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TECHNICAL SPECIFICATION

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Systems interface between customer energy management system and the power management system – Part 3: Architecture

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SYSTEMS INTERFACE BETWEEN CUSTOMER ENERGY MANAGEMENT SYSTEM AND THE POWER MANAGEMENT SYSTEM –

Part 3: Architecture

FOREWORD

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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 TS 62746-3, 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
57/1527/DTS	57/1610/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.

A list of all parts in the IEC 62746 series, published under the general title *Systems interface between customer energy management system and the power management system*, 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

- transformed into an International standard,
- 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- withdrawn,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 purpose of this part of IEC 62746 is to define an architecture for IEC 62746 series of standards that can be leveraged for the management of customer energy resources and DER. These resources may be a combination of load, generation and storage resources that can be managed to respond to signals provided by grid and/or market operators. These resources may be identified and managed as individual resources with specific capabilities, or as virtual resources with an aggregated set of capabilities.

The focus of this architecture is to leverage the Internet for communications between grid operators, market operators, distribution system operators, electricity suppliers, aggregators, service providers and energy resources.

This Technical Specification leverages existing IEC standards.The data model of IEC 62746 is based on the Common Information Model and IEC 61850. IEC 62746 is transport-independent.

Figure 1 shows the relationship of IEC 62746 to other IEC and ISO standards.

