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

Part 1: General overview and requirements

Technologies de l'information — Réseaux de capteurs: Architecture de référence pour réseaux de capteurs —
Partie 1: Vue d'ensemble et exigences

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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.

ISO/IEC 29182-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

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*

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 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 are comprised of seven parts. Brief descriptions of these parts are given next.

Part 1 provides a general overview and the requirements for the sensor network reference architecture.

Part 2 provides definitions for the terminology and vocabulary used in the reference architecture.

Part 3 presents the reference architecture from various viewpoints, such as business, operational, system, technical, functional, and logical views.

Part 4 categorizes the entities comprising the reference architecture into two classes of physical and functional entities and presents models for the entities.

Part 5 provides detailed information on the interfaces among various entities in the reference architecture.

Part 6 provides detailed information on the development of International Standardized Profiles.

Part 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.

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

Part 1: General overview and requirements

1 Scope

This part of ISO/IEC 29182 provides a general overview of the characteristics of a sensor network and the organization of the entities that comprise such a network. It also describes the general requirements that are identified for sensor networks.

2 Normative references

The following referenced documents are indispensable for the application 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 29182-2, *Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) — Part 2: Vocabulary and terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29182-2 apply.

4 Conventions

In this part of ISO/IEC 29182:

The keywords “is required to” indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords “is recommended” indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

The keywords “can optionally” and “may” indicate an optional requirement which is permissible, without implying any sense of being recommended. These terms are not intended to imply that the vendor’s implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

5 Overview of sensor networks

A sensor network is a system of spatially distributed sensor nodes interacting with each other and, depending on application, with ICT (Information and Communication Technology) infrastructures, in order to acquire, process, and provide information about the physical world and optionally react to such information.

This clause describes sensor networks from a communication perspective and a service provisioning perspective. Figures 1, 2 and 3 illustrate from a communication perspective the overall architecture and logical arrangements of components in three classes of sensor networks. The sensor networks shown in Figures 1, 2 and 3 gather information about their physical surroundings and deliver this information to the

sensor network user(s), and any of the communications links may be implemented using wired or wireless technologies: there is no constraint in principle on mixing communications technologies within a network.

Figure 1 depicts a standalone sensor network that operates on its own and is isolated from other networks. This type of sensor network may be regarded as an ad hoc sensor network.

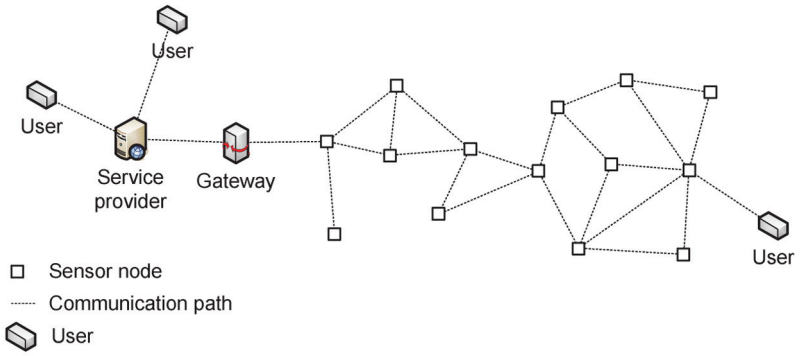

Figure 1 — Standalone sensor network

Figure 2 depicts the case where multiple sensor networks, two in the case of this figure, are interconnected via a gateway. Gateways can play various roles in a sensor network, as shown in Figures 1 and 2 and shortly in Figure 3.

