STUDY COMMITTEE B5

ACTIVITY REPORT

January 2010

SC B5 COVERS POWER SYSTEM PROTECTION, AUTOMATION, METERING AND MONITORING

The scope of Study Committee B5 “Protection and Automation of Substations” covers the basic principles, design, application and management of power system protection, substation control, automation, monitoring, recording and metering – including associated internal and external communications and interfacing for remote control and monitoring.

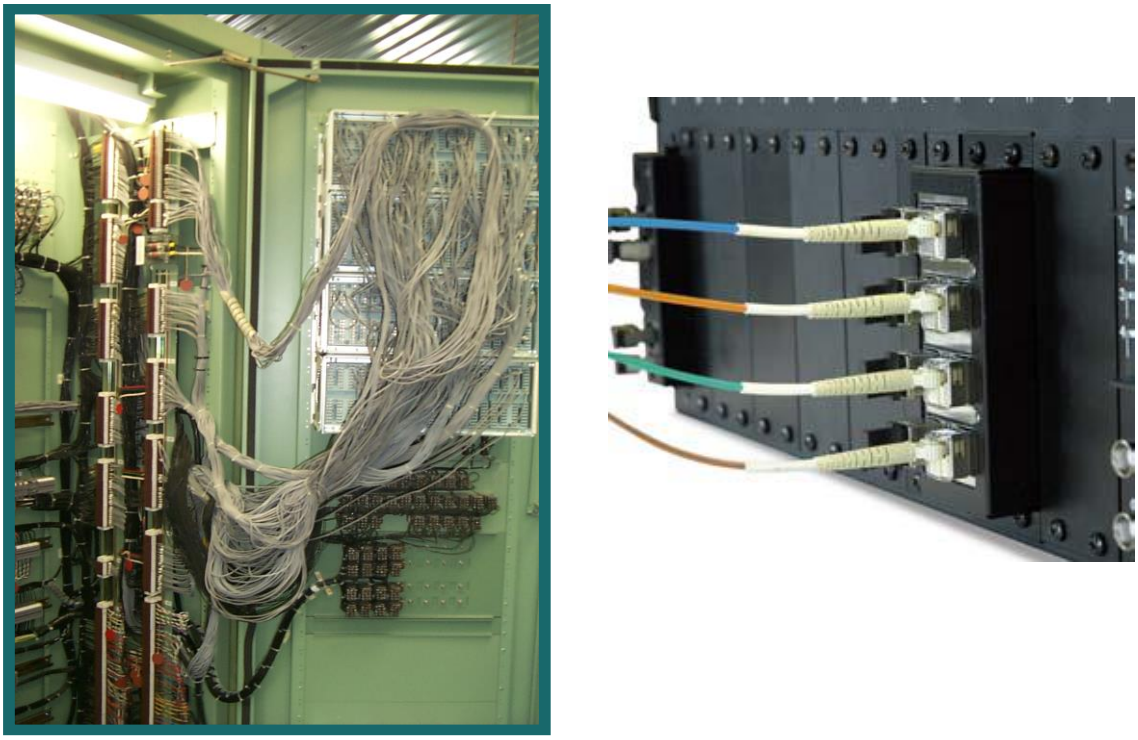

Figure 1 Past and Future of Substation Protection and Automation System

At present, the field of Protection and Automation of Substations is facing a complete change because of the large scale introduction of Digital and Information Technology. New technologies now offer seemingly unlimited opportunities for new protection and automation functions. However, the application of these new techniques has an important impact in the utility organisation. Utilities have difficulty in achieving the expected benefits of the new applications. Now the key issue is not the technology, but the way this technology is applied.

In addition, protection systems have new challenges as a consequence of the increasing connection of Distributed Generation. The network of the future will result in new requirements for the protection system.

THE MAIN DRIVER FOR TECHNOLOGICAL CHANGE IS THE IEC STANDARD 61850

This standard was published in 2004 and allows communication between protection and control devices from different vendors. More importantly, the standard defines a common data model for the whole substation. Substation functions can now be described in structured text (XML). This allows the automatic management of information through all the stages of the substation life cycle as seen in figure 2. This should result in a significant cost reduction for users and suppliers.

