Applikationsintegration i eldistributionsselskaber – Systemgrænseflader til styring af distribution – Del 100: Implementeringsprofiler

Application integration at electric utilities – System interfaces for distribution management – Part 100: Implementation profiles
DS/EN 61968-100
København
DS projekt: M263789
ICS: 33.200

Første del af denne publikations betegnelse er:
DS/EN, hvilket betyder, at det er en europæisk standard, der har status som dansk standard.

Denne publikations overensstemmelse er:
IDT med: IEC 61968-100 ED 1.0:2013.

DS-publikationen er på engelsk.

---

**DS-publikationstyper**
Dansk Standard udgiver forskellige publikationstyper.
Type på denne publikation fremgår af forsiden.

Der kan være tale om:

- **Dansk standard**
  - standard, der er udarbejdet på nationalt niveau, eller som er baseret på et andet landes nationale standard, eller
  - standard, der er udarbejdet på internationalt og/eller europæisk niveau, og som har fået status som dansk standard

- **DS-information**
  - publikation, der er udarbejdet på nationalt niveau, og som ikke har opnået status som standard, eller
  - publikation, der er udarbejdet på internationalt og/eller europæisk niveau, og som ikke har fået status som standard, fx en teknisk rapport, eller
  - europæisk præstandard

- **DS-håndbog**
  - samling af standarder, eventuelt suppleret med informativt materiale

- **DS-hæfte**
  - publikation med informativt materiale

Til disse publikationstyper kan endvidere udgives:

- tillæg og rettelsesblade

---

**DS-publikationsform**
Publikationstyperne udgives i forskellig form som henholdsvis

- fuldt tekstopublikation (publikationen er trykt i sin helhed)
- godkendelsesblad (publikationen leveres i kopi med et trykt DS-omslag)
- elektronisk (publikationen leveres på et elektronisk medie)

---

**DS-betegnelse**
Alle DS-publikationers betegnelse begynder med DS efterfulgt af et eller flere præfiks og et nr., fx DS 383, DS/EN 5414 osv. Hvis der efter nr. er angivet et A eller Cor, betyder det, at det er et tillæg eller et rettelsesblad til hovedstandarden, eller at det er indført i hovedstandarden.

DS-betegnelse angives på forsiden.

---

**Overensstemmelse med anden publikation:**
Overensstemmelse kan enten være IDT, EQV, NEQ eller MOD

- **IDT:** Når publikationen er identisk med en given publikation.
- **EQV:** Når publikationen teknisk er i overensstemmelse med en given publikation, men præsentationen er ændret.
- **NEQ:** Når publikationen teknisk eller præsentationsmæssigt ikke er i overensstemmelse med en given standard, men udarbejdet på baggrund af denne.
- **MOD:** Når publikationen er modificeret i forhold til en given publikation.
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
CONTENTS

FOREWORD ................................................................................................................................. 6
INTRODUCTION .......................................................................................................................... 8

1 Scope ........................................................................................................................................ 9
2 Normative References ............................................................................................................ 10
3 Terms, definitions and abbreviations .................................................................................. 10
  3.1 Terms and definitions ........................................................................................................ 10
  3.2 Abbreviations .................................................................................................................. 10
  3.3 Terminology for common integration technologies .......................................................... 11
    3.3.1 General ....................................................................................................................... 11
    3.3.2 Enterprise Service Bus (ESB) .................................................................................... 12
    3.3.3 Java Messaging Service (JMS) ................................................................................... 12
    3.3.4 Service-Oriented Architecture (SOA) ....................................................................... 12
    3.3.5 Event-Driven Architecture (EDA) ............................................................................... 12
    3.3.6 Simple Object Access Protocol (SOAP) ..................................................................... 12
    3.3.7 Web Services (WS) ..................................................................................................... 13
    3.3.8 Web Services Definition Language (WSDL) .............................................................. 13
    3.3.9 XML Schema (XSD) ..................................................................................................... 13
    3.3.10 Representational State Transfer (REST) ..................................................................... 14
    3.3.11 Queue ......................................................................................................................... 14
    3.3.12 Topic .......................................................................................................................... 14
    3.3.13 Message Destination .................................................................................................. 14
    3.3.14 Request ...................................................................................................................... 14
    3.3.15 Response .................................................................................................................... 14
    3.3.16 Query ........................................................................................................................ 15
    3.3.17 Transaction ............................................................................................................... 15
    3.3.18 Event .......................................................................................................................... 15

