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

Part 3:
Applications integration description method

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

Partie 3: Méthode de description pour l'intégration d'applications

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 5, *Architecture, communication and integration frameworks*.

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*

— *Part 3: Applications integration description method*

Introduction

ISO 18435 defines a set of integration methods intended to be used when integrating diagnostics, capability assessment, and maintenance applications with the applications in production, control, and other manufacturing operations.

ISO 18435-1 provides an overview of the elements as shown in Figure 1 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.

ISO 18435-2 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 from a set of AIMEs are described.

This part of ISO 18435 defines a recommended method based on templates to describe the interoperability between applications in two or more automation domains within an enterprise, at all levels of an enterprise's functional and resource hierarchies. The focus is on the production operations and maintenance operations domains.
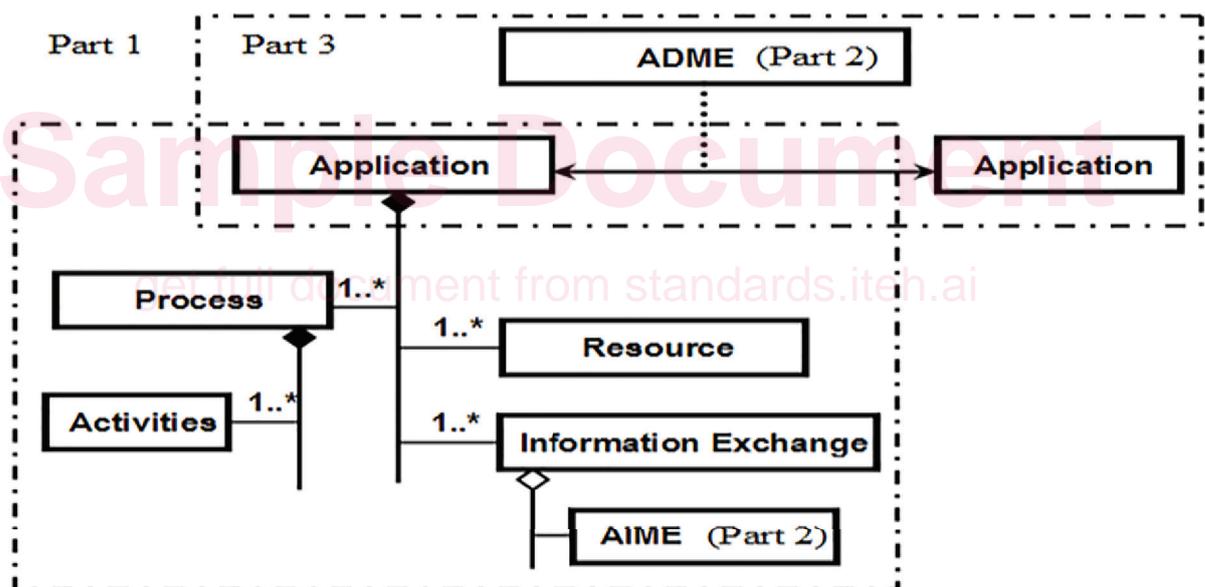
Figure 1 — Relationships between the parts of ISO 18435

UML is used to represent information exchange requirements associated with the interoperability and the integration of plant floor applications, in particular, diagnostics, control, maintenance and production.

The purpose is to focus on how to express the information exchanges:

— about the process, equipment, operators, and materials and other automation assets;

— that are conveyed from control and production systems to various diagnostics and maintenance systems in order to perform asset management.

The intended benefits for representing information exchanges are to:

— facilitate specifying and procuring open systems that support interoperability among diagnostics and maintenance applications;

— reduce the time to develop diagnostics and maintenance solutions that directly address the well-defined integration requirements;

— provide a means to categorize tools intended to enable and verify interoperability and integration across applications.

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

Part 3:
Applications integration description method

1   Scope

This part of ISO 18435 defines the profiling methodology to use the interoperability templates of ISO 18435-2. These profiling methods describe the construction and the use of application domain matrix elements (ADMEs), application interaction matrix elements (AIMEs), and an open technical dictionary (OTD) to support the information exchange.

In particular, this part of ISO 18435 gives guidance related to profiling the information exchange between two applications by establishing the context, conveyance, and contents defined in ISO 18435-2.

