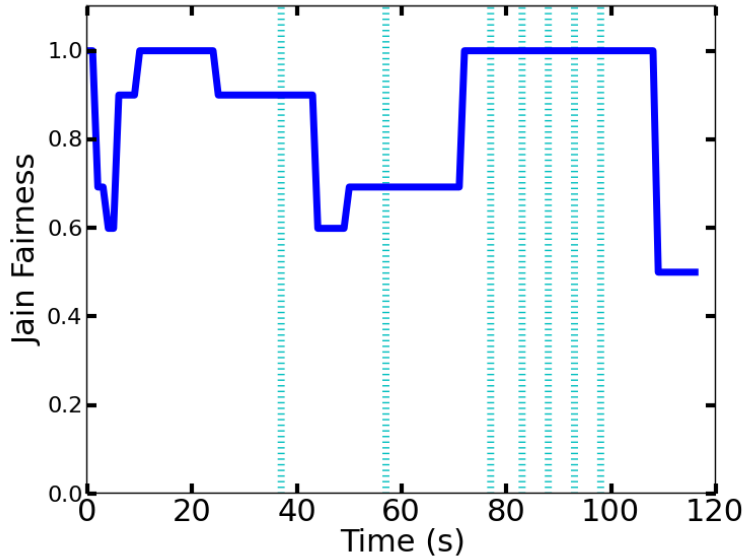
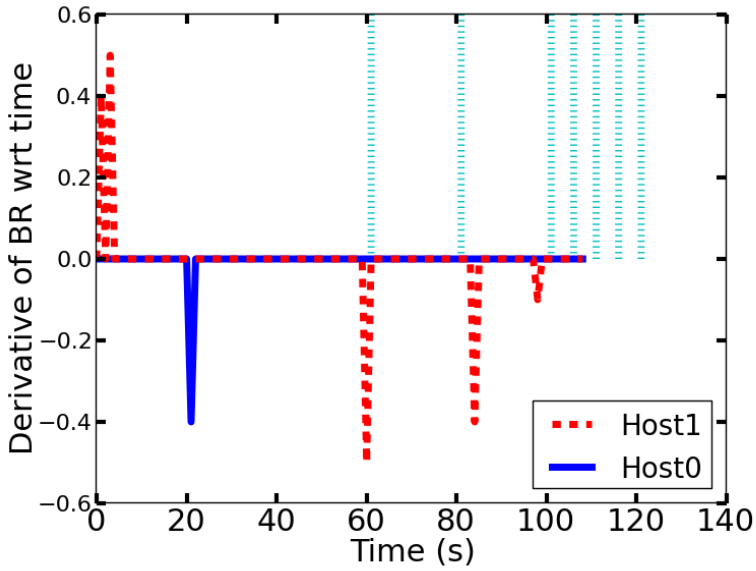
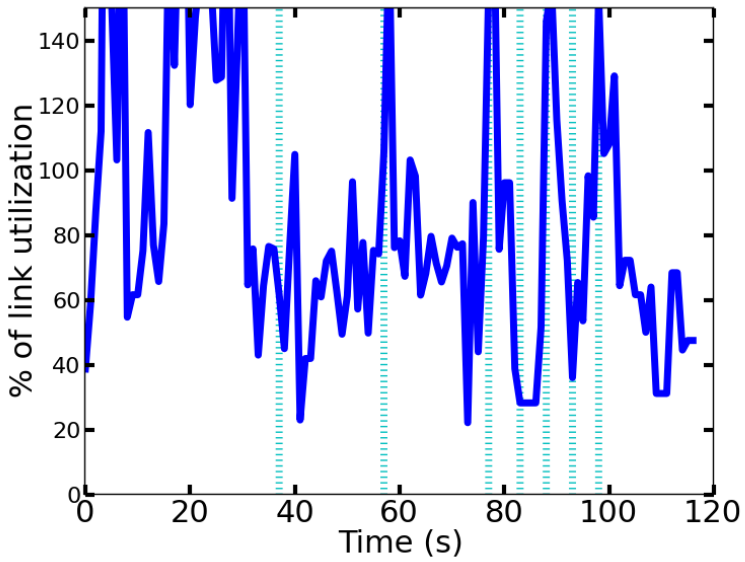
Observation of How α Affects Transmission

