



IEC 61850-7-1

Edition 2.1 2020-08
CONSOLIDATED VERSION

INTERNATIONAL STANDARD



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.200

ISBN 978-2-8322-8823-8

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	11
INTRODUCTION	13
1 Scope	14
2 Normative references	14
3 Terms and definitions	15
4 Abbreviated terms	16
5 Overview of the IEC 61850 series concepts	17
5.1 Objective	17
5.2 Topology and communication functions of substation automation systems	18
5.3 The information models of substation automation systems	19
5.4 Applications modelled by logical nodes defined in IEC 61850-7-4	21
5.5 The semantic is attached to data	24
5.6 The services to exchange information	26
5.7 Services mapped to concrete communication protocols	28
5.8 The configuration of the automation system	28
5.9 Summary	29
6 Modelling approach of the IEC 61850 series	30
6.1 Decomposition of application functions and information	30
6.2 Creating information models by stepwise composition	32
6.3 Example of an IED composition	34
6.4 Information exchange models	35
6.4.1 General	35
6.4.2 Output model	36
6.4.3 Input model	40
6.4.4 Model for statistical and historical statistical data	50
6.4.5 Model for system functions	53
7 Application view	55
7.1 General	55
7.2 First modelling step – Logical nodes and data	57
7.3 Mode and behaviour of a logical node	60
7.4 Use of measurement ranges and alarms for supervision functions	60
7.5 Data used for limiting the access to control actions	61
7.6 Data used for blocking functions described by logical nodes	61
7.7 Data used for logical node inputs/outputs blocking (operational blocking)	61
7.7.1 General	61
7.7.2 Blocking incoming commands	62
7.7.3 Blocking process outputs	62
7.7.4 Blocking the communication of status outputs updates	62
7.8 Data used for testing	63
7.8.1 General	63
7.8.2 Multicast signals used for simulation	63
7.8.3 Input signals used for testing	64
7.8.4 Test mode	66
7.9 Logical node used for extended logging functions	66
8 Device view	67

8.1	General.....	67
8.2	Second modelling step – logical device model	68
8.2.1	The logical device concept.....	68
8.2.2	The device nameplate.....	69
8.2.3	Gateways and proxies.....	70
8.2.4	Logical devices for monitoring external device health.....	74
8.2.5	Logical devices management hierarchy.....	74
9	Communication view.....	76
9.1	General.....	76
9.2	The service models of the IEC 61850 series	76
9.3	The virtualisation	78
9.4	Basic information exchange mechanisms	79
9.5	The client-server building blocks.....	81
9.5.1	Server.....	81
9.5.2	Client-server roles	82
9.6	Logical nodes communicate with logical nodes	83
9.7	Interfaces inside and between devices	84
10	Where physical devices, application models and communication meet.....	85
11	Relationships between IEC 61850-7-2, IEC 61850-7-3 and IEC 61850-7-4	86
11.1	Refinements of class definitions.....	86
11.2	Example 1 – Logical node and data object class	87
11.3	Example 2 – Relationship of IEC 61850-7-2, IEC 61850-7-3, and IEC 61850-7-4 ..	91
12	Formal specification method	93
12.1	Notation of ACSI classes	93
12.2	Class modelling	93
12.2.1	Overview	93
12.2.2	Common data class	95
12.2.3	Logical node class	99
12.3	Service parameters tables	101
12.4	Referencing instances	102
13	Namespaces.....	105
13.1	General.....	105
13.2	Namespaces defined in the IEC 61850-7-x series	106
13.3	Namespaces dependencies	110
13.3.1	General.....	110
13.3.2	Basic namespaces dependencies	110
13.3.3	Other namespaces dependencies	112
13.4	Specification of namespaces.....	113
13.5	Attributes for references to namespaces	113
13.5.1	General.....	113
13.5.2	Attribute for logical device namespace (IdNs)	114
13.5.3	Attribute for logical device basic namespace (LLN0.NamPIt.InNs).....	114
13.5.4	Attribute for logical node namespace (InNs).....	115
13.5.5	Attribute for data namespace (dataNs).....	115
13.5.6	Attribute for common data class namespace (cdcNs)	115
13.5.7	Attribute for naming a common data class name (cdcName)	115
13.6	Deprecation of namespaces	116
14	Common rules for new version of classes and for extension of object classes	116

