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This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



100/4045/CDV

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SECRETARIAT:

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SECRETARY:

Mr Keisuke Koide

OF INTEREST TO THE FOLLOWING COMMITTEES:

PROPOSED HORIZONTAL STANDARD:

☐

Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

☐ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☐ SAFETY

☐ SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

Multimedia gateway in home networks - Guidelines

PROPOSED STABILITY DATE: 2029

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MULTIMEDIA GATEWAY IN HOME NETWORKS – GUIDELINES

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International Standard IEC 62514 has been prepared by technical area 18: Audio, video and multimedia applications for end-user network, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This second edition cancels and replaces the first edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- Added new multimedia processing functions and requirements the HMG shall support, including adaptive multimedia processing, audio/video remote processing, play function enhancement, etc. in chapter 6;
- Added home automation functions and requirements of audio/video analysis, recognition and alarm services based on AI technologies in chapter 7;

- 170 - Added upgrade function and requirements of HMG in chapter 12;
- 171 - Updated the Normative reference and Bibliography to keep the reference information
172 up-to-date;
- 173 - Updated the media format requirements and communication requirements to support the
174 latest protocols;
- 175 - Revised the Introduction to incorporate the changes in the revision;
- 176 - Added new scenarios in Annex A, including home multi-screen interaction, inward remote
177 sharing, Image recognition and alarm;
- 178 Added Annex B to introduce the changes of the revision in detail;The text of this standard is
179 based on the following documents:

FDIS	Report on voting

180 Full information on the voting for the approval of this standard can be found in the report on
181 voting indicated in the above table.

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

183 The committee has decided that the contents of this publication will remain unchanged until the
184 stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to
185 the specific publication. At this date, the publication will be

- 186 • reconfirmed,
- 187 • withdrawn,
- 188 • replaced by a revised edition, or
- 189 • amended.

190

191

INTRODUCTION

192 In the smart home system, in order to meet the various requirements of home intelligence, all
193 kinds of communication devices (computers, consumer-electrical products etc.) and multimedia
194 devices (TV, surveillance camera, etc.) are integrated into a home network. Such a network
195 (comprising home information, entertainment, control services, etc.) thus forms a system of
196 information exchange with outside networks.

197 In a home network system, terminal devices such as information devices, communication
198 devices, entertainment devices, household appliances, meters of gas, water and electricity,
199 health-care equipment, lighting and security systems, etc. are interconnected through the
200 Internet of Things (IoT) technology to implement the network management and services and
201 share the resources and services in the network. Based on the interconnection of terminal
202 devices, home network system can also provide comprehensive multimedia processing
203 services through the use of multi-screen interactive, remote access, image recognition, and
204 other audio and video processing technologies.

205 The multimedia services and the management for devices mentioned above can be performed
206 through a home multimedia gateway.

207

MULTIMEDIA GATEWAY IN HOME NETWORKS – GUIDELINES

1 Scope

This International Standard describes the general guidelines for typical applications of the home multimedia gateway in home networks supporting IP networking.

This standard specifies recommended functions and services to be supported by the home multimedia gateway and, where appropriate, refers to existing standards supported in the market. For general requirements, it is expected that widely adopted standards and technologies will be considered by implementer.

This standard gives supplementary application to IEC 62481, which specifies a central management model in home network supporting various interfaces in LAN side and WAN side (optional).

This standard is applicable to home multimedia gateways in the home network or networks of similar environment.

2 Normative references

The following referenced documents are indispensable for the application 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 62481 (all parts), *Digital living network alliance (DLNA) home networked device interoperability guidelines*

IEC 62481-1, *Digital living network alliance (DLNA) home networked device interoperability guidelines – Part 1: Architecture and protocols*

IEC 62481-2, *Digital living network alliance (DLNA) home networked device interoperability guidelines – Part 2: Media formats*

ISO/IEC 14762, *Information technology – Functional safety requirements for home and building electronic systems (HBES)*

ISO/IEC 29341 (all parts), *Information technology – UPnP Device Architecture*

ISO/IEC 29341-1, *Information technology – UPnP Device Architecture – Part 1: UPnP Device Architecture Version 1.0*

ISO/IEC 29341-3 (all Parts 3), *Information technology – UPnP Device Architecture – Part 3: Audio Visual Device Control Protocol*

ISO/IEC 15045-1, *Information technology – Home electronic system (HES) gateway – Part 1: A residential gateway model for HES*

ITU-T G.9960 /9961/G.hn *Next generation home networking transceivers*

242 Open Connectivity Foundation™: STANDARDS & ARCHITECTURE: *QUALITY OF SERVICE:3*
243 (*all* *parts*),
244 <https://openconnectivity.org/developer/specifications/upnp-resources/upnp/quality-of-service3/>

