

MasterClass on ICT Support for Adaptiveness and (Cyber)Security in the Smart Grid DAT285B

hands-on project framework

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Recall challenges / focal points in the course

- Adaptiveness: Distributed systems and algorithms
- On line processing/streaming of data
- (cyber) Security

Project idea: zooming in a Smart Meter: Simulation / Security testing in AMI

Functions:

input/output consumption
values (internal registers)

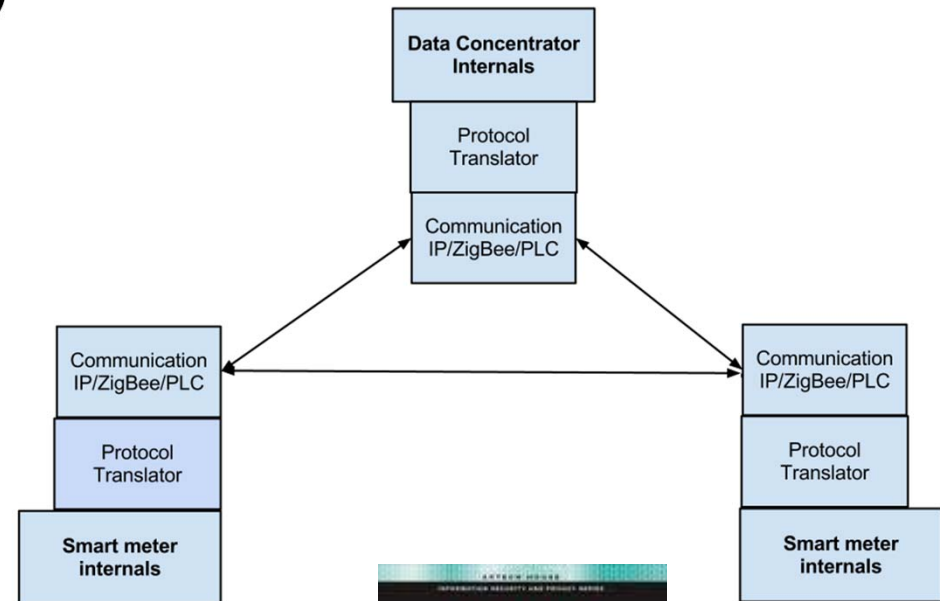
Communication (e.g.
ZigBee, WiFi, other)

Security/fuzzing:

Eg testing/dealing with
stack overflows, ..

Programming in C/Python under
Linux

ARM platform (BeagleBoard,
RaspberryPI)



Project idea:

A simple demand response service

- Build on a communication node, eg on an ARM-based platform, capable to **interface with off-the-shelf** equipment , to
 - monitor consumption and **control** electrical appliances
- implement intelligent **scheduling** algorithms that
 - Can reduce peaks/meet constraints
 - Can possibly allow for cooperation between communication nodes in a way that reduces the total energy consumption of the system



