IEC 61968-100

Edition 1.0 2013-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Application integration at electric utilities – System interfaces for distribution management –
Part 100: Implementation profiles

Intégration d'applications pour les services électriques – Interfaces système pour la gestion de distribution –
Partie 100: Profils de mise en oeuvre

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FOREWORD

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International Standard IEC 61968-100 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

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

FDIS	Report on voting
57/1358/FDIS	57/1382/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.

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

A list of all parts in the IEC 61968 series, published under the general title *Application integration at electric utilities – System interfaces for distribution management*, 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 web site 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- withdrawn,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.

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INTRODUCTION

This part of IEC 61968 defines a set of implementation profiles for IEC 61968 using technologies commonly used for enterprise integration. More specifically, this document describes how message payloads defined by parts 3-9 of IEC 61968 are conveyed using web services and the Java Messaging System. Guidance is also provided with respect to the use of Enterprise service Bus (ESB) technologies. The goal is to provide details that would be sufficient to enable implementations of IEC 61968 to be interoperable. In addition, this document is intended to describe integration patterns and methodologies that can be leveraged using current and future integration technologies.

The IEC 61968 series of standards is intended to facilitate *inter-application integration* as opposed to *intra-application integration*. Intra-application integration is aimed at programs in the same application system, usually communicating with each other using middleware that is embedded in their underlying runtime environment, and tends to be optimised for close, real-time, synchronous connections and interactive request/reply or conversation communication models. IEC 61968, by contrast, is intended to support the inter-application integration of a utility enterprise that needs to connect disparate applications that are already built or new (legacy or purchased applications), each supported by dissimilar runtime environments. Therefore, these interface standards are relevant to loosely coupled applications with more heterogeneity in languages, operating systems, protocols and management tools. This series of standards, which are intended to be implemented with middleware services that exchange messages among applications, will complement, not replace utility data warehouses, database gateways, and operational stores.

This standard is based upon the EPRI Technical Report 1018795 and other contributed works.

The IEC 61968 series, taken as a whole, defines interfaces for the major elements of an interface architecture for distribution systems within a utility enterprise. Part 1: Interface Architecture and General Recommendations, identifies and establishes requirements for standard interfaces based on an Interface Reference Model (IRM). Parts 3 through 9 of IEC 61968 define interfaces relevant to each of the major business functions described by the Interface Reference Model.

As described in IEC 61968, there are a variety of distributed application components used by the utility to manage electrical distribution networks. These capabilities include monitoring and control of equipment for power delivery, management processes to ensure system reliability, voltage management, demand-side management, outage management, work management, automated mapping, meter reading, meter control and facilities management. This set of standards is limited to the definition of interfaces and is implementation independent. It provides for interoperability among different computer systems, platforms, and programming languages. Methods and technologies used to implement functionality conforming to these interfaces are considered outside of the scope of these standards; only the interface itself is specified in these standards.

APPLICATION INTEGRATION AT ELECTRIC UTILITIES – SYSTEM INTERFACES FOR DISTRIBUTION MANAGEMENT –

Part 100: Implementation profiles

1 Scope

This part of IEC 61968 specifies an implementation profile for the application of the other parts of IEC 61968 using common integration technologies, including JMS and web services. This International Standard also provides guidance with respect to the use of Enterprise Service Bus (ESB) technologies. This provides a means to derive interoperable implementations of IEC 61968-3 to IEC 61968-9. At the same time, this International Standard can be leveraged beyond information exchanges defined by IEC 61968, such as for the integration of market systems or general enterprise integration.

Figure 1 attempts to provide an overview of scope, where IEC 61968 compliant messages are conveyed using web services or JMS. Through the use of an ESB integration layer, the initiator of an information exchange could use web services, where the receiver could use JMS, and vice versa. The integration layer also provides support for one to many information exchanges using publish/subscribe integration patterns and key functionality such as delivery guarantees.

