ISO/IEC 10192-4-1

Edition 1.0 2022-03

INTERNATIONAL STANDARD

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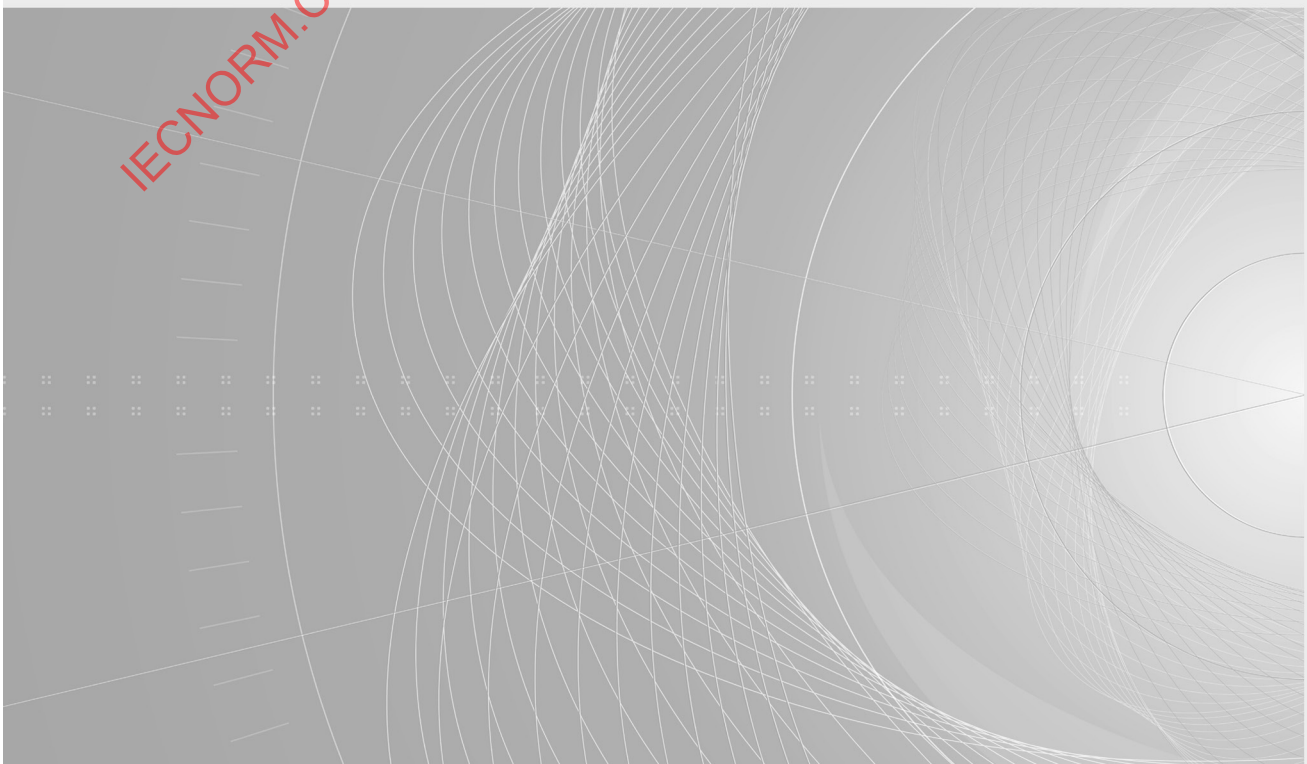
Information technology – Home Electronic System (HES) interfaces – Part 4-1: Common user interface and cluster-to-cluster interface to support interworking among home cluster systems – Architecture



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

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

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CONTENTS

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) INTERFACES –

Part 4-1: Common user interface and cluster-to-cluster interface to support interworking among home cluster systems – Architecture

FOREWORD

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ISO/IEC 10192-4-1 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-SC25/2990/CDV	JTC1-SC25/3032/RVC

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, available at www.iec.ch/members_experts/refdocs and www.iso.org/directives.

A list of all parts in the ISO/IEC 10192 series, published under the general title *Information technology – Home Electronic System (HES) interfaces*, can be found on the IEC website.

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

A home cluster system is implemented by interconnecting several devices to deliver one or more applications. A cluster can function independently of other clusters. Cluster devices include sensors, actuators, a controller, and user interfaces. Multiple home cluster systems can be installed and operated in a single home for the following reasons.

– There are various types of application domains in the home such as lighting, safety, air conditioning, telecommunications, and audio/video, etc. One or more applications are implemented by the constituents of a cluster. If a user purchases several applications, multiple home cluster systems can be installed in a home.

– Home application vendors usually provide systems implemented in clusters of required devices. Depending on the user's needs, several application systems, possibly from different manufacturers, can be installed in a home as separate clusters.

A customer can access a device in a cluster via a user interface provided for that cluster. With multiple clusters a user needs to learn how to operate a range of different interfaces. This document provides the cluster-to-cluster interworking foundation necessary for a single common user interface to manage applications in multiple clusters.

Application-to-application and the resulting device-to-device collaboration are essential for providing integrated services in a multi-device HES environment. For example, if a fire monitoring system detects a fire, the indoor lights should be turned on and the fire announcements should be broadcast through available speakers in the house for prompt evacuation of the residents, the ventilation blowers should be stopped to avoid spreading the fire, and the public fire service should be contacted. This needs collaboration among fire detectors, indoor lights, speakers, HVAC and telecommunication devices. If the devices are located in different clusters, cluster-to-cluster interworking is needed for collaboration among them.

