

SS ISO/IEC 29182-3 : 2019
ISO/IEC 29182-3:2014, IDT
(ICS 35.110)

SINGAPORE STANDARD

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

– Part 3 : Reference architecture views

SS ISO/IEC 29182-3 : 2019
ISO/IEC 29182-3:2014, IDT
(ICS 35.110)

SINGAPORE STANDARD

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

– Part 3 : Reference architecture views

Published by Enterprise Singapore

All rights reserved. Unless otherwise specified, no part of this Singapore Standard may be reproduced or utilised in any form or by any means, electronic or mechanical, including photocopying and microfilming, without permission in writing from Enterprise Singapore. Request for permission can be sent to: standards@enterprisesg.gov.sg.

© ISO/IEC 2014 – All rights reserved
© Enterprise Singapore 2019

ISBN 978-981-48-9428-9

The content of this Singapore Standard was approved on 17 October 2019 by the Manufacturing Standards Committee (MSC) under the purview of the Singapore Standards Council.

First published, 2019

MSC consists of the following members:

	Name	Representation
Chairman	: Dr John Yong	<i>Individual Capacity</i>
Deputy Chairman	: Mr Brandon Lee	<i>Individual Capacity</i>
Secretary	: Mr Lee Wei Guo	<i>Singapore Manufacturing Federation – Standards Development Organisation</i>
Members	: Dr Karen Chong	<i>Science Engineering Research Council</i>
	Ms Fong Pin Fen	<i>Economic Development Board</i>
	Mr Goh Wee Hong	<i>TÜV SÜD PSB Pte Ltd</i>
	Mr Ho Chi Bao	<i>Enterprise Singapore</i>
	Mr Steven Koh	<i>Singapore Precision Engineering Technology Association</i>
	Ms Lee Wan Sie	<i>Infocomm Media Development Authority</i>
	Dr Jim Li Hui Hong	<i>Individual Capacity</i>
	Dr Lim Ee Meng	<i>National Metrology Centre</i>
	Er. Prof Seeram Ramakrishna	<i>The Institution of Engineers, Singapore</i>
	Mr Sze Thiam Siong	<i>Setsco Services Pte Ltd</i>

MSC sets up the Technical Committee on Smart Manufacturing to oversee the preparation of this standard. The Technical Committee consists of the following members:

	Name	Representation
Co-Chairmen	: Mr Yeoh Pit Wee	<i>Individual Capacity</i>
	Dr Tan Puay Siew	<i>Individual Capacity</i>
Secretary	: Mr Louis Lauw	<i>Singapore Manufacturing Federation – Standards Development Organisation</i>
Members	: Mr Ang Wee Seng	<i>Singapore Semiconductor Industry Association</i>
	Dr Ian Chan Hian Leng	<i>Singapore Institute of Manufacturing Technology</i>
	Mr Cheong Siah Chong	<i>Singapore Industrial Automation Association</i>
	Mr David Chia	<i>Beckhoff Automation Pte Ltd</i>
	Dr Andreas Hauser	<i>TÜV SÜD Asia Pacific Pte Ltd</i>
	Mr Sunny Khoo	<i>Toshiba TEC Singapore Pte Ltd</i>
	Mr Brandon Lee	<i>Singapore Manufacturing Federation</i>
	Prof Lee Loo Hay	<i>National University of Singapore</i>
	Mr Zach Lee	<i>Siemens Industry Software Pte Ltd</i>
	Mr Gerry Ong	<i>SMT Technology Pte Ltd</i>
	Prof John Pang	<i>Nanyang Technological University</i>

Members : Er. Prof Seeram Ramakrishna *The Institution of Engineers, Singapore*
Mr Sim Bak Chor *Infocomm Media Development Authority*
Mr Tian Boon Quey *TRUMPF Pte Ltd*
Mr Toh Hong Wee *PBA Systems Pte Ltd*
Dr Carlos Toro *Advanced Remanufacturing Technology Centre*

