Cornell University
School of Electrical and Computer Engineering

Information
Systems
Networks
Seminar

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"A Shapley Value approach to Internet Economics"

Date: Noon, Wednesday October 20th.
Venue: Rhodes Hall, 380.

Internet service providers (ISPs) depend on one another to provide global network services. However, the profit-seeking nature of the ISPs leads to selfish behaviors that result in inefficiencies and disputes in the network. From a macroscopic view, this concern is at the heart of the Network Neutrality debate, which asks for an appropriate compensation structure that satisfies all types of ISPs and content providers.

In this work, we design a profit-sharing mechanism based on the Shapley value originated from Coalition Game Theory. We derive closed-form profit solutions for structured ISP topologies and develop a dynamic programming procedure to calculate solutions for general topologies. Based on these solutions, we draw some implications on the bilateral settlements between ISPs. In practice, these results provide guidelines for ISPs to solve disputes and negotiate stable and incentive settlements and for governments to establish regulatory policies for the Internet industry.

We then further extend the concept of Shapley Values to the scenario of Peer assisted, where the Peers get compensated for reducing the cost of service provision. In general, the drawback of the Shapley Value mechanism is its computational complexity. We demonstrate that this it is not the case for (very) large systems. As the number of peers receiving the service becomes large, the Shapley value received by each player approaches a hybrid fluid- atomic limit, leading to a simple closed form expression for any cost function, and simplifies even further in some scenarios of interest.

Pizza will be served 15 minutes prior to the start of the talk.

Short Bio:
Vishal Misra is an Associate Professor and the Vice Chair in the Computer Science Department at Columbia University. He has received an NSF CAREER Award, a DoE CAREER Award and Google and IBM Faculty Awards. His research emphasis is on mathematical modeling of computer systems, bridging the gap between practice and analysis. His recent work includes the areas of Internet economics, wireless, scheduling mechanisms and peer to peer systems. He has served as the guest editor for the Journal of Performance Evaluation, was TPC co-chair of Sigmetrics 2008, General Chair in 2010 and serves on the editorial board of IEEE/ACM Transactions on Networking and Elsevier Journal Performance Evaluation.