245 RFC 2663, *IP Network Address Translator (NAT) Terminology and Considerations*

246 RFC 3022, *Traditional IP Network Address Translator (Traditional NAT)*

247 IEEE 802.1Q™, *IEEE standard for Local and metropolitan Area Networks – Bridges and Bridge*
248 *Networks*

249 **3 Terms, definitions and abbreviations**

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

251 **3.1 Terms and definitions**

252 **3.1.1**

253 **home multimedia network**

254 high speed network system to transport multimedia information within the home network

255 **3.1.2**

256 **home multimedia gateway**

257 **HMG**

258 logical device in the home network, which provides such functions as multimedia processing and
259 home automations, interconnection, QoS and security, etc.; it can also connect LAN with outside
260 networks (for example internet), implementing protocol translation and offer various network
261 services

262 **3.1.3**

263 **home control network**

264 network that transports control information in the home network

265 **3.1.4**

266 **home control gateway**

267 provides protocol translation, device management, network management and control services in
268 a home control network which can be combined with HMG in the form of a physical device

269 **3.1.5**

270 **control point**

271 retrieves device and service descriptions, sends actions to services, polls for service state
272 variables and receives events from Services

273 NOTE 'Service' is a term that is also defined in the ISO/IEC 29341 series.

274 **3.1.6**

275 **terminal device**

276 devices in the home network that can be controlled and managed by HMG and control point

277 **3.1.7**

278 **media receiver**

279 **MR**

280 device that receives media contents

281 NOTE It normally refers to the media content player.

282 **3.1.8**

283 **home media receiver**

284 **HMRec**

285 device that receives media contents in the home network

286 NOTE HMRec should fully support the function of DMR and DMP which are DLNA device classes defined
287 by IEC 62481-1.

288 **3.1.9**

289 **media source**

290 **MS**

291 device that owns media resources and sends media contents

292 **3.1.10**

293 **home media source**

294 **HMSou**

295 device that provides media contents in the home network; it can be a media server

296 NOTE HMSou should fully support the function of DMS and +PU+, which are defined by IEC 62481-1 and IEC 62481-2.

297 **3.1.11**

298 **WAN media source**

299 **WMS**

300 device that provides media contents in the Wide Area Network (WAN)

301 **3.1.12**

302 **WAN media receiver**

303 **WMR**

304 device that receives media contents in the Wide Area Network (WAN)

305 **3.2 Abbreviations**

306	+DN+	Download Controller
307	+PR+	Printing Controller
308	+PU+	Push Uploader
309	+UP+	Upload Controller
310	AAC	Advanced Audio Coding
311	ADSL	Asymmetric Digital Subscriber Line
312	ANSI	American National Standards Institute
313	ARP	Address Resolution Protocol
314	ATA	Analog Telephone Adapter
315	ATRAC	Adaptive Transform Acoustic Coding
316	AV	Audio and Video
317	AVC	Advanced Video Codec
318	CDS	Content Distribution Service
319	CPU	Central Processing Unit
320	DHCP	Dynamic Host Configuration Protocol
321	DLNA	Digital Living Network Alliance

322	DMC	Digital Media Controller
323	DMR	Digital Media Renderer
324	DMP	Digital Media Player
325	DMP _r	Digital Media Printer
326	DNS	Domain Name System
327	DRM	Digital Rights Management
328	DSCP	Differentiated Service Code Point
329	DSL	Digital Subscriber Line
330	DTV	Digital Television
331	EPG	Electronic Program Guide
332	ETH	Ethernet
333	FTP	File Transfer Protocol
334	GENA	General Event Notification Architecture
335	HMRec	Home Media Receiver
336	HMG	Home Multimedia Gateway
337	HMSou	Home Media Source
338	HTTP	Hyper Text Transfer Protocol
339	ICMP	Internet Control Message Protocol
340	ID	Identification
341	IGD	Internet Gateway Device
342	IGMP	Internet Group Management Protocol
343	IP	Internet Protocol
344	IPTV	Internet Protocol Television
345	ITU	International Telecommunication Union
346	JPEG	Joint Photographic Experts Group
347	LAN	Local Area Network
348	LPCM	Linear Pulse Code Modulation
349	MAC	Media Access Control
350	MIU	Media Interoperability Unit
351	MPEG	Moving Picture Experts Group
352	MR	Media Receiver
353	MRCP	MediaRenderer:1 Control Point
354	MS	Media Source
355	MSCP	MediaServer:1 Control Point
356	NAT	Network Address Translation
357	NAPT	Port-Level NAT
358	NID	Network Infrastructure Device
359	PAN	Personal Area Network

