



Proposal of a Communication Layer for a Renewable Energy Microgrid Testbed



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Abstract: Microgrids (MG) are becoming a definitive solution for the integration of renewable energies sources in the energy matrix. As it becomes an independent cluster of energy apart from the main grid, it needs a specialized control called Microgrid Central Controller (MGCC) and consequently a robust communication layer with the primary controllers in order to prevent failure and disturbances to the grid. This paper proposes a solution to the communication layer, physical and logical, that meet the requirements of a real field application allowing interconnection of real physical and simulation equipment to the testbed.

1 INTRODUCTION

Microgrids are composed of complex electrical, control and communication systems, which operate in a parallel and coordinated manner. This work is a part of a process of planning and deploying a Microgrid Analyses Laboratory in Brazil, as mentioned by [1].

- One of objectives of this paper is listing the technologies and protocols used nowadays in the energy sector and it proposes a flexible communication testbed to laboratory.

The flexibility cited above allows this platform to emulate a microgrid environment, with several topologies and communication protocols, in order to perform analyses in the communication system under aspects of delay, latency, and accuracy of each one the scenarios.

2 MICROGRID CONTROL TOPOLOGY

The microgrid concept assumes a cluster of micro-sources, loads and energy storage systems, all operating in a coordinated and intelligent manner to supply electricity to the costumers, in both grid-connected and islanded mode. The key components are shown in the Figure 1.

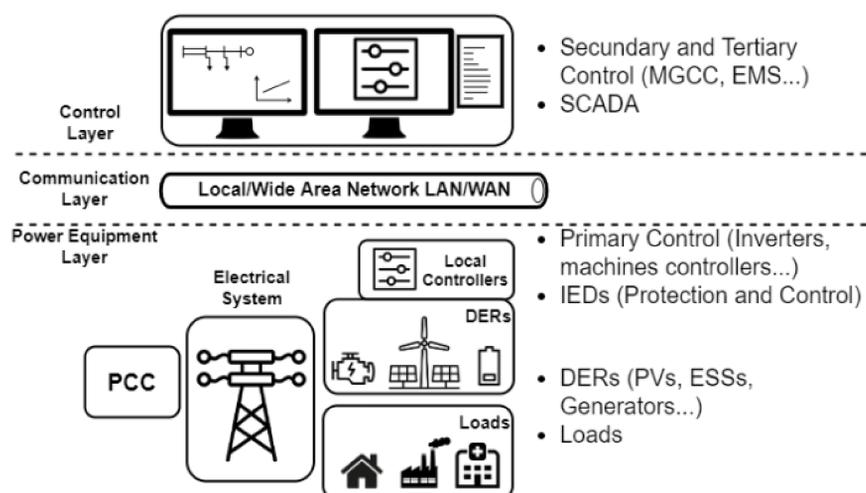


Figure 1. Microgrid Topology [2].

The Primary Control is composed of the local controllers, using local measurements, thus not requiring high level communication. The Secondary and Tertiary Control operates in this Control Layer, constituted by a high-level control system, like an optimal operation point and provide a remote supervisory of the whole system.

3 MICROGRID TESTBED

Considering the different protocols commonly used in microgrid applications such as DNP3, GOOSE, MMS, Modbus; and the raised requirements such as direct or internet link, latency, bandwidth, the Figure 2 shows the proposed testbed for communication systems using physical and/or simulated environment.

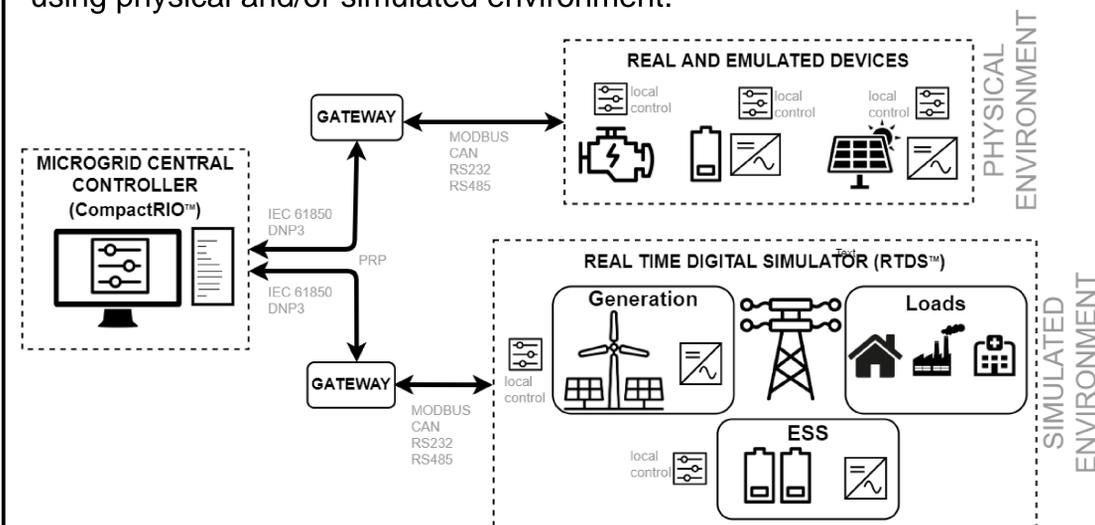


Figure 2. Proposed Testbed for Microgrid Communication.

4 CONCLUSION

- ✓ The microgrid concept is nowadays a reality that could change substantially the conception of the distribution system.
- ✓ The proposed communication layer will be able to perform control algorithms and evaluate the performance on the communication system, both in the logical and physical layer.
- ✓ The usage of ethernet networks is growing in the electrical power system, and this communication testbed was projected to be compatible with several proprietary protocols and real physical systems.
- ✓ Requirements as real-time software, time synchronization, redundancy, and scalability were also considered in the proposed topology, foreseeing updates in the communication technologies.

5 REFERENCES

- [1] A. B. Piardi, R. B. Otto, D. G. Sonoda, F. C. Santos, L. R. A. Ferreira, and R. A. Ramos, "Laboratory for analysis of microgrid with real time simulation," *Renew. Energy Power Qual. J.*, vol. 17, no. 17, pp. 188–193, 2019.
- [2] A. B. Piardi, F. C. dos Santos, D. G. Sonoda, and R. B. Otto, "Aspects of a Hybrid and Flexible Microgrid Laboratory Implementation," *XIV Symp. Spec. Electr. Oper. Expans. Plan.*, pp. 1–12, 2018



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