



# IEC 61850 standard update

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# Content

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- Ongoing work related to IEC 61850
- Making the standard future proof
- Code components

# Ongoing work – Amendment of core

## ■ Amendment to Edition 2

- UML Models of IEC 61850 have been prepared
- Amendment and associated Ed 2.1 will be published
  - Incorporating TISSUES
  - Auto generate the models from the UML model
  - Part 5 and 7-1 are in preparation / circulation as CDV
  - Part 4, 7-2, 7-3 and 7-4 are in preparation / circulation as FDIS

# Ongoing work – domain modeling

## *General*

- IEC 61850-7-5: Use of logical nodes to model applications – generic principles
- IEC 61850-7-6: Guideline how to create Basic Application Profiles
- IEC 61850-90-18: Alarm handling
- IEC 61850-1-2: Guideline for Technical Committees and Working Groups on extending IEC 61850

## ■ *Bulk Power*

- IEC 61850-7-410, Amd: Extensions to include models for steam and gas turbines

# Ongoing work – domain modeling

## *Substation Automation*

- IEC 61850-6-100: Guideline for function modeling in SCL for substation automation
  - May include as well standardizing Function / Subfunctions names for SCL
  - Similar parts required for other domains
- IEC 61850-90-14: Using IEC 61850 for FACTS data modeling
- IEC 61850-90-21: Using IEC 61850 for traveling wave fault location systems

## *HMI*

- IEC 61850-6-2: Configuration description language extension for HMIs

# Ongoing work – domain modeling

## ■ *DA and DER*

- IEC 61850-90-6: Using IEC 61850 for distribution automation
- IEC 61850-90-9: IEC 61850 object models for electrical energy storage systems
- IEC 61850-90-15: IEC 61850 based DER Grid Integration
- IEC 61850-90-23: Microgrids
- IEC 61850-7-420: Preparation of Ed 2
  - Add modeling of Grid codes

# Ongoing work – functionality

## *Engineering and design*

- IEC 61850-90-11: Methodologies for modeling of logics for IEC 61850 based applications
- IEC 61850-90-16: System Management
- IEC 61850-90-20: Guideline for redundant IEDs with IEC 61850
- IEC 61850-90-22: SCD based substation network auto-routing with visualization and supervision support
- AdHoc TF “Engineering Improvements”

## *Testing*

- IEC 61850-10-3: Methodologies for testing of functions in IEC 61850 based systems



# Ongoing work – functionality

## *Communication and security*

- IEC 61850-90-19: Implementation of role based access
- IEC 61850-90-13: Deterministic network topologies
- IEC 61850-90-4, Ed 2: Network engineering guidelines for substations
- IEC 61850-90-12, Ed 2: Wide area network engineering guidelines
- IEC 61850-80-5: Data Conversion between Modbus and IEC 61850
- IEC 61850-8-2: Mapping on Web Services

# Content

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- Ongoing work related to IEC 61850
- Making the standard future proof
  - Versioning in IEC 61850
  - Version compatibility – what does it mean?
  - What has been done
- Code components

# Versions of IEC 61850

## ■ What?

- New Editions
- Amendments

## ■ Why?

- New functionalities
- Fix errors, inconsistencies or ambiguities

## ■ How?

- Versioning of IEC standards is individual per part
- Based on an Amendment, it is possible to publish a consolidated version (e.g. Ed 2.1)

# Code components

- Code components are elements within IEC 61850 that are distributed electronically and are used by SW tools to develop products
  - Schema for Part 6 (SCL)
  - Name Space files for semantic models (e.g. parts 7-2, 7-3, 7-4 or 8-1)
- Code components may require fixes between publication stages of the standard

# How to identify versions?

- Version = Edition of IEC publication
  - Identified by a year (not the publication year)
- Revision = Amendment of IEC publication
  - Identified by a Character
  - A is Edition without amendment and can be skipped
- Release = Update of code component beyond publication
  - Identified by a number
  - Used both for drafts (before publication) and fixes (after publication)
- Example: Schema of IEC 61850-6, Ed 2.1

**2007B4**

# Find the version information

## ■ Version of SCL schema used

```
02 <SCL release="4" revision="B" version="2007" xmlns="http://www.iec...
03 <Header id="TMW" version="1" toolID="TMW SCL Navigator"/>
04 <Communication>
05 <SubNetwork name="SubNetworkName">
```

```
<P type="OSI-TSEL">0001</P>
<IED name="TEMPLATE" manufacturer="TMW" configVersion="1.0" originalSclRelease="4" originalSclRevision="B" originalSclVersion="2007">
  <Services nameLength="64">
  <AccessPoint name="AP">
  <Server>
```

## ■ Version of data model

```
<LDevice inst="CTRI">
  <LN0 InType="LLN0_2007" InClass="LLN0" InName="LN0">
    <LN InType="LPHD_TYPE" InClass="LPHD" InName="LN1">
      <Services/>
  <DataTypeTemplates>
  <LNNodeType id="LLN0_2007" InClass="LLN0">
    <DO name="NamPit" type="LPL_LD2007"/>
```

```
<DOType id="LPL_LD2007" cdc="LPL">
  <DA name="Vendor" bType="VisString255" fc="DC">
    <Val>TMW</Val>
  <DA name="swRev" bType="VisString255" fc="DC">
    <Val>0</Val>
  <DA name="IdNs" bType="VisString255" fc="EX">
    <Val>IEC 61850-7-4:2007</Val>
```