The followings are the generated plots of different α:

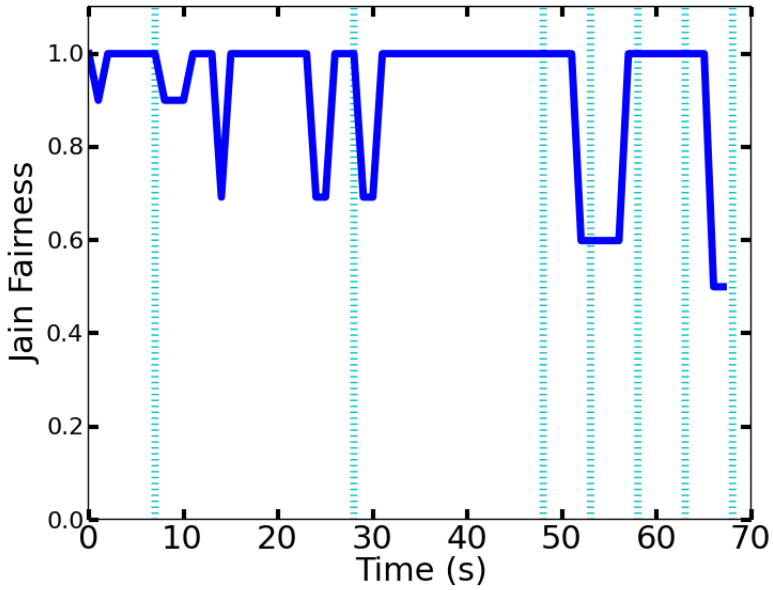
1. α = 0.1, fairness, smoothness, and utilization plots

