



## Master Thesis:

### “Energy-Efficient Jamming and Countermeasures”

This document describes the subject and the general time schedule of the master thesis of Dominic Meier starting on the 09.01.2008. Adaptations or changes can be agreed upon by the advisors.

## Subject

Since wireless networks use a shared medium they are exposed to jamming attacks. Such attacks are carried out by an adversary emitting radio frequency signals. They can severely interfere with the normal operation of wireless networks and, consequently, mechanisms are needed that can cope with jamming attacks. However, unless the adversary has unlimited capacities, it cannot jam all communication channels at once for a long time. In this thesis we want to study the influence of a jammer that disposes of a limited source of energy and can choose when and where to use it for disrupting communication on certain channels. The thesis involves the construction and analysis of algorithms for jammers as well as for wireless nodes, both parties seeking to accomplish an orthogonal task.

The aim of the thesis is to gain insights on adversarial jamming in multi-channel radio networks. You will start by reading “Gossiping in a Multi-Channel Radio Network” by Dolev et al. In their paper, an adversary can jam at most  $t$  of  $c$  channels of a complete graph per round. For a simplified version of the problem, e.g., for  $\epsilon = 0$ , You will analyze alternative models for the adversarial dynamics, for instance, a dynamic model where more channels can be jammed after quiet times. Both deterministic and randomized algorithms for efficient gossiping are of interest. Depending on your findings, we seek to generalize the results for multi-hop networks and other applications, e.g., time synchronization or leader election.

## Schedule

- a) Familiarize yourself with the topic and read related work. [2W]
- b) Devise and study randomized algorithms for the complete graph and investigation of alternative adversaries for simplified gossiping. [5W]
- c) Starting with simple examples, analyze alternative applications such as time synchronization. Moreover, investigate meaningful generalizations to multihop scenarios. [15W]
- d) Write of report and paper. [4W]

## Duties

- a) One meeting with an advisor per week.
- b) Two presentations, the first after about two months, the second at the end of the thesis.
- c) Starting with January, write a short summary on the progress after each month (“Monthly Report”).
- d) Finally, write two documents
  - A report (30 to 50 pages, English or German) presenting your work and your results. This report should also include a critical view on your work.
  - A research paper (10 pages, English) which summarizes your results in a concise, scientific form. Depending on your results, we aim at writing (and submitting) a “real” research paper during this master thesis.

## General

- Independent working is expected
- A possibility to work in the ETZ is provided. It is also possible to work at home.

## References

- [1] Shlomi Dolev, Seth Gilbert, Rachid Guerraoui, and Calvin Newport. Gossiping in a Multi-Channel Radio Network, An Oblivious Approach to Coping with Malicious Interference. In *Symposium on Distributed Computing (DISC'07)*, Lecture Notes in Computer Science, pages 208–222. Springer, 2007.
- [2] S Gilbert, R Guerraoui, and C Newport. Of Malicious Motes and Suspicious Sensors. In *OPODIS 2006*, 2006.
- [3] Chiu-Yuen Koo, Vartika Bhandari, Jonathan Katz, and Nitin H. Vaidya. Reliable broadcast in radio networks: the bounded collision case. In *PODC '06: Proceedings of the twenty-fifth annual ACM symposium on Principles of distributed computing*, pages 258–264, New York, NY, USA, 2006. ACM.
- [4] Srinivasan Krishnamurthy, Mansi Ramakrishnan Thoppian, Srikant Kuppa, S. Venkatesan, Ramaswamy Chandrasekaran, Neeraj Mittal, and Ravi Prakash. Time-efficient layer-2 auto-configuration for cognitive radios. In *IASTED PDCS*, pages 459–464, 2005.

## Contacts/Advisors

Yvonne Anne Oswald	oswald@tik.ee.ethz.ch
Stefan Schmid	schmiste@tik.ee.ethz.ch
Roger Wattenhofer	wattenhofer@tik.ee.ethz.ch