... to eg ARM-platform



cf reading list on Adaptiveness & resources

Building a testbed for AMI

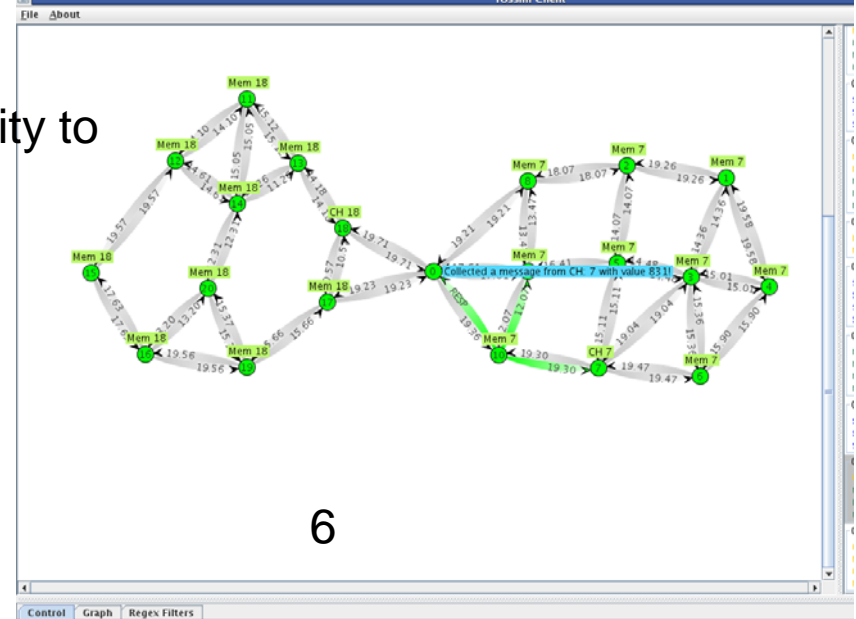
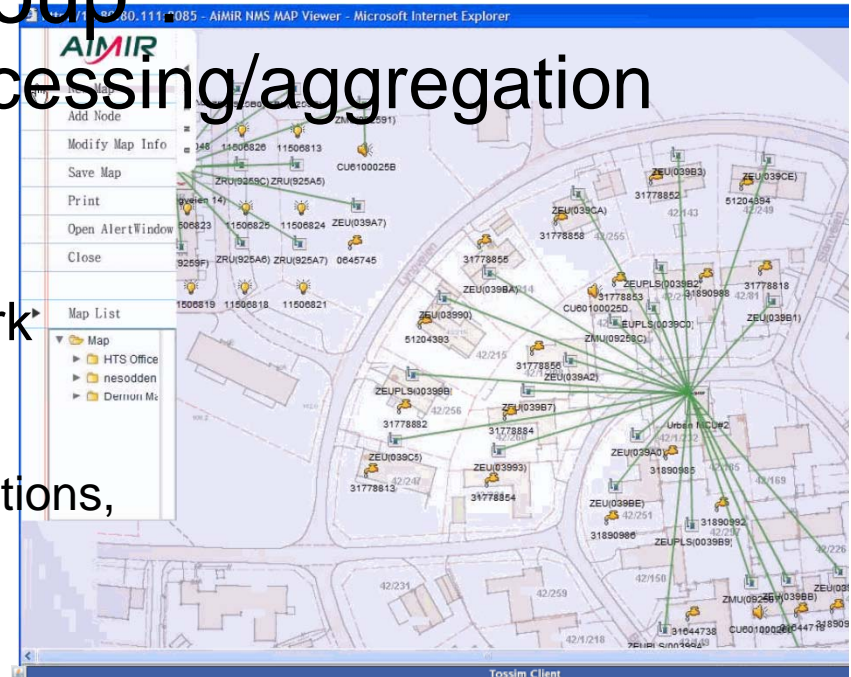
(sub-project of the other related projects or independent and coordinating with them)

- Connect devices into an e-meter testbed:
variety of options
 - Zigbee-based
 - Wifi-based
 - Wired

