Szymon Jakubczak
(a.k.a. Szymon Chachulski)

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General Information

Citizenship: Polish

Education

2005-present *MIT, CSAIL*
Ph.D. candidate in Computer Science, expected 2011
M.Sc. in Computer Science, 2007, GPA 5.0/5.0
Thesis: Trading Structure for Randomness in Wireless Opportunistic Routing

Relevant Coursework: Computer Networks, Distributed Systems Engineering, Advanced Algorithms, Machine Learning, Computer Graphics

2000-2005 *Warsaw University of Technology, Institute of Computer Science*
M.Sc. in Computer Science, GPA 4.98/5.00
Thesis: Joint Rate Control and Stochastic Routing in Packet Networks

2003-2004 *University of Waterloo*
International exchange student, GPA 96/100
Research Project: Fairness Issues in Wireless Mesh Networks

Work Experience

6/2010 - 8/2010 *Google, Cambridge*
software engineering in test, intern, supervised by Michael Klepikov
Participated in the development of the Mobile Latency Lab, which allows engineers to test the networking performance of mobile devices under controlled conditions. Developed a complete "reverse tethering" solution that enabled network emulation for the tested devices. Contributed patches to the Android Open Source Project to facilitate reverse tethering. Ported a web test driver to a new Android test framework in-the-making, and developed it into an automated A/B testing tool for the Android networking stack.

5/2010 - 7/2010 *Barnacle Wifi Tether, szym.net*
free-lance developer
The goal of *wireless tethering* is to share the data plan of a smartphone and provide Internet access to other devices via 802.11 (WiFi). Barnacle Wifi Tether is an app that creates an ad-hoc wireless hotspot on Android devices with root access. For this purpose, Barnacle provides network address translation, but unlike other solutions, does not rely on support in the Linux kernel (NETFILTER). Instead, Barnacle implements a NAT completely in user-space using BPF (packet sockets) and raw IP sockets. To date, Barnacle has been downloaded 600k times and is actively used on over 200k Android devices of at least 20 different makes, despite the technical challenges of obtaining root access.

6/2008 - 9/2008 *Meraki Inc., San Francisco*
intern, supervised by John Bicket and Max Poletto
Explored the performance and capabilities of one of the company's radio hardware platforms, the Atheros 5312 SOC. Focused specifically low-level features such as adaptive noise immunity, carrier sensing, dynamic channel width and device calibration.

Made a subtle software fix that improved the hardware's expected best-case performance by a factor of two and noticeably improved the performance of some real

networks. Also implemented code to measure medium utilization ("how busy are the radio waves?") that helps to debug wireless networks and that the company have since made available to customers on all of their products. Contributed an interface that made it easy to interact with the diagnostic features of the hardware.

Research Experience

9/2008 - 5/2010 *Softcast: One-Size-Fits-All Wireless Video, MIT, NMS*
research assistant, supervised by Dina Katabi
The main challenge in wireless video multicast is to scalably serve multiple receivers who have different channel characteristics. In current wireless transmission schemes, each packet is transmitted at a particular bitrate and is decodable only by receivers that support the chosen bitrate. Therefore, achieving smooth degradation of video quality is difficult and typically requires encoding the video into a base and multiple enhancement layers. SoftCast is an alternative design for wireless video multicast, in which a sender broadcasts a single stream and each receiver watches a video quality that matches its channel quality. From bird's eye view, SoftCast achieves this by making the magnitude of the transmitted signal proportional to the pixel value. Hence, channel noise translates directly to a small perturbation in pixel values (instead of random bit-flips in the MPEG stream), allowing graceful degradation with increasing noise.

Designed and implemented SoftCast in the WARP and GNURadio/USRP radio platforms for real-time performance. Our results show that SoftCast improves the average video quality (PSNR) across multicast receivers by 3-7dB over the current approach.

