Life on the Edge: Connecting Everyday Objects with Energy Harvesting and Fog Computing

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Abstract

Realizing the vision of the fully connected world — the Internet of Things (IoT) — requires advances in multiple areas. Energy harvesting and fog/edge computing can bring everyday objects to life in complementary ways: by using the environment to make the IoT nodes smaller and lighter, and by bringing advanced computing capabilities closer to the nodes to make them more adaptive and intelligent.

In this talk I will first describe our Columbia University work on designing and developing Energy Harvesting Active Networked Tags (EnHANTs), which we envisioned as small, flexible, energetically self-reliant tags that can be attached to objects that are traditionally not networked, such as clothing and produce. I will describe several steps that we took towards realizing this vision: our first-of-its-kind characterizations of the environmental light and motion energy availability for the EnHANTs and for other IoT devices, our energy harvesting adaptive resource allocation algorithms, and our EnHANT prototypes and a first-of-its kind energy-generating EnHANT testbed.

I will also describe our recent Princeton University work on making the IoT systems more intelligent with fog and edge computing. These emerging paradigms, which place advanced computing capabilities away from centralized datacenters and closer to the IoT nodes, are receiving increasing industry attention as the potential next multi-billion dollar tech markets. I will introduce our ongoing work in several related areas: restructuring computing for heterogeneous hierarchical fog architectures, using fog to enable the next generation of immersive augmented reality experiences, and contributing to the industry-wide OpenFog Consortium to inform emerging industry-standard architectures.

The work covered in this talk appeared in the IEEE Transactions on Mobile Computing, the IEEE Journal on Selected Areas in Communications, the IEEE Wireless Communications Magazine, and in the proceedings of ACM MobiCom, IEEE INFOCOM, and ACM SIGMETRICS, among others. It was highlighted in several media outlets including the MIT Technology Review and the New Yorker Magazine.

Biography

Dr. Maria Gorlatova is an Associate Research Scholar at Princeton University Department of Electrical Engineering, and an Associate Director of the Princeton EDGE Lab. Dr. Gorlatova earned her Ph.D. in Electrical Engineering from Columbia University, and her M.Sc. and B.Sc. (Summa Cum Laude) degrees in Electrical Engineering from University of Ottawa, Canada. She has several years of industry experience, where she had been affiliated with Telcordia Technologies, IBM, and D. E. Shaw Research. Dr. Gorlatova is a recipient of the Google Anita Borg USA Fellowship, Canadian Graduate Scholar (CGS) NSERC Fellowships, and the Columbia University Presidential Fellowship. She is a co-recipient of the ACM SenSys Best Student Demonstration Award, the IEEE Communications Society Young Author Best Paper Award, and the IEEE Communications Society Award for Advances in Communications.