



IP CREW

Cognitive Radio Experimentation World

Usage of UTH – NICTA ACM cards in w-iLab.t



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Experimental Scenario

Transmitter Wi-Fi Node



Receiver Wi-Fi Node



Target:

- ✓ Characterize the Energy Efficiency of the 4 different Spectrum Sensing devices

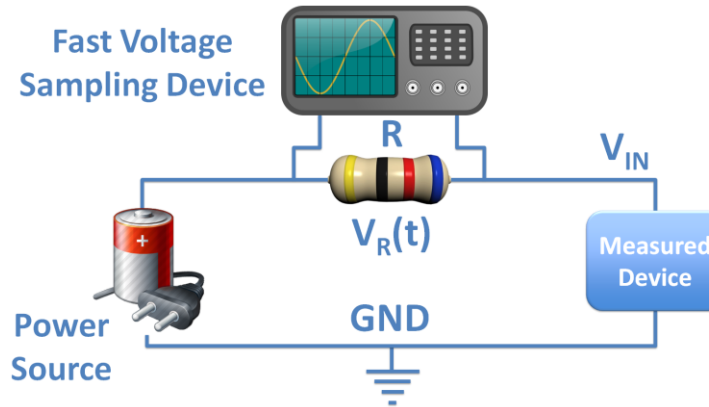
Solution:

- ✓ Customized hardware that follows a generic power consumption measurement procedure
- ✓ Integration with the w-ilab.t testbed architecture.

- ✓ Power consumption can be determined by measuring current and voltage at the device under test.

$$P = U * I$$

- ✓ Actual measurements can be gathered using a fast voltage sampling device, as follows:



- ✓ The instantaneous **power consumption** is the product of the input voltage and current draw on the current shunt resistor **R**:

$$P(t) = V_{IN} \frac{V_R(t)}{R}$$

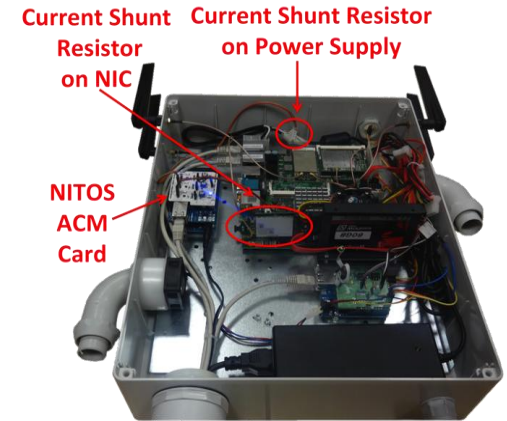
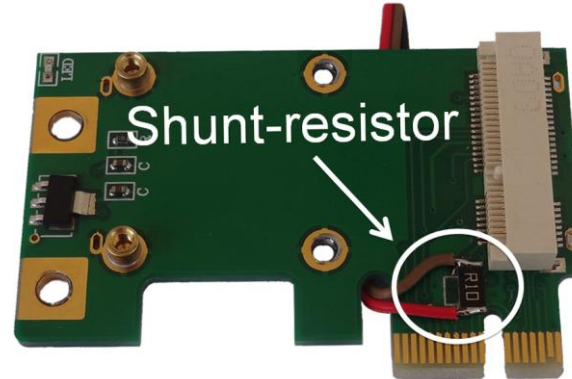
Total Energy Consumption over an interval $\Delta t = t_1 - t_0$ is calculated as the integral of power consumption:

$$E_{t_0 \dots t_1} = \frac{V_{in}}{R} \int_{t_0}^{t_1} v_r(t) dt$$

dt: corresponds to the infinitely small observation duration, which equals the inverse of the configured sampling rate

