Prof. L. Thiele

Master Thesis

- Your network, predictable or adaptive, Sir?
- I will have both, thank you.

Motivation In 2011, the release of Glossy, a wireless flooding protocol [1], changed the game in low-power networking. In Glossy, a sender broadcasts its message to all other nodes in range, which then forward this message to all nodes in their range, and so on. Each packet is thus *flooded* to all the nodes in the network. Glossy's efficiency stems from the disruptive idea of using concurrent transmissions [2], achieving packet reception rates above 99.99% in real-life experiments.

Protocols based on Glossy have flourished, *e.g.*, the Low-power Wireless Bus [3], Chaos, or Pando ; achieving very-high performance in their own application domain. Yet, wireless is still perceived as a lossy and unpredictable communication medium, which hampers the adoption of wireless technology in safety-critical applications.

The goal of this Master Thesis is to demonstrate that low-power wireless communication can reach a level of predictability and reliability comparable to wired networks, without sacrificing the main benefits of wireless: adaptability and flexibility.

Task description In this project, we focus on the Low-power Wireless Bus [3] (LWB). In previous work, we designed fault-tolerance mechanisms that complement LWB to improve its reliability. The general objective of this project is to implement those ideas on real platforms, validate whether or not the modeling assumptions hold, and compare the performance of the implementation with the expectations. Many directions are possible, depending on your own interest.

Protocol design Enhancing the fault-tolerance mechanisms. For example, by considering packet delays to provide probabilistic real-time guarantees, designing self-adapting fault-tolerance protocols that detect and compensate for poor link qualities, or generalizing the fault-tolerance mechanisms to consider other modes of failure.

Programming Implementing other state-of-the-art fault-tolerant protocols and compare their performance in simulation and/or with real experiments.

Modeling Analyzing the impact of our fault-tolerance mechanisms on the overall energy consumption, adapting and evaluating the existing LWB energy model.

Requirements You should be highly motivated, interested in protocol design and have experience in C programming for embedded systems. A good knowledge in probability theory is a plus.

References

[1] Efficient Network Flooding and Time Synchronization with Glossy, F. Ferrari et al., IPSN 2011.
[2] Lets Talk Together: Understanding Concurrent Transmission in Wireless Sensor Networks, D. Yuan, M. Hollick, LCN 2013.
[3] Low-Power Wireless Bus, F. Ferrari et al., SenSys 2012.
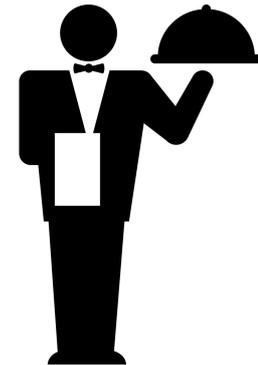
Interested?
Contact me for more details!

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