

Radar Chart: Scanning for High QoE in QoS Dimensions

Yu-Chun Chang¹, Chi-Jui Chang², Kuan-Ta Chen², and Chin-Laung Lei¹

¹Department of Electrical Engineering, National Taiwan University

²Institute of Information Science, Academia Sinica



Outline

- Introduction
- Proposed design of radar chart
- Experiment methodology
- Single-application analysis
- Cross-application analysis
- Applications
- Conclusion

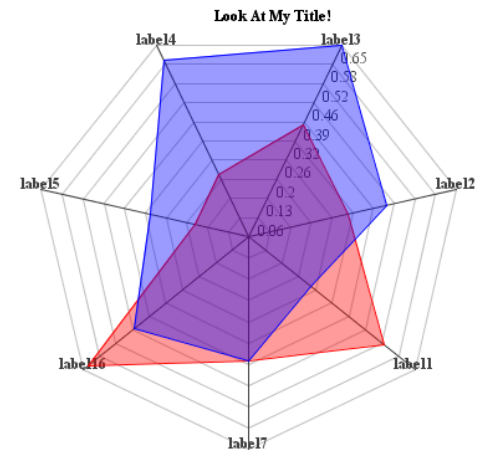
Introduction

- QoE (Quality of Experience)
 - User's subjective satisfaction at a service
 - QoE is multi-dimensional.

$$QoE = f\{M_1, M_2, M_3, \dots, M_n\}$$

- Challenges
 - How to summarize VoIP users' QoE under such a variety of factors?
 - Radar chart

Introduction

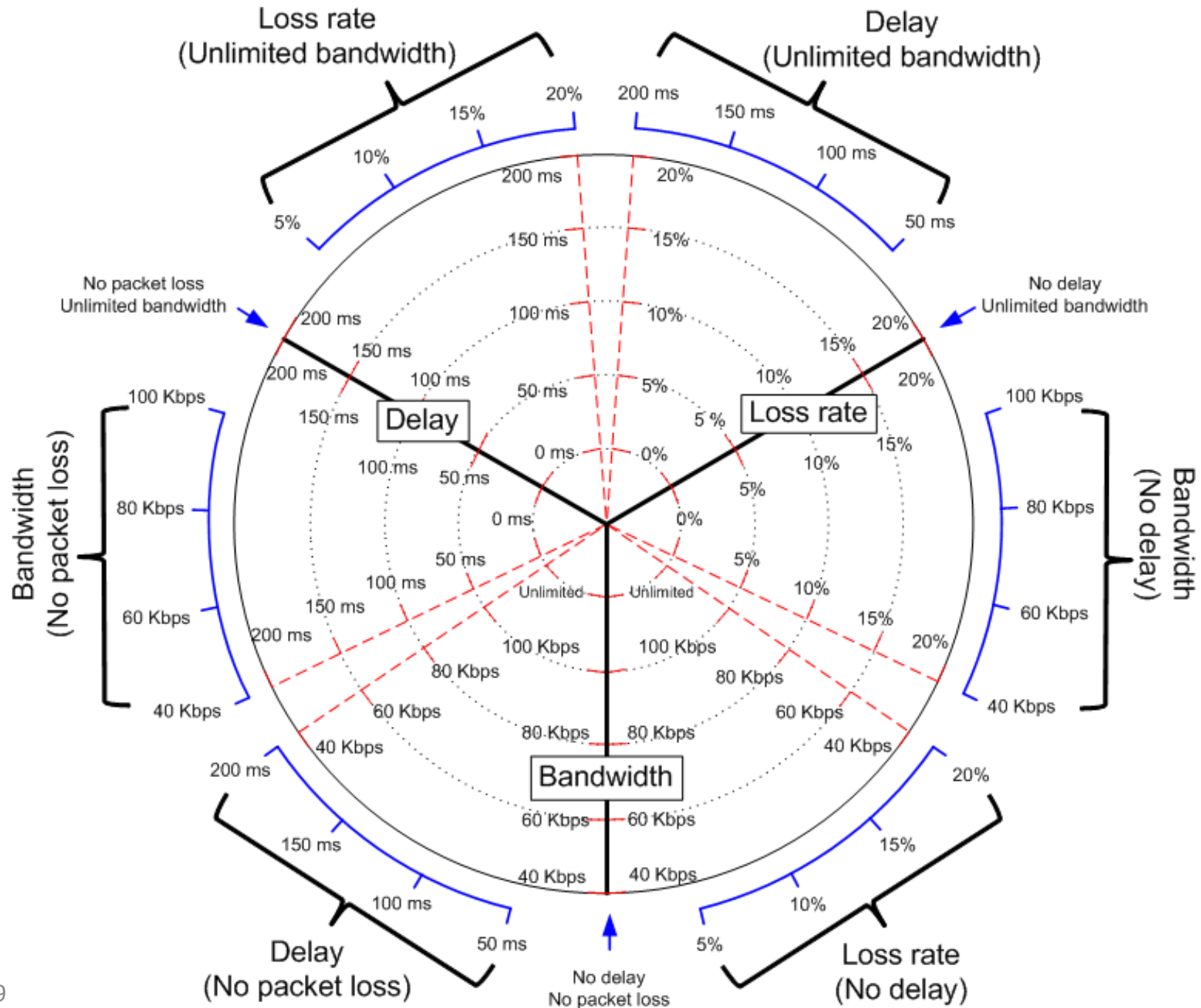


- Advantages of radar chart
 - Demonstrate the total performance of one group.
 - Display easily and clearly the relationship of different groups.
- Contributions
 - We use proposed radar chart to display VoIP users' QoE.
 - We analyze pros and cons of **Skype, MSN Messenger and Google Talk** based on proposed radar chart.
 - With radar chart, we propose two applications
 - Diagnosis
 - User recommendation

Outline

- Introduction
- **Proposed design of radar chart**
- Experiment methodology
- Single-application analysis
- Cross-application analysis
- Applications
- Conclusion