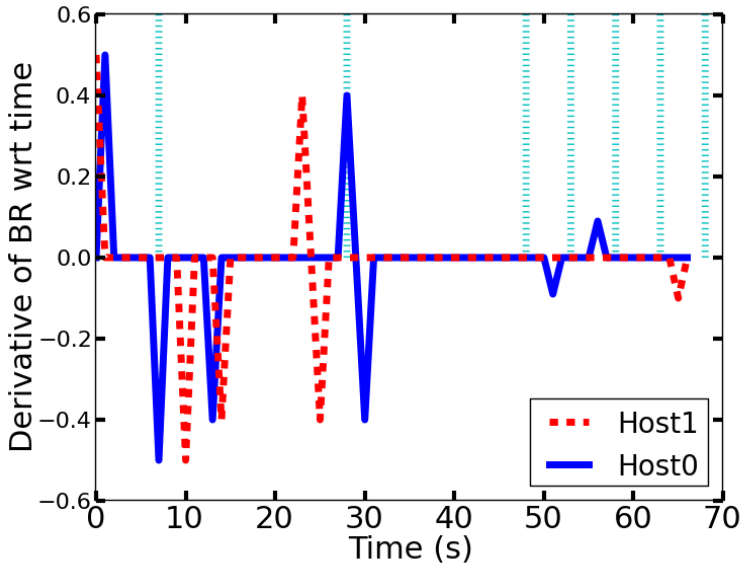


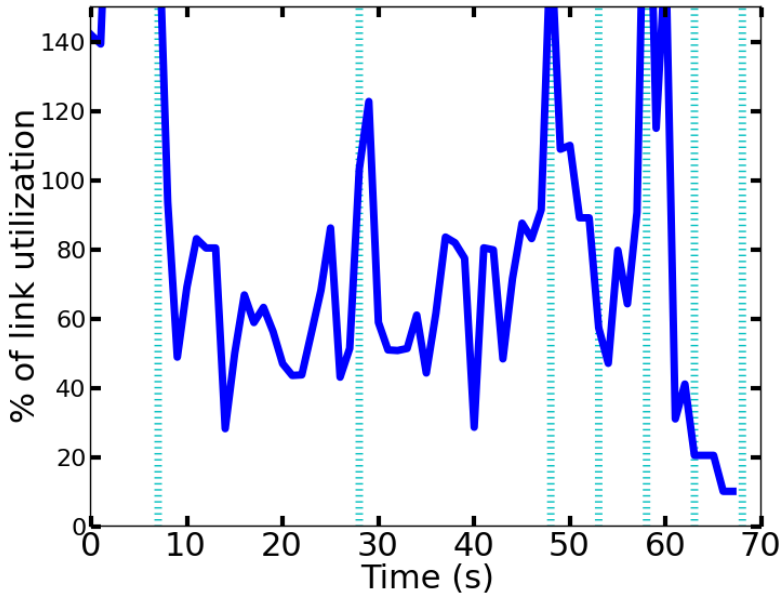




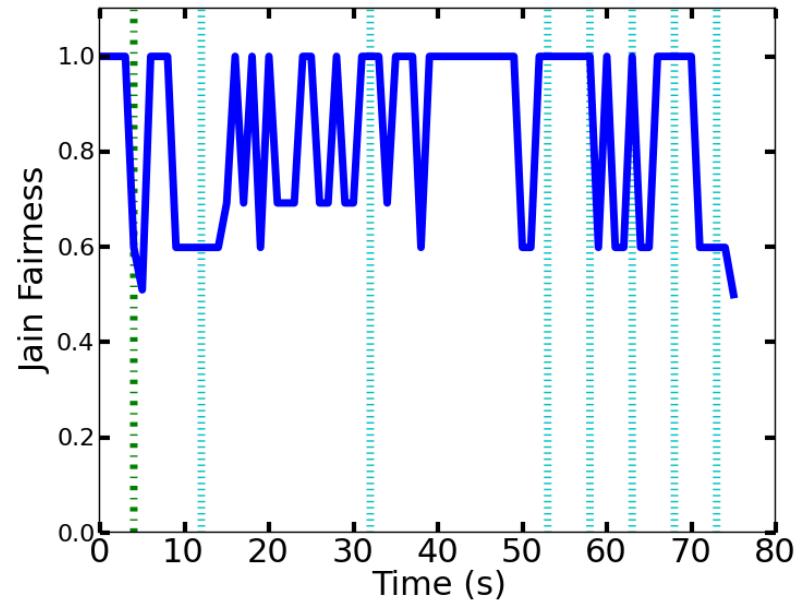
2. α = 0.5, fairness, smoothness, and utilization plots