This part of ISO 18435 is intended to be used in conjunction with ISO 18435-1 and ISO 18435-2.

2   Normative reference(s)

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8000 (all parts), *Data quality*

ISO/IEC 10646, *Information technology — Universal Coded Character Set (UCS)*

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

ISO 18435-1:2009, *Industrial automation systems and integration — Diagnostics, capability assessment and maintenance applications integration — Part 1: Overview and general requirements*

ISO 18435-2:2012, *Industrial automation systems and integration — Diagnostics, capability assessment and maintenance applications integration — Part 2: Descriptions and definitions of application domain matrix elements*

ISO/TS 29002 (all parts), *Industrial automation systems and integration — Exchange of characteristic data*

ISO/TS 29002-5:2009, *Industrial automation systems and integration — Exchange of characteristic data — Part 5: Identification scheme*

3   Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18435-1 and ISO 18435-2 and the following apply.

3.1
ontology
explicit and consensual specification of concepts of an application domain independent of any use of these concepts

[SOURCE: ISO 13584-511:2006, 3.1.20]

4   Abbreviated terms

ADME   Application Domain Matrix Element

AIME   Application Integration Matrix Element

CBM   Condition-Based Maintenance

OTD   Open Technical Dictionary

UML   Unified Modelling Language

XML   eXtensible Markup Language

5   Applications integration description methods

5.1   Introduction to the application integration concept

5.1.1   General

The customer applications integration requirements determine the information exchange profiles that are needed to support the application interoperability requirements. To develop the information exchange profiles for the applications of interest, it is necessary to determine the existing customer domain areas of interest.

Clause 5 describes the method for specifying the information contained in the AIME and the ADME for the information exchange requirements using templates defined in ISO 18435-2. The use of this method will provide interoperability for the applications in the defined context. As this methodology is used for integrating additional applications from various domains, this method can be used for verifying if the information exchange profiles (using the AIME structure) are interoperable as needed by the user. Figure 2 shows an iterative process to verify the intended interoperability of the application integration.
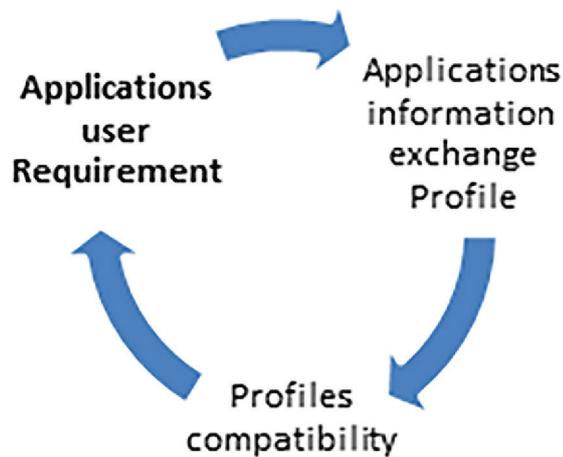
Figure 2 — System design cycle for interoperability

The general structure for the application information exchange profiles are depicted in Figure 3. The methods for assessing the AIME profile compatibility to support the information exchanges will depend upon the context and domains of interest.
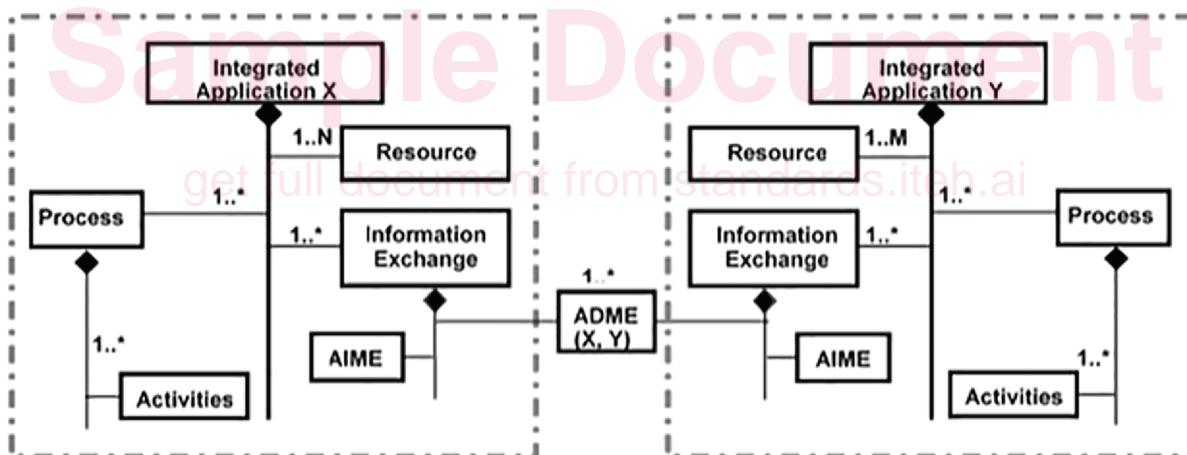

