IEC TR 61850-80-3

Edition 1.0 2015-11

TECHNICAL REPORT

colour inside

Communication networks and systems for power utility automation – Part 80-3: Mapping to web protocols – Requirements and technical choices

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COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 80-3: Mapping to web protocols – Requirements and technical choices

FOREWORD

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IEC TR 61850-80-3, which is a technical report, has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

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

Enquiry draft	Report on voting
57/1584/DTR	57/1624/RVC

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

A list of all parts in 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 stability date indicated on the IEC website 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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

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

The usage of the IEC 61850 communication standard is largely spreading over all the domains connected to the smart grid, pushing the usage of technologies adapted to the connection of a very large number of applications and devices across the intra/internet (see related use cases in Annex A). The involved domains typically use already well-established protocols for exchanging data with IT level applications like resource planning, asset and maintenance management, etc. Therefore, it becomes imperative to provide an integration strategy that allows the integration of IEC 61850 into these various disparate protocols and information.

In this context, Web Protocols are considered the most appropriate technology for communication with backend systems and possibly field devices.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 80-3: Mapping to web protocols – Requirements and technical choices

1 Scope

This part of IEC 61850, which is a technical report, describes the requirements and gives an overview of the technical solution for using Web Protocols as a new communication mapping (SCSM) for the IEC 61850 standard.

NOTE The notion of Web Protocols covers here the Web Services technologies, extended by other well deployed technologies based on standards used in the IT domain (IETF, ISO, W3C, OASIS, etc.). The advantage is that due to a lot of professional knowledge and practical experiences in the IT world the risk of non-interoperable solutions in the smart grid domain will decrease.

The structure of this part of IEC 61850 illustrates a two-step approach:

- Collection of the use cases and requirements based upon emerging Smart Grid architectural considerations, taking into account the new extended scope of IEC 61850. Clause 6 proposes a synthesis of the global requirements, while the use cases of the various domains are described in Annex A. The considered domains are:
  - PV-inverters
  - Hydro and thermal generation
  - Wind power plants
  - Combined Heat and Power (CHP)
  - Smart customers
  - E-Mobility
  - Virtual Power Plants (VPP) and micro grids
  - Feeder automation
- Evaluation and selection of technologies in order to build a consistent SCSM. Clause 7 presents the future SCSM 8-2, including an overview of the main selected technology: XMPP. The following goals have been particularly considered for the definition of this SCSM:
  - Identify a single profile supporting all the services required by the domains and defined today in ACSI.
  - Cover the full life cycle of a IEC 61850 system, in collaboration with the System Management work in WG10 (from configuration, through conformance testing, down to maintenance). For this purpose, this part of IEC 61850 may recommend some changes to other parts of the IEC 61850 series such as Parts 6 and 10, etc.
  - Deploy cyber-security to ensure a secure environment (in compliance with the IEC 62351 series).
  - Propose rules for cohabitation with other mappings such as IEC 61850-8-1 and IEC 61850-9-2, and possibly recommend communication profiles depending on specific application context (pole-top equipment, inside DER, connection of DER, etc.).
  - Only the A-Profile is addressed here. Nevertheless, support of TCP/IP and UDP/IP is required for the T-Profiles.

What is not included in the study:

- Modification of objects specified in IEC 61850-7-3 and IEC 61850-7-4
- Introduction of several competing web protocols profiles

The namespace of this document is: “(Tr)IEC 61850-80-3:2015”

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

IEC 61850-8-1:2011, *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 62351 (all parts), *Power systems management and associated information exchange – Data and communications security*

ISO 9506 (all parts), *Industrial automation systems – Manufacturing Message Specification*

ISO/IEC 8824-1:2008, *Information technology – Abstract Syntax Notation One (ASN. 1): Specification of basic notation*

ISO/IEC 8825-1:2008, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

ISO/IEC 8825-4:2008, *Information technology – ASN.1 encoding rules: XML Encoding Rules (XER)*

RFC 4330, *Simple Network Time Protocol (SNTP) Version 4 for IPv4, IPv6 and OSI, IETF, available at http://www.ietf.org*

RFC 6120, *Extensible Messaging and Presence Protocol (XMPP): Core*

RFC 6121, *Extensible Messaging and Presence Protocol (XMPP): Instant Messaging and Presence*

RFC 6122, *Extensible Messaging and Presence Protocol (XMPP): Address Format*

XEP-0198, Stream Management[1]

XEP-0199, XMPP Ping[2]

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
electrical connection point
ECP
point of electrical connection between the DER source of energy (generation or storage) and any electric power system (EPS)

Note 1 to entry: Each DER (generation or storage) unit has an ECP connecting it to its local power system; groups of DER units have an ECP where they interconnect to the power system at a specific site or plant; a group of DER units plus local loads have an ECP where they are interconnected to the utility power system.