In practice, a safety monitoring cluster might send out a fire-detected message and a lighting cluster might be ready to activate a lighting scene that alerts the occupant by turning on or flashing the appropriate lights. However, the two clusters might not have a way to communicate with each other especially if supplied by different manufacturers possibly using different protocols and messages. This document solves that problem by providing the necessary interworking and interoperability functionality to ensure that the clusters can work together.

When the cluster systems are in different HANs or use different protocols, the interworking is accomplished using the HES gateway (ISO/IEC 15045 series) and related interoperability standards (ISO/IEC 18012 series). Additional standards needed for implementation of this document are under development. For interworking between cluster systems using the same protocols and belonging to the same HAN, HES gateway services may optionally be used if the cybersecurity, privacy and safety features of the HES gateway are desired. This document does not require the Internet to operate, but can connect to the Internet if the application requires.

This document specifies the architecture for interworking home cluster systems where

– the home cluster systems use different HANs or protocols, or

– the home cluster systems use the same HANs and protocols plus the services of the HES gateway.

Figure 1 shows the core interoperability and HES gateway standards. Figure 2 shows the common user interface series of standards designated ISO/IEC 10192-4, *Information technology – Home Electronic System (HES) interfaces – Common user interface and cluster-to-cluster interface to support interworking among home cluster systems*. ISO/IEC 10192-4 consists of three parts:

Part 4-1: Architecture

Part 4-2: Interfaces, services and objects

Part 4-3: Messaging

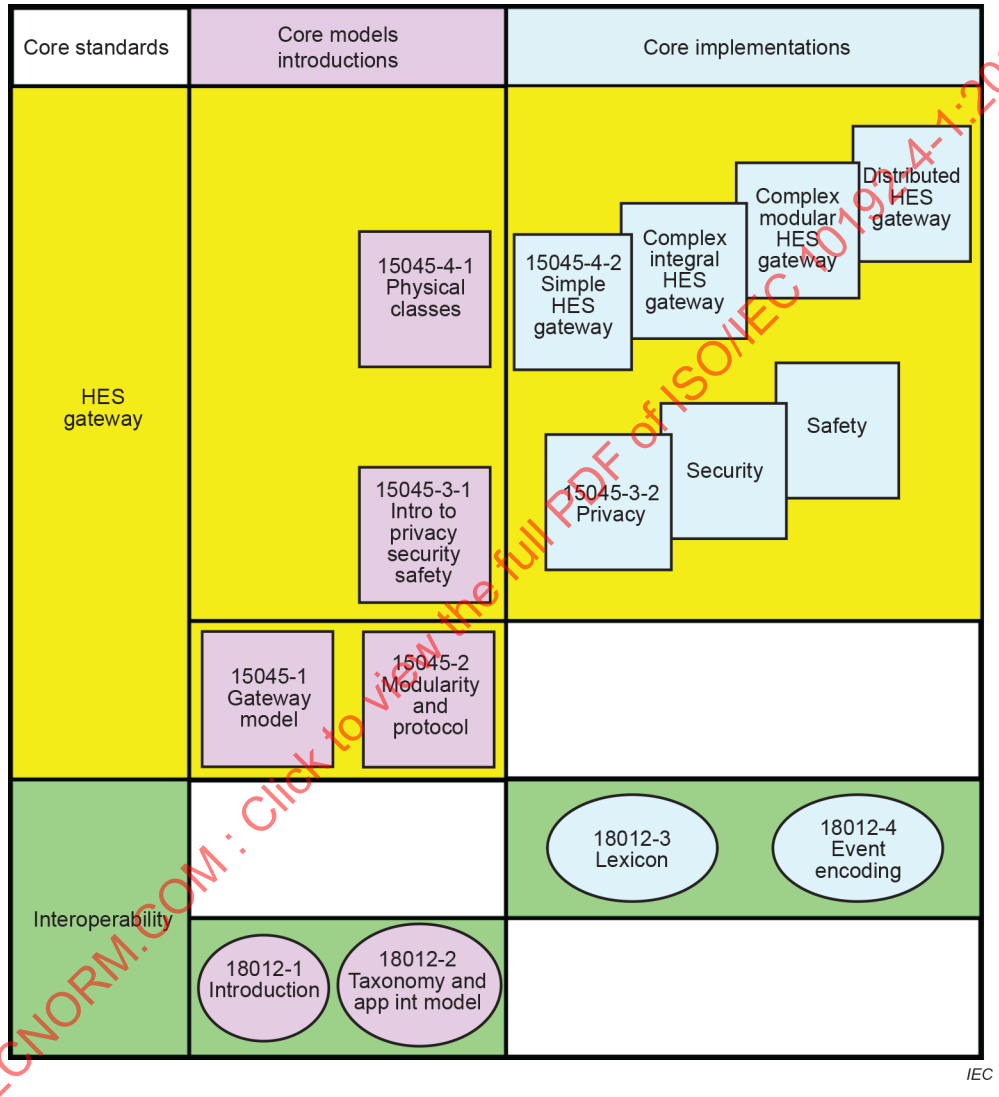

Figure 1 – Core interoperability and HES standards

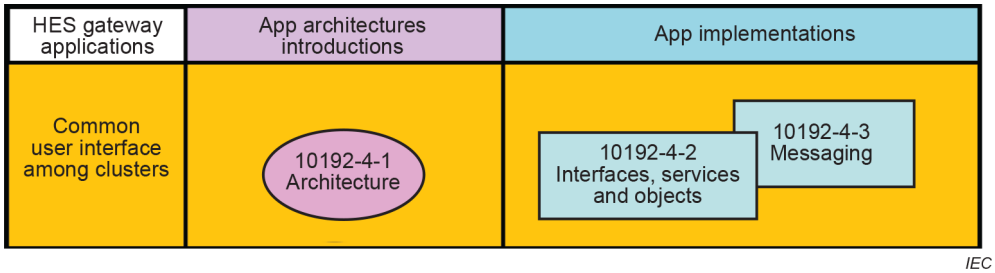

Figure 2 – HES gateway applications standards

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) INTERFACES –

Part 4-1: Common user interface and cluster-to-cluster interface to support interworking among home cluster systems – Architecture