14.1	General.....	116
14.2	Basic rules	116
14.2.1	General.....	116
14.2.2	Use of optional information	119
14.2.3	General rules for enumerations types and enumeration-based data objects and attributes.....	119
14.3	Rules for extensions within private namespace	119
14.3.1	Rules for LN classes	119
14.3.2	New LN classes	120
14.3.3	Rules for Common Data Classes	120
14.3.4	Rules for enumeration types and enumeration-based data objects and attributes	121
14.4	Extensions made within product standard namespaces	121
14.5	Extensions made within transitional namespaces	121
14.6	Extensions made within basic and domain namespaces	121
14.7	Multiple instances of LN classes for dedicated and complex functions	122
14.7.1	Example for time overcurrent	122
14.7.2	Example for PDIS	122
14.7.3	Example for power transformer	122
14.7.4	Example for auxiliary network	122
14.8	Specialisation of data by use of number extensions	123
14.9	Examples for new LNs	123
14.10	Example for new Data.....	123
15	Compatibility between different versions of the standard	124
Annex A	(informative) Overview of logical nodes and data	125
A.1	Compatible logical node classes and data classes (IEC 61850-7-4)	125
A.1.1	List of LN groups (IEC 61850-7-4)	125
A.1.2	LN classes (IEC 61850-7-4).....	125
A.1.3	Data object classes (IEC 61850-7-4).....	125
A.2	Common data class specifications (IEC 61850-7-3)	125
Annex B	(informative) Allocation of data to logical nodes	127
Annex C	(informative) Use of the substation configuration language (SCL)	130
C.1	General.....	130
C.2	SCL and options in logical nodes	130
C.3	SCL and options in data	131
Annex D	(xxx)	132
Annex E	(informative) Relation between logical nodes and PICOMs	133
Annex F	(informative) Mapping the ACSI to real communication systems.....	134
F.1	General.....	134
F.1.1	Mapping example (IEC 61850-8-1).....	136
Annex G	(normative) LGOS/LSVS engineering	142
G.1	General.....	142
G.2	LGOS/LSVS engineering by the ICT	143
G.3	LGOS/LSVS engineering by the SCT	144
Annex H	(normative) GOOSE/SMV Subscription Configuration	146
H.1	General.....	146
H.2	SCT supplied input binding workflow.....	147
H.3	ICT supplied input binding (for later binding).....	148

