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Information technology – Home electronic system (HES) architecture – Part 5-7: Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Remote access system architecture

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FOREWORD

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International Standard ISO/IEC 14543-5-7 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The list of all currently available parts of the ISO/IEC 14543 series, under the general title *Information technology – Home electronic system (HES) architecture*, can be found on the IEC website and ISO website.

This International Standard has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

INTRODUCTION

The ISO/IEC 14543-5 series of standards specifies the services and protocol of the application layer for Intelligent Grouping and Resource Sharing (IGRS) devices and services in the Home Electronic System.

The ISO/IEC 14543-5 series includes the following parts.

- **IGRS Part 5-1: Core protocol**
  - Specifies the TCP/IP protocol stack as the basis and the HTTP protocol as the message-exchange framework among devices.
  - Specifies a series of device and service interaction/invocation standards, including device and service discovery protocol, device and service description, service invocation, security mechanisms, etc.
  - Specifies core protocols for a type of home network that supports streaming media and other high-speed data transports within a home.
- **IGRS Parts 5-21 and 5-22: Application profiles**
  - Based on the IGRS core protocol.
  - Specify device and service interaction mechanisms, as well as application interfaces used in IGRS basic applications.
  - Multiple application profiles are specified, including:
    - Part 5-21: AV profile
    - Part 5-22: File profile

- **IGRS Part 5-3: Basic application**
  - Includes an IGRS basic application list.
  - Specifies a basic application framework.
  - Specifies operation details (device grouping, service description template, etc.), function definitions and service invocation interfaces.
- **IGRS Part 5-4: Device validation**
  - Defines a standard method to validate an IGRS-compliant device.
- **IGRS Part 5-5: Device type**
  - Specifies IGRS device types used in IGRS applications.
- **IGRS Part 5-6: Service type**
  - Specifies basic service types used in IGRS applications.
- **IGRS Part 5-7: Remote access system architecture**
  - Specifies the architecture and framework for the remote access of IGRS devices and services in the Home Electronic System. The remote access communications protocol and application profiles are specified in following parts of this series:
    - ISO/IEC 14543-5-8: Remote access core protocol
    - ISO/IEC 14543-5-9: Remote access service platform
    - ISO/IEC 14543-5-101: Remote AV access profile
    - ISO/IEC 14543-5-102: Remote universal management profile

  - ISO/IEC 14543-5-11: Remote user interface
  - ISO/IEC 14543-5-12: Remote access test and verification
- The relationships between these parts are specified in this part.

➢ **IGRS Part 5-8: Remote access core protocol** (under consideration)

- Provides detailed system constructions, system function modules, basic conceptions of IGRS remote access elements and their relationships, message exchange mechanisms and security related specifications.
- Specifies interfaces between IGRS remote access (RA) client and service platforms. Defines co-operative procedures among IGRS RA clients.

➢ **IGRS Part 5-9: Remote access service platform** (under consideration)

- Specifies the IGRS RA service platform architectures and interfaces among servers in service platforms.
- Based on the IGRS Part 5-8: Remote access core protocol.

➢ **IGRS Part 5-101 and 5-102: Remote access application profiles** (under consideration)

- Define a device and service interaction mechanism for various applications
- Based on the IGRS Part 5-8: Remote access core protocol
- Two profiles are under development:
  - Part 5-101: Remote AV access profile. This part defines the common requirements for IGRS RA AV users/devices in IGRS networks.
  - Part 5-102: Remote universal management profile. This part specifies a mechanism for integrating devices with both relatively high and low processing capabilities into IGRS networks. It also specifies universal remote device discovery and management frameworks.
- Additional application profiles will be specified in the future.

➢ **IGRS Part 5-11: Remote user interface** (under consideration)

- Specifies adaptive user interface generation and remote device control mechanisms suitable for different remote access applications and devices.

➢ **IGRS Part 5-12: Remote access test and verification** (under consideration)

- Defines a standard method to test and verify IGRS-RA compliant devices and service interfaces.

INFORMATION TECHNOLOGY –
HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

Part 5-7: Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Remote access system architecture

1 Scope

This part of ISO/IEC 14543 specifies the architecture and framework for the remote access of IGRS devices and services in the home electronic system. The remote access communications protocol and application profiles are specified in other parts of this series. The relationship among these parts are specified in this standard.

This standard is applicable to the remote access of an IGRS sub-network (called an IGRS subnet) for resource sharing and service collaboration among home and/or remote computers, consumer electronics and communication devices.

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 18028-4, *Information technology – Security techniques – IT network security – Part 4: Securing remote access*

ISO/IEC 24767-1, *Information technology – Home network security – Part 1: Security requirements*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1
IGRS AS
basic service unit composed of one or multiple IGRS servers

Note 1 to entry: Each IGRS AS (Autonomous System) provides services for a dedicated user/device group and constructs an IGRS RA domain. Different IGRS ASs exchange messages with each other according to the IGRS service platform protocol.