Figure 3 — Profile elements

The diagnostic and maintenance mission depends on the objectives of integration between different application domains as shown in Figure 4. The description of this technical mission shall include the identification of the associated assets for which the mission is defined and the application domains involved.

The method for describing the information exchange profiles is dependent upon the context established according to intra- or inter-domain information exchanges. The capability profiles of the resources to support the information exchange shall be described by the AIME.

NOTE   The information exchanges between the allocated resource and definition resources can be described with a sequence diagram according to ISO 18435-2:2012, 5.2.

Application domain categories are defined in ISO 18435-1 as shown in Figure 4. In this part of ISO 18435, interoperability templates are described for integration requirements as depicted in ISO 18435-1 for the interoperability of applications.

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As an illustration of the methodology using interoperability templates, the diagnostic and control application domains are used as shown in Figure 4.
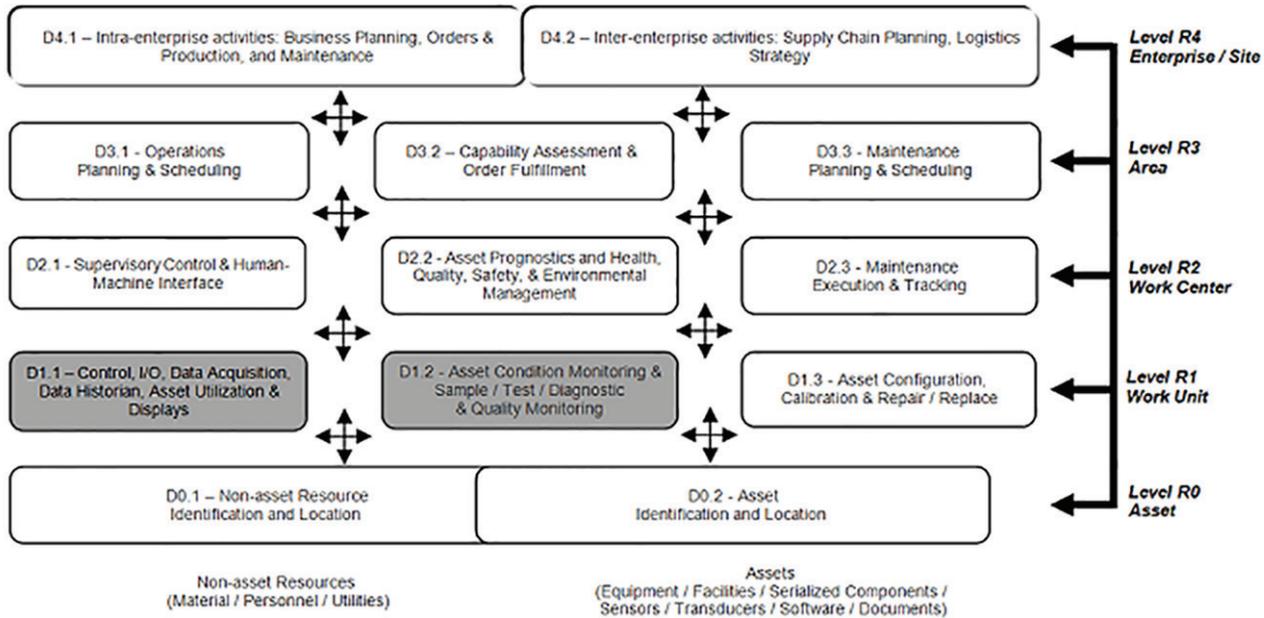

Figure 4 — Categories of application domains

5.1.2 Inter-domain requirements

Interoperability templates for inter-domain application interoperability shall require references to either a specific domain standard or the profile of a specific domain standard, according to ISO 15745, to specify the context of the integration model.

