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Seamless Telecontrol Communication Architecture (sTCA)

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IEC TC 57 has issued recently the International Standards IEC 60870-5-101/104 (telecontrol) and IEC 60870-5-103 (Informative interface for protection). On the market there are now many standard-compliant products available, which are used world-wide.

The new Standard Series **IEC 61850** with standard definitions for the station bus and the process bus for applications within substation automation systems is implemented in devices before being issued as a final standard. The expectation is that this Standard Series will have a great impact on vendors as well on users already in 2001. With regard to the basic concepts and content IEC 61850 provides provisions for re-using comprehensive models. The content goes far beyond the Standard Series 60870-5. The main features of IEC 61850 are:

— **general modelling method** for **distributed automation systems**,
— Definition of **typical process Information** for, e.g., protection**,** control, supervision, and exchange of sampled measured CT and VT values,
— **general information** (e.g. measurands, status, counter values),
— **general communication services** for all process applications,
— **general IT-solutions** as Ethernet, TCP/IP and XML.

Up to now the communication within the substation and between substation and control centre were connected with gateways. With substation automation systems based on the new Standard Series IEC 61850 it makes no sense to keep up this separation and convert protocols and information objects for the control centre vice versa. Rather the general expectation is, that the station bus within the substation can also be used for substation to control centre communication (telecontrol). Details of the new concept with its advantages and features are described below.

Taking this into account the committee IEC TC 57 has set up a task force to analyse the standard series IEC 61850 for telecontrol applications within a seamless TC 57 target architecture at its meeting in June 2001. Members of this task force are the convenors of the concerned working groups of TC 57 (WG 03, WG 07, WG 11 und WG 12) as well as other well known experts.

The first proposal for the

Seamless Telecontrol Communication Architecture (sTCA)

based on IEC 61850 will be discussed within the IEC TC 57 Strategic Policy Advisory Group (SPAG) at the next meeting in spring 2002. With this strategy the first word-wide standardised seamless process communication architecture based on general communication platforms will be possible for energy network operators and other process automation application domains.

The seamless communication based on IEC 61850 has great influence on the future data communication not only within telecontrol systems and substation automation systems but also within and between network operators for electricity, gas and water. The Standard IEC 61850 is also a candidate for other applications, e.g. for wind power plants (IEC TC 88) and gas and water utilities.

With the reasons given above the sTCA is expected to become the kernel activity of TC 57 with an importance far beyond the current scope of TC 57. The sTCA complies with the essential requirements of the enlarged application domain.

To protect the investment in current solutions and installations based on the IEC 60870-5 and IEC 60870-6 standard is an crucial issue when introducing more advanced standard-based solutions. A migration path from the current standard series to IEC 61850 is an essential objective of the IEC TC 57 standardisation, users and vendors. The first proposal of the sTCA will provide a migration path for the current solutions.

Advantages and features of the new seamless telecontrol communication architecture

- Elimination of gateways for conversion of protocols and formats because the communication platform for local communication within the substation (substation bus) and telecontrol is the same (see **figure 1**).
- Instead of a gateway a proxy is used within the substation to present the information objects to the control centre.
- Control centres have individual access rights to the information objects of the substation and can subscribe for information objects published by the directly from the information object or from a proxy (see **figure 2**).
- Transport and routing between substation and control centres can be done by TCP/IP over a router network using logical paths. Compared with dedicated fixed lines redundant logical paths eliminate the need for a physical switch over from a failed link to a reserve link.
- The IP router network can also be used for engineering stations providing direct access over logical paths to IEDs (Intelligent Electronic Devices) in the substation for remote configuration and setting of parameters without the need of separate physical links.
- The information objects are identified with self-describing names instead with numerical addresses (for crucial reports an optimised addressing is defined).
- The device-oriented names of information objects can be mapped in the proxy to process-oriented technological names because the control centre application is process-oriented and logical devices of the substation are therefor hidden.
- Essential parts of the meta data can be exchanged, e.g., technological name, information type, dimension, unit, range of values, and dead band value for reporting (self-describing objects) are inherent part of the communication.
- The TC 57 security architecture for open networks using IP will be part of the sTCA.

In general the sTCA leads to potential less costs for design, configuration, installation, operation, and maintenance combined with higher performance compared with current solutions. Energy network operators which implement this architecture have a comparative advantage in the market. Vendors have the chance to unify and streamline there product lines and lower their cost. Besides this the new architecture offers many possibilities for the product development and differentiation in the market.

