Substation Automation Systems fully under control

Immerse yourself in your SAS

During the commissioning of Substation Automation Systems (SAS) with Protection, Automation and Control (PAC), traditionally the focus of testing is on the protection system and its settings. Protection testing uses established methods, such as parameter testing per IED, or new approaches like system-based testing. Standardization and proper testing tools dramatically increase the efficiency and reliability of protection testing.

When looking at the time spent during commissioning, testing the automation and communication system nowadays consumes even more time than testing the protection. Automation systems have become increasingly complex and the efforts for testing communication and the proper operation of all signals transmitted to Supervisory Control and Data Acquisition (SCADA) systems have grown dramatically.

A new and innovative approach, implemented in StationScout, offers a way out of this dilemma in all phases of the life cycle of modern SAS. By utilizing the capabilities of the IEC 61850 engineering process and the data available in Substation Configuration Description (SCD) files, it is possible to introduce new and more efficient methods for Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT). The approach identifies potential signals to be tested in the SCD file. Communication links and the IEC 61850 services employed are recognized, documented and can be used for generating test plans. These test templates can be created during the specification phase, adapted for FAT and subsequently reused during SAT.

This unique testing solution consists of software and hardware. While the software offers a toolbox for the different tasks, the use of a dedicated test set (MBX1) instead of just another PC software opens up a number of advantages to the test engineer:

> Guaranteed cyber security and safe connection to the substation network
> Real time capabilities to calculate Sampled Values and GOOSE
> Making it possible to deliver multi-IP simulation
> Connection to several networks
> Update possibility for security patches
> Licensing

Cyber security is very important when connecting a universal software based test system, such as a laptop, directly to a SAS. That's why OMICRON has implemented a firewall system to the MBX1 that separates the testing system from the critical environment.

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System under test

The entire SAS is visualized using all the information available in the SCD file. This also covers the information in the substation section (voltage level, bay, etc.). The current standard defines possibilities to model the elements of single line diagrams while the standard presently under development, IEC 61850-6-2, will extend this feature. Current SCD files do not, in most cases, contain this information. Therefore, the proposal is to work with "zero line" to visualize the assets. Zero line means grouping by voltage level and arranging the bays and corresponding assets. The navigation in huge SAS can then be done as it is in map systems. Clicking "Go-live" visualizes the existing status.

Tracing Signals

Within a SAS, the messages are transferred from their source to all receivers. If any error occurs during this communication, the commissioning engineers need to follow the signal on its way through the SAS. Finding such errors was very time consuming in copper wired networks, with IEC 61850 this becomes almost impossible to do manually. StationScout visualizes all links and allows engineers to view how signals propagate through the SAS. To reduce complexity, filters focus the display on the relevant elements. This includes tracing signals communicated as GOOSE as well as Reports and makes troubleshooting communication problems straightforward.

Simple Naming

Because IEC61850 naming could be very confusing, StationScout recognizes the names of the respective elements in their data model, detects their purpose and visualizes them accordingly. These names could be adapted, for instance, into the local language.

Simulation

One of its essential functionalities is to simulate a SAS at any stage, for example to test the communication during the installation phase when some IEDs are not yet implemented.

Outlook

In the future, the new StationScout will enable test engineers to execute logic testing and easy testing after firmware upgrades. All of these processes can be added to test plans that will automate and accelerate the test procedures.

Author

Thomas Schossig, Product Manager Business Development Power Utility Communication at OMICRON electronics.