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Template for smart manufacturing use cases

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IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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Template for smart manufacturing use cases

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

Draft	Report on voting
SyCSM/127/DTS	SyCSM/136/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Systems Reference Deliverable is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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– reconfirmed,
– withdrawn, or
– revised.

INTRODUCTION

The collection, storage and distribution of use cases are intended to show the characteristics of smart manufacturing (SM), including but not limited to the following:

– vertical integration of networked manufacturing systems within enterprises;
– horizontal integration crossing enterprises;
– end-to-end integration of the whole value chain;
– short time-to-market of the new product;
– enhanced engineering and operational efficiency;
– openness for integration;
– self-optimization;
– new business model;
– resource optimization and cost savings;
– flexibility in production;
– sustainability.

In addition, managing a collection of use cases has the following goals:

– to organize use cases according to different aspects such as life cycle, hierarchy;
– to make access to a required use case easy;
– to assist in deepening the understanding of the use cases.

Use cases in SM are developed by many organizations, such as standardization bodies and consortia. With the wide spread of manufacturing Internet of Things (IoT), it is expected that many use cases will continue to be created.

The benefits from use case collection include the following aspects from different perspectives:

– to show how SM related technologies can be used to express business needs and to capture user requirements;
– to derive standardization requirements and improve the capability to use standards;
– to gather experts who are interested in SM;
– to support and promote SyC SM work;
– to help people to understand standards by related use cases.

The benefits for users of identified or analysed use case collections include the following:

– to easily access target use cases using keys corresponding to user concerns or interests;
– to effectively develop the application with use cases;
– establishment of a fundamental platform (repository) for expanding the usage of SM use cases.

In addition, the benefits for IEC itself are as follows:

– to draw attention to the usage of use cases related to SM;
– to provide the potential data query service.

The initial task of the previous SyC SM AHG 2 was the identification of SM use cases which were already available in the IEC and ISO technical work.

It is difficult to compare or contrast catalogues of use cases from different standards development organizations (SDOs) since they are developed from separate sources with different templates for different purposes. It will be useful if they can be tied to a unified framework within the SM landscape.

Therefore, to facilitate the collection of smart manufacturing use cases, SyC SM WG 1 was set up as a subsequent group carrying over the outcomes from the SyC SM AHG 2. It was requested to collaborate with TCs and SCs, ISO/SMCC, other SDOs and external organizations.

The SM use case template is based on SM reference architecture (refer IEC 63339:2024), taxonomy (refer ISO/IEC TR 63306-1:2020), terminology (refer IEC TR 63283-1:2022), and current use cases. The development of the SM use case template follows the V-model shown in Figure 1. The SM use case template is analysed and designed based on the requirement from SDG users, IEC SyC SM WG 3, industry users, etc. Then, it will be verified by WG 1 using use case data, and validated by related SDOs and industry users.

