

SYSTEMS REFERENCE DELIVERABLE



**Use case methodology –
Part 4: Best practices in use case development for IEC standardization
processes and some examples for application outside standardization**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2020 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 Varembe
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 corrigendum or an amendment might have been published.

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 It also gives information on projects, replaced and withdrawn publications.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 once a month by email.

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.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries 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.

SYSTEMS REFERENCE DELIVERABLE



**Use case methodology –
Part 4: Best practices in use case development for IEC standardization
processes and some examples for application outside standardization**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.020

ISBN 978-2-8322-7939-7

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

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
0.1 General.....	6
0.2 Objectives of this document	6
1 Scope.....	8
2 Normative references	8
3 Terms, definitions and abbreviated terms	8
3.1 Terms and definitions.....	8
3.2 Abbreviated terms.....	9
4 Overview of the methodology.....	9
4.1 Concept of systems engineering	9
4.2 Systems engineering methodology for use case development.....	9
4.2.1 General	9
4.2.2 Overview of the phased approach.....	11
4.2.3 Phase 1: Methodology for executives.....	11
4.2.4 Phase 2: Modelling user requirements with use cases	13
4.2.5 Phase 3: Methodology for project engineers: developing detailed user requirements	22
4.3 Use of Unified Modelling Language (UML)	25
4.3.1 General	25
4.3.2 Use case diagram.....	26
4.3.3 Scenario flow chart.....	26
4.3.4 Activity diagram	27
4.3.5 Sequence diagram.....	30
4.3.6 Data class diagram.....	30
4.4 Determining the quality of a use case	30
4.4.1 General	30
4.4.2 Considerations for use case management and collaborative working	31
4.4.3 Version numbering.....	32
4.4.4 Management of use case overarching topics like actors, information objects or requirements	32
4.4.5 Actor hierarchy und multiple instances of an actor	33
4.5 Coordination of parallel system use case supporting the same business use case.....	34
4.5.1 General	34
4.5.2 Decomposition of coordinated high-level use case into sets of low-level use cases, maximizing the use of already existing elements of standards (e.g. implantation example use case)	35
4.5.3 Perform gap analysis to identify necessary standardization work	35
4.5.4 Components as the linking element between use cases, reference architectures model and standards	36
4.6 Outlook to support cooperation of different contributing domains by identifying cross standardization groups use cases	36
Bibliography.....	38
Figure 1 – Project definition process	10
Figure 2 – Internal and external stakeholders for the ATM example	13

Figure 3 – Use case workshop process	15
Figure 4 – Graphically drafted business use case for the ATM example	16
Figure 5 – Graphically drafted system use case for the ATM example	17
Figure 6 – Sequence diagram showing the appropriate boundaries of exchange in the step-by-step analysis	20
Figure 7 – Sequence diagram showing an inappropriate level of detail of information exchange	21
Figure 8 – Flow diagram for alternate (error) scenarios	22
Figure 9 – Base plane of the SGAM showing its requisite domains and zones	25
Figure 10 – Example use case diagram showing actors, assumptions, objectives and preconditions.	26
Figure 11 – Example use case diagram scenario flow	27
Figure 12 – Example activity diagram using Unified Modelling Language showing the interaction of ATM operator bank, contractual bank, and a customer.....	28
Figure 13 – Example activity diagram with object flow	29
Figure 14 – Example for use case modelling down to data flow modelling	29
Figure 15 – Example UML data class diagram showing the elements of a use case	30
Figure 16 – Use case lifecycle process	31
Figure 17 – Management of use case overarching topics	33
Figure 18 – Translation of a technical architecture into an actor hierarchy	33
Figure 19 – Mapping business processes with standards and components.....	35
Figure 20 – Components as the linking element between use cases, reference architecture models and standards	36
Figure 21 – Actor naming in cross-domain use cases.....	37
Table 1 – Use case scenario description according to IEC 62559-2	18
Table 2 – Use case information object description according to IEC 62559-2	19
Table 3 – Use case requirement description according to IEC 62559-2	19
Table 4 – Examples of poorly-formed requirements and requisite improvement.....	24

INTERNATIONAL ELECTROTECHNICAL COMMISSION

USE CASE METHODOLOGY –

Part 4: Best practices in use case development for IEC standardization processes and some examples for application outside standardization

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.

IEC SRD 62559-4, which is a Systems Reference Deliverable, has been prepared by IEC systems committee Smart Energy.

The text of this Systems Reference Deliverable is based on the following documents:

Draft SRD	Report on voting
SyCSmartEnergy/105/DTS	SyCSmartEnergy/114/RVDTS

Full information on the voting for the approval of this Systems Reference Deliverable can be found in the report on voting indicated in the above table.