360	PC	Personal Computer
361	QoS	Quality of Service
362	RID	Request Identity
363	RIP	Routing Information Protocol
364	SOAP	Simple Object Access Protocol
365	STB	Set Top Box
366	TCP	Transmission Control Protocol
367	UDP	User Datagram Protocol
368	UPnP	Universal Plug and Play
369	URI	Uniform Resource Identifier
370	URL	Uniform Resource Locator
371	VDSL	Very-high-bit-rate Digital Subscriber Line
372	VOD	Video on Demand
373	VOIP	Voice over Internet Protocol
374	WAN	Wide Area Network
375	WMS	WAN Media Source
376	WMM	Wireless Multimedia
377	WMR	WAN Media Receiver

378 **4 HMG architecture**

379 **4.1 Architecture of a home multimedia network**

380 A home multimedia network adopts a multiple levels network topology consisting of two network
381 segments, i.e. a home multimedia network and a home control sub-network. The home control
382 sub-network is optional, where appropriate.

383 The home multimedia network supports the central management mode which can be functioned
384 by HMG, as well as supporting peer-to-peer mechanism as specified in the IEC 62481 series.
385 The home multimedia network can access the outside network through an HMG while the home
386 control sub-network can be connected to the home multimedia network through a home control
387 sub-network gateway. The devices in a home control sub-network can intercommunicate and
388 further access outside networks by sub-gateways and HMG.