# Version compatibility

- Information flow between
  - information **user** – information **provider**
- Communication
  - Client – Server
  - Subscriber – Publisher
- Tool
  - SCT (System configuration tool) – ICT (IED configuration tool) of information provider (icd/iid file)
  - ICT of information user – SCT (scd) or ICT of information provider (through SCT with scd)
  - SCT – SCT (sed)

# Definition of compatibility

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## ■ Backwards compatibility

- Information user of a given version can understand information from an information provider of an **older** version

## ■ Forward compatibility

- Information user of a given version can understand information from an information provider of a **newer** version
- Can be improved by tolerant behavior of information user



# Relation to IEC 61850

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## ■ Communication

- Behavior
- Configuration models (e.g. control blocks)

## ■ Data model of the device

- Through communication
- Expressed in an SCL file

## ■ SCL Schema version

- Data model version and schema version can be independent

# Backwards compatibility

- As versions can be identified, an information user can always be designed to understand all previous versions
  - This is not practicable
  - Does not solve all issues from an SCL perspective, as in a mixed system there will be information users of older versions that need to be forward compatible

# Version compatibility in part 6

- With Edition 2, the concept of **must understand / may ignore** was introduced to support forward compatibility
- An Annex describes how to handle **mixed projects**, under the assumption that the **SCT needs to be of the newest version**
- Approach includes the concept of **upgrading and downgrading** of files
  - rules are provided related to both **data model** as well as **SCL elements**
- Assumes SCL and data model of same version for a given device

# Version compatibility in part 7

- New Annex will be added to part 7-1 discussing data model related use cases from a generic perspective
- Part 7-2, 7-3 and 7-4 will have an Annex listing the specific cases
- Goal
  - Provide design requirements on tools and devices to maximize compatibility
  - Provide design guidelines for standard editors concerning future standard revisions
  - Provide history of changes affecting compatibility

# Rules introduced

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## ■ Compatibility rule

- standardized rule for implementation how to handle incompatible changes of the standard

## ■ Specific compatibility rule

- Compatibility rule that is defined in the context of an instance of a change
- Only applicable for backwards compatibility

# Use cases considered

## ■ Data model use cases (18 with variations)

e.g.

- Use a new basic type
  - Add a new type (7-2, 8-x, 9-x)
  - Extend existing CDC with DA of new type and existing FC (7-3)
- Rename a DO
- Deprecate a DA

## ■ Services use cases (6 with variations) e.g.

- Extend control block class with existing type
  - Extend CB with an attribute of existing type
  - Extend service with parameter of existing type

## ■ Cases forbidden for the future (14) e.g.

- Change CDC of a DO
- Rename a control block attribute

# Example – add new DA to CDC

*... of existing type and FC*

- Forward compatibility of a client
    - Achievable with a compatibility rule: Client shall be able to learn the new structure of the CDC
  - Backwards compatibility of a client
    - Guaranteed if DA is optional, achievable with specific compatibility rule if DA is mandatory
- This is defined in part 7-1*

# Example – add new DA to CDC

## ■ Annex of 7-3 is listing

– In Edition 2007B (Ed 2.1) e.g.

- CDC MV – DA “dbRef” added as conditional MO(db)...
- CDC HMW – DA “maxPts” as mandatory...

– In Edition 2007 (Ed 2.0) e.g.

- CDC INS, ING – DA “units” as optional....

## ■ Specific compatibility rule for backwards compatibility for 2007B, DA “maxPts”

– If maxPts is missing, the size of the array is determined by numPts



# Specific treatment Ed 1 and Ed 2

- Cases done before Ed 2 may require special handling
  - They are listed in the Annexes of the specific parts
- Example Ed 2, CDC HVM, DA “har” has been changed from “ARRAY of Vector” to “ARRAY of CMV”
  - Change of type – forbidden as of the new Annex
  - Requires a declaration in the PICS, if the new information user (e.g. client) supports the old CDCs of Ed 1

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# Code components in IEC 61850

- SCL Schema file (IEC 61850-6)
- XML Schema file for namespace description (IEC 61850-7-7)
- Namespace files (NSD files)
  - IEC 61850-7-2,
  - IEC 61850-7-3
  - IEC 61850-7-4xx
  - IEC 61850-8-1
  - Transitional namespaces – from technical reports like IEC 61850-90-xx

# Distribution of code components

- SCL Schema file – IEC 61850-6
  - Latest version for Ed 1 and Ed 2 has been distributed with **57/1604/DC** on July 31, 2015
- Namespace files for core parts
  - Files for Ed 2 (incorporating interoperability TISSUES) have been announced with **57/2023/INF** on July 13, 2018

# Information about schema versions



For IEC use only

57/1604/DC

2015-07-31

**INTERNATIONAL ELECTROTECHNICAL COMMISSION**

**TECHNICAL COMMITTEE 57: POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE**

**Latest version of SCL schema and planned publication of a Technical Corrigendum to IEC 61850-6 Ed. 1 and Ed. 2**

Introductory note: The present document has been developed in TC 57 WG 10 (Power system IED communication and associated data models) and submitted by the WG 10 Convenor. In agreement with the TC 57 Secretariat this document is circulated to IEC national committees for comments.

