IEC TR 62361-103

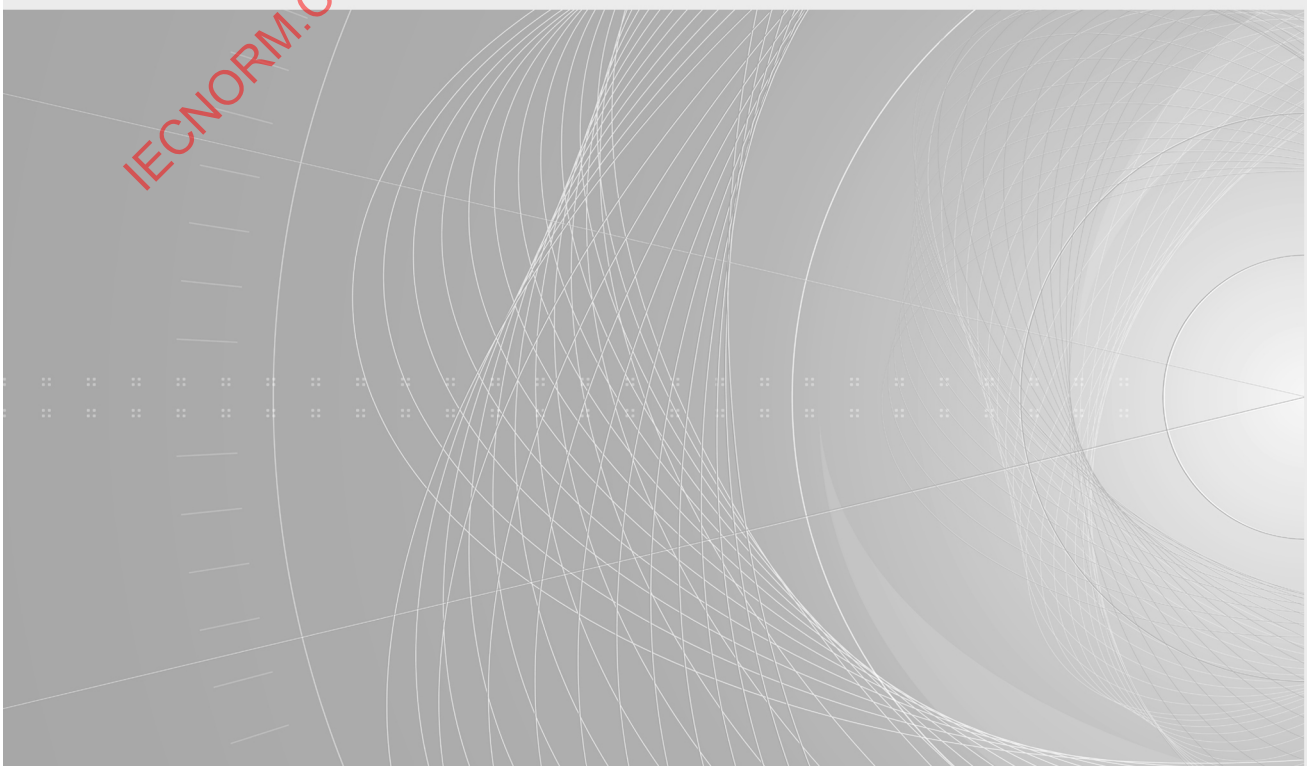
Edition 1.0 2018-04

TECHNICAL REPORT

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

colour inside

Power systems management and associated information exchange – Interoperability in the long term – Part 103: Standard profiling



IEC TR 62361-103:2018-04(en)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2018 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

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 It also gives information on projects, replaced and withdrawn publications.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.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

IEC TR 62361-103

Edition 1.0 2018-04

TECHNICAL REPORT

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

colour inside

Power systems management and associated information exchange – Interoperability in the long term – Part 103: Standard profiling

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 33.200

ISBN 978-2-8322-5529-2

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

CONTENTS

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE – INTEROPERABILITY IN THE LONG TERM –

Part 103: Standard profiling

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.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 62361-103, which is a technical report, has been prepared by IEC technical committee 57, Power systems management and associated information exchange.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
57/1911/DTR	57/1972/RVDTR

Full information on the voting for the approval of this technical report 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 the parts in the IEC 62361 series, published under the general title *Power systems management and associated information exchange – Interoperability in the long term,* 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.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE – INTEROPERABILITY IN THE LONG TERM –

Part 103: Standard profiling

1 Scope

This part of IEC 62361, which is a technical report, describes the concepts of standard profiling for Common Information Model (CIM – IEC 61970, IEC 61968, IEC 62325) and IEC 61850 standard series. It serves as an introduction to profiling concepts and methodologies for the development of profiles for providing interoperability. It describes the specific needs and requirements of the standard application domains and derives profiling concepts respectively. Moreover the document defines the foundation for more detailed descriptions in the respective standard series.

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.

IEC 61850 (all parts), *Communication networks and systems for power utility automation*

IEC 61968 (all parts), *Application integration at electric utilities – System interfaces for distribution management*

IEC 61970 (all parts), *Energy management system application program interface (EMS-API)*

IEC 62325 (all parts), *Framework for energy market communications*

3 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
Basic Application Profile
BAP
user agreed-upon selection and interpretation of relevant parts of the applicable standards and specifications which is intended to be used as building blocks for interoperable user/project specifications

Note 1 to entry: BAPs must not have options, all selected criteria are mandatory to achieve interoperability. For implementation in projects, BAPs might be extended or refined to meet the user specific requirements.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

The term “basic” means here that an elementary application function/subfunction is the chosen context for defining the profile. The level of what is perceived as elementary is application dependant, and may include for example many Logical Node (LN) instances of many LN classes, when using IEC 61850.

[SOURCE: CEN-CENELEC-ETSI SG-CG Report on Interoperability CEN_9762_CLC_9624, 12.1, Terms and definitions]

3.2
Basic Application Interoperability Profile
BAIOP
test sequences and test cases used to extend a BAP for interoperability testing to reach the desired level of interoperability

[SOURCE: CEN-CENELEC-ETSI SG-CG Report on Interoperability CEN_9762_CLC_9624, 12.1, Terms and definitions]

3.3
canonical information model
base information model upon which the profiling process is to be applied for CIM

Note 1 to entry: A canonical information model is a semantic model that is agreed upon as a common language for information describing the power system and processes related to it

Note 2 to entry: The canonical information model is the basis for profiles that describe specific data exchanges. Many user specific profiles can be defined based on the same canonical information model.

Note 3 to entry: In case the profile has an overlap (i.e. an electrical market use registered resources that maps to physical units and this mapping is needed to run safety studies with market data, the canonical information models make sure that it is possible to describe this overlap and that data in market profiles is directly linked with profiles describing the physical units.

