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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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# 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 committee manager.

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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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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.

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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 |
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| **Namespace IEC specific information** | |
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| 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- withdrawn,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.

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# 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.