Mobile Video QoE in Future Mobile Communications

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1. INTRODUCTION

Heterogeneous wireless networks such as WiFi, Wimax, HSDPA and Femto cells enable 'always-online' capability in smart-phones and mobile computers. This poses new challenges for applications, such as video streaming, that need to maintain a high level of service quality when roaming via different heterogeneous networks (e.g., due to mobility, adverse networking conditions, handset energy consumption and economic considerations). Our goal is to measure the effects of network heterogeneity on multimedia applications to propose suitable *handover* policies under varying network and mobility scenarios. We next describe one experimental scenario in order to illustrate the capabilities of our testbed and measurement methodology.

2. TEST SETUP

Our *Mobisense* testbed [2] offers WiFi and HSDPA access to connected computers, Mobile IP for seamless handover and real-time network interface handovers during an ongoing video streaming session. We installed TCP-based Tribler video streaming system on the Mobisense testbed and streamed a 10 minute H.264-encoded VGA-resolution video stream from one server to one client. The video stream was impaired via a traffic-shaper at the server by applying different packet loss (PL) rates. We measured the PSNR (peak-signal-to-noise ratio) between the original and received video clip at the client as explained in [1]. Using the PSNR metric enables us to report user *Quality of Experience*– QoE, which cannot be captured by typical network performance measurements like packet loss or delay/jitter. The PSNR was calculated for different pre-roll delays (buffering time at the client's video decoder before playing back the video) and is plotted in Figure 1.

For brevity, we describe the results for one experimental scenario. We observe that video streaming reacts differently to the *same* network packet loss depending on the underlying network technology (WiFi or HSDPA). For instance, at 5% packet loss, while the video quality remains high for WiFi (higher than 26dB), in an HSDPA network, the video quality becomes unacceptable (around 14dB). Such low quality is experienced in the WiFi network only starting from 15% loss. Also,for a fixed PSNR value, WiFi

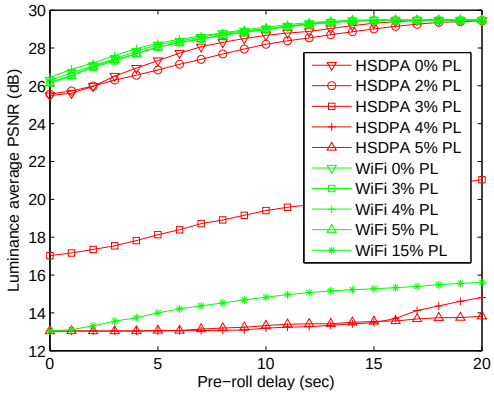

Figure 1: PSNR (dB) vs. pre-roll delay (sec) for different packet losses in WiFi and HSDPA networks.

requires smaller pre-roll delay (e.g., at 28dB, pre-roll delay of ≈ 5s for WiFi and ≈ 10s for HSDPA) and therefore provides a better experience to the user. We identify that the poor performance of HSDPA is due to the time varying bandwidth availability (shared downlink) and higher RTTs that undermine TCP performance.

3. SUMMARY

Our results show that different underlying access technologies directly affect video streaming applications. We have also studied scenarios such as the impact of switching from one access technology to another and are currently studying the effect of using different video codec parameters, the effect of server bandwidth capacity and multiple clients (p2p setting). In addition, we are integrating Femto cells in our testbed to increase diversity of access technologies used. Our measurements will provide insights for more efficient handover policies to cope with time-varying conditions in heterogeneous networks and consequently, improving user QoE for video applications.

4. REFERENCES

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