IEC 61850-7-420

Edition 1.0 2009-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Communication networks and systems for power utility automation – Part 7-420: Basic communication structure – Distributed energy resources logical nodes

Réseaux et systèmes de communication pour l'automatisation des systèmes électriques – Partie 7-420: Structure de communication de base – Nœuds logiques de ressources énergétiques distribuées

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COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 7-420: Basic communication structure – Distributed energy resources logical nodes

FOREWORD

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International Standard IEC 61850-7-420 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

This bilingual version (2019-09) corresponds to the monolingual English version, published in 2009-03.

The text of this standard is based on the following documents:

FDIS	Report on voting
57/981/FDIS	57/988/RVD

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

The French version of this standard has not been voted upon.

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

In Clauses 5 to 8 of this document, each subclause contains an initial informative clause, followed by normative clauses. Specifically, any subclause identified as informative is informative; any clause with no identification is considered normative.

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 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

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- withdrawn,
- replaced by a revised edition, or
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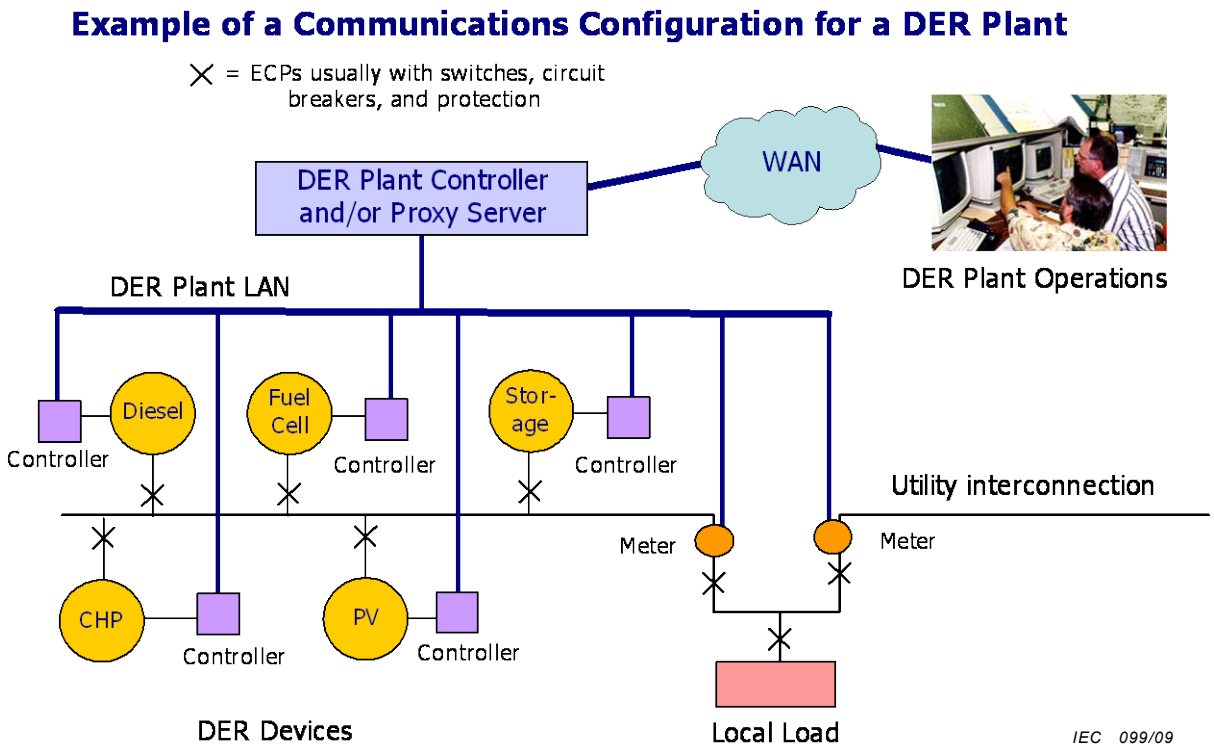
INTRODUCTION

Increasing numbers of DER (distributed energy resources) systems are being interconnected to electric power systems throughout the world. As DER technology evolves and as the impact of dispersed generation on distribution power systems becomes a growing challenge - and opportunity, nations worldwide are recognizing the economic, social, and environmental benefits of integrating DER technology within their electric infrastructure.

