1 Project specification phase – initial structuring of addresses and data

1.1 Introduction

A typical project will start with the utility creating a project specification that defines scope of the project, single line diagrams, device ratings and other required data. The aim is to create a set of technical specifications that can be used for tendering and engineering, irrespective of whether design and installation work will be done in-house or by external parties.

In order to use communication according to IEC 61850, the specification phase should include actions that are indicated below.

1.2 Substation definition files

Naming of devices in the IEC 61850 environment is done with the help of the Substation Configuration description Language (SCL), which is defined in IEC 61850-6.

IEC 61850-6 specifies the files used to create the overall communication framework in the substation. The central file is the SCD (Substation Configuration Description) file. The base for this file is a SSD (System Configuration Description) file that holds the address structure as specified by the purchaser.

In order to create the SCD file a number of ICD (IED Capability Description) files are inserted into the original SSD file. The ICD files are provided by the manufacturer, one file for each type of physical device that shall be included in the communication structure.

Once the SCD file has been created, one CID (Configured IED Description) file is exported back to each individual physical device. The CID file consists of the ICD file completed with the actual addressing structure (address of the IED itself as well as addresses to other devices from where it shall collect information).

If required, a couple of more files can be used: An IID (Instantiated IED Description) is used to transfer settings and parameters from the IED back to the SCD file, a SED (System Exchange Description) is used to transfer information between SCD files, if more than one SCD file is used in the substation (e.g. if there is more than one owner).

Table 1 – Configuration language file types

File type	Formal name	Created by
SSD	System Specification Description	Purchaser (utility)
ICD	IED Capability Description	IED manufacturer
SCD	Substation Configuration Description	System integrator
CID	Configured IED Description	System integrator
IID	Instantiated IED Description	Commissioning engineer
SED	System Exchange Description	System integrator

By system integrator is meant the party that is responsible for the installation of equipment in the substation, which could be someone else than the manufacturer of the devices or the utility. The commissioning party might again be separate from the system integrator. One main reason for having an address convention defined by the purchaser is this division of responsibilities. It is important that everyone involved uses to a correct naming in accordance with the standard and does it in the same manner.

1.3 Designations and addressing

1.3.1 Basic structure

The naming scheme of IEC 61850 is based on the following structure:

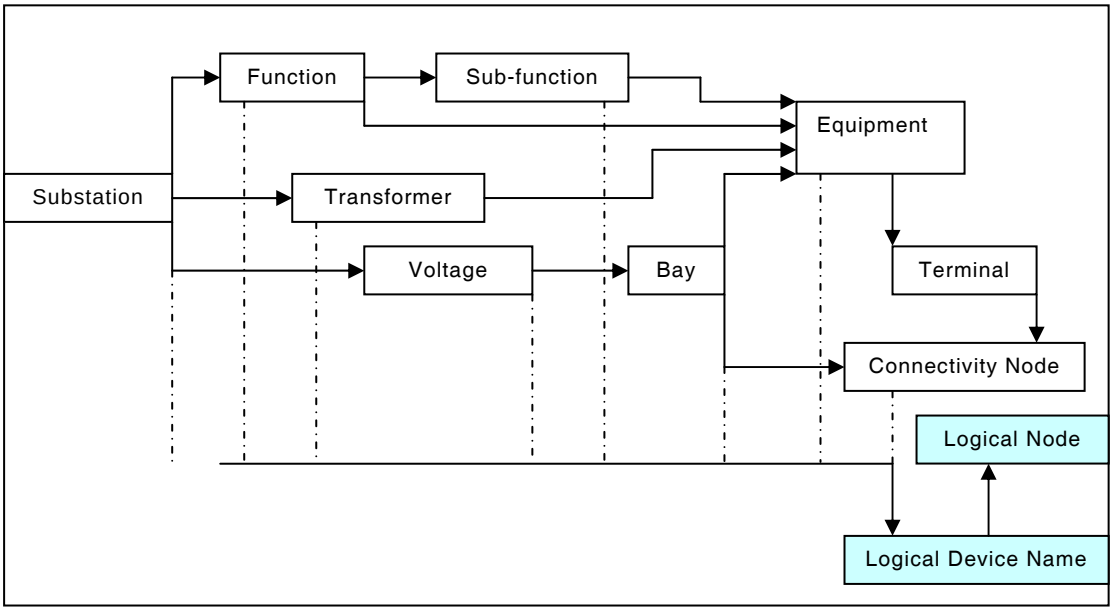

Figure 1 – Object model of SCL

The address string that points to a specific Logical Node is the sum of designation at each level, from the substation name, depending on which way through the structure best suits the IED in question.

The IEC 61850 series does only standardise the names of the Logical Node classes and names of the data objects being part of a logical node. The standard further assumes that a number of Logical Nodes are assembled into a Logical Device. Neither the exact content nor the name of a Logical Device is standardised. The format of the total address string is however defined in IEC 61850-7-2.

The following characters are allowed in the name strings: A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z, _, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

When using a separator between different elements of the name, the slash (/) shall be used in the LD Name part and the stop (.) in the Data Name section.

1.3.2 Using a utility specified designation system

If nothing else is requested by the utility, reference designations according to IEC 61436-2 shall be used.

However, most utilities have their own designation systems, especially for the high voltage equipment. An established system of designations and equipment labels is part of the operational and personnel safety of the plant. In order to avoid confusion, the existing system of designation should in such cases be adhered to as far as possible. Some modifications might however be required in order to comply with the basic rules of addressing as specified in IEC 61850-7-2.

As seen from figure 1, addresses must follow the structure that best suits the use of the device.

- Bay related equipment: Substation name/ voltage level name/ bay name/ device name

- Transformer related equipment: Substation name/ transformer name/ voltage level name or bay level name/ device name
- Substation level common equipment: Substation name/ function name/ sub-function name/ device name

The substation name must be unique within the external network to which it will be connected. The next level, transformer, voltage level and function names shall be unique within the substation. Names used in lower levels must be unique within the context of the level above.

1.3.3 IP addresses

It is the responsibility of the utility to prepare an IP address plan for its network.

1.4 Requirements on redundancy

Redundancy in the communication system can be achieved in different ways. The network topology can be arranged to achieve more or less redundancy:

- Star-connection through a single point of connection – no redundancy.
- Ring-type connection – redundant against loss of one section of the communication media.
- Duplicated star-connections – full redundancy.
- Duplicated ring-type connections – full redundancy with an extra margin against loss of a connection link.

A different level of redundancy is provided by IEDs and how they are arranged:

- A single IED with one communication port – no redundancy.
- A single IED with two communication ports – redundancy against loss of one section of the communication media but no redundancy at IED level.
- Two (redundant) IEDs with one communication port each – full redundancy on IED level, full redundancy on communication level if the communication network also is duplicated.
- Two (redundant) IEDs with two communication ports each – full redundancy with extra margin against the loss of a connection link.

Full redundancy at IED or communication system levels requires fully separated sources of energy supply to devices within each redundant part.

It is possible to mix different levels of redundancy within one substation, the purchaser and supplier should agree on the extent of redundancy for different types of devices.

Redundancy shall be modelled in the configuration file, two redundant devices must have individual names, e.g. /Main1Dst and /Main2Dst for two distance protections on the same transmission line.

1.5 Functional specification

A functional specification prepared by the purchaser should clearly present all required functions; the specification should though avoid indicating how functions should be allocated logical and physical devices.

However, if for redundancy or other security reasons certain functions must be located in separate physical devices, this should be specified.