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Cybersecurity — IoT security and privacy — Device baseline requirements

Cybersécurité — Sécurité et protection de la vie privée pour l'IdO — Exigences de base relatives aux dispositifs

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Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 27, *Information security, cybersecurity and privacy protection*.
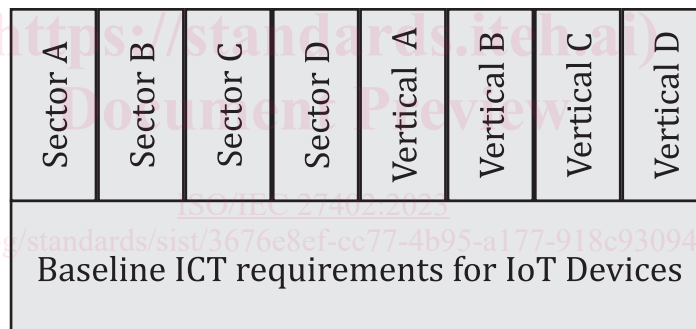
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Introduction

With the increasing number of Internet of Things (IoT) devices and increasing reliance on such devices, the security and privacy risks relating to those "things" are expected to grow. Their widespread deployment in networks and systems make them easy and prime targets for cyber attacks.

This document provides a baseline set of information and communication technologies (ICT) requirements so that IoT devices are able to support security and privacy controls. A risk assessment is critical to develop a risk treatment plan that identifies the necessary IoT device features and countermeasures. The management of systems which use IoT devices depends upon the capabilities of those devices (among other factors).

Broadly speaking, this document addresses ICT requirements for IoT devices that are made available to the market. The requirements in this document are intended as a baseline, upon which vertical markets (such as health, financial services, industrial, consumer electronics and transportation) can build additional requirements for the expected use and risks of IoT devices in their applications, as depicted in Figure 1. In addition to this document, various sectors (e.g. private/industrial, public, defence, national security) and vertical markets have sector- or vertical-specific requirements, for example those found in ETSI EN 303 645[11] for consumer devices and the IEC 62443 series for industrial devices and systems. While this document can provide requirements for a conformity assessment scheme, it is expected that stakeholders for specific sectors and vertical markets will develop consensus around requirements specific to their contexts, building "on top" of this document. Subsequently, conformity assessment programmes can be developed around those specific sectors and vertical markets. This document would be effectively integrated into such programmes while providing a common set of baseline requirements.

Sector A	Sector B	Sector C	Sector D	Vertical A	Vertical B	Vertical C	Vertical D
Baseline ICT requirements for IoT Devices							

NOTE   Additional requirements can be developed or required by specific sectors and vertical markets.

Figure 1 — Relationship between baseline requirements in this document and potential additional requirements

As the complex technical landscape of IoT devices evolves, this document can support a scalable globally harmonized approach to the baseline security and privacy requirements and inform technical policy and regulatory initiatives.

Cybersecurity — IoT security and privacy — Device baseline requirements

1 Scope

This document provides baseline ICT requirements for IoT devices to support security and privacy controls.

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 27000, *Information technology — Security techniques — Information security management systems — Overview and vocabulary*

ISO/IEC 27400:2022, *Cybersecurity — IoT security and privacy — Guidelines*

ISO 31000:2018, *Risk management — Guidelines*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 27000, ISO/IEC 27400, ISO 31000, and the following 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/

3.1.1
identifier
information that unambiguously distinguishes one entity from another one in a given identity context

[SOURCE: ISO/IEC 23093-1:2022, 3.2.7]

3.1.2
user interface
set of all components of an interactive system that provide information and controls for the user to accomplish specific tasks with the interactive system

[SOURCE: ISO 9241-110:2020, 3.10]

3.1.3
internet of things
IoT
infrastructure of interconnected entities, people, systems and information resources together with services which processes and reacts to information from the physical world and virtual world

[SOURCE: ISO/IEC 20924:2021, 3.2.4]

3.1.4
IoT system
system providing functionalities of *internet of things (IoT)* (3.1.3)

Note 1 to entry: An IoT system can include, but is not limited to, *IoT devices* (3.1.5), *IoT gateways* (3.1.7), sensors, and actuators.

Note 2 to entry: Conventional IT devices such as smartphones and laptops can form part of an IoT system.

Note 3 to entry: IoT systems also include cloud and network connectivity.

[SOURCE: ISO/IEC 20924:2021, 3.2.9, modified — notes 2 and 3 to entry have been added.]

3.1.5
IoT device
entity of an *internet of things (IoT) system* (3.1.4) that interacts and communicates with the physical world through sensing or actuating

Note 1 to entry: An IoT device can be a sensor or an actuator.

Note 2 to entry: An IoT device, in this context, is an assembled device usable for its intended IoT functions without relying on being embedded or integrated into any other product.

Note 3 to entry: IoT devices generally interact via communication interfaces.

