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# Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) —

## Part 2: Vocabulary and terminology

*Technologies de l'information — Réseaux de capteurs: Architecture de référence pour réseaux de capteurs —*

*Partie 2: Vocabulaire et terminologie*

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# Foreword

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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

This part of ISO/IEC 29182 was prepared by joint technical committee ISO/IEC JTC 1.

ISO/IEC 29182 consists of the following parts, under the general title *Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA)*:

— *Part 1: General overview and requirements*

— *Part 2: Vocabulary and terminology*

— *Part 3: Reference architecture views*

— *Part 4: Entity models*

— *Part 5: Interface definitions*

— *Part 7: Interoperability guidelines*

The following part is under preparation:

— *Part 6: Applications*

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# Introduction

A wide range of applications has been proposed for sensor networks. In practice, however, sensor networks have been built and deployed for a relatively small number of applications. This is partly due to the lack of a business case for certain applications and partly due to technical challenges in building a non-trivial sensor network of reasonable complexity. The main reason for this impediment is that multi-disciplinary expertise – such as sensors, communications and networking, signal processing, electronics, computing, and cyber security – is required to design a sensor network. Presently, the design process is so complex that one can leverage little from one sensor network design to another. It appears as if one has to start from almost scratch every time one wishes to design and deploy a sensor network. Yet, upon closer inspection, there are many commonalities in instantiations of sensor networks that realize various applications. These commonalities include similarities in the choice of network architecture and the entities/functional blocks that are used in the architecture.

The purpose of the ISO/IEC 29182 series is to

— provide guidance to facilitate the design and development of sensor networks,

— improve interoperability of sensor networks, and

— make sensor networks plug-and-play, so that it becomes fairly easy to add/remove sensor nodes to/from an existing sensor network.

The ISO/IEC 29182 series can be used by sensor network designers, software developers, and service providers to meet customer requirements, including any applicable interoperability requirements.

The ISO/IEC 29182 series comprises seven parts. Brief descriptions of these parts are given next, followed by an introduction to Part 4.

ISO/IEC 29182-1 provides a general overview and the requirements for the sensor network reference architecture.

This part of ISO/IEC 29182 provides definitions for the terminology and vocabulary used in the reference architecture.

ISO/IEC 29182-3 presents the reference architecture from various viewpoints, such as business, operational, system, technical, functional, and logical views.

ISO/IEC 29182-4 categorizes the entities comprising the reference architecture into two classes of physical and functional entities and presents models for the entities.

ISO/IEC 29182-5 provides detailed information on the interfaces among various entities in the reference architecture.

ISO/IEC 29182-6 provides detailed information on the development of International Standardized Profiles.

ISO/IEC 29182-7 provides design principles for the reference architecture that take the interoperability requirements into account.

There are no requirements for compliance in ISO/IEC 29182-1 to ISO/IEC 29182-7. Users should ensure that the sensor nodes, and the related sensor network, are compliant with the application or deployment governing body.

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# Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) —

# Part 2: Vocabulary and terminology

## 1 Scope

This part of ISO/IEC 29182 is intended to facilitate the development of international standards in sensor networks. It presents terms and definitions for selected concepts relevant to the field of sensor networks. It establishes a general description of concepts in this field and identifies the relationships among those concepts. It may also be used as guidance for development of other parts of ISO/IEC 29182 and any other sensor network related standard.

## 2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 2.1 General

**2.1.1**
**actuator**
device that provides a physical output in response to an input signal in a predetermined way

**2.1.2**
**backbone network**
network that connects to sensor network gateways through different access networks to transmit information from sensor network to service provider or user

Note 1 to entry: The Internet is one example of backbone networks.

**2.1.3**
**entity**
unit having distinct set of attributes and connected to other unit(s) defined in the sensor network reference architecture

**2.1.4**
**personal area network**
network consisting of sensor nodes, communication devices, or networked peripheral devices all in the vicinity of a person

**2.1.5**
**sensor**
device that observes and measures a physical property of a natural phenomenon or man-made process and converts that measurement into a signal

Note 1 to entry: Signal can be electrical, chemical, etc.

