A Comparative Analysis of Popular Video Conferencing Applications

Authors

Abstract

Video conferencing has been one of the killer applications of the Internet. The video conferencing application (VCA) landscape has recently undergone significant change owing to the ongoing covid pandemic with the introduction of new VCA applications (e.g., Google Meet, Microsoft Teams) or revamping of incumbent VCA (e.g., Zoom, Bluejeans) to facilitate user engagement. The VCAs, however, have differed in their design choices and features. Understanding these differences with their impact on application performance and network consumptions can help in improving the design of future VCAs.

In this paper, we conduct extensive measurments contrasting the design differences for three popular VCAs, namely Zoom, Google Meet, and Microsoft Teams. We first study the application performance metrics in a 2-person call under different network conditions. We find that differences in application performance under same network conditions which can be attributed to differences in encoding mechanisms, application-level capping, bandwidth estimation techniques. We also found that performance varies across device platform even for the same application (e.g., native client better than the web client). We next study the impact of usage modality (e.g., gallery vs speaker mode in zoom) on network consumption and find some interesting differences in network consumption based on the usage modality. For instance, Zoom typically increases the sent video resolution of the user under speaker mode. Finally, we also study how different VCAs share bandwidth with other applications (file download, video streaming, and other VCAs) in terms of fairness. We find interesting differences wherein we find that applications do not share bandwidth fairly with other internet applications.

1 Introduction

- VCAs have been touted as a killer application for the Internet connecting millions of users. Significant research and measurement studies have been conducted benchmarking the VCAs of the time, their design choices and its impact on application performance.
- The VCA application has undergone significant change in the covid-era of work from home/school with either new VCAs have been introduced or existing applications significantly revamped.
- In the context of these changes, it is important to revist the earlier measurement studies especially understanding how these changes relate to application performance and network consumption.
- In this paper we do a comparative analysis of three popular applications, namely zoom, meets, and teams.
- Our analysis compares the VCAs along these three questions: i) How does the application performance vary under different network conditions?, ii) What is the impact of differnt VCA usage modality on network consumption, iii) Are the VCA applications fair in terms of bandwidth sharing when compared to other applications or transport protocols.
- Insights: We find that ...

2 Background and Methodology/Motivation

This section provides a background on video conferencing applications. We also describe our basic measurement methodology.

2.1 Background on VCAs

- How VCAs work?
- What are the application performance metrics
-

2.2 Measurement Methodology

3 Performance on Different Networks

We begin by measuring how VCAs perform under different network conditions. In the first set of experiments, we study the impact of **bandwidth**, **latency**, and **loss** on application performance. In the second set of experiments, we analyze how these applications respond to new flows on the network.

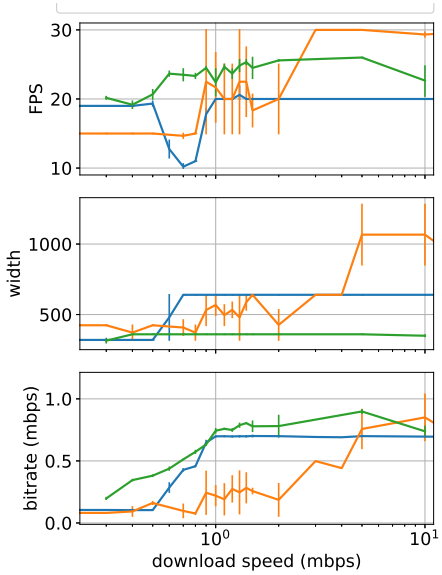

Figure 1: Downlink bandwidth and video quality

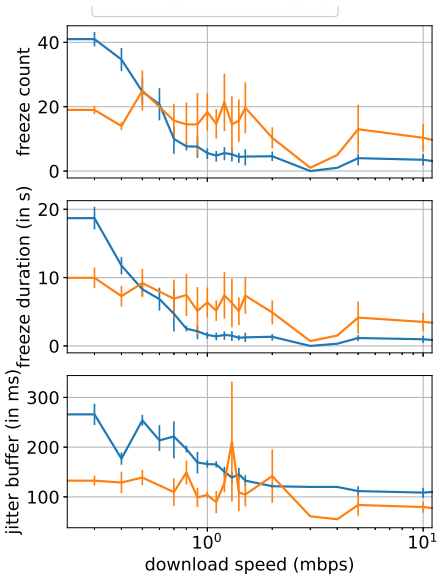

Figure 2: Downlink bandwidth and video freezes

3.1 Static Network Conditions

Methodology.