Annex I (informative) Specification of namespaces for Edition 3	149
I.1 Namespaces dependencies	149
I.1.1 General.....	149
I.1.2 Namespaces dependencies	149
I.2 Example 2 – Standardized data objects used in standardized LNs	150
I.3 Example 3 – Edition 2 device: standardized data object introduced in IEC61850-7-4:2007B	151
I.4 Example 4 – Edition 2 device: standardized LN introduced in IEC61850-7-4:2007B	152
I.5 Example 5 – Edition 1 device: Logical nodes in technical reports	153
I.6 Example 6- Edition 2.1 device: Logical nodes in technical reports defining new CDCs.....	155
I.7 Example 7- Edition 2.1 device: devices for product family standards	156
I.8 Example 8 – Standardized logical nodes introduced by other domain applications	157
I.9 Example 9 – Standardized logical nodes introduced by other domain applications than moved to IEC 61850-7-4	159
Annex J (normative) Use case scenarios examples for clarifying the common rules of Clause 14	162
J.1 General.....	162
J.2 Example 1 – Private LN using standardized DOs	162
J.3 Example 2 – Standardized data objects used in standardized LNs	163
J.4 Example 3 – Edition 2 device: standardized data object introduced in IEC61850-7-4:2007B	163
J.5 Example 4 – Edition 2 device: standardized LN introduced in IEC61850-7-4:2007B	164
J.6 Example 5 – Edition 1 device: Logical nodes in technical reports	165
J.7 Example 6- Edition 2.1 device: Logical nodes in technical reports defining new CDCs.....	167
J.8 Example 7- Edition 2.1 device: devices for product family standards	168
J.9 Example 8 – Standardized logical nodes introduced by other domain applications	169
J.10 Example 9 – Standardized logical nodes introduced by other domain applications than moved to IEC 61850-7-4	171
Annex K (normative) General requirements and recommendations regarding compatibility issues between different versions of IEC 61850.....	174
K.1 Overview.....	174
K.1.1 General.....	174
K.1.2 Definitions (to go to part 2):	174
K.1.3 Introduction to compatibility discussion	175
K.1.4 Assumptions	175
K.1.5 Generic rules	176
K.1.6 Overview on use cases	177
K.2 Use cases related to the data model	181
K.2.1 Use case 1: Add new type	181
K.2.2 Use case 2: Add new FC.....	181
K.2.3 Use case 3: Extend CDC with elements of existing types and FCs	182
K.2.4 Use case 4: Add a new DataObject (DO) based on new CDCs	183
K.2.5 Use case 5: Add a new DO based on existing CDCs	184
K.2.6 Use case 6: Rename a DO.....	184
K.2.7 Use case 7: Rename a DA, subDO or subDA	184

K.2.8	Use case 8: Deprecation of a FC	185
K.2.9	Use case 9: Deprecation of a DA	186
K.2.10	Use case 10: Removal of a DA	186
K.2.11	Use case 11: Deprecation of a DO	187
K.2.12	Use case 12: Use a weaker presence condition	187
K.2.13	Use case 13: Use a stronger presence condition	188
K.2.14	Use case 14: Extend Enumeration List with an enumerated value	188
K.2.15	Use case 15: Modification of an Enumerated value	189
K.2.16	Use case 16: Deprecation of an Enumerated value	190
K.2.17	Use case 17: Extension of a PACKED LIST	190
K.2.18	Use case 18: Extend Name Length	190
K.3	Use cases related to the services I.....	191
K.3.1	Use case 30: Add new type.....	191
K.3.2	Use case 31: Using new control block class	192
K.3.3	Use case 32: Using new services	192
K.3.4	Use case 33: Extending control block class with an attribute of existing type	193
K.3.5	Use case 34: Rename a service parameter not associated with a control block attribute	193
K.3.6	Use case 35: Removing / Deprecating Control Block Classes	193
K.3.7	Use case 36: Using a stronger presence condition.....	194
	Bibliography.....	195
	Figure 1 – Relations between modelling and mapping parts of the IEC 61850 series	17
	Figure 2 – Sample substation automation topology	19
	Figure 3 – Modelling approach (conceptual).....	20
	Figure 4 – Logical node information categories	23
	Figure 5 – Build-up of devices (principle)	23
	Figure 6 – Position information depicted as a tree (conceptual)	24
	Figure 7 – Service excerpt	27
	Figure 8 – Example of communication mapping	28
	Figure 9 – Summary	30
	Figure 10 – Decomposition and composition process (conceptual).....	31
	Figure 11 – XCBR1 information depicted as a tree	33
	Figure 12 – Example of IED composition.....	35
	Figure 13 – Output and input model (principle).....	36
	Figure 14 – Output model (step 1) (conceptual)	37
	Figure 15 – Output model (step 2) (conceptual)	38
	Figure 16 – GSE output model (conceptual).....	38
	Figure 17 – Setting data (conceptual)	39
	Figure 18 – Input model for analogue values (step 1) (conceptual)	41
	Figure 19 – Range and deadbanded value (conceptual).....	42
	Figure 20 – Input model for analogue values (step 2) (conceptual)	43
	Figure 21 – Reporting and logging model (conceptual).....	44
	Figure 22 – Data set members and reporting	45
	Figure 23 – Buffered report control block (conceptual)	46