389 The typical architecture of a home multimedia system is shown in Figure 1 as follows.

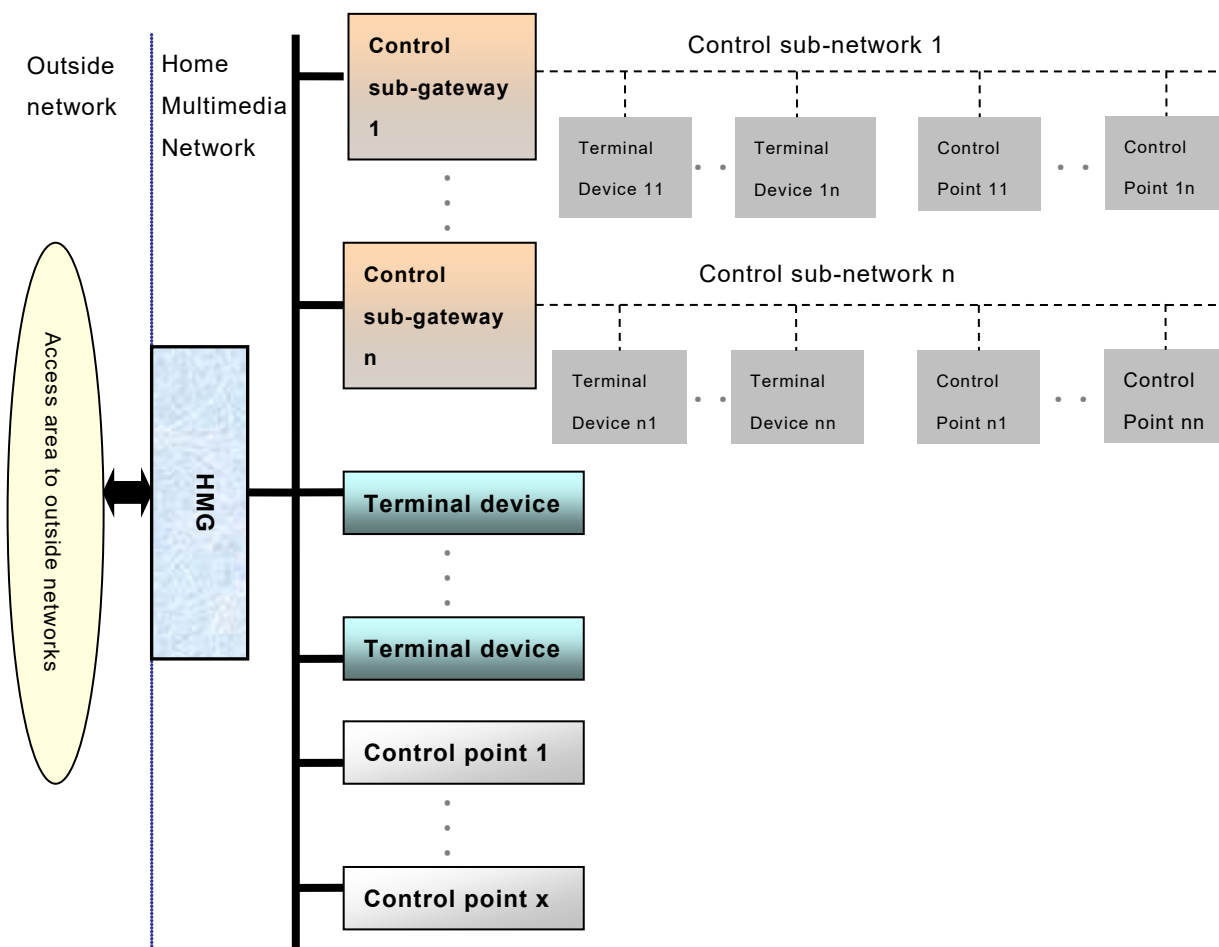


Figure 1 - Architecture for a home multimedia network

4.2 HMG architecture

4.2.1 General

From the aspect of functional structure, the HMG provides such functions as multimedia processing and applications, interconnection, QoS and security, etc. The architecture of the HMG is shown in Figure 2 below.

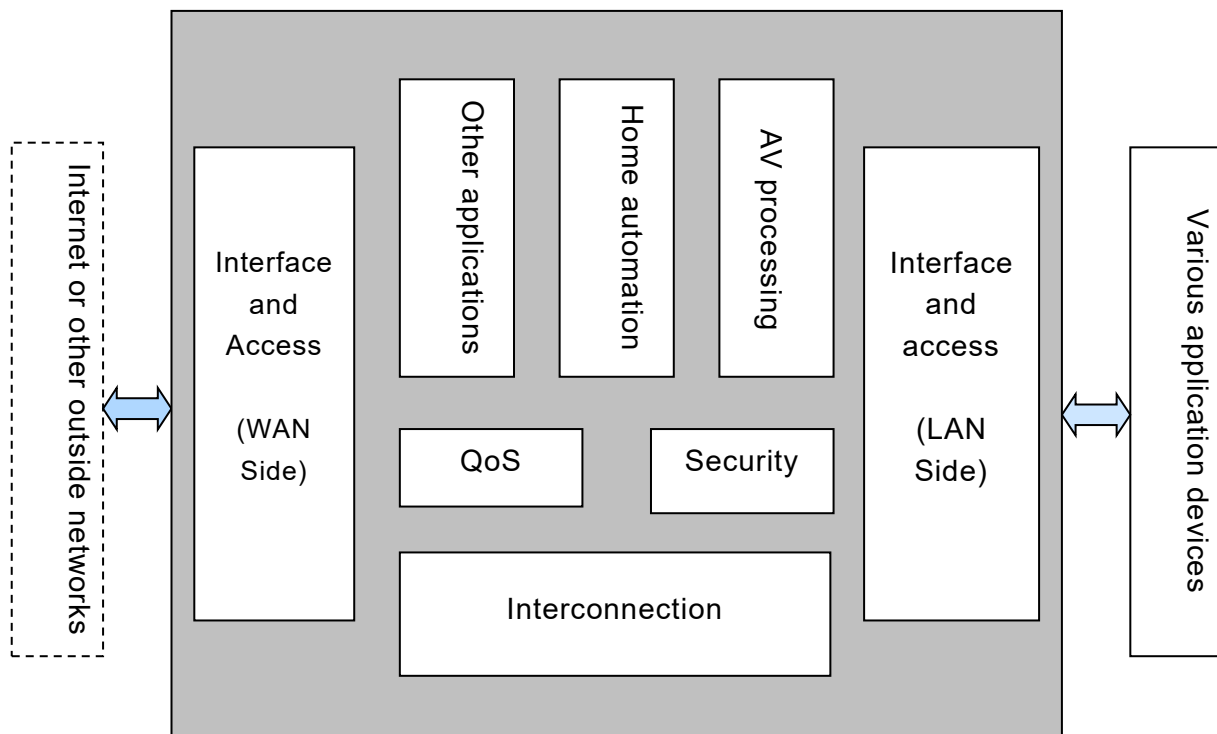


Figure 2 - HMG architecture

4.2.2 AV processing

The HMG shall provide various application services of video and audio in the home multimedia network. It shall fully support all the functions of MIU (includes MSCP, MRCP), DMP+ and +UP+/+DN+/+PR+, which are defined in IEC 62481-1 and IEC 62481-2.

4.2.3 Home automation

The HMG can offer local management and remote management as well as various control services to the devices in the home network.

4.2.4 QoS

HMG should support QoS features in order to transport multimedia contents effectively in the home network where the HMG is involved.

If HMG supports QoS features, then HMG shall use priority tag of QoS in order to transfer the multimedia contents that have IEEE 802.1Q User Priority, WMM Access Category or DSCP.

The detailed requirements of QoS shall be compliant with Networking and Connectivity: QoS requirements in IEC 62481-1.

4.2.5 Security

The HMG shall support DRM, key management, authentication and security to log on outside networks.