EXAMPLE 1   As shown in Figure 5, the application in the control application domain could use the IEC 61512 reference model to describe the model construction, terms, and definition used in the interoperability templates for the ADME. The application in the diagnostic application domain could use the ISO 13374-2 reference model to describe the corresponding diagnostic ADME.

Thus, when exchanging information between different domains, it is necessary to indicate the context and then to describe the content information handled by the conveyance mechanism. The context, conveyance and content information are contained in the ADME using profile specifications. The actual contents of the information exchange shall be defined by profile specifications.

EXAMPLE 2   An ISO 13374 diagnostic information message, advisory generation, is sent from the diagnostic application as an event to the IEC 61512 batch control application.
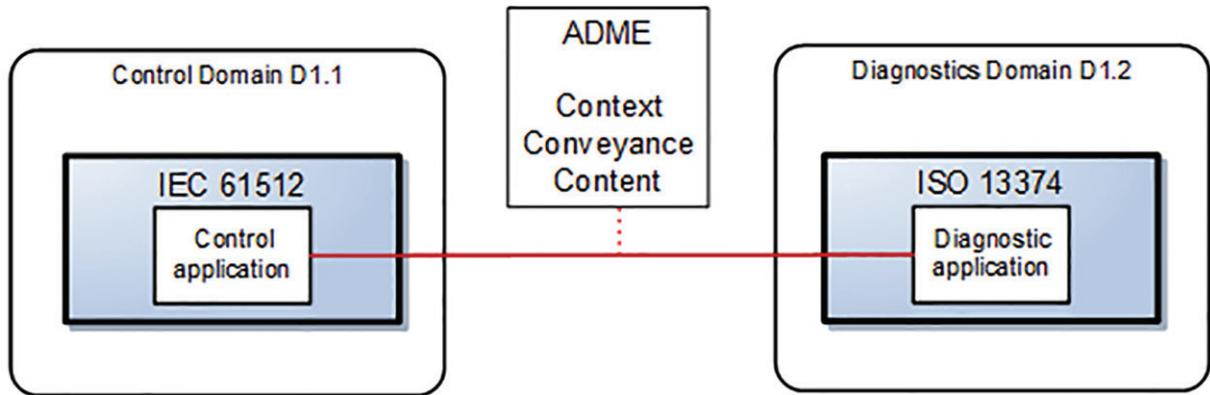
Figure 5 — Inter-domain applications interoperability

The terms and definitions of the information models shall reference standards. The terminology and models of the standards shall be identified and referenced using open technical dictionary (OTD) concepts. In this part of ISO 18435, the information models and terminology use concepts of an open technical dictionary as defined in ISO/TS 29002 (see Annex A). The use of a common set of models and terms for applications in different domains establishes the basis for enabling information exchange.

This applications integration methodology enables the mapping of the inter-domain interoperability requirements into the AIMEs for each application of interest and the ADMEs between applications.

5.1.3 Intra-domain requirements

Intra-domain application interoperability templates shall use a common context for the applications information exchange reference model.

EXAMPLE   As shown in Figure 6, the control applications and the diagnostic applications have the same context for the information exchange such that the representation, terms, definitions have the same structure and meaning. The conveyance and the content sections follow the syntax and semantics of IEC 61512.
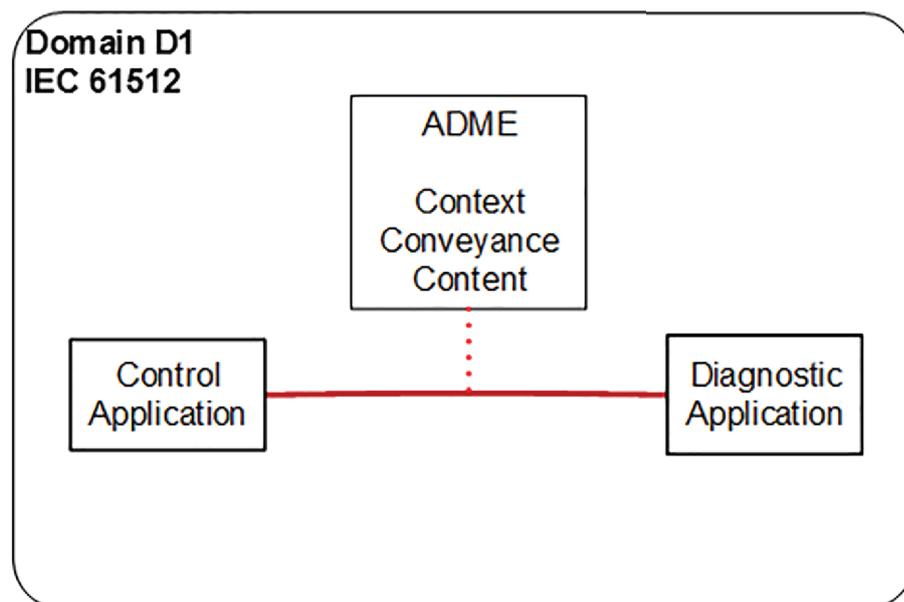

