ISO/IEC 15067-3-51

Edition 1.0 2024-06

INTERNATIONAL STANDARD

colour inside

Information technology – Home Electronic System (HES) application model – Part 3-51: Framework of a narrow AI engine for a premises energy management system using energy management agents

ISO/IEC 15067-3-51:2024-0(en)

Documents
Document Sharing Hub

Full document details: ISO IEC 15067-3-51-2024

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2024 ISO/IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about ISO/IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Documents
Document Sharing Hub

Full document details: ISO IEC 15067-3-51-2024

ISO/IEC 15067-3-51

Edition 1.0 2024-06

INTERNATIONAL STANDARD

colour inside

Information technology – Home Electronic System (HES) application model – Part 3-51: Framework of a narrow AI engine for a premises energy management system using energy management agents

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 35.200

ISBN 978-2-8322-9183-2

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

Documents
Document Sharing Hub

Full document details: ISO IEC 15067-3-51-2024

CONTENTS

FOREWORD 4
INTRODUCTION 6
1 Scope 8
2 Normative references 8
3 Terms, definitions, and abbreviated terms 8
3.1 Terms and definitions 8
3.2 Abbreviated terms 11
4 Conformance 11
5 Narrow AI engine for energy management 11
5.1 General 11
5.2 Narrow AI engine for energy management in smart homes 12
6 Framework of narrow AI engine for smart home energy management 13
6.1 General 13
6.2 Entities in narrow AI engine framework 13
6.2.1 Narrow AI engine 13
6.2.2 Electrical energy measuring system 13
6.2.3 Energy management agent 13
6.2.4 Local renewable energy 14
6.2.5 Premises devices 14
6.2.6 User preference 14
6.2.7 Web-based energy related services 14
7 Narrow AI engine with EMA 14
7.1 General 14
7.2 Algorithm derivation 15
7.3 Algorithm and decision management 15
7.4 Data management 15
7.5 Operational modes of narrow AI engine 15
8 HES gateway support 16
8.1 HES gateway related services 16
8.2 Inside HES gateway 17
8.2.1 Framework for HES gateway services 17
8.2.2 EEMS service 17
8.2.3 Web energy service 18
8.2.4 AI services 18
8.2.5 Authorization service 18
8.2.6 PEMA services 18
8.2.7 Web info interface module (WAN) 18
8.2.8 HAN interface module 18
8.2.9 HES-CLME 18
Annex A (informative) Example internal modules of narrow AI engine for building AI algorithm 19
A.1 Overview 19
A.2 Internal modules of narrow AI engine 19
A.2.1 Block diagram of the narrow AI engine 19
A.2.2 Algorithm selector 20
A.2.3 Algorithm training, validating and testing 21

AVA Documents
Document Sharing Hub
Full document details: ISO IEC 15067-3-51-2024

A.2.4 Algorithm optimization 21
A.2.5 Algorithm dictionary 21
A.2.6 Algorithm store 21
A.2.7 Decision handler 21
A.2.8 Data pre-processing 21
A.2.9 Data store 22
A.2.10 Data collecting 22
Annex B (informative) Use cases for an AI energy management engine 23
B.1 Supply planning and DR prediction for efficient home management based on narrow AI engine 23
B.2 Use cases of narrow AI engine 24
Bibliography 25

Figure 1 – Core interoperability and HES gateway 7
Figure 2 – HES AI applications 7
Figure 3 – Logical framework of smart home energy management with support from narrow AI engine in the deployed mode 12
Figure 4 – Operating flow of narrow AI engine in deployed mode 16
Figure 5 – Operating flow of narrow AI engine in learning mode 16
Figure 6 – Narrow AI for PEMA application ISEE group 17
Figure A.1 – Operating modules of the narrow AI engine in deployed mode 19
Figure A.2 – Operating modules of the narrow AI engine in learning mode 20
Figure B.1 – Scenario of an EMA with narrow AI engine for efficient smart houses 23
Figure B.2 – Use case of DR management with and without narrow AI engine 24

Documents
Document Sharing Hub
Full document details: ISO IEC 15067-3-51-2024

© ISO/IEC 2024

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) APPLICATION MODEL –

Part 3-51: Framework of a narrow AI engine for a premises energy management system using energy management agents

FOREWORD

1) 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.

2) The formal decisions or agreements of IEC and ISO 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 and ISO National bodies.

3) IEC and ISO documents have the form of recommendations for international use and are accepted by IEC and ISO National bodies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC and ISO documents is accurate, IEC and ISO 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 and ISO National bodies undertake to apply IEC and ISO documents transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC and ISO document and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC and ISO do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC and ISO marks of conformity. IEC and ISO are not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this document.