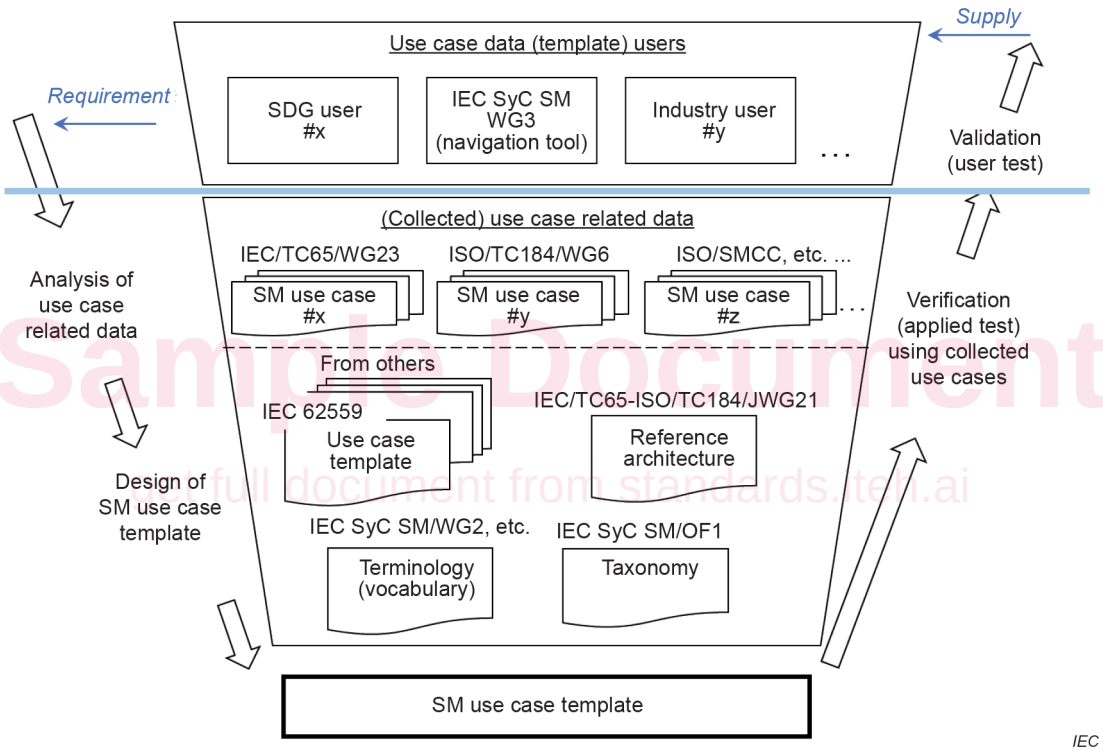

Figure 1 – Development process of SM use case template

It is important to encourage SDOs and industry users to compile the SM use case based on the SM use case template described in 7.1. A guideline for drafting the use cases is provided in 7.2. Use cases from various sources will be brought into the proposed use case management repository (UCMR) for ease of access and reference by standards developers, and industry users of SyC SM applications, shown in Figure 2.

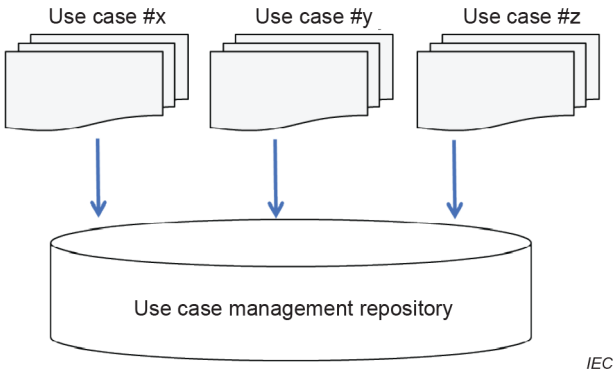

Figure 2 – Use of UCMR

IEC Guide 125 on application of the use case (UC) methodology is under development. It is based on IEC 62559-2, which gives an overview of the individual parts of the IEC 62559 series, provides the background and basics for the use case approach defined therein (like terms or use case types), and introduces processes for collaborative use case collection within IEC. IEC Guide 125 will be the basis for a common use case repository, used to gather use cases within IEC on a common collaborative platform. The SM use case template has the same structuring methodology as IEC Guide 125 and it can be one of the profiles for different domains.

1 Scope

This document specifies the template for smart manufacturing use cases. It is developed for easier storage, search, comparison, and retrieval of use cases from different SDOs and others by having a unified template of use cases.

The storage of SM use cases in IEC UCMR follows the template requirements in this document.

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 terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://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
use case template
form which allows the structured description of a use case in predefined fields

[SOURCE: SG-CG/M490/E:2012-12; 3.2]

3.1.3
user
entity which makes use of the use case template or the services and/or facilities of a database based on the use case template

EXAMPLE SM system developer, SM standard developer and SM application developer.

3.1.4
repository
place where information like use cases can be stored

Note 1 to entry: The information is usually stored as a database (refer to use case repository).

[SOURCE: SG-CG/M490/E:2012-12; 3.12, modified – Supplementary information has been moved to a note to entry.]

3.2 Abbreviated terms

AAL	active assisted living
ISO/SMCC	Smart Manufacturing Coordinating Committee at ISO
SDO	standards development organization
SM	smart manufacturing
SyC	systems committee
UCMR	use case management repository

4 Distribution of SM UCMR specification using the template

This Clause 4 describes relationship among SDOs in the process of design of the template for SM use cases, and the relationship between the template, the specification for implementation of SM UCMR and the UCMR. Figure 3 shows derivation flow for the specification of UCMR through the design of the template. The content in the blue circle is the task of IEC SyC SM/WG 1.

The main structure of the template for SM use cases is based on IEC 62559-2, which is transferred to IEC Guide 125, and adopts items that reflect the characteristics of SM. The process of development of the template will include referring to the reference architecture of IEC TC 65/JWG 21, studying the typical SM use cases and templates from other SDOs, and utilizing the terminology from IEC SyC SM/WG 2 and taxonomy of OF1. The use case templates from other domains, such as IEC TC 8, SyC AAL, SyC Smart Cities, ISO/IEC JTC 1, IEEE, will be referred to as well.

One of the results from WG 1 is the specification for implementation of SM use case management repository (UCMR). The template for SM use cases will provide the requirements for this UCMR. The specification will provide the design of UCMR as one input from SM domain.

