

INTERNATIONAL STANDARD



**Systems interface between customer energy management system and the power
management system –
Part 10-1: Open automated demand response**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SYSTEMS INTERFACE BETWEEN CUSTOMER ENERGY
MANAGEMENT SYSTEM AND THE POWER MANAGEMENT SYSTEM –****Part 10-1: Open automated demand response**

FOREWORD

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International Standard IEC 62746-10-1 has been prepared by IEC project committee 118: Smart grid user interface.

The text of this International Standard is based on the following documents:

CDV	Report on voting
118/91/CDV	118/96B/RVC

Full information on the voting for the approval of this International Standard 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 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 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- withdrawn,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.

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INTRODUCTION

Development of the demand response (DR) market has resulted in a transition from manual DR to OpenADR (this document) in automated DR programs. DR is defined as an action taken to reduce electricity demand in response to price, monetary incentives, or utility directives so as to maintain reliable electric service or avoid high electricity prices. This document was developed to support common auto-DR programs and energy policy objectives to move toward dynamic markets to improve the economics and reliability of the electricity grid. The recent developments have expanded the use of this document to meet diverse market needs, such as ancillary services, dynamic prices, intermittent renewable resources, supplement grid-scale storage, electric vehicles, and load as generation. For example, with real-time price information, an automated client within the customer facility can be designed to continuously monitor these prices and translate this information into continuous automated control and response strategies.

This document's communication has the following defining features:

- Continuous, secure, and reliable – Provides continuous, secure, and reliable two-way communications where the endpoints at the end-use site receive and acknowledge the receipt of DR signals from the energy service providers.
- Translation – Translates DR event information to internet signals to facilitate DR automation. These signals are designed to interoperate with energy management and control systems, lighting, or other end-use controls.
- Automation – Receipt of the external signal is designed to initiate automation through the use of pre-programmed demand response strategies determined and controlled by the end-use participant.
- Opt-out – Provides opt-out or override function to any participants for a DR event if the event comes at a time when changes in end-use services are not desirable.
- Complete data model – Describes a rich data model and architecture to communicate price, reliability, and other DR activation signals.
- Scalable architecture – Provides scalable communications architecture to different forms of DR programs, end-use buildings, and dynamic pricing.
- Open standards – Open standards-based technology such as internet protocol (IP) and web services form the basis of the communications model.

This document is a communications data model, along with transport and security mechanisms, which facilitate information exchange between two end-points: the electricity service provider or DR program operator, and a customer-side resource. It is not a protocol that specifies "bit-structures" as some communications protocols do, but instead relies upon existing open standards such as Extensible Markup Language (XML) and internet protocol (IP) as the framework for exchanging DR signals. In some references, the term "system," "technology," or "service" is used to refer to the features of this document.

IEC 62746-10-1 is designed to facilitate automation of DR actions at the customer location, whether it involves electric load decreases, load increases, or load shifting for various demand response markets. Many emergency or reliability DR events occur at specific times when the electricity grid is strained. The communications are designed to coordinate such signals with facility control systems (commercial, industrial, and residential). This document is also designed to provide continuous dynamic price signals, such as hourly, day-ahead, or day-of real-time pricing. With such price information, an automated client can be configured to continuously monitor these prices and translate this information into continuous automated control and response within a facility. Several reports present the history of this document and the involved research. This document covers the signalling data models for price and reliability signals to both wholesale and retail markets, and can act as a complementary standard to a CIM-based grid control system.

This document provides the following benefits:

- Open specification – Provides a standardized DR communications and signalling infrastructure using open, non-proprietary, industry-approved data models that can be implemented for both dynamic prices and DR emergency or reliability events.
- Flexibility – Provides open communications interfaces and protocols that are flexible, platform-independent, interoperable, and transparent to end-to-end technologies and software systems.
- Innovation and interoperability – Encourages open innovation and interoperability, and allows controls and communications within a facility or enterprise to build on existing strategies to reduce technology operation and maintenance costs, stranded assets, and obsolescence in technology.
- Ease of integration – Facilitates integration of common energy management and control systems (EMCS), centralised lighting, and other end-use devices that can receive internet signals (such as XML).
- Supports a wide range of information complexity – Can express the information in the DR signals in a variety of ways to allow for systems ranging from simple end devices (e.g. thermostats) to sophisticated intermediaries (e.g. aggregators) to receive the DR information that is best suited for its operations.

