CIGRE Study Committee B5

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG* N° B5.53	Name of Convenor : Alex Apostolov (US)
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Technical Issues # (6): 1, 9	Strategic Directions # (2): 1, 3

The WG applies to distribution networks (4): Yes

Title of the Group: Test Strategy for Protection, Automation and Control (PAC) functions in a full digital substation based on IEC 61850 applications

Scope, deliverables and proposed time schedule of the Group :

Background:

Several past and ongoing WG have been working on test of protections and/or control systems :
- TB159 - Testing of numerical protections
- TB 401 - Functional testing of IEC61850 based systems
- Ongoing B5.45 - Acceptance, Commissioning and Field Testing Techniques for Protection and Automation systems

However, none of these Working Groups has covered the testing of a complete digital functional chain, including the use of process-bus for the transmission of the analogue values and station bus for the transmission of trip orders and other signals.

The testing of these full digital functional chains becomes an important issue with the deployment of IEC 61850-based substations using Stand Alone Merging Units, Switch Control Units and / or Non-Conventional Instrument Transformers and featuring both station bus (IEC 61850-8-1) and process bus (IEC 61850-9-2).

The use of digital buses for the transmission of Sampled Values and Signals adds new test cases to the existing functional tests for both protection and substation automation systems. Also, the design of these systems has to take into account the constraints related to functional tests after the commissioning of the systems, e.g. in the framework of maintenance.

This subject is also related to PS2 "Experience & Application of Non-Conventional Instrument Transformers and Merging Units connected to modern Digital Power system protection and Control" of the 2013 B5 colloquium.

Scope

The scope of the Working Group is the testing of the complete digital functional chain, including the use of process-bus for the transmission of the analogue values and station bus for the transmission of trip orders and other signals for protection and substation automation systems. The WG focuses on full IEC 61850 substations and equipments.
The tests in all phases of the lifecycle of these equipments are covered :
- Qualification (NCIT- Non-Conventional Instrument Transformers, SAMU - Stand Alone Merging Units, SCU - Serial Communications Units / protections)
- Interoperability tests,
- Factory Acceptance Tests,
- Commissioning and Site Acceptance Tests,
- Maintenance tests after commissioning

Recommendations for the following tests types for protections and SAS functions:
- Testing of complete functional chains of different possible configurations (NCIT-MU, SAMU, SCU)
- Test of functions acquiring values from different sources,
- Test scenarios related to communication : loss of SV, jitter, loss of synchronisation,
- Functional interoperability tests, including in particular cases with transient signals of different frequencies
- Isolation of test objects for FAT – Factory Acceptance Tests / SAT – Site Acceptance Tests / maintenance tests
- Possible approaches for partial testing of a function with verification of recovery of the different unit tests
- Test of accuracy

The following items are excluded from the WG scope :
- Test of hybrid systems, i.e. systems featuring both conventional analogue inputs and process bus
- Test and qualification of metering chains.

Interaction with other B5 WGs and with other SCs

Cf. background.
A liaison member will be nominated by SC B3 to interact with this WG.

Deliverables :

Technical Brochure, Tutorial, Electra Paper

Time Schedule : start : 2014	**Final report** : 2016

Comments from Chairmen of SCs concerned:

Approval by CIGRE Technical Committee Chairman :
Date : 09/12/2013

(1) Joint Working Group (JWG) - (2) See attached table 1 – (3) See attached table 2
(4) Delete as appropriate

Table 1: Technical Issues of the TC project "Network of the Future" (cf. Electra 256 June 2011)

1	Active Distribution Networks resulting in bidirectional flows within distribution level and to the upstream network.
2	The application of advanced metering and resulting massive need for exchange of information.
3	The growth in the application of HVDC and power electronics at all voltage levels and its impact on power quality, system control, and system security, and standardisation.
4	The need for the development and massive installation of energy storage systems, and the impact this can have on the power system development and operation.
5	New concepts for system operation and control to take account of active customer interactions and different generation types.
6	New concepts for protection to respond to the developing grid and different characteristics of generation.
7	New concepts in planning to take into account increasing environmental constraints, and new technology solutions for active and reactive power flow control.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics.
9	Increase of right of way capacity and use of overhead, underground and subsea infrastructure, and its consequence on the technical performance and reliability of the network.
10	An increasing need for keeping Stakeholders aware of the technical and commercial consequences and keeping them engaged during the development of the network of the future.

Table 2: Strategic directions of the TC (cf. Electra 249 April 2010)

1	The electrical power system of the future
2	Making the best use of the existing system
3	Focus on the environment and sustainability
4	Preparation of material readable for non-technical audience