lamaPLC Communication: IEC 61850 basic

IEC 61850 is an international standard defining communication protocols for intelligent electronic devices at electrical substations. It is a part of the *International Electrotechnical Commission's* (IEC) Technical Committee 57 reference architecture for electric power systems.

The abstract data models defined in IEC 61850 can be mapped to various protocols. Current mappings in the standard are to Manufacturing Message Specification (MMS), **GOOSE** (*Generic Object Oriented System Event*) [see section 3, Terms and definitions, term 3.65 on page 14], SV (*Sampled Values*) or SMV (*Sampled Measure Values*), and so on to web services.

In the previous version of the standard, GOOSE stood for *"Generic Object Oriented Substation Event"*; however, this old definition is still commonly used in IEC 61850 documentation. These protocols can run over TCP/IP networks or substation LANs, utilizing high-speed switched Ethernet to achieve the necessary response times of less than four milliseconds for protective relaying.

IEC 61850 features include

- **Data modelling** – Primary process objects, as well as protection and control functionality in the substation, are modelled into different standard logical nodes, which can be grouped under different logical devices. There are logical nodes for data/functions related to the *logical device* (LLN0) and *physical device* (LPHD).
- **Reporting schemes** – There are various reporting schemes (BRCB & URCB) for reporting data from the server through a server-client relationship, which can be triggered based on pre-defined trigger conditions.
- **Fast transfer of events** – *Generic Substation Events* (GSE) are defined for fast transfer of event data for a peer-to-peer communication mode. This is again subdivided into GOOSE & GSSE.
- **Setting groups** – The *Setting Group Control Blocks* (SGCB) are defined to handle setting groups, allowing the user to switch to any active group according to their requirements.
- **Sampled data transfer** – Schemes are also defined to handle the transfer of sampled values using Sampled Value Control blocks (SVCB)
- **Commands** – Various command types are also supported by IEC 61850, which include direct & *Select Before Operate* (SBO) commands with regular and enhanced security.
- **Data storage** – *Substation Configuration Language* (SCL) is defined for the complete storage of configured substation data in a specific format.

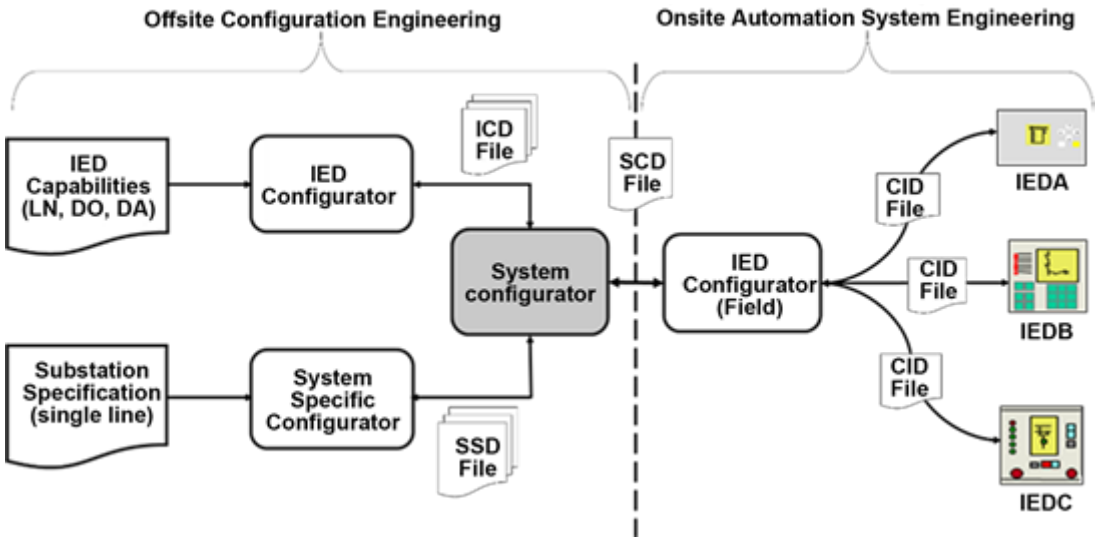
Substation Configuration Language (SCL)

Substation Configuration Language (SCL) is an XML-based language defined in IEC 61850-6 for configuring Intelligent Electronic Devices (IEDs) and the communication infrastructure within an electrical substation. It enables the interoperable exchange of configuration data, describing the substation's structure, IEDs, their logical functions (as represented by logical nodes), and associated data.

