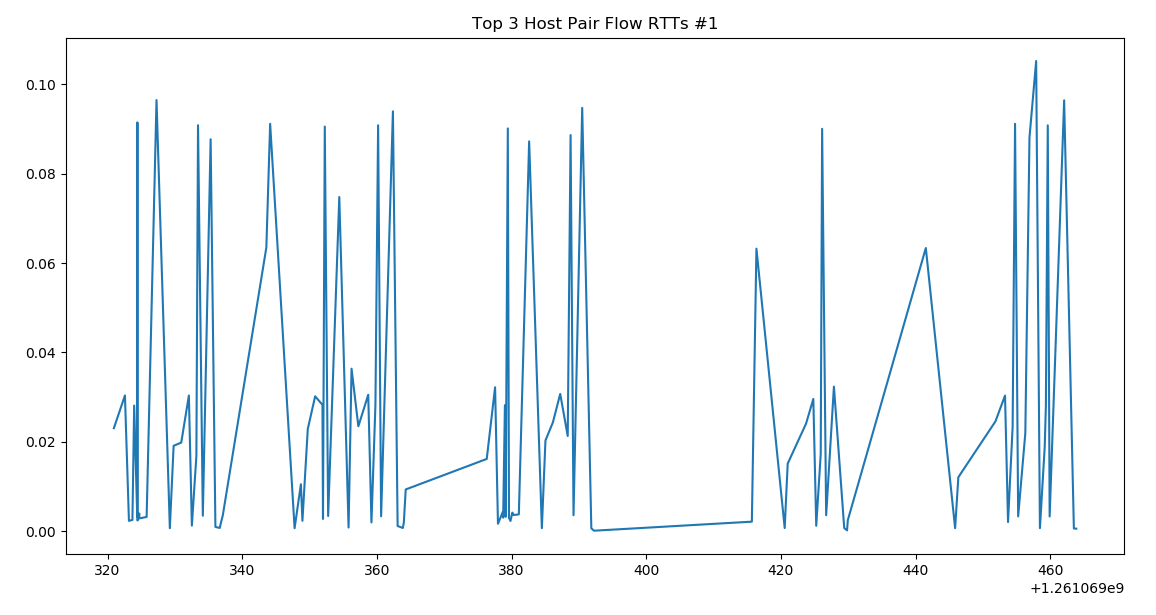
 

***Chart Analysis:***

* This flow is the same as #3 in “Top 3 in Term of Packet number” and as such the analysis is the same.

