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Industrial automation systems and integration — Diagnostics, capability assessment and maintenance applications integration —

Part 2: Descriptions and definitions of application domain matrix elements

Systèmes d'automatisation industrielle et intégration — Diagnostics, évaluation des moyens et intégration des applications de maintenance —

Partie 2: Descriptions et définitions des éléments de matrice du domaine d'application

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Foreword

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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 18435-2 was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 5, *Interoperability, integration, and architectures for enterprise systems and automation applications*.

ISO 18435 consists of the following parts, under the general title *Industrial automation systems and integration — Diagnostics, capability assessment and maintenance applications integration*:

— *Part 1: Overview and general requirements*

— *Part 2: Descriptions and definitions of application domain matrix elements*

The following part is under preparation:

— *Part 3: Applications integration description method*

Introduction

The relationship between the different parts of ISO 18435 is illustrated in Figure 1. The focus of each part is indicated by dotted lines that bound specific portions of the unified modeling language (UML) class diagram representing the integration model for an application and between applications.

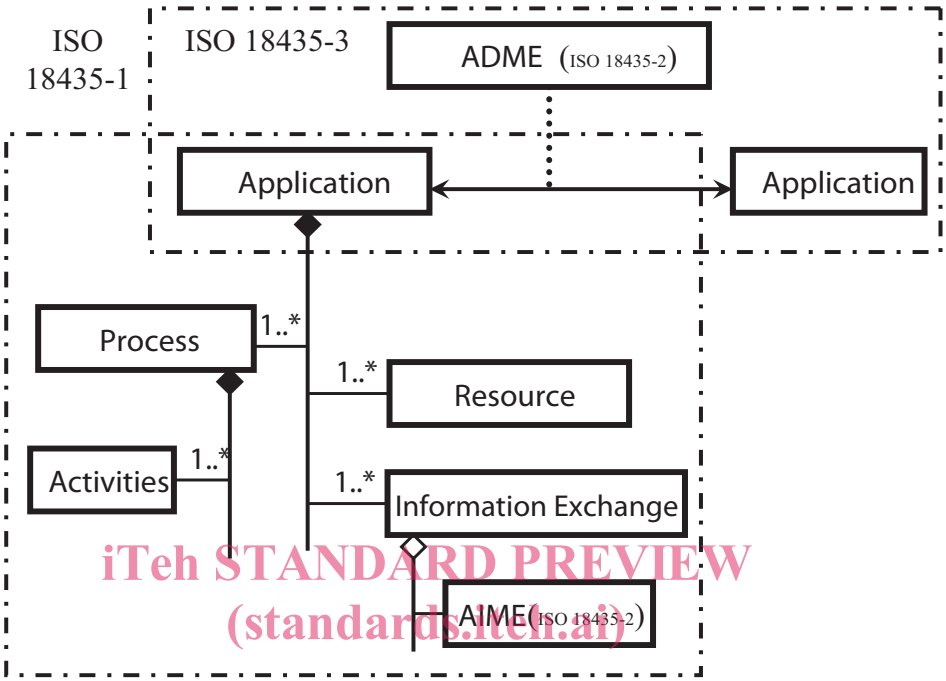

Figure 1 — Relationship between the different parts of ISO 18435

ISO 18435-1 provides an overview of the elements and the rules of a method to describe an automation application's integration requirements. The elements include the key aspects when integrating an automation application with other applications and the relationships of these key aspects. The rules include the information exchanges to support interoperability within an application and between applications. The focus is on the production operations and maintenance operations domains, including the capability assessment activities.

This part of ISO 18435 provides the detailed definitions of the application interaction matrix element (AIME) and application domain matrix element (ADME) structures and their relationships. In particular, the steps for constructing an ADME that can be supported by a specific combination of a set of AIMEs are described.

ISO 18435-3 defines a recommended method to describe the interoperability and integration requirements between applications in two or more automation domains within an enterprise. The focus is on the production operations and maintenance operations domains, including the capability assessment activities.