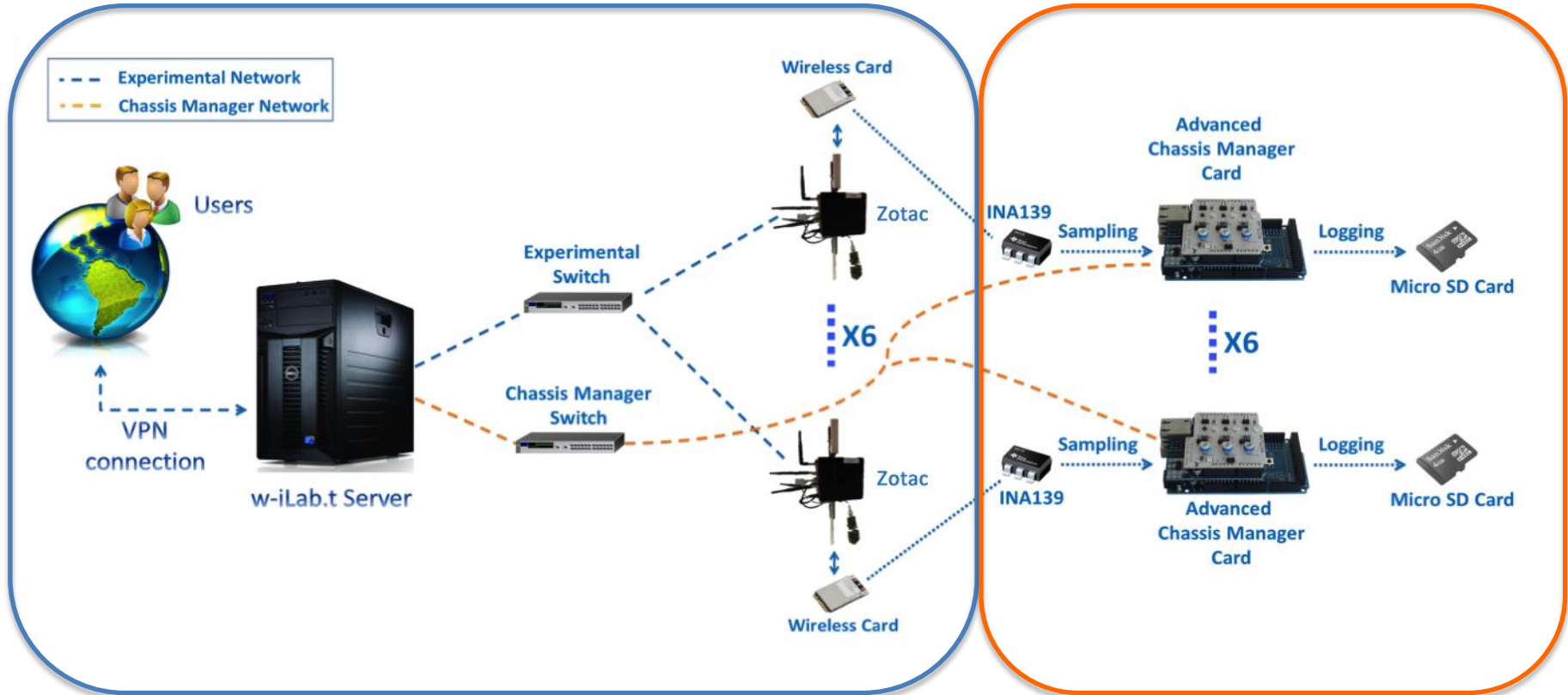
Δt : corresponds to the total duration of each specific **experiment**

In the case of **Spectrum Sensing experiments**, **Δt** corresponds to the total duration of the sensing process and needs to be precisely calculated in each scenario.



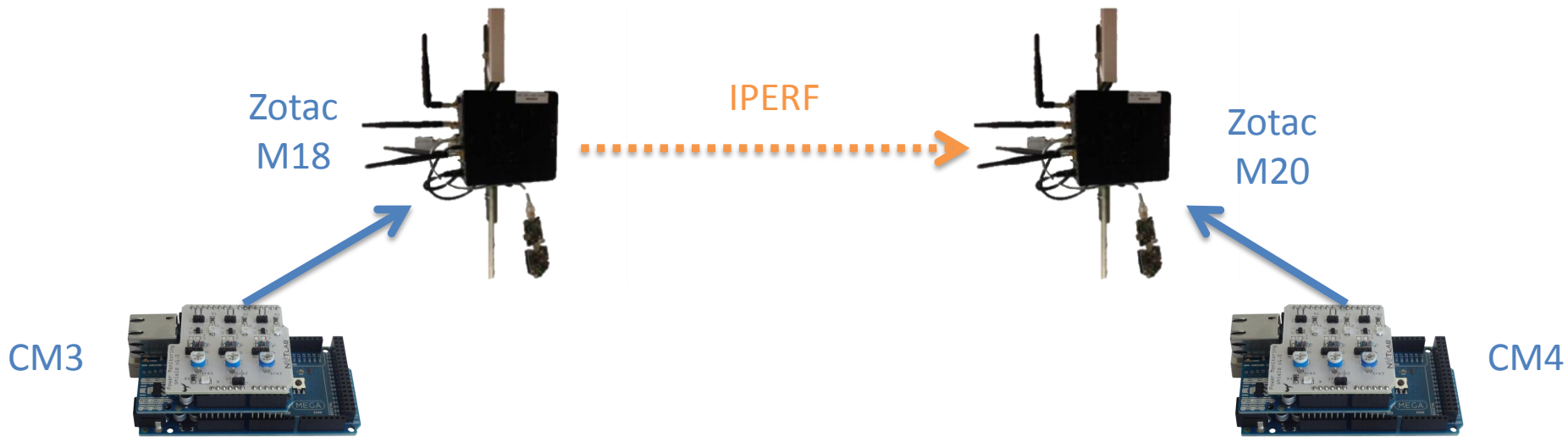
- ✓ **Online Monitoring** of realistic testbed experiments
- ✓ **Distributed** Architecture through Network communication
- ✓ **High Accuracy** (comparable with high-end devices)
 - ✓ **High Sampling Rate (63 KHz)**
 - ✓ Adaptable to heterogeneous devices
(wireless nodes/ cards, sensors, mobile phones, etc.)
 - ✓ **Low-cost (less than 80€)**

Integration with w-ilab.t Testbed architecture



Existing w-ilab.t Architecture

UTH / NICTA experiment extension



We use 2 testbed nodes (ZotacM18, ZotacM20) to establish a link in *ad-hoc* mode and the attached

NITOS ACM cards (CM3, CM4) to measure the power consumption in the following experiment:

1. ZotacM18 transmits to ZotacM20 at the Traffic Rate of 10 Mbps for 10 seconds
2. No transmissions are active for 5 seconds
3. ZotacM18 transmits to ZotacM20 at the Traffic Rate of 20 Mbps for 10 seconds
4. The wireless cards are deactivated and the experiment ends.

Experiment is executed through the
OMF Control and Measurement Framework
 and the expected results follow:

