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Automation systems and integration — The Big Picture of standards

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National foreword

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TECHNICAL REPORT

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Automation systems and integration — The Big Picture of standards

Systèmes d'automatisation et intégration — Panorama des documents normatifs

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*.

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Introduction

The main objective of the Big Picture is to clarify the landscape of standards and standardization projects in smart manufacturing (covering all sectors of activity, all value chains, and all types of control: discrete, batch and continuous) by using clearly defined criteria of analysis (object of standardization, type of standard, industrial sector, life cycle, value chain, role level, etc.).

The IEC Sector Board 3 (SB3) activity began around 1997 and had members consisting of executives and technical managers from selected industrial sectors. The SB3 was assisted by a technical steering group of representatives from ISO/TC 184, IEC/TC 65 and other technical committees developing international standards for these industrial sectors. The SB3 efforts and deliverables (e.g. ISO/IEC Guide 75) focused on establishing the rationale, direction and strategic actions to assist both industry and the standards development organizations in assessing the market relevance of proposed standardization projects. The "Big Picture" project delivered necessary tools in realizing the SB3 objectives.

The first utilization of the term "Big Picture" by ISO/TC 184 was made by ISO/TC 184/SC 4/IMTF (Integrated Manufacturing Task Force) in its report to ISO/TC 184/SC 4 in 2001. This report was limited to the identification of the place and role of the various standards developed within TC 184/SC 4 and to their relationship. The main interests of this report were the first attempt for an overall representation of the ISO/TC 184/SC 4 area of work using a graphical representation on which each concerned standard or project of standardization can be placed as well as the methodology to obtain this representation.

This work was preceded by other work done in 1999 and 2000 by TC 184/SC 4/JWG 8, on the request of the Chairman of ISO/TC 184/SC 4, on "manufacturing related standards". Nevertheless, this work includes preliminary considerations on redundancy, on the impact of the point of view used in each standard. It also includes a preliminary list of ISO/TC 184 and non ISO/TC 184 standards related to manufacturing as well as a first analysis of the relationships between features that can have the same naming in different standards but address concepts that are in fact different.

Later on, ISO/TC 184 set up a task force led by its Advisory Group and named "BSAD", which was appointed to list the various areas of interest (universe of discourse) for ISO/TC 184 and its subcommittees. The objectives of this work was again to try to identify the place of existing standards and possible areas of work in the ISO/TC 184 "universe of discourse", using a distinction between developments that are in the core of the scope of ISO/TC 184, areas that are impacted by ISO/TC 184 work and/or are likely to impact ISO/TC 184 developments, and areas that are just to be monitored according to the fact that they are in the "universe of discourse" of ISO/TC 184 without any other relationship with its work.

These activities were followed by the first attempts to carry the "Big Picture" effort to ISO/TC 184/SC 5 and finally at the ISO/TC 184 level (Louisville meeting between SC 4 and SC 5).

A common activity between ISO/TC 184 and IEC/TC 65 started in July 2008 by a meeting between Chairmen and continued with Joint Advisory Group meetings in 2009, in Frankfurt and Paris.

In 2010, a draft technical report was prepared.

In 2011, a renewed matrix and its user manual were circulated in ISO/TC 184 and IEC/TC 65. These documents were reviewed in the Joint Advisory Group meeting in 2011 (Berlin).

The ISO/TC 184 and IEC/TC 65 reference framework for the Big Picture was circulated at the end of 2011. Both ISO/TC 184 and IEC/TC 65 and their subcommittees populated the Big Picture Matrix on this reference framework.

This document is an update of the Big Picture reference framework circulated internally in ISO/TC 184 and IEC/TC 65 in 2011.

In 2012 and 2013, the French National Committee (AFNOR) continued refining the concepts.

In 2014 and 2015, EDF (Électricité de France) conducted a project for the exploiting of the Big Picture data in a smarter way. The project involved two academic institutions: Centre Universitaire d'Informatique (Geneva) and Centrale Lille\IG2I. The aim was to provide a "smart" access to

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information on standardization and standards in order to facilitate their development and promote their interoperability, and to develop and present the methodology for access to normative information (see Annex A).

At the ISO/TC 184 plenary meeting in Nara, the results of the EDF project were demonstrated and Resolution 563 was endorsed: "TC 184 welcomes the EDF initiative to exploit and present the Big Picture, invites projects such as OGI to provide additional use cases and invites its Secretariat to pursue the creation of an ISO project under the TMB to further develop the tool. It is suggested that if the tool enters general use, consideration should be given to extending the ISO NP form to include the identification of categories of use."

Figure 1 shows a summary of the Big Picture project history.

