



SLOVENSKI STANDARD
oSIST prEN IEC 63339:2023
01-januar-2023

Enoten referenčni model za pametno proizvodnjo

Unified reference model for smart manufacturing

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Ta slovenski standard je istoveten z: prEN IEC 63339:2022

<https://standards.iteh.ai/catalog/standards/sist/375a0993-c72f-44ff-9f51-c10a4d29367f/osist-pr-en-iec-63339-2023>

ICS:

25.040.01	Sistemi za avtomatizacijo v industriji na splošno	Industrial automation systems in general
-----------	---------------------------------------------------	------------------------------------------

oSIST prEN IEC 63339:2023

en,fr,de



65/946/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: IEC 63339 ED1	
DATE OF CIRCULATION: 2022-11-18	CLOSING DATE FOR VOTING: 2023-02-10
SUPERSEDES DOCUMENTS: 65/930/CD, 65/939A/CC	

IEC TC 65 : INDUSTRIAL-PROCESS MEASUREMENT, CONTROL AND AUTOMATION	
SECRETARIAT: France	SECRETARY: Mr Didier GIARRATANO
OF INTEREST TO THE FOLLOWING COMMITTEES: SyC SM,ISO/IEC JTC 1/SC 41	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input type="checkbox"/> SAFETY	
<input checked="" type="checkbox"/> SUBMITTED FOR CENELEC PARALLEL VOTING	<input type="checkbox"/> NOT SUBMITTED FOR CENELEC PARALLEL VOTING
<p>Attention IEC-CENELEC parallel voting</p> <p>The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.</p> <p>The CENELEC members are invited to vote through the CENELEC online voting system.</p>	

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE: Unified reference model for smart manufacturing

PROPOSED STABILITY DATE: 2027

NOTE FROM TC/SC OFFICERS:

Copyright © 2022 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**UNIFIED REFERENCE MODEL FOR SMART
MANUFACTURING**
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/ISO 63339 has been prepared committee by IEC technical committee 65: Industrial-process measurement, control and automation and by ISO technical committee 184: Automation systems and integration. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

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 International Standard 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/standardsdev/publications.

52 The committees have decided that the contents of this document will remain unchanged until
53 the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related
54 to the specific document. At this date, the document will be

- 55 • reconfirmed,
- 56 • withdrawn,
- 57 • replaced by a revised edition, or
- 58 • amended.

59

60

iTeh STANDARD PREVIEW (standards.iteh.ai)

[oSIST prEN IEC 63339:2023](https://standards.iteh.ai/catalog/standards/sist/375a0993-c72f-44ff-9f51-c10a4d29367f/osist-pren-iec-63339-2023)

<https://standards.iteh.ai/catalog/standards/sist/375a0993-c72f-44ff-9f51-c10a4d29367f/osist-pren-iec-63339-2023>

61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103

Unified reference model for smart manufacturing

CONTENTS

FOREWORD	2
Introduction	8
1 Scope	12
2 Normative references	12
3 Terms, definitions, and conventions	12
3.1 Terms and definitions	12
3.2 Abbreviated terms and acronyms	16
3.3 Conventions	17
4 Conformance	17
4.1 Intended usage	17
4.2 Full conformance	18
4.3 Partial conformance	18
4.3.1 Conformance to purpose and context requirements	18
4.3.2 Conformance to dimensions and coherence	18
4.3.3 Conformance to semantic modelling of aspects	18
4.3.4 Conformance to facets and frameworks	18
5 The URMSM in smart manufacturing concepts	18
6 Reference model concepts	19
6.1 SM modelling	19
6.2 Modelling purpose	20
6.3 Modelling dimensions	21
6.4 Dimension coherence	21
6.5 Stakeholders	22
6.6 Concerns	22
6.7 Use Case	23
6.8 Viewpoints and views	24
6.9 Perspectives	24
6.9.1 Use of perspective	24
6.9.2 Stakeholder perspectives	24
6.9.3 Analytical framework	24
6.10 Aspects	25
6.11 Life cycle modelling	25
6.12 SM semantic modelling	26
6.12.1 Semantic modelling overview	26
6.12.2 Forms of semantic representation	27
6.12.3 Granularity of semantic models	28
7 Dimensions of URMSM	29

