IEC TS 62939-2

Edition 1.0 2018-11

TECHNICAL SPECIFICATION

colour inside

Smart grid user interface –
Part 2: An architecture and requirements

IEC TS 62939-2:2018-11(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC TS 62939-2

Edition 1.0 2018-11

TECHNICAL SPECIFICATION

colour inside

Smart grid user interface –
Part 2: An architecture and requirements

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.200

ISBN 978-2-8322-6229-0

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

SMART GRID USER INTERFACE –

Part 2: An architecture and requirements

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.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

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

IEC TS 62939-2, which is a Technical Specification, has been prepared by IEC project committee 118: Smart grid user interface.

The text of this Technical Specification is based on the following documents:

Enquiry draft	Report on voting
118/93/DTS	118/97A/RVDTS

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

A list of all parts in the IEC 62939 series, published under the general title *Smart grid user interface*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document 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

Over the years, several ecosystems (especially telecommunications, sustainable energy, home automation) have been growing in parallel but separately in the customer premises. The perspective of energy applications is triggering a high level of interest in new markets such as smart home, smart community, smart building, smart industrial park, distributed energy resources, and electric vehicles. It is a growing trend that the traditional energy consumer may eventually turn out to be the prosumer, who not only consumes power from but also feeds power back to the grid, which raises the challenge for grid management.

Considering the relevance and common interests while connecting various demand-side objects with the power grid, it is urgent and important to ensure effective, economical and secure operation of the power grid from the point of view of a user as well as enhance the energy efficiency of the demand-side system and equipment. Under the circumstances, information exchange may play a more critical role in this field. Currently, various communication standards have been developed by organizations and manufacturers for customer facility management and control. However, the industry has become impatient with the lack of standard interfacing methods and solutions to exchange information with the grid.

This document focuses on standardization in the field of interfacing for information exchange between smart equipment and/or systems and the grid from the point of view of the user to the grid for customer facility management and control applications.

IEC 62939 consists of the following parts under the general title *Smart grid user interface*:

Part 1: Interface overview and country perspectives

Part 2: An architecture and requirements

In addition to the above parts, two documents in the IEC 62746 series cover the SGUI bridge standard for demand response application. The first is IEC PAS 62746-10-1 and the other is IEC 62746-10-3.

SMART GRID USER INTERFACE –

Part 2: An architecture and requirements

1 Scope

This part of IEC 62939 provides an architecture to define interfaces for the information exchange between smart equipment/systems from the demand side and the power grid. It facilitates the interoperability between the IEC common information model (CIM) and customer facility standards for smart grid applications.

This document presents one possible architecture to connect non-CIM/IEC 61850-based demand-side standards to the CIM, to support demand response type applications. It presents an immediately available architecture approach for home and building grid users for demand response applications to cope with the fragmented market and lack of harmonized standard solutions.

It proposes that a three-layer application be implemented but this does not preclude the ongoing long-term efforts of IEC ideally to promote from a semantic perspective only two-layer implementations.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
adapter
layer of software that connects one component to another component to exchange information

Note 1 to entry: An adapter can consist of multiple functions, for example, model mapping, data transformation, service matching and communication protocol mapping.

3.1.2
application
simple function, such as sending an ‘open/close’ command, or complicated one, consisting of a group of logically connected function units, such as demand response

Note 1 to entry: Apart from the ‘physical’ application, there can also be a ‘virtual’ one, for example, data transformation, power efficiency assessment, etc.

Note 2 to entry: In this document, "application" stands for "smart grid application".

3.1.3
demand response
action resulting from management of the electricity demand in response to supply conditions

[SOURCE: IEC 60050-617:2011, 617-04-16]

3.1.4
profile
defines a subset of an entity (e.g. standard, specification or a suit of standards/ specifications). Profiles enable interoperability and therefore can be used to reduce the complexity of a given integration task by:

- selecting or restricting standards to the essentially required content, e.g. removing options that are not used in the context of the profile
- setting specific values to defined parameters (frequency bands, metrics, etc.)