[SOURCE: ISO/IEC 20924:2021, 3.2.6, modified — notes 1, 2 and 3 to entry have been added.]

3.1.6
IoT device developer
entity that creates an assembled final *internet of things (IoT) device* (3.1.5)

Note 1 to entry: "Final" in this definition means the stage of delivery to the IoT service developer in the assemble process.

[SOURCE: ISO/IEC 27400:2022, 3.4]

3.1.7
IoT gateway
entity of an IoT system that connects one or more proximity networks and the IoT devices on those networks to each other and to one or more access networks

[SOURCE: ISO/IEC 20924:2021, 3.2.8]

3.1.8
trusted computing base
TCB
totality of protection mechanisms within a computer system, including hardware, firmware and software, the combination of which is responsible for enforcing a security policy

3.1.9
cryptographic module
set of hardware, software, and/or firmware that implements security functions and are contained within the cryptographic boundary

[SOURCE: ISO/IEC 19790:2012, 3.25]

3.1.10
critical security parameter
CSP
security-related information whose disclosure or modification can compromise the security of a *cryptographic module* (3.1.9)

Note 1 to entry: A CSP can be plaintext or encrypted.

Note 2 to entry: In the example, "certificates" refers to private keys matching public keys inside certificates.

EXAMPLE 1   Secret and private cryptographic keys, authentication data such as passwords, PINs, certificates or other trust anchors.

EXAMPLE 2   Configuration settings required for initialization.

[SOURCE: ISO/IEC 19790:2012, 3.18, modified — note 2 to entry and example 2 have been added.]

3.1.11
sensitive security parameter
SSP
critical security parameters (3.1.10) and public security parameters

[SOURCE: ISO/IEC 19790:2012, 3.110]

3.1.12
factory default
state of the device after factory reset or after final production/assembly

Note 1 to entry: This includes the physical device and software (including firmware) that is present on it after assembly.

3.1.13
fail-safe mode
device or feature which, in the event of failure, responds in a way that causes no harm, or minimizes the harm, to other devices, and causes no danger, or minimizes the danger, to personnel

[SOURCE: ISO 25197:2020, 3.32]

3.2   Abbreviated terms

API   application programming interface

ASLR   address space layout randomization

CPU   central processing unit

CSP   critical security parameter

ICT   information and communication technologies

IoT   internet of things

PIN   personal identification number

PSP   public security parameter

RoT   root of trust

TCB   trusted computing base

SWID   software identification

XML   extensible markup language

4   Overview

IoT systems bring security and privacy risks, and ISO/IEC 27400 provides general information and guidance about these risks and threats to security and privacy. To address these risks, users (organizations and consumers) should implement appropriate controls, which are also detailed in

ISO/IEC 27400. These controls cannot be implemented if the IoT devices do not have the supporting functionality (process policies, capabilities etc.)

The IoT system developers are expected to develop their own requirements and seek IoT devices that support them. This document provides baseline ICT requirements for IoT devices. In many cases, additional requirements will be imposed or are expected to address the security and privacy risks of specific vertical markets or higher risk environments.

5 Requirements

5.1 Requirements for IoT device policies and documentation

5.1.1 Risk management

5.1.1.1 Requirements

5.1.1.1.1 IoT devices shall have documentation recording the results of a risk assessment process performed at the IoT device level in the context of a risk assessment at the system level.

5.1.1.1.2 The risk assessment process shall take into account intended outcomes for the intended use case.

5.1.1.1.3 The risk assessment process shall also take into account the needs and expectations of interested parties (e.g. those parties on networks to which the IoT device is connected), including physical and logical undesired effects.

NOTE 1   Risk assessment techniques can be found in IEC 31010 and ISO/IEC 27005.

NOTE 2   IoT device developers usually perform the risk assessments and produce the risk treatment plans.

5.1.1.1.4 The risk assessment shall take into account that IoT devices can be constrained (e.g. limited battery, little memory, "weak" CPU), which informs the risk treatment process.

5.1.1.1.5 Risk assessment and treatment processes shall be defined and applied as follows:

a) determine if separate risk assessment and treatment processes are necessary for different products;

b) select appropriate risk treatment options, taking account of the risk assessment results;

    NOTE 1   Sector- or vertical market-specific standards can be used in addition to this document. Such a standard can provide a risk assessment and/or risk treatment plan specific to the sector or vertical market. Complying with such standards can be used to satisfy requirements in this document.

c) determine all controls that are necessary to implement the risk treatment option(s) chosen;

d) identify all security and privacy features of the IoT device from the controls identified in c) above;

    NOTE 2   IoT device developers can design features as required or identify them from any appropriate source, such as an industry standard or sector guidance.

e) compare the features identified in d) above with those in 5.2, and verify that no necessary features have been omitted;

    NOTE 3   5.2 contains a list of baseline features. Users of this document are directed to 5.2 to ensure that no requirements are overlooked.