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Optimizing HTTP-Based Adaptive Streaming in Vehicular Environment using Markov Decision Process

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Abstract

Hypertext transfer protocol (HTTP) is the fundamental mechanics supporting web browsing on the Internet. An HTTP server stores large volumes of contents and delivers specific pieces to the clients when requested. There is a recent move to use HTTP for video streaming as well, which promises seamless integration of video delivery to existing HTTP-based server platforms. This is achieved by segmenting the video into many small chunks and storing these chunks as separate files on the server. For adaptive streaming, the server stores different quality versions of the same chunk in different files to allow real-time quality adaptation of the video due to network bandwidth variation experienced by a client. For each chunk of the video, which quality version to download, therefore, becomes a major decision-making challenge for the streaming client, especially in vehicular environment with significant uncertainty in mobile bandwidth. In this talk, we demonstrate that for such decision making, Markov decision process (MDP) is superior to previously proposed non-MDP solutions. Using publicly available video and bandwidth datasets, we show that MDP achieves up to 15x reduction in playback deadline miss compared to a well-known non-MDP solution when the MDP has the prior knowledge of the bandwidth model. We also consider a model-free MDP implementation that uses Q-learning to gradually learn the optimal decisions by continuously observing the outcome of its decision making. We find that MDP with Q-learning significantly outperforms MDP that uses bandwidth models.

About the Speaker

Dr. Salil Kanhere received his M.S. and Ph.D. degrees, both in Electrical Engineering from Drexel University, Philadelphia. He is currently an Associate Professor in the School of Computer Science and Engineering at the University of New South Wales in Sydney, Australia. His current research interests include pervasive computing, crowdsourcing, embedded sensor networks, mobile networking, privacy and security. He has published over 160 peer-reviewed articles and delivered over 15 tutorials and keynote talks on these research topics. He is a contributing research staff at National ICT Australia and a faculty associate at Institute for Infocomm Research, Singapore. Salil regularly serves on the organising committee of a number of IEEE and ACM international conferences. He currently serves as the Area Editor for Pervasive and Mobile Computing and Computer Communications. Salil is a Senior Member of both the IEEE and the ACM. He is a recipient of the Humboldt Research Fellowship in 2014.