3.1.2
IGRS LAN device
device that conforms to ISO/IEC 14543-5-1 through ISO/IEC 14543-5-6

Note 1 to entry: An IGRS LAN device can join an IGRS remote access (RA) network with the assistance of an IGRS RA agent.

3.1.3
IGRS RA user
user of the IGRS RA devices and application services

Note 1 to entry: Generally, an IGRS RA user is a human being. Each IGRS RA user has a unique user ID (identification). A bundle relationship can be established between one IGRS RA user and another. A binding relationship can be established between one IGRS RA user and one IGRS device.

3.1.4
IGRS RA device
device that is controlled by the IGRS RA user in the IGRS RA system

Note 1 to entry: Each IGRS RA device has a unique device ID (identification). A binding relationship can be established between an IGRS RA device and an IGRS RA user.

3.1.5
IGRS RA agent
functional entity that can provide an IGRS RA service to IGRS LAN devices

Note 1 to entry: The main functionalities of the IGRS RA agent are sending/receiving instructions to/from the IGRS RA service platform and translating the instructions of local IGRS networks to/from those of the IGRS RA networks. The IGRS RA agent provides compatibility among local IGRS devices to IGRS RA devices.

3.1.6
IGRS RA server
instantiation of a service provider that can be assembled into an IGRS RA AS

Note 1 to entry: An IGRS RA server is deployed on the Internet. It maintains relationships among the IGRS RA user and IGRS devices. It also provides retransmissions of collaborative messages. The IGRS RA user/device can start a data connection to the IGRS RA service platform and supports interconnection using the data connection and retransmission functions of the IGRS RA service platform. An IGRS RA AS consists of one or multiple IGRS RA servers.

3.1.7
IGRS RA service platform
collection of IGRS RA service providers that consist of one or multiple IGRS RA AS

Note 1 to entry: Each IGRS RA AS provides services in its own domain and exchanges information with other IGRS RA ASs to provide resource sharing and collaborative services between different domains.

3.1.8
IGRS RA universal management
mechanism for the universal management of all IGRS home appliances and devices

Note 1 to entry: An IGRS RA can manage not only smart devices that have relatively high computation capacities with IP addresses but also non-smart devices that have relatively low computation capacities without IP addresses.

3.2 Abbreviations

AS	Autonomous System
AV	Audio and Video
CPU	Central Processing Unit
ID	IDentification
IGRS	Intelligent Grouping and Resource Sharing
IMT	International Mobile Telecommunication
IP	Internet Protocol
LAN	Local Area Network
NAT	Network Address Translation
PC	Personal Computer
RA	Remote Access

RUI Remote User Interface
SMS Short Message Service
TCP Transmission Control Protocol
TV Television
WAN Wide Area Network

4 Conformance

An IGRS RA system conforming to this standard shall be designed according the architecture specified in Clause 5, the framework specified in Clause 6 and the security guideline specified in Clause 7.

5 IGRS remote access (RA) system architecture

5.1 IGRS RA functionality overview

The IGRS RA specifies a remote network environment that enables an IGRS user/device located outside of the home LAN coverage to connect to an IGRS RA service platform via the Internet or other IP network (such as cable, wireless or mobile network). All IGRS RA specifications are backward compatible with ISO/IEC 14543-5-1 through ISO/IEC 14543-5-6. The IGRS RA protocols extend the functionality of these parts.

According to IGRS RA standards, IGRS RA user/device and IGRS LAN devices can group intelligently, share resource with each other conveniently and interoperate with each other collaboratively.

The IGRS RA series specify:

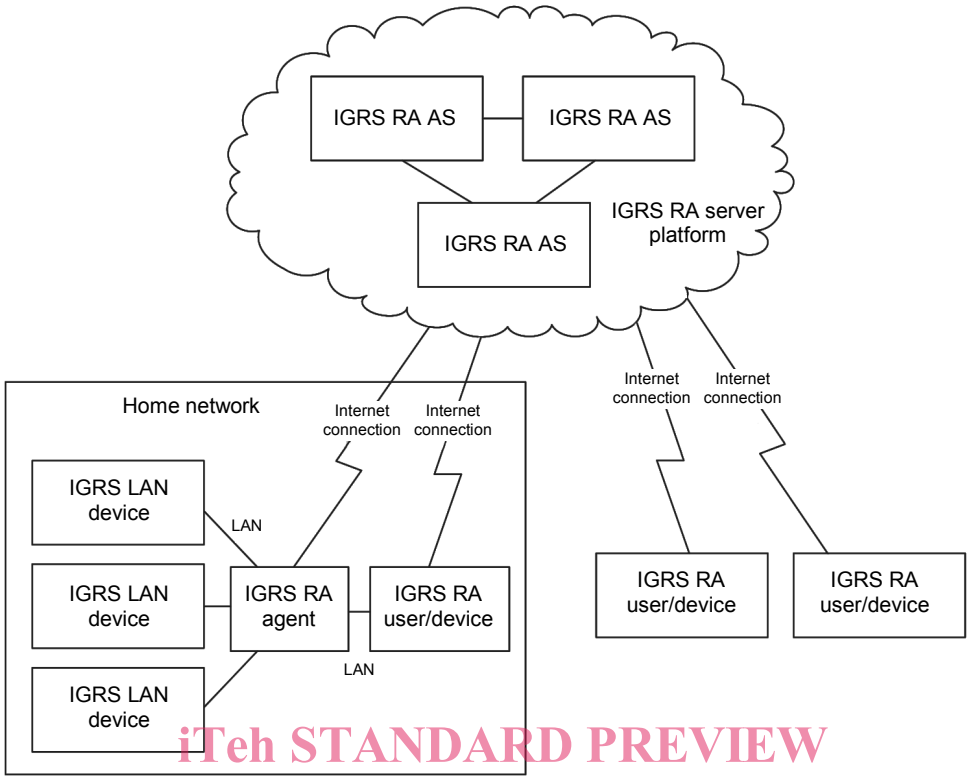
a) the concepts of “IGRS RA user”, “IGRS RA device” and “IGRS RA service platform”;
b) descriptions of interconnectivity and interoperation relationships of “User-Device”, “Device-Device” and “User-User”;
c) interfaces between IGRS RA user/device and service platforms;
d) IGRS RA user/device online status query, description, control and notification mechanisms;
e) binding process between IGRS RA user and device in different subnets;
f) mechanisms for multiple message-exchange modes between IGRS RA clients, such as point-to-point, point-to-multiple point, instantaneous transmission, offline storage, etc. These messages may be transmitted through NAT (network address translation) devices so that IGRS RA clients can discover and share resources within the subnet of each device;
g) uniformed IGRS application layer primitives so that different applications of different providers may interconnect and interact with each other. Additionally, extended application message interfaces are offered to application providers to allow for self-defined interaction messages using an IGRS RA protocol stack.

In the IGRS RA system, TCP/IP persistent connections are established and maintained between the IGRS RA server and terminals. This enables the IGRS RA server to address and to push messages to an online IGRS RA terminal, even if the terminal is behind a NAT device.

NOTE Detailed differences between IGRS RA NAT traversal and other NAT traversal mechanisms, such as ISO/IEC 29341-8 (UPnP Internet gateway device control protocol) and IETF RFC 4918 (WebDAV) will be described in ISO/IEC 14543-5-8 (under consideration).

5.2 IGRS RA system structure

A system diagram of IGRS RA is shown in Figure 1.



IGRS RA AS: IGRS remote access autonomous system

IEC

Figure 1 – IGRS RA system structure

In Figure 1, an IGRS RA system consists of an IGRS RA user/device, IGRS RA server platform, IGRS LAN device and IGRS RA agent (which is used for establishing a connection between IGRS RA user/device and IGRS LAN devices). All IGRS LAN devices and IGRS RA devices within a subnet shall use published IGRS protocols (such as ISO/IEC 14543-5-1, ISO/IEC 14543-5-21, ISO/IEC 14543-5-22, ISO/IEC 14543-5-3, ISO/IEC 14543-5-4, ISO/IEC 14543-5-5, and ISO/IEC 14543-5-6) to interconnect with each other and to establish a home IGRS subnet. That is, IGRS RA protocols are backward compatible to the published IGRS protocols.

When any IGRS RA device enters an IGRS home subnet, it operates as an IGRS LAN device. This IGRS RA device cannot only connect to other IGRS LAN devices by using the IGRS protocols, but can also access an IGRS RA service platform through a connection to an IGRS RA agent. In addition, if the IGRS RA user/device in the home LAN area can access the Internet directly, it may build a connection to the IGRS RA service platform and access the IGRS RA services without any intermediary agent.

An IGRS RA agent may be an independent device or an IGRS RA device embedded with an agent function. An IGRS RA agent shall maintain active Internet connections and can access an IGRS RA service platform by those Internet connections. Through the IGRS RA agent, IGRS LAN devices without IGRS RA functions can both access the IGRS RA service platform and be accessed by other IGRS RA users/devices.

The IGRS RA user/device can maintain a persistent connection to the IGRS RA service platform if it establishes an Internet access connection after leaving the home LAN environment.

An IGRS RA user/device shall register itself with a unique ID in the IGRS RA service platform. A “binding” relationship shall be maintained between the IGRS RA user and his/her devices.