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Ingénierie des logiciels et des systèmes — Pratique recommandée pour la description architecturale des systèmes exigeant beaucoup de logiciels

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IEEE Recommended Practice for Architectural Description of Software-Intensive Systems

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Abstract: This recommended practice addresses the activities of the creation, analysis, and sustainment of architectures of software-intensive systems, and the recording of such architectures in terms of architectural descriptions. A conceptual framework for architectural description is established. The content of an architectural description is defined. Annexes provide the rationale for key concepts and terminology, the relationships to other standards, and examples of usage.
Keywords: architectural description, architecture, software-intensive system, stakeholder concerns, system stakeholder, view, viewpoint

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IEEE Introduction

(This introduction is not part of IEEE Std 1471-2000, *IEEE Recommended Practice for Architectural Description of Software-Intensive Systems*.)

It has long been recognized that "architecture" has a strong influence over the life cycle of a system. In the past, hardware-related architectural aspects were dominant, whereas software-related architectural integrity, when it existed, often was to be sacrificed first in the course of system development. Today, software-intensive systems are pervasive. The cost of software development and the increasing complexity of software systems have changed the relative balance. Software technology is maturing rapidly. The practice of system development can benefit greatly from adherence to architectural precepts.

However, the concepts of architecture have not been consistently defined and applied within the life cycle of software-intensive systems. Despite significant industrial and research activity in this area, there is no single, accepted framework for codifying architectural thinking, thereby facilitating the common application and evolution of available and emerging architectural practices.

The IEEE Architecture Planning Group (APG) was formed in August 1995 to address this need. The APG was chartered by the IEEE Software Engineering Standards Committee (SESC) to set a direction for incorporating architectural thinking into IEEE standards. The result of the APG's deliberations was to recommend an IEEE activity with the following goals:

- To define useful terms, principles and guidelines for the consistent application of architectural precepts to systems throughout their life cycle
- To elaborate architectural precepts and their anticipated benefits for software products, systems, and aggregated systems (i.e., "systems of systems")
- To provide a framework for the collection and consideration of architectural attributes and related information for use in IEEE standards
- To provide a useful road map for the incorporation of architectural precepts in the generation, revision, and application of IEEE standards

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In April 1996 SESC created the Architecture Working Group (AWG) to implement those recommendations.

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Participants

At the time this recommended practice was completed, the Architecture Working Group had the following membership.

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IEEE Recommended Practice for Architectural Description of Software-Intensive Systems

1. Overview

1.1 Scope

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This recommended practice addresses the architectural description of software-intensive systems. A *software-intensive system* is any system where software contributes essential influences to the design, construction, deployment, and evolution of the system as a whole.

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The scope of this recommended practice encompasses those products of system development that capture architectural information. This includes architectural descriptions that are used for the following:

a) Expression of the system and its evolution
b) Communication among the system stakeholders
c) Evaluation and comparison of architectures in a consistent manner
d) Planning, managing, and executing the activities of system development
e) Expression of the persistent characteristics and supporting principles of a system to guide acceptable change
f) Verification of a system implementation's compliance with an architectural description
g) Recording contributions to the body of knowledge of software-intensive systems architecture

1.2 Purpose

The purpose of this recommended practice is to facilitate the expression and communication of architectures and thereby lay a foundation for quality and cost gains through standardization of elements and practices for architectural description.

Despite significant efforts to improve engineering practices and technologies, software-intensive systems continue to present formidable risks and difficulties in their design, construction, deployment, and evolution. Recent attempts to address these difficulties have focused on the earliest period of design decision-making and evaluation, increasingly referred to as the *architectural level* of system development. The phrases *archi-*

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tectural level and *architecture* are widely, if imprecisely, used. Their use reflects acceptance of an architectural metaphor in the analysis and development of software-intensive systems. A key premise of this metaphor is that important decisions may be made early in system development in a manner similar to the early decision-making found in the development of civil architecture projects.

Many innovations are resulting from this attention to the architectural level, among them architectural description languages and associated tools and environments; architectural frameworks, models, and patterns; and techniques for architectural analysis, evaluation, and architecture-based reuse. While these efforts differ considerably in important aspects, sufficient commonality exists to warrant the development of a recommended practice to codify their common elements.

These innovations are occurring, and maturing, rapidly within many research and application communities, and they reflect differing interests, influences, insights, and intentions. There is a general consensus on the importance of the *architectural level of systems development*, and that that level consists of early decision-making about overall design structure, goals, requirements, and development strategies. However, there has not yet emerged any reliable consensus on a precise definition of a system's *architecture*, i.e., how it should be described, what uses such a description may serve, or where and when it should be defined. The boundaries and relationships between architectural trends and practices, and other practices; and between architectural technology and other technology, are not yet widely recognized.

In such situations, progress often depends on mediating influences. Potential adopters of architectural practices and technology need a frame of reference within which to address implementation and adoption decisions. Technology developers need a frame of reference within which to communicate the motivating concepts of their technology, and to accumulate and appreciate feedback from early adoption.

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To these ends, this recommended practice is intended to reflect generally accepted trends in practices for architectural description and to provide a technical framework for further evolution in this area. Furthermore, it establishes a conceptual framework of concepts and terms of reference within which future developments in system architectural technology can be deployed. This recommended practice codifies those elements on which there is consensus: specifically the use of multiple views, reusable specifications for models within views, and the relation of architecture to system context.

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1.3 Intended users

The principal class of users for this recommended practice comprises stakeholders in system development and evolution, including the following:

- Those that use, own, and acquire the system (users, operators, and acquirers, or *clients*)
- Those that develop, describe, and document architectures (architects)
- Those that develop, deliver, and maintain the system (architects, designers, programmers, maintainers, testers, domain engineers, quality assurance staff, configuration management staff, suppliers, and project managers or *developers*)
- Those who oversee and evaluate systems and their development (chief information officers, auditors, and independent assessors)

A secondary class of users of this recommended practice comprises those involved in the enterprise-wide infrastructure activities that span multiple system developments, including methodologists, process and process-improvement engineers, researchers, producers of standards, tool builders, and trainers.

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