



SLOVENSKI STANDARD
SIST-TS CEN/TS 14818:2005

01-april-2005

Enterprise integration - Decisional reference model

Enterprise integration - Decisional reference model

Unternehmensintegration - Referenz Model zur Entscheidungsunterstützung

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ICS:

03.100.01	Organizacija in vodenje podjetja na splošno	Company organization and management in general
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TECHNICAL SPECIFICATION
SPÉCIFICATION TECHNIQUE
TECHNISCHE SPEZIFIKATION

CEN/TS 14818

August 2004

ICS 03.100.01

English version

Enterprise integration - Decisional reference model

This Technical Specification (CEN/TS) was approved by CEN on 9 March 2004 for provisional application.

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Foreword

This document (CEN/TS 14818:2004) has been prepared by Technical Committee CEN/TC 310, “Advanced manufacturing technologies”, the secretariat of which is held by BSI.

During its preparation, contributions have also been received from ISO/TC 184/SC5, “Industrial automation systems and integration/Architecture, communications and integration frameworks”, ISO/TC 184/SC 5 – IEC/SC 65 A /JWG15, “Enterprise control-system integration”, and the IFAC/IFIP Task Force on Enterprise Integration.

The concepts, rules and model defined in this document are an implementation of the requirements defined in ISO 15704. It also constitutes an input for the work on enterprise control system integration being undertaken by ISO/TC 184/SC 5 – IEC/SC 65 A /JWG15.

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Introduction

This document defines the generic concepts and rules in terms of a decisional reference model that are needed to enable the creation of a particular enterprise decisional model for industrial business and to provide support for the use of the reference model by industrial enterprises to achieve better enterprise integration.

Enterprise integration can be achieved in various manners and at various levels. It can be obtained by:

- a) data (data modelling), in ISO 10303 (STEP) and ISO 15531 (MANDATE);
- b) organization (modelling of systems, processes, etc.), as in prEN ISO 19439 (former ENV 40003), prEN ISO 19440 [1] (former ENV 12204);
- c) communication (modelling of networks), as in the OSI seven-layer model.

This document addresses the integration as being dealt with by consistent and integrated enterprise-wide decision-making [2] [3]. The approach is based on and contains selected elements from the GRAI decisional model.

It is not the intention of this document to suggest users should abandon their own method of handling decision-making, but to define the set of decisions that are necessary to control production and provide a structured decision-making environment leading to a better coordination and synchronization of these decisions.

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This document aims at supporting the development of Decisional Hierarchy Model defined in ISO/IEC 62264 – *Enterprise-Control System Integration*. It contains definitions and descriptions of the common concepts, rules and principles necessary to model enterprise-wide decision-making structure, focusing on the production management and control system. The decisional model defined in this document is a reference model which is consistent and complementary to: prEN ISO 19439 (revision of ENV 40003), *Framework for enterprise modelling*, prEN ISO 19440 (revision of ENV 12204) [1], *Language constructs for enterprise modelling*, and ISO 15704, *Requirements for enterprise reference architecture and methodologies*.

1 Scope

This document gives guidelines for enterprise integration by using concepts and rules for modelling enterprise-wide decision-making structures, focusing on the production of management and control systems.

This document does not deal with standard decision processes, or how each individual decision is taken, but defines an integrated decision-making structure within which decisions are consistently made system-wide.

2 Normative references

The following referenced documents are indispensable for the application 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.

prEN ISO 19439 ¹⁾ *Enterprise integration - Framework for enterprise modelling - Specification (ISO/FDIS 19439:2004)*.

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*.

ISO 15531-1, *Industrial automation systems and integration — Industrial manufacturing management data — Part 1: General overview*.

ISO 15704:2000, *Industrial automation systems — Requirements for enterprise-reference architectures and methodologies*.

IEC 62264-1:2003, *Enterprise-control system integration — Part 1: Models and terminology*.

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3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. Some of the terms defined in ISO 15704:2000, ISO 15531-1:2000, and prEN ISO 19439:2003 are repeated below for convenience.

NOTE Definitions copied verbatim from other standards are followed by a reference to the source standard in brackets. Definitions that have been adapted from other standards are followed by an explanatory note.

3.1

activity

part (or all) of functionality that transforms an input to an output using allocated resource(s)

NOTE Adapted from ISO 15704:2000.