## Top 3 Host Pairs with most TCP Connections:

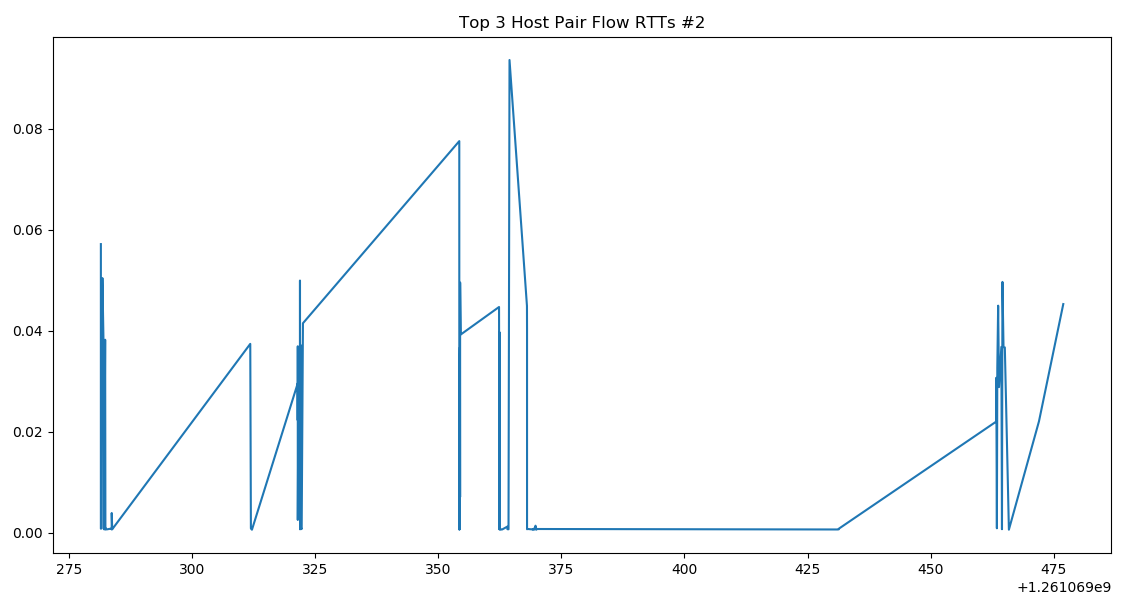
**Host Pair #1:**



***Analysis:***

* For this host-pair, the flows seems to occur fairly frequently and are in a relatively stable pattern (very stable lows and highs) in terms of RTT, meaning that the flows between the hosts operate relatively similarly throughout the dataset.
* This seems to suggest that the connection between the two hosts operates in a relatively stable manner at worst and at best.

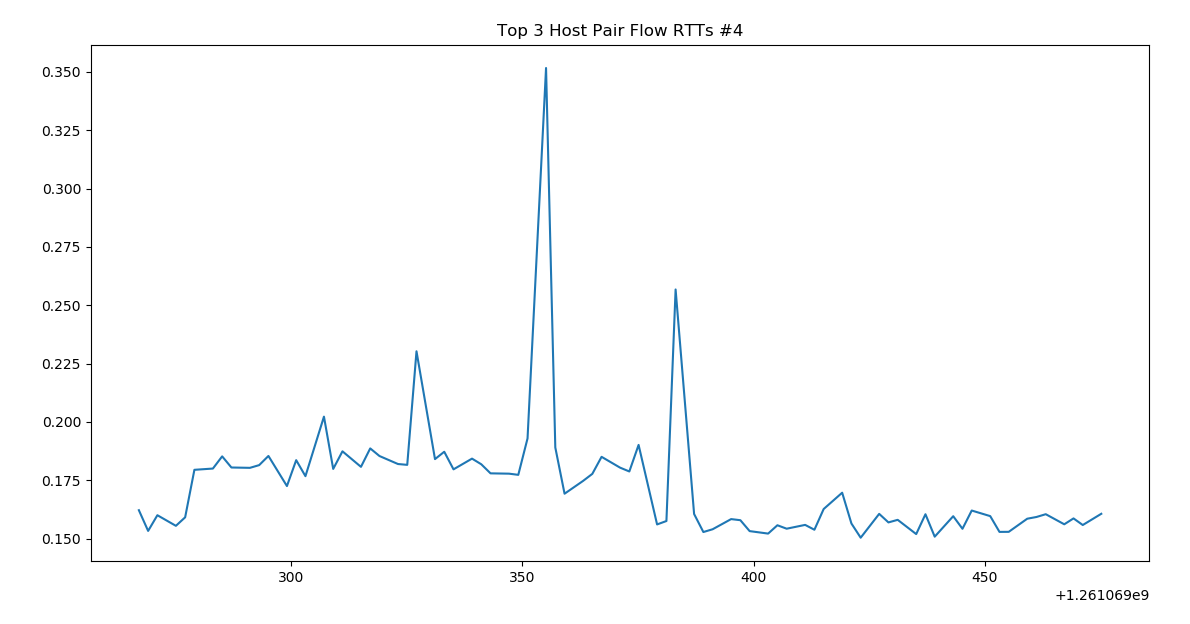
**Host Pair #2:**



***Analysis:***

* This host pair seems to be fairly infrequently used in terms of time blocks but given that the number of flows is second to most, it would seem that either the density of the flow are high at certain time blocks or that many of the connections never returned acknowledgments.
* This second case could be possible as our charts ignored flows that did not have any map-able acknowledgements.

**Host Pair #4:**



***Analysis:***

* First thing to note is that this is the host-pair with the 4th most TCP flows associated with it. This was the case because, as mentioned above, we ignored cases in which we could not map acknowledgments to packets and **all flows** for the third most host-pair had all packets in which they could not be mapped.
* This host-pair exhibits more evenly distributed time block of connections than the other two.
* As well, this host-pair does not have the same consistency in terms of RTT than the other two in that there are very clear spikes in RTT here.
* This could mean that this connection is more susceptible to congestion than the other two.