104	7.1	Identifying aspect interactions and modelling dimensions of smart manufacturing	29
105			
106	7.2	Specifying modelling dimensions	29
107	7.2.1	Collections of aspects as dimensions of smart manufacturing	29
108	7.2.2	Collections of dimensions as an analytical framework for smart manufacturing	30
109			
110	7.2.3	Collections of life cycle phases as dimensions of smart manufacturing	31
111	7.3	Using a semantic model for analytical reasoning in smart manufacturing	32
112	7.4	Identifying meaningful dimension interactions	32
113	7.5	Selecting facet dimensions based upon concerns	32
114	7.6	Frameworks as visualizations of interactions	34
115	8	Using the URMSM	37
116	8.1	Utility of a reference model for smart manufacturing	37
117	8.2	Industry specific application of the URMSM	38
118	8.3	Specializing URMSM	38
119	8.3.1	Specific utilization of the URMSM and rules for derivatives of SMRMs	38
120	8.3.2	Manipulating reference models to match purpose	39
121	9	Use cases of the URMSM	40
122	9.1	Analysis use case	40
123	9.1.1	Examining interactions at intersections of aspects	40
124	9.1.2	Examining interactions near intersections of aspects	41
125	9.1.3	Inserting new capabilities to analyse	41
126	9.2	Synthesis use case	41
127	9.2.1	Identifying necessary coverage of aspect interactions	41
128	9.2.2	Sequencing activities based upon dependencies	41
129	9.3	Simulation in SMRM	42
130	9.4	Implementation use case	42
131	10	Family of reference models based upon the URMSM	44
132	10.1	A base of essential SM modelling dimensions	44
133	10.2	Re-arranging framework dimensions	45
134	10.3	Complementary frameworks for same situation	46
135	10.4	Using multiple SMRMs to achieve purpose	46
136	Annex A (informative)	Concept areas of SM	48
137	A.1	Aspects of production and products	48
138	A.2	Perspectives of production and products stakeholders	48
139	A.3	Lifecycle considerations	49
140	A.4	Modelling of products and production using semantic models	49
141	A.5	Semantic models	51
142	Annex B (Informative)	Formal Foundation for URMSM	53
143	B.1	Modelling framework for URMSM	53
144	B.1.1	Formalism caveat	53
145	B.1.2	Modelling framework formalism	53
146	B.1.3	Using a URMSM framework	56
147	B.1.4	Semantic models of dimensions composed of aspects	57
148	Annex C (Informative)	Positioning URMSM among reference models	61
149	C.1	Positioning URMSM among reference models	61
150	Annex D (Informative)	Meta-model for reference model analysis	62
151	D.1	Meta-model analysis	62

152	D.2	Using a meta-model	62
153	D.2.1	General	62
154	D.2.2	Assumptions, constraints and guidance	62
155	D.2.3	Concepts	63
156	Annex E (Informative)	Principles of semantic modelling	68
157	E.1	Top level conceptual model.....	68
158	E.2	Semiotic conceptual model	70
159	E.3	Top level model domains	73
160	Annex F (informative)	Practitioner’s modelling activity in a systematic usage of	
161	URMSM		75
162	F.1	Use case derivation of concerns, aspects, and perspectives	75
163	F.2	Relationship between aspects on a dimension and model contents	77
164	F.2.1	General	77
165	F.2.2	Implication of the dimension of lifecycle	77
166	F.2.3	Implication of the dimension of smart technology	78
167	F.2.4	Implication of the dimension of enterprise hierarchy.....	78
168	F.2.5	Implication of the dimension of capability level.....	78
169	F.3	Concept of step-by-step approach.....	78
170	F.3.1	Formalism caveat	78
171	F.3.2	Practical procedure.....	79
172	Annex G (informative)	Use case: Value stream	81
173	G.1	Overview.....	81
174	G.2	Conveyor system project.....	81
175	G.3	SM use case	81
176	G.4	Dimensions	83
177	G.4.1	Information in context	83
178	G.4.2	Dimension coherence using semantic models	84
179	G.4.3	Interactions between dimensions	84
180	G.4.4	Dimension S – the supply chain	84
181	G.4.5	Dimension C - product/production system design.....	84
182	G.4.6	Dimension D - production system.....	85
183	G.4.7	Dimension H - operations management (shown within the production	
184		systems dimension D).....	85
185	G.4.8	Dimension I - control/process level 1 (shown within Dimension D)	85
186	G.5	Project flow and interaction	86
187	G.5.1	Product concept (Ctx) quotation.....	86
188	G.5.2	Product order process	87
189	G.5.3	New product concept(Ctx) quotation	87
190	G.5.4	Interaction matrix	87
191			
192	Figure 1 – Using URMSM.....		9
193	Figure 2 – SM standard developer perspective of facet reuse		33
194	Figure 3 – Projection steps for standards developers		34
195	Figure 4 – A one dimensional framework representation		35
196	Figure 5 – A two dimensional framework representation.....		36
197	Figure 6 – Nested processes (centre oval) and user members (right)		36
198	Figure 7 – URMSM abstraction stack		38
199	Figure 8 – Example of a model for use case #1		43