1 Scope

This part of ISO/IEC 10192 specifies an architecture for a common user interface and cluster-to-cluster interface to support interworking among home cluster systems. It specifies a cluster-to-cluster interface to enable interworking among home cluster systems and interoperability among the applications supported by these cluster systems as well as a common user interface to these cluster-system applications. This common user interface provides input and output methods for user information exchange to access, monitor and control applications running on home cluster systems.

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.

ISO/IEC 15045 (all parts), *Information technology – Home Electronic System (HES) gateway*

ISO/IEC 18012 (all parts), *Information technology – Home Electronic System (HES) – Guidelines for product interoperability*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
C2C interface
interface in a cluster that supports HAN communication for C2C interworking with an HES gateway by a cluster controller in a home cluster system

3.1.2
CUI user object
local user object and service that enable users to access, monitor, and control applications running on their home cluster system and to schedule coordination among them

3.1.3
home cluster system
set of functional units under common control in a home environment that includes sensors, actuators, user interfaces, and a cluster controller

3.1.4
master CUI C2C interface
C2C interface of a home cluster system that includes CUI user objects that initiate actions on remote systems

3.1.5
NSEE group
group of HAN and WAN network interface modules, service modules and HES-CLME event encoding to support a particular application or operation

3.1.6
receptive CUI C2C interface
C2C interface of a home cluster system that manipulates the local cluster based upon receipt of CUI user objects from a remote master CUI

3.1.7
user interface
functional system used specifically to interface the computer-based control system to the operator, maintenance personnel, or engineer

[SOURCE: IEC 62270:2013]

3.2 Abbreviated terms

C2C	cluster to cluster
CLME	common language messaging exchange
CUI	common user interface
HAN	home area network
HES	home electronic system
HVAC	heating, ventilation, and air conditioning
NSEE	network (e.g. HAN and WAN network modules), service (e.g. service modules), and event encoding (e.g. HES-CLME)
WAN	wide area network

4 Conformance

Home cluster systems that claim conformance to this document shall:

– support the configuration as specified in Clause 5;
– support the C2C interface as specified in Clause 6.

An HES gateway that claims conformance to this document shall include service modules and features that:

– support the cluster interworking as specified in Clause 6;
– support the common user interface as specified in Clause 7;
– support the C2C interworking application NSEE group as specified in Clause 8.

5 Typical home cluster system

A typical home cluster system is composed of a cluster controller, zero, one or more local sensors, local actuators and local user interfaces, see Figure 3.

A typical home cluster system in this document is an independent cluster that shall have

– one cluster controller in charge of managing local devices in the cluster, and
– zero or more local user interfaces for accessing the cluster functions, and
– at least one or more local sensors and/or actuators.

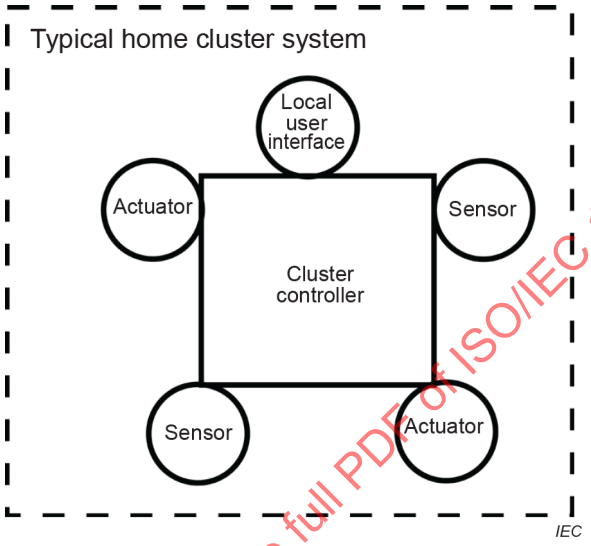

Figure 3 – Typical home cluster system

6 Cluster interworking

To support multi-cluster operation, a typical home cluster system is enhanced with an additional C2C interface to become a C2C enhanced home cluster system. The C2C interface communicates to a cluster controller in a home cluster system via a home area network (HAN), as shown in Figure 4. A cluster can have a remote access interface for external access, which can be used as the C2C interface. Each cluster is designed for a particular transmission medium with a specific communication protocol for the C2C interface. Therefore, the characteristics of the C2C interface can be different for each cluster.

