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**Information technology — DevOps —
Building reliable and secure systems
including application build, package
and deployment**

*Technologies de l'information — DevOps — Création de systèmes
fiables et sûrs notamment en matière de compilation, paquetage et
déploiement d'applications*

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IEEE Standard for DevOps: Building Reliable and Secure Systems Including Application Build, Package, and Deployment

Developed by the

Software & Systems Engineering Standards Committee
of the
IEEE Computer Society

Approved 9 February 2021

IEEE SA Standards Board

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Abstract: Technical principles and processes to build, package, and deploy systems and applications in a reliable and secure way are specified. Establishing effective compliance and information technology (IT) controls is the focus. DevOps principles presented include mission first, customer focus, left-shift, continuous everything, and systems thinking. How stakeholders, including developers and operations staff, can collaborate and communicate effectively is described. The process outcomes and activities herein are aligned with the process model specified in ISO/IEC/IEEE 12207:2017 and ISO/IEC/IEEE 15288:2015.

Keywords: agile, continuous delivery, continuous deployment, continuous integration, DevOps, IEEE 2675™, left-shift

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Introduction

This introduction is not part of IEEE Std 2675™-2021, IEEE Standard for DevOps: Building Reliable and Secure Systems Including Application Build, Package, and Deployment.

The complexity of software systems has increased to an unprecedented level. This has led to new opportunities, but also to increased challenges for the organizations that create and utilize systems. One of the greatest challenges has been to address the increased rate of change in modern development methodologies, including agile and even rapid iterative development. These challenges exist throughout the life cycle of a system and at all levels of architectural detail. This document highlights the manner in which DevOps can help address the challenges inherent in accelerated development methodologies and achieve end user goals for increased productivity and quality.

DevOps is an interdisciplinary approach and means to enable the realization of successful software systems. It focuses on defining stakeholder needs and required functionality early in the development cycle, documenting requirements, and performing design synthesis and system validation while considering the complete problem. It integrates the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation and maintenance. It considers both the business and the technical needs of stakeholders with the goal of providing a quality product that meets the needs of users and other applicable stakeholders. This life cycle spans the conception of ideas through to the retirement of a system. It provides the processes for acquiring and supplying systems. It helps improve communication and cooperation among the parties that create, utilize, and manage modern software systems. In addition, this framework provides for the assessment and improvement of the life cycle processes.

This document is appropriate both for organizations that are unused to applying engineering process standards, and for those who have used longstanding standards, who have the goal of implementing effective information technology (IT) controls, embracing and managing risk, while enabling more rapid development (higher velocity). Organizations that are already embracing IEEE standards can find IEEE Std 2675 to be essential in helping them to implement the DevOps transformation. Organizations that choose IEEE Std 2675 as their first industry standard can subsequently apply a broader family of IEEE standards.

This document is closely aligned with the life cycle processes in ISO/IEC/IEEE 12207:2017 [B14]¹ and ISO/IEC/IEEE 15288:2015. Configuration management is the basis of DevOps and hence it is also closely aligned with IEEE Std 828™ [B3], along with other related standards.

¹ The numbers in brackets correspond to those of the bibliography in Annex A.

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IEEE Standard for DevOps: Building Reliable and Secure Systems Including Application Build, Package, and Deployment

1. Overview

1.1 Scope

This document provides requirements and guidance on the implementation of DevOps to define, control, and improve software life cycle processes. It applies within an organization or a project to build, package, and deploy software and systems in a secure and reliable way. This document specifies practices to collaborate and communicate effectively in groups including development, operations, and other key stakeholders.

This document applies a common framework for software life cycle processes, with well-defined terminology. It contains processes, activities, and tasks that are to be applied to the full life cycle of software systems, products, and services, including conception, development, production, utilization, support, and retirement. It also applies to the acquisition and supply of software systems, whether performed internally or externally to an organization. These life cycle processes are accomplished through the involvement of stakeholders, with the ultimate goal of achieving customer satisfaction. The life cycle processes of this document can be applied concurrently, iteratively, and recursively to a software system and incrementally to its elements.

This document applies to software systems, products, and services, and the software portion of any system. Software includes the software portion of firmware. Those aspects of system definition needed to provide the context for software systems, products, and services are included.