200	Figure 9 – Diversified smart manufacturing systems expected from different	
201	stakeholders	44
202	Figure 10 – Basic structure for a family of SMRM with alternative 3D representations	46
203	Figure A.1 – SM contextual relationships	50
204	Figure A.2 – Semiotic Triangle with 3 semiotic domains and 3 morphisms (relations	
205	between pairs of semiotic domain artefacts).....	51
206	Figure A.3 – Product standards catalogue concept model	52
207	Figure B.1 – Semantic model scenario dimensions	58
208	Figure B.2 – Semantic model scenario as relationship graph	59
209	Figure C.1 – Example of cascading reference models	61
210	Figure D.1 – Meta-model for SMRM	67
211	Figure E.1 – Top level conceptual model "The Semantic Triangle"	68
212	Figure E.2 – Knowledge Ontology (K-Pyramid) explained by the three coloured corners	
213	of the Semiotic Triangle (Concept Symbol Phenomenon)	69
214	Figure E.3 – I4.0 Methodology / Theory of Data: Flattening the Knowledge/Data	
215	Pyramid	70
216	Figure E.4 – Cyclic Semiotic Relationships (Morphisms)	71
217	Figure E.5 – A First High Level Consolidation of Interactions (I) - including IIoT Control	
218	Structure.....	71
219	Figure E.6 – Composition of SM knowledge from different SM domains	72
220	Figure E.7 – Top level concept model for model domain	73
221	Figure E.8 – Natural aspect concept model – dynamics	74
222	Figure F.1 – Utilization of the URMSM through a modelling activity of SM practitioners.....	75
223	Figure F.2 – Projection steps for SM practitioners.....	76
224	Figure F.3 – Relationship between aspects on a dimension and model contents	77
225	Figure F.4 – Potential problem of the modelling activity by SM practitioners.....	79
226	Figure F.5 – Step-by-step approach	80
227	Figure G.1 – Product model interactions	83
228	Figure G.2 – Production System Dimension D.....	85
229		
230	Table B.1 – Semantic model scenario	57
231	Table B.2 – Semantic model scenario as N-squared diagram.....	58
232	Table B.3 – Semantic model scenario Direct Intersections	59
233	Table B.4 – Semantic model scenario Indirect Interactions	60
234	Table G.1 – Interaction matrix.....	88
235		

236

Introduction

237 “Manufacturing” refers to a range of human activities, from handicraft to high tech, and is
238 commonly applied to industrial production, where raw materials and parts are transformed into
239 finished goods on small to large scale by a series of interconnected processes. Smart
240 manufacturing (SM) is an emergent characteristic of manufacturing achieved by digital
241 technologies, gradually built up through digital transformation, combining diversity and
242 uniformity, demonstrating continuous value delivery by a highly complicated collection of
243 processes interacting on different time scales. In today’s manufacturing landscape,
244 manufacturing is no longer characterized as a set of serial processes, but instead as a highly
245 interconnected set of distributed processes that are able to cooperate on different time scales.
246 A set of supervisory processes achieve coordination of these distributed processes using links
247 that enable dynamic response to changing conditions in demands, supply, environment, energy
248 and, other human or naturally caused probabilistic events. Since these probabilistic events are
249 not known before occurrence, they often are disruptive and result in changing conditions.

250 The purpose of smart manufacturing is to accommodate those disruptive events, while
251 supporting the introduction of new technologies and methods in a coordinated manner across
252 the variety of customers, suppliers and stakeholders at various stages in the value chain.

253 Building upon the common knowledge and results found in IEC TR 63319 [4] - A meta-modelling
254 analysis approach to smart manufacturing reference models and as depicted in Figure 1, this
255 document specifies the unified reference model for smart manufacturing (URMSM) to create
256 purpose-specific domain and application reference models for smart manufacturing initiatives
257 by specifying the necessary structure and terminology for expressing such models. The URMSM
258 is applicable across the many domains and applications found within a manufacturing enterprise.