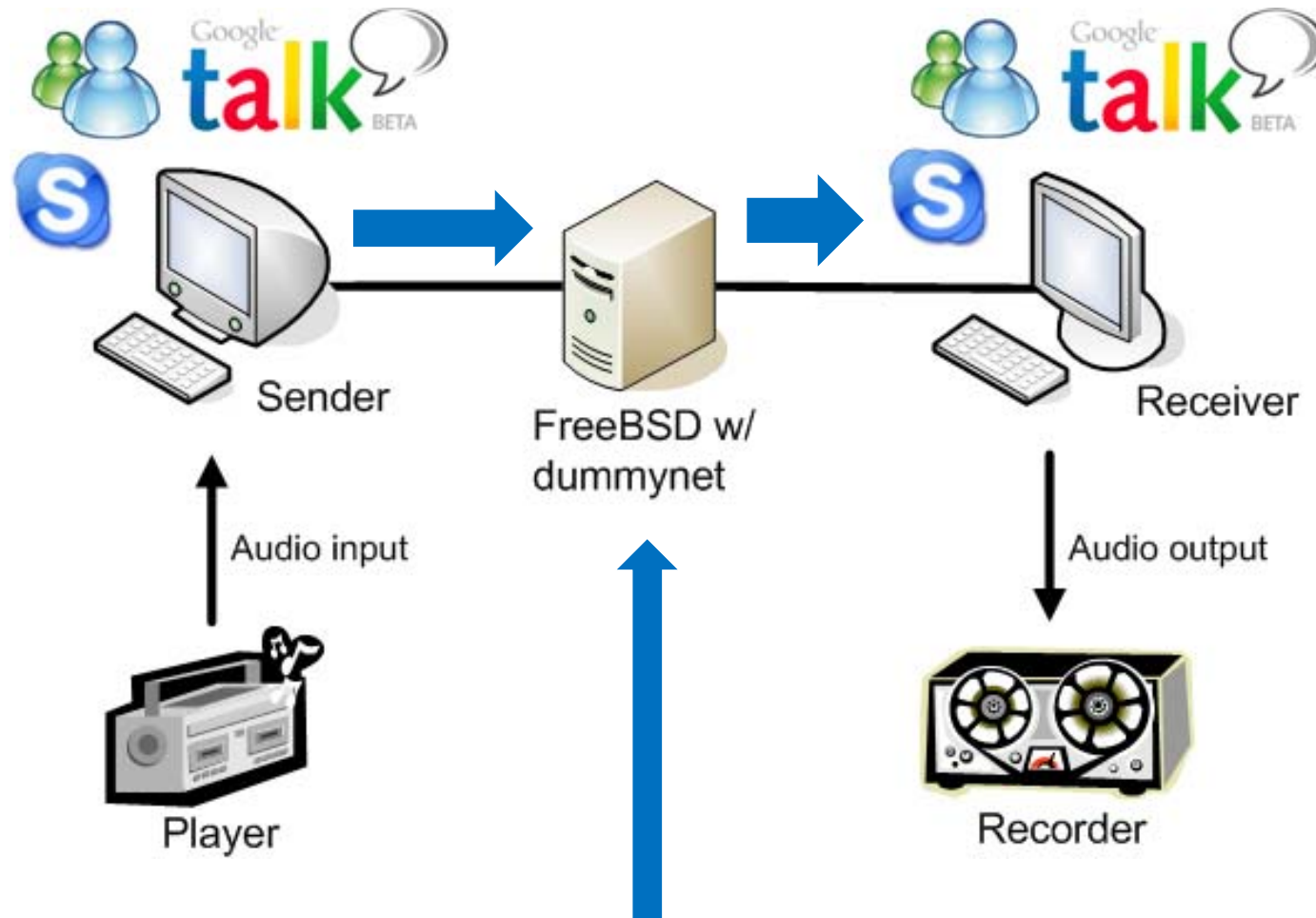
Proposed design of radar chart



Outline

- Introduction
- Proposed design of radar chart
- **Experiment methodology**
- Single-application analysis
- Cross-application analysis
- Applications
- Conclusion