Note 1 to entry: The 'CIM profile' is simply some formal subset of the CIM, in terms of classes, attributes and relationships that can have additional restrictions imposed.

[SOURCE: IEC TR 62357-1:2016, 3.1.11, modified – the second paragraph of the definition has been deleted and a note has been added.]

3.1.5
smart grid user interface
SGUI
bi-directional, logical, abstract interface that supports appropriately secure communication of information between an entity within the customer domain (e.g., home or building energy management system, electrical load, and energy storage system or generation source) and an external energy service provider

Note 1 to entry: Devices and applications will implement the SGUI between service providers and customers to facilitate machine-to-machine communications. The SGUI has to meet the needs of today's grid interactions (e.g., demand response, grid-aware energy management, EV charging equipment interactions) and those of the future (e.g., retail market transactions).

3.2 Abbreviated terms

ACSI	Abstract communication service interface
CFMC	Customer facility management and control
CIM	Common information model
CIS	Component interface specification
DER	Distributed energy resource
DMS	Distribution management system
DR	Demand response
EMS	Energy management system
ESB	Enterprise service bus
EV	Electrical vehicle
FSGIM	Facility smart grid information model
ICT	Information and communications technology
IEM	Information exchange model
OLTC	On load tap changer
PAB	Profile, adapter and bridge
RDF	Resource description framework
SCADA	Supervisory control and data acquisition

SGAM	Smart grid architecture model
SGUI	Smart grid user interface
XML	eXtensible Markup Language
XSD	XML schema definition

4 Objectives

A smart grid is a very large and complex system of systems covering bulk generation, transmission, distribution, DER and customer premises. Those systems, used for grid operations, apply the common information model (CIM) or IEC 61850 data model. Within the customer premises, smart equipment and systems usually use different information models and communication protocols for facility management and control, for example, EEBus, KNX, ECHONET Lite, LonMark, BACnet[1], etc.

The market experiences have revealed that the factors that can affect the interoperability between the customer facility and grid are as follows:

- the technologies used can be incompatible with each other,
- the legacy systems may not have a strong motivation to be upgraded or even substituted,
- the capital investment and time cost for a system upgrade may not be acceptable to both stakeholders and operator, and
- the current standards may not closely keep pace with the requirements of emerging smart grid applications.

In these circumstances, the objective of this document is to describe an interfacing reference architecture for DR applications that need to exchange information between the CIM and customer facility standards. This will enable the smart grid to:

– bridge the grid operations and the customer facility management and control,

NOTE See IEC TR 62939-1.

– boost the customer involvement in the smart grid,
– offer a fast response to the market requirements and fill the gaps in this cross-cutting field,
– reduce the cost and time for the development and maintenance of cross-domain applications,
– protect the investment in legacy systems and make the existing resources reusable,
– improve smart grid interoperability, compatibility and flexibility.

5 Reference architecture

5.1 General

Clause 5 presents the SGUI reference architecture, which provides a common practice for how to build interfaces for information exchange between the CIM and customer facility standards. IEC 62939 (all parts), shown in Figure 1, facilitates the applications in customer facility management and control (CFMC) to connect the IEC TC57 reference architecture.

---

[1] EEBus, KNX, ECHONET Lite, LonMark, BACnet are examples of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of these products.

