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Effects of Internet Path Selection on Video-QoE: Analysis and Improvements

Abstract:

This paper presents large-scale Internet measurements to understand and improve the effects of Internet path selection on perceived video quality, or quality of experience (QoE). We systematically study a large number of Internet paths between popular video destinations and clients to create an empirical understanding of location, persistence, and recurrence of failures. These failures are mapped to perceived video quality by reconstructing video clips and conducting surveys. We then investigate ways to recover from QoE degradation by choosing one-hop detour paths that preserve application-specific policies. We seek simple, scalable path selection strategies without the need for background path monitoring. Using five different measurement overlays spread across the globe, we show that a source can recover from over 75% of the degradations by attempting to restore QoE with any $k$randomly chosen nodes in an overlay, where k is bounded by $O(ln(N))$. We argue that our results are robust across datasets. Finally, we design and implement a prototype packet forwarding module called source initiated frame restoration (SIFR). We deployed SIFR on PlanetLab nodes and compared the performance of SIFR to the default Internet routing. We show that SIFR outperforms IP-path selection by providing higher on-screen perceptual quality.