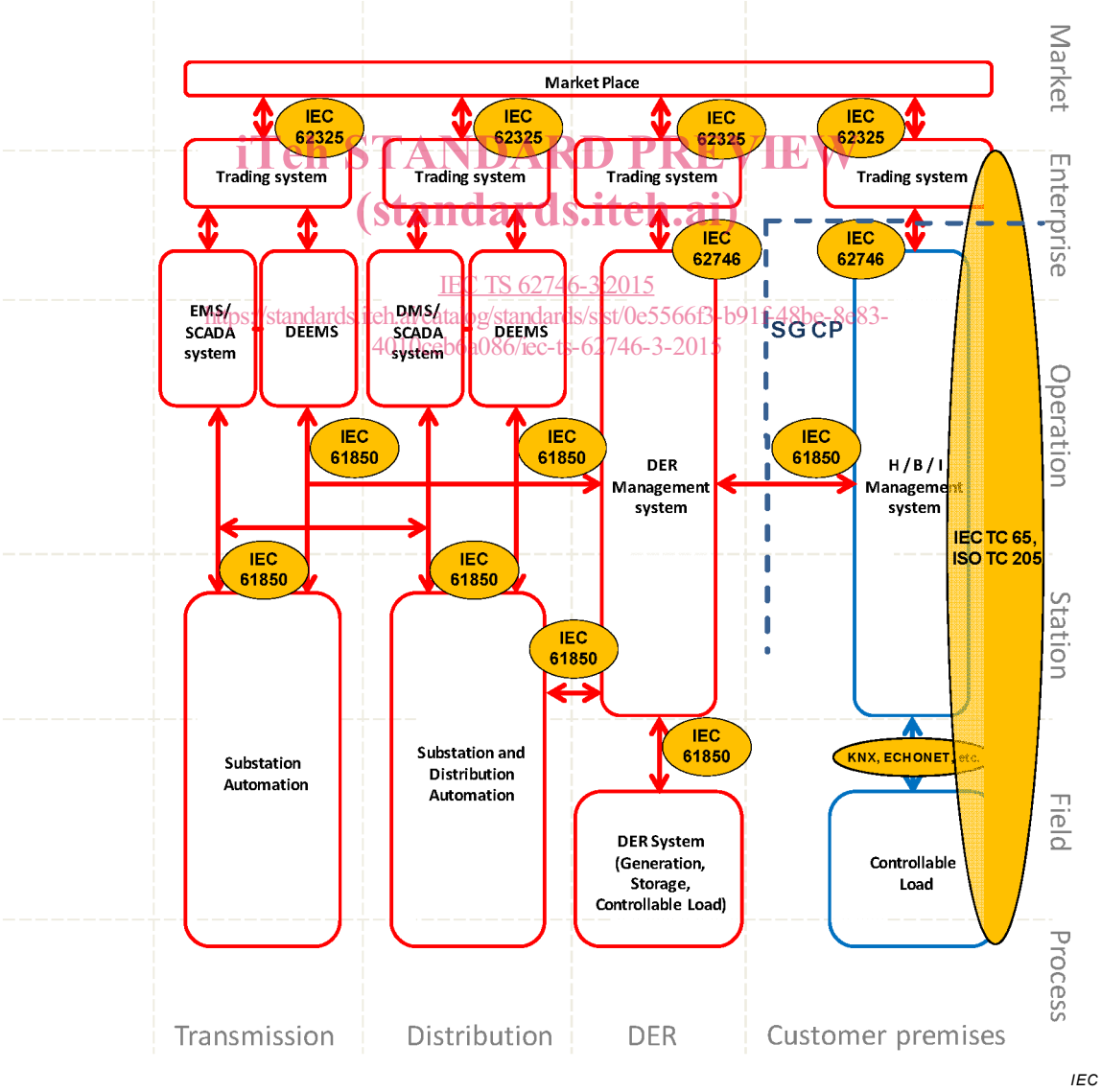

Figure 1 – Relationship of IEC 62746 to other standards

SYSTEMS INTERFACE BETWEEN CUSTOMER ENERGY MANAGEMENT SYSTEM AND THE POWER MANAGEMENT SYSTEM –

Part 3: Architecture

1 Scope

This part of IEC 62746, which is a Technical Specification, establishes an architecture that is supportive of interfaces between the Customer Energy Management System and the Power Management System.

A DER Management System can also be a Customer Energy Management System.

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 61968-9:2013, *Application integration at electric utilities – System interfaces for distribution management – Part 9: Interfaces for meter reading and control*

IEC 61968-100, *Application integration at electric utilities – System interfaces for distribution management – Part 100: Implementation profiles*

IEC 62351 (all parts), *Power systems management and associated information exchange – Data and communications security*

IEC TR 62746-2:2015, *Systems interface between customer energy management system and the power management system – Part 2: Use cases and requirements*

IEC 62443 (all parts), *Industrial communication networks – Network and system security*

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
aggregation
collection of the capabilities of multiple resources into a single virtual resource

Note 1 to entry: A common use of aggregation is to collect many small resources and offer their capabilities in the form of a single larger resource to a market.

3.1.2
cascading
event which occurs when a message published in one communication domain causes another message to be published in one or more other communication domains at a different level of a hierarchy

3.1.3
communication domain
logical association of a VTN with a set of VENs supported by an underlying communication infrastructure

Note 1 to entry: This provides for authentication of VENs and secure communication services. Since VTN and VEN are roles within a Communication Domain, it is possible for an actor to take a VTN role in one Communication Domain and potentially one or more VEN roles in other Communication Domains.

Note 2 to entry: This term is defined by this technical specification.

3.1.4
customer energy manager
CEM
central managing function used by the customer to manage the flow of information between the grid and connected smart devices at the customer premises

Note 1 to entry: This is defined in more detail in IEC TR 62746-2.

3.1.5
demand response
DR
incentivizing of customers by costs, ecological information or others in order to initiate a change in their consumption or feed-in pattern (“bottom-up approach” = Customer decides, based on EURELECTRIC Views on Demand-Side Participation [1])

Note 1 to entry: Alternative definition: In IEC 60050-617:2009, 617-04-15 it is defined as: action resulting from management of the electricity demand in response to supply conditions.

3.1.6
distributed energy resource

specialized energy resource with a flexible load and/or supply generally at the distribution level

3.1.7
message
method of conveying information between parties in a communication network

Note 1 to entry: The information may reflect a description of an object and/or data related to the object.

3.1.8
node
logical destination address for messages that are published using a publish/subscribe communication infrastructure

Note 1 to entry: Depending upon the specific communication infrastructure this may also be called a ‘topic’ or ‘subject’.

3.1.9
publish/subscribe
communication pattern where a message sent from a source may be received by zero or more interested subscribers

SEE: IEC 61968-100

3.1.10
request/reply
communication pattern where a request message is sent from one process to another process, where there is that the expectation that a response message will be returned by the receiver of the request message

SEE: IEC 61968-100.

3.1.11
resource
provider or consumer of energy

Note 1 to entry: A VEN may be responsible for managing one or more energy resources.

Note 2 to entry: Resources may be physical or aggregated.