Figure 24 – Buffer time	47
Figure 25 – Data set members and inclusion-bitstring	48
Figure 26 – Log control block (conceptual).....	48
Figure 27 – Peer-to-peer data value publishing model (conceptual)	49
Figure 28 – Conceptual model of statistical and historical statistical data (1)	51
Figure 29 – Conceptual model of statistical and historical statistical data (2)	53
Figure 30 – Concept of the service tracking model – Example: control service tracking.....	55
Figure 31 – Real world devices	56
Figure 32 – Logical nodes and data (IEC 61850-7-2)	57
Figure 33 – Simple example of modelling	58
Figure 34 – Basic building blocks	58
Figure 35 – Logical nodes and PICOM	59
Figure 36 – Logical nodes connected (outside view in IEC 61850-7-x series).....	59
Figure 37 – Mode and behaviour data (IEC 61850-7-4)	60
Figure 38 – Data used for limiting the access to control actions (IEC 61850-7-4)	61
Figure 39 – Data used for logical node inputs/outputs blocking (IEC 61850-7-4)	62
Figure 40 – Data used for receiving simulation signals.....	63
Figure 80 – GOOSE subscription supervision state machine	64
Figure 81 – SV subscription supervision state machine.....	64
Figure 41 – Example of input signals used for testing	65
Figure 42 – Test mode example	66
Figure 43 – Logical node used for extended logging functions (GLOG)	67
Figure 44 – Logical device building block	68
Figure 45 – Logical devices and LLN0/LPHD	69
Figure 46 – The common data class DPL	70
Figure 47 – Logical devices in proxies or gateways.....	72
Figure 79 – Logical devices in proxies or gateways (functional naming).....	73
Figure 48 – Logical devices for monitoring external device health	74
Figure 49 – Logical devices management hierarchy	75
Figure 50 – ACSI communication methods	77
Figure 51 – Virtualisation	79
Figure 52 – Virtualisation and usage	79
Figure 53 – Information flow and modelling	80
Figure 54 – Application of the GSE model.....	80
Figure 55 – Server building blocks	81
Figure 56 – Interaction between application process and application layer (client/server)	82
Figure 57 – Example for a service.....	82
Figure 58 – Client/server and logical nodes	82
Figure 59 – Client and server roles	83
Figure 60 – Logical nodes communicate with logical nodes.....	84
Figure 61 – Interfaces inside and between devices	85
Figure 62 – Component hierarchy of different views (excerpt)	86

Figure 63 – Refinement of the DATA class.....	87
Figure 64 – Instances of a Data object class (conceptual).....	91
Figure 65 – Relation between parts of the IEC 61850 series	92
Figure 66 – Abstract data model example for IEC 61850-7-x.....	94
Figure 67 – Relation of TrgOp and Reporting.....	99
Figure 68 – Sequence diagram	102
Figure 69 – References.....	102
Figure 70 – Use of FCD and FCDA	103
Figure 71 – Object names and object reference	105
Figure 72 – Definition of names and semantics	106
Figure 73 – Name space as class repository	107
Figure 74 – All instances derived from classes in a single name space	108
Figure 75 – Instances derived from multiple namespaces	109
Figure 76 – Inherited namespaces	109
Figure 77 – Basic namespaces dependencies.....	111
Figure 78 – Other namespaces dependencies.....	112
Figure 78 – Basic extension rules diagram.....	117
Figure B.1 – Example for control and protection LNs combined in one physical device	127
Figure B.2 – Merging unit and sampled value exchange (topology)	128
Figure B.3 – Merging unit and sampled value exchange (data)	128
Figure C.1 – Application of SCL for LNs (conceptual)	130
Figure C.2 – Application of SCL for data (conceptual).....	131
Figure E.1 – Exchanged data between subfunctions (logical nodes)	133
Figure E.2 – Relationship between PICOMS and client/server model	133
Figure F.1 – ACSI mapping to an application layer.....	134
Figure F.2 – ACSI mappings (conceptual).....	135
Figure F.3 – ACSI mapping to communication stacks/profiles	136
Figure F.4 – Mapping to MMS (conceptual).....	136
Figure F.5 – Mapping approach	137
Figure F.6 – Mapping detail of mapping to a MMS named variable.....	138
Figure F.7 – Example of MMS named variable (process values)	138
Figure F.8 – Use of MMS named variables and named variable list.....	139
Figure F.9 – MMS information report message.....	140
Figure F.10 – Mapping example.....	141
Figure G.1 – LGOS/LSVS engineering	143
Figure G.2 – LGOS/LSVS engineering by ICT.....	144
Figure G.3 – LGOS/LSVS engineering by the SCT.....	145
Figure H.1 – GOOSE/SMV subscription engineering workflow.....	146
Figure H.2 – SCT supplied input binding	147
Figure H.3 – ICT supplied input binding (for later binding).....	148
Figure I.1 – Private LN using standardized DOs (Edition 2).....	150
Figure I.2 –Standardized data objects used in standardized LNs.....	151

