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TECHNICAL REPORT

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Communication networks and systems for power utility automation – Part 90-11: Methodologies for modelling of logics for IEC 61850 based applications

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COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-11: Methodologies for modelling of logics for IEC 61850 based applications

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Technical report IEC 61850-90-11 has been prepared by Technical Committee 57: Power systems management and associated information exchange.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2. This IEC standard includes Code Components i.e. components that are intended to be directly processed by a computer.

Such content is any text found between the markers <CODE BEGINS> and <CODE ENDS>, or otherwise is clearly labelled in this standard as a Code Component.

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Table 1 shows all tracking information of (Tr)IEC 61850-90-11:2019A namespace building-up.

Table 1 – Tracking information of (Tr)IEC 61850-90-11:2019A namespace building-up

Attribute	Content
Namespace IEC specific information	
Version of the UML model used for generating the document (informative)	WG10built7
Date of the UML model used for generating the document (informative)	2020-05-19
Autogeneration software name and version (informative)	j61850DocBuilder 01v03 based on jCleanCim 02v02-NS beta6

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

Enquiry draft	Report on voting
57/2129A/DTR	57/2211/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.

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- withdrawn,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.

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, describes the methodologies for the modelling of logics for IEC 61850 based applications. IEC 61850 defines communication networks and systems for power utility automation, and more specifically the communication architecture for subsystems like power system automation systems. The defined architecture in part IEC 61850-7-x provides both a power utility specific data model and 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 can 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 can be accessed using services defined in IEC 61850-7-2. These common data classes are used in this part to define the compatible data object classes.

To reach interoperability, all data objects in the data model (IEC 61850-7-3, IEC 61850-7-4) need a strong definition with regard to syntax and semantics. The semantics of the data objects is mainly provided by names assigned to common logical nodes defined and data objects they contain, as defined in part IEC 61850-7-4, and dedicated logical nodes defined in domain specific parts like for hydro power control systems (IEC 61850-7-410).

A data object with full semantics is only one of the elements required to achieve interoperability. The standardised 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 intelligent electronic devices (IED), a proper device model is needed also. To describe both the device capabilities and the interaction of the devices in the related system, also a configuration language is needed as defined in part IEC 61850-6 by the System Configuration description Language (SCL).

Besides the application of functions based on predefined logical nodes as given by IEC 61850-7-4 or other domain standards, there is a need to manage project specific logic schemes. These logic schemes define logic operations across logical nodes implementing a function. An increased benefit of IEC 61850 system engineering is the capability of the IEDs to handle such user programmable logics modelled with IEC 61850 concepts. This document provides a standardised methodology to describe and manage logic which is applicable for both on a local function as well as for distributed function logic.

Logics are not limited to functions represented by GAPC class as described in this document. The modelling principles can be applied to all LN classes containing the needed information. Since GAPC class offers the widest flexibility in application, which goes with the usage of logics, this LN class is taken as an example in this document.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 90-11: Methodologies for modelling of logics for IEC 61850 based applications

1 Scope

1.1 General

This part of IEC 61850, which is a Technical Report, describes the methodologies for the modelling of logics for IEC 61850 based applications in power utility automation. In particular, it describes the functional view of logic based on existing logical nodes for generic process automation and the operational modes of the logic. Furthermore it includes the specification of the standard language to be applied to specific the logic as well as the related data exchange format between engineering tools and their application as well as the mapping of logic elements to IEC 61850 data types.

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

If extensions are needed in the application examples, 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.

This document describes the use of IEC 61850 extensions for modelling logics, therefore it implies some tutorial material. However it is advisable to read IEC 61850-6 and IEC 61850-7-1 in conjunction with IEC 61850-7-3 and IEC 61850-7-2 first and IEC 61131-3 as reference for the programming language of logic.

The different logics included in any IED in an IEC 61850 based system can be classified into two groups:

- Fixed Logic: These logics are predefined mostly for critical and complex functions. They are typically included in the IED´s defined application, potentially implemented in software, firmware or hardware, and are not modifiable with IEC 61850 tools and services. These logics are implementation specific. Fixed logic is out of the scope of this document.
- Editable Logic: These are user configurable / programmable logics which shall be modelled through IEC 61850 configuration tools and be accessible by IEC 61850 services. These logics can be application specific.

The major goal of this document is to adopt the given functionality of an IED to fit to specific application function demands. This is to provide a definition of the methodology for describing and exchanging logics using an IEC 61850 compatible solution. As a benefit the same logic description will be valid and vendor-independent, so it could be used for different IEDs. It is up to the tools to understand this standard description in order to be able to manipulate the logics and to properly configure the IEDs.

Graphical representation of logic is currently out-of-scope of the IEC 61850 series, even if it is part of the PLCopen XML specification. The representation is subject to the engineering tools.

Modelling logics requires some extension of the currently defined data model and / or an extension of the content in the SCL files which is described and which needs to be considered in later editions of IEC 61850-6 and IEC 61850-7-4.