Note 2 to entry: For those ECPs between a utility EPS and a plant or site EPS, this point is identical to the point of common coupling (PCC) in IEEE 1547, *Standard for Interconnecting Distributed Resources with Electric Power Systems*.

3.2
electric power system
EPS
all installations and plant provided for the purpose of generating, transmitting and distributing electricity; particular installations, substations, lines or cables for the transmission and distribution of electricity

[SOURCE: IEC 60050-601:1985, 601-01-01, 601-01-02, modified (removal of Note to entry)]

3.3
electrical network
grid
particular installations, substations, lines or cables for the transmission and distribution of electricity

Note 1 to entry: IEC 61850 also uses the following terms:

Utility Grid or Utility electrical network – this corresponds to the area EPS as defined in IEEE.

Facility Grid or Facility electrical network – this corresponds to the local EPS as defined in IEEE.

[SOURCE: IEC 60050-601:1985, 601-01-02, modified (modification of Note 1 to entry)]

3.4
point of common coupling
PCC
ECP between a utility electrical network and facility electrical network

Note 1 to entry: ECP and PCC are related to the physical connectivity of the electrical network only and are independent from application functions.

Note 2 to entry: Other terms used are POC, PUC and PGC with sometimes similar meanings. These are not further considered within IEC 61850, since ECP and PCC are sufficient.

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[1] This specification defines an XMPP protocol extension for active management of an XML stream between two XMPP entities, including features for stanza acknowledgements and stream resumption.

[2] This specification defines an XMPP protocol extension for sending application-level pings over XML streams. Such pings can be sent from a client to a server, from one server to another, or end-to-end.

3.5
private network
network used by a unique entity mastering all the data flows, the performance seen by which is guaranteed in terms of bandwidth, throughput, transmission delay, availability, etc.

Note 1 to entry: A private network may be based on a public or shared infrastructure, as soon as the level of services can be guaranteed.

3.6
public network
network not used by a unique entity mastering all the data flows or if the performance seen by the entity using the network is not guaranteed in terms of bandwidth, throughput, transmission delay, availability, etc.

3.7
smart grid
electric power system which uses communication networks for coordinating the actions of the generators and consumers connected to it in order to efficiently deliver sustainable, economic and secure electricity supplies

4 Abbreviated terms

CHP	Combined heat and power
DDEMS	DSO DER Energy Management System
DER	Distributed Energy Resource
DMS	Distribution Management System
DR	Demand Response
DSO	Distribution system operator
ECP	Electrical Connection Point
ENTSO-E	European network of transmission system operators for electricity
EPS	Electric Power System
PCC	Point of Common Coupling
SO	System operator
TSO	Transmission system operator
VPP	Virtual power plant
WAN	Wide Area Network

5 Main involved sub-systems and stakeholders

Figure 1 presents an overview of the main involved sub-systems and indicates for which interactions the new IEC 61850-8-2 web protocols mapping is intended. The sub-systems mentioned in the picture are then described in Table 1 together with other systems and stakeholders considered in this document.