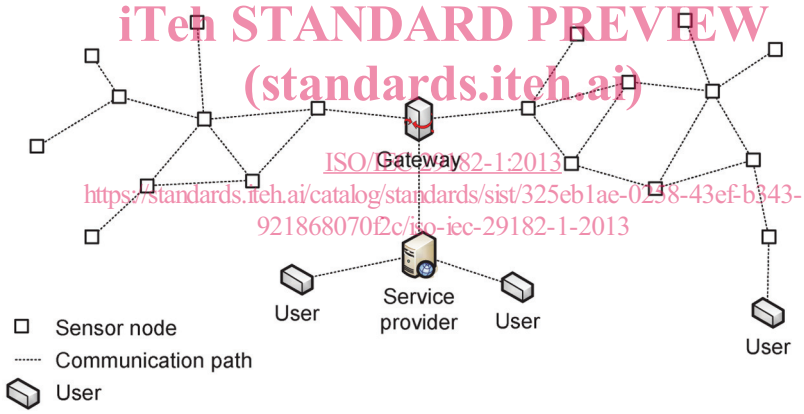

Figure 2 — Interconnected sensor networks

Figure 3 depicts sensor networks, two in the case of this figure, which are connected to a backbone network or other entities. In this case, gateways provide sensor networks with connectivity to other networks possibly through access networks.

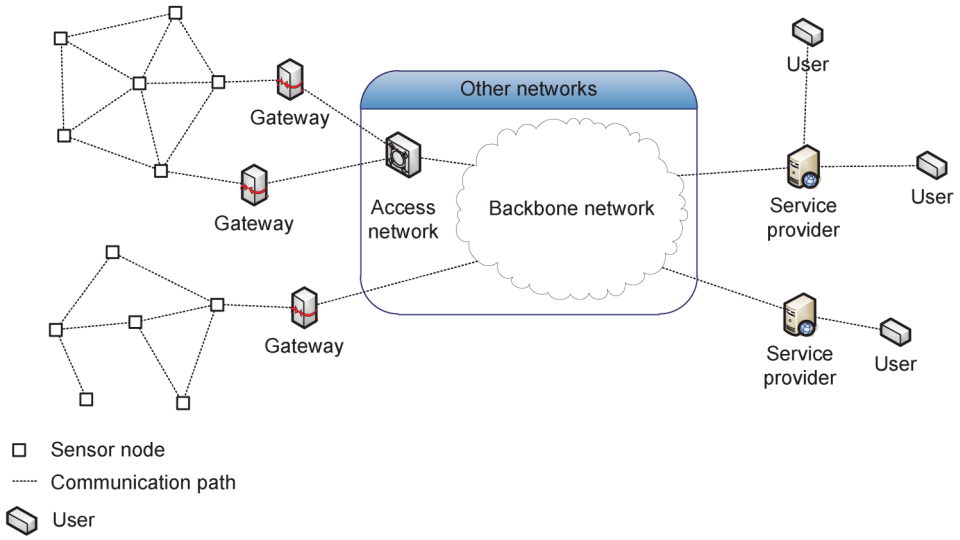

Figure 3 — Sensor networks connected to other networks

Sensor network applications may require application-layer technologies such as data processing (data integration, data filtering), sensor information description and presentation. Data are acquired by sensor nodes and either processed within the sensor network (e.g. sensor nodes in the sensor network) or by service providers connected to the sensor networks, as in Figure 1 and Figure 2. Alternatively it can be transferred, through a backbone network, to applications and other entities such as service providers, as in Figure 3.

As for service provisioning, sensor network services may be provided either by a sensor node directly or by a service provider. Users may request services, without an intermediary, from an arbitrary or a designated sensor node, as in the case of the users on the right side of Figure 1 and 2 or from a service provider, as in the case of the users on the left side of Figure 1, the middle part of Figure 2 and the right side of Figure 3. A service provider gathers sensor data either from sensor networks directly or through a backbone network and facilitates the negotiation of the service to be provided. In some cases, a user that requests services from a sensor node may be integrated with that sensor node.

6 Characteristics of sensor networks

6.1 General

Wired or wireless sensor networks have unique characteristics which differentiate them from traditional data networks. Sensor networks not only perform data transmission but also perform data acquisition, data processing, data aggregation, data management, network management, resource management, automation (sensing and actuation), and other functions and services.

Clause 6 identifies the unique characteristics of sensor networks which differentiate from traditional networks.

6.2 Service provisioning for individual requirements

Sensor network applications and services allow arbitrary and evolving types and grouping of users. For example, weather information may be provided to consumers such as tourists and fishermen as well as business partners such as airlines, shipping companies and travel agencies. Functions and services provided by sensor networks may be quite diverse supporting many applications, market segments and types of users.