

TECHNICAL SPECIFICATION

**Communication networks and systems for power utility automation –
Part 80-1: Guideline to exchanging information from a CDC-based data model
using IEC 60870-5-101 or IEC 60870-5-104**

IEC TS 61850-80-1:2008

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**COMMUNICATION NETWORKS AND
SYSTEMS FOR POWER UTILITY AUTOMATION –****Part 80-1: Guideline to exchanging information from a CDC-
based data model using IEC 60870-5-101 or IEC 60870-5-104**

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 61850-80-1, which is a technical specification, has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

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

Enquiry draft	Report on voting
57/916/DTS	57/969/RVC

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

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

The bold characters in some tables are used to highlight the most essential terms or functions inside the figures to improve readability. Shading of parts of the figures is used for the same purpose.

A list of all parts of 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 publication will remain unchanged until the maintenance result 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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual edition of this document may be issued at a later date.

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COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 80-1: Guideline to exchanging information from a CDC- based data model using IEC 60870-5-101 or IEC 60870-5-104

1 Scope and object

This technical specification gives a guideline on how to exchange information from a CDC-based data model (for example IEC 61850) using IEC 60870-5-101 or IEC 60870-5-104 between substation(s) and control center(s). Mostly guidelines for functions needed in a substation gateway device are given.

The goal of this technical specification is to describe standardized mapping of device-oriented data models (for example IEC 61850) with already defined attributes of CDC's and services (for example IEC 61850-7) onto the already defined ASDU's and services of IEC 60870-5-104 or IEC 60870-5-101. It is not the goal of this technical specification to add any extensions to published standards (for example IEC 61850 or IEC 60870-5-104 or IEC 60870-5-101).

After an introduction giving a basic description of the mapping, the mapping of the information model with associated data classes, and the mapping of services are described. Clause 9 shows how the mapped data and services according to the IEC 60870-5-104 and IEC 60870-5-101 protocol are marked (selected) in the interoperability sheet.

The scope of this technical specification is to achieve real-time exchange of process information required for operational purposes between a substation using a CDC-based data model (for example IEC 61850) and (a) control centre(s) using a communication link over a wide area network (WAN) compliant to the definitions of IEC 60870-5-101 or IEC 60870-5-104. The amount of real-time information provided by the substation-gateway device can vary dependent on the operational needs. Actors could be regional and nationwide control centers that receive real-time information in order to monitor and control geographically widespread processes. The described mapping can be used for several fields of application of power utilities, such as substations, hydro and wind power plants, and decentralized energy resources DER. The mapping is based on the definitions of the standard series IEC 61850 Edition 1.0 and IEC 60870-5-104:2006/IEC 60870-5-101:2003. The scope of the mapped IEC 60870-5-104 and IEC 60870-5-101 subset is given in Clause 9.

This technical specification focuses mainly on defining rules and functions of a gateway device as a part of the substation. However, the rules and functions are also valid when an IED may optionally be connected directly to a WAN compliant with IEC 60870-5-101 or IEC 60870-5-104 and therefore, the mapping has to be done inside the IED.

2 Normative references

The following referenced documents are indispensable for the application 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 60870-5-3, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 3: General structure of application data*

IEC 60870-5-4:1993, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 4: Definition and coding of application information elements*

IEC 60870-5-5:1995, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 5: Basic application functions*

IEC 60870-5-101:2003, *Telecontrol equipment and systems – Part 5-101: Transmission protocols – Companion standard for basic telecontrol tasks*

IEC 60870-5-104:2006, *Telecontrol equipment and systems – Part 5-104: Transmission protocols – Network access for IEC 60870-5-101 using standard transport profiles*

IEC 61850 (all parts), *Communication networks and systems in substations*

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

IEC 61850-7-2:2003, *Communication networks and systems in substations – Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI)*

IEC 61850-7-3, *Communication networks and systems in substations – Part 7-3: Basic communication structure for substation and feeder equipment – Common data classes*

IEC 61850-8-1, *Communication networks and systems in substations – Part 8-1: Specific Communications Service Mapping (SCSM) – Mapping to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3*

Document 57/963/INF: *IEC 61850 – Technical issues* (see www.tissue.iec61850.com)

IEC 61400-25-2, *Wind turbines – Part 25-2: Communications for monitoring and control of wind power plants – Information models*

IEEE 754:2008, *IEEE Standard for Binary Floating-Point Arithmetic*

RFC 2200, *Internet Official Protocol Standards, Request for Comments 2200 (June 1997)*

3 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

ACSI	Abstract communication service interface (defined for example in IEC 61850-7-2)
ASDU	Application service data unit
CASDU	Common address of ASDU
CDC	Common data class (defined for example in IEC 61850-7-3)
CI	Counter interrogation
COT	Cause of transmission
GI	General interrogation
GOOSE	Generic object oriented substation event
HMI	Human machine interface
IED	Intelligent electronic device
IOA	Information object address
LD	Logical device