3.4
conformance
accordance of the implementation of a product, process or service with all specified requirements or standards

Note 1 to entry: Additional features to those in the requirements / standards may be included.

Note 2 to entry: All features of the standard/specification are implemented and in accordance, but some additional features are not covered by the standard/specification.

[SOURCE: CEN-CENELEC-ETSI SG-CG Report on Interoperability CEN_9762_CLC_9624, 12.1, Terms and definitions]

3.5
conformance testing
act of determining to what extent a single implementation conforms to the individual requirements of its base standard

Note 1 to entry: An important condition in achieving interoperability is the correct implementation of the standards. This can be verified by conformance testing.

Note 2 to entry: Determines whether an implementation conforms to a profile as written in the PICS. The latter testing can be interoperability testing if profile covers the interoperability requirements additional to the conformance testing requirements of standards applied. Conformance testing is a prerequisite for interoperability testing.

[SOURCE: CEN-CENELEC-ETSI SG-CG Report on Interoperability CEN_9762_CLC_9624, 12.1, Terms and definitions]

3.6
context
set of business conditions and circumstances that are relevant to a domain, a situation, an event or an information exchange

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

3.7
cyber security
measures that protect and defend information and information systems by assuring their confidentiality, integrity, access controls, availability and accuracy

Note 1 to entry: As defined in ISO/IEC 27002:2005 “Information security is the protection of information from a wide range of threats in order to ensure business continuity, minimize business risk, and maximize return on investments and business opportunities”.

3.8
interchangeability
ability of two or more devices or components to be interchanged without making changes to other devices or components in the same system and without degradation in system performance

[SOURCE: CEN-CENELEC-ETSI SG-CG Report on Interoperability CEN_9762_CLC_9624, 12.1, Terms and definitions]

3.9
interoperability
ability of two or more networks, systems, devices, applications or components to interwork, to exchange and use information in order to perform required functions.

[SOURCE: CEN-CENELEC-ETSI SG-CG Report on Interoperability CEN_9762_CLC_9624, 12.1, Terms and definitions]

3.10
interoperability testing
testing which should be performed to verify that communicating entities within a system are interoperable, i.e. they are able to exchange information in a semantically and syntactic correct way

Note 1 to entry: During interoperability testing, entities are tested against peer entities known to be correct (profiles).

[SOURCE: CEN-CENELEC-ETSI SG-CG Report on Interoperability CEN_9762_CLC_9624, 12.1, Terms and definitions]

3.11
profile
agreed-upon subset of derived from a specification

Note 1 to entry: A common profile is required for achieving interoperability especially in those cases when a specification could have more than one interpretation and there are probably many optional features.

3.12
SGAM (Smart Grid Architecture Model)
high level conceptual model of the Smart Grid describing the main actors of the Smart Grid and their main interactions

Note 1 to entry: This concept is introduced in IEC 62357-1:2016.

[SOURCE: CEN-CENELEC-ETSI SG-CG M490, Set of standards report CEN_9762_CLC_9624, Chapter 7.3, SGAM introduction]

ftp://ftp.cencenelec.eu/EN/EuropeanStandardization/HotTopics/SmartGrids/SGCG_Interoperability_Report.pdf

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

4 Profiling concepts

4.1 General

4.1.1 Overview

A profile in the domain of power systems management and associated information exchange describes a specific usage of a published standard or a collection of published standards by restricting offered flexibility. Functional requirements may lead to the proposal of extensions to the standard. Profiling needs to support both aspects.

Two implementations engineered from the same standard may not interoperate due to them having a different set of elements offered by the flexibility of the standard.

The main goal of defining a profile is to facilitate interoperability for the data exchange between elements to achieve the functions as specified in the specific use of the standard.

Profiling may serve many objectives, depending on the project where the profile is used, but within the different objectives one could get closer to interchangeability.

Therefore a profile may contain

a) definitions of restricted flexibilities for
   - data models
   - communication services and capabilities
   - engineering related requirements
     - functional allocation
     - including optional naming rules
   - cyber-security requirements

b) functional requirements for example state machines describing required sequences of actions needed to ensure interoperability, etc.

c) testing requirements

To reduce the number of profiles related to the similar usage, architectural variants and functional variants may be needed. Wherever possible, contained profile information should be supplemented with information in machine readable form.

Complementary aims and objectives of profiling are to

- promote the re-use of defined profiles in different projects
- facilitate interoperability tests, increase the quality of interoperability and potentially increase test efficiency
- facilitate pre-engineering and commissioning focussing on interoperability related topics

The profile contents are built based on requirements derived from use cases. These use cases may have very diverse inputs including specific local use cases and national or regional regulations.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

4.1.2 Framework for defining a profile

The methodology to capture the profile requirements as illustrated in Figure 1 is structured on an approach based on Business Processes which need to be further broken down into functions. Both will have to be expressed through use cases, in order to extract the requirements for information exchange.

These requirements are the main input for defining a profile, with the additional constraint to map these requirements over a selected set of standards (in current case, CIM or IEC 61850).

Besides the definition of the profile itself, it is important to capture the context of testing the defined profile.

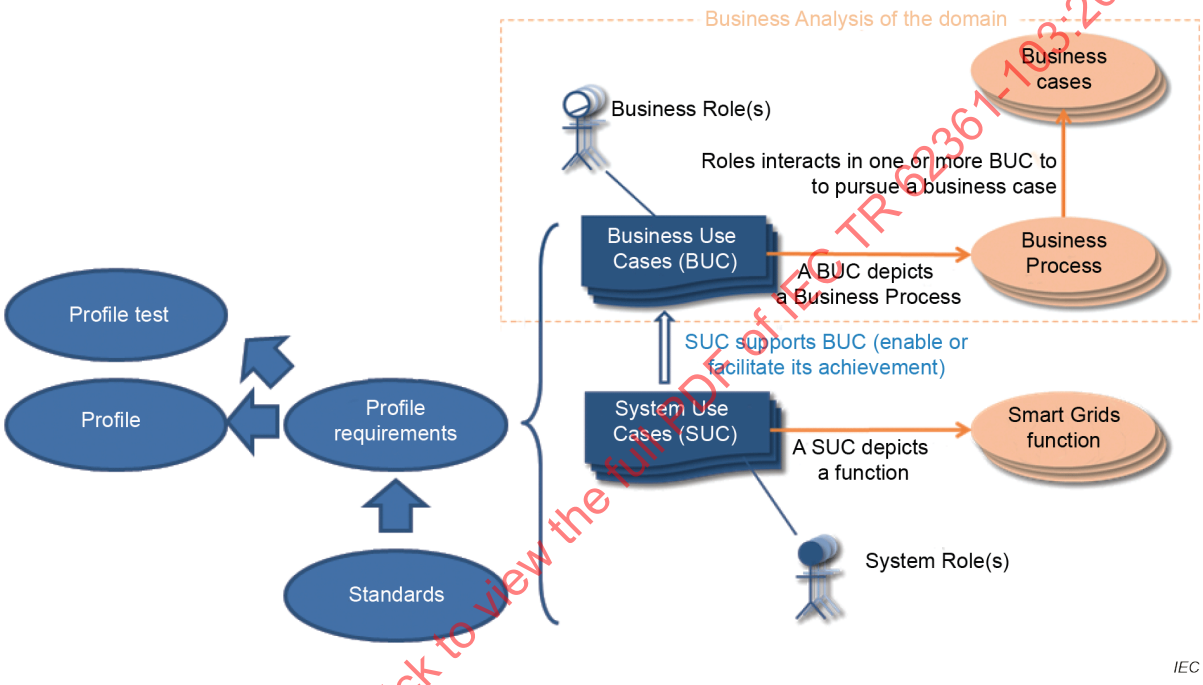


Figure 1 – Framework for defining a profile

4.1.3 Framework for profiling

Figure 2 presents an outline of standardized rules and relations between the main concepts related to profiling and its contribution to project development.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

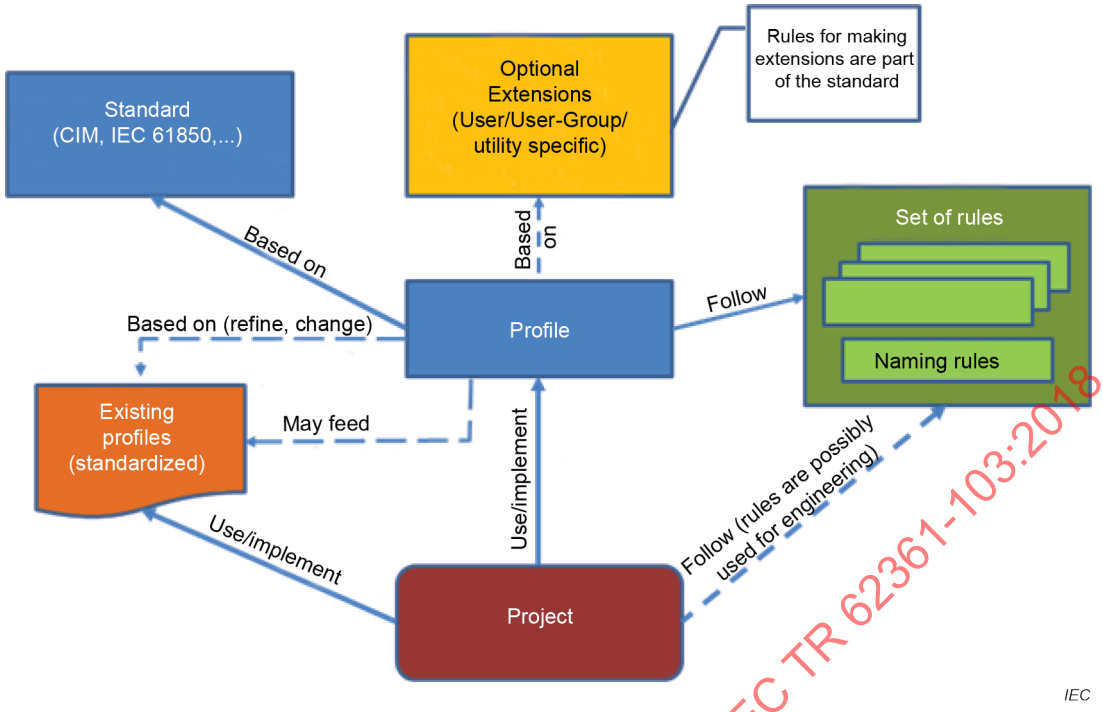


Figure 2 – Framework for profile

In principle a profile shall be defined based on the corresponding standard. The definitions of the standard might be extended optionally by User or User Group specific requirements. The optional extensions shall follow the rules which should be defined as part of the standard.

A profile shall follow a set of rules which may be additionally defined (i.e. rules for naming of objects).

A mature and proven profile can be standardized as well. If there are additional requirements or refinements to an existing standardized profile is needed the standardized profile may be extended following the rules for extension as stated above.

To facilitate interoperability in a project the use of profiles (either existing standardized profiles or project specific defined profiles) is highly recommended.

4.1.4 Framework for testing profiles

Figure 3 presents the basic framework of activities and elements needed to achieve interoperability within a project. It describes in addition the main area of involvement of standardisation activities.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

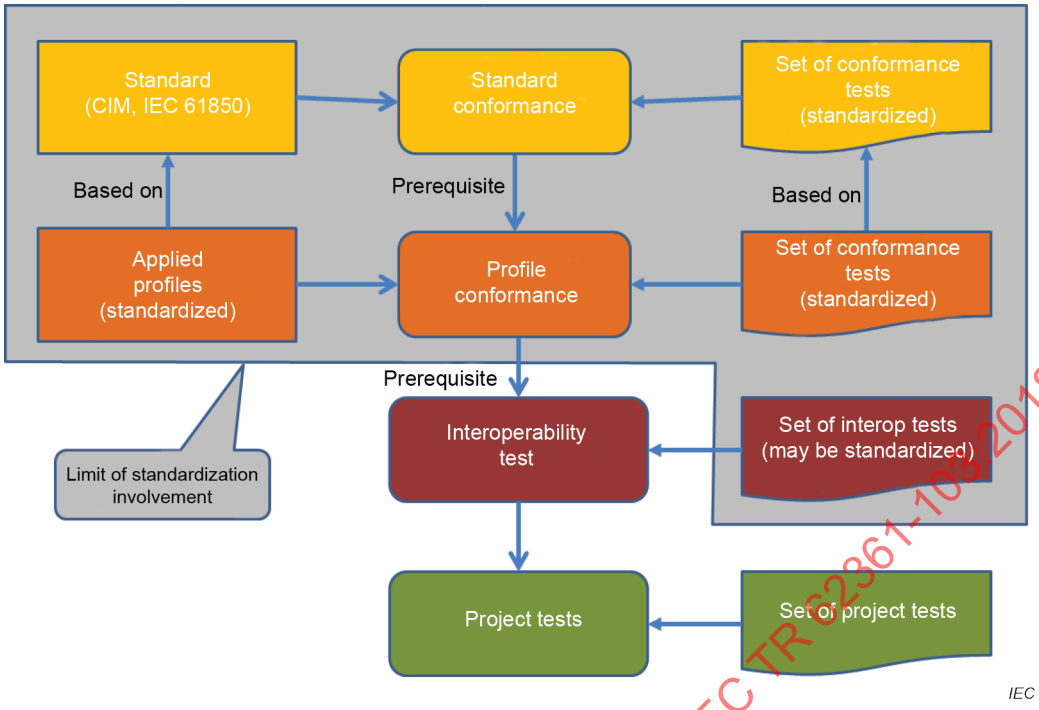


Figure 3 – Framework for testing profile

The conformance of an implementation to a standard in a device shall be tested following a standardized set of rules and/or test cases. To test the conformance of an implementation to a profile the proven conformance to a standard is a prerequisite. A set of rules and/or test cases for testing conformance to a profile may also be standardized. An interoperability test may be based on a set of Interoperability test cases which may complement the conformance test (considered as prerequisite) related to an underlying profile.

4.2 Constraints due to the technology used for defining profiles

The technology used to express/implement the profile content may lead to limitations in expressing some specific profile requirements.

One example of these limitations is – in the case of IEC 61850 – that presence condition details may not be all machine-processable. Textual descriptions shall remain.

The following aspects need to be refined in this subclause:

- Management of (project specific) extensions which are not part of the base specification
- Challenge – flexibility vs. strictness in order to achieve interoperability
- Profiles implicitly require agreed-upon decisions and consequently profiles are bound to these decisions and potential constraints
- Guarantees that the desired function is properly implemented in the profile

4.3 Management of extensions to standards

Standards may support custom defined extensions, and the profile may rely on these specific extensions.

In order to encourage the re-use of extensions, to avoid duplication of contents, but also to facilitate the versioning of content of different speed of change, hosting in a separate specification is strongly recommended.

Capabilities of accessing all existing extensions are under definition.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

4.4 CIM profiling concept

4.4.1 General

The Common Information Model (CIM) specifies the basis for the semantics for message payload exchanges. The profile specifications, which are contained in other parts of IEC 61970, IEC 61968 and IEC 62325, specify the content of the payloads exchanged.

Payload exchanges occur always in a given context. The context could be a domain, a situation, an event, etc. However the context is more than just a state; it is also the set of conditions and circumstances that are relevant to a domain, a situation, an event, a location etc. Note that a context could also be a combination of different contexts.

A context is the formal description of a specific business circumstance and is defined by:

- its scope (relevance, applicability, business context) of information exchange(s),
- the information that is exchanged,
- the circumstances in which particular data is or is not relevant.

In this document, the scope of a context is payload exchanges in an integrated and interoperable environment. The scope could be broad (for example: exchanges for a domain like power network analysis) or specific (for example: exchanges for a given business process like European market scheduling or periodic meter readings).

The goal of the CIM as a logical information model is to provide interoperability between systems, allow data exchanges to be easily defined and implemented, and enable an enterprise architecture that would shorten the time to integration. Where the CIM provides a broad coverage for the domain of the electric utility industry, specific data exchanges will only convey a relatively small subset of the classes, attributes and relationships that are described by the CIM. Similarly, many systems or applications that participate in information exchanges only 'understand' a subset of the information described by the CIM. For these reasons, there is the need to formally identify that subset of information that is needed for a given information exchange, without forcing a source or target system to have a complete understanding of the entirety of the CIM.

The CIM profiling approach makes the definition of exchange payloads consistent, where both producers and consumers agree upon meaning. But additionally, and perhaps more importantly, the receiver has a clear understanding of how data from multiple sources, spanning multiple profiles and exchange technologies, can be readily and unambiguously composed into a cohesive model suitable for business analysis and systems integration. As such, profiles and the profile methodology provide the foundation to reach the goal of interoperable information exchange.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

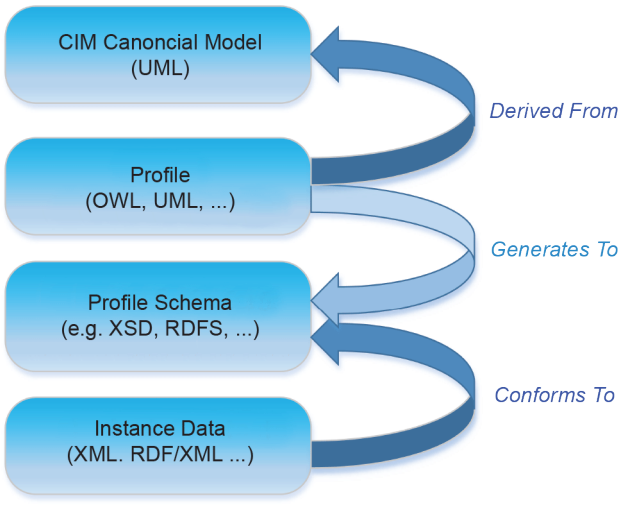


Figure 4 – Main steps for profiling CIM

Figure 4 shows that a CIM profile is derived from the CIM canonical model, which is maintained in the form of a logical information model using UML. Once defined, the profile can be used to generate an associated schema definition, most commonly (but not exclusively) as an XML Schema (XSD) or RDF Schema (RDFS). The instance data for given information exchange must then conform to the schema defined for the profile in order to be valid. This may take into account additional restrictions that are defined for the profile over what is defined by the CIM, as almost everything is otherwise optional in the CIM by virtue of its role as a logical information model.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