This document's purpose is to manage the growing demand for demand-side flexibility – the ability to modify the load profile of the consumers over time. This low-cost communications infrastructure is used to improve the reliability, repeatability, robustness, and cost-effectiveness of DR.

This technology has been field tested for over a decade and deployed in a number of DR programs worldwide. While the scope of this document focuses on signals for DR events and prices, significant supporting research work has been done to study DR strategies and techniques to automate DR within facilities. This document interacts with facility control systems that are pre-programmed to take action based on a DR signal, enabling a response to a DR event or a price to be fully automated, with no manual intervention.

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

Part 10-1: Open automated demand response

1 Scope

This part of IEC 62746-10, OpenADR 2.0 (this document), specifies a minimal data model and services for demand response (DR), pricing, and distributed energy resource (DER) communications. This document can be leveraged to manage customer energy resources, including load, generation, and storage, via signals provided by grid and/or market operators. These resources can be identified and managed as individual resources with specific capabilities, or as virtual resources with an aggregated set of capabilities.

This document specifies how to implement a two-way signaling system to facilitate information exchange between electricity service providers, aggregators, and end users. The DR signalling system is described in terms of servers (virtual top nodes or VTNs), which publish information to automated clients (virtual end nodes, or VENs), which in turn subscribe to the information.

This document provides application-level service communication that can be used to incentivise a response from a customer-owned DER. Price and DR signals over the internet allow indirect control of customer-owned devices that otherwise would not be available.

This document's services are independent of transport mechanisms. For the purposes of interoperability, this document provides basic transport mechanisms and their relevant interaction patterns to address different stakeholder needs. In addition, this document specifies cyber security mechanisms required for data confidentiality, integrity, authentication and message-level security, in order to provide non-repudiation and mitigation of cyber security risks.

The services make no assumption of specific DR electric load control strategies that can be used within a DR resource or of any market-specific contractual or business agreements between electricity service providers and their customers.

This document provides a clear set of mandatory and optional attributes within each of the services to meet broader interoperability, testing and certification requirements. All necessary XML schema are included in Annex E.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

INTERNET ENGINEERING TASK FORCE (IETF). RFC 2616: *Hypertext Transfer Protocol – HTTP/1.1* [online]. Edited by R. Fielding et al. June 1999 [viewed 2018-08-02]. available at: <http://www.ietf.org/rfc/rfc2616.txt>

INTERNET ENGINEERING TASK FORCE (IETF). RFC 3986: *Uniform Resource Identifier (URI): Generic Syntax* [online]. Edited by T. Berners-Lee et al. January 2005 [viewed 2018-08-02]. available at:
<http://www.ietf.org/rfc/rfc3986.txt>

INTERNET ENGINEERING TASK FORCE (IETF). RFC 5246: The Transport Layer Security (TLS) Protocol Version 1.2 [online]. Edited by T. Dierks et al. August 2008 [viewed 2018-08-02]. available at
<https://tools.ietf.org/html/rfc5246>

INTERNET ENGINEERING TASK FORCE (IETF). RFC 6120: *Extensible Messaging and Presence Protocol (XMPP): Core* [online]. Edited by P. Saint-Andre. March 2011 [viewed 2018-08-02]. available at:
<http://www.ietf.org/rfc/rfc6120.txt>

INTERNET ENGINEERING TASK FORCE (IETF). RFC 6121: *Extensible Messaging and Presence Protocol (XMPP): Instant Messaging and Presence* [online]. Edited by P. Saint-Andre. March 2011 [viewed 2018-08-02]. available at:
<http://www.ietf.org/rfc/rfc6121.txt>

XMPP Standards Foundation. *XEP-0030: Service Discovery* [online]. Edited by J. Hildebrand et al. October 2017 [viewed 2018-08-02]. available at:
<http://xmpp.org/extensions/xep-0030.html>

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

OpenADR 2.0

specification that provides the basis for this document

3.1.2

PUSH and PULL operations

mode of operation by which this document can be used in either PULL mode (VEN pulling information from VTN) or in a PUSH mode (VTN pushing information to the VEN)

Note 1 to entry: The XMPP transport uses a PUSH model, although VENs can still make requests of the VTN, excluding the use of oadrPoll.

3.1.3

simple HTTP

HTTP implementation that uses HTTP POST over TLS to propagate payloads

3.1.4

virtual end node

VEN

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