

INTERNATIONAL
STANDARD

ISO/IEC/
IEEE
21839

First edition
2019-07

Systems and software engineering — System of systems (SoS) considerations in life cycle stages of a system

*Ingénierie du logiciel et des systèmes — Études du système des
systèmes (SdS) dans les étapes du cycle de vie d'un système*

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[ISO/IEC/IEEE 21839:2019](https://standards.itih.ai/catalog/standards/iso/1c0b64ea-a836-45b4-b300-10d249bc520f/iso-iec-ieee-21839-2019)

<https://standards.itih.ai/catalog/standards/iso/1c0b64ea-a836-45b4-b300-10d249bc520f/iso-iec-ieee-21839-2019>



Reference number
ISO/IEC/IEEE 21839:2019(E)

© ISO/IEC 2019
© IEEE 2019

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO/IEC/IEEE 21839:2019

<https://standards.iteh.ai/catalog/standards/iso/1c0b64ea-a836-45b4-b300-10d249bc520f/iso-iec-ieee-21839-2019>



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2019

© IEEE 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Published in Switzerland

Institute of Electrical and Electronics Engineers, Inc
3 Park Avenue, New York
NY 10016-5997, USA

stds.ipr@ieee.org
www.ieee.org

Contents

Page

Foreword	iv
1 Scope	1
1.1 Purpose	1
1.2 Field of application	1
1.3 Limitations	1
2 Normative references	1
3 Terms, definitions and abbreviated terms	1
3.1 Terms and definitions	1
3.2 Abbreviated terms	2
4 Concepts	3
4.1 System of systems	3
4.2 Constituent systems	3
4.3 System life cycle stages	4
4.4 SoS technical base	6
5 System of systems considerations in SoI life cycle stages	6
5.1 SoS considerations in the Concept Stage	6
5.1.1 General	6
5.1.2 Concept stage capability considerations	6
5.1.3 Concept Stage technical considerations	9
5.1.4 Concept Stage management considerations	11
5.2 Addressing SoS considerations in the development stage	12
5.2.1 General	12
5.2.2 Development stage capability considerations	12
5.2.3 Development stage technical considerations	15
5.2.4 Development stage management considerations	17
5.3 Addressing SoS considerations during the production stage	19
5.4 Addressing SoS considerations during utilization and support stages	20
5.4.1 General	20
5.4.2 Utilization and support stage capability considerations	20
5.4.3 Utilization and support stage technical considerations	23
5.4.4 Utilization and support stage management considerations	24
5.5 Addressing SoS considerations in retirement stage	24
Annex A (informative) System of systems technical base	27
Annex B (informative) Example SoS considerations in the life cycle stages of a constituent system	28
Annex C (informative) Relationship to other standards	30
Bibliography	31
IEEE notices and abstract	32

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the rules given in the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. The IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While the IEEE administers the process and establishes rules to promote fairness in the consensus development process, the IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see <http://patents.iec.ch>).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

ISO/IEC/IEEE 21839 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*, in cooperation with the Systems and Software Engineering Standards Committee of the IEEE Computer Society, under the Partner Standards Development Organization cooperation agreement between ISO and IEEE.

ISO/IEC/IEEE 21839 is one of three standards dealing with systems of systems. The relationship among the three standards is described in [Annex C](#).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Systems and software engineering — System of systems (SoS) considerations in life cycle stages of a system

1 Scope

1.1 Purpose

This document provides a set of critical system of systems (SoS) considerations to be addressed at key points in the life cycle of the system of interest (SoI). This document refers to considerations that apply to an SoI that is a constituent system that interacts in an SoS. The considerations and life cycle model align with those which are already defined in ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 24748-1. Selected subsets of these considerations can be applied throughout the life of systems through the involvement of stakeholders. The ultimate goal is to achieve customer satisfaction, so that when delivered, the SoI will operate effectively in the operational or business environment which is typically characterized as one or more systems of systems.

This document concerns those systems that are man-made and are configured with one or more of the following: hardware, software, humans, procedures and facilities.

1.2 Field of application

This document addresses SoS considerations that apply to systems at each stage of their respective life cycles.

There is a wide variety of systems in terms of their purpose, domain of application, complexity, size, novelty, adaptability, quantities, locations, life spans and evolution. This document is concerned with describing the system of systems considerations that apply to a system that is the SoI; that is a constituent system within a system of systems. It applies to one-of-a-kind systems, mass produced systems or customized, adaptable systems.

1.3 Limitations

This document does not detail the approach to addressing system of systems considerations in terms of methods or procedures.

This document does not detail the described documentation in terms of name, format, explicit content and recording media of documentation.

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.

ISO/IEC/IEEE 24765, *Systems and software engineering — Vocabulary*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions in ISO/IEC/IEEE 24765 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/>
- IEC Electropedia: available at <https://www.electropedia.org/>
- IEEE Standards Dictionary Online: available at <https://ieeexplore.ieee.org/xpls/dictionary.jsp>

3.1.1

constituent system

independent system that forms part of a *system of systems (SoS)* (3.1.4)

Note 1 to entry: Constituent systems can be part of one or more SoS. Each constituent system is a useful system by itself, having its own development, management, utilization, goals, and resources, but interacts within the SoS to provide the unique capability of the SoS.

3.1.2

life cycle

evolution of a system, product, service, project or other human-made entity from conception through retirement

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.23]

3.1.3

system of interest

SoI

system whose life cycle is under consideration in the context of this document

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.48, modified — the abbreviated term "SoI" has been added; "this International Standard" has been replaced with "this document".]

3.1.4

system of systems

SoS

set of systems or system elements that interact to provide a unique capability that none of the *constituent systems* (3.1.1) can accomplish on its own

Note 1 to entry: System elements can be necessary to facilitate the interaction of the constituent systems in the system of systems.

3.1.5

stage

period within the life cycle of an entity that relates to the state of its description or realization

Note 1 to entry: As used in this document, stages relate to major progress and achievement milestones of the entity through its life cycle.

Note 2 to entry: Stages often overlap.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.43, modified — "this International Standard" has been replaced with "this document".]

3.2 Abbreviated terms

SoI	system of interest
SoS	system of systems
SoSE	system of systems engineering