4.4.2 CIM profile definition

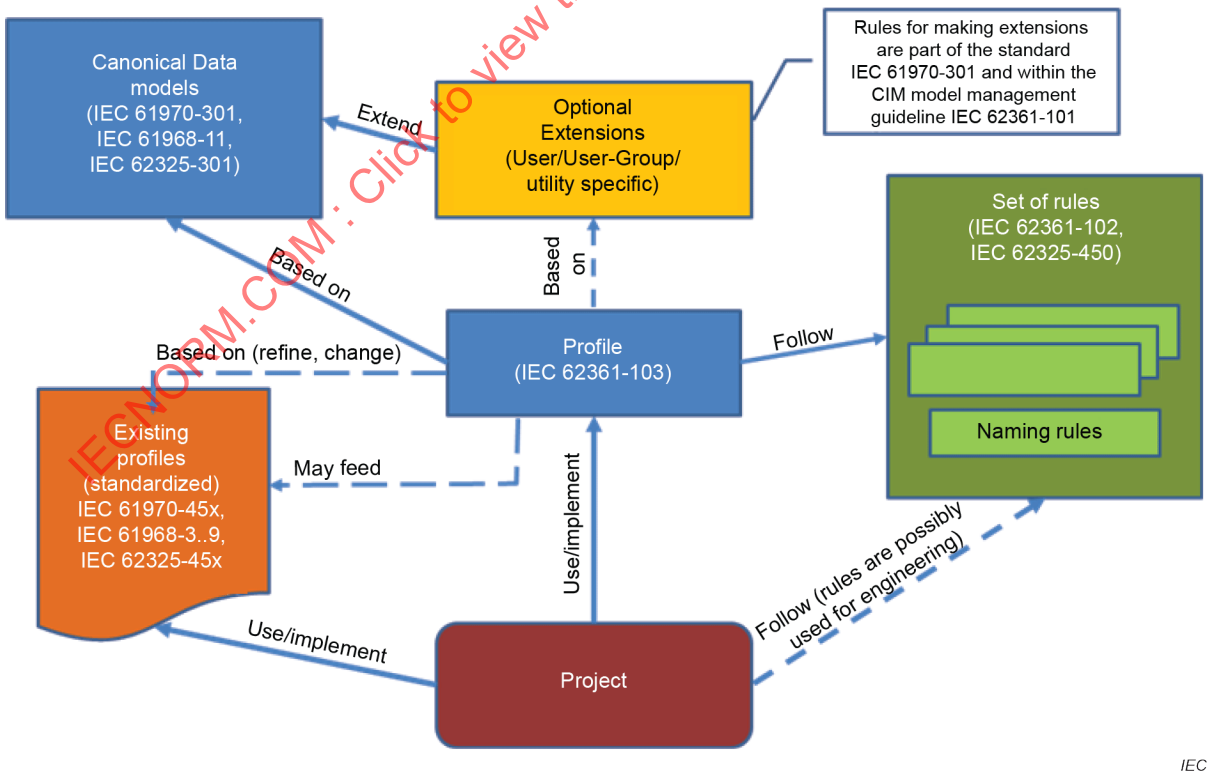


Figure 5 – Framework for profiling CIM

As described in Figure 5, a CIM profile is some formal subset of the information defined by the CIM canonical model, in terms of classes, attributes and relationships. Additionally, a set of restrictive rules can be imposed over this subset of the CIM, where specific elements can be defined as being required or specific constraints imposed on relationships. Each CIM profile is given a name, where the name may be used to define a container element for the profile. A CIM profile may be realized in a variety of forms, but most commonly an XML Schema or RDF schema, where it can be used to facilitate specific information exchanges.

4.4.3 Requirements

Each profile definition is assigned a unique name, so that when the corresponding information is exchanged the name of the profile can be used to distinguish it from other profile definitions. This name can be used to define a unique namespace. The elements within each profile definition retain, in general, their original names as defined in the CIM. In certain circumstances, if precise rules are published, this original names may be altered by adding a Prefix. Anyhow in all circumstances an explicit traceability from elements in the profile definition to the corresponding source elements in the CIM is provided.

4.4.4 Use cases for CIM profiles

A high-level use case for CIM profiles involves the definition of interfaces to be used for information exchanges between systems. There are three general situations where this can arise: first in the definition of interface standards as in the case of the IEC 61968, 61970 and 62325 series (where the actor is a team developing a draft standard), secondly where a vendor is designing interfaces to be part of their product offering that are otherwise not covered by an industry (i.e. IEC) standard (where the actor is a vendor development team), or lastly where an integration project needs to define interfaces where there is not an appropriate coverage by industry standards or vendor products (where the actor is an integration team). In all three cases, the source and target systems for a given information exchange will almost without exception only have an understanding of some subset of the information described by the CIM.

In any of these cases the first step is to identify the information to be exchanged, where this is often referred to as the ‘payload’ of the information exchange. This will typically begin with a more detailed use case defining the specific information exchange requirements. The specific information will typically be some subset of the IEC CIM logical information model, in terms of a subset of classes, attributes and relationships that are relevant to the desired information exchange, conveying either a transaction, event or query result set. There is also the need to add ‘restrictions’, to be more explicit with respect to the information required for a given information exchange (i.e. what is required vs. what is optional). Using appropriate tools, a profile definition is derived from the CIM logical data model. In some cases there may be the need to identify extensions to the CIM where the current CIM version did not provide necessary coverage, but the details of this process is left as a separate use case.

After deciding upon other factors related to the implementation of the information exchange (i.e. web services, messaging, file, integration pattern, security), tools can be used to generate design artefacts (i.e. XML Schema, RDF Schema) from the profile definition as needed to support implementation of the integration.

4.4.5 Concept outline

Description that profile refinement is done in specific application domains (i.e. EMS, DMS and Energy Market).

The description of profile refinement is described in IEC 62325-450, *Framework for energy market communications – Part 450: Profile and context modelling rules* and in the upcoming IEC 61970-401, *Energy Management System Application Program Interface (EMS-API) – Part 401: Component interface specification (CIS) framework*.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

4.4.6 Profile development methodology

The genesis of any profile is a business problem that defines the need for some standardized payload exchange. Any given exchange may or may not be part of a defined sequence of exchanges, and may or may not require specification of the communication technologies employed in exchanging data. All these aspects are important, and shall also be defined somewhere.

A profile is the specification that relates an instance data exchange to the canonical model. As such it is the key definition of how business exchanges are structured and used. Implementations working with instance data exchanges are strictly governed by profiles. The canonical model is used to assist in giving consistency and meaning to the content of instance data but implementation conformance can only be realized against a profile.

The prime requirement of the profile development methodology is to achieve consistent exchange forms that reflect all the business requirements for an exchange or exchanges in a given business context.

The second requirement of the methodology is to achieve consistent exchange forms by deriving the semantics of all related access / exchange specifications according to an explicitly defined method from one normalized canonical information model.

This last consistency is important because it addresses the global design of exchange payloads that for some given business context involve tens or hundreds or even thousands of them. In the grand scheme of things all these profiles are contributing to the operation of the same whole. They will be functionally related. This is a challenging problem. Since we cannot know the global requirements completely at the time a given profile is designed, we cannot use the usual deterministic design methods.

The profile development methodology aim is to facilitate the integration process by allowing systems and components on different machines from different vendors to be interoperable, that means they can share data and have the ability to exchange information and to use it.

The basis for this facilitation is to achieve both syntactic and semantic interoperability:

Semantic interoperability is the ability to automatically interpret the exchanged information meaningfully and accurately in order to produce useful results as defined by the end users of both systems. To achieve semantic interoperability, both sides must refer to a common information exchange reference model. The content of the information exchange requests are unambiguously defined: what is sent is the same as what is understood.

Syntactic interoperability refers to the packaging and transmission mechanisms for data and is a prerequisite for semantic interoperability.

The approach pursued by the IEC CIM working groups for:

- semantic interoperability is based on the use of a canonical data model, a well-known pattern that is commonly part of SOA strategies,
- syntactic interoperability is based on standards from the W3C like XML or RDF Schema.