3.1.12
signal
message that is sent to indicate a condition or information of potential interest

3.1.13
smart grid connection point
SG CP
information access point from the grid to the customer premises

Note 1 to entry: This is a logical connection point but not the electrical connection point.

Note 2 to entry: This is described in more detail in IEC TR 62746-2.

3.1.14
technical role
role which identifies responsibilities associated with participation within information exchanges with other actors

Note 1 to entry: Actors defined by use cases have assigned roles with associated responsibilities. Technical roles are physically realized through software and associated systems integration infrastructure. This is a term defined here for the purposes of this Technical Specification.

3.1.15
virtual end node

technical role assumed by an actor where the actor is a consumer and/or producer of messages that are defined by this Technical Specification

Note 1 to entry: A Virtual End Node (VEN) can be associated with zero or more resources. A VEN can receive messages pushed from a VTN or send requests or events to a VTN. A VEN may communicate with multiple VTNs, where each VTN is part of a different Communication Domain.

Note 2 to entry: This term is defined by this Technical Specification as a technical role, noting that there is a somewhat related definition for an 'End Device' as defined by IEC 61968-9. While the concept is generic, the specific term is borrowed from OpenADR 2.0 with the normative definition being provided by this Technical Specification.

3.1.16
virtual resource
set of one or more physical resources that is represented as a single, aggregated resource

Note 1 to entry: This may be comprised of multiple entities that may be geographically distributed. Virtual Resources can be an aggregated model of many types of load, generation and storage, such as VPP, PV, factory, building, home, etc. Since the Virtual Resource can include both energy consumer and energy provider, the related "net load curve" can be positive (in this case the Virtual Resource acts as a consumer which consumes electrical power), or negative (in this case the Virtual Resource acts as generation assets to produce electrical power).

3.1.17
virtual top node
technical role assumed by an actor that is assuming responsibility for the coordination of VENs within a Communication Domain

Note 1 to entry: This is a special case of a VEN, where a Virtual Top Node (VTN) is effectively a parent of many VENs with the responsibility for coordination of those VENs. A VTN is responsible for pushing to or receiving message from many VENs. A market operator, grid operator or aggregator are examples of actors which will typically implement a VTN interface.

Note 2 to entry: This term is defined by this Technical Specification as a technical role, noting that there is a related definition provided by IEC 61968-9. While the concept is generic, the specific term is borrowed from OpenADR 2.0 with the normative definition being provided by this Technical Specification.

3.1.18
wire protocol
in a network, the mechanism transmitting data from a sender to a receiver

Note 1 to entry: If the sender and receiver use the same wire protocol they are said to interoperate. This does not literally mean that signals are conveyed over a metal wire, as the term is also used in conjunction with wireless and fiber communication media.

Note 2 to entry: This is a widely used phrase without a specific normative definition, where a definition is provided here for the purposes of this technical specification.

3.2 Abbreviations

Abbreviation	Description
CEM	Customer Energy Manager
CIM	Common Information Model
DER	Distributed Energy Resources
DMZ	De-Militarized Zone, a perimeter network used to shield an internal trusted network from attacks from external networks such as the Internet
DoS	Denial of service
DR	Demand Response
EV	Electric Vehicle
HAN	Home area network
IEC	International Electrotechnical Commission
IETF	Internet Engineering Task Force
JMS	Java Message Service
LAN	Local area network
PAN	Premise area network, could be a LAN or HAN
PV	Photovoltaic generator
SG CP	Smart Grid Connection Point
SM	Smart Meter
VEN	Virtual End Node
VPP	Virtual Power Plant
VTN	Virtual Top Node
XML	Extensible Markup Language
XMPP	Extensible Messaging and Presence Protocol
XSD	XML Schema
W3C	World-wide Web Consortium

4 Architectural overview

4.1 Application area

Figure 2 shows a resource-level view of the area to be addressed by this Technical Specification, where examples of specific actors are provided as related to interactions between the smart grid and the customer premises at what is called the ‘smart grid connection point’ (SG CP).