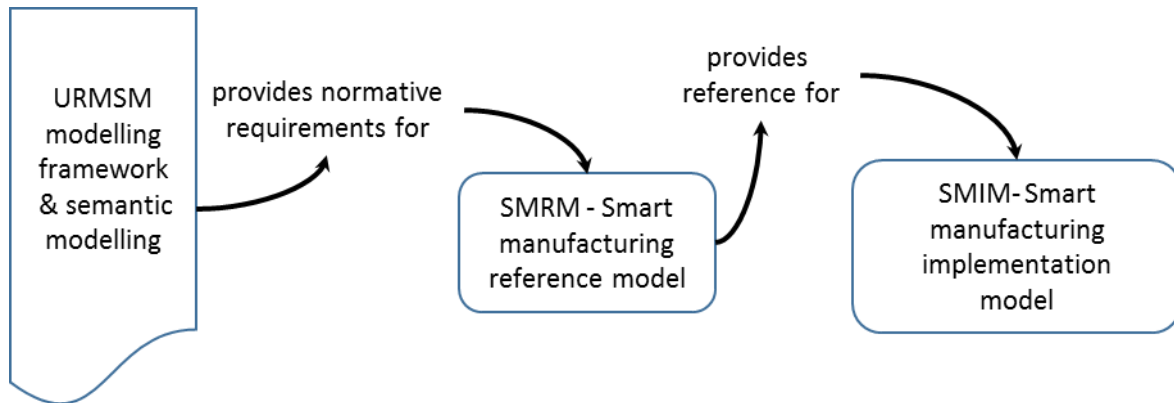
259 Smart manufacturing reference models (SMRM), which conform to the specifications of this
260 document, provide SM standards developers and SM practitioners with better opportunities for
261 implementing models of production systems and products that take full advantage of
262 technological innovations. These innovations occur during;

- 263 • analysis and synthesis using models of manufacturing,
- 264 • application of new materials, processes and facilities for manufacturing,
- 265 • understanding the emergence of digital twin concepts and either smart manufacturing
266 technologies.

267 The URMSM is not one model or one model visualization. The URMSM is a specification for a
268 family of reference models that share structural and behavioural properties intended to promote
269 interoperability.

270 NOTE Clause 8.2 provides more information regarding relationships among models and derivation relations.

271 The URMSM brings together concepts from existing works, both standards and practice, to
272 support the variety of existing reference models, the adaptation of existing reference models
273 for new uses, and the emergence of new reference models, all of which take advantage of the
274 evolution in manufacturing technologies.



275

276

Figure 1 – Using URMSM

277 The model-based approach of the URMSM has two major structural components. The first is a
 278 modelling framework to support various arrangements of manufacturing elements into
 279 conceptual configurations deemed pertinent to domains of manufacturing enterprises. The
 280 second is the conceptualization of semantic models that reside within the modelling framework.
 281 A concise URMSM terminology supports both the modelling framework and the conceptual
 282 semantic models.

283 Since smart manufacturing is essentially a human conception of improved manufacturing
 284 technologies and practices, differences in interpretation of that concept can lead some
 285 practitioners to over-simplify the complicated nature of perspective and property interactions in
 286 today's manufacturing systems. Objectifying the notion of 'smart' for manufacturing is a
 287 challenge since developers and practitioners have been getting smarter about manufacturing
 288 for over 200 years already.

289 For IEC work in a domain of similar complexity, the author of [1] summarizes "smartness" in the
 290 domain of Smart Cities as: Smartness is an emergent characteristic of a system

- 291 – achieved by digital technologies,
- 292 – explicitly architected and engineered to reduce complexity,
- 293 – gradually built up through digital transformation,
- 294 – permanently demonstrating value delivery,
- 295 – combining diversity and uniformity,
- 296 – coordinating and cooperating between all the stakeholders.

297 Considering this characterization, the URMSM provides the means for creating reference
 298 models for smart manufacturing that enable emergence of more digitally oriented, engineered
 299 solutions for delivering additional value from manufacturing operations. The result is improved
 300 performance aspects with integrated and intelligent use of processes and resources in cyber,
 301 physical and human spheres to create and deliver products and services, which also collaborate
 302 with other domains within enterprises' value chains [2].