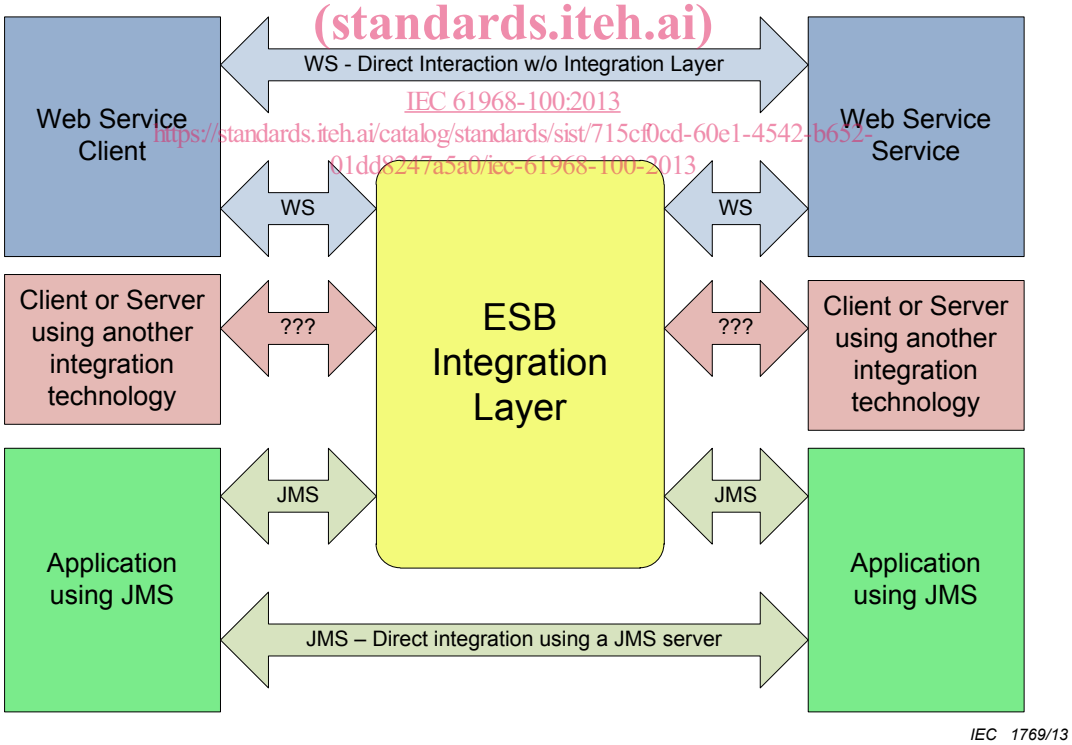

Figure 1 – Overview of Scope

The scope of this document specifically includes the following:

- integration patterns that support IEC 61968 information exchanges
- design of interfaces for use of strongly typed web services
- design of interfaces for use of generically typed web services
- design of interfaces using JMS

- definition of standard design artefacts and related templates
- recognition that technologies other than JMS and web services may be used for integration leveraging this standard (with some specific examples and associated recommendations described in appendices)

This profile can also be applied to integration problems outside the scope of IEC 61968.

It is important to note that other implementation profiles can potentially be defined for IEC 61968, and that this is not intended to be the only possible implementation profile. In addition, this profile can be adapted to meet specific needs of specific integration projects.

It is also not within the scope of this document to prescribe those implementation details as required for security.

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 60050-300, *International Electrotechnical Vocabulary – Electrical and electronic measurements and measuring instruments – Part 311: General terms relating to measurements – Part 312: General terms relating to electrical measurements – Part 313: Types of electrical measuring instruments – Part 314: Specific terms according to the type of instrument*

IEC 61968-1, *Application integration at electric utilities – System interfaces for distribution management – Part 1: Interface architecture and general recommendations*

IEC/TS 61968-2, *Application integration at electric utilities – System interfaces for distribution management – Part 2: Glossary*

IEC 61968-11, *Application integration at electric utilities – System interfaces for distribution management – Part 11: Common information model (CIM) extensions for distribution*

IEC 61970-301, *Energy management system application program interface (EMS-API) – Part 301: Common information model (CIM) base*

IEC 61970-552, *Energy management system application program interface (EMS-API) – Part 552: CIM XML Model Exchange Format*

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

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this specification, the terms and definitions given in IEC 60050-300, IEC/TS 61968-2, IEC 62051, IEC 62055-31 apply.

3.2 Abbreviations

The following terms and abbreviations are used within this document:

API	Application Programming Interface
AMQP	Advanced Message Queue Protocol
CIM	Common Information Model
CME	Common Message Envelope
CRUD	Create, Read, Update, Delete
EDA	Event Driven Architecture
ESB	Enterprise Service Bus
IEC	International Electrotechnical Commission
IETF RFC	Internet Engineering Task Force Request For Comments
ISO	International Standards organization
JEE	Java Enterprise Edition
JMS	Java Message Service
JSR	Java Specification Request
mRID	CIM master resource identifier
OASIS	Organization for the Advancement of Structured Information Standards
RDF	Resource Description Framework
REST	REpresentational State Transfer
RFC	Request for Comments
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
SSL	Secured Socket Layer
TLS	Transport Layer Security
UML	Unified Modelling Language
URL	Uniform Resource Locators
UUID	Universal Unique Identifier
W3C	World-Wide Web Consortium
WS	Web Services
WS-*	Web Services standards
WS-I	Web Services Interoperability
WSDL	Web Services Definition Language
XML	eXtensible Markup Language
XSD	XML Schema
XSL	XML Stylesheet Language

3.3 Terminology for common integration technologies

3.3.1 General

Where there is a difference between the definitions in this standard and those contained in other referenced IEC standards, then those defined in IEC/TS 61968-2 shall take precedence over the others listed, and those defined in this document shall take precedence over those defined in IEC/TS 61968-2.

3.3.2 Enterprise Service Bus (ESB)

An Enterprise Service Bus (ESB) refers to a software architecture construct that is used as an integration layer. This construct is typically implemented by technologies found in a category of middleware infrastructure products, usually based on recognized standards, which provide foundational services for more complex architectures via an event-driven and standards-based messaging engine (the bus).

