

Innovation type:
Test framework

TRL: 5-6

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Target group:

Actor/ purpose	x
DSO, TSO	X
Technology provider	X
Member organisation	
Market operator	
Research/ Consultancy	X
Teaching	X

Laboratory setup for testing private 5G based line protection

Challenge

Limited availability of high TRL level infrastructure to test and validate new methods, protection techniques, and emerging technologies such as 5G for next generation power systems.

Solution

Testbed integrating smart grid lab with private 5G network from NOKIA operated by NTNU has been developed. Other variant of the testbed using open source 5G software and radio platform are also integrated. Communication protocols such as IEC1850 were implemented, and the testbed has been used to test protection methods of power lines, with 5G facilitating inter-substation communication.

Potential

The developed testbed environment can be utilized to test and validate new methods, protection techniques, and customized 5G configurations tailored for real-world smart grid applications in a lab environment at a TRL level of 5 to 6.

- Engineering students, grid operators, and researchers can use the test environment to explore and gain hands-on experience with new techniques for protection in power system in a controlled setting.
- Technology providers can leverage the setup to test innovative ideas, protection schemes, or technologies in a laboratory environment.
- System operators can use the setup for practical training, to enhance their skills in new systems such as protection based on advanced communication technologies/5G.

Reference in CINELDI

- S. Sanchez-Acevedo, T.A. Zerihun, M. Khalili, H.K. Høidalen, T. Zinner: [“Line protection with 5G communication”](#), IEEE PES ISGT Europe, 14-16 October 2024.
- J.I. Hoyos Jaramillo: “Implementing Smart Grid Use-case on Top of 5G”, MSc thesis, June 2024.
- H. Lundkvist, T.A. Zerihun, H. Austad: [“Real-Time Exchange of IEC 61850 Sample Values over 5G for Grid Monitoring and Operation”](#), ICSGSC 2024 (2024 8th International Conference on Smart Grid and Smart Cities), 25-27 October 2024.