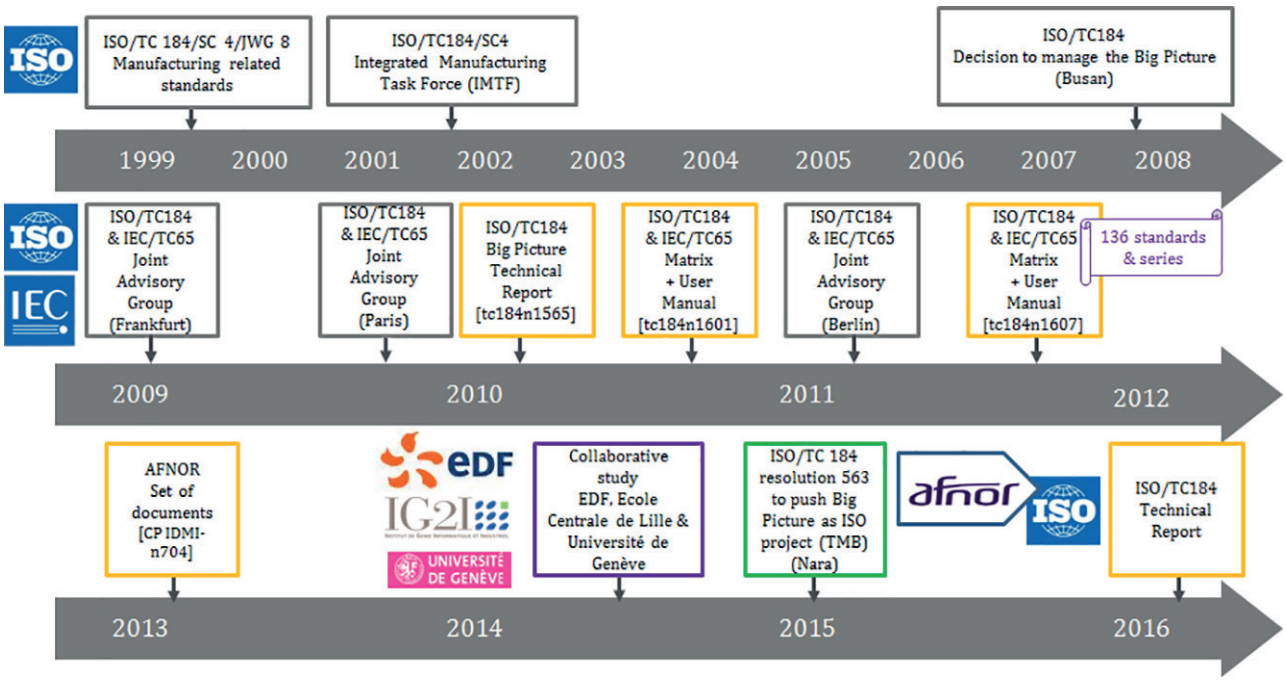

Figure 1 — History of the Big Picture project

This Technical Report may be used in the context of the common ISO-IEC project of international reference model for smart manufacturing.

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Automation systems and integration — The Big Picture of standards

1 Scope

This document is the reference framework for the Big Picture project.

The Big Picture aims at monitoring the consistency of published standards and current or future standardization projects.

The Big Picture enables the standardization stakeholders to identify, for each concerned standard or standardization project, the relevant characteristics related to the positioning and impact of the standard or standardization project in the industry.

Although the Big Picture was designed initially for the universe of discourse of ISO/TC 184 and then IEC/TC 65, it applies to manufacturing in general.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
generalization
act of removing or modifying detail from a specific concept to produce a more general extent, use or purpose of this concept or the concept resulting from this operation

Note 1 to entry: Generalization is the inverse of *specialization* (3.9).

[SOURCE: ISO 19439:2006, 3.34, modified — the order has been changed]

3.2
generic
property of being a *generalization* (3.1) from a number of distinguishable entities based on their shared characteristics

[SOURCE: ISO 19439:2006, 3.35]

3.3
genericity
extent to which a concept or an object is *generic* (3.2)

[SOURCE: ISO 19439:2006, 3.37, modified— “or an object” has been added]

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3.4
life cycle
set of distinguishable phases and steps within phases which an entity goes through from its creation until it ceases to exist

[SOURCE: ISO 19439:2006, 3.42]

3.5
model
abstract description of reality in any form (including mathematical, physical, symbolic, graphical or descriptive) that presents a certain aspect of that reality

[SOURCE: ISO 19439:2006, 3.47, modified — Note 1 to entry has been deleted]

3.6
point of view
aspect
specific set of properties addressed by a standard or project of standardization according to specific stakeholder concerns

EXAMPLE The point of view of a manufacturer, a user or a supplier.

Note 1 to entry: This concept is the application to standards of the concept of modeller views developed in ISO 15704, ISO 14258 and ISO 19439.

