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Information technology — Sensor Networks: Sensor Network Reference Architecture (SNRA) — Part 5: Interface definitions

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

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ISO/IEC 29182-5 was prepared by Working Group ISO/IEC JTC 1/WG 7, Working Group on Sensor Network.

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/Terminology*

— *Part 3: Reference architecture views*

— *Part 4: Entity models*

— *Part 5: Interface definitions*

— *Part 6: Application profiles*

— *Part 7: Interoperability guidelines*

Introduction

There are a number of sensor network applications, with a variety of sophisticated functionalities such as burglar alarming, fire alarming, structural health monitoring and meteorological information gathering. Recently sensor network applications are being evolved by new technologies such as wireless sensor networking, context-based processing, global standards, open service environment, nationwide integration, etc. The aim of Sensor Network Reference Architecture (SNRA) is to give an overall understanding that can support this variety of sensor network applications and services.

ISO/IEC 29182 standards comprise of seven parts.

Part 1 provides the general overview and the requirements identified for reference architecture.

Part 2 part provides the definitions of all the terminology and vocabulary used in the sensor network reference architecture.

Part 3 provides the reference architecture views, e.g., business, operational, systems, technical as well as different presentation of the architecture, e.g., functional, logical, etc.

Part 4 provides the description of entity models, e.g., system, subsystem, component models, with their interfaces, functional descriptions, and how they are used in the reference architecture and for implementation.

Part 5 provides detailed, supportive information on the interfaces among the entity models in the reference architecture. The interface definitions include the data/information descriptions, system level specifications, and so on.

Part 6 provides the application profiles that are derived from studies of use cases, scenarios, etc., for sensor network based applications and services.

Part 7 provides the design principles for interoperability based on the reference architecture which is developed with interoperability requirements.

These International Standards can be used by sensor network designers, software developers and service providers to meet customer requirements and the organization's own requirements for interoperability.

Information technology — Sensor Networks — Sensor Network Reference Architecture (SNRA) — Part 5: Interface definitions

1 Scope

This international standard provides the definitions of SN interfaces among the entity models in the reference architecture and covers the following aspects:

- General description of SN interfaces

- Functional requirements of SN interfaces

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 29182-1, *Information technology – Sensor Network: Sensor Network Reference Architecture (SNRA) – Part 1: General overview and requirements*

ISO/IEC 29182-2, *Information technology – Sensor Network: Sensor Network Reference Architecture (SNRA) – Part 2: Vocabulary/Terminology*

ISO/IEC 29182-3 *Information technology – Sensor Network: Sensor Network Reference Architecture (SNRA) – Part 3: Reference architecture views*

ISO/IEC 29182-4 *Information technology – Sensor Network: Sensor Network Reference Architecture (SNRA) – Part 4: Entity models*

ISO/IEC 29182-7 *Information technology – Sensor Network: Sensor Network Reference Architecture (SNRA) – Part 7: Interoperability guidelines*

(To be added)

3 Terms and definitions

For the purposes of this document, the terms and definitions are given in ISO/IEC 29182-2 and ISO/IEC 29182-7.

4 Symbols (and abbreviated terms)

This document uses the following abbreviations and acronyms:

SN Sensor Network

API Application Programming Interface

I/F HW_ SBNF Interface between hardware and services and basic node functions

I/F SBNF_ASM Interface between services and basic node functions and application software modules

I/F N_N Interface between sensor nodes or sensor node and gateway node

I/F SN_ROTW Interface between sensor network and the "Rest of the world"

[To be added]

5   General description of SN interfaces

Sensor network is a system consisting of interconnected and spatially distributed sensor nodes to acquire, process, transfer, and provide information from the physical world and optionally react.

SN has many different applications in different domains such as environment monitoring, logistics management and industrial automation. Up to now, SNs were generally implemented as isolated networks. There exists huge distinguishes on services, processing functions, interfaces, operational attributes of these isolated SNs.