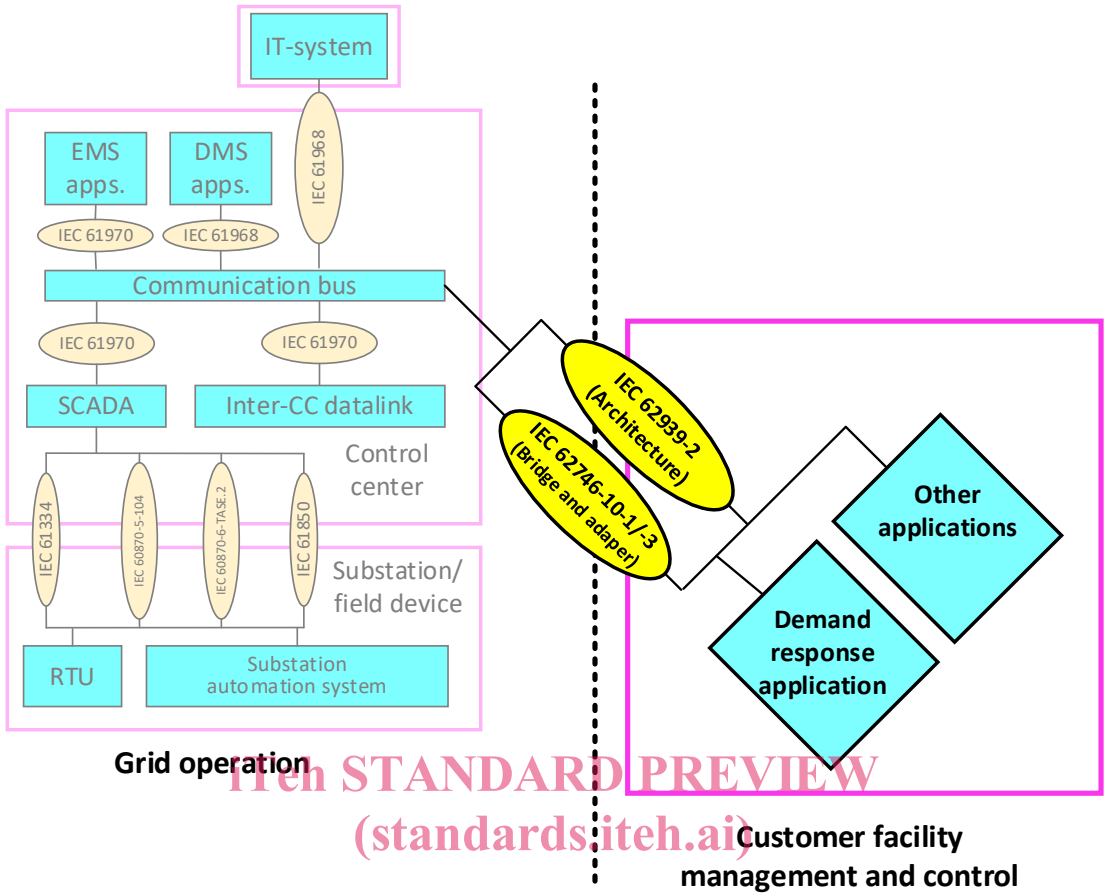

Figure 1 – Relationship with other IEC standards in parts of TC57 reference architecture

The idea of bridge is the key concept of the SGUI architecture. A demand response (DR) application from the point of view of the customer is embedded within the CFMC block. By using IEC 62939-2 (architecture) and IEC PAS 62746-10-1 and IEC 62746-10-3 (specific bridge and adapter for DR), the DR application can build the connection to the communication bus in the grid at the enterprise level. In the grid operation, on the left side of Figure 1, the communication bus can integrate EMS/SCADA, DMS and other utility business systems by using IEC 61970-1 and IEC 61968-1 respectively. So, through the SGUI, the DR application in CFMC has the ability to exchange information with relevant applications in EMS or DMS according to the use cases.

The SGUI reference architecture may be applicable to other applications that need the cooperation of equipment and systems from both the power system and the customer premises, for example, power efficiency assessment, black-out prevention, etc. Therefore, a block called 'other applications' is added in the CFMC block in Figure 1. By using the SGUI architecture and proper application-specific bridges and adapters, those applications can connect to the utility systems as the DR application mentioned above does.

Common to most of the smart grid technologies is an increased use of communications and IT technologies, including an increased interaction and integration of formerly separate systems (see IEC TR 63097). With this in mind, the SGUI architecture may not be limited to the state-of-the-art information and communications technology (ICT) and may be independent from the specific underlying technology. For example, the communication bus in Figure 1 can be a middleware, enterprise service bus (ESB) or cloud platform depending on the application requirements and deployment and operation environments. Therefore, the SGUI should have the ability for extensions to match the fast-changing environment both from the perspective of the power system and the customer facility.