Experiment methodology

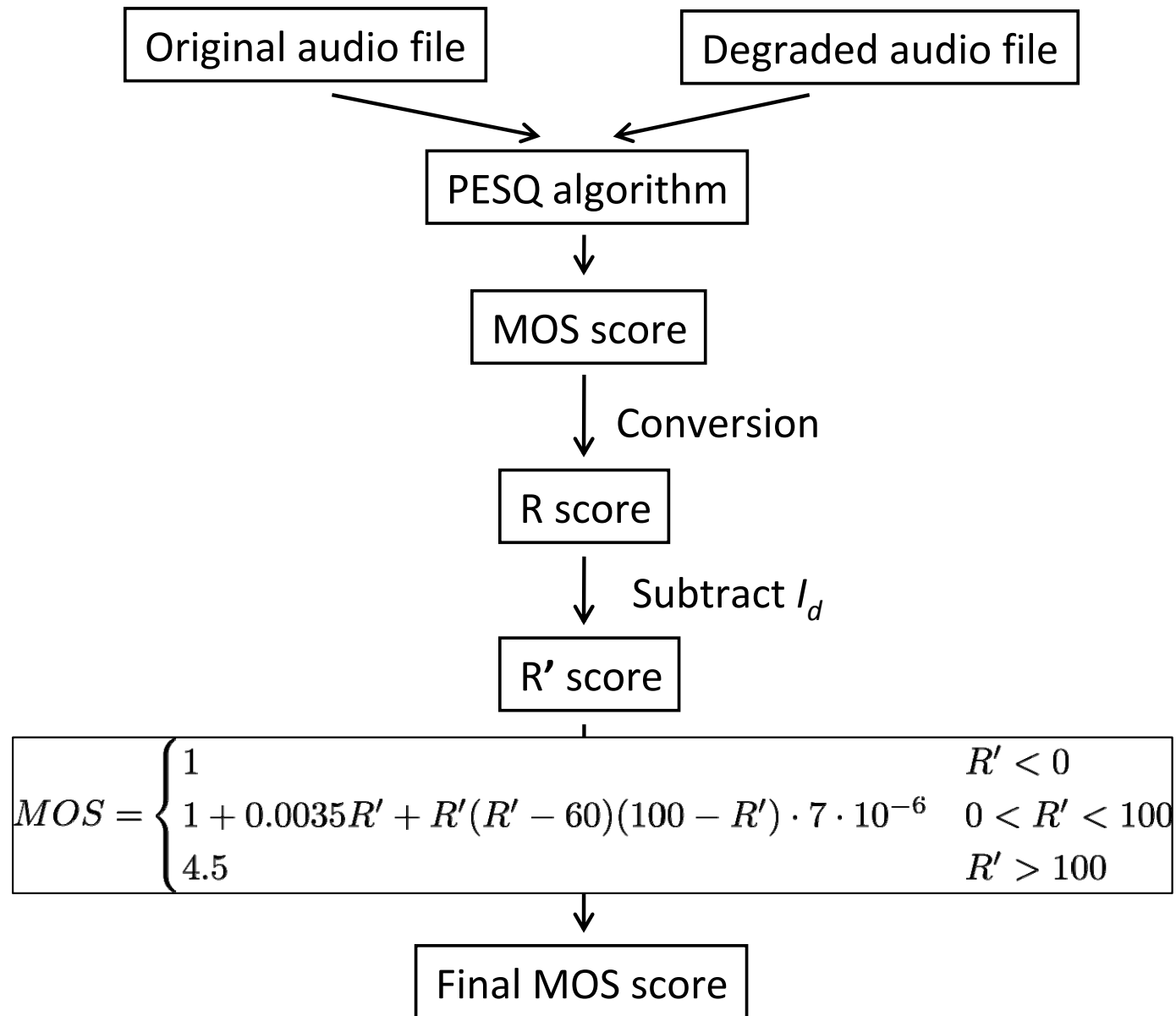


Delay: 0 ms, 50 ms, 100 ms, 150 ms, 200 ms

Loss: 0%, 5%, 10%, 15%, 20%

BW: 40 Kbps, 60 Kbps, 80 Kbps, 100 Kbps, Unlimited

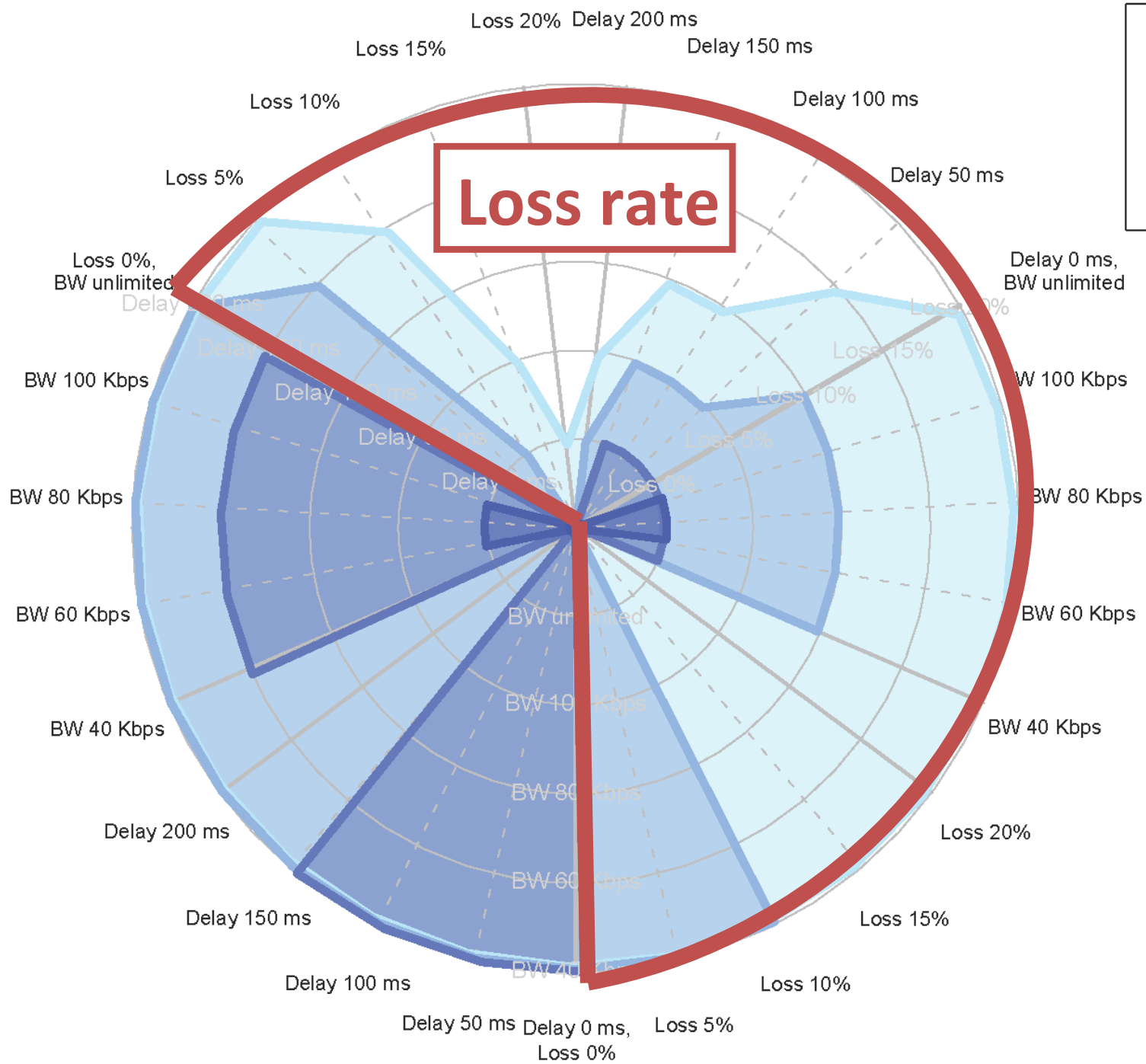
Assessment of Objective QoE



Outline

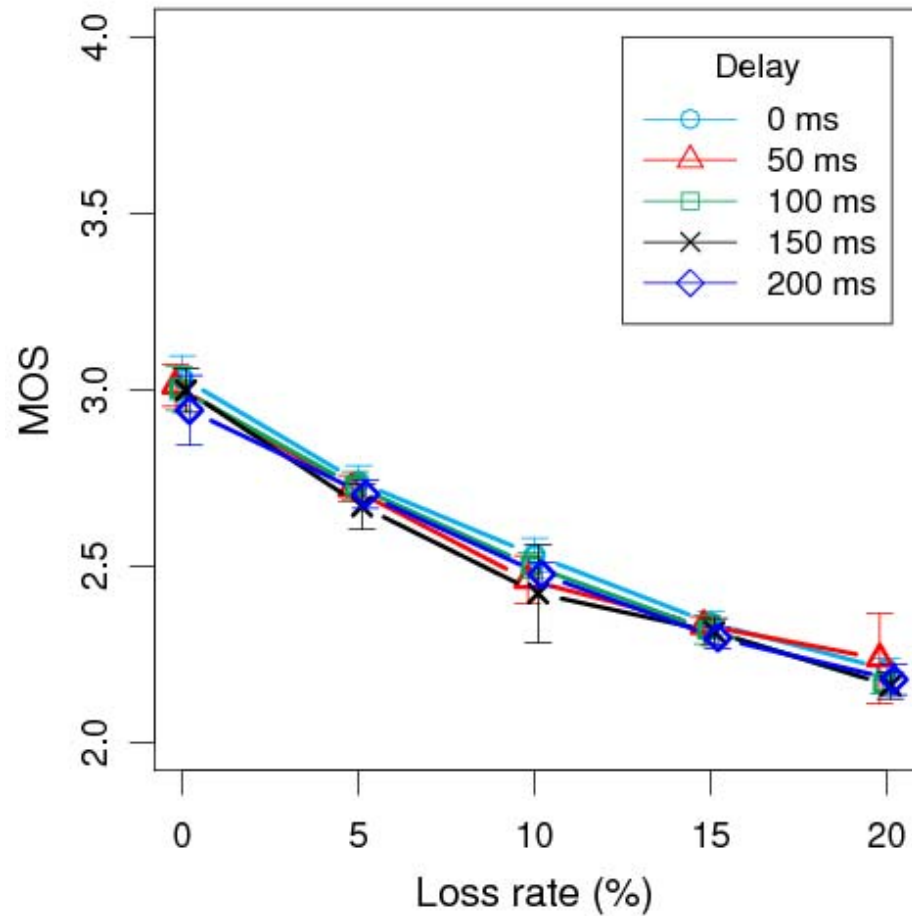
- Introduction
- Proposed design of radar chart
- Experiment methodology
- **Single-application analysis**
- Cross-application analysis
- Applications
- Conclusion

