Technical Report

ISO/TR 24464

Visualization elements of digital twin — Visualization fidelity

Éléments de visualisation du jumeau numérique — Fidélité de la visualisation

Second edition
2025-03

Reference number
ISO/TR 24464:2025(en)

© ISO 2025



COPYRIGHT PROTECTED DOCUMENT

© ISO 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Abbreviated terms ... **3**
5 Needs of DTw visualization ... **4**
5.1 Atom world and a bit world ... 4
5.2 Visualization of big and small things ... 4
5.3 Visualization of big data ... 5
5.4 Visualization fidelity of the twinning interface ... 6
6 Three-elements architecture of the iDTw system visualization ... **6**
6.1 General ... 6
6.2 Component technologies of DTw visualization ... 7
6.3 Comparison with existing architecture ... 7
7 Characteristics of the iDTw system ... **10**
7.1 Mutual augmentation through twinning cycles ... 10
7.1.1 General ... 10
7.1.2 Augmentation from PTw to iDTw ... 11
7.1.3 Augmentation from iDTw to PTw ... 11
7.2 Life cycle of iDTw system ... 12
7.2.1 General ... 12
7.2.2 Separation between artificial model and digital replica ... 13
7.2.3 Spatial fidelity enhancement along the life cycle ... 14
7.3 Inclusion between iDTw and PTw ... 14
8 Visualization fidelity of iDTw ... **16**
8.1 General ... 16
8.2 Level of detail (LoD) of plant equipment models ... 16
8.3 Fidelity measure ... 18
8.3.1 General ... 18
8.3.2 Space measure: Spatial resolution ... 20
8.3.3 Time measure: Latency and sampling rate ... 21
Annex A (informative) **Collection of DTw definitions** ... **23**
Annex B (informative) **Selection of terms** ... **25**
Annex C (informative) **Analysis of international standards related to DTw visualization** ... **28**
Annex D (informative) **Comparison with CPS and AR** ... **35**
Annex E (informative) **Use cases of the three-elements architecture of iDTw system** ... **41**
Bibliography ... **46**

© ISO 2025 – All rights reserved

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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity, or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 4, *Industrial data,* in collaboration with Technical Committee ISO/IEC JTC 1 *Information Technology*, Subcommittee SC 24, *Computer graphics, image processing and environmental data representation* and Technical Committee ISO/TC 171, *Document management applications*, Subcommittee SC 2, *Document file formats, EDMS systems and authenticity of information*.

This second edition cancels and replaces the first edition (ISO/TR 24464:2020), which has been technically revised.

The main changes are as follows:

— the title is changed;

— a three-elements architecture is added;

— this document focuses more on fidelity among visualization elements.

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.

© ISO 2025 – All rights reserved

Introduction

This document analyses the visualization fidelity among the visualization elements of a digital twin system. Since digital twin (DTw) is a new technology, various definitions are being proposed in the sector as a whole, so they collide with each other, and cross-reference is underway at the same time. This document analyses the element technologies and the properties that make up the DTw system, it also attempts to reveal the nature of the DTw, and focuses on visualization elements. This is expected to further solidify the identity of DTw, reduce confusion and consequently help further spread the use of DTw technology.

© ISO 2025 – All rights reserved

Visualization elements of digital twin — Visualization fidelity

1 Scope

The content of this document is divided into two parts.

— This document analyses the overall configuration of an industrial digital twin system, and proposes a three-elements architecture, focusing on the twinning interface between the physical twin (PTw) and industrial digital twin (iDTw).

— The characteristics, and the visualization elements and visualization fidelity of iDTw are analysed.

This document:

a) analyses the twinning interface between the PTw and iDTw;

b) proposes a three-elements architecture;

c) analyses the visualization element and its fidelity, which is a key component of the interface among the three-elements architecture;

d) analyses the elements that constitute an iDTw system to understand the unique properties of iDTw;

e) explores the differentiation from cyber physical systems (CPS) or augmented reality (AR), which are similar to existing concepts of iDTw.

This document excludes:

— applications of iDTw;

— implementation of iDTw.

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 a terminology database for use in standardization at:

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

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

3.1
accuracy
closeness of agreement between a test result or measurement result and the true value

[SOURCE: ISO 3534-2:2006, 3.3.1, modified — Notes 1 to 3 to entry have been removed.]

© ISO 2025 – All rights reserved