There is a wide variety of software systems in terms of their purpose, domain of application, complexity, size, novelty, adaptability, quantities, locations, life spans, and evolution. This document describes the processes that comprise the life cycle of software systems. It therefore applies to one-of-a-kind software systems, software systems for wide commercial or public distribution, and customized, adaptable software systems. It also applies to a complete stand-alone software system and to software systems that are embedded and integrated into larger, more complex, and complete systems.

1.2 Purpose

The purpose of this standard is to specify required practices for operations, development, and other key stakeholders to collaborate and communicate to deploy systems and applications in a secure and reliable way. This document provides a defined set of processes and methods to facilitate DevOps principles and practices, including improved communication between stakeholders throughout the systems life cycle, not just during development and operations. This document is written for DevOps stakeholders, which includes, but is not limited to, acquirers, suppliers, developers, integrators, operators, maintainers, managers, quality assurance managers, compliance managers, auditors, and users of software systems, products, and services. It can be used by a single organization in a self-imposed mode or in a multi-party situation. Parties can be from the same organization or from different organizations, and the situation can range from an informal agreement to a formal contract.

The processes in this document can be used as a basis for implementing DevOps while establishing organizational environments, e.g., methods, procedures, techniques, tools, and trained personnel. The processes in this document provide guidance on the use of DevOps principles and practices for processes used by an organization to construct software life cycle models appropriate to its products and services. An organization, depending on its purpose, can select and apply an appropriate subset to fulfill that purpose.

This document can be used in one or more of the following modes:

- a) By an organization—to establish DevOps principles and practices in support of an environment of desired processes. These processes can be supported by an infrastructure of methods, procedures, techniques, tools, and trained personnel. The organization may then employ this environment to perform and manage its projects and progress software systems through their life cycle stages. In this mode, this document is used to assess conformance of a declared, established environment to its provisions.
- b) By a project—to establish DevOps principles and practices to help select, structure, and employ the elements of an established environment to provide products and services. In this mode, this document is used in the assessment of conformance of the project to the declared and established environment.
- c) By an acquirer and a supplier—to establish DevOps principles and practices to help develop an agreement concerning processes and activities. Via the agreement, the processes and activities in this document are selected, negotiated, agreed to, and performed. The acquirer and supplier can be part of the same organization or separate organizations.
- d) By process assessors—to establish DevOps principles and practices in a process reference model for use in the performance of process assessments that may be used to support organizational process improvement.

1.3 Word usage

The word *shall* indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals *is required to*).^{2, 3}

The word *should* indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (*should* equals *is recommended that*).

² The use of the word *must* is deprecated and cannot be used when stating mandatory requirements, *must* is used only to describe unavoidable situations.

³ The use of *will* is deprecated and cannot be used when stating mandatory requirements, *will* is only used in statements of fact.

The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals *is permitted to*).

The word *can* is used for statements of possibility and capability, whether material, physical, or causal (*can* equals *is able to*).

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

This document has no normative references.

3. Definitions, acronyms, and abbreviations

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.⁴

For additional terms and definitions in the field of systems and software engineering, see ISO/IEC/IEEE 24765 [B20], which is published periodically as a “snapshot” of the SEVOCAB (Systems and software Engineering Vocabulary) database and is publicly accessible at computer.org/sevocab.

NOTE—While the aim is to provide consistency in terminology throughout the IEEE standards, it is worth noting that, particularly from the DevOps perspective, there are often alternative terms for similar roles or processes. The applicability of terms to development, operations, testing, security, and performance was separately considered so that the terminology used was applicable in every case.⁵

aligned: Group agreement and alliance to one or more shared objectives.

NOTE—Key concepts are that each member understands critical inputs (i.e., information, context, and constraints), acts according to a plan that is communicated to all members, accepts responsibility for their part in requisite activities and tasks, and harmoniously collaborates with other members and external resources.

archive: Location of system elements that are no longer present in runtime environments, but are available for examination for audit, regulatory, and other processes.

audit: Independent, continuous examination of a work product or set of work products to assess compliance with specifications, standards, contractual agreements, or other criteria for the purpose of providing assurance against risk.

NOTE 1—Generating evidence of information technology (IT) controls that support audit is often automated where practical.

⁴ *IEEE Standards Dictionary Online* is available at: <http://dictionary.ieee.org>. An IEEE Account is required for access to the dictionary, and one can be created at no charge on the dictionary sign-in page.

⁵ Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.