Google Talk

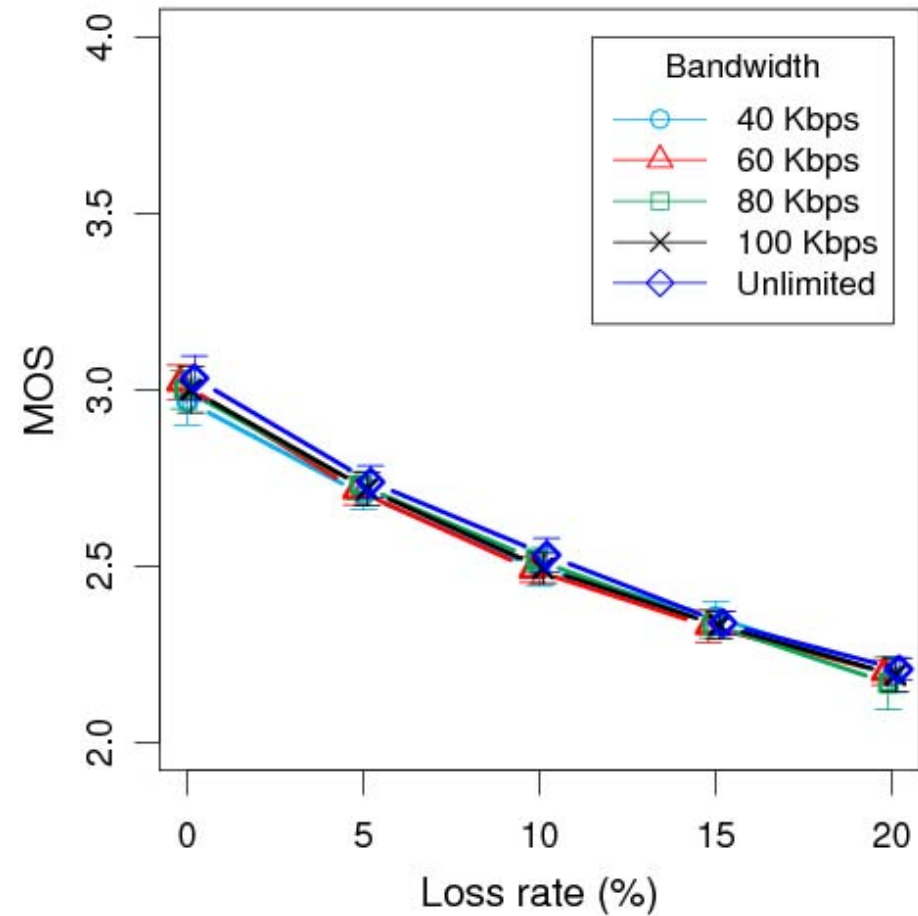


Google Talk

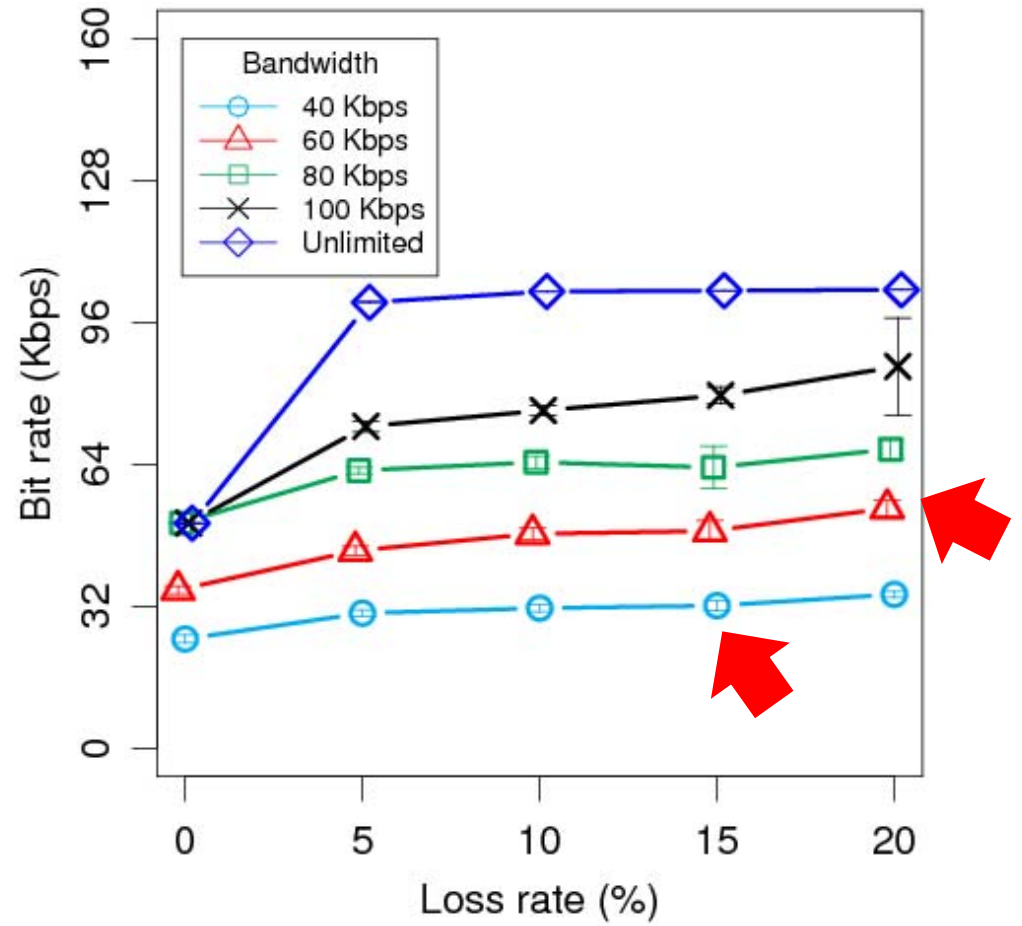
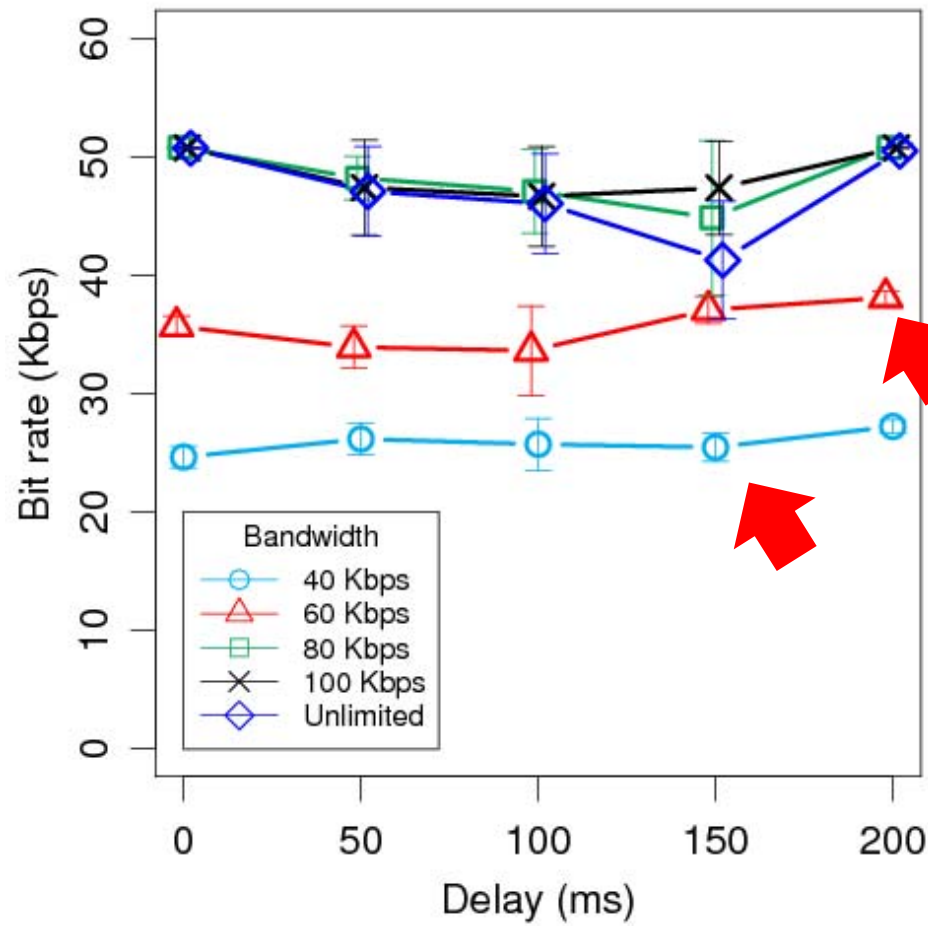
Delay