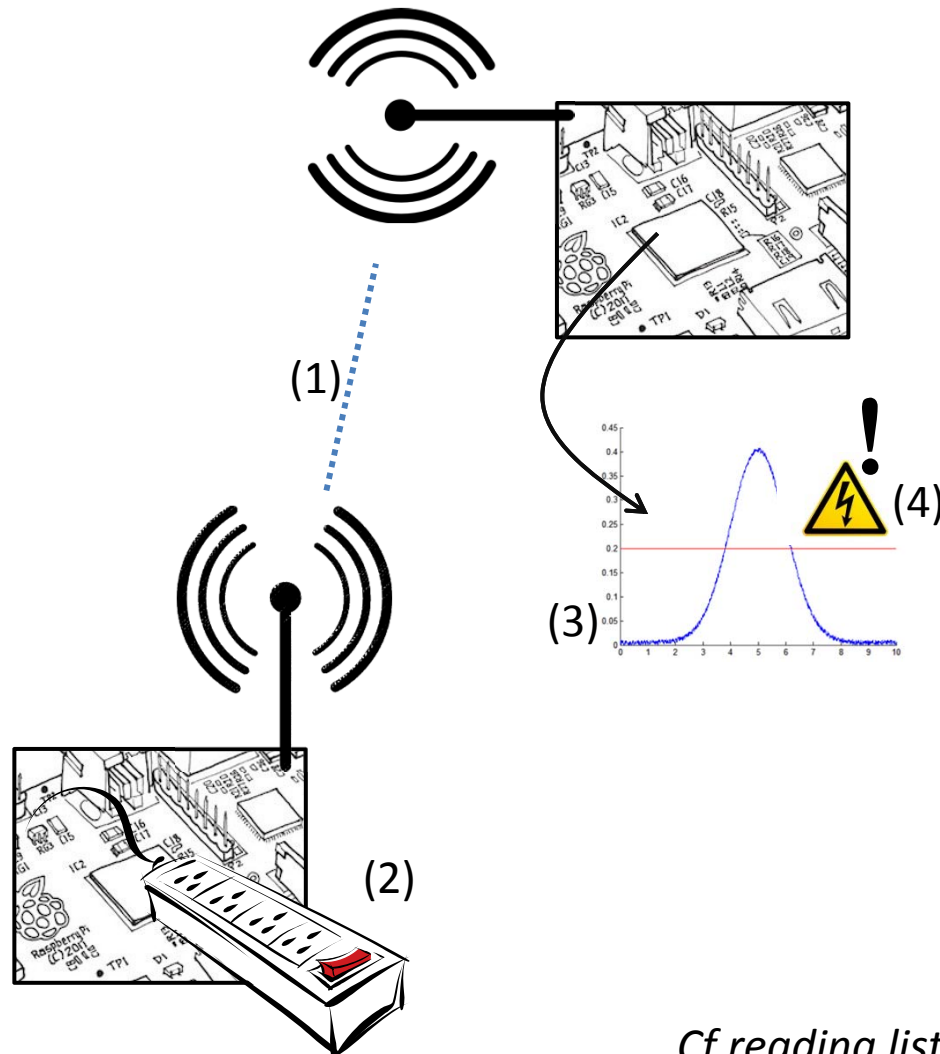


Project "group": data communication + processing/aggregation

- computation/streaming over data while collecting it in a hierarchical/mesh network
 - e.g. average, variance, %, clustering,
 - for **monitoring**, detection of **alarming** situations, input to resource management, etc
- prototype/experimental part
 - Over connected ARM platforms
 - **Combine** with the prev. projects; possibility to work on an **actual microgrid**
 - Programming in C/Python
 - Possibility to connect to **visualization**



Online monitoring of energy consumption



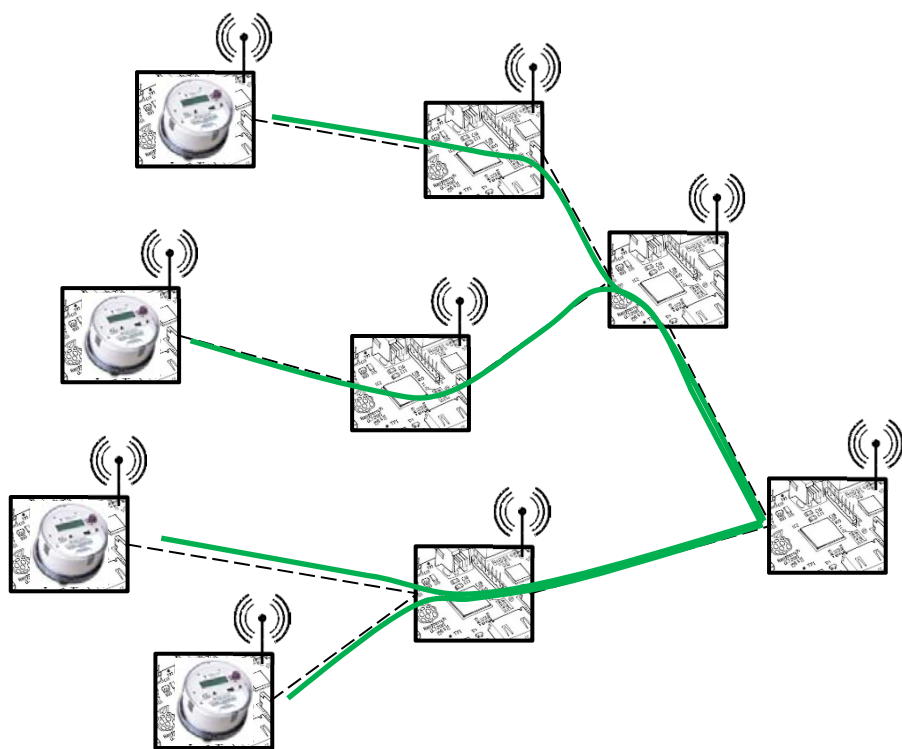
1. on ZigBee (or other protocol) network
2. Forward energy consumption readings
3. Process information with **Stream Processing Engine**
4. Generate “alarms”

Cf reading list on streaming

Online monitoring of energy consumption

- network with
 - Source sensor
 - forward energy consumption information
 - Server sensor
 - Check energy consumption against set of user-defined alarms.
- Example
 - send an “alarm” message each time the last hour average consumption exceeds a threshold.

Simulation and in-network aggregation of smart meters data



1. On ZigBee (or other comm-protocol) network
2. Simulate smart meters readings (various models)
3. Aggregate information in the hierarchical topology with **distributed Stream Processing Engine**

Cf reading list on streaming

Simulation and in-network aggregation of smart meters data

- Hierarchical topology
 - Source sensors:
 - Simulate energy consumption.
 - Different models: houses, shops, factories, ...
 - Server sensors:
 - In-network aggregation

Towards deciding:

- This is a "framework" we suggest.
- There is overlap between projects
- The details can be fixed interactively, with you
- Let us use the first week after the break to do the project "assignment"