Industrial automation systems and integration — Diagnostics, capability assessment and maintenance applications integration —

Part 2:
Descriptions and definitions of application domain matrix elements

1 Scope

This part of ISO 18435 defines the structures and templates for

— an application interaction matrix element;

— an application domain matrix element.

This part of ISO 18435 also defines the relationship between these types of elements.

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 18435-1, *Industrial automation systems and integration — Diagnostics, capability assessment and maintenance applications integration — Part 1: Overview and general requirements*

ISO 15745-1, *Industrial automation systems and integration — Open systems application integration framework — Part 1: Generic reference description*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18435-1 and the following apply.

3.1
application domain matrix
matrix depicting application domains

3.2
application domain matrix element
ADME
entry in an application domain matrix to organize information exchange among applications

3.3
application interaction matrix
AIM
matrix depicting information exchange among resources

3.4
application interaction matrix element
AIME
entry in application interaction matrix to denote the capabilities of the resource to support information exchange

3.5
application interoperability profile
AIP
single specification referencing a group of profiles that reference parts of base specifications which may themselves be profiles

NOTE The group of profiles can include process profile(s), information exchange profile(s), resource profile(s) and sometimes other AIPs.

3.6
capability
ability to perform actions, including attributes on qualifications and measures of the ability

NOTE If the software resource type is MSU (manufacturing software unit) as in ISO 16100, then the definition of capability is the same as defined in ISO 16100-1.

4 Abbreviated terms

ADID	Application Domain Integration Diagram
ADME	Application Domain Matrix Element
AIM	Application Interaction Matrix
AIME	Application Interaction Matrix Element
AIP	Application Interoperability Profile
CM	Condition Monitoring
DA	Data Acquisition
DM	Data Manipulation
NC	Numerical Controller
RC	Robot Controller
SD	State Detection
UML	Unified Modeling Language
XML	eXtensible Mark-up Language

5 Overview of application interaction matrix element (AIME) and application domain matrix element (ADME)

5.1 Concept of AIME and ADME

This part of ISO 18435 provides a detailed definition of AIME and ADME. The general concept of an ADME is to model the information exchanges between applications as shown in Figure 2 using the application interoperability profile notation that shall be as described in ISO 15745-1.

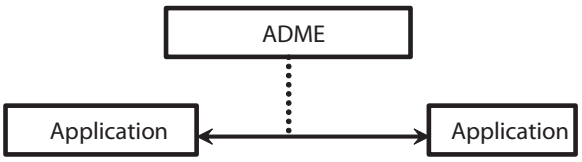

Figure 2 — Application domain matrix element

The ADME, which shall be as defined in ISO 18435-1, uses a description method for detailing the information exchanges between the applications. For each application, a set of interfaces shall be described using the AIME. The AIME enumerates the interface profiles supported by the application and its corresponding resources as shown in Figure 3.

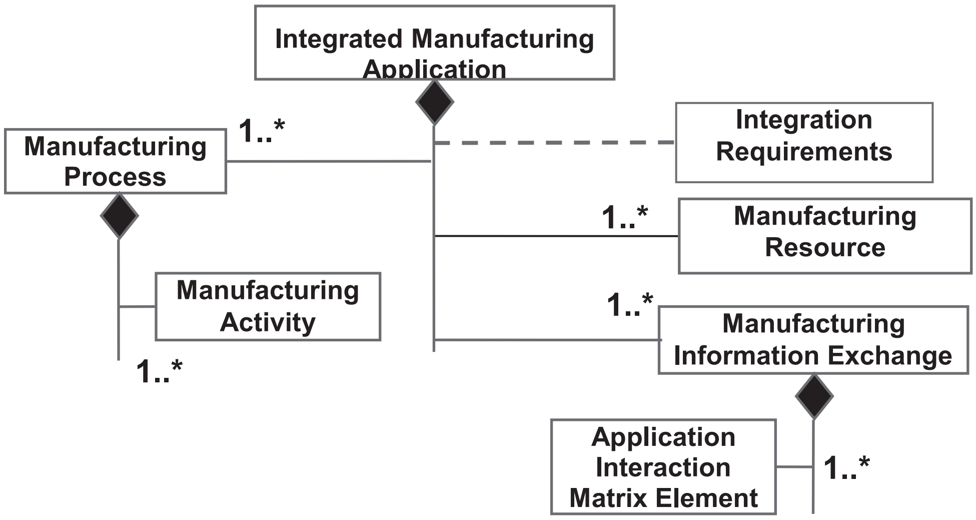

Figure 3 — AIME concept

An AIME enumerates those resource capabilities, including interfaces, as noted in each application interoperability profile. An application may have one or more AIMEs to support all the information exchanges involving the application.