3.2 Dynamic Network Conditions

3.2.1 Temporary Interruptions

Methodology.

3.2.2 Competing Flows

Methodology.

4 Application context and network consumption

In this section, we analyze the impact of different usage modalities such as the number of persons in the call, viewing mode, and device type on the network consumption.

4.1 Number of Users

4.2 Viewing Mode

5 Related Work

VCA measurement studies
Performance of other applications
Application fairness

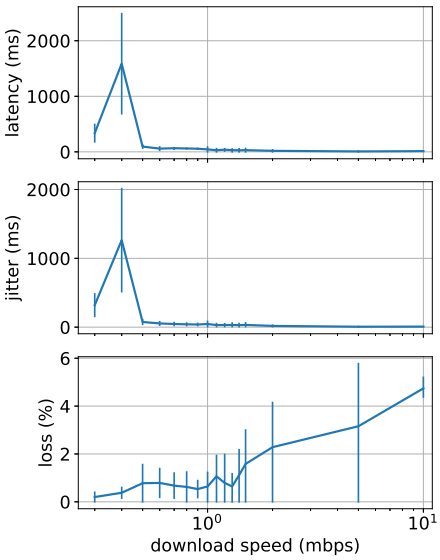

Figure 3: Downlink bandwidth and QoS metrics zoom

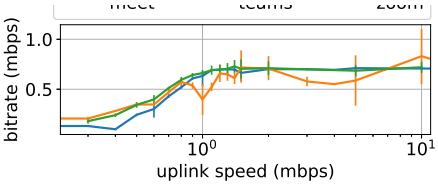

Figure 4: Uplink bandwidth and sent video bitrate

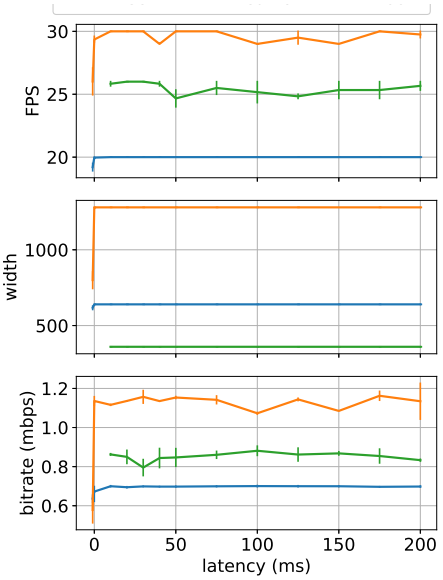

Figure 6: Latency and video quality