Figure I.3 – Edition 2 device: standardized data object introduced in IEC61850-7-4:2007B	152
Figure I.4 – Edition 2 device: standardized LN introduced in IEC61850-7-4:2007B.....	153
Figure I.5 – Edition 1 device: Logical nodes in technical reports	154
Figure I.6 – Edition 2 device: Logical nodes in technical reports	155
Figure I.7 – Edition 2.1 device: Logical nodes in technical reports defining new CDCs	156
Figure I.8 – Edition 2.1 device: standardized LNs extended by other domains	157
Figure I.9 – Edition 2 device: standardized LN introduced in IEC 61850-7-420:2009	158
Figure I.10 – Edition 2.1 device: standardized LN introduced in IEC 61850-7-420:2015	159
Figure I.11 – Edition 2 device: standardized LN moved from introduced in IEC 61850-7-420:2009 to IEC 61850-7-4:2007	160
Figure I.12 – Edition 2.1 device: standardized LN moved from introduced in IEC 61850-7-420:2009 to IEC 61850-7-4:2007	161
Figure J.1 – Private LN using standardized DOs (Edition 2)	162
Figure J.2 –Standardized data objects used in standardized LNs	163
Figure J.3 – Edition 2 device: standardized data object introduced in IEC61850-7-4:2007B	164
Figure J.4 – Edition 2 device: standardized LN introduced in IEC61850-7-4:2007B	165
Figure J.5 – Edition 1 device: Logical nodes in technical reports.....	166
Figure J.6 – Edition 2 device: Logical nodes in technical reports.....	167
Figure J.7 – Edition 2.1 device: Logical nodes in technical reports defining new CDCs	168
Figure J.8 – Edition 2.1 device: standardized LNs extended by other domains.....	169
Figure J.9 – Edition 2 device: standardized LN introduced in IEC 61850-7-420:2009	170
Figure J.10 – Edition 2.1 device: standardized LN introduced in IEC 61850-7-420:2015	171
Figure J.11 – Edition 2 device: standardized LN moved from introduced in IEC 61850-7-420:2009 to IEC 61850-7-4:2007	172
Figure J.12 – Edition 2.1 device: standardized LN moved from introduced in IEC 61850-7-420:2009 to IEC 61850-7-4:2007	173
Table 1 – LN groups	21
Table 2 – Logical node class XCBR (conceptual)	32
Table 3 – Excerpt of integer status setting	40
Table 4 – Comparison of the data access methods	45
Table 5 – ACSI models and services.....	77
Table 6 – Logical node circuit breaker.....	88
Table 7 – Controllable double point (DPC)	90
Table 8 – ACSI class definition	93
Table 9 – Single point status common data class (SPS).....	95
Table 10 – Quality components attribute definition	96
Table 16 – Attributes of DetailQual	97
Table 11– Functional constraints (excerpt).....	98
Table 12– Trigger option.....	98
Table 13 – GenLogicalNodeClass definition.....	100
Table 14 – Excerpt of logical node name plate common data class (LPL).....	114
Table 15 – Excerpt of the abstract common data class BasePrimitiveCDC	114

