

# The Modelica language and the FMI standard for modeling and simulation of Smart Grids

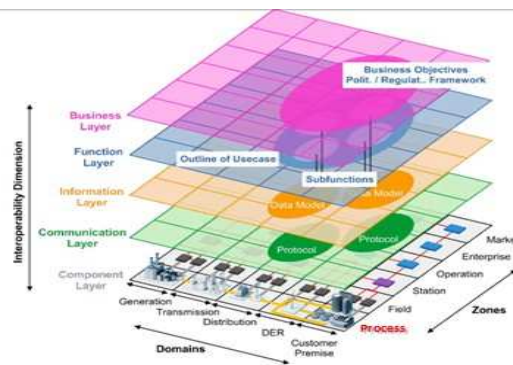
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The smart power grids will extensively rely on network control to increase efficiency, reliability, and safety; to enable plug-and-play asset integration, such as in the case of distributed generation and alternative energy sources; to support market dynamics as well as reduce peak prices and stabilize costs when supply is limited. In turn, network control requires an advanced communication infrastructure with support for safety and real-time communication (Figure1). Simulating such complex systems is required for the development of Smart Grids. Several simulation tools are available on the market but these tools have two major drawbacks: they are generally not designed to import models developed for other tools, they are not adapted to large scale complex system of systems or cyber-physical systems as smart grids which require time-consuming calculation.

One solution to bypass these drawbacks is to use a co-simulation platform which can connect together several simulators and FMUs (Functional Mock-up unit). EDF R&D is funding the development of its own co-simulation platform (MECSYCO) dedicated to the Smart Grids in partnership with LORIA-INRIA.



**Figure 1.** The Smart Grid Architecture Model (SGAM)

This paper provides first an overview of the EDF R&D Modelica library **GridSysPro** (GSP) composed of electrical components mapped on the zone related to the process of a Smart Grid (Figure1). Besides that, to comply with the modeling of large scale electrical networks, a solution to co-initialize several interconnected FMUs exported from Dymola is described.

## References

Julien Vaubourg, Yannick Presse, Benjamin Camus, Christine Bourjot, Laurent Ciarletta, Vincent Chevrier, Jean-Philippe Tavella, Hugo Morais, Boris Deneuville, & Olivier Chilard (PAAMS 2015). SmartGrid Simulation with MECSYCO.