The set of AIMEs representing the resource capabilities that meet the information exchange requirements to support the interoperability of two applications shall comprise a key part of an ADME.

An ADME that qualifies interoperability relationship between two applications noted in Figures 1 and 2 is further elaborated in Figure 4. The ADME is constructed from interoperability profiles referenced in AIMEs. AIMEs used for constructing ADME express compatibility of resources to support necessary information exchange between applications to achieve interoperability.

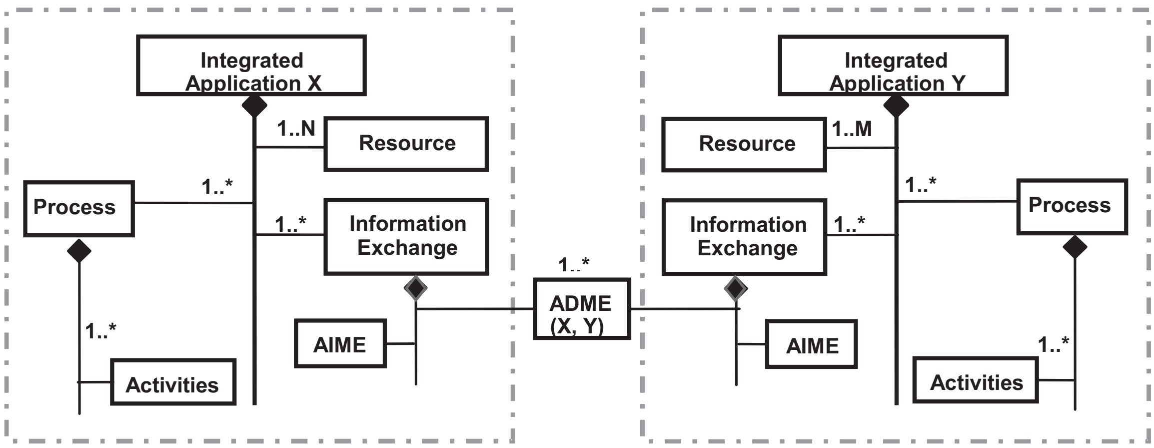

Figure 4 — Interoperability of applications

5.2 Information exchanges between resources

The manufacturing resources form an integrated system and enable a process that involves required flows of material, information and energy. The interoperability of the resources requires the use of compatible interfaces. These interfaces shall be configured to support characteristics of the flows between the resources. The integration requirement of realizing the required flows constrains the resource interfaces.

Each flow can be modelled as a detailed UML sequence diagram showing the resources involved. Each transfer between resources can be associated with a type of interface that is configured and deployed in each resource participating in the particular transfer.

To support the information flows between the manufacturing resources, the information exchange interfaces shall be configured in a compatible manner.

The interoperability of the resources is enabled by a set of information exchange interfaces. The number and the type of interfaces required to support the information exchanges are assumed to be available and configured appropriately in each resource participating in the information exchanges.

NOTE 1 Media-level interface types for information exchanges are transducer interfaces for physical signal acquisition and actuation, human-machine interfaces for operator commands and displays, and communications network interfaces for devices. Content-level interface services handle data type, structure, sequence, timing and semantics of the information item exchanged.

Each information exchange interface shall be associated with a set of required information handling services, where each service shall offer a particular grade of service and a specific quality of service. These interfaces enable the interoperability of the resources whenever information items need to be exchanged in a specified sequence, timing, throughput, latency, physical extent, fidelity and security.

NOTE 2 Conditions to be supported by the resources can consist of:

— exchanges at, before, after, or during, a certain time, period of time, event, or rate; or

— exchanges at, by, or within, a certain volume of space, or location.