4.4.7 Profiling process

The profiling process defines the models (semantic and syntactic) that will drive the exchanges, models that will reflect as much as possible the different business or context requirements. Those models are described by artefacts that are related one to each other:

The contextual model artefacts are related to both canonical model artefacts and syntactic model artefacts, as shown in Figure 6.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

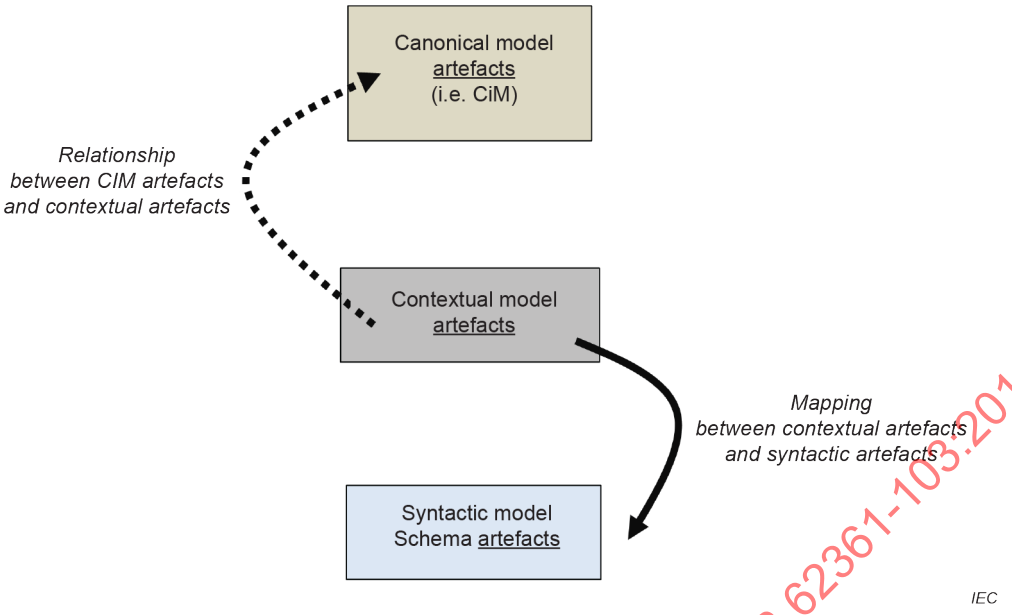


Figure 6 – Relation of contextual model artefacts

How contextual model artefacts are related to the canonical ones is one part of the profiling methodology. The other part is the mapping between contextual model artefacts and the syntactic model artefacts.

The other purpose of the profiling process is to provide all information that is required for a producer to create a payload instance, for a consumer to interpret a payload instance, and for an impartial party to judge conformance of a payload instance. This requires two things which are rigorously separated in this profiling methodology:

- A contextual semantic model that specifies:
  - the structural elements that capture the information content. This includes the names of data items and the relationship between named data items that make up the payload.
  - the type of information content of the structural elements, so that it can be interpreted unambiguously by parties in different environments
- A profile (syntactic model) that specifies how the contextual semantic model is expressed in a given syntax, so that it can be transferred from producer to consumer, where those parties may be in different computing environments, as shown in Figure 7.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

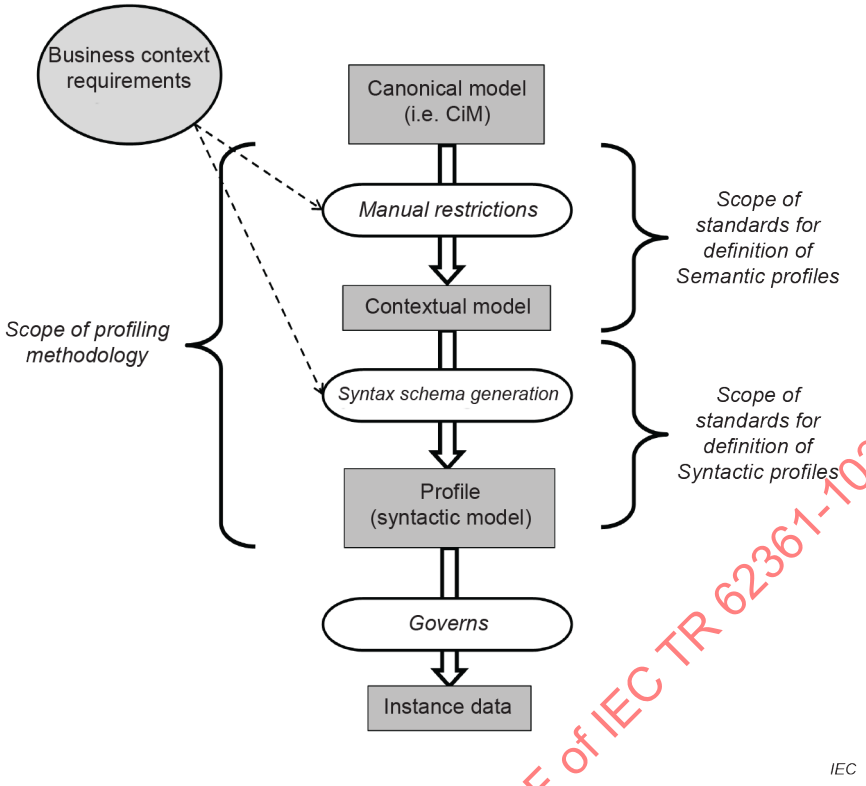


Figure 7 – Process of profiling CIM

The profiling process includes the following steps:

1) Collect the context requirements:
   a) Payload information required
   b) Datatypes requirements
   c) Syntactic model target (RDFS, XSD, etc.)
2) Choose the canonical model version (CIM version)
3) Define the contextual model as a new model based on CIM canonical model:
   a) Choose a representation for the contextual model (UML, OWL, etc.)
   b) Choose the syntactic target (RDFS, XSD) for the syntactic model
   c) Choose profiling rules (example keeping inheritance or not) that are going to be used and that define how contextual model artefacts are related to canonical model artefacts
   d) Select required classes, as defined by the context requirements
   e) Select/restrict required properties (attributes and associations)
   f) Define appropriate multiplicity for the properties
4) Define how requirements of datatypes are going to be expressed: in the contextual model or through notes
5) Generate the syntactic model, according to standard rules that defines how contextual model artefacts are mapped to syntactic model artefacts
6) Generate a document with the syntactic model or a reference to the syntactic model, along with the requirements that are not expressed in the syntactic model.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

4.5 IEC 61850 profiling concept

4.5.1 General

The IEC 61850 standard series' primary goal is to provide interoperability between subsystems and components in order to enable more or less complex system functions. Therefore the standard series covers specifications for functional and non-functional requirements, information and communication aspects for devices and systems as well as device and system engineering. With that the IEC 61850 series offers a broad basis for communication networks and systems in power utility automation.

Due to its broad coverage of power utility automation functions and applications, it is up to the user of the standard (utility, vendor, system integrator, etc.) to pick and choose specific options offered by the standard in order to meet the requirements according his intended project objectives. As a consequence implementations of IEC 61850 represent specific subsets of the standard instead of covering it as a whole.

IEC 61850 profiles express (interoperability) requirements of actors' roles in a specific business context to be fulfilled by devices and systems.