Figure 2 Substations Automation Systems Life Cycle

However, the application of digital Substation Automation Systems has a significant impact in the current organization of utilities. It implies new roles and responsibilities for operation, protection, communication and SCADA staff. Additionally, new skills and capabilities should be developed. Maintenance of Digital Substation Automation Systems has been one of the preferential subjects of the B5 2009 Colloquium in Jeju (Korea). The main conclusion has been that a paradigm change in the maintenance strategy is needed. Another conclusion was that much work remains to be done for maintenance testing.

In this regard, WGB5.32 has recently published a Technical Brochure that addresses the needs of utilities, integrators and testers on functional testing of IEC 61850 based systems. A method is proposed based on XML as a suitable way to describe functions to develop automatic testing systems. This report has been submitted as a proposal to IEC TC57 WG10.

Present applications of 61850 are mainly at substation bus level. This means the connection between the station and the bay level. The standard 61850 also includes the concept of a process bus. A Process bus addresses all connections between bay level devices and process equipment including breakers and switches and instrument transformers. The concept implies the substitution of conventional wiring by optical fiber, with the consequential cost reduction.

According to the SC B5 session in 2008, this technology is ready for large scale application but it may be required in future to work on standardization for the integration of modules from multiple vendors. In this regard, a new WG has been set up to address the requirements on transient response of a complete signal processing chain, including Merging Units and Non-conventional Instrument Transformers.

THE APPLICATION OF THE NEW DIGITAL TECHNOLOGY REPRESENTS NEW OPPORTUNITIES AND CHALLENGES

Digital technology allows the integration of several protection and control functions within a single device. This implies a reduction in the number of devices and in the overall cost. However, it may challenge long established utility practices such as separation of protection and control functions, protection redundancy criteria and back up protection policies. In 2009, WG B5.13 delivered a TB about the impact of Functional Integration. The main conclusion is that the technology is available but users are not ready to change their well established practices. Application of the concept of functional integration will require a full understanding of all possible implications. In this regard a new WG will address the development of standardized protection schemes for specific types of circuits and the potential to save time, resources and cost.

One of the main enablers of this new technology is the communication system. Traditionally, there has been a knowledge gap between protection and communication people. This gap has significantly increased in recent years. On one hand it is difficult for protection people to keep up to date with the rapid evolution of communication technology. On the other hand, deregulation has resulted in some cases where communication services are provided by public communication companies. In order to try to reduce this gap a joint B5/D2 WG has been introduced in 2009. Also a Joint B5/D2 session will be held in the Paris session in 2010.

NEW PROTECTION REQUIREMENTS ARISING FROM THE NETWORK

It should be noted that technology is not the only driver for changing substation secondary systems. The limitation in the construction of new lines and connection of large renewable generation in remote areas from the load has resulted in an increased application of non conventional technology.

In 2009 WG B5.10 has published a TB regarding the protection of series compensated lines. The installation of series compensation requires the previous analysis of existing protection schemes and, in some cases, the replacement of a large number of protective relays.

The application of an HVDC system has significant implications for the protection system. For instance, the problem of how to protect and properly co-ordinate the protection within an AC system taking into account the HVDC converter performance and control response during disturbances and faults. A joint working group between B5 and B4 has been launched to identify possible and potential undesirable impacts on protection, and to provide guidelines and recommendations on how to solve these issues.

High impedance faults are one of these very important issues. If an energized primary conductor makes electrical contact with a quasi-insulated object such as a tree branch, the current flowing to ground is so low that it cannot be

detected by conventional relays. WG B5.94 has presented in 2009 a TB compiling the practices and experiences of electricity companies worldwide with High Impedance Faults. In spite of the important progress that has been made with current systems, it is still not possible to guarantee the full detection of High Impedance Faults on Distribution Networks.

Another conventional problem that requires further study is the protection of cables. This is driven by the increasing installation of underground cable in the supply of large cities. A new WG addresses the Short circuit protection of circuits with mixed conductor technologies in transmission networks.

In conclusion, Substation secondary systems are facing a complete change. The role of SC B5 is to facilitate the development and application of new technological solutions in order to satisfy the reliability requirements of modern networks, and to improve the efficiency of utilities and manufacturers organizations.