IEC 61850 – changing the way of testing?

Testing in an IEC 61850 environment requires new tools and offers new possibilities

The application of IEC 61850 introduces several new issues for testing substation devices. The most obvious change is the different way of wiring to obtain the signals.

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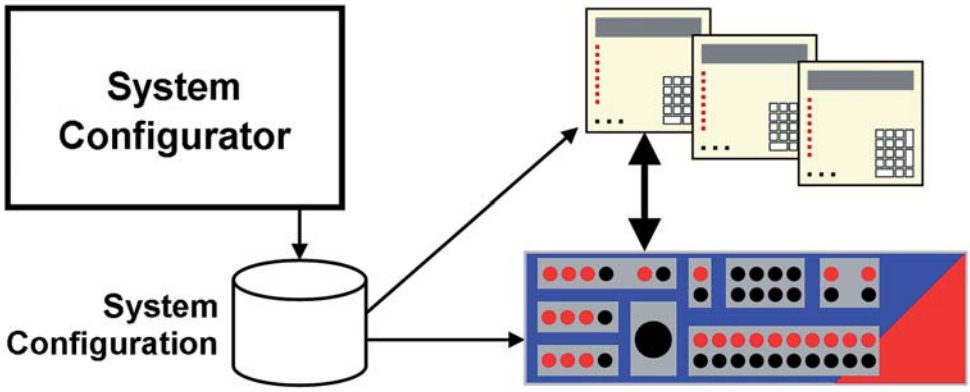

Usage of configuration information for testing

Data and protocols of different nature need to be covered. But there are other issues that change the way of testing, such as configuration. The availability of machine readable, system wide configuration information opens new possibilities for an extended testing scope (system testing).

The IEC 61850 engineering concept and testing

The use of the system configuration information enables new, automated procedures for the configuration of tests.

Many data, which formerly had to be painfully read from circuit diagrams and terminal lists are now available in the system configuration, from where a test system can read them. The automatic import also eliminates many sources of error during manual input.

GOOSE

In *classical technology*, the data exchange between the substation devices on the bay level was established by hard-wired connections between binary outputs and binary inputs of the devices. With IEC 61850, this becomes replaced by the GOOSE mechanism.

Modern test equipment must be able to connect to these GOOSE messages. The feedback from and stimulus to the devices under test that was formerly exchanged via binary I/Os, must now be established by *wiring* the test equipment to the substation network.

Sampled values

IEC 61850 specifies as well protocols for the transmission of instantaneous voltage and current values from the energy system. These data are called *Sampled Values* and will replace the secondary values.

A test equipment must be able to simulate the so-called merging units by generating Sampled Values and publishing them on the network to be subscribed by the devices under test.

Functional Testing of Protection

By "wiring" protective relays and test sets through the substation network, the test configuration is just transformed into the networked world.

Figure 2 "Fully networked" protection testing

Looking at classical testing of protection functions, the world appears not to have changed very much. Regarding the scope of test usually performed until now, this is true. The protection functions of the relays still work in the same way. E.g. testing a distance protection will be performed by using the exact same fault scenarios and

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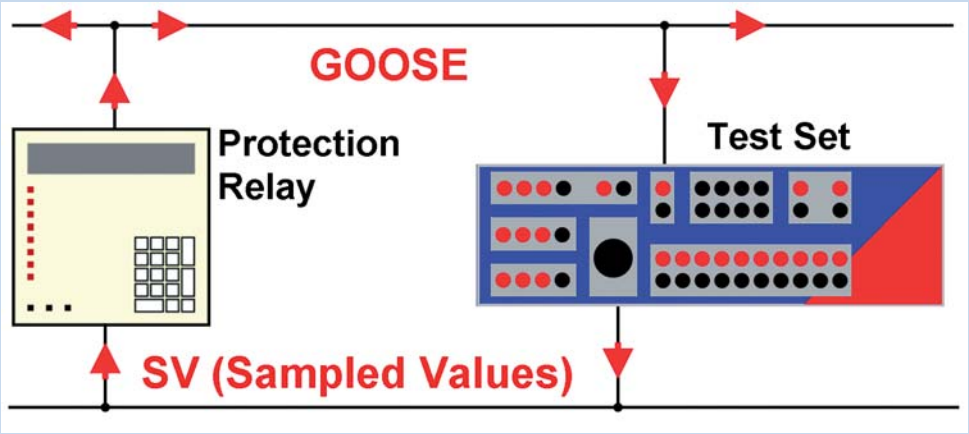
assessment criteria as before. It is important that a test system preserves the working environment from classical testing and allows the re-use of existing test procedures for use with IEC 61850.

Many aspects of the test configuration can be efficiently supported by using the substation configuration data.

Client/Server SCADA Communication

The substation devices provide a lot of additional information to be used for SCADA purposes.

With IEC 61850, these data are all served in a standardized way. By using a generic tool that works with all relays, a tester may easily look up some additional status data (e.g. specific pick-up information). This will provide extended depth of testing.



„Fully networked" protection testing

System Testing

System tests were and are already performed to a certain extent. Prominent examples are the End-to-End tests for sophisticated line protection schemes. Now, with the availability of substation wide configuration data, the feasibility of tests involving more devices is very much facilitated. Test with multiple points of test signal injection and measurement of response will become more easily to implement in IEC 61850 installations. Test sets used in such applications need to have the ability to perform coordinated and precisely synchronized tasks as a part of distributed, system wide test system. The ongoing progress of the technology prepares the ground for such systems in the near future.