4.2.6 Interconnection

HMG shall support the network management, protocol translation, address assignment, configuration and management on the home networked devices, in different multimedia networks.

4.2.7 Interfaces and access

These provide the connection between the home network and outside networks (for example the Internet) when necessary, which is optional.

The detailed interface and communication protocol requirements on both LAN side and WAN side are specified in Clause 11. The specific protocol that is to be applied depends on the application case.

5 Interconnection

5.1 General connection requirements

Where the home multimedia network is an IP network, the requirements for the HMG should be as follows:

- a) HMG shall implement a Dynamic Host Configuration Protocol (DHCP) server in order to assign IP address to DHCP client in the home network where the HMG is involved.
- b) HMG should support Domain Name System (DNS) in order to use device name for better user experience.
- c) Those messages are formatted by using the SOAP HTTP binding, which shall be compliant with ISO/IEC 29341-1.
- d) HMG should collect information with respect to all the devices connected to the home network by using device description and service description of each device in order to manage the devices.
- e) HMG also should control other devices such as HMRec and HMSou by using appropriate actions to realize use cases described in this standard.

HMG shall also conform to the following requirements defined and specified in IEC 62481-1.

- f) HMG shall support a TCP/IP stack that includes IPv4, TCP, UDP, ARP, and ICMP.
- g) HMG may also support general capability recommendations and device recommendations.
- h) The detailed methods of interconnection shall be compliant with 7.3 of IEC 62481-1:2007 (Device discovery and control).
- i) HMG shall support Simple Object Access Protocol (SOAP) header and body elements, and the messages are delivered via HTTP. The HMG as well as HMSou and HMRec support the messaging scheme by using GENA protocol to exchange the event information inside the high-speed system. A control point invokes the action to the device's service in order to control it and when the action has completed or failed, the service returns any results or errors of the action.
- j) HMG shall support the detailed methods of device management.

5.2 Address assignment and resolution

5.2.1 Address assignment

The HMG shall support the functions of address assignment as follows:

- a) HMG shall assign the identifiers to each control sub-network in order to identify different sub-networks.
- b) The control sub-network gateway shall apply for the addresses, which comply for the higher-level network protocol and are composed of sub-network identifier and network address, from the HMG.
- c) The HMG shall have the following address assignment functions.
 - 1) The HMG shall support DHCP server to assign the addresses for the devices managed in the home network. Through a management and configuration interface on the HMG, the DHCP can be enabled or disabled, and the data such as address pool assignment on the DHCP can be configured as well.
 - 2) The terminal devices shall also support AutoIP in case there is no DHCP server in the sub-network.

5.2.2 Address resolution

The HMG shall support the functions and requirements of address resolution as follows:

- a) If the source devices and destination devices are located in the same control sub-network or multimedia network, then the HMG shall forward the data packet directly without any processing.
- b) If the source devices and the destination devices are not located in the same control sub-network or multimedia network, then
 - 1) The source devices shall know the identifier and network address of the control sub-network or multimedia network in which the destination devices are located.
 - 2) The HMG shall resolve the data packet sent from the source devices and identify the identifiers and network addresses of the control sub-network or multimedia network in which the source devices and destination devices are located respectively.
 - 3) The HMG shall confirm the network and address of the destination devices located according to the identifier and network address of that control sub-network or multimedia network.
 - 4) The HMG shall confirm the communication protocol of the destination devices from the device registry.
 - 5) The HMG shall then re-pack the data and send to the destination device in accordance with the communication protocol confirmed.
- c) The HMG shall support the ARP protocol as well.

5.3 Data transfer

The HMG

- a) shall support router working mode, bridge working mode or the hybrid working mode of both router and bridge,
- b) shall support the static router in the router working mode,

- 510 c) should support the dynamic router and support RIP V1/V2 in the router working mode.
- 511 d) shall support NAT and NAPT in accordance with RFC 2663 and RFC 3022 in the bridge
- 512 working mode.
- 513 e) shall support the transparent bridge protocol in accordance with IEEE 802.1Q in the bridge
- 514 working mode.
- 515 f) shall support the relevant functions of both router working mode and bridge working mode
- 516 when working the hybrid mode of router and bridge.

517 **5.4 Protocol translation**

518 The HMG shall support the application protocol translations when communicating and
519 interacting among different networks or sub-networks.

520 **6 AV processing**

521 **6.1 General**

522 The HMG may offer services for applications in home network systems. In summary, service
523 requirements include multimedia transformation and multimedia stream control and may be
524 fulfilled by using the services and actions which are defined by UPnP AV specifications (ISO/IEC
525 29341-3) and DLNA guidelines (IEC 62481). All these AV processing services need some
526 requirements for hardware and software of the HMG.

