In-depth evaluation of Wi-Fi HaLow technology in real life networks - HaLow -

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Experiment description

CONCEPT AND OBJECTIVES

Objectives of the Methods2Business experiment defined in the call proposal are:

- Evaluate performance (throughput and frame latency) of Wi-Fi HaLow networks under various conditions
- Evaluate effects of new features introduced by IEEE802.11ah (like NDP frames, PV1 frames, TWT, …) on overall performance of Wi-Fi HaLow network
- Validate Methods2Business algorithms for network optimization
- Validate Methods2Business automated protocol checker on real life sniffer traces

All objectives of the experiment are met.

Experiment description

BACKGROUND AND MOTIVATION

- Methods2Business (M2B) is a European semiconductor company on the leading edge of developing the world's first Wi-Fi HaLow chips which will bring another level of connectivity and automation to the Internet of Things (IoT).
- The company is a key contributor to the Wi-Fi CERTIFIED® HaLow™ program of Wi-Fi Alliance, expected to be launched in 2021
- Wi-Fi HaLow operates in Sub-GHz ISM bands (750-950 MHz) targeting low power, long range (Industrial) IoT applications.
- Methods2Business plans to use results collected in this experiment as a reference to a further fields tests with their devices

Experiment description

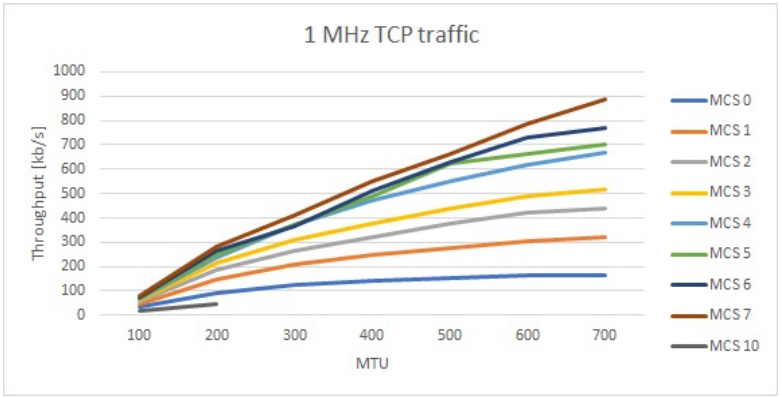
EXPERIMENT SET-UP

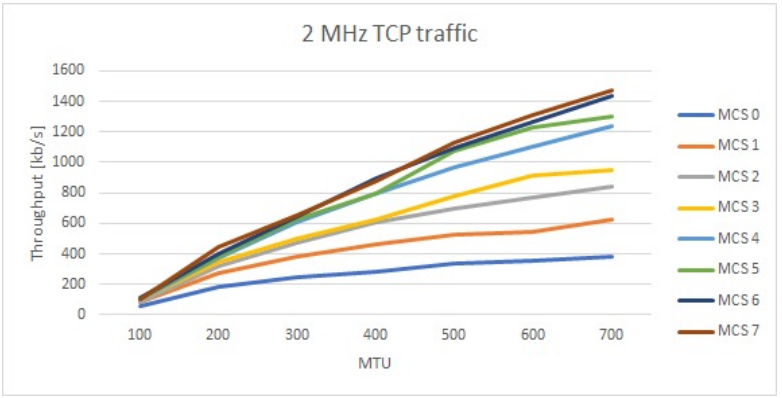
Experiment consists of:

- Methods2Business Wi-Fi HaLow Station and Access Point IP solutions mapped on two Xilinx ZC706 Evaluation Kit - Zynq® 7000 SoC + AD FMCOMM radio frontend SDR Hardware platform