The manufacturers of DER devices are facing the age-old issues of what communication standards and protocols to provide to their customers for monitoring and controlling DER devices, in particular when they are interconnected with the electric utility system. In the past, DER manufacturers developed their own proprietary communication technology. However, as utilities, aggregators, and other energy service providers start to manage DER devices which are interconnected with the utility power system, they are finding that coping with these different communication technologies present major technical difficulties, implementation costs, and maintenance costs. Therefore, utilities and DER manufacturers recognize the growing need to have one international standard that defines the communication and control interfaces for all DER devices. Such standards, along with associated guidelines and uniform procedures would simplify implementation, reduce installation costs, reduce maintenance costs, and improve reliability of power system operations.

The logical nodes in this document are intended for use with DER, but may also be applicable to central-station generation installations that are comprised of groupings of multiple units of the same types of energy conversion systems that are represented by the DER logical nodes in this document. This applicability to central-station generation is strongest for photovoltaics and fuel cells, due to their modular nature.

Communications for DER plants involve not only local communications between DER units and the plant management system, but also between the DER plant and the operators or aggregators who manage the DER plant as a virtual source of energy and/or ancillary services. This is illustrated in Figure 1.



Key

CHP combined heat and power

WAN wide area network

DER distributed energy resources

PV photovoltaics

LAN local area network

Figure 1 – Example of a communications configuration for a DER plant

In basic terms, “communications” can be separated into four parts:

- information modelling (the types of data to be exchanged – nouns),
- services modelling (the read, write, or other actions to take on the data – verbs),
- communication protocols (mapping the noun and verb models to actual bits and bytes),
- telecommunication media (fibre optics, radio systems, wireless systems, and other physical equipment).

This document addresses only the IEC 61850 information modelling for DER. Other IEC 61850 documents address the services modelling (IEC 61850-7-2) and the mapping to communication protocols (IEC 61850-8-x). In addition, a systems configuration language (SCL) for DER (IEC 61850-6-x) would address the configuration of DER plants.

The general technology for information modelling has developed to become well-established as the most effective method for managing information exchanges. In particular, the IEC 61850-7-x information models for the exchange of information within substations have become International Standard. Many of the components of this standard can be reused for information models of other types of devices.

In addition to the IEC 61850 standards, IEC TC 57 has developed the common information model (CIM) that models the relationships among power system elements and other

information elements so that these relationships can be communicated across systems. Although this standard does not address these CIM relationships for DER, it is fully compatible with the CIM concepts.

The interrelationship between IEC TC 57 modelling standards is illustrated in Figure 2. This illustration shows as horizontal layers the three components to an information exchange model for retrieving data from the field, namely, the communication protocol profiles, the service models, and the information models. Above these layers is the information model of utility-specific data, termed the common information model (CIM), as well as all the applications and databases needed in utility operations. Vertically, different information models are shown:

- substation automation (IEC 61850-7-4),
- large hydro plants (IEC 61850-7-410),
- distributed energy resources (DER) (IEC 61850-7-420),
- distribution automation (under development),
- advanced metering infrastructure (as pertinent to utility operations) (pending).

