INTERNATIONAL STANDARD

ISO 15745-1

First edition
2003-03-01

Industrial automation systems and integration — Open systems application integration framework —

Part 1: Generic reference description

Systèmes d'automatisation industrielle et intégration — Charpente d'intégration d'application de systèmes ouverts —

Partie 1: Description de la référence générale

Reference number
ISO 15745-1:2003(E)

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Published in Switzerland

Contents

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15745-1 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 5, *Architecture, communications and integration frameworks*.

ISO 15745 consists of the following parts, under the general title *Industrial automation systems and integration — Open systems application integration framework*:

— *Part 1: Generic reference description*

— *Part 2: Reference description for ISO 11898-based control systems*

— *Part 3: Reference description for IEC 611158-based control systems*

— *Part 4: Reference description for Ethernet-based control systems*

Introduction

Real world application systems are developed from application specifications (i.e. specifications that describe the functionality and performance that are required for the application). Such application specifications typically contain textual descriptions, drawings, diagrams, and references to other specifications. Many system integrators and end users who frequently operate in specific market sectors either generate multiple similar application specifications (one for each project), or generate a master application specification with variants for each project.

The application integration framework (AIF) defines elements and rules that facilitate:

— the systematic organization and representation of the application integration requirements using integration models;

— the development of interface specifications in the form of application interoperability profiles (AIPs) that enable both the selection of suitable resources and the documentation of the "as built" application.

Figure 1 depicts the relationship between the AIF (specified in ISO 15745), the integration models and AIP (developed by an AIP developer), and a real world application system.

The left section of Figure 1 shows a generic AIF that is specified in part 1 of ISO 15745 and is extended in subsequent parts to cover specific technologies.

The middle section of Figure 1 shows the AIP (which can contain one or more other AIPs) consisting of one process profile, one or more resource profiles, and one or more information exchange profiles. Underlying the AIP are the relevant integration models which represent the application requirements.

The right section of Figure 1 shows the real world application system consisting of:

— resources (devices, communication networks, equipment, humans, materials);

— processes;

— exchanges of information.

