Sensors Lab: A Preliminary Analysis

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1 Introduction

Nowadays, wireless sensor networks (WSNs) are deployed everywhere with applications ranging from sensing in agricultural and industrial environments to home automation and monitoring sports athletes. To advance the WSNs innovation, a lot of research is conducted to energy efficient and reliability network protocols. You will investigate one of the most popular of such network stacks that is being used today: IPv6 over the TSCH mode of IEEE 802.15.4e (6TiSCH). More specifically, you will focus on the Time-Slotted Channel Hopping (TSCH) Medium Access Control (MAC) layer that is at the basis of 6TiSCH. In order to so, you will use the widely used Zolertia Re-Mote hardware development platform and the Contiki-NG firmware.

2 Analysing the 6TiSCH energy consumption

For this first analysis, you compare the energy consumption during a certain time period of the entire 6TiSCH stack to when only enabling the TSCH MAC layer, after network convergence. For both analyses, you report on the consumption of the root and the leaf node separately. In your report you explain the reasons for the consumption differences.

3 Analysing the TSCH joining process

This analysis investigates the joining process of a node to a TSCH network. You disable the 6TiSCH stack. You report on the time it takes to join the network and the energy consumed by the joining node. Your report should explain the different parameters that influence this joining process and how. Moreover, you need to investigate the *EB period* in greater detail: if you vary this parameter, how does this affect the joining time and energy consumption?

4 Analysing range capabilities

Here you will research the range capabilities in terms of latency, throughput and energy consumption (i.e., Joule and kbits/Joule) of the Zolertia Re-Motes using the TSCH MAC layer. You disable the 6TiSCH stack and set up a TSCH network for the two nodes. You statically allocate one dedicated cell in the TSCH schedule for the leaf node to the root. This cell will be used to send one packet per second: 1 meter, 10 meters, 50 meters and 100 meters. Make sure that your the nodes are in line-of-sight (LOS). Your report has to

include a satellite photo showing the different measurement positions of the leaf (and root) node. You explain how the different metrics are affected by varying the distance.

5 Submission practicalities

You submit both your report and the code you used to execute your analyses. Your report should be submitted via Blackboard and sent to us via mail (glenn.daneels@uantwerpen.be). You grant us access to your Git repository that should be a fork of the Contiki-NG repository, *develop* branch (`https://github.com/contiki-ng/contiki-ng`). For all analyses, you will use the default network stack settings configured by Contiki-NG, unless a change is required for the particular analysis (such changes *must* be mentioned in the report).

In your repository, we should find three extra project directories, one per analysis. Each project directory contains all the Contiki-NG project files and also all the *parsing and plotting scripts* needed for that particular analysis (even if this would mean that multiple project directories contain duplicate scripts). If for some reason, you needed to make changes to the firmware for one analysis that are incompatible with another analysis, you can work with different Git branches (and have one analysis per branch) instead of three project directories. Each analysis also contains a README file that details 1) the different files in the project directory, 2) how to compile/flash your analysis project and 3) run your parsing scripts. Your project and parsing code *must be formatted and documented professionally.* Finally, each analysis project must also contain the data in a .zip file which was fed to your parsing scripts and used in your report.

Your report should be written in the IEEE conference paper template (`https://www.ieee.org/conferences/publishing/templates.html`). The report should be scientifically sound meaning that you sufficiently describe your experiment methodology and setup, show and discuss your results.

To summarize, you submit:

- Scientific report
- Contiki-NG code (per analysis)
- Parsing and plotting scripts (per analysis)
- README file (per analysis)
- Data (in compressed format) used for the results (per analysis)

6 Deadline

The deadline for these analyses is Sunday, 10th of November at 11.59PM.