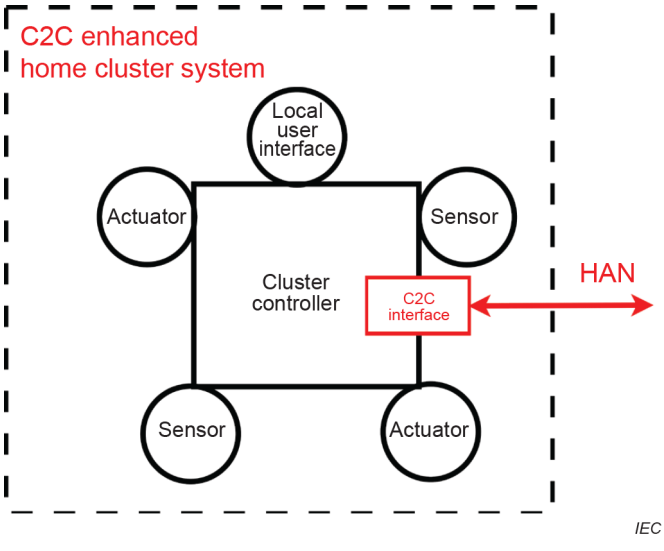

Figure 4 – C2C enhanced home cluster system

A C2C enhanced home cluster system in this document is an independent cluster that shall have

– one C2C interface connected to a HAN, and

– one cluster controller in charge of managing local devices in the cluster so they co-ordinate with devices in other clusters by interworking with other clusters through the C2C interface, and

– zero or more local user interfaces for accessing the cluster functions and optionally servicing as a common user interface for other clusters, and

– at least one or more local sensors and/or actuators.

C2C enhanced home cluster systems shall communicate with each other via the HES gateway (specified in the ISO/IEC 15045 series and ISO/IEC 18012 series) as shown in Figure 5. For interworking between cluster systems using the same protocols and belonging to the same HAN, HES gateway services may optionally be used if the cybersecurity, privacy and safety features of the HES gateway are desired. To comply with this document the C2C interface supports the transfer of information and protocols necessary for the C2C interworking. Cluster manufacturers shall implement the C2C interface in their cluster controllers to support C2C interworking.

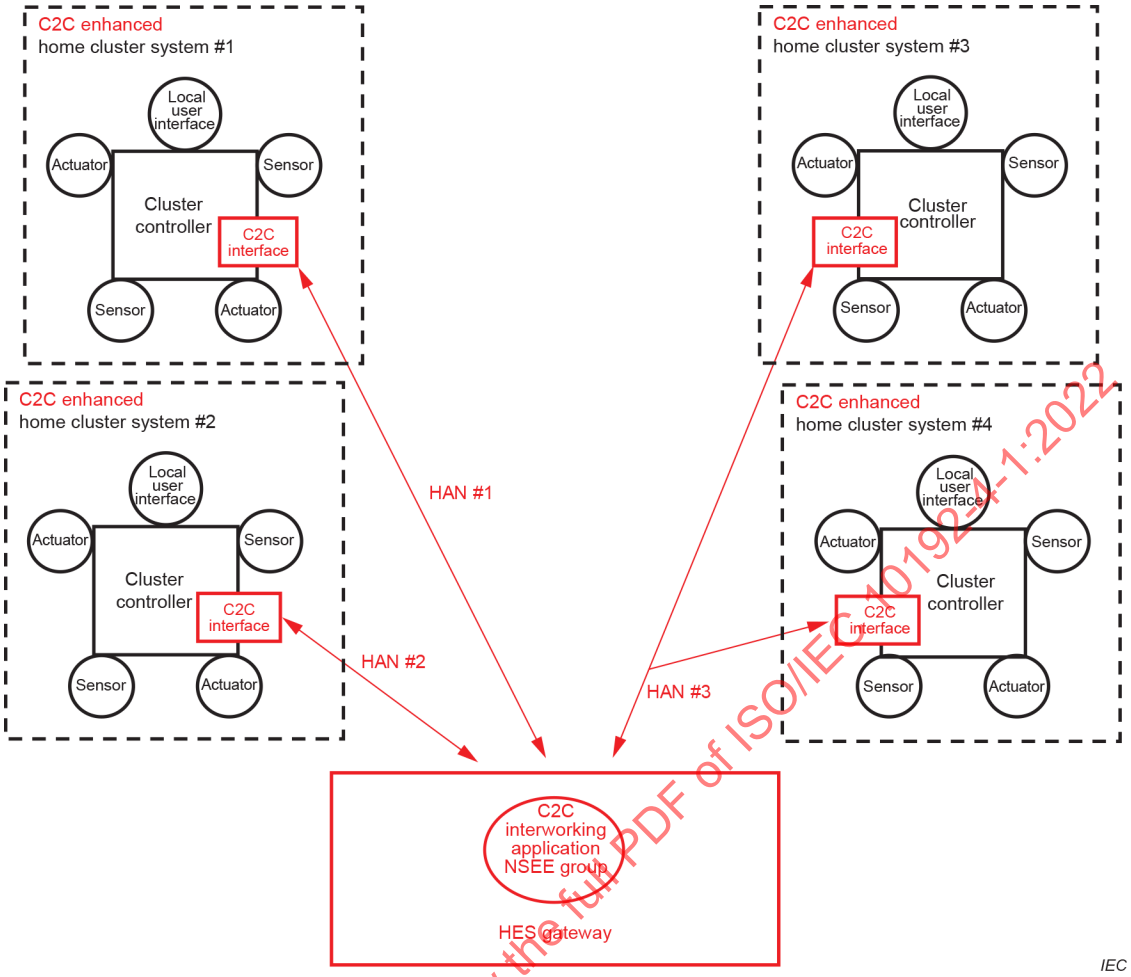

Figure 5 – System layout for cluster interworking

With the communications foundation provided by the cluster interworking functionality, a common user interface can be implemented in a cluster as a separate device or as a service module in the HES gateway.