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**2.1.6**
**sensor network**
system of spatially distributed sensor nodes interacting with each other and, depending on applications, possibly with other infrastructure in order to acquire, process, transfer, and provide information extracted from its environment with a primary function of information gathering and possible control capability

Note 1 to entry: Distinguishing features of a sensor network can include wide area coverage, use of radio networks, flexibility of purpose, self-organization, openness, and providing data for multiple applications.

**2.1.7**
**sensor network gateway**
sensor network element that connects a sensor network to another network with different architectures or protocols, permitting information exchange between them

Note 1 to entry: Sensor network gateway functionalities may include address or protocol translation.

**2.1.8**
**sensor node**
sensor network element that includes at least one sensor and, optionally actuators with communication capabilities and data processing capabilities

Note 1 to entry: It may include additional application capabilities.

## 2.2 Reference architecture

**2.2.1**
**reference architecture**
framework that provides common features collected from different types of sensor networks not only to provide developmental guidelines and reuse but also to describe the interrelations and interactions among the entities in a sensor network and possibly between sensor networks

**2.2.2**
**sensor network application**
use case of sensor networks, which provides a set of functions to users to meet defined requirements

EXAMPLE Monitoring forests to detect natural fires; monitoring seismic activity; monitoring pollution levels in environment.

**2.2.3**
**sensor network service**
set of functionalities offered by individual sensor network elements or the sensor network

EXAMPLE Generating an alarm signal if the measurement made at a sensor exceeds or drops out of certain prescribed range; providing average sensor measurements over a given geographic area.

**2.2.4**
**sensor network service provider**
agent that offers sensor network services to users

## 2.3 Communications and networking

### 2.3.1 Protocol stack

**2.3.1.1**
**application layer**
layer that provides means for the application processes to access the OSI environment

[SOURCE: ISO/IEC 2382-26:1993]

Note 1 to entry: This layer provides means for the application processes to exchange data and it contains the application-oriented protocols by which these processes communicate.

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**2.3.1.2**
**data link layer**
layer that provides services to transfer data between network layer entities, usually in adjacent nodes

[SOURCE: ISO/IEC 2382-26:1993]

Note 1 to entry: The data link layer detects and possibly corrects errors that may occur in the physical layer.

**2.3.1.3**
**media access control**
data link sublayer that is responsible for transferring data to and from the physical layer

[SOURCE: ISO/IEC 8802-3:2000]

Note 1 to entry: It provides channel access control mechanisms that make it possible for several sensor nodes to communicate within a sensor network that incorporates a shared medium.

**2.3.1.4**
**network layer**
layer that provides for the entities in the transport layer the means for transferring blocks of data, by routing and switching through the network between the open systems in which those entities reside

[SOURCE: ISO/IEC 2382-26:1993]

Note 1 to entry: The network layer may use intermediate systems.

Note 2 to entry: Network layer intermediate systems are commonly referred to as “routers” and may be used to perform network layer routing of communications between nodes.

**2.3.1.5**
**physical layer**
layer that provides the mechanical, electrical, functional, and procedural means to establish, maintain and release physical connections for transfer of bits over a transmission medium

[SOURCE: ISO/IEC 2382-26:1993]

**2.3.1.6**
**transport layer**
layer that provides a reliable end-to-end data transfer service

[SOURCE: ISO/IEC 2382-26:1993]

Note 1 to entry: Under specific conditions, the transport layer may improve the service provided by the network layer.