LN	Logical node
PI	Process image
P/N	Positive/negative
QOI	Qualifier of interrogation
QDS	Quality descriptor
RFC	Request for comments
S/E	Select/execute
SCADA	Supervisory control and data acquisition
SCSM	Specific communication service mapping (defined for example in IEC 61850-8-1)
SCL	Substation configuration language (defined for example in IEC 61850-6)
TCP	Transmission control protocol
TI	Type Identification
TISSUE	Technical issue as part of the maintenance process of IEC 61850
WAN	Wide area network
XML	Extensible mark-up language

4 The mapping architecture

The mapping architecture consists of 5 parts:

- 1) conceptual architecture of a gateway device and associated use cases;
- 2) conceptual architecture of an IED directly connected to a WAN (optional);
- 3) mapping of the information model;
- 4) mapping of the data (which is in fact part of the information model);
- 5) mapping of the services.

5 Conceptual architectures and associated use cases

5.1 Conceptual architecture of a gateway device

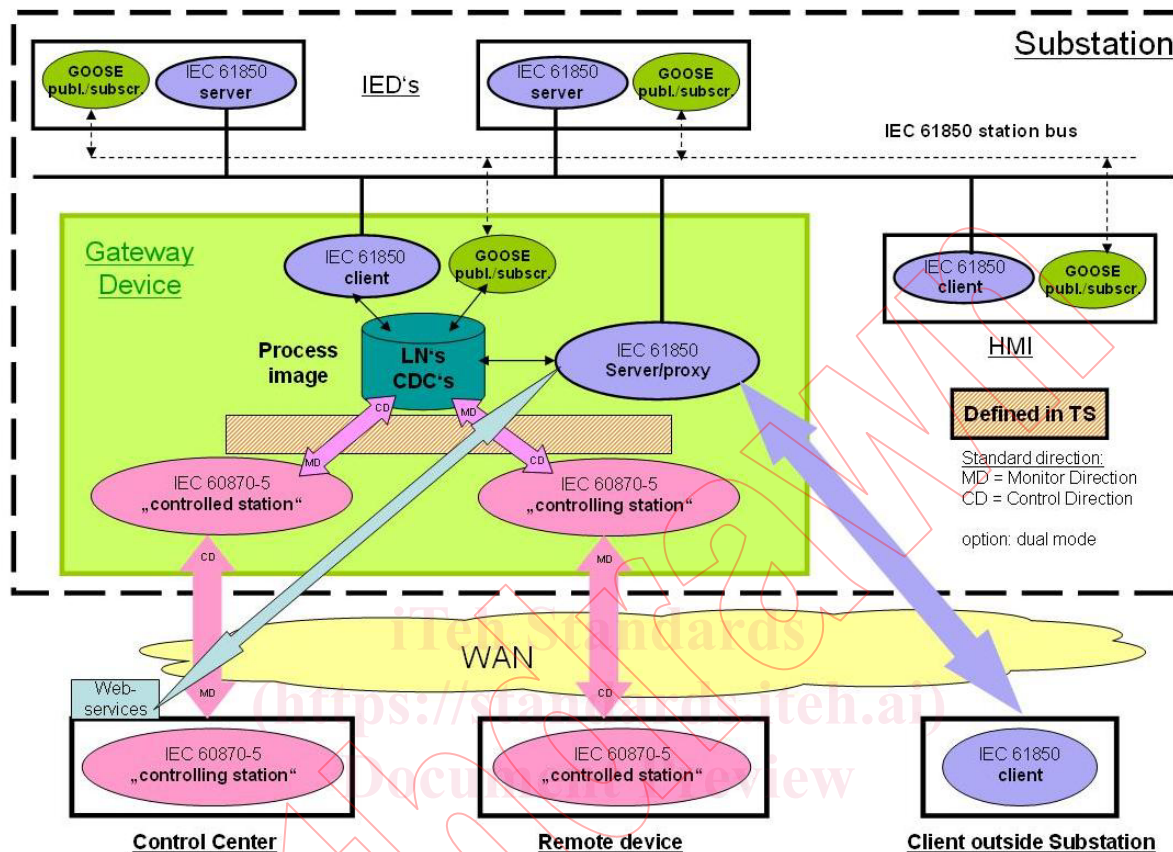


Figure 1 – Conceptual architecture of a gateway device

Figure 1 describes the conceptual architecture of a gateway device within a substation. The gateway device is decoupling the IEC 61850 station bus from the IEC 60870-5-101 or IEC 60870-5-104 WAN via a process image (PI). The advantage of this approach is that only services for control model interaction need to be mapped.

The PI is organized according the data model of IEC 61850 (LDs, LNs, CDCs).

The IEC 61850 client/GOOSE subscriber is used to update the PI with process data made available by the IEDs.