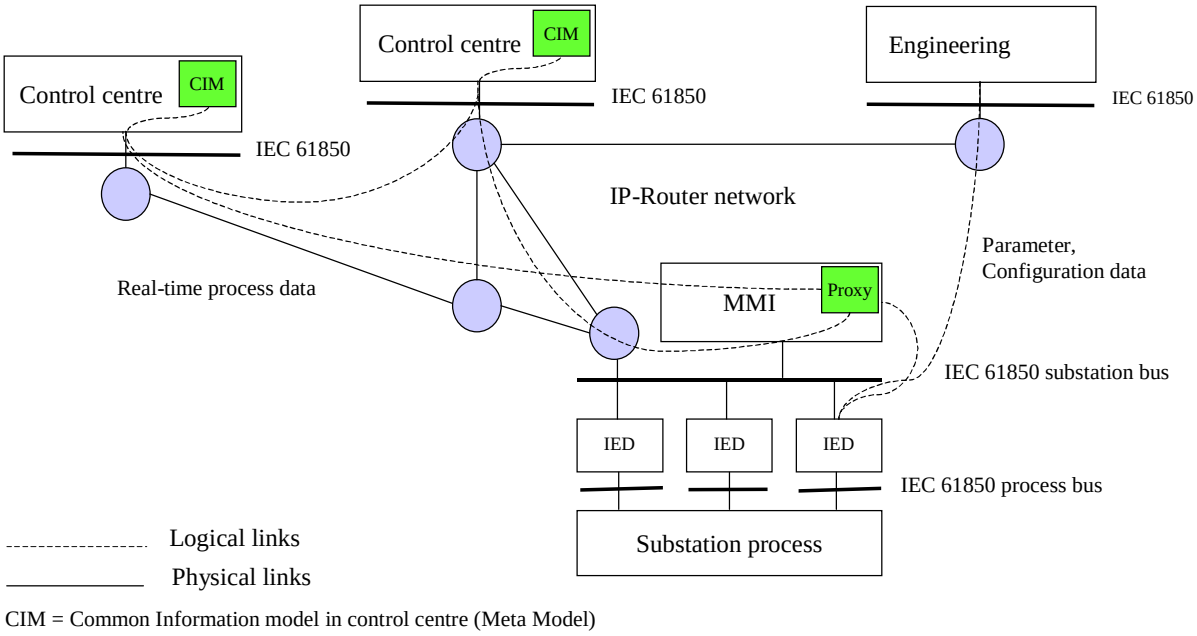

Figure 1: Seamless Communication architecture from the process to the control centres without gateways

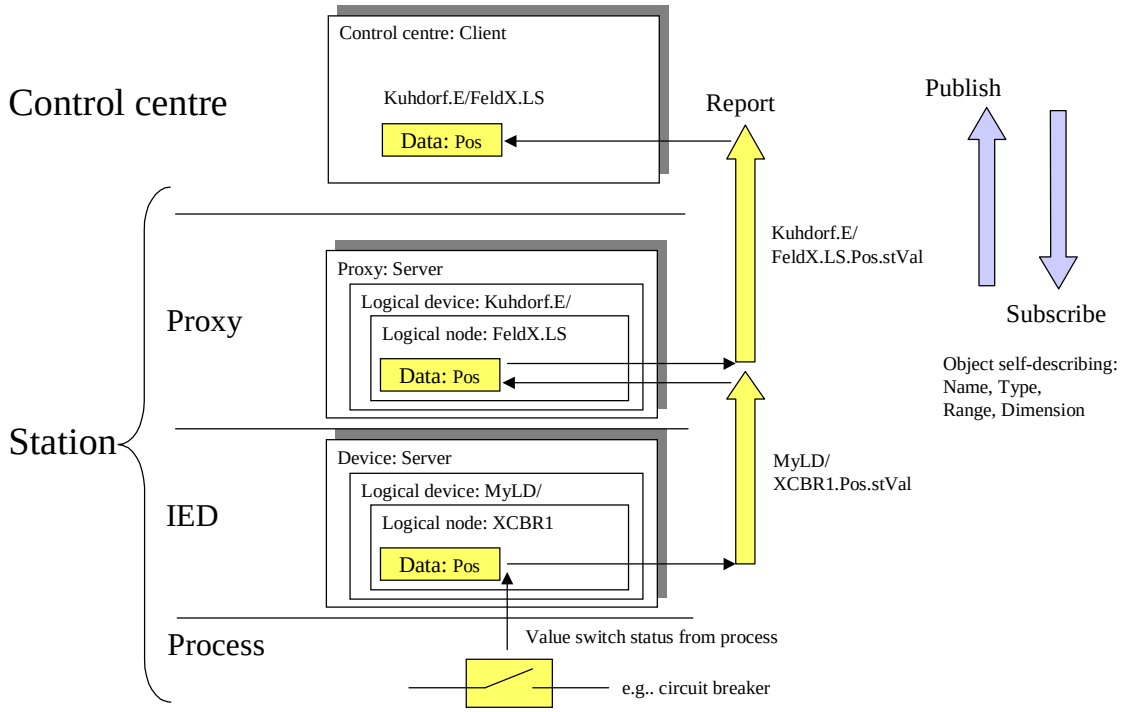

Figure 2: Seamless communication platform and data modelling with inherent meta data

The realisation of sTCA affords the following additional standardisation activities:

- Co-operation with and support to IEC TC 57, SPAG, to perform the action items making IEC 61850 ready for telecontrol.
- Detailed description of the sTCA architecture with identification of necessary further standardisation activities.
- Co-operation and standardisation within WG10, 11, and12 for IEC 61870 to be extended to meet all requirements for sTCA..
- Co-operation with WG13 to map the IEC 61850 information objects to the CIM meta data model (Common Information Model, future Standard IEC 61970-301) of the process, especially to the measurand object within the SCADA packet.
- Co-operation with WG15 for the extension of IEC 61850 to comply with the TC 57 security architecture.
- Co-operation with standardisation bodies outside the IERC TC 57 (e.g., with IEC TC 88 and IEEE SCC 36).