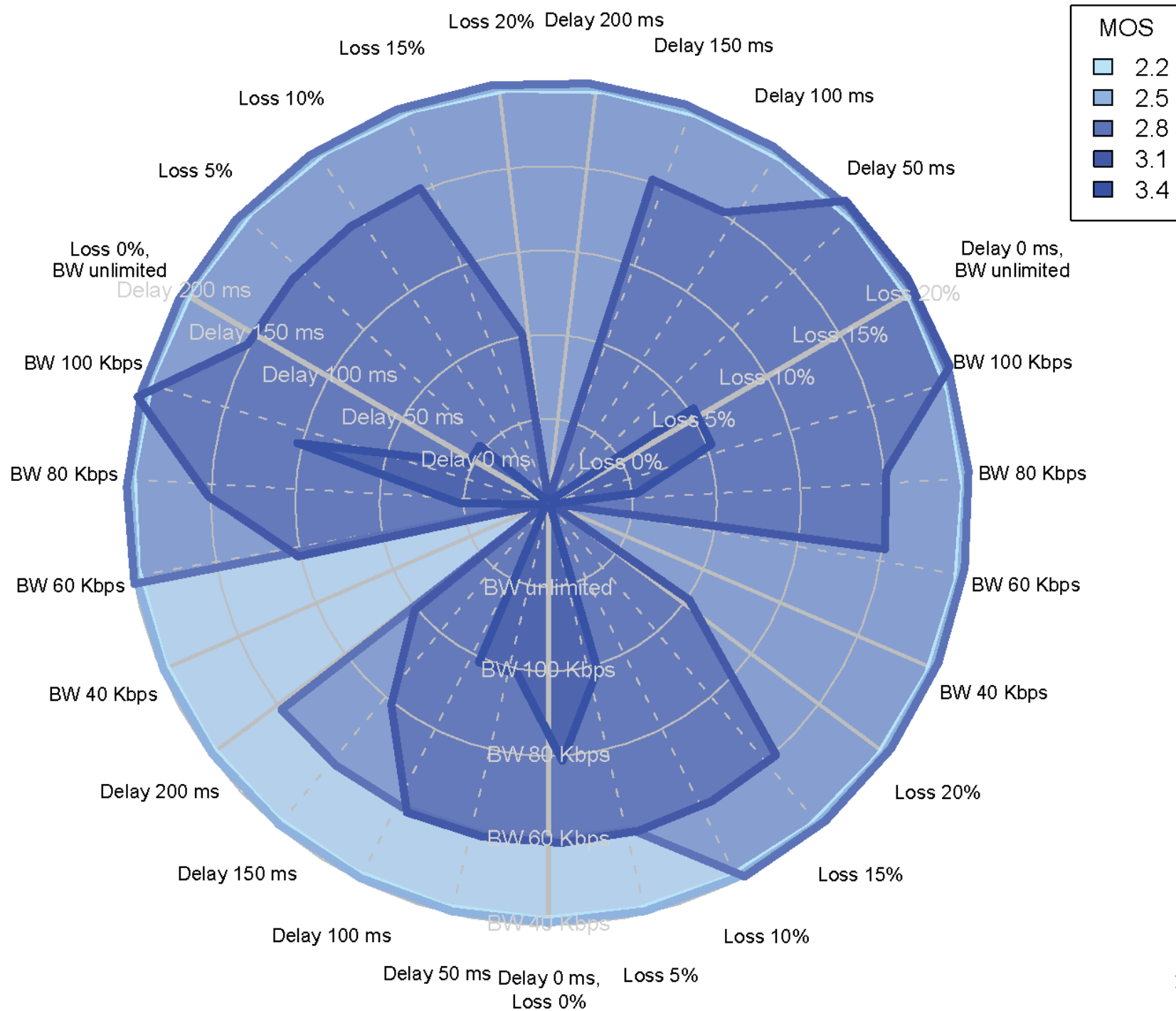
Bandwidth



Skype



MSN Messenger

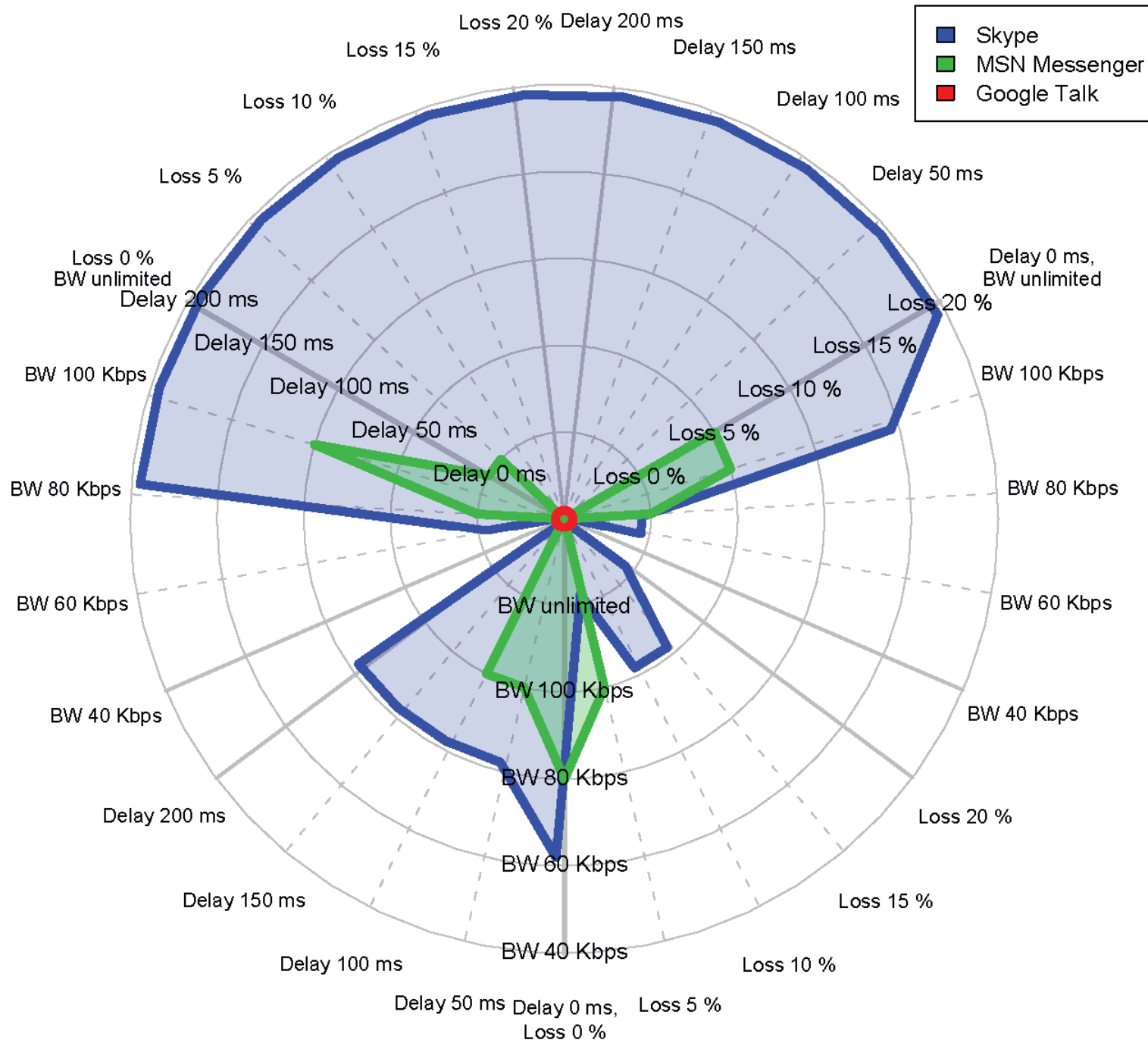


Outline

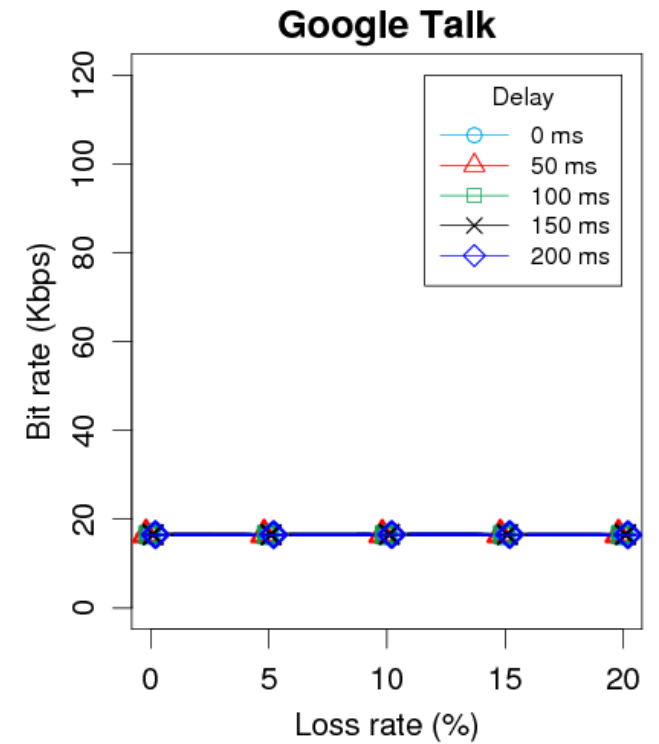
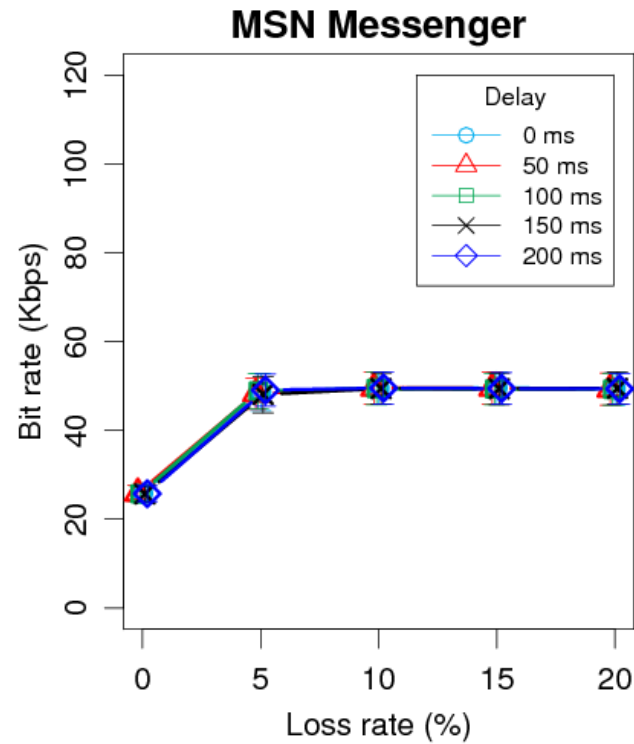