The purpose of developing generic and generalized definition for SN interfaces is to promote the interoperability among sensor nodes (include sensor, actuator, and communications units, and other hardware in the node), sensor networks, and various developers and users. It is an efficient approach to solve the Interoperability problem among the heterogeneous sensor networks.
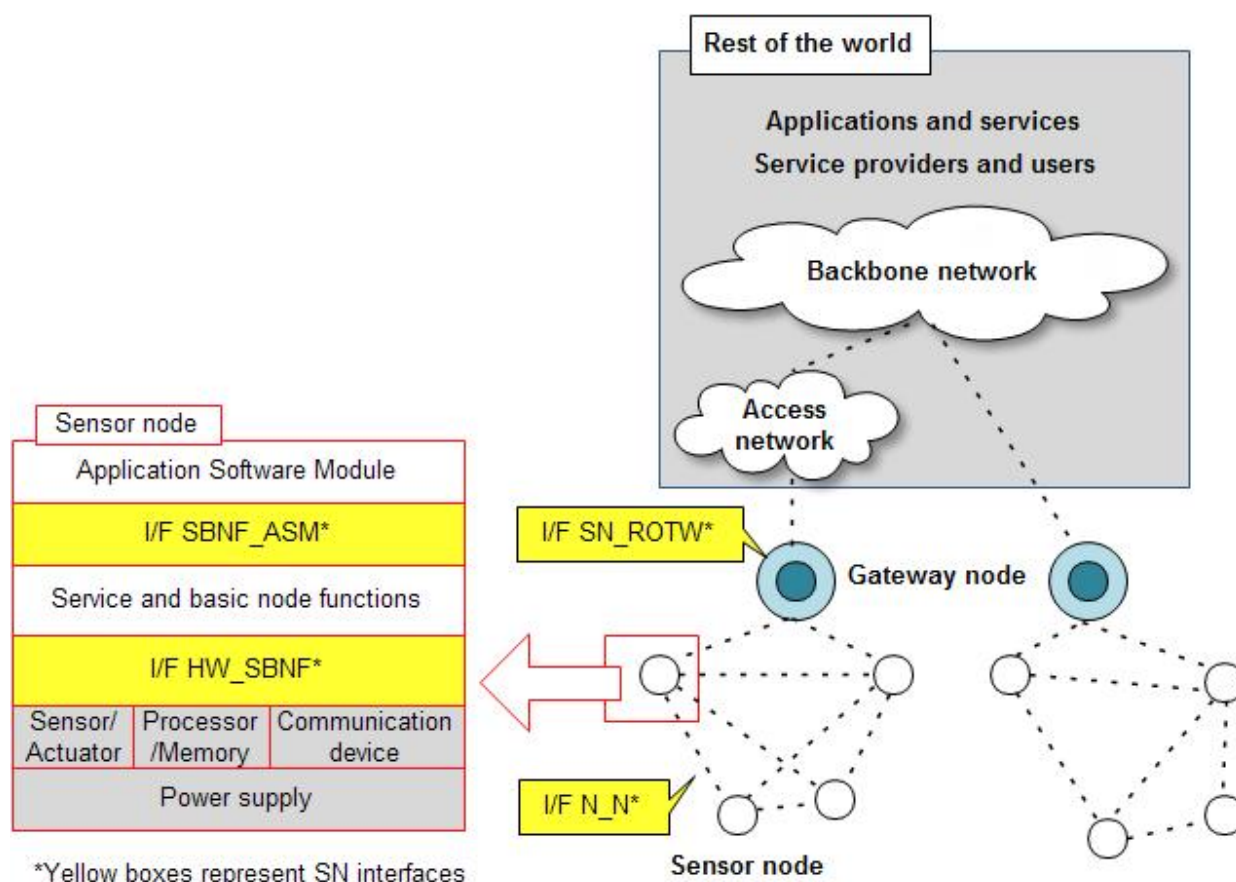

Figure 1-Overall architecture with interfaces for SNs

The left part of Figure 1 shows the main components of a sensor node as follows:

● Node hardware with different types of sensors (see the grey dialog boxes);

● Services and basic node functions;

● Application software modules.

The sensor nodes in the network communicate and collaborate with each other to provide sensed data to target application systems. The SN gateway node connects the "Rest of the World" with other sensor nodes to support the needs of "Rest of the World." The "rest of the world" includes IT companies, service providers, and end-users.