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

A list of all parts in the IEC 62559 series, published under the general title *Use case methodology*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- 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

0.1 General

The IEC 62559 use case template and methodology evolved from work originally performed by the Electric Power Research Institute (EPRI) as part of the IntelliGrid program. The primary purpose of that effort was to develop descriptions of existing and future power systems and their functions and requirements. In the evolution of this effort, the value of use cases as a means to accurately and completely describe the requirements for these systems and functions was demonstrated. The use case template was contributed to the IEC and this became a Publicly Available Specification (IEC PAS 62559:2008). As the best practice of use cases evolved, IEC PAS 62559:2008 was cancelled and replaced by IEC 62559-2:2015 to reflect these updates.

This methodology was originally developed as part of the IntelliGrid Architecture developed by the Electrical Power Research Institute (EPRI) as a means to implement the “IntelliGrid vision” of the automated, self-healing, and efficient power system of the future. However, the aim of IEC 62559 has changed in such a way that it is now intended to describe a methodology which is generic enough to become applicable for all domains served by IEC or other standardization bodies.

Initially, IEC 62559 was dedicated to the smart grid domain, but with the introduction of systems committees within IEC's organizational structure, the focus was widened to allow the use of the use case methodology also for other domains like active assisted living or smart cities. This document also explains how the generic methodology of IEC 62559 can be dedicated to a certain domain by complementary standards, e.g. the IEC 62913 series for smart energy [1], [2].

0.2 Objectives of this document

As defined by the IEC, the scope of IEC systems committees like Smart Energy (SyC SE), Active Assisted Living (SyC AAL) and others is to prepare and coordinate, in co-operation with IEC technical committees and subcommittees, the development of International Standards and other deliverables with emphasis on overall system aspects of technical systems and acceptable balance between cost and quality for the users of these technical systems.

While SyC SE's main focus is on standardization in the field of smart energy in order to provide systems level standardization, coordination and guidance in the areas of smart grid and smart energy, including interaction in the areas of heat and gas, SyC SE works also on methodology and tools to support the systems approach in standardization. In this regard, SyC SE has the aim to widely consult within the whole IEC community and the broader stakeholder community to provide overall systems level value, support and guidance to the TCs and other standards development groups, both inside and outside the IEC.

This document has therefore been developed to address the following objectives:

- To develop a standard methodology for determining and defining user requirements in a consistent and comprehensive manner. Standards often address only the technical issues that are included in technical specifications; however, it is just as vital to develop standards to assist users to clearly and comprehensively define their requirements.
- To clarify the distinction between “user requirements” (the “what” as needed by domain system experts) and “technical specifications” (the “how” as technical descriptions of systems, applications, and information flows to meet the “what”). Currently this distinction is an “invisible line” so that often the “what” and the “how” are mixed together – with technology-oriented project engineers jumping directly to the “how” without fully exploring the “what” with the domain system experts.

- To emphasize the critical need to determine all user requirements first, before any commitments are made on “how” to meet those requirements. Because automation and control systems are so complex and are becoming increasingly so, if all requirements are not clearly defined first, then the premature design of systems can block or seriously hinder meeting those requirements that were not initially recognized.
- To provide a means for testing the systems once implemented to ensure that the user requirements are truly met, regardless of what standards and technologies are ultimately incorporated by the vendors.

USE CASE METHODOLOGY –

Part 4: Best practices in use case development for IEC standardization processes and some examples for application outside standardization

1 Scope

This document specifies best practices for an entity to engage in a use cases redaction process to determine and describe their user requirements for systems, based on the business needs. It complements the information in IEC TR 62559-1, IEC 62559-2 [3] and IEC 62559-3 [4] by providing users with best practices in:

- use cases drafting process,
- determining the skill sets of the people required,
- use case repository management, and
- using use cases for IEC or enterprise projects.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1.1

use case

specification of a set of actions performed by a system, which yields an observable result that is, typically, of value for one or more actors or other stakeholders of the system

[SOURCE: ISO/IEC 19505-2:2012, 16.3.6]

3.1.2

business use case

use case that describes how business roles interact to execute a business process

Note 1 to entry: The business processes are derived from services, i.e. business transactions, which are needed to achieve different strategic goals for an organization; e.g. for the purpose of achieving specified and measurable results/products for internal or external customers.

Note 2 to entry: Business use cases are system agnostic.

[SOURCE: IEC TR 62559-1:2019, 3.8, modified – Note 2 to entry has been added.]