An experiment using an Object-oriented standard – IEC 61850 to integrate IEDs Systems in Substations

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Abstract– **The integration of microprocessed equipment from different manufacturers has been a difficulty in the automation of power substations, considering that the development of protocol converters is a demanding task, with questionable and costly results for the Utilities. Even with the adoption of protocols that were particularly developed for the electric power sector, such as the IEC 60870-5 and the DNP, failed to solve all problems, as it only facilitates the communication between equipments, and a considerable engineering effort still must be made in the integration of such data. In response to such needs, the EPRI issued a set of recommendation standards that is now known as UCA. The IEC organization is working on the integration of UCA protocols, models and services for substations by means of the IEC 61850 standard. This article introduces the use of such protocol in substation automation from the user's viewpoint, analyzing the needed requirements to implement and integrate equipments using the IEC 61850 standard.**

Index Terms– **Open Supervision and Control systems, IED integration, GOMSFE, GOOSE, UCA, IEC 61850, SCADA.**

Nomenclature

UCA – Utility Communications Architecture;
IED – Intelligent Electronic Devices;
MMS – Manufacturing Message Specification;
GOOSE – Generic Object Oriented Substation Event;
GOMSFE – Generic Object Models for Substation and Feeder Equipment;
CASM – Common Application Service Model;
ACSI – Abstract Communication Service Interface;
OPC – Object Process Control;
EPRI – Electric Power Research Institute;
SCADA – Supervisory Control and Data Acquisition.

I. Introduction

In their search for a higher integration level of real time information sources, the Utilities have been investing an increasing amount of resources. In the attempt to assure the interoperability of IEDs, international entities are proposing a new object-based technology, in order to provide distributed processing features between microprocessed devices from different manufacturers.

Currently, there are 152 distinct data communication protocols used by utilities and 28 different communication protocols in specific devices, such as temperature, level and pressure sensors supplied by a variety of manufacturers [1].

In an attempt to discipline the evolution of real time automation systems used in transmission lines, power plants and substations, the EPRI issued in 1999 a set of international standards that is now known as UCA 2.0. Such standards have the purpose at improving greatly the integration of real time data produced by the use of object-oriented technology, thus contributing to decrease engineering, commissioning, operation and maintenance costs of electric automation systems.

For such purpose, this standard establishes object models that are used to logically represent the digital devices and their components; such models are known as GOMSFE. These objects also react in response to events, by means of a data model named GOOSE [2], [3].

The UCA standard differs from most of the preceding protocols by the use of an object-oriented modeling of all devices and their components. These objects define common data formats, identifiers and controls for substation equipments, such as circuit breakers, voltage regulators, and switches, e.g. substation and feeders devices. Additionally, the models specify the behavior for the devices' most common functions and enable a customization of such objects by the manufacturers.

This standard is being adopted by the suppliers of equipments and software for electric automation systems and the IEC – which is now working on the generalization of UCA protocols, models and services for substations through the IEC 61850 standard; such standard is now in the approval phase.

This technology will probably revolutionize the concepts of electrical systems automation, as it allows measuring, handling and acting on the process by means of different IEDs working on a seamless integration.

To adopt this new technology, the utilities must analyze the benefits and difficulties associated to its use; therefore, we intend to evaluate in this article, from the end user's viewpoint, the advantages and requirements related to the adoption of the IEC 61850 standard for power substation automation in the following aspects: ease of implementation

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