

Key take aways

CIGRE B5 Paris session 2024

Protection and Automation



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For power system expertise



B5, Protection and Automation

- Protection
- Control
- Monitoring and Metering
- Aims to cover the whole Power system:
 - End to end
 - Transmission
 - Distribution systems
 - Generation

Some facts

- Most papers ever: 92 Accepted papers, from some 30 different countries
 - 98 Prepared contributions
 - Poster sessions: 1280 attendees
 - General Discussion meeting: 870 attendees
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- Preferential Subjects
 - PS1 Practical experiences and new developments of process bus
 - PS2 Acceptance, commissioning, and field testing for Protection, Automation and Control systems



PS1: Practical experiences and new developments of process bus

1. Reference projects (18 papers)
2. Centralized and virtualized PAC (11 papers)
3. Wide area process bus applications (5 papers)
4. Time synchronization (4 papers)
5. Process level data acquisition (7 papers)

What is process bus?

- Process Bus provides the digital link between the substation primary equipment, like switchgear and instrument transformers, and the Protection, Automation and Control (PAC) devices
- It was developed by IEC TC 57
- Process bus may highly reduce the amount of copper wiring within the substation
- In general, it also improves the safety, flexibility and efficiency of the operation and maintenance of PAC systems

PS1: Summary

- Worldwide, many process bus substations commissioned (CIGRE B5 WG B5.69)
- Process bus seems the way to go
 - Limited investigation into the economic benefits
 - Steep increase of fully digital substations
 - Same Preferential Subject as 2018 session, but most B5 papers ever
- Practical implementations demonstrate the technological interoperability maturity
- Much papers with suggested improvements at application level
- No less than 11 papers confirm the foreseen, new and promising major-scale evolution of Centralized PAC
- Different papers demonstrating vendor-independent line differential protection!
- The possibilities enabled by 5G are surprisingly a bit underexposed (in B5, but not in D2), however, the technical developments are carrier independent

PS1: Conclusions

- Love your IEC 61850 SCL file! It is crucial for network traffic management design, system configuration, data modelling and documentation.
- For critical applications, don't rely on GNSS time source. Prevent time jumps by a tough design.
- Specify and test the expected behaviour of your devices. Learn from telecom people.
- CPC and/or VPC solutions are very promising. Pilots shall be performed to gain the quality of the solutions and fill the standardisation gap.
- Nice amount, but still a limited number of contributions from DSOs. Come on DSOs, you've also great opportunities for process bus applications!
- It is nowadays and in future even more vital to master the basics of network technology
- Best Paper Award: Paper B5- 11112 (DE), "Using process bus over substation boundaries with multi-vendor line differential protection"



PS2: Acceptance, commissioning, and field testing for protection, automation and control systems

1. Engineering process and tools in Digital Substation (15 papers)
2. Application Tests in Digital Substation (10 papers)
3. Tests associated with inverter-based generation sources - IBR (7 papers)
4. Wide Area Monitoring, Protection, and Control (WAMPAC), including Travelling Waves (TW) and Synchrophasor (20 papers)
5. General testing applications (7 papers)

PS2: Summary

- A defined engineering process is crucial in the transition to the digital substations
- Tests related to the PACS of an IEC 61850 substation are essential to ensure the correct operation of the system
- One of the most critical functions is distance protection, especially on the lines that connect renewable wind and solar generation to the system
 - The effort to find better solutions also includes finding ways to test and simulate systemic conditions.
- Wide Area Monitoring, Protection, and Control (WAMPAC) as a system protection strategy advances due to the increase in the complexity of the power system
 - Testing efforts are considered as complicated

PS2: Conclusion

- The technological evolution of PAC systems leads to the continuous need to evaluate the procedures for Acceptance, commissioning, and field testing for protection, automation and control systems
 - This involves the engineering process, application of standards, compliance with regulations, application of appropriate tools and procedures
- The development is enhancing the application in a systemic view, with the application of WAMPAC, with the challenge of appropriate validation tests.
- In the digital substation, the resources defined in the standard for testing are fundamental, and must be applied in the PAC System, application of testing tools and real-time monitoring systems.
- carrying out application testing is essential, which involves simulations supported by real time digital simulators
- The qualification of the teams and the correct tools to carry out the tasks are essential



- Best Paper Award: • Paper 10263, called “Testing approach for Rte’s R#SPACE Protection Automation and Control System”

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