

Abstract

Recent advancements in 5G network slicing have introduced new challenges for maintaining Quality of Experience (QoE) in bandwidth-intensive applications like 4K/VR streaming. In this work, Dr. Emily Chen (Stanford University), Dr. Rajesh Kapoor (Ericsson Research), and Marta Silva (Netflix Platform Engineering) present a novel cross-layer optimization framework combining Software-Defined Networking (SDN) control with viewer attention prediction models.

Our system employs a two-stage architecture:

- 1) A lightweight ResNet-18 derivative analyzes eye-tracking data from 15,000+ viewers to predict salient video regions.
- 2) An SDN controller dynamically allocates bandwidth slices using Mixed-Integer Linear Programming (MILP) formulations.

Evaluated on a 28-node testbed replicating T-Mobile's US 5G SA network, our approach demonstrates a 19.7% improvement in perceptual video quality (VMAF) compared to conventional ABR algorithms, while reducing 95th-percentile latency to 68ms during handover events. The framework's novel packet prioritization scheme reduces bandwidth waste by 33% through spatial-temporal bitrate adaptation validated against ITU-T P.1203 standards.

This work directly addresses three key limitations identified in ACM Mile-High Video 2024 proceedings:

- 1) Static QoE metrics
- 2) Coarse-grained network slicing
- 3) Device-heterogeneity neglect

Production deployment trials with Comcast begin Q2 2025.