527 **6.2 Multimedia transformation service**

528 **6.2.1 Requirements summary**

529 The following requirements apply.

- 530 a) The HMG shall provide the media conversion service, including code conversion
- 531 (transcoding), resolution conversion (transcaling), and shall provide the media conversion
- 532 service of frame rate conversion (transrating).
- 533 b) The HMG should support voice code conversion.
- 534 c) The media conversion service request message shall include the URI of the media resources,
- 535 which specifies media code format, resolution, frame rate and transport protocols needed by
- 536 the requester. In the case of getting contents from WMS, it can also include the code format,
- 537 resolution and frame rate of the requested contents, as well as the media transport protocols
- 538 supported by the media content owner.
- 539 d) The HMG should be able to convert audio streams into voice streams.
- 540 e) The HMG should be able to convert voice streams into audio streams.
- 541 f) The HMG should be able to provide the video clip function, which shall be done in accordance
- 542 with the capability of receiving terminals.
- 543 g) HMG shall be able to convert multimedia based on receiver's ability.
- 544 h) HMG shall be able to convert multimedia based on network environment.
- 545 i) HMG shall be able to request multimedia with specific parameters from the media source.
- 546 j) HMG shall be able to communicate with remote HMRec.

6.2.2 Applications mode

6.2.2.1 Media conversion

6.2.2.1.1 General

Media stream conversion is to convert a media stream from one mode to another. It includes code conversion, resolution conversion, rate conversion and transport protocol translation. As shown in Figure 3, the green media stream indicates a dynamic conversion process; the HMG converts a MPEG2 media stream transmitted from the HMSou into an H.264 media stream transmitted through the hyper text transfer protocol (HTTP); then the HMG sends the stream to the HMRec. In case the media server can know the devices at the user's home and the media formats supported, it can use the remaining capabilities of the HMG to convert the media contents on the media server into the format needed by the players. In this way, when such contents are played, they need not be dynamically converted, as the conversion might affect the QoS in real-time playback.

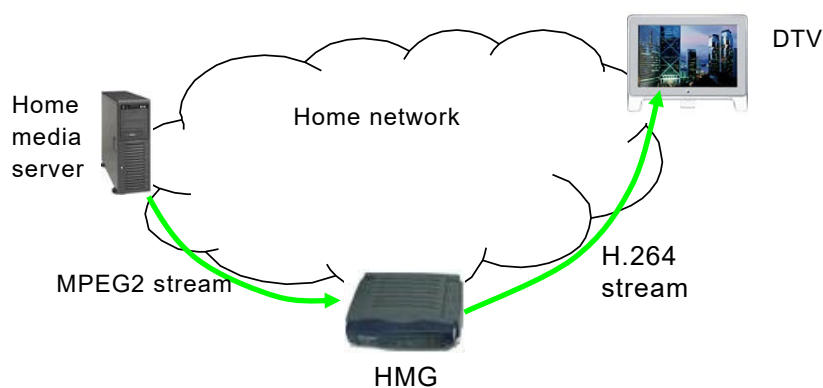


Figure 3 - Conversion of media streams

As shown in the Figure 3, media conversion can be performed in two modes. In the first mode, the media sender sends the media to the HMG; then the HMG converts the media and sends it to the media receiver. The one that requests media conversion might be the media sender or the media receiver. In the second mode, the device sends the media to the HMG. After being converted, and the media is returned to the device and is irrelevant with other application devices. In this mode, the HMG can be regarded as an extension of the device. In this case, there is no transport protocol translation.

The following text will describe the possible work modes of the HMG.

6.2.2.1.2 HMRec requests media conversion service

Figure 4 shows the process of how the HMRec requests the media conversion service from the HMG when HMRec gets media resource from HMSou Here it is supposed that:

- a) The HMG has obtained the uniform resource identifier (URI) for media resources on HMSou. The HMG can browse/search the directory of devices providing media contents and obtain the URI. The HMG also has obtained the code format, resolution and frame rate of the media resources.
- b) The HMG shall support to convert the media format and expose all of them in the CDS which is defined in the ISO/IEC 29341 series.

- c) The HMRec has obtained the uniform resource identifier (URI) for media resources on HMG. The HMRec can browse/search the directory of devices providing media contents and obtain the URI. The HMRec also has obtained the code format, resolution and frame rate of the media resources.

The request process is as follows:

1. The HMRec sends a request content message to the converted media URI of HMG.
2. The HMG sends a request content message to the original media URI of HMSou.
3. The HMSou accepts the request of the HMG and sends the original media stream to the HMG.
4. The HMG converts the media stream and sends the converted media stream to the HMRec.