Some examples are included for guidance in Annex B.

1.2 Published versions of this standard and related namespace name

This technical report defines two namespaces:

- An IEC 61850 data model namespace (NSD)
- An SCL schema namespace (SCL)

Table 2 provides an overview of the references between the published versions of this standard and the related namespace names.

Table 2 – Reference between published versions of the standard and related namespace name

Edition	Publication date	Webstore	Namespace NSD	Namespace http://www.iec.ch/61850/2019/SCL/90-11
Edition 1.0	2020-06	IEC TR 61850-90-11:2020	(Tr)IEC 61850-90-11:2019A	2019A2

1.3 Namespace name and version

Table 3 shows all attributes of the data model namespace.

Table 3 – Attributes of data model namespace

Attribute	Content
Namespace nameplate	
Namespace Identifier	(Tr)IEC 61850-90-11
Version	2019
Revision	A
Release	2
Full Namespace Name	(Tr)IEC 61850-90-11:2019A
Namespace Type	transitional
CodeComponentName	NSD
Namespace dependencies	
extends	IEC 61850-7-4 version:2007 revision:B
Namespace transitional status	
Future handling of namespace content	The name space (Tr)IEC 61850-90-11:2019A is considered as "transitional" since the models are expected to be included in further editions IEC 61850-7-4xx. Potential extensions/modifications may happen if/when the models are moved to the International Standard status

Table 4 shows all the attributes of the XML schema namespace

Table 4 – Attributes of xsd namespace

Attribute	Content
Namespace nameplate	
Namespace Identifier (xmlns)	http://www.iec.ch/61850/2019/SCL/90-11
XSD version header attribute	2019A2
Recommended reference name	eIEC61850-90-11SCL
Version	2019
Revision	A
Release	2
CodeComponentName	SCL

1.4 Code Component distribution

1.4.1 General

Each Code Component is a ZIP package containing at least the electronic representation of the Code Component itself and a file describing the content of the package (IECManifest.xml).

The life cycle of a code component is not restricted to the life cycle of the related publication. The publication life cycle goes through two stages, Version (corresponding to an edition) and Revision (corresponding to an amendment). A third publication stage (Release) allows publication of Code Component in case of urgent fixes of InterOp Tissues, thus without need to publish an amendment.

Consequently, new release(s) of the Code Component may be released, which supersede(s) the previous release, and will be distributed through the IEC TC57 web site at:

http://www.iec.ch/tc57/supportingdocuments

The latest version/release of the document will be found by selecting the file for the code component with the highest value for VersionStateInfo, e.g. IEC_TR_61850-90-11.NSD.{VersionStateInfo}.light.zip.

1.4.2 Data model namespace code component

The data model code component is an NSD file as specified in IEC 61850-7-7. It will be available in a light and full version:

- The full version contains definition of the whole data model defined in this standard with the documentation associated and access is restricted to purchaser of this part
- The light version does not contain any documentations but contains the whole data model as per full version

The light version is freely accessible on the IEC website for download at:

http://www.iec.ch/tc57/supportingdocuments/IEC_TR_61850-90-11.NSD.2019A2.light.zip.

but the usage remains under the licensing conditions.

In case of any differences between the downloadable code and the IEC pdf published content, the downloadable code(s) is(are) the valid one; it may be subject to updates. See history files.

1.4.3 XML schema namespace code component

The SCL code component namespace is an XML schema file. It will be available in a full version.

The full version is freely accessible on the IEC website for download at:

http://www.iec.ch/tc57/supportingdocuments/IEC_TR_61850-90-11.SCL.2019A2.full.zip

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In case of any differences between the downloadable code and the IEC pdf published content, the downloadable code(s) is(are) the valid one; it may be subject to updates. See history files.

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 61131-3, *Programmable controllers – Part 3: Programming languages*

IEC TS 61850-1-2, *Communication networks and systems for power utility automation – Part 1-2: Guideline on extending IEC 61850*

IEC 61850-5, *Communication networks and systems for power utility automation – Part 5: Communication requirements for functions and device models*

IEC 61850-6, *Communication networks and systems for power utility automation – Part 6: Configuration description language for communication in electrical substations related to IEDs*

IEC 61850-7-1, *Communication networks and systems for power utility automation – Part 7-1: Basic communication structure – Principles and models*

IEC 61850-7-2, *Communication networks and systems for power utility automation – Part 7-2: Basic information and communication structure – Abstract communication service interface (ACSI)*

IEC 61850-7-3, *Communication networks and systems for power utility automation – Part 7-3: Basic communication structure – Common data classes*

IEC 61850-7-4:2010, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes*

Extensible Markup Language (XML) 1.0 (Fifth Edition), W3C Recommendation 26 November 2008 (available at http://www.w3.org/TR/2008/REC-xml-20081126/)

PLCopen XML, XML formats for IEC 61131-3 (available at http://www.plcopen.org)