7) No liability shall attach to IEC and ISO or their directors, employees, servants or agents including individual experts and members of its technical committees and IEC and ISO National bodies 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 ISO/IEC document or any other IEC and ISO documents.

8) Attention is drawn to the Normative references cited in this document. Use of the referenced publications is indispensable for the correct application of this document.

9) IEC and ISO draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC and ISO take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC and ISO had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch and www.iso.org/patents. IEC and ISO shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15067-3-51 has been prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
JTC1-SC25/3225/FDIS	JTC1-SC25/3245/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1, and the ISO/IEC Directives, JTC 1 Supplement available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

Documents
Document Sharing Hub

Full document details: ISO IEC 15067-3-51-2024

© ISO/IEC 2024

A list of all parts of the ISO/IEC 15067 series, published under the general title *Information technology – Home Electronic System (HES) application model*, can be found on the IEC and ISO websites.

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.

Documents
Document Sharing Hub

Full document details: ISO IEC 15067-3-51-2024

INTRODUCTION

This document adds artificial intelligence (AI) functions to support the energy management agent (EMA) specified in ISO/IEC 15067-3 for EMAs located on customer premises. A narrow AI engine framework and guidelines for implementation in an EMA are provided. Furthermore, the placement of AI support infrastructure in an EMA addresses the challenges of developing a scalable energy management solution for home energy management. The narrow AI engine is a system that is deployed inside a home to operate as the protected on-premises system for energy management. The narrow AI engine responds to energy management events by operating an AI algorithm customized for energy management.

The HES gateway, specified in the ISO/IEC 15045 series and ISO/IEC 18012 series, supports the AI functionality. The term "premises energy management agent (PEMA)" is introduced as a type of EMA that is hosted on the HES gateway. The PEMA primarily focuses on the needs, including generation and storage, of the premises, while the connection to the public utility can also be included when aligned with the needs of the premises.

The objective of the AI functions in an EMA is to help the consumer decide from which source and when to acquire power and to which loads and at which times this power should be allocated. Sources may include a public power utility, an aggregator, a prosumer (a producer and consumer with excess power who offers the surplus for sale through a transactive energy scheme), local generators (such as wind or solar), or batteries (stationary or mobile). Loads can include consumer electronics, appliances, and EV chargers. The EMA decision assistance is predicated on the consumer’s time and day preferences for appliance usage and electric vehicle (EV) charging, constrained by the consumer’s budget for energy and any preference for reducing greenhouse gas emissions to mitigate climate change. The EMA is introduced to provide energy management focused on the needs of a premises, while considering local power generation such as wind turbines and solar panels, and energy storage (collectively called PER – premises energy resources).

This document specifies a high-level framework of a narrow AI engine to facilitate an energy management system. The narrow AI engine provides several capabilities such as demand prediction, decision making for energy consumption, and control. This AI framework offers a robust and scalable energy management solution for home energy management.

The EMA provides automation to help the user make and execute complex decisions in real time. We are seeking practical AI that can be deployed locally. On-premises deployment implies that the narrow AI engine can be executed in consumer or commercial electronic devices that are affordable in a competitive marketplace. Also, customer data are not shared with a service provider in the cloud, thus protecting privacy. Energy consumption patterns can reveal considerable information about equipment owned and activities identifiable by location and time. For this reason, the AI implementation specified is called "protected on-premises." In many cases, AI performance, and hence the value of the EMA, may be significantly increased if at least part of the AI learning phase is performed in the cloud or at other computational entities outside the premises. The cloud, as well as the use of additional local computational resources outside the premises, allows for use of more computational power as well as access to additional aggregated data that can improve the results of AI algorithms. If there is use of any customer data outside the premises in a learning phase, it would be subject to customer permission and may be protected by the HES gateway functions.

This AI framework may be extended beyond energy management for other home applications.

Figure 1 shows the core interoperability and HES gateway documents. Figure 2 shows the narrow AI engine series of documents consisting of three parts:

– ISO/IEC 15067-3-51: Framework
– future planned parts on data model (ISO/IEC 15067-3-52) and service procedure and message flow (ISO/IEC 15067-3-53).