4.5.2 IEC 61850 profile definition

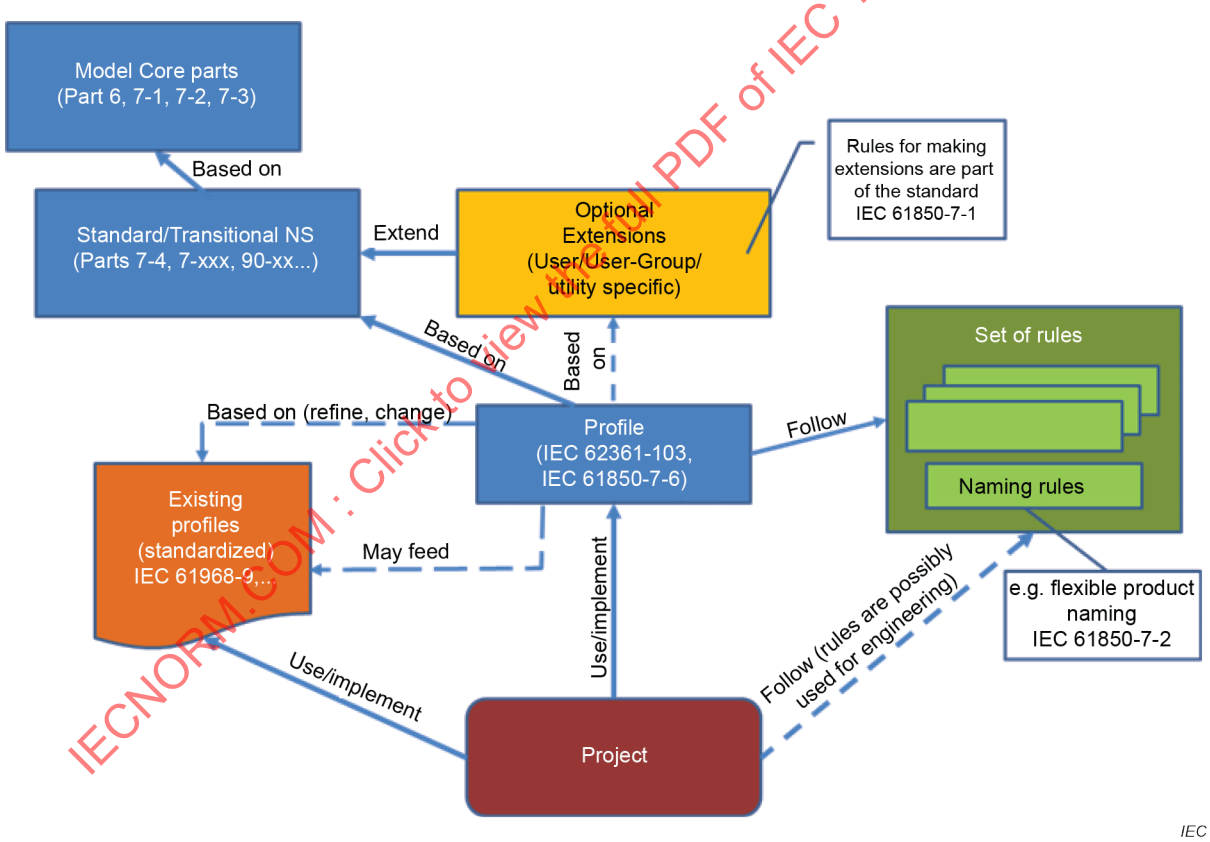


Figure 8 – Framework for profiling IEC 61850

Figure 8 shows the main relationship between the different elements constituting the profiling activity of IEC 61850.

An IEC 61850 standard profile may contain a selection of data models (mandatory and optional elements) and communication services applicable for a specific role within a detailed use case. The data models and communication services are all based on the same core parts as described in Figure 8.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

It is acknowledged that a profile cannot be less demanding than the standard itself, i.e. a field or item said mandatory (or forbidden) by the standard shall remain mandatory (or forbidden) in a profile. The standard represents a sort of minimum base line.

Furthermore a profile may define instances (i.e. pay load, specific device types) and procedures (i.e. programmable logics, message sequences). Subclause 4.5.3 provides possible content of a profile.

Depending on the scope and objective different profile types can be distinguished:

- User profile – defined subset that is valid for a specific user / community of users (i.e. utility)
- Product profile – implemented subset in a specific vendor product
- Basic Application Profile – subset1 to support a specific application function (i.e. protection function)
- Domain profile – defined subset for a specific domain and relevant use cases (i.e. asset management)
- Application profile subset covering a specific application mostly based by aggregating BAPs (i.e. substation interlocking)
- Device profile – subset covering a typical IED functionality (i.e. bay controller)
- Protocol profile – subset covering specific communication protocol definitions (i.e. IEC 61850-8-x)

These profile types target reducing complexity and improving interoperability for their specific scope. In order to achieve these goals both a properly defined profile and appropriate implementations (processes, tools, products) that support the profile are required.

4.5.3 IEC 61850 field or items which may be considered when profiling

An IEC 61850 standard profiling activity starts as soon as a field or item declared optional by the standard, i.e. with the flexibility to implement it or not, is made “less” flexible for a specific usage. Profiling may also rely on a “non-standard” namespace.

Profiling may be applied:

a) At data model level (generic):
   - mostly affecting the presence condition cardinality:
     - from Optional to required
     - from Omulti to restricted multi required (within a possible range)
     - from AtLeastOne to a required set of
     - from AllOrNone to a required selected group
   - possibly:
     - from optional to “not expected in the context of the profile” (equivalent of Forbidden in the context of the profile, but possibly used in other profile contexts)

[1] Most of the profile types above may follow a standardization process, in order to collect the widest range of comments and guarantee their stability for a defined period.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

b) At server data interface instance level such as:
   – LD presence
   – LD naming rule
   – LD arrangement of LNs
   – LN presence
   – LN prefix naming rule and suffix numbering rule
   – Object presence (same principle than the one described above for the model)
   – Enumeration values to be supported
   – Attribute presence (same principle than the one described above for the model)
   – Attribute enumeration/range to be supported
c) At IED and or accesspoint attribute level
   – Required attributes
   – List of required communication services and services to be supported
   – IP address range
d) Possibly other performance parameter ranges

A profile may specify as well certain engineering capabilities and certain functionalities expected from engineering tools associated with IEC 61850 SCL.

4.5.4 Requirements

The profile shall meet the following requirements:

- Profile can be combined/merged between each other
  - Shall follow the same content structure/tree diagram
- Profile could be specialised by other profiles
  - Profile requirements may be inherited by others (multiple inheritance), and relying on a specific profile set, these may just specify (add) their specific requirements
- IED capabilities (expressed by ICD file and extended by the MICS/PICS specific content) can be compared to profile requirements (i.e. machine-processable format)
- Profiles can be compared one to each other (i.e. machine-processable)

Profile versioning is a key topic. In order to be efficient and to make reliable comparison, it is recommended that each contained item is tagged with a unique ID.