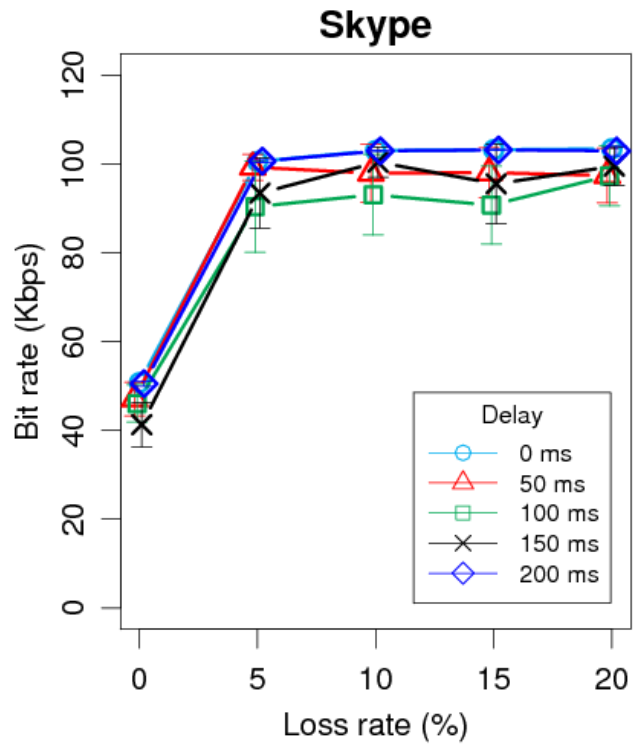
- Introduction
- Proposed design of radar chart
- Experiment methodology
- Single-application analysis
- **Cross-application analysis**
- Applications
- Conclusion

