TECHNICAL SPECIFICATION

ISO/IEC TS 24748-6

First edition
2016-12-01

Systems and software engineering — Life cycle management —

Part 6: System integration engineering

Ingénierie des systèmes et du logiciel — Gestion du cycle de vie — Partie 6: Ingénierie de l'intégration du système

Reference number
ISO/IEC TS 24748-6:2016(E)

© ISO/IEC 2016



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, 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
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword ..... **v**

Introduction ..... **vi**

1 Scope **1**

2 Normative references **1**

3 Terms, definitions and abbreviated terms **2**
3.1 Terms and definitions 2
3.2 Abbreviatied terms 4

4 Conformance **4**
4.1 Intended usage 4
4.2 Conformance to processes 4
4.3 Conformance to information item content 4
4.4 Full conformance 5
4.5 Tailored conformance 5
4.5.1 Processes 5
4.5.2 Information items 5

5 Concepts and principles **5**
5.1 General 5
5.2 Integration fundamentals 5
5.2.1 Terms and approaches 5
5.2.2 Notions of aggregate and of interface 7
5.2.3 Integration based on architecture and design 8
5.2.4 Integration by layers of systems 9
5.2.5 Environmental context 10
5.2.6 Integration strategy 11
5.2.7 Verification principles related to integration engineering 17
5.2.8 Validation principles related to integration engineering 18
5.2.9 Efficiency of the integration strategy 18
5.3 Practical considerations 19
5.3.1 Iteration and recursion of processes 19
5.3.2 Integration Enabling System 19

6 Processes **22**
6.1 Integration engineering activities 22
6.2 Integration Process 22
6.2.1 Purpose 22
6.2.2 Outcomes 23
6.2.3 Activities and tasks 24
6.3 Other technical processes related to integration engineering 28
6.3.1 Business or mission analysis process 28
6.3.2 Stakeholder needs and requirements definition process 28
6.3.3 System requirements definition process 28
6.3.4 Architecture definition process 29
6.3.5 Design definition process 29
6.3.6 System analysis process 30
6.3.7 Verification process 30
6.3.8 Validation process 30
6.4 Integration management 30
6.4.1 Management overview 30
6.4.2 Composition of integration teams and skills 30
6.4.3 Integration planning, assessment and control 31
6.4.4 Relationship to Project assessment and control 31
6.4.5 Relationship to Configuration management 31
6.4.6 Relationship to Agreement processes 32

© ISO/IEC 2016 – All rights reserved

7 Information items outlines **32**
7.1 Integration Plan 32
7.2 System Integration Aggregate Definition Information 33
7.3 System Integration Procedure and Report 33
Bibliography **35**

 © ISO/IEC 2016 – All rights reserved

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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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 document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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).

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Systems and software engineering*.

A list of all parts of the ISO/IEC 24748 series can be found on the ISO website.

© ISO/IEC 2016 – All rights reserved

Introduction

This document was developed in response to a need for consistent terminology, definitions and guidance that elaborates the area of system integration, taking into account the context of use and the proven practices for the development of systems.

ISO/IEC/IEEE 15288 includes an integration process that focuses on physically assembling the implemented system elements composing a system to obtain an "integrated system". This process interfaces directly to other technical processes and indirectly to activities and tasks of other technical processes, in particular, the processes that define the system requirements, architecture and design.

The purpose of this document is to facilitate the usage of the integration process of the latest revision of ISO/IEC/IEEE 15288 by providing guidance on system integration.

This document describes the integration engineering activities dealing with planning, performing and managing the integration of a system, including the related activities of other technical processes, in particular, verification and validation processes. These are real practices in industry, i.e. the integration of a system is technically engineered and managed as a project (included in the system development project). Although these practices are performed, they were not formalized in a standard or a guide when this document was written.

© ISO/IEC 2016 – All rights reserved

Systems and software engineering — Life cycle management —

Part 6: System integration engineering

1 Scope

This document

— specifies activities and processes to be implemented for engineering the integration of systems-of-interest throughout the life cycle (systems made of products and/or services; see Note 1),

— provides guidance for the integration process and its relationships to other system life cycle processes as described in ISO/IEC/IEEE 15288,

— specifies the information items to be produced through the implementation of the integration engineering (integration process and its relationships to other system life cycle processes),

— specifies the contents of the information items, and

— provides guidelines for the format of the information items.

This document can be applied to

— those who use or plan to use ISO/IEC/IEEE 15288 on projects dealing with man-made systems, software-intensive systems, products and services related to those systems, regardless of project scope, methodology, size or complexity, and

— anyone performing integration engineering activities to aid in ensuring that the application of the integration process and its relationships to other system life cycle processes conform to ISO/IEC/IEEE 15288.

NOTE 1 Systems concerned within this document are those as defined in ISO/IEC/IEEE 15288, i.e. systems that are man-made and can be configured with one or more of the following: hardware, software, data, humans, processes (e.g. processes for providing service to users), procedures (e.g. operator instructions), facilities, materials and naturally occurring entities.