3.7
product
thing or substance produced by a natural or artificial process

[SOURCE: ISO 10303-1:1994, 3.2.26]

3.8
resource
enterprise entity that provides some or all of the capabilities required by the execution of an enterprise activity and/or business process

[SOURCE: ISO 15704:2000, 3.18]

3.9
specialization
general concept modified for a more limited extent, specific use or purpose, or the act of adding or modifying details to a general concept to produce a specialization thereof

Note 1 to entry: Specialization is the inverse of *generalization(3.1)*.

[SOURCE: ISO 19439:2006, 3.62]

3.10
system
collection of real-world items organized for a given purpose

[SOURCE: ISO 15704:2000, 3.20, modified — Note 1 to entry has been deleted]

3.11
universe of discourse
collection of concrete or abstract things that belong to an area of the real world, selected according to its interest for the scope of the concerned standardization committees

[SOURCE: ISO 15531-1:2004, 3.6.50, modified — “the system to be modelled and for its corresponding environment” has been replaced with “scope of the concerned standardization committees” and Note 1 to entry has been deleted]

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4 Objectives of the Big Picture

4.1 General

The objectives of the Big Picture are the improvement and the facilitation of systems, components, products and applications integration along the different life cycles. They can be split into three areas:

— identifying the place and role of the relevant standards and projects of standardization of ISO/TC 184 and IEC/TC 65;

— providing an outreach tool to other standardization committees; and

— promoting and explaining standardization efforts to industry managers and users of standards.

4.2 Identification of place and role of the concerned standards and projects of standardization in ISO/TC 184 and IEC/TC 65

Identifying the place and role of existing standards and projects of standardization in the universe of discourse of both ISO/TC 184 and IEC/TC 65 is necessary in order to enable standardization stakeholders to identify any need for new standards, to monitor possible overlaps and to clarify their roles and relationships in the field of automation systems and integration concerning:

— collaborative manufacturing throughout the life cycles of products, enterprises, supply chains;

— the application of multiple technologies, techniques and tools to manage and control the flow of information, materials and other resources within an extended enterprise or supply chain.

4.3 An outreach tool to other standardization committees

The Big Picture is designed to help and facilitate:

— cooperation and collaboration to reduce conflicts in work items;

— promoting the use of related deliverables and their benefits.

4.4 Promotion and explanation of standardization efforts to industry managers and users of standards

The promotion and explanation of standardization efforts specially address:

— the industry managers and standards users;

— the explanation of the place and role of each standard in the automation and integration process in manufacturing;

— highlighting the benefits of the use of concerned standards.

5 Conceptual background

Systems theories support explicitly or implicitly most of the standards developed in the universe of discourse of ISO/TC 184 (especially those developed by ISO/TC 184/SC 5 and ISO/TC 184/SC 4) as well as some of the standards developed by IEC/TC 65. Accordingly, any process or automation application may be described systematically as depicted in Figure 2 adapted from ISO 15531-31:2004, Annex D.

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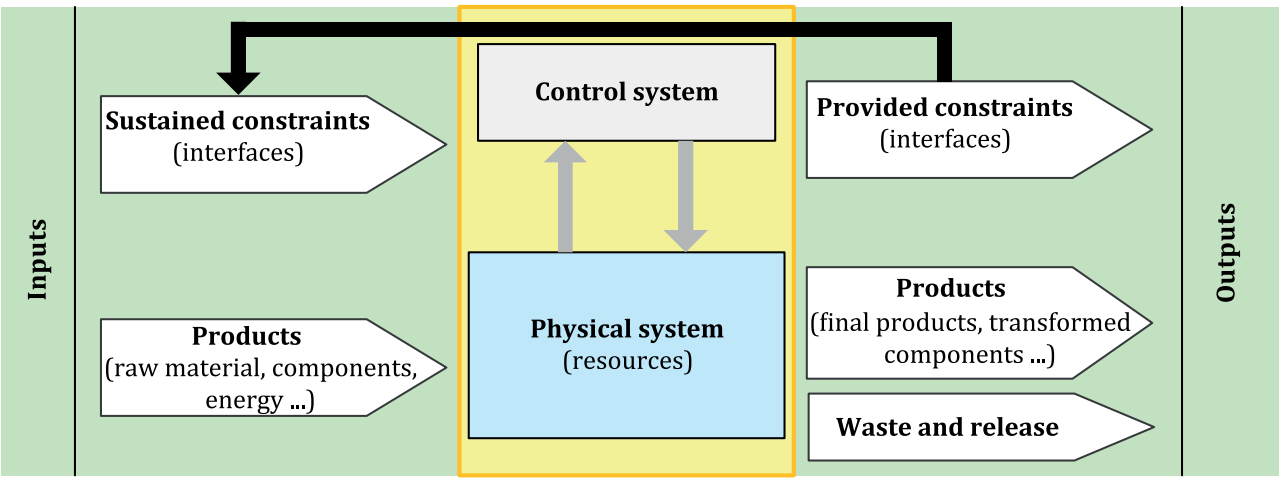

Figure 2 — Production or manufacturing system

Any system, including the control system and the physical system, may be divided in subsystems that will be described in the same way. Systems address applications and processes including software and hardware components (subsystems).