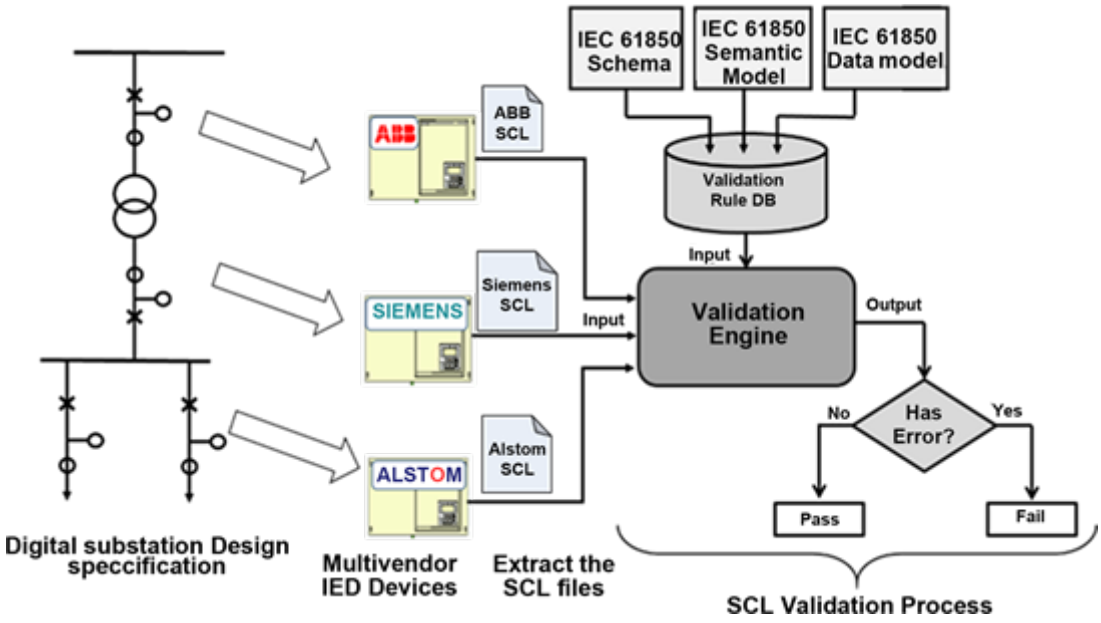
SCL facilitates complete system configuration by providing a standardized way for different software tools to exchange and understand substation automation system data.

The SCL file is a critical element in the complete life cycle of an SA system, including design, commissioning, testing, and evaluation. To implement a simple and easy technique for exchanging data between engineering tools at various levels of the SA system, it is essential to design a single file format compatible with all devices. This is achieved using the SCL file, as it can, in its design process, take into account the different and sometimes proprietary data definitions and data formats.

The SCL file contains the static description of an IED that is IEC 61850 compatible. It helps to describe the capabilities of the IED device. It can also serve as a means to document the complete system for easy analysis, especially during extensions and retrofitting. By developing a database library of substation configurations in the form of single-line diagrams, it is possible to easily adjust the substation system design to check for compatibility and perform performance measurements before actual implementation. The SCL file can be used to generate and analyze the semantic model of the IED under consideration, with or without reference to the manufacturer’s documentation.



The SCL file can also be used to retrieve a section of the IED using the self-description capability of the IED for verification against the standard. It can serve as a means to create a virtual IED on a computer using the appropriate simulation tools. It can be used in conjunction with the appropriate simulation tools to test various communication scenarios and techniques that cannot be implemented physically due to the associated costs.



Sources

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IEC 61850 SCL Validation Using UML Model in Modern Digital Substation: https://www.scirp.org/journal/paperinformation?paperid=86998

1-wire topics on lamaPLC

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