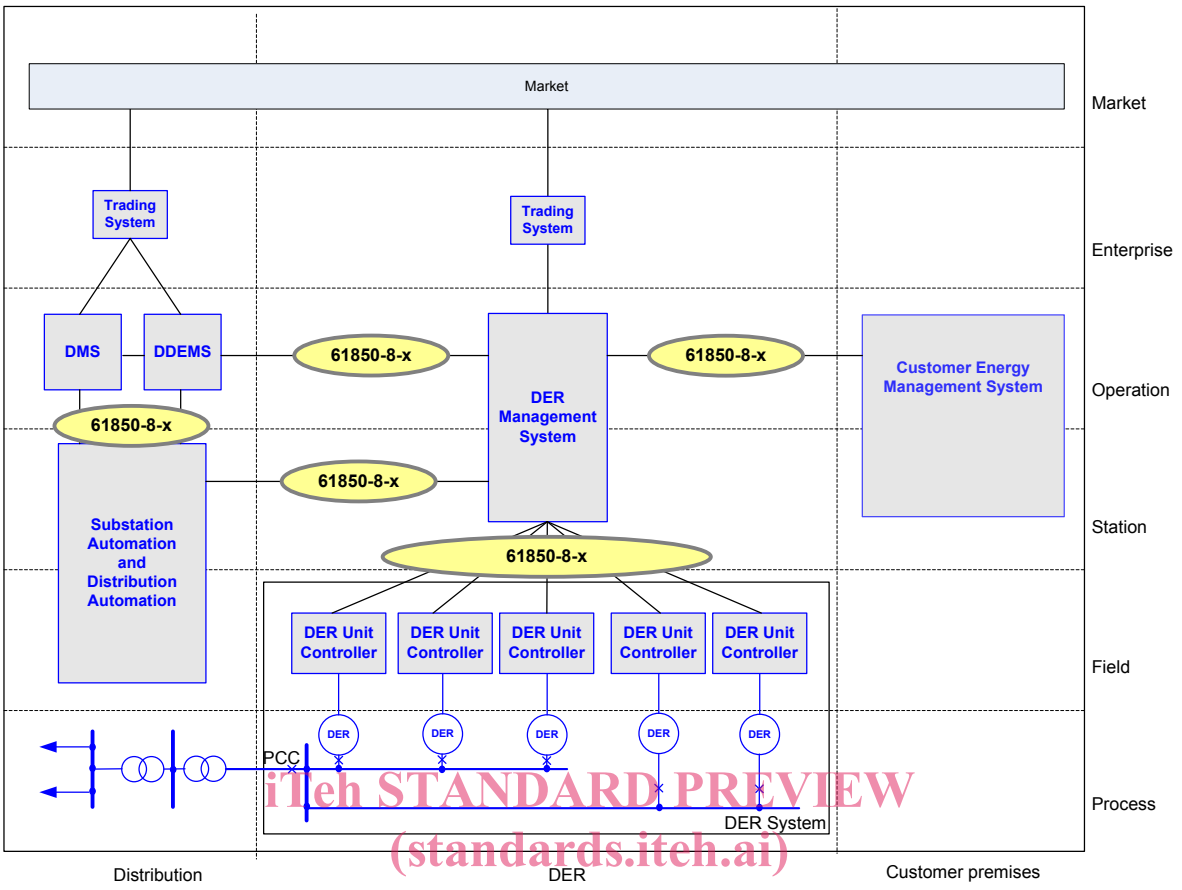

Figure 1 – Architecture overview

Table 1 – Main involved sub-systems and stakeholders

Type	Name	Description
Role	**Aggregator**	Offers services to aggregate energy production, storage capability and energy consumption. Acts towards the grid as one entity, including local aggregation of demand (Demand Response management) and supply (generation management). In cases where the aggregator is not a supplier, it maintains a contract with the supplier
Role	**Balance responsible party**	A party that has a contract proving financial security and identifying balance responsibility with the imbalance settlement responsible of the market balance area entitling the party to operate in the market. This is the only role allowing a party to buy or sell energy on a wholesale level
System	**DER unit controller**	Local controller for the DER unit. May control several DER local servers
System	**DER local server**	A processing unit interacting directly with the DER process by using proprietary communications means. Act as a communication server for the higher level systems
System	**DER management system**	Control Center of the VPP or Microgrid, used for monitoring and controlling the various sub-systems that are registered as participant in the VPP. Provides ancillary and balancing services to DSO
Role	**DER operator**	Any natural or legal person operating a DER plant (often this is either the plant owner or the DSO)
Role	**DER owner**	Any natural or legal entity owning a power generating facility like e.g. CHP plants, Wind power plants, PV plants
Role	**DER manufacturer**	Entity in charge of designing, producing and selling DER Units. May be also in charge of the maintenance
System	**DER unit**	One or several devices at process level that are controlled by the same system at field level. All included devices have the same type (e.g. PV) and can be for generation purpose as well as for storage