BSI Standards Publication

Internet of things (IoT) — Real-time IoT framework

bsi.

National foreword

This British Standard is the UK implementation of ISO/IEC 30165:2021.

The UK participation in its preparation was entrusted to Technical Committee IOT/1, Internet of Things.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2021

ISBN 978 0 539 12819 2

ICS 33.020

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 February 2022.

Amendments/corrigenda issued since publication

Date	Text affected

ISO/IEC 30165

Edition 1.0 2021-07

INTERNATIONAL STANDARD

colour inside

Internet of things (IoT) – Real-time IoT framework

ISO/IEC 30165:2021-07(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

ISO/IEC 30165

Edition 1.0 2021-07

INTERNATIONAL STANDARD

colour inside

Internet of things (IoT) – Real-time IoT framework

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.020

ISBN 978-2-8322-9897-8

CONTENTS

INTERNET OF THINGS (IoT) – REAL-TIME IoT FRAMEWORK

FOREWORD

1) ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.
2) The formal decisions or agreements of IEC and ISO on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC and ISO National bodies.
3) IEC and ISO documents have the form of recommendations for international use and are accepted by IEC and ISO National bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC and ISO documents is accurate, IEC and ISO cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC and ISO National bodies undertake to apply IEC and ISO documents transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC and ISO document and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC and ISO do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC and ISO marks of conformity. IEC and ISO are not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this document.
7) No liability shall attach to IEC and ISO or their directors, employees, servants or agents including individual experts and members of its technical committees and IEC and ISO National bodies for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this ISO/IEC document or any other IEC and ISO documents.
8) Attention is drawn to the Normative references cited in this document. Use of the referenced publications is indispensable for the correct application of this document.
9) Attention is drawn to the possibility that some of the elements of this ISO/IEC document may be the subject of patent rights. IEC and ISO shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 30165 has been prepared by subcommittee 41: Internet of Things and Digital Twin, of ISO/IEC joint technical committee 1: Information technology. It is an International Standard.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
JTC1-SC41/216/FDIS	JTC1-SC41/229/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

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, available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This document addresses a special kind of IoT system operating in real-time that is called real-time IoT (RT-IoT) systems.

The correct behaviour of a real-time system depends not only on the logical correctness, but also on the timeliness of its actions. Design and development of a real-time system are different from conventional computer systems in terms of real-time OS, embedded development, task scheduling, etc.

[1][1] emphasizes the requirements of timeliness and predictability in real-time systems as follows.

"The challenges and trade-offs faced by the designers of real-time systems are quite different from those who design general purpose computing systems. To achieve the fundamental requirements of timeliness and predictability, not only do conventional methods for scheduling and resource management have to be redesigned, but new concepts that have not been considered in conventional systems need to be added. New paradigms are necessary to specify and validate real-time systems."

Lack of understanding of real-time systems could lead to unsuccessful RT-IoT system deployment where real-time computation is required. A deployment of an RT-IoT system based on the very general real-time capabilities defined in ISO/IEC 30141 [2] is not enough to fully support real-time requirements. Therefore, it is important to complement the real-time capabilities of IoT reference architecture for RT-IoT systems.

Basically, an RT-IoT system has features of a typical IoT system except real-time capability. ISO/IEC 30141 explains real-time capability of an IoT system as follows:

– a characteristic of a system or mode of operation in which computation is performed during the actual time that an external process occurs, in order that the computation results can be used to control, monitor, or respond in a timely manner to the external process

Considering the characteristics of real-time capability, any IoT system embraces real-time aspects to some extent simply because it continuously interacts with the physical world.

Requirements for real-time capability depend on the peer that an IoT system interfaces with. For example, a human–machine interface guarantees a maximum delay of 250 ms in presenting responses to humans, whereas 150 ms is sufficient in a telephone service. Any IoT system interfacing with physical things guarantees some extent of timeliness because any event in the physical world demands timely adjustment from the IoT system.

This document focuses on real-time capability in addition to very general description given in ISO/IEC 30141, because failing on timing constraints could cause serious damage to an IoT system or to its environment, including injury or even death of people involved. Certain RT-IoT systems, such as industrial IoT (IIoT) systems and cyber-physical systems (CPS), consider time as of high importance.

The purpose of this document is to provide a guideline for deploying an RT-IoT system to avoid pitfalls that usually occur during real-time system developments.

[1] Numbers in square brackets refer to the Bibliography.

INTERNET OF THINGS (IoT) – REAL-TIME IoT FRAMEWORK

1 Scope

This document specifies the framework of a real-time IoT (RT-IoT) system, including:

– RT-IoT system conceptual model based on domain-based IoT reference model defined in ISO/IEC 30141;

– impacts of real-time parameters in terms of four viewpoints (time, communication, control and computation).

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 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 http://www.iso.org/obp

3.1.1
real-time IoT
RT-IoT
IoT system with timing constraints

Note 1 to entry: Correct behaviour of an RT-IoT system depends not only on the logical correctness, but also on being able to meet timing constraints.

3.1.2
timeliness
property of meeting timing constraints, finishing before the deadline and giving compulsory response

3.2 Abbreviated terms

2G/3G/4G	second/third/fourth generation mobile networks
5G	fifth generation mobile networks
AI	artificial intelligence
ASD	application and service domain
CPU	central process unit
IoT	Internet of Things
LAN	local area network
OMD	operation and management domain
PED	physical entity domain