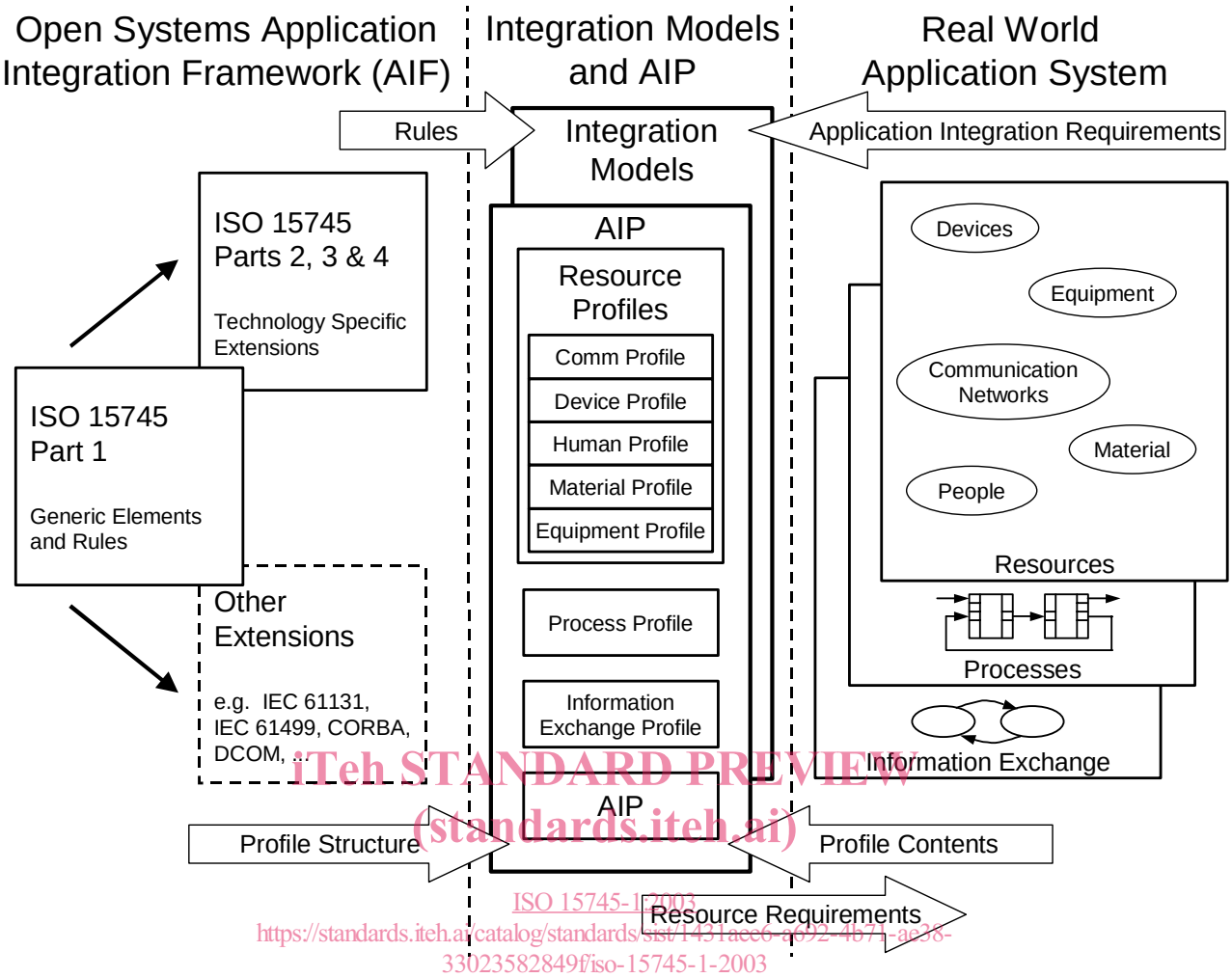

Figure 1 – Context of ISO 15745

Some of the benefits to be gained are that:

— end users can facilitate the specification and procurement of open systems by referencing pre-defined AIPs;

— system integrators can reduce the time to develop a solution based on open systems by using generic tools based on the AIF;

— automation vendors can provide and develop new products using generic tools based on the AIF e.g. an automation vendor can demonstrate that his products support the application requirements by referencing the resource profiles of an AIP.

The primary users of this International Standard will be developers of AIPs, using a variety of system platforms and product technologies in application domains such as:

— continuous process control systems;

— batch process control systems;

— machine control systems;

— discrete control systems;

— diagnostic systems.

Industrial automation systems and integration — Open systems application integration framework — Part 1: Generic reference description

1 Scope

This International Standard defines an application integration framework - a set of elements and rules for describing integration models and application interoperability profiles.

This part of ISO 15745 defines the generic elements and rules for describing integration models and application interoperability profiles, together with their component profiles - process profiles, information exchange profiles, and resource profiles.

NOTE Parts 2, 3 and 4 of this International Standard define the technology specific elements and rules for describing both communication network profiles and the communication related aspects of device profiles based upon particular fieldbus technologies - these parts can be used in conjunction with this part to form an application integration framework for a specific fieldbus technology.

This International Standard is applicable to industrial automation applications such as discrete manufacturing, process automation, electronics assembly, semiconductor fabrication, and wide-area material handling. It may also be applicable to other automation and control applications such as utility automation, agriculture, off-road vehicles, medical and laboratory automation, and public transport systems.

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.

ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

ISO/IEC 7498-4:1989, *Information processing systems – Open Systems Interconnection – Basic Reference Model – Part 4 : Management framework*

IEC 61069-1:1991, *Industrial-process measurement and control – Evaluation of system properties for the purpose of system assessment – Part 1: General considerations and methodology*

REC-xml-20001006, *Extensible Markup Language (XML) 1.0 Second Edition – W3C Recommendation 6 October 2000*

REC-xmlschema-1-20010502, *XML Schema Part 1: Structures – W3C Recommendation 02 May 2001*

REC-xmlschema-2-20010502, *XML Schema Part 2: Datatypes – W3C Recommendation 02 May 2001*

UML V1.4, *OMG - Unified Modeling Language Specification (Version 1.4, September 2001)*

3 Terms and definitions

NOTE The UML terminology and notation used in this document is described in Annex A.

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

3.1
action
something which happens [ISO/IEC 10746-2]

NOTE Every action of interest for modelling purposes is associated with at least one object (see ISO/IEC 10746-2).

3.2
actor
coherent set of roles that users of use cases play when interacting with these use cases [UML]

NOTE An actor has one role for each use case with which it communicates.

3.3
aggregation
special form of association that specifies a whole-part relationship between the aggregate (whole) and a component part [UML]

3.4
AIP developer
person (or persons) who uses the application integration framework to develop integration models and/or profiles

3.5
association
semantic relationship between two or more classifiers that specifies connections among their instances [UML]

3.6
base specification
reference document containing information that is referenced by a profile

3.7
class
description of a set of objects that share the same attributes, operations, methods, relationships, and semantics [UML]

3.8
classifier
mechanism that describes behavioural and structural features [UML]

NOTE Classifiers include interfaces, classes, data types, and components.

