NSERC SMART MICROGRID NETWORK

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Project 3.1

Universal Communications Infrastucture

Prof. David G. Michelson (University Of British Columbia)
Sina Mashayekhi (PhD student)
Robert White (MASc student)
with contributions from
Alex Corbett (MASc student)
Andrew Mei (MEng student)
Peter Chen (MEng student)
Kevin Lin (MEng student)
Jack Chen (Meng student)

Presented by
Sina Mashayekhi (PhD student)

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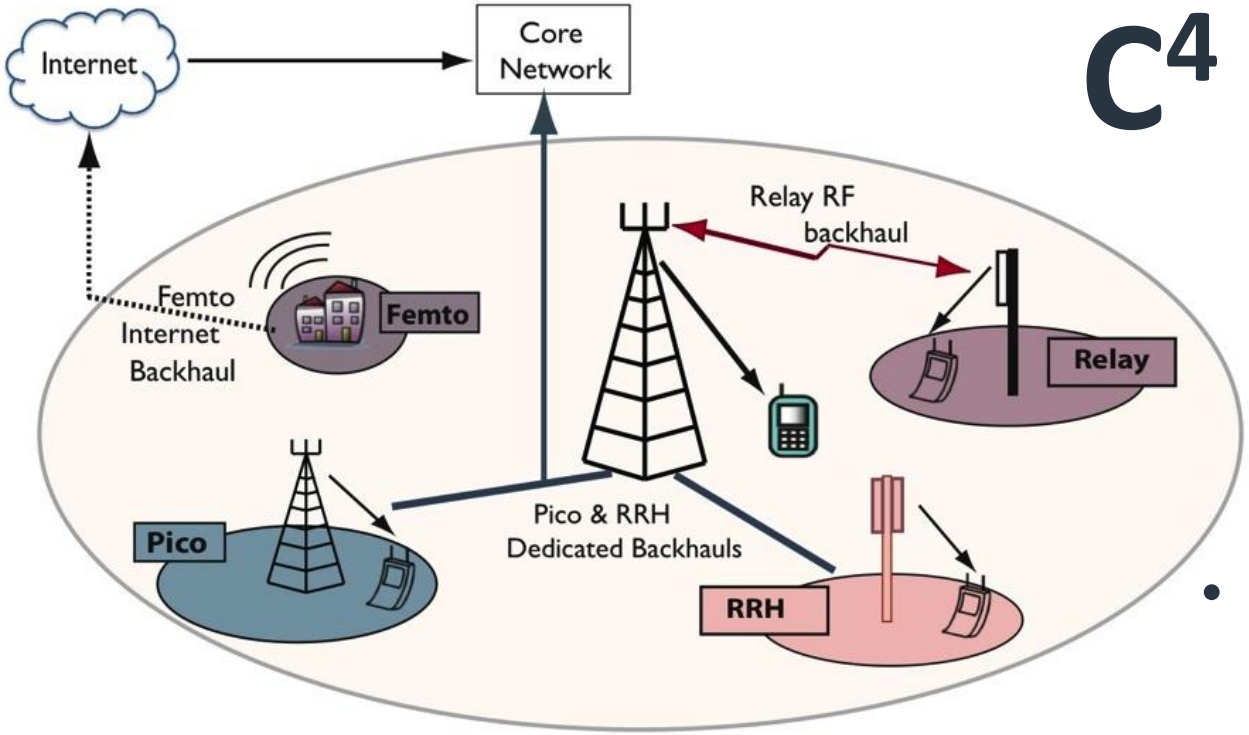
Introduction

- Planning of communications infrastructure must account for *physical impairments* that degrade performance.
- Many of the scenarios encountered in the Smart Grid are quite different from those encountered previously.
- Designers run the risk of over or under-designing the network, thereby incurring unwanted expense.
- Our goal is to **reduce risk** by developing models that capture our knowledge and understanding of these impairments in a form useful in simulation and design.
- We are doing so by working with our partners to combine demonstration and deployment projects (that meet industry needs) with measurement campaigns (that produce research outcomes).

Use of Heterogeneous Networks in Smart Grid Presents Both Challenges and Opportunities



C⁴

- Connectivity
- Coverage
- Coexistence
- Cost

- Wide area wireless
- Short range wireless

- Optical fibre

- Low-voltage power-line communications
- Medium-voltage power-line communications

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Selected P3.1 Demonstration Projects/Measurement Campaigns

- Shadow fading on Relay Nodes – *BC Hydro*
- Characterization of Wireless Noise in Substations – *BC Hydro*
- Coexistence between Radios in Relay Nodes – *BC Hydro, Cisco, Rohde & Schwarz*
- Clean Tech Smart Microgrid Demonstration Program – *Corinex, Powertech Labs, BC Hydro, UBC Student Housing*
- Powerline Communications Planning Tool – *Corinex*
- Wireless Network Characterization – *Tantalus (proposed)*
- Characterization of Outdoor-to-Indoor Wireless Links for Demand-Response – *AWD, Energate (proposed)*