NOTE 2 This document is intended to be consistent with the other parts of ISO/IEC 24748.

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 15288:2015, *Systems and software engineering — System life cycle processes*

© ISO/IEC 2016 – All rights reserved

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC/IEEE 15288 and the following 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 https://www.iso.org/obp/

3.1.1
acquirer
stakeholder that acquires or procures a product or service from a *supplier* (3.1.9)

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.1]

3.1.2
aggregate
composition of several implemented *system elements* (3.1.11) that are *assembled* (3.1.3), on which a set of *verification actions* (3.1.17) and/or *validation actions* (3.1.15) is applied

3.1.3
assemble
activities for combining and connecting implemented *system elements* (3.1.11) or *aggregates* (3.1.2) to support specific goals, i.e. *integration* (3.1.5), *verification* (3.1.16), *validation* (3.1.14), manufacturing and production.

3.1.4
enabling system
system (3.1.10) that supports a *system-of-interest* (3.1.12) during its life cycle stages, but does not necessarily contribute directly to its function during operation

EXAMPLE When a system-of-interest enters the production stage, a production enabling system is required.

Note 1 to entry: Each enabling system has a life cycle of its own. ISO/IEC/IEEE 15288 is applicable to each enabling system when, in its own right, it is treated as a system-of-interest.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.18]

3.1.5
integration
activities of combining several implemented *system elements* (3.1.11) and activating the *interfaces* (3.1.8) to form a realized system (product or service) that enables interoperation between the system elements and with other *systems* (3.1.10) to satisfy system requirements, architecture characteristics and design properties

Note 1 to entry: In this document, the term “integration” is limited to the integration of the implemented system elements which compose a system and the necessary life cycle related activities. Integration may occur to connect a *system-of-interest* (3.1.12) with external interoperating systems and/or *enabling systems* (3.1.4).

Note 2 to entry: The process of combining software components, hardware components or both into an overall system (ISO/IEC/IEEE 24765).

© ISO/IEC 2016 – All rights reserved

3.1.6
integration engineering
set of activities that defines, analyzes and executes *integration* (3.1.5) across the life cycle, including interactions with other life cycle processes

Note 1 to entry: The application of the system life cycle processes and knowledge of the *system-of-interest* (3.1.12) are necessary in order to integrate a set of *system elements* (3.1.11) into a *system* (3.1.10).

3.1.7
integration management
set of activities that plans, assesses and controls the integration activities and all related activities

Note 1 to entry: It helps ensure that the process outcomes are achieved and that the integration related information items are identified, documented, maintained, communicated and traced throughout the life cycle of the concerned *system* (3.1.10).

3.1.8
interface
set of logical and/or physical characteristics required to exist at a common boundary or connection between *system elements* (3.1.11)

Note 1 to entry: As examples of interface definition, refer to ISO/IEC/IEEE 24765.

3.1.9
supplier
organization or individual that enters into an agreement with the *acquirer* (3.1.1) for the supply of a product or service

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.45]

3.1.10
system
combination of interacting elements organized to achieve one or more stated purposes

Note 1 to entry: A system may be considered as a product or as the services it provides.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.46]

3.1.11
system element
member of a set of elements that constitute a *system* (3.1.10)

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.47]

3.1.12
system-of-interest
system (3.1.10) whose life cycle is under consideration in the context of this document

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.48]

3.1.13
user
individual or a group that benefits from a *system* (3.1.10) during its utilization

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.52, modified]

3.1.14
validation
confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

Note 1 to entry: A *system* (3.1.10) is able to accomplish its intended use, goals and objectives (i.e. meet stakeholder requirements) in the intended operational environment. The right system was built.

© ISO/IEC 2016 – All rights reserved

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.53]

3.1.15
validation action
action that describes what is to be validated (the element as reference), on which item the action is performed, the expected result from the performance of the action, the validation technique to apply and at which level of decomposition of the *system-of-interest* (3.1.12)

3.1.16
verification
confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.54]

3.1.17
verification action
action that describes what is to be verified (the element as reference), on which item the action is performed, the expected result from the performance of the action, the verification technique to apply and at which level of decomposition of the *system-of-interest* (3.1.12)

3.2 Abbreviatied terms

IES Integration Enabling System

NDI Non-Developmental Item

SEI Software Engineering Institute

SoI System-of-Interest

4 Conformance

4.1 Intended usage

This document provides requirements and guidance for the execution of ISO/IEC/IEEE 15288 processes and activities that deal with integration engineering. This document also provides definition of the content and recommendations for the format of the information items or documentation that result from the implementation of the related processes.

4.2 Conformance to processes

This document provides requirements and recommendations for a number of integration engineering processes and related activities suitable for usage during the life cycle of a system (made of products and/or services).

The requirements and recommendations for processes in this document are contained in Clause 6.

4.3 Conformance to information item content

This document provides requirements and recommendations for a number of integration engineering information items to be produced during the life cycle of a system (made of products and/or services).

© ISO/IEC 2016 – All rights reserved