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INTERNATIONAL STANDARD

Internet of Things (IoT) - Data format, value and coding for interoperability

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Information technology - Internet of Things (IoT) - Data format, value and coding for interoperability

FOREWORD

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The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1, and the ISO/IEC Directives, JTC 1 Supplement available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

INTRODUCTION

Digital transformation depends strongly on data. Within the field of Internet of Things (IoT), many leading organizations try to model physical entities and environments with structured data.

Digital twins, city and building information models, process industry, automation, automotive and even healthcare, are all technologies or fields in which data models are developed to accommodate domain-specific needs.

Sensors form the backbone of live data generation and help synchronize the digital world with the real world. Numerous data and information models occur in the Information Technology (IT) and Operational Technology (OT) landscape, at various layers in digital systems. Some are verbose, text-based formats (e.g. XML or JSON) that come with more or less rich metadata, while some formats contain only minimal metadata.

The huge variability in how sensory data are represented poses a problem for all parties in the value chain – not least for the data producers themselves. This variability not only affects interoperability but also has significant economic implications. This often puts the economic viability of data collection out of reach, since low data accessibility for data consumers also means poor return of economic value for the data producer.

This has often limited large-scale data collection to domains in which there is a strong need for very specific data collection (such as the automotive industry), and favoured applications where a single data producer has a direct business agreement with the data consumer, and full control over the data model. The design of the data gathering process has often been guided by a single customer's need, with one fixed requirement for data quality.

General purpose data collection remains challenging in the context of Big Data.

The variability in format and inconsistency in data quality are issues that undermine new stakeholders' trust in third-party value chains. Where data might have been accurate enough, an insufficient amount of consistent data-source documentation dissuaded any potential new data consumers – further limiting the capital value of data.

In the end, it has proven difficult for data producers to generate data that is cost-effective to produce and consume – especially with data about physical environments.

This document provides guidance by outlining principles and technical solutions for overcoming this variability and proposes a fundamental representation of data points for sensors and physical quantities that can be used everywhere in the digital landscape to improve the consistency of how both data and metadata are to be interpreted by application logic. When applied correctly, with an agnostic attitude towards application requirements, these principles also help form a baseline for data quality and accessibility.

With the perspective taken in this document, sensory data (after their collection) are regarded as descriptions of a physical entity. This also includes any other physical measurement, such as the physical parameters of real-world objects and systems. The intention is to allow for sensory data to be possible to integrate seamlessly with other data points in physical models under a shared, homogeneous interpretation.

1 Scope

This document defines common formats, values, and coding for data interoperability and exchange among systems in the Internet of Things (IoT).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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/IEC 20924, *Internet of Things (IoT) and digital twin - Vocabulary*

ISO/IEC Guide 99, *International vocabulary of metrology - Basic and general concepts and associated terms (VIM)*

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- [6] BIPM, *The international System of Units (SI)*
Available at: <https://www.bipm.org/en/publications/si-brochure/>
- [7] Quantities Units Dimensions and Data types
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- [8] IEC 60050-723, *International Electrotechnical Vocabulary (EV) - Chapter 723: Broadcasting: Sound, television, data*
- [9] ISO/IEC 60559:2022, *Floating-point arithmetic*²⁰
- [10] ISO/IEC 21823 (all parts), *Internet of things (IoT) - Interoperability for IoT systems*

²⁰ Equivalent with the IEEE-754 standard.