Optimization of SmartGrid critical-event management

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1. Motivation of the work

- **Smart Grid (SG)** requires a strong integration between all the electrical elements and control nodes by intensively using IT systems.
- SG technologies play a **key role in the transition to distributed and renewable power sources**.
- SG requires **near real-time processing of critical events** in order to keep the proper operation of the Grid.
- **Two problems** related to the management of **critical events in SG** demand specific attention:

The **performance** of IoT protocols currently used in SG, especially in applications where **low latency** is a critical requirement.

The use of Machine Learning algorithms for **real-time detection of anomalies** from SG sensor values.

2.Thesis Objectives

Comparison of standardized application layer IoT protocols used in SG to handle critical events.

Proposal of **improvements for one IoT protocol performance** in time-critical applications.

Using **CLA** (Cortical Learning Algorithm) to find anomalies in a SG critical parameter: **phasors**.

Development of an **open-source simulation environments** for both IoT communication and SG models to conduct experiments.

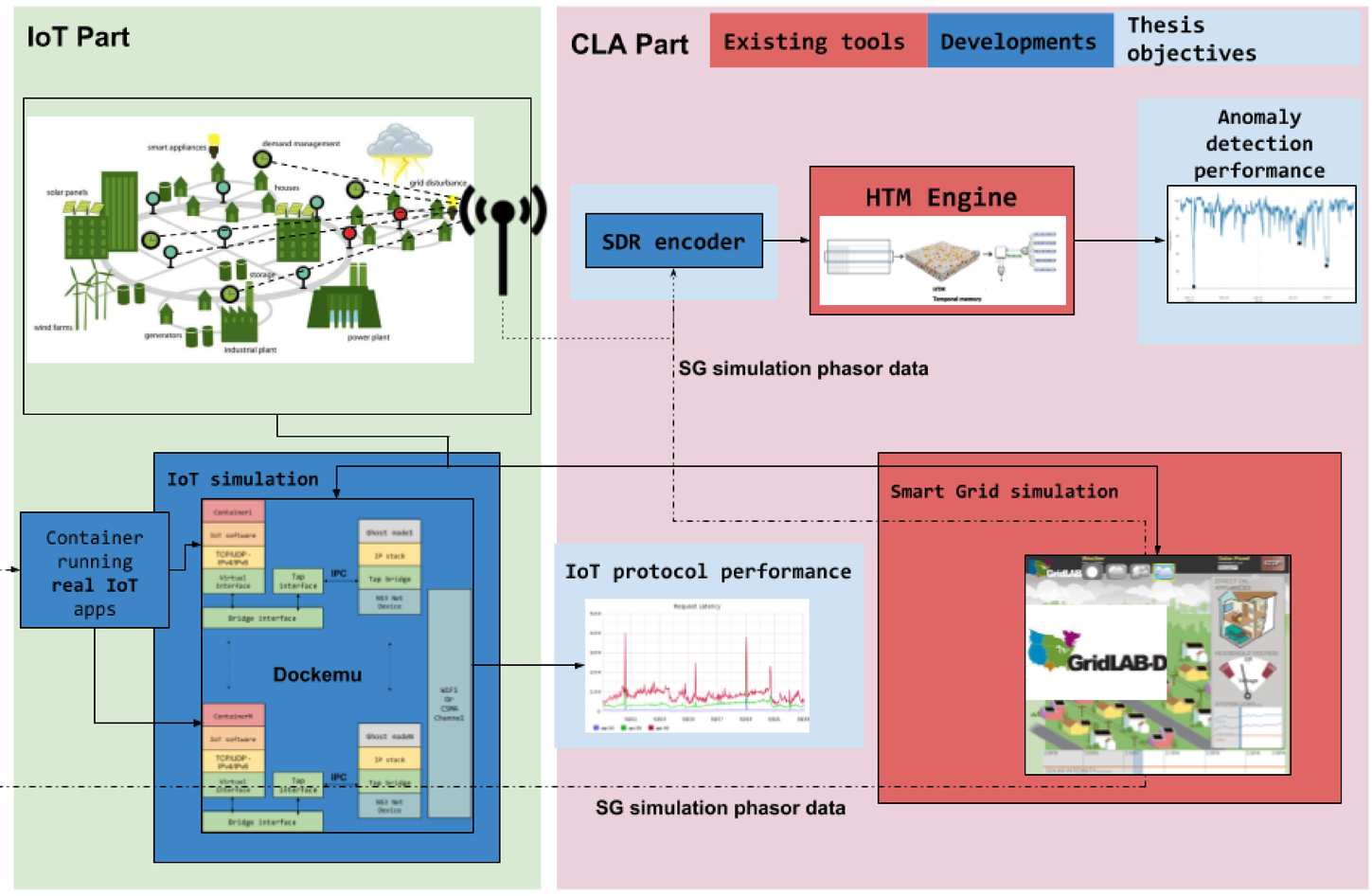


Figure 1: This diagram gives a complete view of the thesis of objectives. It is divided in two main parts: IoT and CLA. The blue box in the **IoT part** represents the adapted *Dockemu* simulator [1] and the red boxes on the **CLA part** represents the HTM engine to detect anomalies and the GridlabD SG simulation to generate a realistic sample of phasor values.

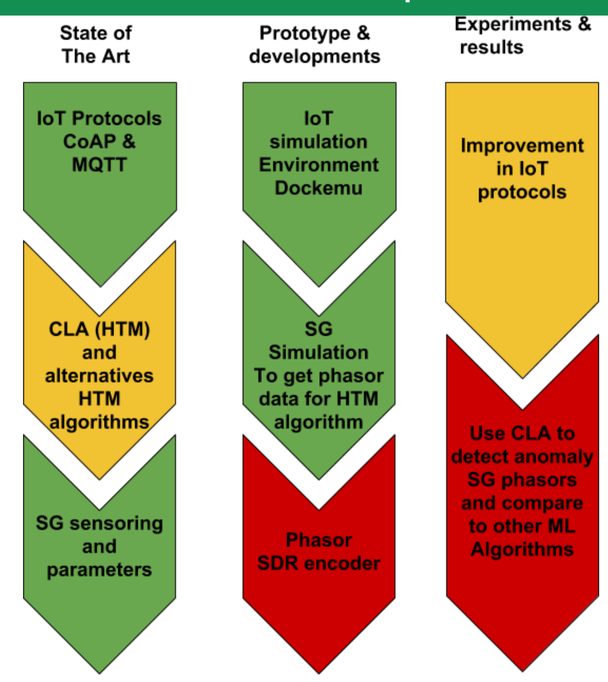
3. Results

It was **hard to replicate simulations** from other papers and use real software.

I decided to adapt and improved an exiting network simulation framework based on NS3 and Linux containers [2].

- The new version allows to simulate **real implementations of IoT protocols under different network conditions**.