Project results

MAXIMUM ACHIEVABLE THROUGHPUT OF WI-FI HALOW NETWORKS USING DEFAULT PARAMETERS

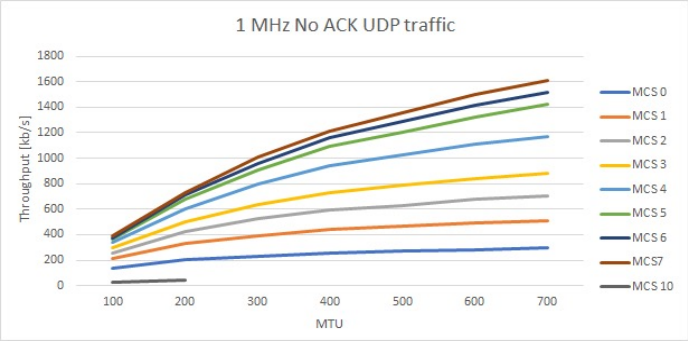


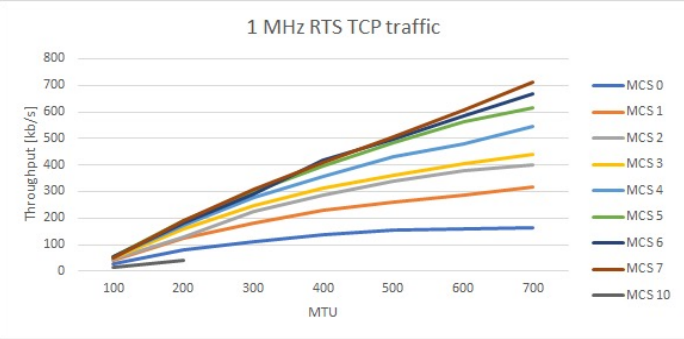


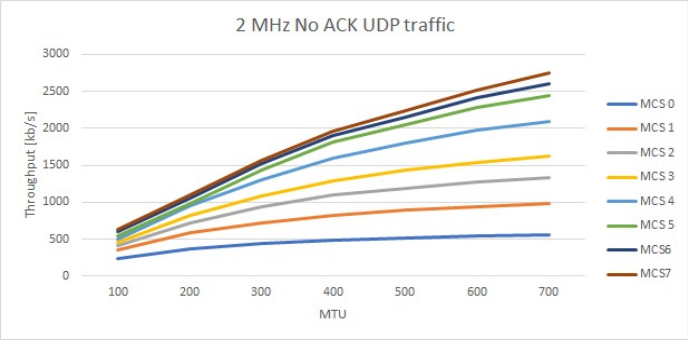
Default parameters: TCP traffic, Normal Acknowledgement, No aggregation, Long Guard interval, 1x1 Spatial stream

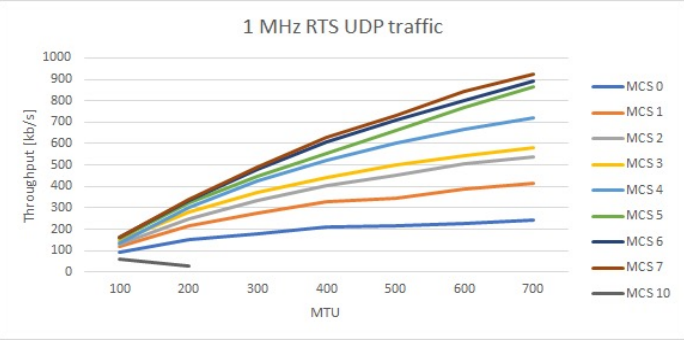
Project results

PERFORMANCE OF WI-FI HALOW NETWORKS UNDER NO ACK POLICY AND WHEN USING RTS PROTECTION MECHANISM







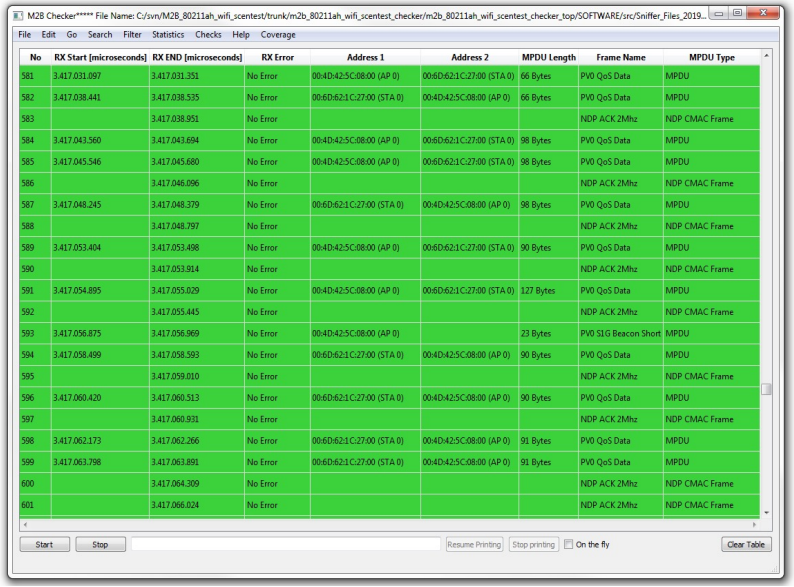


Project results

M2B WI-FI HALOW PROTOCOL CHECKER VALIDATION

M2B Wi-Fi HaLow protocol checker validated on as system deployed in a Fed4FIRE test lab