Cross-app. analysis

MOS = 3.4



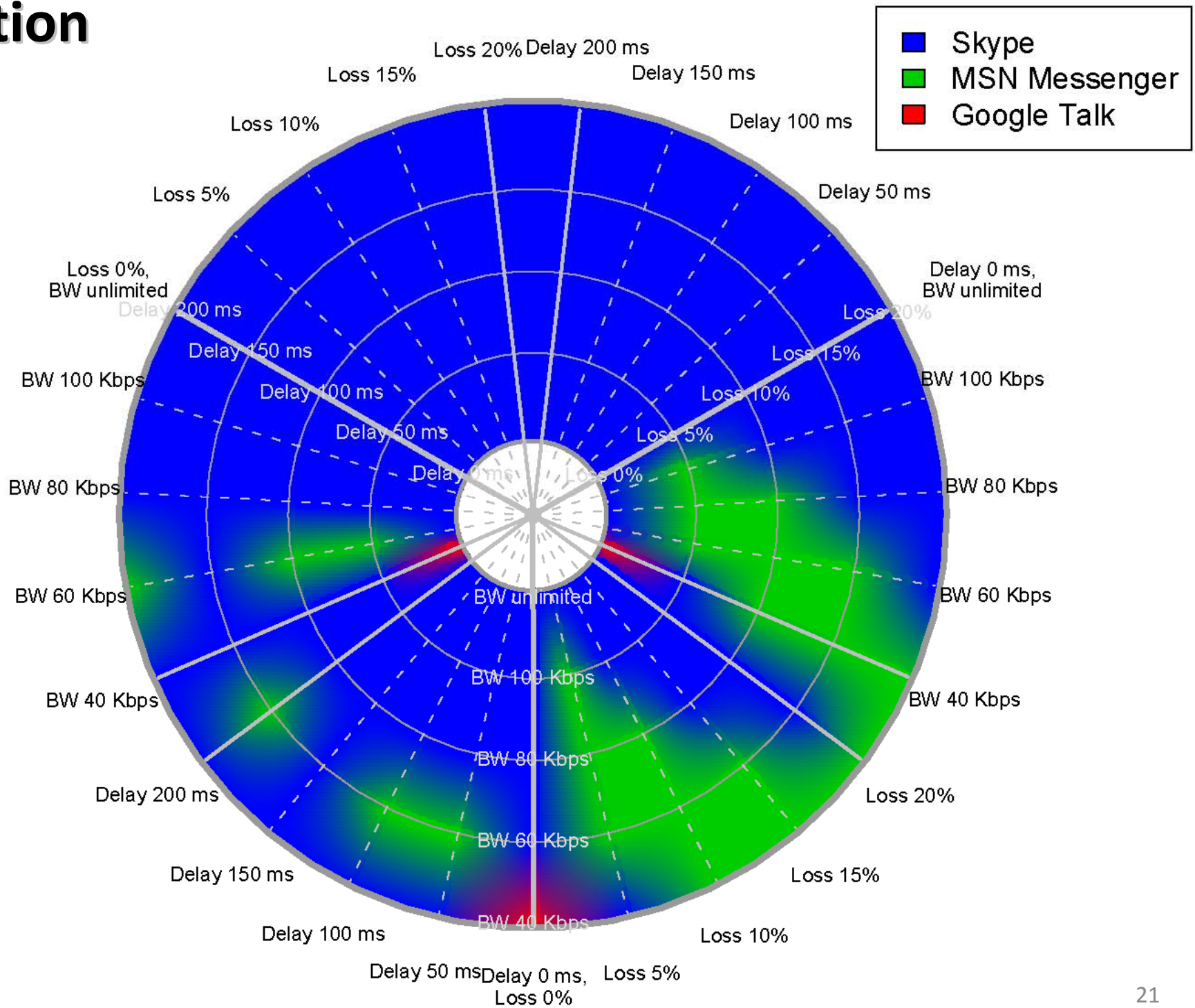
Cross-app. analysis



Outline

- Introduction
- Proposed design of radar chart
- Experiment methodology
- Single-application analysis
- Cross-application analysis
- **Applications**
- Conclusion

