BCWS Seminar Series

Efficient and Agile Self-Healing in Autonomic Networks Using Network Coding

by

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Time: Monday, November 22, 10:00 - 11:00 am
Place: Room 2014 (Minto Board Room), Minto Centre, Carleton University

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Abstract: Since network backbones carry huge amounts of traffic, the failure of a single link can result in the loss of service, and consequently revenue. This is why backbone networks are required to be self-healing, and to automatically recover from failures. Recovery from failures has traditionally been provided using either restoration or protection techniques, where protection is the faster, and hence the preferred mode of survivable operation. However, proactive protection requires reserving backup resources, which are typically close to two thirds of the resources. This presentation will discuss recent advances in providing the self-healing functionality in networks such that self-healing is both fast, and resource efficient, which is achieved by using the technique of network coding. In this case, one set of protection circuits provides protection for multiple connections, and multiple signals can be transmitted on the same protection circuit simultaneously. This is done by linearly combining those signals using the technique of network coding. The strategy enables the transparent and instantaneous recovery from link failures, similar to proactive protection, but at a reduced cost due to protection circuit sharing. We show how this technique can be implemented to protect against single link failures, and then how it can be extended to protect against multiple failures. The advantage of this technique is twofold: failures do not have to be detected, and signals do not have to be rerouted, hence leading to less involvement of the control and management planes, which expedites the error recovery process. Also, protection circuits are shared by multiple connections, since multiple signals are linearly combined and transmitted on the same circuit, hence leading to the implementation of protection at a reduced cost. This technique can be implemented in the data forwarding plane, e.g, at the IP or MPLS layers, and can be regarded as a method for implementing Fast IP or MPLS protection, respectively.

Biography: Ahmed E. Kamal (S'82-M'87-SM'91) is a professor of Electrical and Computer Engineering at Iowa State University. His research interests include optical networks, wireless and sensor networks and performance evaluation. He is a senior member of the IEEE, a senior member of the Association of Computing Machinery, and a registered professional engineer. He was the co-recipient of the 1993 IEE Hartree Premium for papers published in Computers and Control in IEE Proceedings, and the best paper award of the IEEE Globecom 2008 Symposium on Ad Hoc and Sensors Networks Symposium. He was the organizer and co-chair of the first and second Workshops on Traffic Grooming 2004 and 2005, respectively, and chaired, and co-chaired the Technical Program Committees of a number of conferences including the Optical Symposium of Broadnets 2006, the Optical Networks and Systems Symposium of the IEEE Globecom 2007, and the Optical Networks and Systems Symposium of the IEEE Globecom 2010. He is on the editorial boards of the Computer Networks journal, and the Journal of Communications.