Technical Specification

ISO/TS 25271

Automation systems and integration — Industrial digital twin interface architecture

Systèmes d'automatisation et intégration — Architecture de l'interface du jumeau numérique industriel

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Foreword

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This document was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 4, *Industrial data*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

With the continuous improvement in the fidelity of digital models for physical products, there is an increasing preference for using digital models over their physical counterparts. This trend is particularly prominent in cases where physical products operate in remote environments, such as offshore wind power systems or Mars exploration vehicles, as well as operations regulated by thorough standards in terms of safety.

As the concept of digital twins evolves, various frameworks and architectures have emerged. This document aims to analyse the fundamental components of digital twin systems to establish a standardized architecture for industrial applications. It also evaluates the positioning of digital twins in the context of augmented reality (AR), the Metaverse and cyber-physical systems (CPS), while providing comparisons with other existing frameworks and architectures.

Among the points of differentiation from existing standards, physical twin is a concept that contrasts with the definition of target entity (according to ISO/IEC 30173:2023 [1], 3.1.3) which is described in Clause B.2. This differentiation leads to the adoption of industrial digital twin.

Automation systems and integration — Industrial digital twin interface architecture

1 Scope

This document specifies the interface architecture of industrial digital twin systems, which is structured around three key elements: the digital twin, the physical twin and the interface that links them. Together, these elements form the essential framework of an industrial digital twin.

The following are within the scope of this document:

a) Defining the elements of industrial digital twin systems that embody a distinct architecture.

b) Analysing the interactions among the three core elements of industrial digital twin systems

c) Identifying the characteristics that distinguish industrial digital twin systems from related concepts or technologies

d) Examining typical use cases that implement the three-element interface architecture

The following is outside the scope of this document:

e) Detailed applications of industrial digital twin systems

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 terminology databases for use in standardization at the following addresses:

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

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

3.1
asset
any item, *thing* (3.15) or *entity* (3.7) that has potential or actual value to an organization

[SOURCE: ISO/TS 15926-11:2023 [2], 3.1.1]

3.2
augmented reality
AR
virtual objects superimposed upon or composited with the real world

[SOURCE: ISO/IEC 30173:2023 [1], 3.5.6]

3.3
cyber-physical system
CPS
smart system that includes engineered interacting networks of physical and computational components

[SOURCE: ISO/IEC TR 15067-3-8:2020 [3], 3.8]

3.4
digital mock-up
DMU
digital specification given to a *product* (3.13) or sub-system with an independent function, not only of the geometric properties but also of its function, performance or both in a particular field

[SOURCE: ISO 10209:2022 [4], 3.8.34, modified — "complete mechanical product" has been changed to "product".]

3.5
digital twin
DTw
digital representation of a *target entity* (3.14) with data connections that enable convergence between the physical and digital states at an appropriate rate of synchronization

[SOURCE: ISO/IEC 30173:2023 [1], 3.1.1]

3.6
digital twin system
system providing functionalities for the *digital twin* (3.5) composed of inter-operating target entities, digital entities, data connections, and models, data and interfaces involved in the data connection process

[SOURCE: ISO/IEC 30173:2023 [1], 3.1.21]

3.7
entity
concrete or abstract *thing* (3.15) in the domain under consideration

[SOURCE: ISO 8000-2:2022 [5], 3.3.3]

3.8
industrial digital twin
iDTw
digital representation of a *physical entity* (3.11) with *twinning interface* (3.17)

Note 1 to entry: It represents the bit world rather than the atom world.

Note 2 to entry: iDTw primarily focuses on the digital replication of physical entities even though it includes a software (SW). See Annex B and Annex D.

3.9
industrial digital twin system
compound model composed of a *physical twin* (3.12), an *industrial digital twin* (3.8) and a *twinning interface* (3.17) which is used for state synchronization between two twins

3.10
metaverse
hypothetical iteration of the Internet as a single, universal and immersive virtual world

3.11
physical entity
entity (3.7) in the physical world that can be the subject of sensing and/or actuating

[SOURCE: ISO/IEC 20924:2024 [6], 3.1.25]

3.12
physical twin
PTw
object which exists in the real world

Note 1 to entry: It represents the atom world rather than the bit world.

Note 2 to entry: It is similar to the *physical entity* (3.11), but can be a large *product* (3.13) which can include software.

[SOURCE: ISO/TR 24464:2025 [7], 3.1.7, modified — The Notes to entry have been added.]

3.13
product
thing (3.15) or substance produced by a natural or artificial process

[SOURCE: ISO 10303-1:1994 [8], 3.2.26]

3.14
target entity
entity (3.7) providing a functional purpose in reality which is the subject of digital representation

Note 1 to entry: The target entity, which provides some functional purpose in reality, can be either physical or digital under consideration.

[SOURCE: ISO/IEC 30173:2023 [1], 3.1.3]

3.15
thing
actual part of the real world, perceived part of the real world, or subject of thought

Note 1 to entry: A thing can be a material or non-material object, idea or action.

Note 2 to entry: This definition is adapted from ISO 15926-2, within which "thing" is an *entity* (3.7), but not a defined term.

[SOURCE: ISO/TS 15926-6:2013 [9], 3.1.26]

3.16
twinning
pairing or union of two similar or identical objects

[SOURCE: ISO/TR 24464:2025 [7], 3.14]

3.17
twinning interface
mediator which allows *mutual augmentation* (3.18) between *iDTw* (3.9) and *PTw* (3.12)

[SOURCE: ISO/TR 24464:2025 [7], 3.15]

3.18
mutual augmentation
two-way complementation between *iDTw* (3.8) and its *PTw* (3.12) by addressing each other's weaknesses through a near-real-time, high-resolution *twinning interface* (3.17)

Note 1 to entry: The *iDTw* (3.8) updates with the *PTw* (3.12) to stay accurate and up to date, while the *PTw* (3.12) benefits from the *iDTw* (3.8)'s simulations and predictions to operate more efficiently and safely.

3.19
interface
shared boundary between two functional units, defined by various characteristics pertaining to the functions, physical interconnections, signal exchanges, and other characteristics, as appropriate

[SOURCE: ISO/IEC 2382:2015 [10], 2121308, modified — The Notes to entry have been removed.]