

Millimeter Wave Capacity Improvements: A Systems Perspective

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2017-08-17

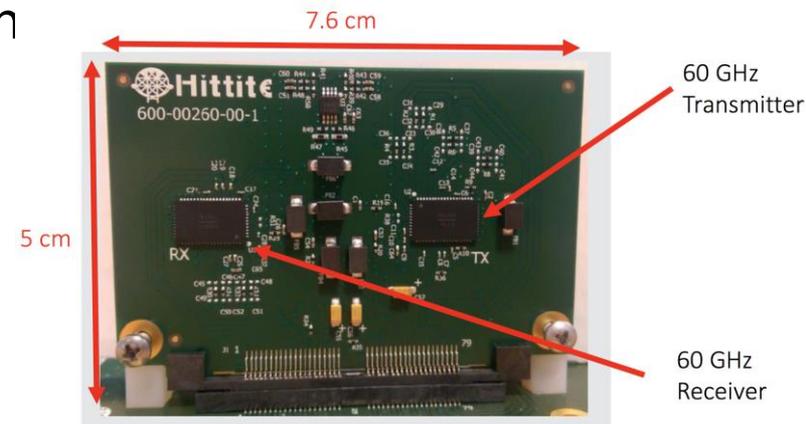
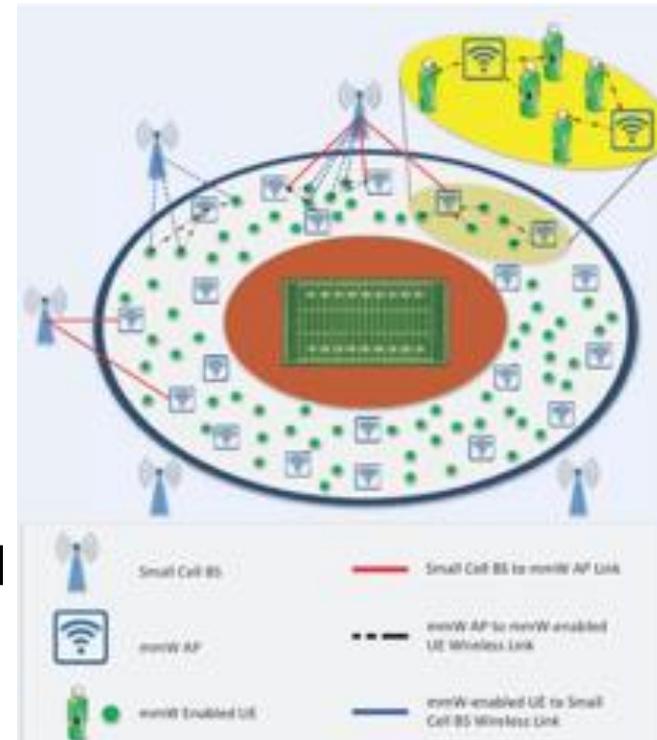
Introduction

- Faculty member at Virginia Tech since 2003.
- Associate Director of Wireless @ Virginia Tech.
- Research in Wireless Communications and Networks
- Research Themes
 - Applications of Game Theory
 - Resource and Spectrum Management in Future Networks
 - Experimentation



My Research

- A major goal of my research is understanding how new physical layer technologies can be integrated successfully into networks.
- “Enabling Cellular Networks to Exploit Millimeter-Wave Opportunities (NEMOs)”
 - We explore the creation of wireless networks that combine millimeter-wave communication links integrated with small cell infrastructure in high-density venues.
 - We seek to develop and evaluate network architectures and resource allocation and sharing models, informed and enriched with dedicated mmW channel measurements.



The Easy Parts

- Main Attractions of Millimeter Wave Frequencies
 - Enormous amounts of potentially available spectrum, and
 - Relatively poor propagation enables high reuse.
- High-density, indoor deployments make an obvious first deployment target for mobile millimeter wave.
- Claim: Massive MIMO and beamforming are unnecessary in such an environment.
 - Distances are short.
 - Can get some antenna gain from fixed directional beams from mmW access points.₄

The Hard Parts

- Providing Good Quality of Experience using Millimeter Wave Links will be a nightmare.
 - Changes required across the entire protocol stack.
 - Application Layer (variable QoS requirements, caching)
 - Transport Layer (multi-session/multi-RAT transport)
 - Link Layer (new MACs, macro diversity, and resource allocation)
- Robust infrastructure sharing (and probably virtualization) is critical.
 - Multiple sets of infrastructure would be cost prohibitive and will not be deployed, even in high-density venues.