Lecturer: Prof. Shervin Shirmohammadi

Title: Distributed Measurement Schemes for Internet Latency Estimation

Abstract:

Estimating latency between network nodes in the Internet can play a significant role in the improvement of the performance of many applications and services that use latency to make routing decisions. A popular example is peer to peer (P2P) networks, which need to build an overlay between peers in a manner that minimizes the delay of exchanging data among peers. Measurement of latency between peers is therefore a critical parameter that will directly affect the quality of applications such as video streaming, gaming, file sharing, content distribution, server farms, and massively multiuser virtual environments (MMVE) or massively multiplayer online games (MMOG). But acquisition of latency information requires a considerable amount of measurements to be performed at each node in order for that node to keep a record of its latency to all the other nodes. Moreover, the measured latency values are frequently subject to change and need to be regularly repeated in order to be updated against network dynamics. This has motivated the use of techniques that alleviate the need for a large number of empirical measurements and instead try to predict the entire network latency matrix using a small set of latency measurements. Coordinate-based approaches are the most popular solutions to this problem. The basic idea behind coordinates based schemes is to model the latency between each pair of nodes as the virtual distance among those nodes in a virtual coordinate system.

In this tutorial, we will cover the basics of how to measure latency in a distributed manner and without the need for a bottleneck central server. We will start by an introduction and background to the field, then we will briefly explain measurement approaches such as Network Time Protocol, Global Positioning System, and the IEEE 1588 Standard, before moving to coordinate based measurement approaches such as GNP (Global Network Positioning), CAN (Content Addressable Network), Lighthouse, Practical Internet Coordinates (PIC), VIVALDI, and Pcoord. In the end, we also propose a new decentralized coordinate-based solution with higher accuracy, mathematically-proven convergence, and locality-aware design for lower delay.

The target audiences of this tutorial are practitioners, scientists, and engineers who work with networking systems and applications where there is a need to measure and estimate delay among network nodes, possibly a massive number of nodes (thousands, tens of thousands, or even hundreds of thousands nodes).

Bio:

Shervin Shirmohammadi, SM-IEEE, is IEEE Distinguished Lecturer and an Associate Professor at the School of Information Technology and Engineering, University of Ottawa, Canada, where he is Co-Director of the Multimedia Communications Research Lab (MCR Lab) and Associate Director of the Distributed and Collaborative Virtual Environment Research Laboratory (DISCOVER Lab). His research is in Multimedia Systems and Networking, including instrumentation and measurement techniques and applications for virtual environments, gaming systems, video systems, and medical/health technologies.

The results of his research have lead to more than 160 publications, over a dozen technology transfers to the private sector, and a number of awards and prizes including Best Paper Awards. His research has been funded by both public and private sectors (IBM, Nokia, CAE, Magor, Espial, Cognivue), totaling close to $10 million over his career. He is Associate Editor of numerous reputable transactions, including *IEEE Transactions on Instrumentation and Measurement*.