Each cluster interworks with other clusters exclusively through the HES gateway and exclusively using the objects and messaging of the ISO/IEC 18012 series. Directing cluster-to-cluster communications via the HES gateway ensures that the privacy, security and safety features of the HES gateway protect clusters while supporting full and open interoperability among applications from diverse manufacturers.

The HES gateway contains the C2C interworking application NSEE group to support cluster interworking. The NSEE group specifies the HAN and WAN network interface modules, service modules and HES-CLME event encoding for operations, such as registering the clusters to interwork, user authentication among the clusters, and interworking message translation among the clusters to provide interoperability among heterogeneous clusters.

7 Common user interface

7.1 General

The common user interface (CUI) feature enables one local user interface to be used for multiple clusters in order to access devices in another cluster (if registered with the HES gateway) and to allow collaboration among them, regardless of cluster type or manufacturer. Standardized HES lexicon CUI user objects in a future ISO/IEC 18012-3 provide interoperability of CUI features across the full spectrum of implementations.

The user interface can be implemented with one of three alternatives: in a cluster, as a separate device, or as a service module mounted on the HES gateway.

7.2 Alternative #1: common user interface in a cluster

The local user interface of one of the clusters is chosen to function as the common user interface with the other clusters reacting to this user interface.

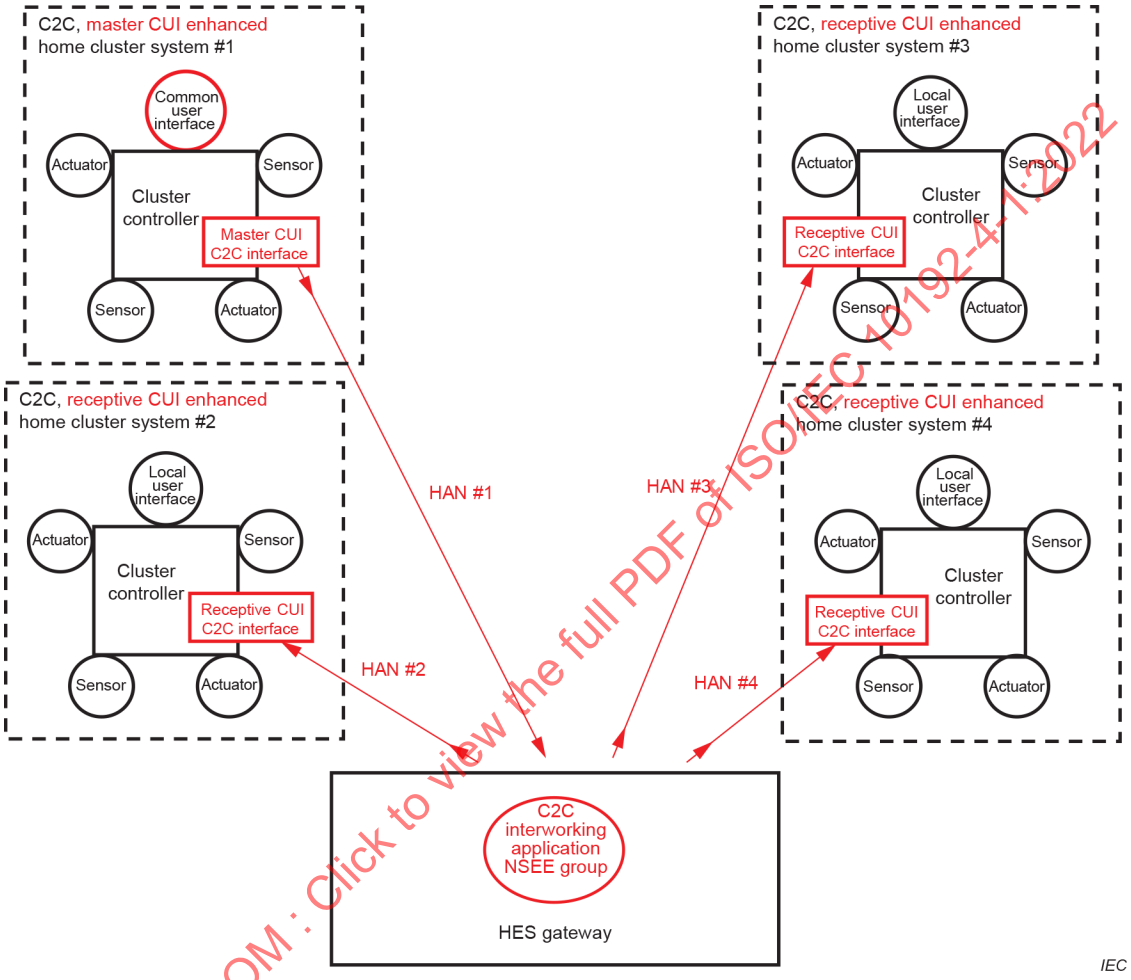

Figure 6 – Common user interface in a cluster

In the example of Figure 6, home cluster system #1 has a common user interface (CUI) feature, which enables it to access not only cluster #1 as a local user interface, but also clusters #2, #3 and #4. This cluster, with the operating common user interface, becomes the C2C, master CUI enhanced home cluster system [1]. The master CUI C2C interface is a communications interface for cluster #1 to communicate via the cluster #1 HAN. The CUI interface supports the transfer of information and procedures necessary over the HAN to operate other clusters through the C2C interworking application NSEE group in the HES gateway.