- More than 20 Wi-Fi scenarios executed while running more than 3000 automated checks on PC in background
- In depth performance analysis of executed Wi-Fi scenarios (PER, data rate, time between transmissions)



Business impact

VALUE PERCEIVED

- Experiments provided in depth insight of Wi-Fi HaLow technology performance and Methods2Business IP implementation in real life networks.
- Results of the experiment confirmed expected performance of Methods2Business IP which is valuable to be shared with Methods2Business customers.
- Examination of the results of the experiments has led to new ideas for further improvement of the performance of Methods2Business solution.

Business impact

VALUE PERCEIVED

- If testbed infrastructure via Fed4FIRE+ was not available, Methods2Business would have considered other test labs for building experience with remote testing of the Wi-Fi HaLow technology using Methods2Business devices
    - This would probably result in higher cost of the experiment.
    - Methods2Business sees that these types of experiments can provide a high value when deploying a new technology.
- Methods2Business conducts field testing of Wi-Fi HaLow technology using their own devices.
- Results obtained from Fed4FIRE+ experiment are used as a reference for future field testing
- Methods2Business sees benefits in using Fed4FIRE+ facilities for enabling customers to remotely test Wi-Fi HaLow technology using Method2Business devices in heterogenous wireless environment

Business impact

FUNDING

- Allocated budget was sufficient to conduct the reported experiments because Methods2Business could rely on own developed Wi-Fi HaLow test environments and design implementation
- Methods2Business has not received other funding for executing this experiment
- Methods2Business would execute this project without receiving any external funding
- Methods2Business would consider paying for such experiment. Most valuable components are resources and expert consultancy services.

Feedback

RESOURCES AND TOOLS USED

- Resources used at imec w-iLab.t 2:
    - 2x Xilinx ZC706 Evaluation Kit - Zynq® 7000 SoC + AD FMCOMM radio frontend
- Methods2Business has used all requested resources
- Reserved resources were used most of the time
- Methods2Business has used jFed tool:
    - Experience with the jFed tool was excellent.
    - Easy to setup
    - It is well documented.

Feedback

DESIGN/SET-UP/RUNNING EXPERIMENT

Procedure:

- Project proposal and final report template are clear and well defined, it was not big overhead providing required feedback

Set-up experiment:

- Process obtaining access to the testbed, including generation of the certificate, making reservation of devices and initial setup of experiment went very smoothly.

Fed4FIRE+ portfolio:

- Resources provided by FED4FIRE+ testbeds were sufficient for execution of this experiment
- Methods2Business suggests FED4FIRE+ consortium to install more Xilinx ZC706 Evaluation Kit - Zynq® 7000 SoC + AD FMCOMM radio frontend, which would enable more experiments on larger scale
- Technical offering was fully in line with our expectations

Feedback

DESIGN/SET-UP/RUNNING EXPERIMENT

Documentation and support:

- Methods2Business would find very useful to add more information on how to setup Xilinx ZC706 Evaluation Kit - Zynq® 7000 SoC + AD FMCOMM radio frontend systems.
- Methods2Business didn't use first level support dashboard
- Methods2Business was in direct contact with staff of testbed. All issues were resolved extremely fast

Experiment environment:

- Environment was trustworthy
- We have enough control of the environment to repeat the experiment in an easy manner

Experiment execution and results:

- We had enough time to conduct experiment
- Results were in line with initial goals and expectations
- Main problem in execution of the experiment was porting of Methods2Business Wi-Fi HaLow IP on Xilinx ZC706 boards. This step took more than it was expected. Next to that, main challenge was to port M2B Linux image on ARM A9 core available on the board.

Feedback

WHY FED4FIRE+ WAS USEFUL

Execution of the experiment:

- Main reasons for choosing Fed4FIRE+ were:
    - Easy procedure for applying
    - Access to resources that were not available in Methods2Business office
    - Availability of the budget

Added value of Fed4FIRE+:

- Methods2Business finds following as added values of Fed4FIRE+:
    - Diversity of available resources
    - Support and documentation
    - Easy setup of experiment

What is missing:

- Adding more SDR nodes in wireless testbed would enable more larger scale experiments.
- We encourage Fed4FIRE+ federation to offer consultancy services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WWW.FED4FIRE.EU