

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP¹

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| WG N° B5.69 | Name of Convenor: Alex Apostolov (US) | |
| Strategic Directions #²: 1 | | Technical Issues #³: 6 |
| The WG applies to distribution networks⁴: Yes | | |
| Potential Benefit of WG work #⁶: 2, 3 | | |
| Title of the Group: Experience gained and Recommendations for Implementation of Process Bus in Protection, Automation and Control Systems (PACS) | | |
| <p>Scope, deliverables and proposed time schedule of the Group:</p> <p>Background:</p> <p>In recent years, an increasing number of publications reported the design or commissioning of demonstrations, pilot projects, pre-series or series of fully digital substation Protection, Automation and Control Systems (PACS) using IEC 61850 process bus. This constitutes a major development, as up to now PACS were mainly using only IEC 61850 station bus. The availability on the market of both Binary Input / output Intelligent Electronic Device (IED) (BIED), Stand Alone Merging Units (SAMU) and Low-Power Instrument Transformers (LPIT) sustains this trend.</p> <p>The scope, goals and design of these projects vary widely. This includes the number of feeders, the number of different manufacturers involved, the use of LPIT and/or SAMU, with or without trip signal to the circuit breakers (real trip / monitoring only).</p> <p>Also, the estimated or reported economic benefits show a considerable variation depending on the considered use case and context.</p> <p>In order to gain confidence and enable a realistic technical and economic evaluation of these technologies, it is necessary for the industry to obtain an overview over these projects and the experience gained and lessons learnt so far.</p> <p>It can be noted that deployment of LPIT, SAMU and BIED depends on the availability of process-bus capable PACS. The overview produced by this WG will also help utilities draft their strategy for the deployment of process bus based PACS.</p> <p>Scope:</p> <p>The general aim of the WG is to perform a review of PACS employing IEC 61850 based process bus. This review shall be based on available publications (cf. references) from demonstrators and pilot projects of PACS involving process bus.</p> <p>The Technical Brochure elaborated by the WG will include:</p> <ol style="list-style-type: none"> 1. Review of process-bus based PACS projects (demonstrations, pilot, pre-series or series), including namely the following details: <ul style="list-style-type: none"> ○ Description and list of characteristics, key figures, purpose and goals for each project. ○ Overview of publications related to these PACS. ○ Overview tables and diagrams comparing and classifying the different projects with conclusions regarding advantages and drawbacks for different aspects depending on the employed solution. ○ General evaluation of the state of the art, identified issues and probable | | |

evolutions over the coming years.

2. Experience gained for PACS with process bus, including
 - Implemented Architecture
 - Operational and Maintenance experience
 - Time synchronisation
 - Functional integration
 - Experience with Testing and Commissioning
 - Experience related to update of configuration or functional extensions
3. Economic evaluations and associated assumptions, including equipment and labour cost
4. Experience with interfacing of LPIT and SAMU to PACS applications
5. Experience with functional protection chains
 - Specifically end-to-end timing performance
 - Robustness of protection application on time synchronization dependency
6. Use of process bus to monitor High Voltage (HV) equipment or for other innovative functions
7. Recommendations for PACS with process bus based on the experience gained, covering
 - PACS process bus design
 - Design criteria for maintenance and extension
 - Update of PACS firmware, software or configuration
 - Test and commissioning

A significant number of references about PACS demonstrators have been published in the recent years. Rather than to launch an open survey, the new WG is encouraged to contact and interview authors of these publications. A participation of those authors in the WG is welcomed.

The Working Group is also encouraged to submit a paper for B5 PS2 2020 (Communication network in PACS - Experience and challenges).

Exclusions

1. Near Process Unit requirements, including monitoring of HV equipment, are covered by ongoing WG B5.59. The new WG will liaise with B5.59 in order to make sure that there is no overlapping. It shall focus on the experience feedback gained from the commissioned projects.
2. Test and commissioning aspects have been covered by B5.53. The new WG shall focus on the experience feedback gained from the testing of the projects and reference to the TB published by B5.53 when necessary.

References to be used as input:

1. CIGRE B5 PS1 2017 and PS2 2018 papers, special report and group discussion
2. PAC World issue autumn 2018
3. Papers concerning pilot projects and demonstrators published in DPSP 2018
4. CIGRE WG B5.53, B5.59, JWG B5/D2 67 reports or draft reports
5. IEC 61850 series
6. IEC 61869 series

Deliverables:

- Technical Brochure and Executive summary in Electra
- Electra report
- Tutorial⁵

Time Schedule: start: April 2019**Final Report:** September 2022**Approval by Technical Committee Chairman:****Date:** December 19th, 2018

Notes: ¹ or Joint Working Group (JWG), ² See attached Table 2, ³See attached Table 1,
⁴Delete as appropriate, ⁵ Presentation of the work done by the WG, ⁶ See attached table 3

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

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| 1 | Active Distribution Networks resulting in bidirectional flows |
| 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 (ref. Electra 249 April 2010)

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| 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 |

Table 3: Potential benefit of work

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| 1 | Commercial, business or economic benefit for industry or the community can be identified as a direct result of this work |
| 2 | Existing or future high interest in the work from a wide range of stakeholders |
| 3 | Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry |
| 4 | State-of-the-art or innovative solutions or new technical direction |
| 5 | Guide or survey related to existing techniques. Or an update on past work or previous Technical Brochures |
| 6 | Work likely to have a safety or environmental benefit |