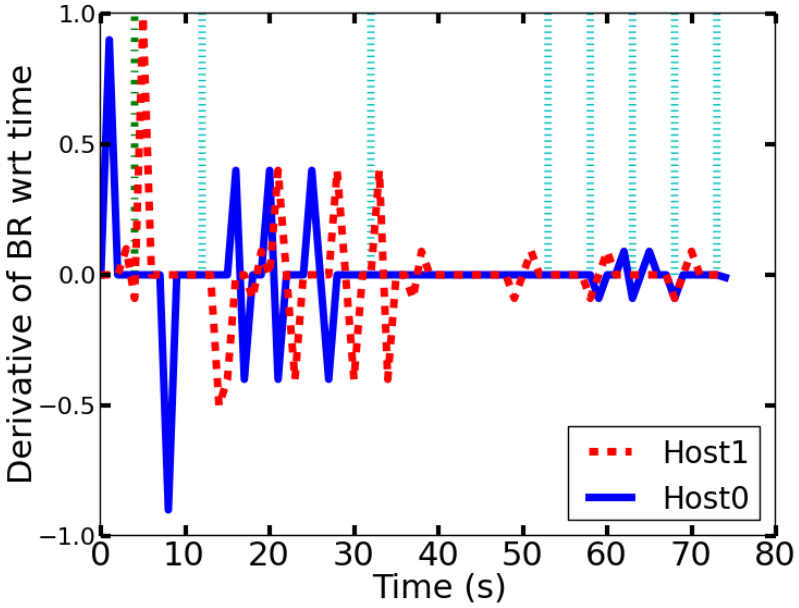


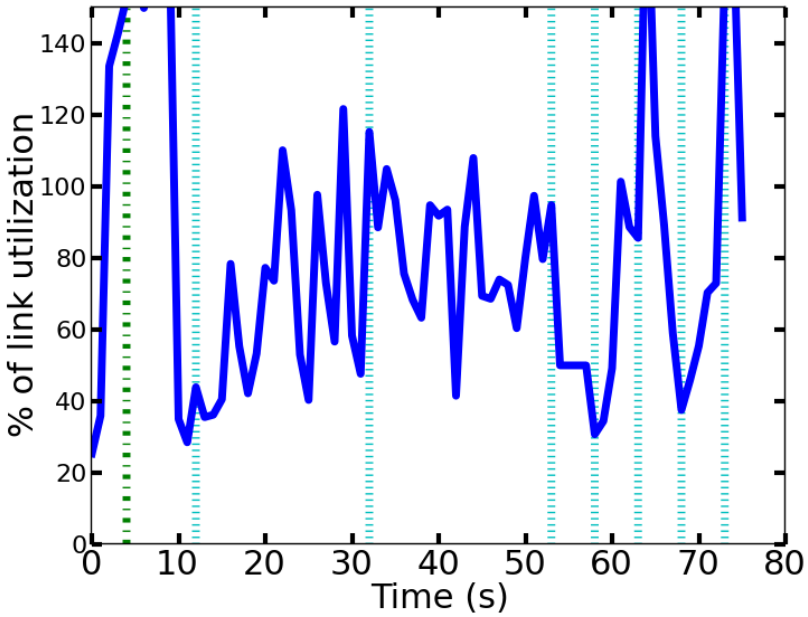




3. α = 0.9, fairness, smoothness, and utilization plots


Jain Fairness
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
60
70
80
Time (s)


Derivative of BR wrt time
1.0
0.5
0.0
−0.5
−1.0
0
10
20
30
40
50
60
70
80
Time (s)
Host1
Host0



Analysis:

The throughput is an Exponential Moving Average of all the past instantaneous throughput statistics. Intuitively, the smaller α leads to less significant effect of new measured throughputs on the calculated throughputs. This is also what happened in my simulations. It is very obvious that when α is small, the requested bitrate drops slowly even if the bandwidth and new throughput has shrunk a lot. And when α is large, the proxy asks for chunk with larger bitrate as long as it observes that the last chunk has large throughput.

In summary, smaller α leads to the following characteristics:

- More stable video quality. Proxy is not very sensitive to throughput change, so it rarely changes the requested bitrate.
- More fluctuating link utilization rate when the link has a changing bandwidth. Like have mentioned, proxy is not sensitive. When the link has a shrunk bandwidth, proxy would not instantly ask for chunk with lower bitrate. Also, when the bandwidth increases, proxy would not ask for higher bitrate in the next second. The requested bitrate does not follow the link bandwidth closely.
- Worse fairness performance. This is also caused by its insensitivity.
- More buffering. Since proxy with smaller α does not adjust the requested bitrate frequently. It is very likely that the requested bandwidth is even larger than the link bandwidth. In this case, buffering would happen.

From browser user's perspective, choosing α is the tradeoffs between more stable video quality and less buffering. We do not want the video bitrate to change due to an insignificant bandwidth fluctuation. We neither want any buffering when video is playing. Thus, the best approach is to set an α that is neither too large nor too small.