Documents
Document Sharing Hub
Full document details: ISO IEC 15067-3-51-2024

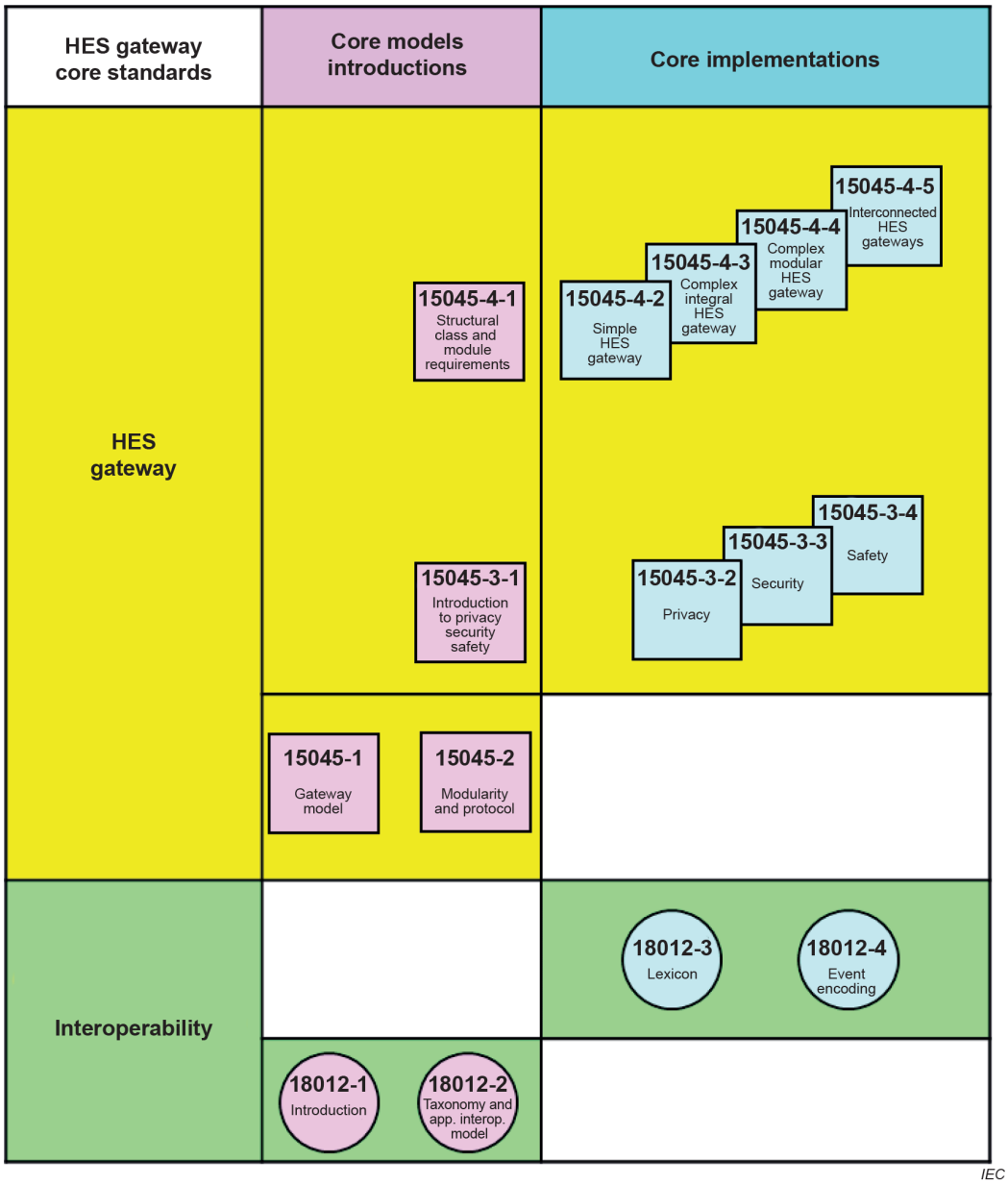

Figure 1 – Core interoperability and HES gateway

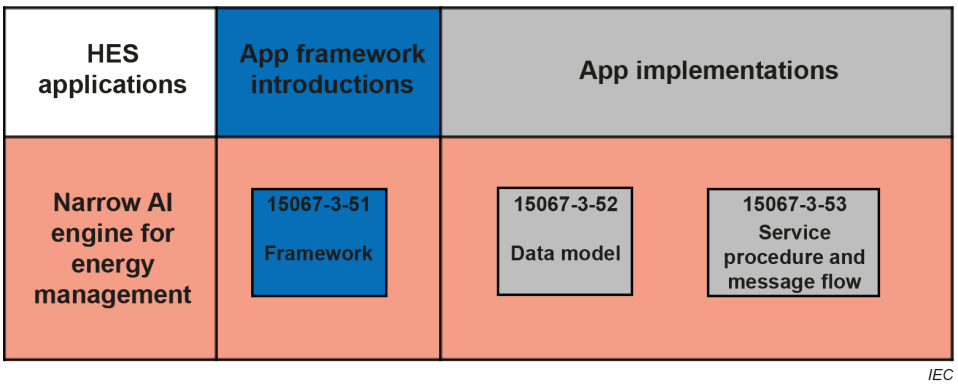

Figure 2 – HES AI applications

NOTE Additional documents needed for implementation are under development.

Documents
Document Sharing Hub
Full document details: ISO IEC 15067-3-51-2024