Innovation type:
Technology

TRL: 3

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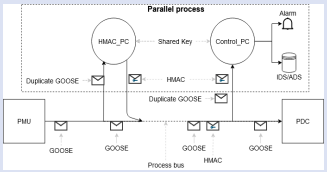
Target group:

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



Overview of the delayed integrity check concept

Concept for Delayed Integrity Check of PMU measurements

This innovation is a method for checking the integrity of synchrophasor measurements (PMU), without introducing delays to the processes depending on low latency transfer of synchrophasor measurements.

Challenge

Future power system operation is expected to rely on continuous measurements for monitoring, controlling and protection purposes, and specifically the use of synchrophasor measurements. The IEC 61850 standard defines communication protocols for electrical substations, including synchrophasor measurement transmission. However, IEC 61850 does not properly address cyber security, leaving this critical infrastructure highly vulnerable to cyber attacks.

Solution

We have developed a novel mechanism for delayed integrity check for synchrophasor measurements. Briefly stated, regular PMU traffic is sent unmodified as before, but a special device (denoted HMAC_PC in the figure) makes a local copy of each GOOSE message and calculates an HMAC code which is sent separately (with lower priority) to the receiving system. On the recipient side, another unit (Control_PC) collects the HMAC value and the GOOSE packet and verifies the correctness of the HMAC. The Control_PC needs to buffer all GOOSE messages and generate an alarm if either no HMAC message is received within a certain deadline, or if the associated HMAC is incorrect (indicating a tampered GOOSE message).

Potential

The results show that the solution manages to detect when integrity of the synchrophasor transmission is compromised, without adding any overhead or delay to the time-critical synchrophasor transmission itself.

The current proof-of-concept implementation has not been deployed in a real substation. Next step would be to implement the solution in a more realistic context, e.g. in the Smart Grid Lab. The idea has been incorporated as part of the H2020 Whitenergy proposal submitted on August 27th 2020.

Reference in CINELDI

R. Gudmestad: "Delayed Integrity Check for IEC 61850 Communication", MSc thesis at University of Stavanger.
R. Gudmestad, S. Houmb, M. Jaatun: "Saving Nine Without Stitching in Time: Integrity Check After-the-fact", 2nd International Conf. on Societal Automation