Products may include raw material, intermediate components and final products.

The physical system has resources (humans, machines, facilities...) that contribute to the transformation of inputs (product such as raw materials, components...) into others products (final products, transformed components). Some resources may be considered as products in other systems.

EXAMPLE A drill is a resource in a system which drills a hole such as a drilling machine. The same one is a product in a system which sharps it such as a sharpening tool.

The control system is the part of the system that treats information coming from the physical system and from the environment (e.g. other systems), such as sustained constraints to monitor the physical system and submit needed information to the environment (e.g. others systems) such as provided constraints. It manages the interfaces with the environment and especially with the other concerned systems.

6 Big Picture diagram

6.1 Graphical representation

This graphical representation is a three-axis diagram, where the three axes are:

— the role level axis;

— the value chain axis;

— the life cycle axis.

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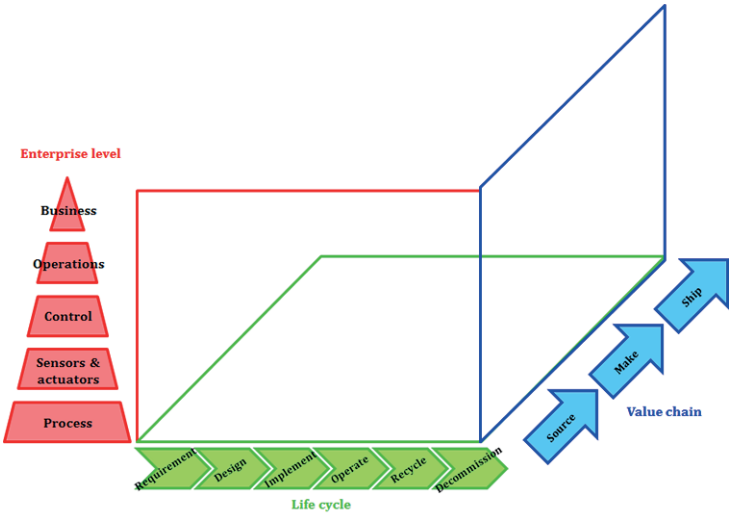

Figure 3 — Big Picture diagram

The target of this graphical representation (See Figure 3) is to identify in a clear, simple and educational way the place of the standard or standardization project in the universe of discourse of manufacturing automation and integration.

For example, Figure 4 shows “control and make” standards.

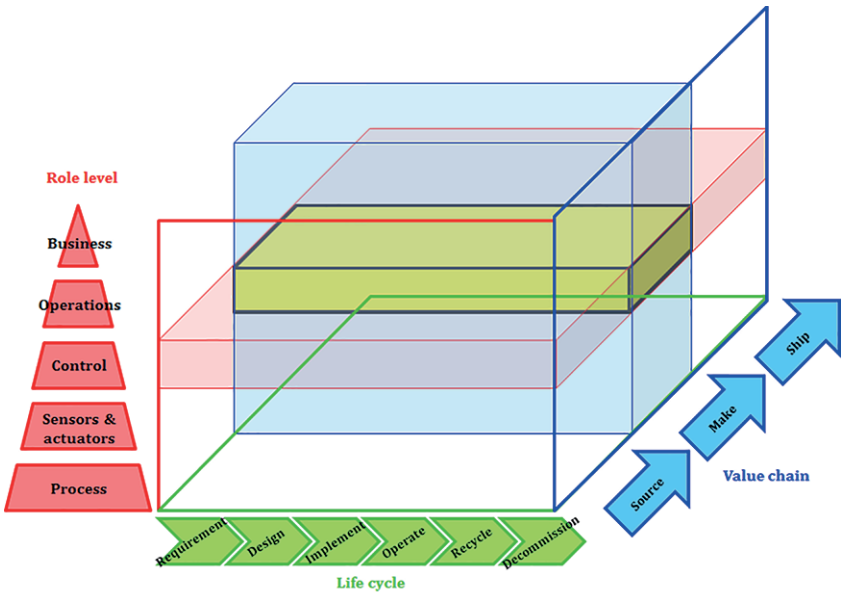

Figure 4 — Example: control and make

For example, Figure 5 shows “business, operate and ship” standards.

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