3.2

activity cycle

total elapsed time to complete an activity

3.3

decision

result of choosing between different courses of action

[prEN ISO 19439]

¹⁾ To be published

CEN/TS 14818:2004 (E)**3.4****decisional activity**

activity aimed at making choice

3.5**decision constraint**

limitations on values of decision variables

3.6**decision level**

set of decisional activities having the same horizon and period

3.7**decision objective**

piece of information indicating which types of performances are targeted

NOTE These performances may be the production costs, the delivery lead-time, the level of quality, etc. Objectives are needed everywhere a decision is made. Global objectives refer to the entire production system and, according to the principle of coordination are consistently detailed to give local objectives to all decision centres¹⁾.

3.8**decision variable**

item that a decision-maker acts on to make its decisions in order to reach its objectives

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¹⁾ Whether the local objectives are actually derived from global objectives or the global objective is derived from local objectives by way of some form of aggregation or generalization is immaterial; as long as the global objective is valid, the local objectives are feasible, and the two sets are consistent.

3.9**decisional**

related to those activities or processes that are concerned with making choices

NOTE Adapted from prEN ISO 19439.

3.10**domain**

<enterprise> part of the enterprise considered relevant to a given set of business objectives and constraints for which an enterprise model is to be created

3.11**enterprise**

one or more organizations sharing a definite mission, goals and objectives to offer an output such as a product or service

[ISO 15704:2000]

3.12**enterprise modelling**

act of developing an enterprise model

[ISO 15704:2000]

3.13**framework**

structure expressed in diagrams, text and formal rules that relates the components of a conceptual entity to each other

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NOTE Adapted from ISO 15704:2000.

3.14**horizon**

time interval over which a decision extends

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3.15**model**

abstract description of reality in any form (including mathematical, physical, symbolic, graphical, or descriptive) that presents a certain aspect of that reality

NOTE Adapted from ISO 15704:2000.

3.16**performance indicator**

aggregated piece of information allowing the comparison of the performance of the system to the system's objectives

3.17**period**

time interval after which a decision is reviewed

3.18**product**

finished good or a sub assembly, part or raw material

3.19**production control**

function of monitoring and controlling the movement of goods through the entire manufacturing cycle

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[ISO 15531-1:2000]

3.20**production planning**

function of setting appropriate levels or limits to the future manufacturing operations according to sales forecast, economic constraints and resource requirements and availability

NOTE Adapted from ISO 15531-1:2000.

3.21**reference model**

general or generic model representing common characteristics of systems of a given class.

NOTE The model gives the generic structure of the system to be studied.

3.22**resource**

any device, tool and means at the disposal of the enterprise to produce goods or services

[ISO 15531-1:2000]

NOTE Resources as they are defined here include human resources considered as specific means with a given capability and a given capacity.

3.23**structure**

definition of the relationships among the components of an organization

[ISO 15704:2000]

3.24**system**

collection of real-world items organized for a given purpose

[ISO 15704:2000]

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4 Abbreviated terms

GERAM Generic Enterprise Reference Architecture and Methodologies

GRAI Graph of Results and Activities Interrelated

IFAC International Federation of Automatic Control

IFIP International Federation for Information Processing

5 The decisional reference model**5.1 Overview**

A reference model is a common structure in a given domain. Namely, it is a form of “skeleton” to be further developed to obtain the model of a system in that domain. A reference model may be considered as a technical specification. It is possible to measure the difference between the reference model and the models. It can also be considered as a basic model in a given domain, i.e. as a generic model which needs for each new case in that domain, an adaptation or a particularization.

The decisional reference model defines a generic integrated decision system structure in terms of a set of decision centres and decision links. It is a common structure for integrated decision-making in the domain of production planning and control. It serves as a basis to elaborate the decisional model of a particular system.

5.2 Model concepts

5.2.1 Decision-making

The term “decisional” relates to “those activities or processes that are concerned with making choices”; the decision itself is “the result of choosing between different courses of action”. The activity to make decisions consists of choosing from amongst a set of known alternatives (variables) the one which meets best the objective within constraints.

5.2.2 Functional and time categories of decision-making

5.2.2.1 Functional categories

Decision-making activities are classified into functional categories depending on the basic items they handle [Products (P), Resources (R) and Time (T)]. The different combinations of these lead to a categorization as follows (also see Figure 1):

- “manage products” (e.g. finished goods, sub-assemblies, parts and raw materials). This is concerned with the management of products in the time domain ($P \cap T$). Major decisions of this category are concerned with what, when and in what quantity those products are to be procured and which levels of inventory are appropriate;
- “manage resources” (e.g. information technology and manufacturing technology resources as well as humans). It deals with the management of resources in the time domain ($R \cap T$). Major decisions of this category are concerned with the management of the capacity of the resources;
- “plan production” (e.g. master schedule, shop floor scheduling, etc.). These decisions are concerned with production planning that synchronizes the flow of products via the resources in the time domain ($P \cap R \cap T$).