The IEC 61850 server/proxy is used to:

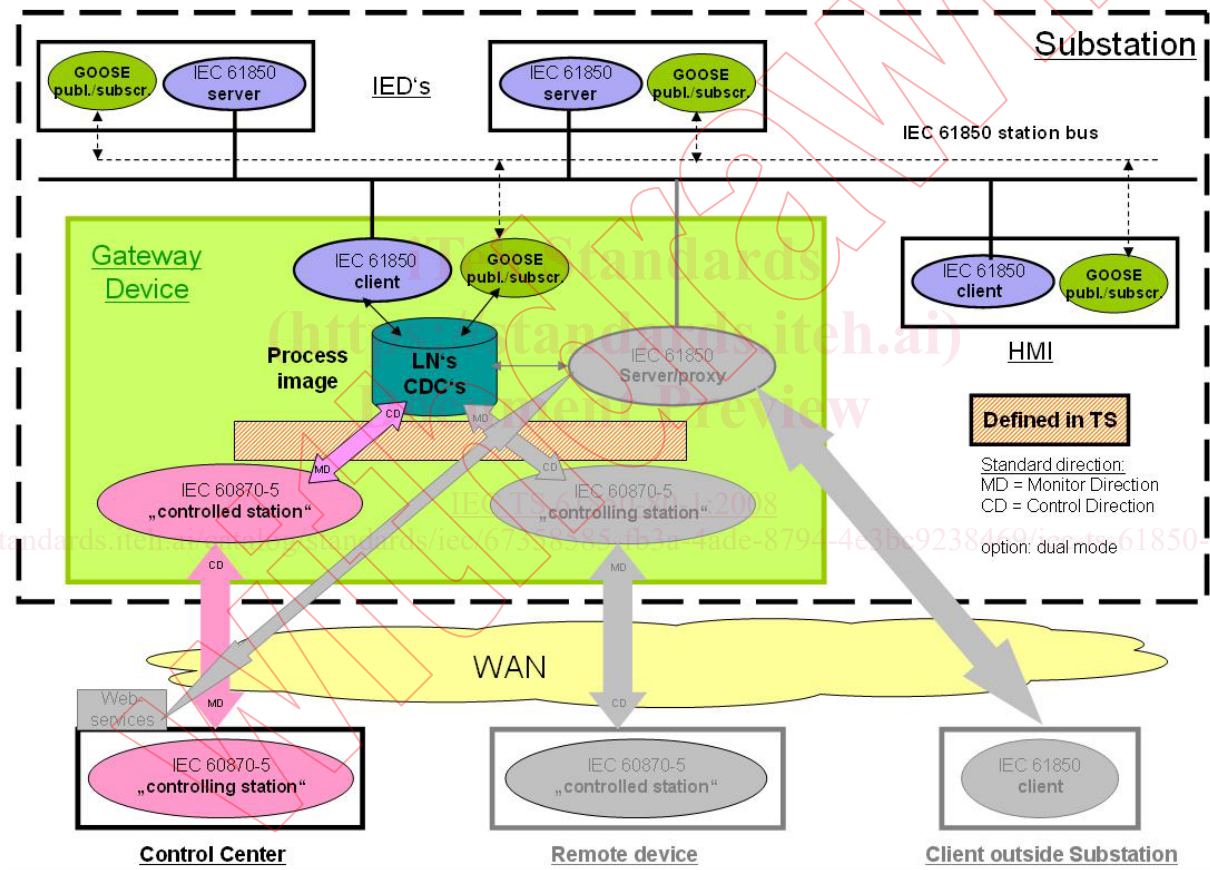
- make process data coming from remote devices available for IEDs inside the substation;
- retrieve the data model for:
 - IEC 61850 clients **inside** the **substation** (for example HMI);
 - IEC 61850 clients **outside** the **substation** (for example future control centers);
 - existing **control centers** using IEC 60870-5-101 or IEC 60870-5-104 for WAN communication by using **additional services** (for example SCL extensions or web services).

The IEC 60870-5-101 or IEC 60870-5-104 controlled and controlling functionality makes use of the attributes of CDCs in a defined way to build up ASDUs to communicate with control centers or “devices on the WAN network” using WAN communication based on IEC 60870-5-101 or IEC 60870-5-104 (including redundant connections).

The IEC 60870-5-101 or IEC 60870-5-104 controlling functionality inside the gateway device is used to connect “devices on the WAN network” with IEC 60870-5-101 or IEC 60870-5-104 controlled functionality to the substation.

The gateway device can optionally act as a “mediator” between the substation and all “devices on the WAN network”. When IEC 60870-5-101 or IEC 60870-5-104 “dual mode functionality” is used, the same ASDUs are used in the monitor and the control direction on the WAN.

5.1.1 Use case a) for a gateway device



IEC 2256/08

Figure 2 – Use case a) for a gateway device

Figure 2 describes use case a) using a subset of functions of the conceptual architecture. The IEC 61850 client/GOOSE subscriber is used to update the PI with process data made available by the IEDs.

The IEC 60870-5-101 or IEC 60870-5-104 controlled functionality makes use of the attributes of CDCs in a defined way to build up ASDUs to communicate with control centers using WAN communication based on IEC 60870-5-101 or IEC 60870-5-104 (including redundant connections).