WHAT IS IEC 61850?

In terms of the technology being deployed for the control, protection, and condition monitoring of the power system, we have to understand the "what" and "how" of using the new IEC 61850 technology.

By Rod Hughes, Rod Hughes Consulting

IEC 61850 has already been around for six years and will soon be the "conventional" way of doing things. In just the last two years alone the number of deployments has doubled to over four thousand substations with impressive savings in time and money. CIGRE has already published more than 10 extensive Technical Brochures on various aspects of implementation of IEC 61850 (www.e-cigre.org – members can download for free) so there is much experience which can be leveraged.

As reported by this author in the April/May 2010 issue of Transmission & Distribution ("Unlocking the real benefit of IEC 61850") there is much to be gained in using IEC 61850 but there is much to be sorted out. Large savings in project costs, months of engineering and commissioning time reduction and increased reliability don't just happen because the boxes you buy are now "IEC 61850 compliant".

PROTOCOL AS AN OPTION TO CHANGE

It is worthwhile to be clear on what IEC 61850 is not. It is NOT just a protocol as an option to change from DNP3 or Modbus. IEC 61850 goes way beyond a 1 second polling cycle or 10 millisecond time tag reporting protocol that tells you what happened in the substation "a little while ago". Changing the SCADA system protocol between the substation and the master station may be a step you take in due course but there is so much to be done to use IEC 61850 within the substation fence where it already particularly excels.

IEC 61850 is the way things work in the substation in real time by defining the structure of information and the mechanism to communicate that information. As one example, IEC 61850 defines messages for the instantaneous measurements of the current or voltage waveform taken every 0.078 milliseconds which used to be done in a proprietary way inside the relay– these samples replace the 1A CT and 110V VT connections as inputs to the protection, control and metering devices. There are real implementations which are already benefiting from the savings in wire numbering, marshalling boxes, field commissioning and cable trenches where the thousands of wires for CT and VT have been replaced by a single optical fibre.

DEFINED COMMUNICATION PROCESSES

The Standard defines that any function in the electrical plant can be created by using standardised building blocks called Logical Nodes and defines the range of parameters for configuring these Logical Nodes. The defined data structure and the defined communication processes (such as GOOSE – Generic Object Oriented Substation Event – when something happens a message is sent) means that all the device-to-device wiring can be replaced by an Ethernet connection where the interoperability has been correctly applied with the resultant elimination of engineering of wire numbers, connection schematics, terminal layouts and of course all the testing and commissioning to prove the wires are correct.

RIGHT BOXES FOR OUR APPLICATION

Indeed the standard achieves interoperability of devices. However, buying a new compliant box does not mean that "any box can be used any old how". Just as buying the right nut and bolt, we have to buy the right boxes for our application which depends on what capabilities it provides, what options within that part of the Standard are available and how up to date it and the other boxes are. If the system requires a certain capability or number of elements in the devices, it is best to buy boxes that provide the requirements – perhaps it is obvious (apparently not from some specifications I've seen) but that means you have to first define your system and what it does before you buy any boxes.

REUSABLE ENGINEERING

Most often ignored is that IEC 61850 is also the engineering process to design the automation system. There are many stages, organisations and departments involved in producing the design of the substation. From the time the single line diagram is conceived to the time the plant is commissioned there is a vast volume of information collated into specifications and drawings so as to convey the physical implementation from one person to another and one software tool to another. The Substation Configuration Language defined in Part 6 of the Standard deals with the exchange and evolution of information at each step in the engineering cycle so as to produce one coherent engineering file which describes the entire functioning of the system – what relates to what, what parameters are set, what signals are sent – all in one file. The engineering process is therefore where REUSABLE ENGINEERING will provide the biggest impact allowing an entire new bay to be implemented in minutes rather than weeks. Choosing the right tools and using them according to the Standard can easily be forgotten when a vendor is trying to sell the ability to configure their box to get the sale.

IS IT JUST FOR THE SUBSTATION?

We had to start somewhere with the substation arena but the title has just been changed subtly as "Communication networks and systems for power utility automation". We now have special models for hydro power plants and distributed generation whilst wind turbines are modelled in accordance with IEC 61850 under a companion reference IEC 61400-25. The Standard is currently being enhanced (so called Edition 2) to provide for substation-to-substation requirements in particular. Collaboration also continues between IEC 61850 and the Common Information Model (CIM) used for SCADA master station configuration.

WHAT ARE THE OPERATIONAL IMPACTS?

Getting rid of wires saves lots of money and lots of time in design and construction but this must be achieved in the context of being able to operate the substation for the next 70-80 years.

Reliability is a major benefit of IEC 61850 knowing that new bays or replacement equipment can be implemented using the same messages as already in service without having to start again drawing wires.

Asset owners also insist on certain operator facilities and arrangements for test block arrangements for wire-based systems. The Standard provides specific elements to enable operation and test of the system but attention must be given to the physical provision of these facilities. Indeed, as an Ethernet system, the new SAS has the opportunity to increase security of who is doing what, provide automation of routine isolation tasks and provide an appropriate location away from electrical hazards to connect laptops and test equipment. Just as a brain surgeon can't operate on himself, a device should not be used to isolate itself, patented solutions provide secure access, control and testing of the SAS which allow the asset owner to standardise on systems without the confusion of different devices and different procedures for each. td

www.rodhughesconsulting.com