Table A.2 – List of common data classes (excerpt)	125
Table K.1 – Information users and information providers	175
Table K.2 – Data model use cases	177
Table K.3 – Services use cases	179
Table K.4 – Data Forbidden cases	180
Table K.5 – Add new basic type	181
Table K.6 – Extend CDC with DA of new FC	182
Table K.7 – Add new DA using existing type and FCs	182
Table K.8 – Add a new DO based on new CDC using existing types and FCs	183
Table K.9 – Adding a new DO based on existing CDC	184
Table K.10 – Renaming a DO	184
Table K.11 – Renaming a DA, subDO or subDA	185
Table K.12 – Deprecation of a FC	186
Table K.13 – Deprecation of a DA	186
Table K.14 – Removal of a DA	187
Table K.15 – Deprecation of a DO	187
Table K.16 – Use of a weaker presence condition	188
Table K.17 – Use of a stronger presence condition	188
Table K.18 – Extend an enumeration with an enumerated value	189
Table K.19 – Modification of an enumerated value from an enumeration list	189
Table K.20 – Deprecate an enumerated value from an enumeration list	190
Table K.21 – Extension of a PACKED LIST	190
Table K.22 – Extend size of names / references	191
Table K.23 – Add new basic type	191
Table K.24 – Adding new Control Blocks	192
Table K.25 – Adding new services	192
Table K.26 – Add new attributes in control block	193
Table K.27 – Deprecating control block class	193
Table K.28 – Using a stronger presence condition	194

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 7-1: Basic communication structure – Principles and models

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 61850-7-1 edition 2.1 contains the second edition (2011-07) [documents 57/1121/FDIS and 57/1145/RVD] and its amendment 1 (2020-08) [documents 57/2201/FDIS and 57/2221/RVD].

International Standard IEC 61850-7-1 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

This second edition edition constitutes a technical revision.

Compared to the first edition, this second edition introduces:

- the model for statistical and historical statistical data,
- the concepts of proxies, gateways, LD hierarchy and LN inputs,
- the model for time synchronisation,
- the concepts behind different testing facilities,
- the extended logging function.

It also clarifies the following points:

- the use of numbers for data extension,
- the use of namespaces,
- the mode and behaviour of a logical node,
- the use of range and deadbanded values,
- the access to control actions and others.

Compared to the second edition, this first revision of the second edition:

- provides clarifications and corrections to the second edition of IEC 61850-7-1, based 55 on the tissues = {828, 874, 948, 1060, 1072, 1129, 1151, 1196, 1251, 1268, 1312, 1396, 1437, 1468, 1491};
- re-edit the Clause 8.2.3 on gateways and proxies;
- re-edit the complete Clauses 13 and 14 about namespaces and rules for extension of object classes;
- include three new normative annexes respectively for LGOS/LSVS engineering (G), GOOSE/SMV Subscription Configuration (H) and use case scenarios examples for clarifying the common rules of Clause 14 (J);
- introduces in the informative annex I, the concept of decoupling domain namespaces from basic namespaces in edition 3 of this document;

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

A list of all parts of the IEC 61850 series, 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 the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication 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 the IEC 61850 series provides an overview of the architecture for communication and interactions between systems for power utility automation such as protection devices, breakers, transformers, substation hosts etc.

This document is part of a set of specifications which details a layered communication architecture for power utility automation. This architecture has been chosen to provide abstract definitions of classes (representing hierarchical information models) and services such that the specifications are independent of specific protocol stacks, implementations, and operating systems.

The goal of the IEC 61850 series is to provide interoperability between the IEDs from different suppliers or, more precisely, between functions to be performed by systems for power utility automation but residing in equipment (physical devices) from different suppliers. Interoperable functions may be those functions that represent interfaces to the process (for example, circuit breakers) or substation automation functions such as protection functions. This part of the IEC 61850 series uses simple examples of functions to describe the concepts and methods applied in the IEC 61850 series.