Profile shall be testable (a necessary path to reach interoperability), and a test procedure shall be attached to each profile.

A formal representation of profile (i.e. machine processable format) may be the most efficient way to answer above requirements.

4.5.5 Concept Outline

The profiling concept selected by IEC 61850 is a classical modular bottom-up approach to enhance the interoperability between functions/subfunctions located in IEDs forming a substation automation environment. IEC 61850-5 shows how the domain of substation automation can be decomposed into functions/subfunctions. A profile of such a decomposed function/subfunction is called a Basic Application Profile (BAP). That concept, as presented in Figure 9, is recommended by the Interoperability Report worked out by the Smart Grid Coordination Group of CENELEC.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

IEC TR 61850-7-6 offers a guideline on how to define BAPs in more detail and also shows some BAP examples.

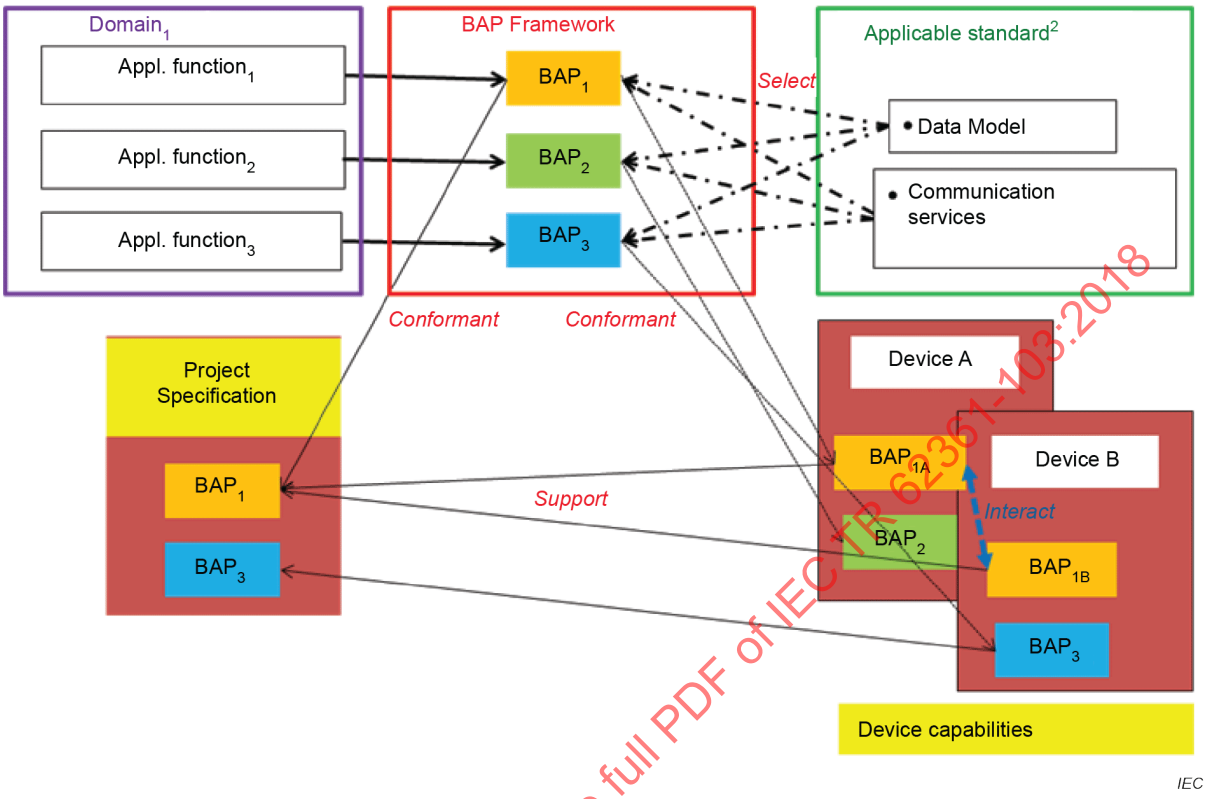


Figure 9 – Aggregating BAPs

A BAP is an agreed-upon selection and interpretation of relevant parts of IEC 61850 and is intended to be used as building blocks for interoperable IED specifications.

The key ideas for building up BAPs are:

- BAPs are elements in a modular framework for decomposed application functions/subfunctions in a specific domain.
- Combinations of different BAPs are used in IEDs as building blocks.
- Project specific refinement additional to the BAP might be necessary to meet specific requirements for implementation in projects. These additional requirements should be frequently fed back into the User Group and may lead to a new or revised BAP based on user experiences and group decisions.
- BAPs are intended to represent a user agreed common denominator of a recommended implementation or a proven best practice implementation of an application function in a specific smart grid system/subsystem, but they are not aimed to cover all possible implementation options.
- BAPs should not have options; all selected features (inclusion or exclusion) are therefore mandatory in the interest of interoperability. If variants of BAPs for an application function are needed it has to be shown by variants of the selected features.

BAP should include:

a) Functional description
   – Verbal description of the function supported by figures to explain the required functional behaviour of the application function

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018

b) Description of the use case and the associated roles/actors
   - List of roles /actors
   - Sequence diagram showing the typical interactions between the associated roles/actors

c) Logical architecture
   - Description of the application function by using LNs and description of the interaction between those LN's using attributes defined inside the LNs

d) Allocation variants (optional)
   - This clause shall be used if the allocation of subfunctions (LNs) into different physical devices can be done in different ways i.e. Allocation of subfunctions (LNs) in configuration with or without process bus

e) Functional variants (optional)
   - To avoid multiple BAP definitions for the same application function caused by slightly different behaviour this clause can be used to define so called implementation variants for the same application function the use of attributes needed for these functional variants has to be shown in the description of the data model i.e. with or without monitoring of status signals

f) Performance requirements (optional)
   - Functional related i.e. required behaviour in case of loss of communication
   - Service related
   - i.e. timing constraints, required reaction time, etc.

g) Description of data model per actor
   - Semantic model
     - In case functional variants are used, it has to be shown in the semantic data model by using columns for each functional variant
   - Syntactic model

h) Communication services
   - Description of the IEC 61850 services used to perform the required behavior of the application function

i) Device related requirements (optional)
   - Configuration capabilities
   - Communication capabilities

j) Engineering tool related requirements (optional)

k) Capabilities for testing

   A taskforce within the IEC is currently working on a document (IEC 61850-10-3) defining standardized capabilities of application functions and rules needed for interoperability testing. i.e. the standardized use of the data attributes "Mod" and "Beh" as well the standardized use of the quality attribute "test" which might also may lead to a test BAP.

The objective of a BAP is to reduce complexity, clarify vague or ambiguous specifications and so aims to facilitate interoperability.

IECNORM.COM : Click to view the full PDF of IEC TR 62361-103:2018