The home clusters #2, #3 and #4 have receptive CUI C2C interfaces, which communicate over their respective HANs. These clusters become C2C, receptive CUI enhanced home

[1] C2C, master CUI: cluster to cluster (C2C), master common user interface (master CUI).

cluster systems[2]. These interfaces accept the information from the remote user interface (through the HAN) and operate their respective home clusters accordingly.

The master CUI C2C interface emits CUI user objects and the receptive CUI C2C interfaces react to the CUI user objects.

7.3 Alternative #2: common user interface as a separate device

As shown in Figure 7, the CUI separate device is a standalone device for the user interface. This CUI feature enables it to access all the clusters. The master CUI interface is a communications interface for this CUI to communicate via a HAN (e.g. HAN #5). The CUI interface supports the transfer of information and procedures necessary over the HAN to communicate with other clusters through the C2C interworking application NSEE group in the HES gateway.

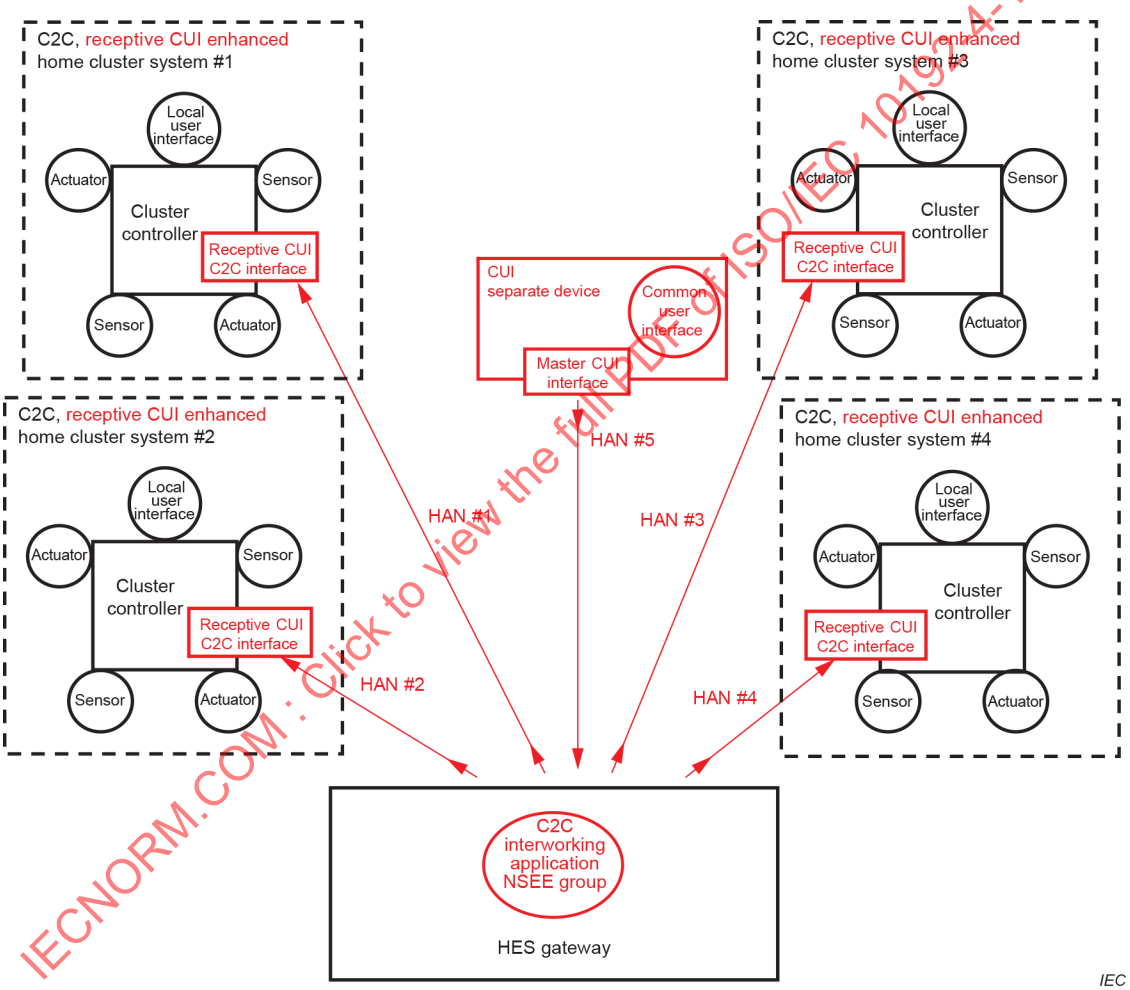

Figure 7 – Common user interface as a separate device

The home clusters have receptive CUI C2C interfaces, which communicate over their respective HANs. These interfaces accept the information from the remote user interface (through the HAN) and operate their respective home clusters accordingly.

---

2 C2C, receptive CUI: cluster to cluster (C2C), receptive common user interface (receptive CUI).

The master CUI interface emits CUI user objects and the receptive CUI C2C interfaces react to the CUI user objects.

7.4 Alternative #3: common user interface in a service module

As shown in Figure 8, the common user interface is supported by the common user interface service module in the HES gateway. The common user interface (CUI) feature enables it to access all the clusters. The service module supports the transfer of information and procedures necessary over the HES-CLME to operate on other clusters through C2C interworking application NSEE group in the HES gateway.