303 This document identifies a collection of criteria for arranging aspects of the smart manufacturing
 304 domain as reference models. The important relationships among manufacturing elements
 305 enable useful examination and derivation of practical designs in order to fulfil a defined purpose,
 306 and to maintain and improve the resulting system through methods for analysis and synthesis.

307 The URMSM provides insight into the modelling of aspects of manufacturing elements to
 308 consider when developing new elements. Smart support methods for conducting that
 309 development or modification can require an evolution from existing practice to a more unified
 310 model-based approach.

311 This document can be used to support the development processes of smart manufacturing, and
 312 to assure coherence and compatibility during the development of standards.

313 This document identifies ways to apply those aspects of manufacturing and the acumen
314 essential to developing a smart manufacturing model for a particular industrial enterprise.

315 The URMSM goes beyond the representational features of manufacturing elements to enable
316 examination of interactions among those elements through the use of models to address issues
317 arising in the course of smart manufacturing initiatives.

318 Expectations regarding the outcome of a satisfactory URMSM are:

- 319 – enabling the examination of value within a value creation network;
- 320 – enabling a range of appropriate libraries such as use-cases, interface definitions, models
321 for semantics, information and data, and international standards as modelled views relative
322 to modelling purposes for particular smart manufacturing situations;
- 323 – enabling representation as a multi-dimensional space composed from various collections of
324 aspects to accommodate particular modelling purposes, such as aspects of production,
325 aspects of product, aspects of smart technology, and their relationships over their respective
326 life cycles;
- 327 – enabling assurance that information is consistently structured using standards for
328 information, data and modelling languages, without ambiguous meaning, by applying
329 semantic models and techniques;
- 330 – enabling efficient usability for the creation of tailored smart manufacturing models that
331 address a stakeholder's particular concerns.

332 The URMSM supports all three modalities of interoperation (unified, integrated, and federated)
333 that can co-exist within a modelling framework, albeit with varying extents of effectiveness and
334 efficiency (see ISO 11354). Having a formal understanding of modelling frameworks enables
335 more effective and efficient utilization of frameworks.

336 Clause 4 specifies extents of conformance to URMSM based upon meeting the requirements
337 and recommendations in their entirety, as full conformance, or for particular sub-clauses, as
338 partial conformance.

339 Clause 5 presents aspects of manufacturing commonly associated with 'smart manufacturing'.

340 Clause 6 presents modelling concepts essential for constructing suitable reference models in
341 the domain of smart manufacturing.

342 Clause 7 establishes examination and derivation criteria for interoperation of aspects in
343 manufacturing.

344 Clause 8 presents ways to use the URMSM specification criteria to create purpose-specific
345 reference models.

346 Clause 9 presents use cases for the URMSM and a progression of capability markers that
347 indicate maturity in the application of the URMSM.

348 Clause 10 discusses ways to manipulate and use reference frameworks for extended analysis
349 and synthesis for systems used in smart manufacturing.

350 Annex A presents concept areas of smart manufacturing.

351 Annex B provides a formal foundation for the URMSM approach including a modelling
352 framework for URMSM.

353 Annex C provides an example figure of cascading reference models.

354 Annex D provides a summary of the meta-model for reference model analysis from IEC TR
355 63319 [4].

356 Annex E provides an introduction to the principles underlying semantic modelling.

357 Annex F provides a practitioner's modelling activity in a systematic usage of URMSM.

358 Annex G provides an extended example of the URMSM applied to a multi-dimensional
359 manufacturing scenario.

360

iTeh STANDARD PREVIEW (standards.iteh.ai)

[oSIST prEN IEC 63339:2023](https://standards.iteh.ai/catalog/standards/sist/375a0993-c72f-44ff-9f51-c10a4d29367f/osist-pren-iec-63339-2023)

<https://standards.iteh.ai/catalog/standards/sist/375a0993-c72f-44ff-9f51-c10a4d29367f/osist-pren-iec-63339-2023>

361 Unified reference model for smart manufacturing

362 1 Scope

363 This document specifies the unified reference model for smart manufacturing (URMSM) using
 364 a terminology and structure, and establishes criteria for creating reference models, as
 365 specializations, that support smart manufacturing. The terminology and structure comprise a
 366 set of common modelling elements, their associations, and conformance criteria. These
 367 common modelling elements address aspects and perspectives of products and production and
 368 their lifecycle considerations.

369 The URMSM enables an approach for creating multiple models based upon a reference model
 370 that is sufficient for understanding significant relationships among entities involved in smart
 371 manufacturing (SM) and for the development of standards and other specifications.