- A paper documenting the design, implementation and early result was submitted to **Simultech 2018** [1].

4. Research plan



5. Next year planning

	TASK TITLE	% COMPLETE	2017 Q1 J	F	M	2017 Q2 A	M	J	J	2017 Q3 A	S	O	N	D	2018 Q1 J	F	M	2018 Q2 A	M	J	J	2018 Q3 A	S	O	N	D	2019 Q1 J	F	M	2019 Q2 A	M	J	J	2019 Q3 A	S	O	N	D	2020 Q1 J	F	M	2020 Q2 A	M	J	J	A
1	Project Conception and Initiation																																													
1.1	HTM Study	100%																																													
1.1.1	IoT protocol analysis	100%																																													
2	IoT protocol analysis																																													
2.1	Study simulation allternatives	22%																																												
2.2	IoT simulation paper	100%																																												
2.3	CoAP and MQTT experiments	40%																																												
2.4	CoAP Tunning paper	0%																																												
	CoAP vs MQTT paper	0%																																												
3	HTM application in IoT																																													
3.1	HTM model for phasor	10%																																												
3.2	Phasor encoder implementation	0%																																												
3.2	Simulation model	10%																																												
3.2.1	Phasor encoder paper	0%																																												
4	Results and writing																																													
4.1	Final simulations	0%																																												
4.2	Writing of memory	0%																																												

6. References

[1] Anton Roman and Martin Lopez. Dockemu: extension of a scalable network simulation framework based on docker and ns3 to cover iot scenarios. In *2018 Simultech 8th International Conference on Simulation and Modeling Methodologies, Technologies and Applications (Submitted)*, may 2018.

[2] Marco Antonio To, Marcos Cano, and Preng Biba. DOCKEMU – a network emulation tool. In *2015 IEEE 29th International Conference on Advanced Information Networking and Applications Workshops*. IEEE, mar 2015.