## **1. Background**

An important part of IEC 61850-6 is the XML schema file that describes the format of the SCL file. This file is currently included in each standard edition as an Annex. However, this file is subject to revisions due to errors and corrections across the whole standard. The latest version of the file is distributed with the electronic version of the standard. There is however no official mechanism through IEC in place for distribution of updates of that file nor is it possible, that a user of the standard knows which is the latest version, per editions, to be used. To improve that situation, the process described in this DC is proposed.

# Distribution of Namespace Files



For IEC use only

57/2023/INF

2018-07-13

**INTERNATIONAL ELECTROTECHNICAL COMMISSION**

**TECHNICAL COMMITTEE 57: POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE**

**Electronic distribution of name space files for IEC 61850**

## **1. Background**

With IEC 61850-7-7, a machine processable format for the distribution of IEC 61850 data models has been defined. Based on that, in the future, all IEC 61850 models will be as well available in this format as namespace files (NSD files).

The namespace files are code components, that are intended to be directly processed by a computer. The purchase of the associated IEC standard carries a copyright license for the purchaser to sell software containing Code Components from this standard to end users either directly or via distributors, subject to IEC software licensing conditions, which can be found at: <http://www.iec.ch/CCv1>.

Note that the same applies as well to the schema file from IEC 61850-6. An information about the distribution of the schema file has already been distributed as 57/1604/DC.

# IEC process for code components

## ■ Distribution as zip file

- Manifest – xml file describing the content of the package
- The component file(s)
- History.txt

## ■ Website

[www.iec.ch/tc57/supportdocuments](http://www.iec.ch/tc57/supportdocuments)

- Public access
- Website will contain all versions
- Proposed / approved











## ■ Notification of the national committees with a **DC** document

- NCs may raise concerns

Documents available in this area are supporting documents uploaded by the committee. The IEC is not liable for the content of these documents.

TC 57 Supporting Documents

Table search:  ×   

Title, description	Downloads	Created	Publication reference
<b>IEC_61850-6.2003.SCL.1.7.full.zip</b> IEC 61850-6 SCL schema V1.7 (a.k.a. 2003), see the IEC 61850-6:2003 for full legal notices	 1121 kB	2017-09-05	IEC 61850-6:2003
<b>IEC_61850-6.2009.SCL.2007B.full.zip</b> IEC 61850-6 SCL schema V2007B, see the IEC 61850-6:2009 for full legal notices	 1725 kB	2017-09-05	IEC 61850-6:2009
<b>IEC_61850-6.2018.SCL.2007B4.full.zip</b> IEC 61850-6 SCL schema V2007B4, see the IEC 61850-6:2009/AMD1:2018 for full legal notices	 1874 kB	2018-06-08	IEC 61850-6:2009+AMD1:2018 CSV
<b>IEC_61850-7-2.NSD.2007A2.light.zip</b> IEC 61850-7-2 2007A2 NSD light, see the IEC 61850-7-2:2010 for full legal notices	 15 kB	2018-07-13	IEC 61850-7-2:2010
<b>IEC_61850-7-3.NSD.2007A2.light.zip</b> IEC 61850-7-3 2007A2 NSD light, see the IEC 61850-7-3:2010 for full legal notices	 22 kB	2018-07-13	IEC 61850-7-3:2010
<b>IEC_61850-7-4.NSD.2007A2.light.zip</b> IEC 61850-7-4 2007A2 NSD light, see the IEC 61850-7-4:2010 for full legal notices	 32 kB	2018-07-13	IEC 61850-7-4:2010
<b>IEC_61850-7-7.2017.NSD.2017A.full.zip</b> IEC TS 61850-7-7 SCL schema V2017A, see the IEC TS 61850-7-7:2018 for full legal notices	 972 kB	2018-03-16	IEC TS 61850-7-7:2018
<b>IEC_61850-8-1.NSD.2003.light.zip</b> IEC 61850-8-1 2003 NSD light, see the IEC 61850-8-1:2011 for full legal notices	 14 kB	2018-07-13	IEC 61850-8-1:2011
<b>IEC_61850-90-6.NSD.2018A.light</b> IEC 61850-90-6 light code component - See IEC TR 61850-90-6 for full legal notices	 17 kB	2018-10-05	IEC TR 61850-90-6:2018
<b>IEC_62351-7.2017_ed1.0.MIBS.1.0.light.zip</b> MIBS Code component ; see the IEC_62351-7:2017 for full legal notices.	 32 kB	2017-07-24	IEC 62351-7:2017





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