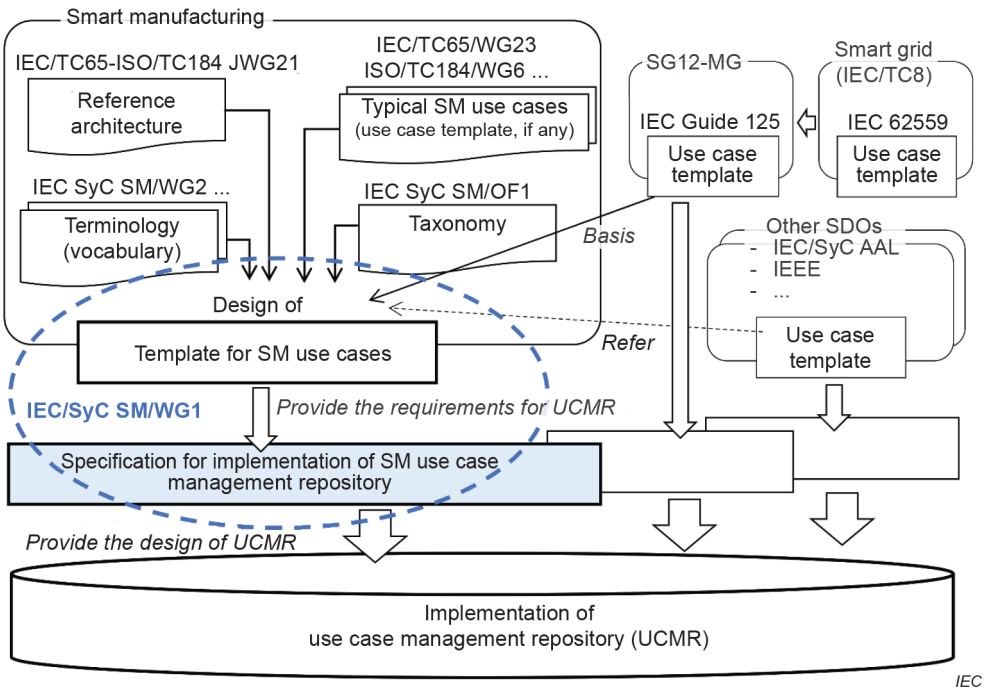

Figure 3 – Derivation flow for the specification of UCMR through the design of the template for SM use cases

5 Saving use cases to UCMR using the template

This Clause 5 describes the process of how the template for SM use cases is used by SDOs. Figure 4 shows data flow using the template for SM use cases.

Based on the collection scheme to be provided by WG 1, SM use case data from different SDOs, such as IEC TC 65/WG 23, ISO/TC 184/WG 6 and ISO/SMCC, will take the template for SM use cases developed by WG 1 to be saved in UCMR. In this way, users can easily search, compare, and learn the use cases by the key factors of this template.

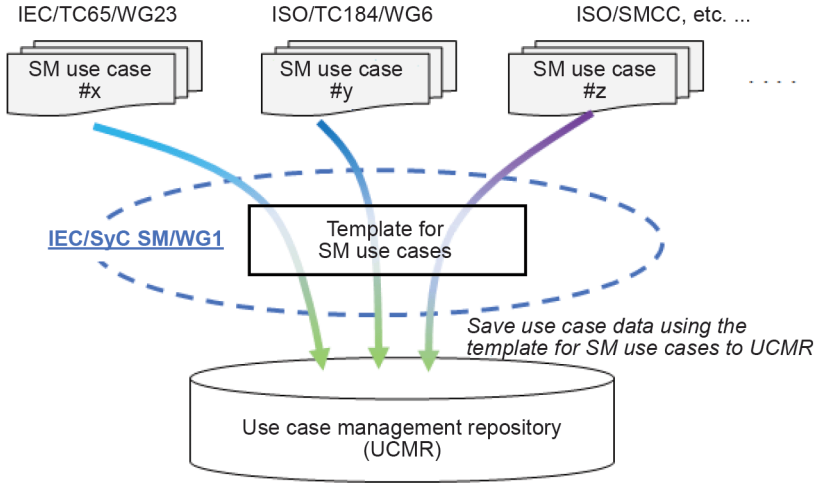

Figure 4 – Saving use cases to UCMR using the template for SM use cases

6 Requirements for the template for SM use cases

6.1 Requirements from other SDOs

The main structure of IEC 62559-2, is a general guide of use case template for different domains. It is important to specify the items of the use case template to reflect the aspects of SM, such as life-cycle management, manufacturing intelligence, etc. Since SM is concerned with system engineering, the logical relationships between actors should be analysed. The items in the SM use case template will be determined and clarified in this document to help users to complete the template and so the data can be stored in the repository.

The templates used in IEC TR 63283-2, IEC TS 63134 and ISO/IEC TR 24030 are derived from IEC 62559-2, but are different because of specific considerations from each domain. The comparison of these templates is shown in Table 1.

From the comparison in Table 1, the following requirements can be derived.

a) The use case template will include two parts, which are common items and special requirements for its domain.
   1) Common items can include:
      i) description of the use case: name of use case or ID, version management, narrative;
      ii) diagrams of use case to depict the use case;
      iii) technical details: actors, references;
      iv) requirements for standardization.