Figure 1 also shows the four primary interfaces (see the yellow dialog boxes) in sensor networks. They are:

● Interface between node hardware and services and basic node functions layer;

● Interface between services and basic node functions layer and application layer;

● Interface between sensor nodes;

● Interface between sensor network and the "Rest of the world".

6   Definitions and functional requirements of SN interfaces

6.1   General

A variety of sensor network applications and services can be established by many alternative networking approaches, middleware, and application functions. For the purpose of standardization, the SN interfaces are required to be determined and developed.

6.2   Interface HW_ SBNF

This is the interface between node hardware and services and basic node function layer in sensor node.

Node hardware supplies the infrastructure including the processor, memory, sensor, communication device, power supply, and other additional hardware etc. The interface HW_SBNF provides the driver service for basic node function layer to use node hardware.

Interface mechanisms that describe data/information between sensor node hardware and different services in service layer or functions in basic node function layer should be defined and developed.

The functional guidelines are summarized below to define the interface HW_SBNF:

◇ Characteristics of sensor node hardware should be explicitly described.

◇ Intelligent sensors/transducers can be integrated with wireless sensor networks when developing the standards for wireless sensor networks. It is necessary to develop the standard interface for sensors/transducers.

◇ Parameters on quality of physical sensor signals shall support target sensor network services for physical data/information delivery requirements.

[To be added]

6.3   Interface SBNF_ASM

This is the interface between services and basic node functions layer and application software module in sensor node.

Application layer has the target application module for the sensor node such as sensor data processing, temperature monitoring, and theft protection. The application software modules can be complex which depending on the complexity of the application.

Service layer provide services to the devices in sensor network such as the sensor node itself as well as other external entities. These services include communication management, group management, data management, device management, security management, location service, etc.

Basic node function layer provide basic function in sensor node such as the clock, network connection, sensing, control, etc. Because basic function layer has the interfaces to the physical connectivity such as network, clock, sensor, actuator, and other hardware that support the sensor node functionality.

The functional guidelines are summarized below to define the interface SBNF_ASM:

◇   For each and every service and basic node function, standard APIs should be developed. Based on these APIs which are considered as "construction modules," application programmers will be able to deliver solutions to users' needs over sensor networks. The modules in service and basic node function layer have the interfaces for application software modules to call.

◇   Induct the list of the common application software modules for the similar applications, and the list of the special application modules for heterogeneous applications to make sure that the standards address all possible sensor network applications.

◇   Identify and setup sets of required services and basic node functions in sensor node, depending on the application demand to analyze the representative services and basic node functions.

◇   Support the bidirectional interaction mechanisms between application software modules and service layer.

[To be added]

6.4   Interface N_N

The sensor node has to transmit sensed data to gateway node or forward to gateway node. The interface N_N is between sensor nodes or sensor node and gateway node.

The functional guidelines are summarized below to define the interface between nodes:

◇   The interface shall support wired and/or wireless connection.

◇   The interface shall include the precondition for data transfer. e.g., communication protocols, connection method.

◇   The physical layer, the media access control and the routing protocol should to be addressed.

◇   Standards should to be either developed or leveraged for wired/wireless communications and for routing the data within the network.

[To be added]

6.5   Interface SN_ROTW

Users have to access sensor networks in order to configure and control the networks. The networks have to be able to push data to and pull data from the application domain, which is the "rest of the world."

The interface SN_ROTW is between sensor network and rest of the world. The functional guidelines are summarized below to define the interface SN_ROTW:

◇ The interface definition should be referred to the connection object in the reference application architecture.

◇ In the remote applications, gateway node can connect to the access network or backbone network from the physical view, and supply data for the middleware of application domain from the logical and functional view. The interface should support the connection to heterogeneous networks. Interface between sensor network and the application domain has to be standardized to support different sensor network applications and the users' needs.

◇ In the local area applications, gateway node can connect to the application service system which is composed by one or more devices running application service software and displaying result for users. The interface should support the connection to the application service system. Interface between sensor network and the application domain has to be standardized to support different sensor network applications and the users' needs.

[To be added]

Bibliography

[1]   ISO/IEC JTC1 SGSN N149, *SGSN Technical Document Version 3.*