### 2.3.2 Basic functions

**2.3.2.1**
**relaying**
process of receiving data from a sensor network element and retransmitting it for the purpose of extending the communication range

**2.3.2.2**
**routing**
process of establishing paths, between a source and a destination, over which packets flow

## 2.4 Data and information processing

**2.4.1**
**information**
structured data concerning objects, such as facts, events, things, processes, or ideas, including concepts, that within a certain context has a particular meaning

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**2.4.2**
**aggregation**
process of combining data from various sources

**2.4.3**
**collaborative information processing**
form of information processing in which multiple sensor network elements collaborate, in order to enhance efficiency and improve the quality and reliability of the output

**2.4.4**
**fusion**
deriving information by processing data from various sources

Note 1 to entry: Such data may be sensed data, aggregation of sensor data, or other processed data.

## 2.5 Interfaces

**2.5.1**
**data interface**
specification of data type and exchange protocol used on a physical interface

**2.5.2**
**physical interface**
mechanical, electrical, electromagnetic and/or optical interface

Note 1 to entry: A physical interface may, for example, be defined between two devices such as a sensor, an actuator, and a sensor network element or between a device and a cable.

**2.5.3**
**sensor interface**
set of software and hardware functionalities used to attach sensors to a sensor node, which may be physical interfaces or data interfaces or both

## 2.6 Security and privacy

**2.6.1**
**authentication**
act of verifying the claimed identity of an entity

Note 1 to entry: Entity may include sensor, actuator or sensor network element.

**2.6.2**
**authorization**
granting of rights, which includes the granting of access based on access rights

**2.6.3**
**availability**
property of being accessible and useable upon demand by an authorized entity

[SOURCE: ISO 7498-2:1989, definition 3.3.11]

**2.6.4**
**confidentiality**
property that information is not made available or disclosed to unauthorized individuals, entities, or processes

[SOURCE: ISO 7498-2:1989, definition 3.3.16]

**2.6.5**
**data integrity**
property that data has not been altered or destroyed in an unauthorized manner

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**2.6.6**
**data security**
preservation of data to guarantee availability, confidentiality and data integrity

**2.6.7**
**privacy**
right of individuals to control or influence what information related to them may be collected and stored and by whom and to whom that information may be disclosed

[SOURCE: ISO 7498-2:1989, definition 3.3.43]

## 2.7 Provision of service

**2.7.1**
**device management**
procedures to operate and maintain a sensor network element

**2.7.2**
**identification**
process of recognizing an entity by using its attributes, identifier, etc.

**2.7.3**
**identifier**
character, or string of characters, used to unambiguously identify an entity such as a sensor network element

**2.7.4**
**middleware**
software which allows for interaction between two or more different software entities by hiding their structure and complexity from each other

**2.7.5**
**network management**
care for operation and maintenance of a sensor network, including the monitoring and controlling of its elements and the configuration of the sensor network, and the allocation of resources across the sensor network

**2.7.6**
**quality of service**
collective effect of service performance, which determines the satisfaction of users

Note 1 to entry: The quality of service may be defined at the "user satisfaction" level by a number of metrics that may vary from one sensor network application to another. Quality of service may also be characterized through a number of lower level metrics. For example, when it comes to transmission of information within a sensor network, the appropriate metrics would include packet loss rate and latency, which affect transmission quality.

**2.7.7**
**sensor network integration platform**
middleware which integrates any given sensor network into a wider IT system using an abstraction layer, controls the interaction between sensor networks and existing enterprise infrastructures and supports intra-corporate and cross-company integration

**2.7.8**
**service layer**
conceptual layer that consists of sets of services provided by sensor networks

## 2.8 Others

**2.8.1**
**homogeneous sensor network**
sensor network in which all nodes are interoperable and functionally identical

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**2.8.2**
**heterogeneous sensor network**
sensor network in which not all nodes are interoperable or functionally identical

**2.8.3**
**interoperability**
ability of diverse sensor networks or sensor nodes to exchange information and to make mutual use of the information that has been exchanged

**2.8.4**
**interworking**
functionality to interconnect dissimilar networks in terms of communication technology and/or information manipulation

**2.8.5**
**user**
any person, organization, process, device, program or system which uses services provided by others, and may benefit from the operation of a sensor network

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# Annex A
(informative)

# Alphabetical index



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