6/2007 - 9/2007 *Collaborative Neighborhood Networks, Intel Research, Pittsburgh*
research intern, supervised by Michael Kaminsky and David Andersen
Last mile technology today, such as Cable and DSL, suffer from limited upstream capacity, thus restricting the type of services home users can engage in. In this project we have designed and implemented a file transfer protocol, Link-alike, that exploits available wireless bandwidth in a neighborhood to reach and make use of multiple wired uplinks, thus overcoming the upstream limitations of existing last mile technologies. The sender opportunistically broadcasts packets to neighbors, which intelligently use their aggregate upstream capacity to offer faster transfer completion times. Our opportunistic technique improves both throughput and efficiency by 30% when compared to the traditional unicast approach to this problem.

Designed and implemented Link-alike to work in a physical testbed comprised of Soekris-based PCs with Intel and Atheros wireless mini-PCI.

9/2005 - 1/2007 *Wireless Opportunistic Routing via Network Coding, MIT, NMS*
research assistant, supervised by Dina Katabi
MORE is a MAC-independent opportunistic routing protocol for wireless networks. It employs randomized linear network coding at the forwarders to avoid transmitting redundant information. Thus, MORE unlike ExOR, the state-of-the art opportunistic routing protocol, needs no special scheduler to coordinate routers and can run directly on top of 802.11. Experimental results from a 20-node wireless testbed show that MORE's average unicast throughput is 20% higher than ExOR, and the gains rise to 50% over ExOR when there is a chance of spatial reuse. For multicast, MORE's gains increase with the number of destinations, and are 35-200% greater than ExOR.

Designed and implemented MORE to work in a physical testbed comprised of off-the-shelf PCs equipped with Atheros-based network interfaces. Also developed the framework used to manage testbed experiments.

Teaching Experience

Spring 2011 *6.046 Design and Analysis of Algorithms*
teaching assistant, supervised by Charles Leiserson and Dana Moshkovitz
Held weekly recitation for 40 students, regular office hours.

Spring 2007 *6.033 Computer System Engineering*
teaching assistant, supervised by Barbara Liskov and Frans Kaashoek
Held office hours with guidance in design project, taught tutorials, graded papers.

Publications

[7] *S. Jakubczak*, J. Z. Sun, D. Katabi, and V. Goyal, *Performance Regimes of Uncoded Linear Communication over AWGN Channels*, IEEE CISS, March 2011

[6] J. K. Sundararajan, D. Shah, M. Medard, *S. Jakubczak*, M. Mitzenmacher, J. Barros, *Network Coding Meets TCP: Theory and Implementation*, Proceedings of the IEEE, March 2011

[5] *S. Jakubczak* and D. Katabi, *SoftCast: Clean-slate Scalable Wireless Video*, ACM S^3, September 2010

[4] *S. Jakubczak*, H. Rahul and D. Katabi, *One-Size-Fits-All Wireless Video*, ACM HotNets, October 2009

[3] *S. Jakubczak*, D. G. Andersen, M. Kaminsky, K. Papagiannaki and S. Seshan, *Link-alike: Using Wireless to Share Network Resources in a Neighborhood*, ACM MC2R, October 2008

[2] *S. Chachulski*, M. Jennings, S. Katti, and D. Katabi, *Trading Structure for Randomness in Wireless Opportunistic Routing*, ACM SIGCOMM, August 2007

[1] *S. Chachulski*, M. Jennings, S. Katti, and D. Katabi, *MORE: A Network Coding Approach to Opportunistic Routing*, MIT-CSAIL-TR-2006-049, MIT, June 2006

Reviewing Duties

- IEEE/ACM Transactions on Networking
- IEEE Journal of Selected Area in Communication
- IEEE Communications Letters
- IEEE Transactions on Wireless Communications
- IEEE Transactions on Mobile Computing
- IEEE Transactions on Vehicular Technology
- ICC Wireless Networking
- IEEE Globecom CQRPM
- IEEE Transactions on Intelligent Transportation Systems

References

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Max Poletto
Meraki Inc.
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Michael Kaminsky
Intel Research Pittsburgh
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