Master Thesis
"Wireless Multihop communications for First Responder Connectivity"

Wireless multihop communication technologies are envisioned for use in public safety operations to dynamically provide flexible and robust communications in challenging environments. This research targets the data communication needs of first responders entering a building where conventional radios are unable to maintain connectivity with the incident command center outside the building. Through detailed indoor propagation studies and proposed link assessment schemes, the objective of this work is to develop algorithms for real-time multihop network creation as first responders enter and move about a building, and to utilize this network to monitor and relay vital signs back to incident command.

Current first responder radio communication technologies are susceptible to interruption and disconnection due to propagation loss of the radio signal with distance and obstructions, especially in large buildings with metal construction. Multihop networks use intermediate nodes to relay the signal over multiple, shorter hops from source to destination. By constantly measuring the state of the wireless link, inexpensive relays can be dropped as "breadcrumbs" at appropriate points along a first responder's path into a building to maintain multihop communications with the outside. Challenges include developing accurate real-time link state measurement techniques, determining the optimal placement of wireless breadcrumbs, and adapting to time-varying environmental conditions to maintain end-to-end connectivity.

The goal of this thesis is to build a prototype of such a reliable ad – hoc multihop communication based on 900 MHz Crossbow Motes. Building such a prototype also covers detailed propagation studies, signal strength measurements and signal-to-noise ratio measurements.
One of the main focuses will be set to the dropping algorithm of necessary relay stations to obtain a reliable multihop network.

Contacts / Advisors

- Michael Suryal: souryal@nist.gov
- Leonard E. Miller: lmiller@nist.gov
- Roger Wattenhofer: wattenhofer@inf.ethz.ch