Sensors Lab: Review your analyses

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November 2019

1 Sensors Lab Conference

The remainder of this sensor lab course will be organized as a scientific conference. We consider your first submitted paper as your initial *manuscript* to this conference. As it happens in real scientific conferences, you will receive feedback on your submitted paper from external reviewers. These reviews will be sent to your group by email. Your task is to update your submitted paper so it answers and applies all questions and remarks of the reviewers. It is perfectly possible that you will have to conduct more experiments and/or redo some of your experiments. *If you did not manage to conduct all of the assignments before the previous deadline, these must be conducted now. If you did not manage to answer all analysis questions, these must be answered now.* The deadline for your reviewed paper is mentioned in Section 4. You submit your reviewed paper (and code) exactly the same as in the previous assignment, as stated in Section 3.

At the end of the semester you will have to present your final paper. Your grade for this course will depend on your progress during the semester, your final paper and your presentation.

2 Assignment

The analyses are slightly adjusted compared to the previous assignment. Look explicitly for differences with the old assignment, such as new requested analysis insights and experiments. Incorporate the required changes in your updated paper, *in addition to the remarks of the reviewers*. There is also an extra assignment of finding related work and we added extra information to help you conduct the analyses successfully.

2.1 Related work

As is the case in every scientific paper, you will have to add a related work section to your submitted paper. Such a section offers the reader of your work insight into other closely related work within this field. For each related paper the authors offer a brief summary, mention the most important finding(s) and clearly state the differences with the work they are proposing. Reading such related work can actually help you gain insight into how to conduct, visualize, interpret and discuss your experiments and results.

Your assignment is to find a minimum of 2 *recent* papers that conduct research to TSCH in Contiki-NG. Try to find work as closely related to your analyses as possible. These works should be cited, briefly summarized and differentiated from your work. To find such papers, you can use `http://https://scholar.google.be/`.

2.2 Analysing the 6TiSCH energy consumption

For this first analysis, you compare the energy consumption during a certain time period of the entire IPv6 over the TSCH mode of IEEE 802.15.4e (6TiSCH) stack to when only enabling the Time-Slotted Channel Hopping (TSCH) Medium Access Control (MAC) layer, after network convergence. For both analyses, you report on the consumption of the root and the leaf node separately. Is there a difference in consumption or not? Is this expected and why (not)?

2.3 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 *and the root node*. Your report should explain the different parameters that influence this joining process and how. Moreover, you need to investigate the *EB period* and the *TSCH channel hopping sequence* in greater detail. Explain these parameters. If you vary these parameters, how do they affect the joining time and energy consumption *(during and the after joining process)*? Why?

2.4 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 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. Explain in detail how the different metrics are affected by varying the distance and why this is the case.

Subsequently, repeat this analysis with a smaller and larger TX power value. How does this parameter change the latency and throughput results? Why? Can you draw any conclusion about the effects of this parameter on the energy consumption?

To conduct this analysis successfully, we advise you to look at the `examples/nullnet` and `examples/6tisch/simple-node` examples. These will give you insight in how send a packet (without a network layer) and how to allocate cells.

3 Submission practicalities

You submit both your scientific paper*, max. 6 pages (excluding appendices)*, and the code you used to execute your analyses. Your paper 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 paper).

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 paper.

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

To summarize, you submit:

- Scientific paper
- 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)

4 Deadline

The deadline for your updated submission is Wednesday, 18th of December at 11.59PM.