3.9
communication network profile
representation of the integration aspects of a communication network supported by a networked device

EXAMPLE Examples of integration aspects are communication object types and the associated operating relationships (client-server, producer-consumer, etc.), services and attributes for the object types, data types for the object types and services, and encoding rules used.

3.10
compliance
relation between two specifications, A and B, that holds when specification A makes requirements which are all fulfilled by specification B (when B complies with A) [ISO/IEC 10746-1]

3.11
device
entity that performs control, actuating and/or sensing functions and interfaces to other such entities within an automation system

NOTE Devices alone do not perform material processing, material transport or material storage functions. (See 3.15).

3.12
device profile
representation of the integration aspects of a device

EXAMPLE Examples of integration aspects are functions provided, configuration across the network, behaviour on the network, and communication of I/O data.

3.13
element
atomic constituent of a model [UML]

3.14
entity
any concrete or abstract thing of interest [ISO/IEC 10746-2]

3.15
equipment
entity that is stand alone, or interfaces to an automation system, and that performs material processing, material transport, or material storage functions

EXAMPLE Conveyor, vessel, pump.

NOTE 1 Equipment can contain devices. (See 3.11).

NOTE 2 Equipment cannot have a direct connection to the communication network – only devices can be directly connected to the communication network.

3.16
equipment profile
representation of the integration aspects of an item of equipment

EXAMPLE Examples of integration aspects are conveyor speed, vessel capacity, pump delivery rate.

3.17
generalization
taxonomic relationship between a more general element and a more specific element [UML]

NOTE The more specific element is fully consistent with the more general element and contains additional information. An instance of the more specific element may be used where the more general element is allowed.

3.18
human profile
representation of the integration aspects of a person

EXAMPLE Examples of integration aspects are level of responsibility, level of competency, availability.

3.19
information
any kind of knowledge, that is exchangeable amongst users, about things, facts, concepts and so on, in a universe of discourse [ISO/IEC 10746-2]

3.20
instance
entity that has unique identity, a set of operations that can be applied to it, and state that stores the effects of the operations [UML]

3.21
interface
named set of operations that characterize the behaviour of an element [UML]

3.22
material
matter used in manufacturing the product

EXAMPLE Raw materials, consumables, catalysts.

3.23
material profile
representation of the integration properties of the material

EXAMPLE Examples of integration properties are dimensions, mass, density, shelf life, required storage temperature and humidity, hardness, formability, and viscosity.

3.24
message
specification of the conveyance of information from one instance to another, with the expectation that activity will ensue [UML]

3.25
name
term which, in a given naming context, refers to an entity [ISO/IEC 10746-2]

3.26
object
entity with a well-defined boundary and identity that encapsulates state and behaviour [UML]

NOTE State is represented by attributes and relationships, behaviour is represented by operations, methods, and state machines. An object is an instance of a class.

3.27
operation
service that can be requested from an object to effect behaviour [UML]

3.28
profile
set of one or more base specifications and/or sub-profiles, and, where applicable, the identification of chosen classes, conforming subsets, options and parameters of those base specifications, or sub-profiles necessary to accomplish a particular function, activity, or relationship

NOTE Adapted from ISO/IEC TR 10000-1

3.29
relationship
semantic connection among model elements [UML]

EXAMPLE Associations and generalizations.

3.30
resource
device, communication network, equipment, human or material used in a process

3.31
state
condition or situation during the life of an object during which it satisfies some condition, performs some activity, or waits for some event [UML]

3.32
system
something of interest as a whole or as comprised of parts [ISO/IEC 10746-2]

NOTE Therefore a system may be referred to as an entity. A component of a system may itself be a system, in which case it may be called a subsystem. (See ISO/IEC 10746-2).

3.33
<X> template
specification of the common features of a collection of <X>s in sufficient detail that an <X> can be instantiated using it [ISO/IEC 10746-2]

NOTE <X> can be anything that has a type

3.34
type (of an <X>)
predicate characterizing a collection of <X>s [ISO/IEC 10746-2]

3.35
use case
<class> specification of a sequence of actions, including variants, that a system (or other entity) can perform, interacting with actors of the system [UML]

3.36
view
projection of a model, which is seen from a given perspective or vantage point and omits entities that are not relevant to this perspective [UML]

4 Abbreviated terms

4.1 General

AIF	Application Integration Framework
AIP	Application Interoperability Profile
ASCII	American Standard Code for Information Interchange
CORBA	Common Object Request Broker Architecture
DCOM	Distributed Component Object Model
FDA	Food and Drug Administration
HMI	Human Machine Interface
IAS	Industrial Automation Systems
OSI	Open Systems Interconnection
UML	Unified Modelling Language
XML	eXtensible Markup Language