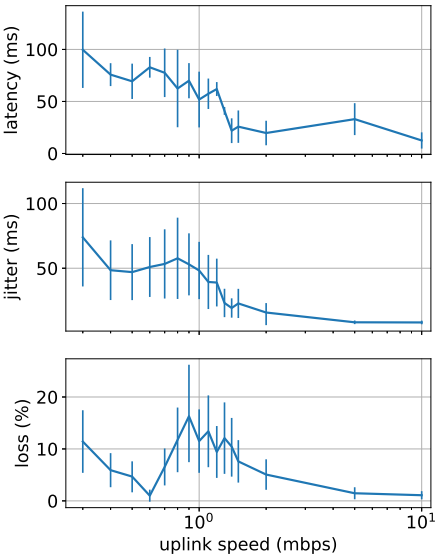

Figure 5: Uplink bandwidth and QoS metrics

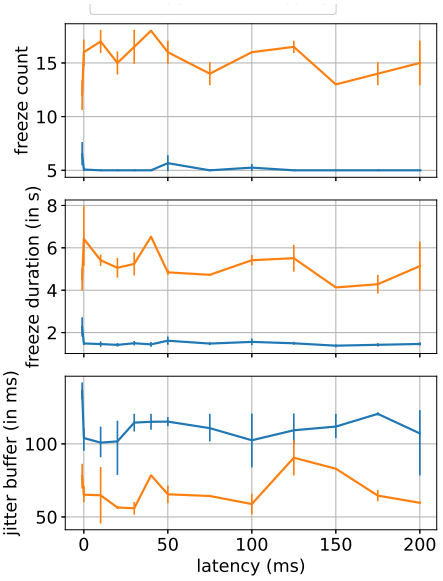

Figure 7: Latency and video freezes

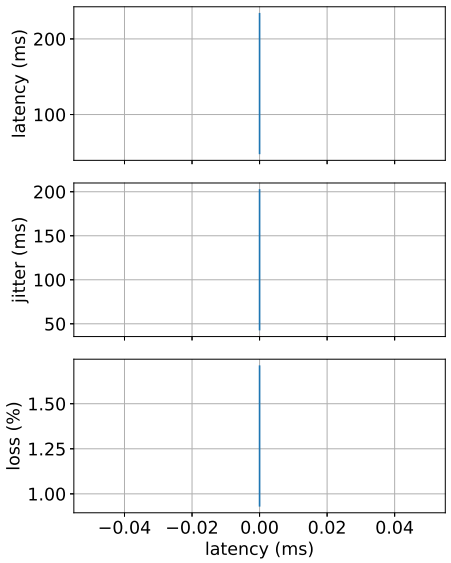

Figure 8: Latency and QoS metrics zoom

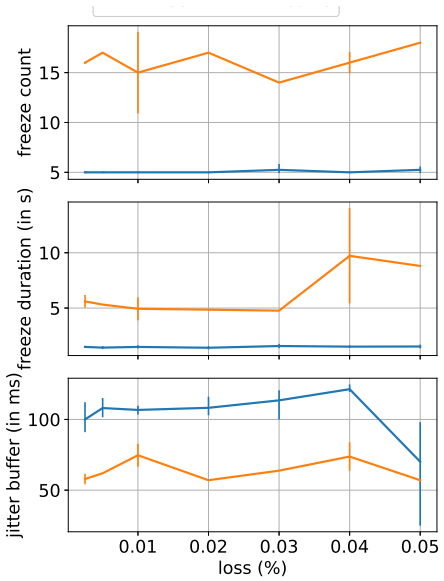

Figure 10: Loss and video freezes

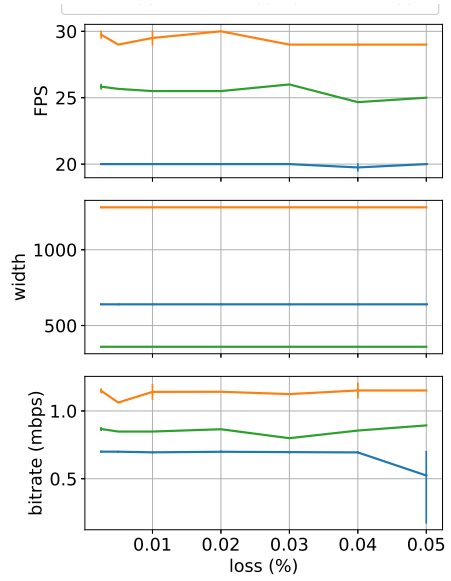

Figure 9: Loss and video quality

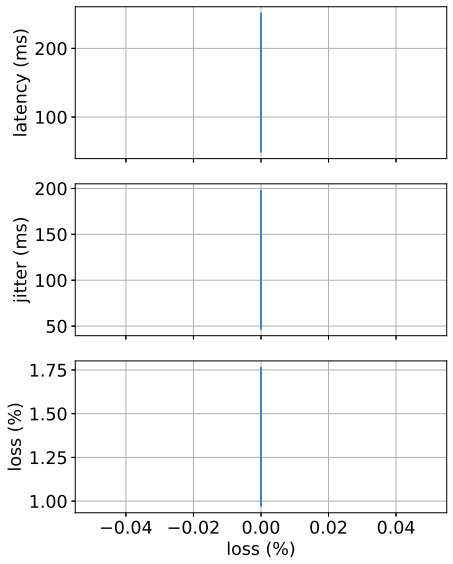

Figure 11: Loss and QoS metrics zoom

6 Conclusion

We analyse three major video conferencing applications.

Future work: - generalizability to other VCAs ? how do we obtain ground truth metrics for other VCAs? can we infer application performance metrics from network data?