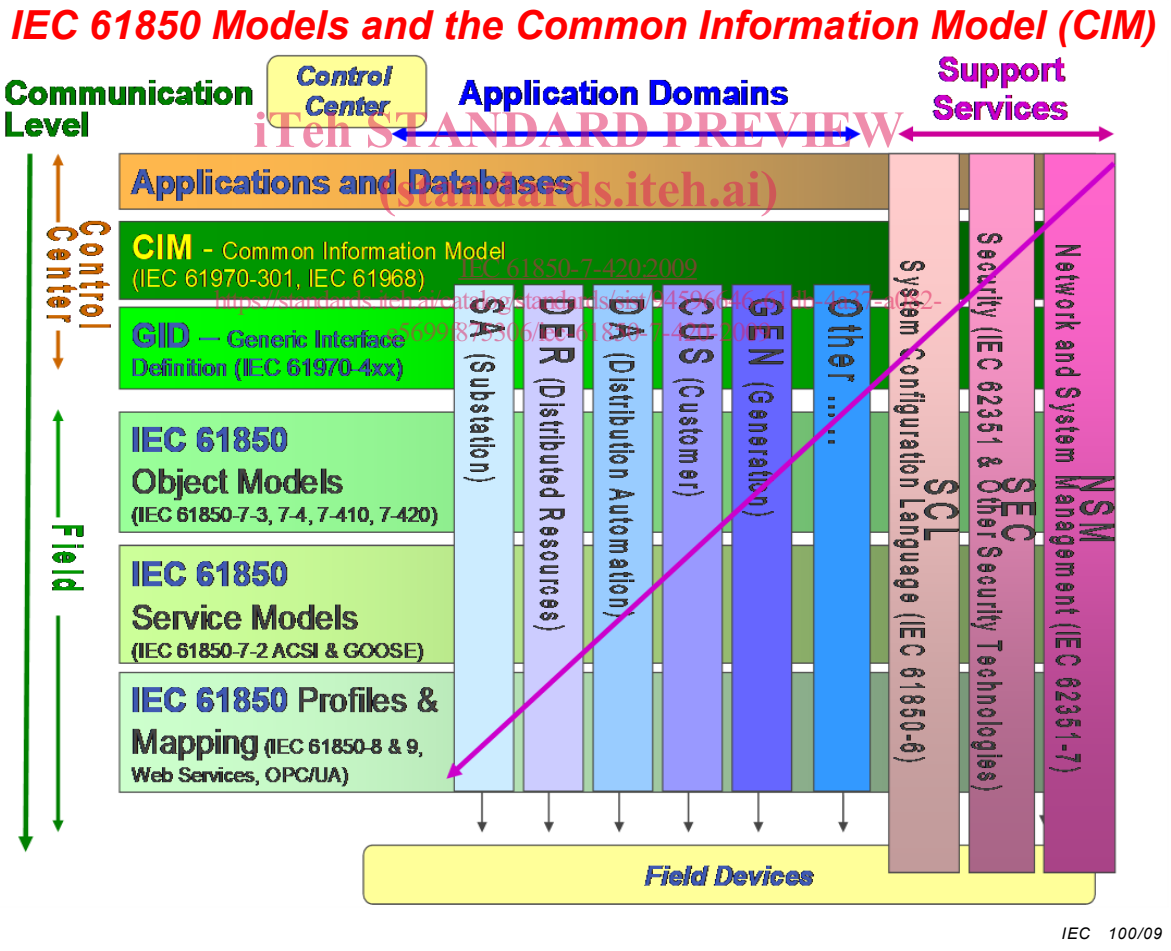


Figure 2 – IEC 61850 modelling and connections with CIM and other IEC TC 57 models

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 7-420: Basic communication structure – Distributed energy resources logical nodes

1 Scope

This International Standard defines the IEC 61850 information models to be used in the exchange of information with distributed energy resources (DER), which comprise dispersed generation devices and dispersed storage devices, including reciprocating engines, fuel cells, microturbines, photovoltaics, combined heat and power, and energy storage.

The IEC 61850 DER information model standard utilizes existing IEC 61850-7-4 logical nodes where possible, but also defines DER-specific logical nodes where needed.

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 61850-7-2:2003, *Communication networks and systems in substations – Part 7-2: Basic communication structure for substations and feeder equipment – Abstract communication service interface (ACSI)* [1)]

IEC 61850-7-3:2003, *Communication networks and systems in substations – Part 7-3: Basic communication structure for substations and feeder equipment – Common data classes* [1)]

IEC 61850-7-4:2003, *Communication networks and systems in substations – Part 7-4: Basic communication structure for substations and feeder equipment – Compatible logical node classes and data classes* [1)]

IEC 61850-7-410, *Communication networks and systems for power utility automation – Part 7-410: Hydroelectric power plants – Communication for monitoring and control*

ISO 4217, *Codes for the representation of currencies and funds*

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1) A new edition of this document is in preparation.

3 Terms, definitions and abbreviations

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

3.1 Terms and definitions

3.1.1
ambient temperature
temperature of the medium in the immediate vicinity of a device

[IEC/TS 62257-8-1:2007, definition 3.15 modified]

3.1.2
combined heat and power (CHP) co-generation
production of heat which is used for non-electrical purposes and also for the generation of electric energy

[IEV 602-01-24, modified]

NOTE Conventional power plants emit the heat produced as a useless byproduct of the generation of electric energy into the environment. With combined heat and power, the excess heat is captured for domestic or industrial heating purposes or – in form of steam – is used for driving a steam turbine connected to an air-conditioner compressor. Alternatively, the production of heat may be the primary purpose of combined heat and power, whereas excess heat is used for the generation of electric energy.

3.1.3
common data class
CDC
classes of commonly used data structures which are defined in IEC 61850-7-3

3.1.4
device
material element or assembly of such elements intended to perform a required function

[IEV 151-11-20]

NOTE A device may form part of a larger device.

3.1.5
electrical connection point
ECP
point of electrical connection between the DER source of energy (generation or storage) and any electric power system (EPS)

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 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 the IEEE 1547 "*Standard for Interconnecting Distributed Resources with Electric Power Systems*".

3.1.6
electric power system
EPS
facilities that deliver electric power to a load

[IEEE 1547]