The Best Application

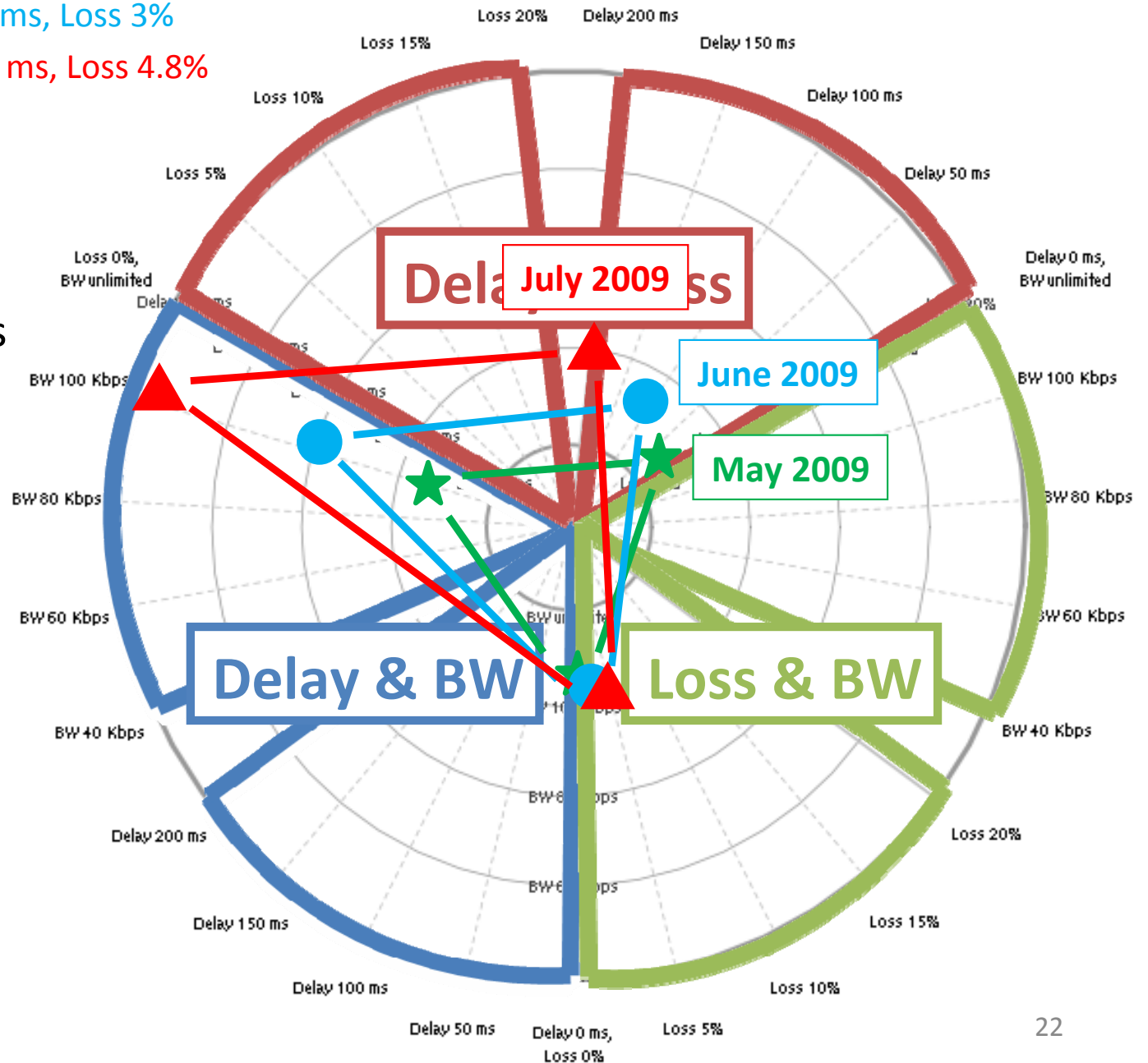


Diagnosis

Records of network conditions:

1. **May 2009:** BW 340 Kbps, Delay 32 ms, Loss 1.5%
2. **June 2009:** BW 325 Kbps, Delay 92 ms, Loss 3%
3. **July 2009:** BW 311 Kbps, Delay 182 ms, Loss 4.8%

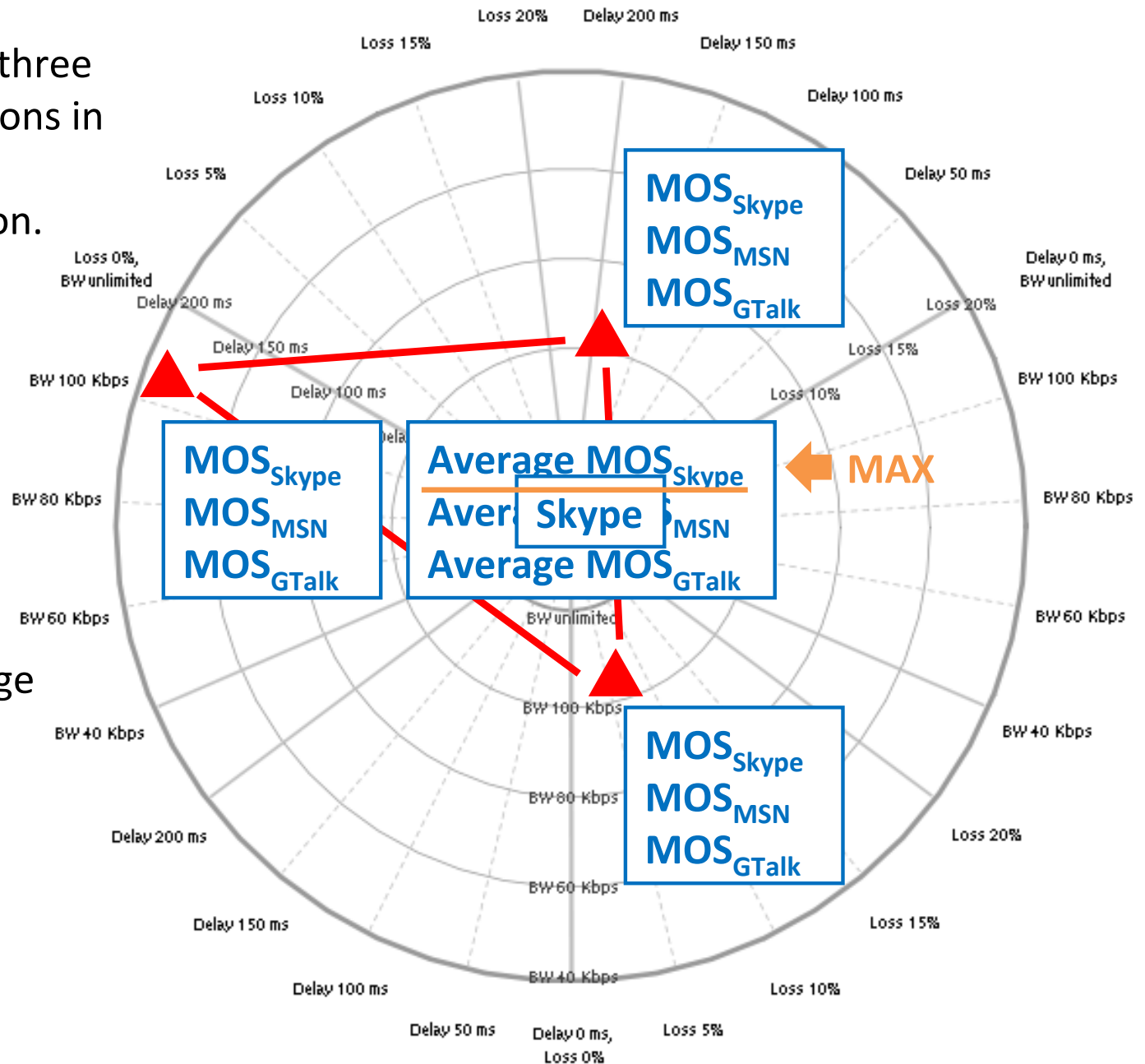
- Display network conditions of user's PC.
- Three factors
 - > Reduce to 3 sections
 - 1). Delay & loss rate
 - 2). Delay & bandwidth
 - 3). Loss rate & bandwidth



User Recommendation

Suggest user a recommended VoIP application based on his network condition.

1. Our database is composed of three MOS scores of VoIP applications in each coordination.
2. Measure the network condition.
BW 311 Kbps, Delay 182 ms, Loss 4.8%
3. Compute MOS scores of each point.
 - **Bilinear interpolation**
4. Compute three average MOS scores of three points.
5. Conclude the recommended VoIP application whose average MOS score is the max.



Conclusion

- We propose a type of demonstration, **radar chart**, to display VoIP users' QoE.
- With radar chart, we give users a way of tracking and diagnosis for their network conditions, and suggest them the recommended VoIP application.
- Future work
 - Evaluate the accuracy of our method for user recommendation

Thank you for your attention!