4 Use Cases .................................................................................................................................. 15
  4.1 General .................................................................................................................................. 15
  4.2 Simple request/reply ............................................................................................................ 16
  4.3 Request/reply using an ESB ............................................................................................... 16
  4.4 Events .................................................................................................................................... 17
  4.5 Transactions .......................................................................................................................... 18
  4.6 Callback ............................................................................................................................... 19
  4.7 Adapters ............................................................................................................................... 20
  4.8 Complex messaging ............................................................................................................ 21
  4.9 Orchestration ......................................................................................................................... 22
  4.10 Application-level use cases ............................................................................................... 22

5 Integration Patterns .................................................................................................................. 23
  5.1 General .................................................................................................................................. 23
  5.2 Client and server perspectives ............................................................................................. 23
    5.2.1 General ......................................................................................................................... 23
    5.2.2 Basic web service pattern ............................................................................................. 24
    5.2.3 Basic JMS request/reply pattern ................................................................................... 24
    5.2.4 Event listeners .............................................................................................................. 26
    5.2.5 Asynchronous request/reply pattern ........................................................................... 27
  5.3 Bus perspective ...................................................................................................................... 27
9  Security .......................................................................................................................... 78
10 Version control ............................................................................................................... 79
Annex A (normative) XML schema for common message envelope .............................. 81
Annex B (normative) Verbs .............................................................................................. 91
Annex C (normative) Procedure for strongly typed WSDL generation ....................... 93
Annex D (normative) Generic WSDL ............................................................................. 106
Annex E (informative) AMQP ......................................................................................... 108
Annex F (informative) Payload Compression Example ................................................... 109
Annex G (informative) XMPP ......................................................................................... 111
Bibliography ..................................................................................................................... 112

Figure 1 – Overview of Scope ................................................................................................. 9
Figure 2 – Simple Request/Reply .......................................................................................... 16
Figure 3 – Request/reply using intermediaries ..................................................................... 17
Figure 4 – Events .................................................................................................................. 18
Figure 5 – Point-to-Point (One Way) Pattern ...................................................................... 19
Figure 6 – Transaction Example .......................................................................................... 19
Figure 7 – Callbacks ............................................................................................................. 20
Figure 8 – Use of Adapters ................................................................................................. 21
Figure 9 – Complex messaging ............................................................................................ 22
Figure 10 – Application-level use case example ................................................................... 23
Figure 11 – Basic request/reply using web services .............................................................. 24
Figure 12 – Basic request/reply using JMS .......................................................................... 25
Figure 13 – Event listeners using JMS .................................................................................. 25
Figure 14 – Asynchronous request/reply pattern .................................................................. 27
Figure 15 – ESB content-based routing .............................................................................. 28
Figure 16 – ESB with smart proxy and content-based routing ............................................. 29
Figure 17 – ESB with proxies, routers and adapters .............................................................. 30
Figure 18 – ESB Integration to non-compliant resources .................................................... 31
Figure 19 – Messaging between clients, servers and an ESB ................................................ 33
Figure 20 – Example payload schema .................................................................................. 35
Figure 21 – Common message envelope ............................................................................. 37
Figure 22 – Common message header structure ................................................................. 39
Figure 23 – Request message structure ............................................................................... 41
Figure 24 – XML for example RequestMessage ................................................................... 42
Figure 25 – Example 'Get<Noun>}' profile ......................................................................... 43
Figure 26 – ResponseMessage structure ............................................................................ 44
Figure 27 – Reply message states ........................................................................................ 45
Figure 28 – Error structure ................................................................................................ 46
Figure 29 – XML for example ResponseMessage ................................................................. 47
Figure 30 – XML example of payload compression ............................................................. 47
Figure 31 – XML example for error ResponseMessage ...................................................... 48
Figure 32 – EventMessage structure ................................................................................... 48
INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 100: Implementation profiles

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.

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:

<table>
<thead>
<tr>
<th>FDIS</th>
<th>Report on voting</th>
</tr>
</thead>
<tbody>
<tr>
<td>57/1358/FDIS</td>
<td>57/1382/RVD</td>
</tr>
</tbody>
</table>

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.

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

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.
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.

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: