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BSI Standards Publication

Communication networks and systems for power utility automation

Part 7-500: Basic information and communication structure – Use of logical nodes for modeling application functions and related concepts and guidelines for substations

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee PEL/57, Power systems management and associated information exchange.

A list of organizations represented on this committee can be obtained on request to its secretary.

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FOREWORD

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IEC TR 61850-7-500, which is a technical report, has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
57/1817/DTR	57/1865/RVDTR

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61850 series, published under the general title *Communication networks and systems for power utility automation*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of IEC 61850, which is a technical report, shows the use of Logical Nodes as defined in IEC 61850-7-4 for application functions in the substation domain. IEC 61850 defines Communication Networks and Systems for Power Utility Automation, and more specifically the communication architecture for subsystems like substation automation systems. The sum of all subsystems may also result in the description of the communication architecture for the overall power system management. The defined architecture provides in IEC 61850-7-x both a power utility-specific data model and also a substation domain specific data model with abstract definitions of data objects classes and services independently from the specific protocol stacks, implementations, and operating systems. The mapping of these abstract classes and services to communication stacks is outside the scope of IEC 61850-7-x and may be found in IEC 61850-8-x and in IEC 61850-9-x.

IEC 61850-7-1 gives an overview of the basic communication architecture to be used for all applications in the power utility domain. IEC 61850-7-3 defines common attribute types and common data classes related to all applications in the power system domain. The attributes of the common data classes may be accessed using services defined in IEC 61850-7-2. These common data classes are used in this part to define the compatible data objects classes.

To reach interoperability, all data objects in the data model (IEC 61850-7-4, IEC 61850-7-3) need a strong definition with regard to syntax and semantics. The semantics of the data objects are mainly provided by names assigned to common logical nodes and data objects they contain as defined in IEC 61850-7-4, and dedicated logical nodes are defined in domain-specific parts (IEC 61850-7-x) e.g. for hydro power control systems in IEC 61850-7-410. Interoperability is reached with minimum effort if as many as possible of the data objects are defined as mandatory. Because of different philosophies and technical features, some data objects, especially settings, were declared as optional in this edition of the standard. After some experience has been gained with this standard, this decision may be reviewed in the next edition of the relevant parts of the standard.

A data object with full semantics is only one of the elements required to achieve interoperability. Standardized access to the data objects is defined in compatible, power utility and domain specific services (see IEC 61850-7-2). Since data objects and services are hosted by devices (IED), a proper device model is also needed. To describe both the device capabilities and the interaction of the devices in the related system, a configuration language is also needed as defined in IEC 61850-6 by the System/Substation Configuration description Language (SCL).

A lot of functions in power systems are complex combinations of local Logical Nodes in one IED, or distributed Logical Nodes in many IEDs linked by a dedicated data exchange. For some functions different solution concepts exist resulting in different implementations. Depending on the kind of differences they may result in increased requirements for system integration engineering tools or, in the worst case, destroy interoperability. The goal of this informative document is to show the most common application of Logical Nodes in modelling simple and complex application functions, to improve common understanding in modelling and data exchange in general, and finally to stimulate implementations which support in any case interoperability.

The data model of IEC 61850 i.e. the Logical Nodes (LN) contain only the data provided by the application functions described but not the source where the data which are needed as input for the application functions are from. This gap is also closed in this document either expicitely by naming the input data or implicitely by showing the connections between the different LNs used.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 7-500: Basic information and communication structure – Use of logical nodes for modeling application functions and related concepts and guidelines for substations

1 Scope

This part of IEC 61850, which is a technical report, describes the use of the information model for devices and functions of IEC 61850 in applications in substation automation systems, but it may also be used as informative input for the modeling of any other application domain. In particular, it describes the use of compatible logical node names and data objects names for communication between Intelligent Electronic Devices (IED) for use cases. This includes the relationship between Logical Nodes and Data Objects for the given use cases. If needed for the understanding of the use cases, the application of services is also described informatively. If different options cannot be excluded they are also mentioned.

The modelling of the use cases given in this document are based on the class model introduced in IEC 61850-7-1 and defined in IEC 61850-7-2. The logical node and data names used in this document are defined in IEC 61850-7-4 and IEC 61850-7-3, the services applied in IEC 61850-7-2. The naming conventions of IEC 61850-7-2 are also applied in this document.

If extensions are needed in the use cases, the normative naming rules for multiple instances and private, compatible extensions of Logical Node (LN) Classes and Data Object Names defined in IEC 61850-7-1 are considered.

IEC 61850-7-5 describes in examples the use of logical nodes for modeling application functions and related concepts and guidelines in general, independently from any application domain respectively valid for all application domains in the electric power system (substation automation, distributed energy resources, hydro power, wind power, etc.). This document describes in examples the use of logical nodes for application functions in substation automation including also line protection between substations. It also implies some tutorial material where helpful. However it is recommended to read IEC 61850-5 and IEC 61850-7-1 in conjunction with IEC 61850-7-3 and IEC 61850-7-2 first.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60255-24/IEEE C37.111:2013, *Measuring relays and protection equipment – Part 24: Common format for transient data exchange (COMTRADE) for power systems*

IEC 61588, *Precision clock synchronization protocol for networked measurement and control systems*

IEC TS 61850-2, *Communication networks and systems in substations – Part 2: Glossary*