The Technical Committee sets up the Working Group on Smart Manufacturing Readiness Level to prepare this standard. The Working Group consists of the following experts who contribute in their *individual capacity*:

Name

Co-Convenors : Mr Brandon Lee
Mr Shridhar Ravikumar

Secretary : Mr Louis Lauw

Members : Dr Ian Chan Hian Leng
Mr Cheong Siah Chong
Mr David Chia
Dr Andreas Hauser
Mr Michael Leong
Dr Lin Wei
Dr Gary Ng
Prof John Pang
Dr Tan Puay Siew
Mr Yeoh Pit Wee

The organisations in which the experts of the Working Group are involved are:

Advanced Remanufacturing Technology Centre
Beckhoff Automation Pte Ltd
INTECH Process Automation Pte Ltd
Nanyang Technological University
Rockwell Automation Southeast Asia Pte Ltd
SESTO Robotics Pte Ltd
Singapore Industrial Automation Association
Singapore Institute of Manufacturing Technology
TÜV SÜD Asia Pacific Pte Ltd

(blank page)

Contents	Page
National Foreword	6
Foreword	7
Introduction	8
1 Scope	9
2 Normative References	9
3 Terms and Definitions	9
4 Abbreviated terms	10
5 Purpose of Sensor Network Reference Architecture	10
6 Overview of Sensor Network Reference Architecture	12
7 Business Architecture	22
8 Information Architecture	23
8.1 Introduction	23
8.2 Application Architecture	23
8.3 Data Architecture	24
9 Technical Architecture	24
9.1 Introduction	24
9.2 Physical View	27
9.3 System View	29
9.4 System Functionality	30
9.5 Technical View	31
Bibliography	34

National Foreword

This Singapore Standard was prepared by the Working Group on Smart Manufacturing Readiness Level set up by the Technical Committee on Smart Manufacturing under the purview of MSC.

This standard is identical with ISO/IEC 29182-3:2014, "Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) — Part 3: Reference architecture views" published by the International Organization for Standardization.

NOTE 1 – Where appropriate, the words "International Standard" are read as "Singapore Standard".

NOTE 2 – Reference to International Standards are replaced by applicable Singapore Standards and Technical References.

This standard is expected to be used by system integrators, government agencies, testing, inspection and certification bodies, professional institutions, institutes of higher learning and training providers.

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions. Where SSs are deemed to be stable, i.e. no foreseeable changes in them, they will be classified as "Mature Standards". Mature Standards will not be subject to further review, unless there are requests to review such standards.*
2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore and the Singapore Standards Council shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR. Although care has been taken to draft this standard, users are also advised to ensure that they apply the information after due diligence.*
3. *Compliance with a SS or TR does not exempt users from any legal obligations.*

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 29182-3 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 6: Applications*
- *Part 7: Interoperability guidelines*

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 of International Standards (ISs) is to

- provide guidance to facilitate the design and development of sensor networks,
- improve interoperability of sensor networks, and
- make sensor network components 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, system integrators, 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.

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

ISO/IEC 29182-2 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.

This part of ISO/IEC 29182 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.

Information technology — Sensor Networks: Sensor Network Reference Architecture (SNRA) – Part 3: Reference architecture views

1 Scope

This International Standard (IS) provides Sensor Network Reference Architecture (SNRA) views. The architecture views include business, operational, systems, and technical perspectives, and these views are presented in functional, logical, and/or physical views where applicable. This IS focuses on high-level architecture views which can be further developed by system developers and implementers for specific applications and services.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 networks: Sensor Network Reference Architecture (SNRA) — Part 1: General overview and requirements*

ISO/IEC 29182-2, *Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) — Part 2: Vocabulary and terminology*

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

ISO/IEC 29182-5, *Information technology — Sensor networks: Sensor Network Reference Architecture (SNRA) — Part 5: Interface definitions*