Figure 6 — Intra-domain applications interoperability

5.2 Profiling concept

5.2.1 General

The general profiling concept is depicted in Figure 7. In ISO 18435-2, the general templates for context, conveyance, and contents are specified. The template information for intra-domain information exchange profiles is the information directly from the reference domain standards. For the inter-domain profiles, the open technical dictionaries (OTDs) will need to be referenced to ensure compatibility of terms and definitions for the information exchange information. The OTDs shall contain profiling information for the referenced domains using the methodology of ISO 15745-1; the inter-domain information exchange may require mapping concepts from two technical dictionaries.
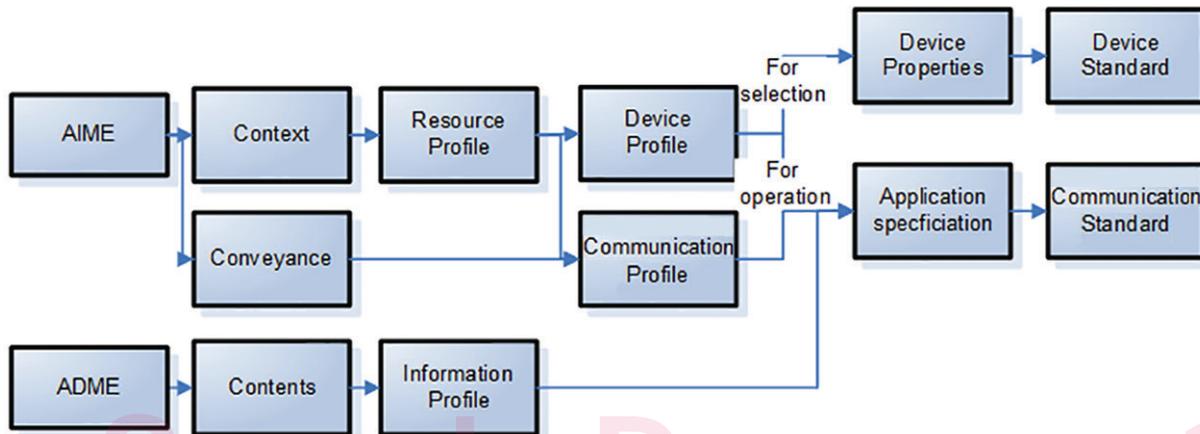

Figure 7 — Profile aggregation

The AIME defines the capability profile to support the information exchange requirements of the ADME. The capability profiles for intra-domain applications are by definition compatible. For instance the device profile and communication profiles conform to a common set of specifications.

Devices can be selected and their relevant properties can be identified and referenced by using component data dictionary such as IEC 61360 [Common Data Dictionary (CDD)]. Device class identification codes and property identification codes can be used to refer to generic components characteristics.

NOTE   Descriptions of switchgear and controlgear classes are given by IEC 62683 and descriptions of process equipment are given by IEC 61987.

The capability profiles for inter-domain applications can conform to different device and communications profiles. The application information exchange profile defines the preferred context and conveyance profiles to support the information exchange. The capability profiles defined in the AIMEs shall be checked to verify compatibility. Since the context is specified as a profile referencing a profile, multiple levels of profile checking are required.

5.2.2 Intra-domain information exchange compatibility

The intra-domain information exchange shall use the same context and conveyance profiles as shown in Figure 8. For intra-domain information exchange, this reduces the complexity in the selection process for resource profiles.