



HALOWEX

Concurrent multiple sensing for better channel utilization of Wi-Fi HaLow networks

Open Call partner
Methods2Business



Patron
imec



OBJECTIVES

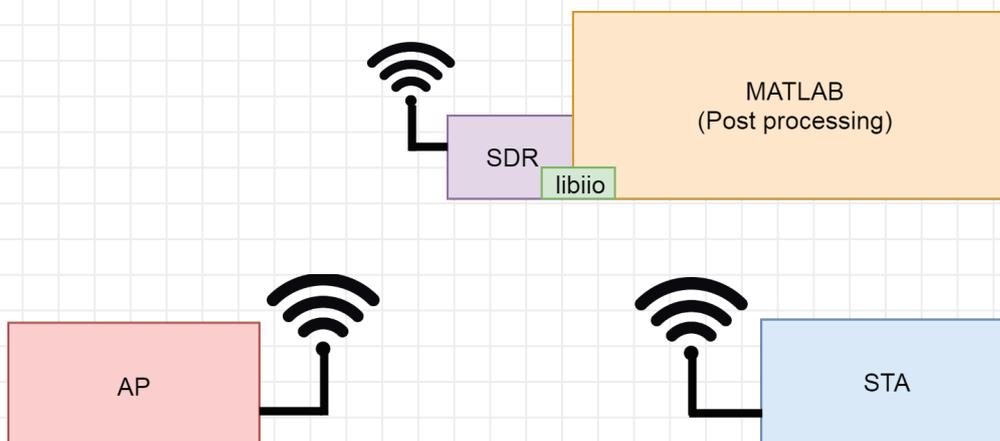
Methods2Business major objective was to prove that concurrent sensing of multiple channels in a Wi-Fi HaLow network leads to a more efficient channel utilization, maximizing the throughput of Wi-Fi HaLow devices in the network. The intention was to apply the Digital Down Converter (DDC) filters provided by the ORCA project for the channel sensing and develop a mechanism for channel switching.

CHALLENGES

The two main challenges were on the one side, to identify a reliable metric for classifying channels in a Wi-Fi network based on the measured wireless activity in the channel, and on the other side, to develop an efficient mechanism for channel switching that complies with the IEEE 802.11ah standard.

EXPERIMENT SETUP

The experiment consists of two Xilinx ZC706 Evaluation Kit - Zynq® 7000 SoC boards, from which the first one represents an Access Point (AP) and the second one represents a Station (STA). The traffic between them is captured with an SDR-based sniffer that is connected to MatLab using the libio library from Analog Devices Inc. The figure below shows the experiment setup at the imec w-iLab.t.2 lab.





HALOWEX

Concurrent multiple sensing for better channel utilization of Wi-Fi HaLow networks

MAIN RESULTS

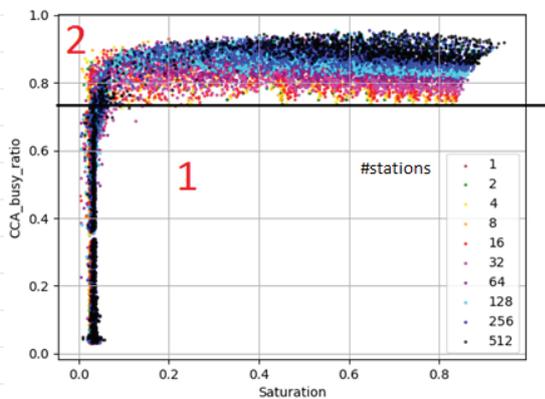
Methods2Business developed two metrics for channel classification, one based upon the CCA_busy_ratio which represents the percentage of period of time that the channel is occupied and another one based upon the Traffic Saturation Metric (TSM) representing the average channel idle time. Based on these two metrics, channels could be classified.

The figures below show the CCA_busy_ratio and the Traffic Saturation Metric in function of the saturation of the network which is defined by the following formula.

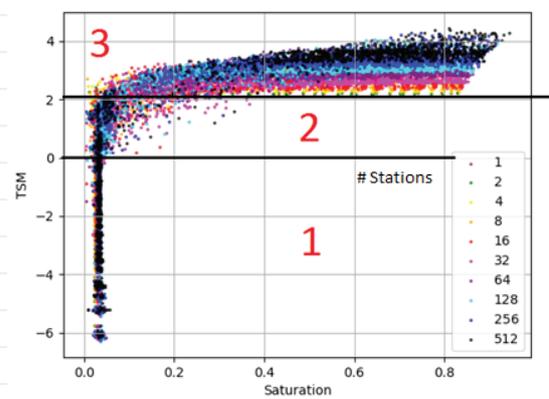
SAT = 1- Effective throughput/Desired throughput / where Desired throughput is the sum of the throughputs STAs are trying to achieve

The numbers (1, 2 and 3) mean: 1- No Saturation, meaning effective throughput equals desired throughput. 2- Partial saturation. 3- Full saturation

As indicated by the figures below, classification based upon the Traffic Saturation Metric gives a more precise indication of the channel condition.



CCA_busy_ratio in function of network saturation



Traffic Saturation Metric in function of Network Saturation

In addition to channel classification, Methods2Business developed two mechanisms for channel switching, one to be applied during initialization of the network and another for a network in operation.

CONCLUSIONS

Concurrent sensing of multiple channels to enable channel switching, is a promising concept for maximizing throughput in a Wi-Fi HaLow network. The mechanisms developed for channel sensing based on ORCA's DDC filters and channel switching, were illustrated using the imec test facility and showed promising results for further implementation in Methods2Business commercial Wi-Fi HaLow access points.

FEEDBACK

Methods2Business is very satisfied with the ease of use and tool support provided in ORCA to bring-up our full Wi-Fi HaLow MAC and Baseband implementation for a client and an access point on the available prototyping boards (ZYNQ FPGA with AD9361 radio cards) present in the imec w-iLab.t.2 lab. Thereafter, it was very straightforward to run remotely our intended experiments. For the near future, Methods2Business sees great opportunities to further exploit the services offered by imec w-iLab.t.2 lab facilities for offering remote access to our Wi-Fi HaLow demonstration platform to early adopters of the Wi-Fi HaLow technology all over the world.

Thanks to the DDC filters provided by the ORCA team and the access to the Testbed of the imec test lab, Methods2Business was able to develop and test a working mechanism for channel sensing for the purpose of channel switching to maximize the throughput of devices in the network. Methods2Business will apply these concepts into their access point products to create a competitive advantage in the market. The Methods2Business team very much appreciated the professionalisms of the people running the imec test lab and the in-depth knowledge in wireless networks of the ORCA team.