Key Milestones/Outcomes

- Demonstration that shadow fading at pole-top relay nodes is worse than previously realized and must be accounted for when planning coverage.
  - Lower design risks and more cost-effective deployments
- Contribution to Industry Canada policy concerning use of directional antennas at relay nodes. (in progress)
  - Better government policy and more cost-effective deployments
- Development of new methods for characterizing coexistence between radios at relay nodes. (in progress)
  - Lower design risks and more cost-effective deployments

Key Milestones/Outcomes

- Development of improved models for wireless noise in substations. (in progress)
  - Lower design risks and more cost-effective deployments
- Development of improved planning tools for powerline communications over medium voltage lines. (in progress)
  - More cost-effective deployments
  - Competitive advantage for Corinex
- Development of improved models for spectrum occupancy in ISM bands. (in progress)
  - Better government policy and more cost-effective deployments

Links to other projects

Our work concerning the effect of physical deployment on network connectivity supports:

- Project 3.2 (Le-Ngoc) <- wireless connectivity models
- Project 3.3 (Meng) <- wireless noise models
- Project 3.4 (Farhangi) <- power line channel models

We have shared both Theme 3 and Project 3.1 activities at conferences such as:

- 2012 Utilities Telecom Canada Conference - Vancouver
- 2012 IEEE Antennas and Propagation Conference - Chicago

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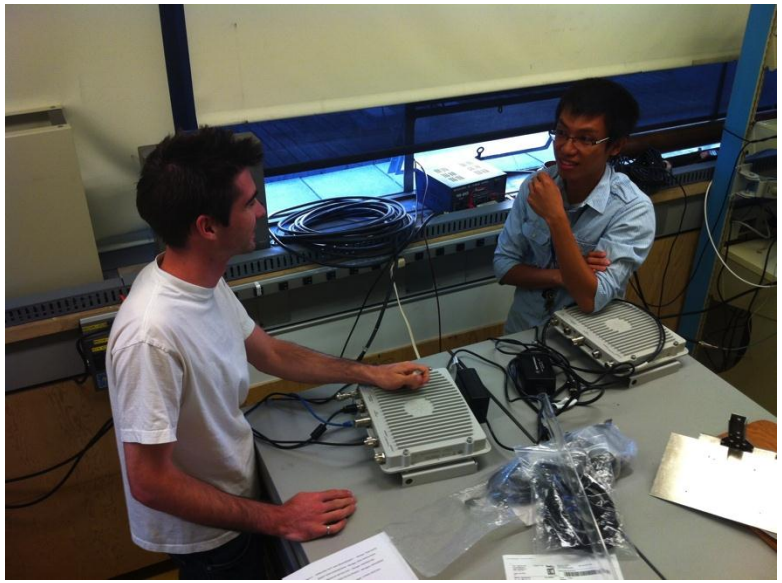
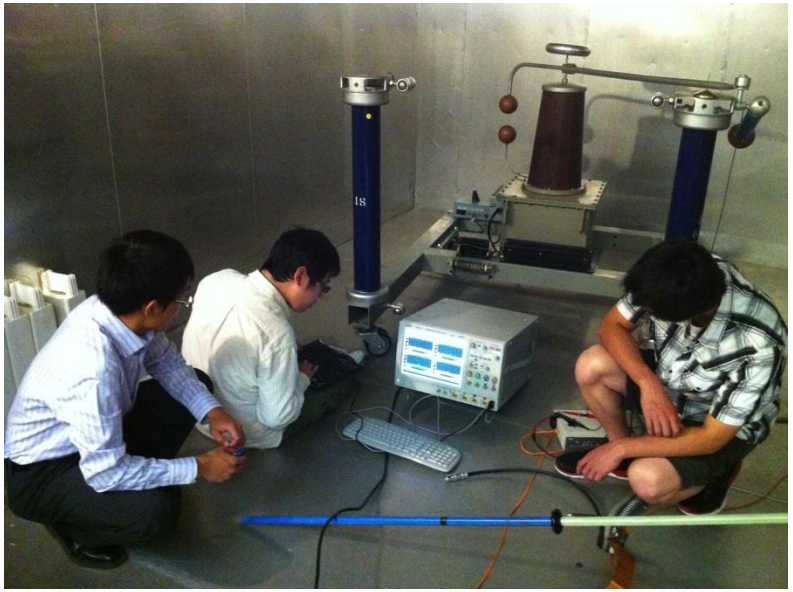
Our projects expose our research students and volunteers to Industry Practice and visits to Field Sites



↑ Configuring RF sensors for spectrum occupancy measurements



↑ Planning a wireless deployment

Evaluating wireless measurement gear In the high voltage lab at UBC ←

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Frequent and regular interaction with industry partners is key to achieving success.

↑ Bench testing at UBC with industry partners.

↑ Configuring a grid router

At a rooftop transmitting site with industry partners. ←

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Questions?

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