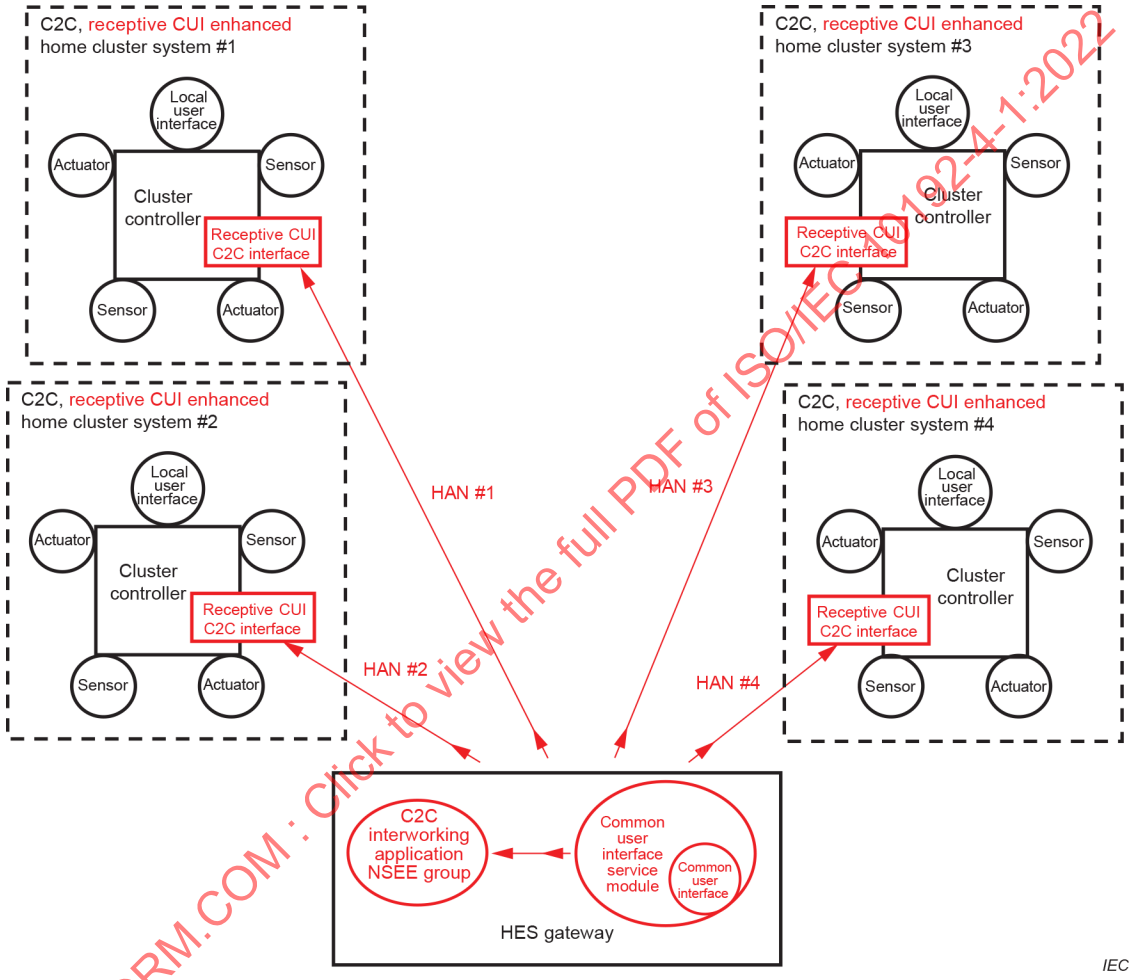

Figure 8 – Common user interface in a service module

The home clusters have receptive CUI C2C interfaces, which communicate over their respective HANs. These interfaces accept the information from the remote user interface (through the HAN) and operate their respective home clusters accordingly.

The common user interface service module in the HES gateway emits CUI user objects and the receptive CUI C2C interfaces react to the CUI user objects.

Annex A describes a use case of a common user interface in an HES gateway service module.

8 Operational system requirements

8.1 General

An operational system requires at its core the C2C interworking application NSEE group in the HES gateway, and also requires the C2C interface in the C2C enhanced home cluster systems, and associated common HES lexicon cluster and CUI user objects.

The C2C interworking application NSEE group within the HES gateway consists of the network interface modules (HAN and WAN), service modules and HES-CLME event encoding necessary to support the cluster-to-cluster interworking application, as shown in Figure 9.

