



IEC PAS 63441

Edition 1.0 2022-10

PUBLICLY AVAILABLE SPECIFICATION



Functional architecture of industrial internet system for industrial automation applications

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040

ISBN 978-2-8322-3964-3

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms, definitions, abbreviated terms, and acronyms	7
3.1 Terms and definition	7
4 General	9
4.1 Function and architecture.....	9
4.1.1 Hierarchy.....	9
4.1.2 Activities of End Layer (Layer 0).....	10
4.1.3 Activities of Edge Layer (Layer 1).....	11
4.1.4 Activities of IaaS Layer (Layer 2).....	11
4.1.5 Activities of PaaS Layer (Layer 3).....	11
4.1.6 Activities of SaaS Layer (Layer 4).....	11
4.1.7 Security	11
4.2 Functional Model	11
5 End layer.....	13
5.1 Overview.....	13
5.2 Model and architecture	13
5.3 Activities of End Layer	14
5.4 End Supports to Edge	14
6 Edge Layer.....	15
6.1 Overview.....	15
6.2 Model and architecture	15
6.3 Activities of Edge Layer	16
6.4 Edge Supports to IaaS.....	16
6.5 Edge Supports to PaaS.....	16
7 IaaS Layer.....	17
7.1 Overview.....	17
7.2 Model and architecture	17
7.3 Activities of IaaS Layer	18
7.4 IaaS Supports to PaaS.....	18
8 PaaS Layer.....	18
8.1 Overview.....	18
8.2 Model and Architecture	19
8.3 Activities of PaaS Layer	20
8.4 PaaS Supports to SaaS	20
9 SaaS Layer.....	20
9.1 Overview.....	20
9.2 Model and architecture	21
9.3 Activities of SaaS.....	21
Annex A (informative) Architecture Case of Industrial Internet System	22
A.1 Overview.....	22
A.2 Application cases.....	22
A.2.1 End and Edge Layer	22
A.2.2 IaaS Layer	23

A.2.3 PaaS Layer..... 24

A.2.4 SaaS Layer..... 25

A.2.5 Smart Application Implementation of SaaS Platform 26

Annex B (informative) Architecture of Mass Customization Platform..... 29

Bibliography..... 31

Figure 1 – Overall architecture of industrial Internet system..... 10

Figure 2 – Functional model of industrial Internet..... 12

Figure 3 – Structure of end layer..... 14

Figure 4 – Functional model of edge layer 15

Figure 5 – Functional structure of IaaS 17

Figure 6 – Functional model of PaaS layer..... 19

Figure 7 – Functional model of SaaS 21

Figure A.1 – Overall architecture of the industrial Internet system in this case 22

Figure A.2 – Full lifecycle service framework of the end and edge layer 23

Figure A.3 – IaaS framework..... 24

Figure A.4 – PaaS service architecture 25

Figure A.5 – Service pattern framework of SaaS 26

Figure A.6 – Equipment management application architecture 27

Figure A.7 – Energy management application architecture 28

Figure B.1 – Overall technical architecture of mass customization platform..... 29

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FUNCTIONAL ARCHITECTURE OF INDUSTRIAL INTERNET
SYSTEM FOR INDUSTRIAL AUTOMATION APPLICATIONS**
FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

A PAS is an intermediate specification made available to the public and needing a lower level of consensus than an International Standard to be approved by vote (simple majority).

IEC PAS 63441 has been processed by IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Draft PAS	Report on voting
65/927/DPAS	65/933/RVDPAS

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of 2 years starting from the publication date. The validity may be extended for a single period up to a maximum of 2 years, at the end of which it shall be published as another type of normative document, or shall be withdrawn.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

For traditional plants, each piece of equipment is isolated, and the production data of equipment is collected manually, while the efficiency of manual statistics is also very low. With the continuous development of industrial automation, digitalization, and intelligent technologies, the intelligent and connected plant combined with "end-edge-cloud" collaboration extends the scope of the original plant and builds close ties between people and production equipment via data. In this way, it realizes the whole process with real-time interconnection between users, equipment and products, achieving zero distance between them, with transparent visibility of the whole process. In addition, the in-depth application of artificial intelligence and big data technologies in the industrial field contributes a large number of algorithms for intelligent optimization and decision-making, thus providing critical solutions for upgrading toward intelligent industrial systems.

FUNCTIONAL ARCHITECTURE OF INDUSTRIAL INTERNET SYSTEM FOR INDUSTRIAL AUTOMATION APPLICATIONS

1 Scope

This document defines the functional architecture and functional model of the industrial internet system for industrial applications. It presents the models, structures, activities, and interaction contents between layers of the end, edge, and cloud: infrastructure as a service (IaaS), platform as a service (PaaS), and software as service (SaaS), respectively.

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.

IEC 62264-1:2013, *Enterprise-control system integration – Part 1: Models and terminology*

IEC 62264-2:2013, *Enterprise-control system integration – Part 2: Object and attributes for enterprise-control system integration*

IEC 62264-3:2016, *Enterprise-control system integration – Part 3: Activity models of manufacturing operations management*