To support all the information exchanges of all the activities in each manufacturing process, each and every manufacturing resource participating in the manufacturing process shall provide a required set of interoperability interfaces. For each resource, the set of interfaces and configuration settings can be denoted in a resource interoperability profile, as defined in ISO 15745.

6 Application interaction matrix element (AIME)

6.1 AIME concept

In Figure 3, each manufacturing application shall be associated with a set of manufacturing resources that are deployed to perform a corresponding set of information exchanges. An AIME shall represent a set of capabilities provided by a set of resources of an application, in order to exchange information with another set of resources associated with another application.

In an AIME corresponding to a single resource, the set of information items that may be transferred from this resource to another resource shall be a subset of the information items defined in the application denoted in the AIME.

An interface specified in an AIME may support multiple information item transfers with another resource. These information transfers may be represented by a UML sequence diagram.

Each information exchange description may include the characteristics of the information being exchanged, the frequency and the latency of the exchange, the criticality of the exchange and the resources involved. For instance, an AIME associated with a single resource may specify a list of information exchange descriptions that the resource is able to perform.

An AIM shall consist of a set of AIMEs to represent the complete set of information exchange requirements among all the resources in a process, and these AIMEs shall denote the information exchange interfaces required to coordinate the execution of the process.

An application consisting of a set of processes can be associated with a set of AIMEs specifying the information exchange capabilities of its resources. These AIMEs denote the capability of an application to conduct information exchanges with other applications.

6.2 AIME formal structure

6.2.1 General

An AIME represents a capability of an entity acting as a source to convey a set of information items to another entity acting as a destination. The matrix element corresponds to a particular information flow between two actors in a UML sequence diagram. The information exchange can also be illustrated in terms of activity diagrams, as well as state diagrams.

The structure of an AIME shall consist of two parts: a header and a body. The body further consists of a context section and a conveyance section. Each section may be represented as an XML schema segment.

6.2.2 AIME template header

The AIME template header section defines the attributes in Table 1.

Table 1 — AIME template header attributes

Attribute	Description	Example
MEidentification	AIME identification	ISO_AIME
MErevision	Revision of the AIME	V01.01.01a
MEname	Descriptive name of the AIME	D.2.2.Ay_D.2.2Az
MEsource	Identification of the AIME developer	AIMEsrc
MEclassID	Identification of the AIME class	AIP
MEdate	The release data of this version of the AIME	2007-03-29
MEregistry	Registry name for this AIME	Industry_specific_registry_name

6.2.3 AIME template context section

The AIME context section defines the attributes in Table 2.

Table 2 — AIME context section

Section	Description	Example
domainSection	Domain ID where the source application is resident Domain ID where the destination application is resident	Asset_Health_Assessment_domain Asset_Health_Assessment_domain
applicationSection	Application ID corresponding to the source application Application ID corresponding to the destination application	Health_assessment Prognostics
applicationRelationshipSection	Application domain specific context(s)	Condition_Monitoring_Context
processSection	Process ID associated with the source Resource Process ID associated with the destination Resource	Current_health_grade_evaluation Future_health_grade_evaluation
resourceSection - resourcePack	Resource Pack Name Resource name Available or planned capability profiles in the resource	PLC01 MotionDrive CIP_ISO_15745_profile

6.2.4 AIME template conveyance section

The AIME conveyance section defines the attributes in Table 3.

Table 3 — AIME conveyance section

Section	Description	Example
informationType	Types of information exchanged	CavitationInformationRequest
roleType	Enumeration of capabilities exhibited by the participant for a particular information exchange	PumpControlRole CavitationDetectionRole
relationshipType	Identifies the application role types and behaviour	CavitationDetection2PumpControl
participantType	Types of collaborating parties for information exchange	CavitationDetection
channelType	Point of information item exchange between participants	CIP_FTLD_channel

6.3 Graphical representation of the AIME

Graphical representations of the AIME are shown in Figures 5, 6 and 7. These figures follow the convention described in ISO/IEC 29500-2.