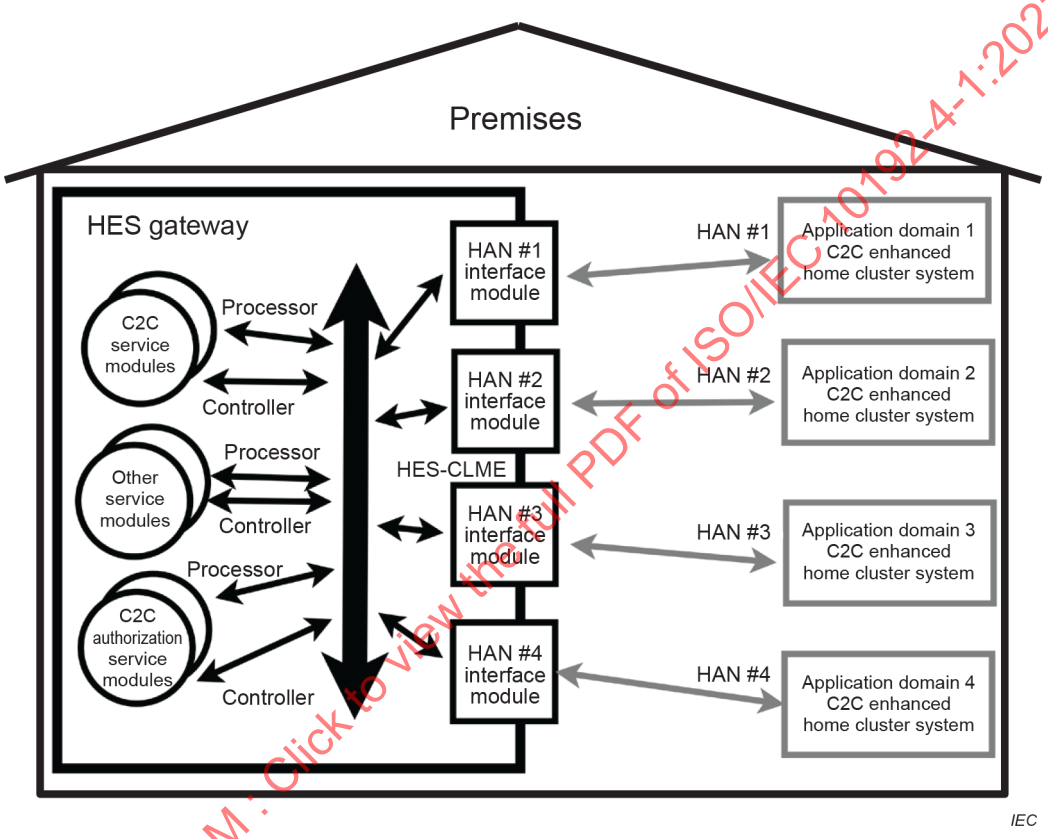

Figure 9 – C2C interworking application NSEE group

The C2C controller service module implements the setup and configuration, such as cluster registration for the C2C processor service. It manages information about the home cluster systems participating in the C2C interworking.

The C2C processor service module executes the real time operation necessary for C2C interworking operation.

The C2C service modules provide support for clusters beyond what is supported by the binding map service module.

The C2C authorization controller service module implements the setup and configuration for the C2C authorization processor service.

The C2C authorization processor service module executes the real time authorization for the cluster-to-cluster operation. This module allows a user authenticated in the cluster to access associated peer clusters without additional authentication.

The C2C authorization service modules provide cluster authorization beyond what is supported by the standard HES gateway authorization service module.

Other controller and processor service modules, such as the binding map, provide operations necessary for the HES gateway to support these applications.

The HAN interface modules (connected to C2C enhanced home cluster systems through HANs) convert their respective HAN messages into standardized HES-CLME messages. All interface modules and service modules communicate to each other using HES-CLME messages.

If the common user interface is in the HES gateway, for example using alternative #3 in 7.4, then there would be in addition a common user interface controller service module and a common user interface processor service module in the HES gateway.

8.2 Other parts of ISO/IEC 10192-4

The detailed specifications for the following will be contained in a future ISO/IEC 10192-4-2 on interfaces, services and objects:

a) HES gateway:
   1) reference to the user objects, service objects and interface objects specified in a future ISO/IEC 18012-3 lexicon standard;
   2) reference to the binding map service specified in a future ISO/IEC 18012-3 lexicon standard and accompanying notes for using this service with clusters;
   3) reference to pertinent network interface and service modules within the ISO/IEC 15045 series;
   4) privacy, security and safety considerations with regard to HES gateway;
   5) other services in the HES gateway provide for clusters such as clock, encryption, etc.

b) Cluster:
   1) specific requirements including objects for the C2C interface in the C2C enhanced home cluster system.

c) The detailed specifications that will be contained in a future ISO/IEC 10192-4-3 on messaging:
   1) reference to pertinent event encoding sections specified in a future ISO/IEC 18012-4 encoding standard;
   2) messaging to support the interfaces, services and objects of ISO/IEC 10192-4-2.

Annex A
(informative)

Use case of common user interface in the HES gateway

A.1 Overview

Annex A describes a use case of a common user interface (CUI) functioning as an application co-ordinator and located in a service module of the HES gateway, as described in 7.4 and as shown in Figure 8.

An application co-ordinator is a controller responsible for managing a group of application domains. The application co-ordinator can provide common scheduling for the applications and facilitate status notification among the applications using lexicon objects to be standardized in a future ISO/IEC 18012-3.

The HES gateway contains the application co-ordinator and CUI features as shown in Figure A.1 and Figure A.2.

A.2 Unified access to devices

As shown in Figure A.1, clusters communicate with other clusters via the HES gateway. During network setup, the application co-ordinator in the HES gateway is configured through the CUI to allow specific clusters to communicate with each other. The user interface at the HES gateway shows which home system clusters are accessible and to which messages devices in those clusters will respond. This allows the application co-ordinator to configure the home system clusters and indirectly affect devices in those clusters.

Once configured, messages are sent from one cluster controller to another cluster controller through the HES gateway. The recipient cluster controller then determines what action to take upon receipt of a specific message.

Since the clusters are likely developed independently by different manufacturers, cluster controllers will communicate with the HES gateway with messages that report status or react to an event. For example, there can be a desire for a fire detection cluster to activate a certain scene on a lighting cluster, such as flashing warning lights. In order to accomplish this, the fire detection system does not send a control signal to the lighting devices directly since it cannot know how many lights are present and where they are located. Instead it tells the lighting controller via the HES gateway where a fire has been detected. The lighting controller then manages the lighting devices, perhaps by initiating a lighting scene with flashing lights in a sequence to indicate an emergency and to show the nearest exit (like emergency cabin lighting in an airplane).