This part of the IEC 61850 series describes the relationships between other parts of the IEC 61850 series. Finally this part defines how interoperability is reached.

NOTE Interchangeability is the ability to replace a device from the same vendor, or from different vendors, utilising the same communication interface and as a minimum, providing the same functionality, with no impact on the rest of the system. If differences in functionality are accepted, the exchange may also require some changes somewhere else in the system. Interchangeability implies a standardisation of functions and, in a strong sense, of devices which are outside the scope of this standard. Interchangeability is outside the scope, but it will be supported following this standard for interoperability.

This part of the IEC 61850 series is intended for all stakeholders of standardised communication and standardised systems in the utility industry. It provides an overview of and an introduction to IEC 61850-7-4, IEC 61850-7-3, IEC 61850-7-2, IEC 61850-6, and IEC 61850-8-1.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 7-1: Basic communication structure – Principles and models

1 Scope

This part of the IEC 61850 series introduces the modelling methods, communication principles, and information models that are used in the various parts of the IEC 61850-7-x series. The purpose of this part of the IEC 61850 series is to provide – from a conceptual point of view – assistance to understand the basic modelling concepts and description methods for:

- substation-specific information models for power utility automation systems,
- device functions used for power utility automation purposes, and
- communication systems to provide interoperability within power utility facilities.

Furthermore, this part of the IEC 61850 series provides explanations and provides detailed requirements relating to the relation between IEC 61850-7-4, IEC 61850-7-3, IEC 61850-7-2 and IEC 61850-5. This part explains how the abstract services and models of the IEC 61850-7-x series are mapped to concrete communication protocols as defined in IEC 61850-8-1.

The concepts and models provided in this part of the IEC 61850 series may also be applied to describe, among others, information models and functions for:

- hydroelectric power plants,
- substation to substation information exchange,
- information exchange for distributed automation,
- substation to control centre information exchange,
- information exchange for metering,
- condition monitoring and diagnosis, and
- information exchange with engineering systems for device configuration.

NOTE 1 This part of IEC 61850 uses examples and excerpts from other parts of the IEC 61850 series. These excerpts are used to explain concepts and methods. These examples and excerpts are informative in this part of IEC 61850.

NOTE 2 Examples in this part use names of classes (e.g. XCBR for a class of a logical node) defined in IEC 61850-7-4, IEC 61850-7-3, and service names defined in IEC 61850-7-2. The normative names are defined in IEC 61850-7-4, IEC 61850-7-3, and IEC 61850-7-2 only.

NOTE 3 This part of IEC 61850 does not provide a comprehensive tutorial. It is recommended that this part be read first – in conjunction with IEC 61850-7-4, IEC 61850-7-3, and IEC 61850-7-2. In addition, it is recommended that IEC 61850-1 and IEC 61850-5 also be read.

NOTE 4 This part of IEC 61850 does not discuss implementation issues.

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

IEC 61850-3, *Communication networks and systems in substations – Part 3: General requirements*

IEC 61850-4, *Communication networks and systems for power utility automation – Part 4: System and project management*

IEC 61850-5, *Communication networks and systems in substations – 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 61850-7-2, *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, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes*

IEC 61850-8-1, *Communication networks and systems for power utility automation – Part 8-1: Specific Communication Service Mapping (SCSM) – Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3*

IEC 61850-9-2, *Communication networks and systems in substations – Part 9-2: Specific Communication Service Mapping (SCSM) – Sampled values over ISO/IEC 8802-3*

IEC 61850-10, *Communication networks and systems in substations – Part 10: Conformance testing*

ISO/IEC 8802-3, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

ISO/IEC 8825 (all parts), *Information technology – ASN.1 encoding rules*

ISO 9506-1, *Industrial automation systems – Manufacturing Message Specification – Part 1: Service definition*

ISO 9506-2, *Industrial automation systems – Manufacturing Message Specification – Part 2: Protocol specification*