372 The URMSM specifications in this document accommodate consistent, coherent, compatible
 373 specializations for relevant aspects of manufacturing systems consisting of equipment, products,
 374 and services within the domain of manufacturing. Provisions of this document are applicable for
 375 a new smart manufacturing reference model (SMRM) or elaboration of existing SMRM
 376 capabilities, for example, improving capabilities for analysis of opportunities and synthesis of
 377 technological advances, and improving interoperability of new and existing systems.

378 This document is not intended to prescribe interoperability considerations or data schemas of
 379 models. Standardization of content relative to models will be the subject of other standards and
 380 texts specific to those model domains.

381 2 Normative references

382 The following documents are referred to in the text in such a way that some or all of their content
 383 constitutes requirements of this document. For dated references, only the edition cited applies.
 384 For undated references, the latest edition of the referenced document (including any
 385 amendments) applies.

386 ISO 15704:2019 Enterprise modelling and architecture – Requirements for enterprise-referencing
 387 architectures and methodologies

388 ISO/IEC/IEEE 42010 Systems and software engineering – Architecture description

389 3 Terms, definitions, and conventions

390 3.1 Terms and definitions

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

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

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

396 3.1.1 397 aspect

398 labelled designation for a collection of concepts in a particular context

399 EXAMPLE functional, structural, information, security, availability, customer

400 Note 1 to entry: An aspect is often expressed as a view across one or more model for a manufacturing system.

401 Note 2 to entry: Elements of an aspect can have functional, non-functional or other kinds of descriptors.

402 Note 3 to entry: The identification of an aspect is often the result of prior knowledge, experience and practice in the
 403 domain to which the aspect applies.

404 **3.1.2**
405 **aspect interaction**
406 relationship between two or more *aspects* (3.1.1) where one aspect influences or is influenced
407 by the presence of another aspect

408 Note 1 to entry: Influence includes but is not limited to dependence and control.

409 **3.1.3**
410 **business**
411 series of processes, each having a clearly understood purpose, involving one or more person,
412 realised through the exchange of information and directed towards some mutually agreed upon
413 goal, extending over a period of time

414 [SOURCE: ISO/IEC 15944-20:2015(en), 2.2]

415 **3.1.4**
416 **complex**
417 **<context>**
418 decision situation characterised by unordered decision variables, and ill-defined categories,
419 criteria and dependencies

420 **3.1.5**
421 **complicated**
422 **<context>**
423 decision situation characterised by enumerated decision variables, and well-defined categories,
424 criteria and dependencies

425 **3.1.6**
426 **concern**
427 matter of relevance or importance to a *stakeholder* (3.1.20) regarding a manufacturing system
428 or element thereof

429 Note 1 to entry: Stated concerns are useful when relevant to the purpose of the modelling effort and refer to specific
430 rather than categorical difficulties, problems, or requirements.

431 Note 2 to entry: Concern expression takes many forms, including among others: as questions about features or
432 characteristics, as a keyword label for many related matters, and as expected quality attributes of the manufacturing
433 system or its products and services.

434 [SOURCE: ISO/IEC/IEEE 42010 Ed2, 3.10, added - "regarding a manufacturing system element
435 thereof]

436 **3.1.7**
437 **dimension**
438 coherent collection of *aspects* (3.1.1) relevant to a *manufacturing domain* (3.1.12)

439 Note 1 to entry: The coherence requirement of the dimension can result in a collection of aspects that are unordered,
440 partially ordered, fully ordered, or related in some other manner, or not ordered in any way (see 6.4 on dimensional
441 coherence for further information).

442 **3.1.8**
443 **element**
444 tangible or intangible constituent of a manufacturing system or of a product

445 Note 1 to entry: A constituent can range from atoms of raw material or logical constructs or items of information
446 through manufacturing models or equipment and entire factories, plants or supply chains and added value networks
447 to finished goods, and software and services.

448 Note 2 to entry: While the term as defined has broad meaning, designation of a specific meaning for an element of
449 manufacturing or manufactured product includes an adjective to constrain the meaning appropriate to that particular
450 manufacturing element.

451 Note 3 to entry: Requirements expressed in a specification are the kind of information for a particular element in
452 the manufacturing domain.

453 **3.1.9**
454 **facet**
455 framework composed of one or more dimension (3.1.7)

456 Note 1 to entry: Composition rules for coherent dimensions distinguish facets from other modelling frameworks.