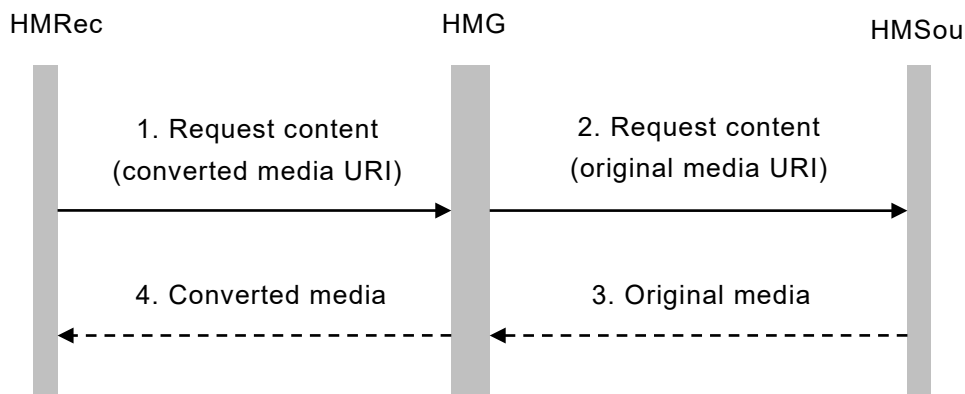


Figure 4 - HMRec requests media conversion from HMG

When the MS is the WMS, if DRM and authority management are taken into account, the process shall include the procedure of how the HMG can pass the WMS authentication. Because there are a rich variety of DRM and authority management modes, the HMG can hardly support all DRM systems and authority management modes.

Figure 5 shows an optimized process. Before the HMRec requests the media conversion service from the HMG, it first requests media stream redirection from the WMS. Here it is supposed that:

- a) The HMRec has obtained the URI of needed media resources.
- b) The HMRec might have obtained the code format, resolution and frame rate of the needed media resources.
- c) The HMRec might have known the media transport protocol used by the media sender.
- d) The HMRec needs the conversion service for sure.
- e) The HMRec has finished necessary DRM authentication and device authentication with the WMS.

The process is as follows:

1. The HMRec sends a Request Redirection message to the WMS, which includes:
 - The URI of the media resources on the WMS requested by the HMRec.
2. The WMS satisfies the request of the HMRec and allocates a Request identity (RID) in the response message.

NOTE When the media source receives a media service request from the media receiver, it allocates an identity to authenticate the media conversion service device, that is, the HMG, provided by the media receiver (MR). This identity is called the request identity. The media conversion service is originated by the media receiver; the request identity allocated by the media source is transferred to the HMG. When obtaining original media contents from the media source, the HMG needs to provide the request identity to the media source to prove its validity.

3. The HMRec sends a request conversion message to the HMG, which includes:
 - The URI of the media resources on the WMS requested by the HMRec
 - The media code format, resolution and frame rate needed by the HMRec
 - Media transport protocols supported by the HMRec
 - RID allocated by the WMS
 - (Optional) media code format, resolution and frame rate of the media contents requested by the HMRec
 - (Optional) media transport protocols supported by the WMS
4. If the HMG can accept the conversion request, it can send a message to the HMRec, indicating that the request is accepted; otherwise the HMG shall send a message to refuse the request.
5. The HMG requests the media resources needed by the HMRec from the WMS. The request message shall include the RID and the URI of the media resources on the WMS requested by the HMRec; or the RID shall be sent back upon the request of the WMS. In case the HMG cannot request resources, or if the HMG cannot make conversion after the resources are obtained, it shall send a message to the HMRec, indicating that the service cannot be fulfilled
6. The WMS accepts the request of the HMG after authenticating the RID. Then it sends the original media stream to the HMG.
7. The HMG converts the media stream and sends the converted media stream to the HMRec according to the media code format, resolution and frame rate needed by the HMRec.

In the above procedure, the WMS does not implement DRM authentication on the HMG but transmits the media stream directly. DRM authentication is completed by the HMRec before step

1. The WMS authenticates the RID to verify the validity of the HMG. In this way, the HMG does not need to support various DRM methods, but has new requirements on the WMS.

In practice, encrypted transmission is needed between the WMS and the HMG, and between the HMG and the HMRec. As a result, keys need to be exchanged between the WMS and the HMG, and between the HMG and the HMRec. It is easy to exchange keys between the HMRec and the HMG, as both devices are at home and can adopt a standard method. Because different service systems in the WAN adopt different DRM systems and different encryption algorithms, it is hard for the HMG to satisfy the media conversion requests from various service terminals. It is easy to unify the DRM method in the home network; however, it is hard to unify various services in the WAN. The HMG is required to support various encryption algorithms and key exchange methods. Even if a control channel is reserved between the HMRec and the WMS for key exchanges, through which the HMRec sends to the HMG the key exchanged with the WMS, the HMG still needs to support multiple encryption algorithms.