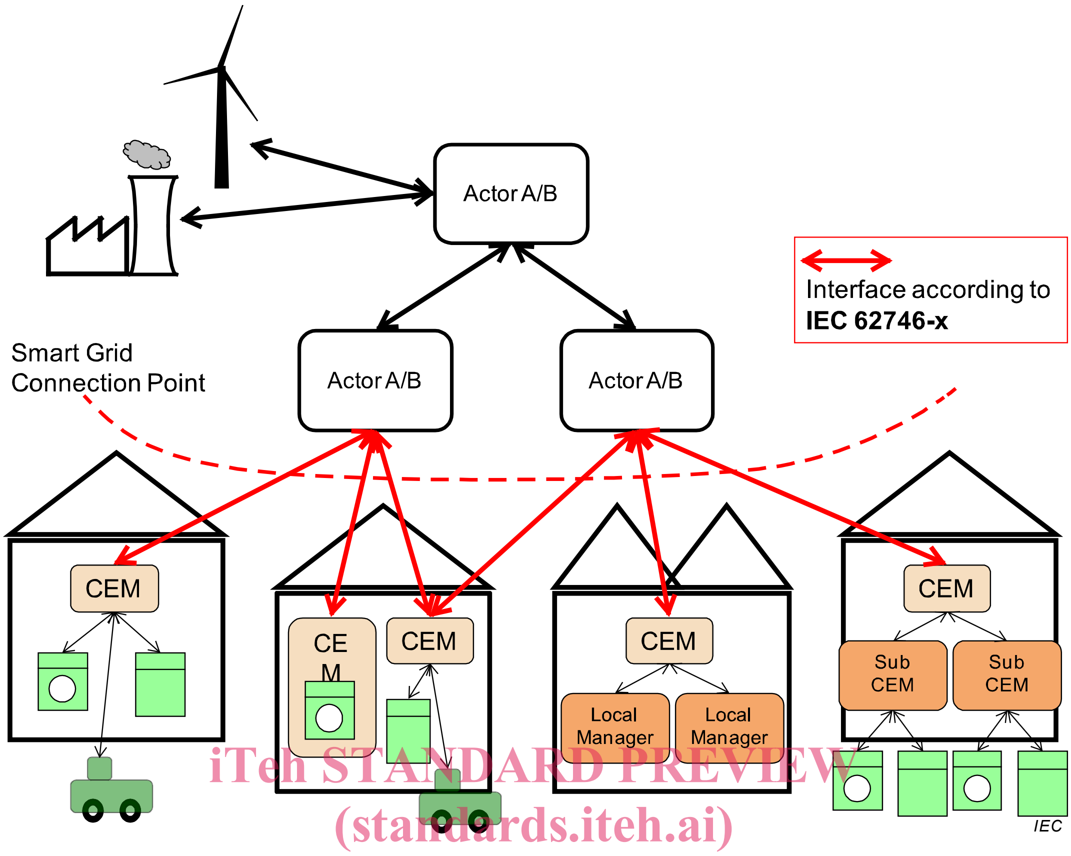

Figure 2 – Resource-level view

However, the problem space is extended upward to support coordination of these resources by actors representing markets, aggregators and operations. In order to support the coordination of these actors, there are a variety of information exchanges that are conveyed using IEC 62746. More examples are provided by the use cases of IEC TR 62746-2.

4.2 Actors, roles and relationships

The purpose of this subclause is to provide an architecture overview from the perspective of the identification of technical roles and associated communication standards that can be applied to a set of actors in support of their respective functional roles and relationships. The definitions of specific actors are provided by IEC TR 62746-2. The intent of the architecture is to enable communications (primarily using public wide area networks, such as Internet) between a wide variety of actors, including (but not limited to) utilities, market operators, service providers, aggregators and customers for the purposes of coordinating and operating distributed energy resources (DER) and demand response (DR).

IEC TR 62746-2 defines a large number of actors. It can be readily seen that there are many similarities in some of those actors as well as functional overlap in the roles of many of the actors. However, from the perspective of defining a supporting architecture it is important to define technical roles and responsibilities that can be taken on by those actors.

It is not the intent of this Technical Specification to provide examples of all actors defined by IEC TR 62746-2 or restate the definitions of those actors, and consequentially some higher-level categorization of actors will be used within this Technical Specification as opposed to specific actors in describing the use of this Technical Specification. Additionally it is the intent of this architecture to support specific actors who are yet unknown. The basic requirement is that an actor can assume (either directly or by proxy) the technical roles of 'VTN' and/or 'VEN' as defined by this architecture.