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Australian/New Zealand Standard™

# Systems and software engineering — Taxonomy of systems of systems



AS/NZS ISO/IEC/IEEE 21841:2021

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- Australian Digital Health Agency
- Australian Society for Technical Communication, NSW
- Department of Defence (Australian Government)
- Engineers Australia
- Griffith University
- Institute of IT Professionals New Zealand
- IT Service Management Forum Australia
- NSW Business Chamber
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## Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee IT-015, Software and Systems Engineering.

The objective of this Standard is to define a normalized taxonomy for systems of systems (SoS) to facilitate communications among stakeholders. It also briefly explains what a taxonomy is and how it applies to the SoS to aid in understanding and communication.

This Standard is identical with, and has been reproduced from, ISO/IEC/IEEE 21841:2019.

As this document has been reproduced from an International Standard, a full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

# Contents

<b>Preface</b> .....	<b>ii</b>
<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
3.1 General terms .....	1
3.2 SoS types .....	2
<b>4 Concepts and application</b> .....	<b>3</b>
4.1 Overview .....	3
4.2 Importance of taxonomies to SoS .....	3
4.3 Use of SoS taxonomies .....	3
<b>5 Taxonomies for systems of systems</b> .....	<b>4</b>
5.1 General .....	4
5.2 Taxa: directed, acknowledged, collaborative and virtual .....	4
5.2.1 Overview .....	4
5.2.2 Description of the taxa .....	4
5.2.3 Examples of potential application of the taxa .....	5
5.2.4 When to use .....	5
5.2.5 How to use .....	5
5.2.6 Why to use .....	5
5.2.7 Limitations .....	6
5.2.8 Benefits of use .....	6
<b>Annex A</b> (informative) <b>Summary of SoS taxonomies</b> .....	<b>7</b>
<b>Bibliography</b> .....	<b>8</b>
<b>IEEE notices and abstract</b> .....	<b>9</b>

## 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](http://www.iso.org/directives)).

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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](http://www.iso.org/iso/foreword.html).

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

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](http://www.iso.org/members.html).

This corrected version of ISO/IEC/IEEE 21841:2019 incorporates the following correction:

- The publication date on the cover page has been corrected.

## Introduction

Systems of systems engineering (SoSE) is a concept that is increasingly thought of as a discipline important for the realization and sustainability of large and persistent sociotechnical systems in areas as diverse as healthcare, transportation, energy, defense, corporations, cities and government.

While SoSE applies broadly to hardware, software, middle-ware as well as embedded, cyber-physical and digital systems, the importance of SoSE has been heightened in the last fifteen years by the rapid increase in the pervasiveness of information technology (IT), illustrated by new technologies and paradigms such as Sensor Networks, Cloud Computing, the Internet of Things, Big Data, Smart Devices and Artificial Intelligence. It is, for instance, the application of these technologies to cities that transform them into “smarter” cities.

This pervasiveness of IT was not only driven by the availability of these technologies, but also more importantly by the requirements in our resource and environmentally-constrained world for increased and sustainable economic development and, ultimately, personal well-being.

SoSE goes well beyond IT and potentially applies to all types of systems, including hardware and cyber physical systems where IT is an enabler. SoSE addresses functionality, performance and interdependencies of the systems as well as their connectivity. The interconnectivity of systems has become pervasive in large command and control systems, defense systems, communications systems, transportation systems and medical/health systems, among others. The accelerating need to share information and leverage capabilities from other systems has changed how systems need to be viewed and engineered.

Taxonomies provide a means in many fields to classify and describe the relationships among the relevant elements being studied. The elements of a taxonomy, or taxa, form a partitioning or means of classification within that body of knowledge. In the context of systems of systems (SoS), the relevant elements of the system of interest are, by definition, systems themselves. Using essential characteristics to partition the various types of SoS provides an abbreviated nomenclature for thinking about SoS. Based on taxonomies, different approaches to the engineering of systems of systems are possible, improving the efficiency and effectiveness of systems of systems engineering.

## NOTES

# Australian/New Zealand Standard

## Systems and software engineering — Taxonomy of systems of systems

### 1 Scope

This document defines a normalized taxonomy for systems of systems (SoS) to facilitate communications among stakeholders. It also briefly explains what a taxonomy is and how it applies to the SoS to aid in understanding and communication.

### 2 Normative references

There are no normative references in this document.

### 3 Terms and definitions

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

NOTE For additional terms and definitions in the field of systems and software engineering, see ISO/IEC/IEEE 24765, which is published periodically as a “snapshot” of the SEVOCAB (Systems and software Engineering Vocabulary) database and is publicly accessible at [www.computer.org/sevocab](http://www.computer.org/sevocab).

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/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>
- IEEE Standards Dictionary Online: available at <http://dictionary.ieee.org>

#### 3.1 General terms

##### 3.1.1

##### **constituent system**

##### **CS**

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* (3.1.3), utilization, goals, and resources, but interacts within the SoS to provide the unique capability of the SoS.

[SOURCE: ISO/IEC/IEEE 21839:2019, 3.1.1, modified — The abbreviated term "CS" has been added.]

##### 3.1.2

##### **governance**

process of establishing and enforcing strategic goals and objectives, organizational policies and performance parameters

Note 1 to entry: This definition is adapted from Reference [8].

##### 3.1.3

##### **management**

system of controls and processes required to achieve the strategic objectives set by the organization's governing body

Note 1 to entry: Management is subject to the policy guidance and monitoring set through corporate *governance* (3.1.2).

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.2338]