The 12th International Workshop on Electric Power Control Centers
June 2-5, 2013 Bedford Springs, PA USA

A Unified Smart Grid Architecture Model – Methodology and Practical Application

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KEYWORDS
Interoperability, Migration, Domains, Communication, Standardization, Cyber Security

OVERVIEW
A novel smart grid architecture model has been developed, which enables utilities and industry to represent system aspects of smart grids in a holistic, consistent and comprehensive way. This methodology for visualization, validation and design of smart grid architectures is increasingly applied in research projects, standardization, utilities and vendor industry. This paper introduces the methodology and presents the experience from practical application in projects.

METHODS
An overview is given on the worldwide activities regarding smart grid standardization in the context of smart grid architectures - in Europe, US, Asia and Pacific region.
Common to these activities is the need to present functional, informational and communication specific relationships between smart grid domains and involved systems, being the motivation for the development of the architecture model. A crucial aspect was the consideration of interoperability and non-functional requirements (e.g. cyber security, reliability, energy efficiency).

The principle and basic concept of the smart grid model is introduced. The use of the model is illustrated by a representative example use case of DER integration and Voltage/Var Control function. Practical experience from use of the model is presented and discussed for the following examples:

- In standardization for the identification of gaps in standards
- In a smart grid research project for the selection and design of communication and information architecture

RESULT
The unified smart grid architecture model features the following benefits

- The model allows the representation and comparison of architectures in order to identify differences and common aspects.
- Current installations and future scenarios can be depicted in order to develop migration roadmaps towards smarter grids.

CONCLUSION
The unified smart grid architecture model is a powerful methodology for the analysis and design of smart grid architectures for the energy industry. This has been proven through various applications. Spreading increasingly in the market, this model is on the way getting a standardized smart grid methodology.
Figure: Smart Grid Architecture Model