An ESB generally provides an abstraction layer on top of an implementation of an enterprise messaging system, which allows integration architects to exploit the value of messaging without writing code. Contrary to the more classical enterprise application integration (EAI) approach of a monolithic stack in a hub and spoke architecture, the foundation of an enterprise service bus is built of base functions broken up into their constituent parts, with distributed deployment where needed, working in harmony as necessary.

An ESB does not implement a service-oriented architecture (SOA) but provides the features with which one may be implemented.

3.3.3 Java Messaging Service (JMS)

The Java Message Service (JMS) API is a Java Message Oriented Middleware API for sending messages between two or more clients. JMS supports request/reply, publish/subscribe and point to point messaging patterns. JMS is a part of the Java Platform, Enterprise Edition, and is defined by a specification developed under the Java Community Process as JSR 914.It is important to note that some ESB product vendors provide language bindings for JMS using C, C++ and/or C#, making the term JMS a misnomer. Where the wire protocol is different between different JMS implementations it is often trivial to bridge between different JMS implementations.

3.3.4 Service-Oriented Architecture (SOA)

Service Oriented Architecture (SOA) is a computer systems architectural style for creating and using business processes, packaged as services, throughout their lifecycle. SOA also defines and provisions the IT infrastructure to allow different applications to exchange data and participate in business processes. These functions are loosely coupled with the operating systems and programming languages underlying the applications. SOA separates functions into distinct units (services), which can be distributed over a network and can be combined and reused to create business applications. These services communicate with each other by passing data from one service to another, or by coordinating an activity between two or more services. SOA concepts are often seen as built upon and evolving from older concepts of distributed computing and modular programming.

3.3.5 Event-Driven Architecture (EDA)

Event-Driven Architecture (EDA) is a software architecture pattern that promotes the production, detection and consumption of events. An event is any change of state of potential interest. Within an EDA, events are transmitted between loosely coupled software components and services, typically using publish/subscribe messaging patterns. EDA is complementary to SOA, to the extent that SOA 2.0 is also known as ‘event-driven’ SOA. EDA is fundamental to a variety of business intelligence patterns, including complex event processing patterns.

3.3.6 Simple Object Access Protocol (SOAP)

The Simple Object Access Protocol (SOAP) is a standard that defines the formatting of XML messages. SOAP serves as a foundation layer of the web services protocol stack. SOAP is also commonly used within JMS. Common transports for SOAP include HTTP, HTTPS and proprietary JMS transports. SOAP is also now sometimes referred to as ‘Service-Oriented Architecture Protocol’. SOAP is a W3C Recommendation.

Two versions that are in common use include SOAP 1.1 and SOAP 1.2. New integrations or interfaces should use SOAP 1.2 when applicable.

3.3.7 Web Services (WS)

A Web Service is defined by the W3C as 'a software system designed to support interoperable Machine to Machine interaction over a network.' Web services are frequently just Web APIs that can be accessed over a network, such as the Internet, and executed on a remote system hosting the requested services.

The W3C Web service definition encompasses many different systems, but in common usage the term refers to clients and servers that communicate using XML messages that follow the SOAP standard. Common in both the field and the terminology is the assumption that there is also a machine readable description of the operations supported by the server written in the Web Services Description Language (WSDL). The latter is not a requirement of a SOAP *endpoint*, but it is a prerequisite for automated client-side code generation in many Java and .Net development tools.

Where web services have two primary styles, document-centric and RPC-centric, the focus of this specification is document-centric. This is supportive of SOA and the transport of IEC 61968 payloads. For increased interoperability, the document wrapped form is required.

It is important to note that web services do not readily support publish/subscribe messaging unless mechanisms such as WS-Eventing are used. However, this specification also describes an approach for the ESB to route messages asynchronously to configured subscribers.

This standard will discuss two approaches for use of web services, where WSDL operations are either generic or strongly typed. Generic web services have WSDLs and related operations that are defined in a payload type independent manner. Strongly typed web services are defined where WSDLs and operations are defined individually for specific payload types.

This also provides for automated frameworks for server-side validation of message content based on message schemas contained in the WSDL document.

3.3.8 Web Services Definition Language (WSDL)

Web Services Definition Language (WSDL) is an XML-based language that is used to describe web services. WSDL is often used in combination with SOAP and XML schema to provide web services over the internet (or an intranet). WSDL is a W3C Recommendation.

Two versions that are in common use include WSDL 1.1 and WSDL 2.0.WSDL 2.0 better supports interoperability between Java and .Net implementations.

The WSDL templates provided by this document are based upon WSDL 1.1, and consequentially WSDL 1.1 is a requirement. In order to better support interoperability between dverse implementations, all WSDL documents are WS-I Basic Profile 1.1 compliant.

3.3.9 XML Schema (XSD)

XML Schema, published as a W3C recommendation in May 2001, is one of several XML schema languages. It was the first separate schema language for XML to achieve Recommendation status by the W3C.

Like all XML schema languages, XML Schema can be used to express a schema: a set of rules to which an XML document shall conform in order to be considered 'valid' according to that schema. However, unlike most other schema languages, XML Schema was also designed with the intent that determination of a document's validity would produce a collection of