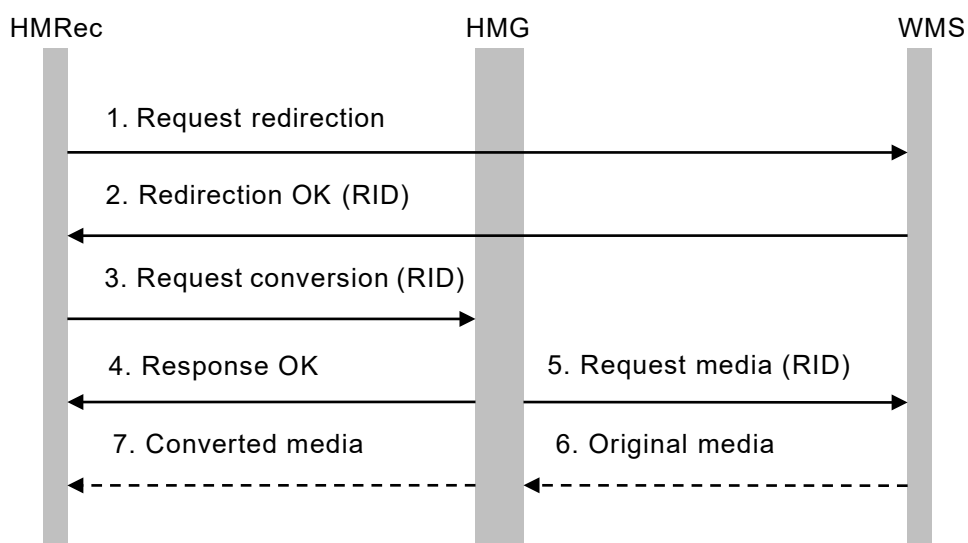


Figure 5 - HMRec requests WMS to support redirection

In order to support the workflow of HMRec requests media conversion, HMG shall follow:

- a) The HMG shall provide the media conversion service. Upon receiving a media conversion request message from the HMRec, it should request media contents from the WMS.
- b) The HMG should judge whether it can accept the media conversion request according to the capability needed by the requester, available capability, and its processing capability.
- c) If the HMG finds that it cannot satisfy the requirement of the conversion service requester after obtaining the media resources, it should send a message to the conversion service requester, explaining that the conversion service cannot be fulfilled.
- d) The HMG should support the conversion of streaming media.
- e) The HMG should support the DRM.
- f) If the HMG receives a RID from the HMRec, it shall include the RID when requesting media contents from the WMS; or it shall feedback the RID upon the query of the WMS.
- g) The HMG should support encrypted transmission with the WMS.
- h) The HMG should support encrypted transmission with the HMRec.
- i) The HMG should support various encryption algorithms.
- j) The HMG should support various key management methods.

In order to support the workflow of media conversion, WMS shall follow:

- a) The WMS should be able to accept the media redirection request of the HMRec.
- b) After the WMS accepts a media redirection request from the media receiver, it can allocate a RID to the media receiver so as to authenticate the HMG.
- c) Existing DRM methods should be optimized to support the media conversion service.
- d) New DRM methods should be adopted to support the media conversion service.

In order to support the workflow of media conversion, HMRec shall follow:

- a) The HMRec should be able to send a media redirection request to the WMS.

674 b) The HMRec should be able to request the media conversion service from the HMG. The
675 request message should include the URI of the media resources, media code format,
676 resolution, frame rate and transport protocols needed by the HMRec. It can also include the
677 code format, resolution and frame rate of the requested contents, as well as the media
678 transport protocols supported by the media content owner.

679 c) If the HMRec sends a media redirection request to the WMS and receives a RID allocated by
680 the MS, it should include this RID when sending a media conversion service request to the
681 HMG.

682 **6.2.2.1.3 HMSou requests media conversion service**

683 When the HMSou actively sends media contents to the HMRec, it can request the media
684 conversion service from the HMG and sends media contents to the HMRec after they are
685 converted.

686 Supposing that

687 a) The HMG shall support to convert the media format and expose all of them in the CDS, then
688 the process in Figure 6 is as follows.

689 b) The HMSou sends a request conversion message to the HMG, requesting the media
690 conversion service. The message may includes

- 691 • the media code format, resolution and frame rate of the media contents sent by the
692 HMSou,
- 693 • the media transport protocol of the HMSou,
- 694 • the URI for the media source sent by HMSou.

695 c) The HMG sends a request conversion message to the HMRec, requesting the media
696 conversion service. The message may includes

- 697 • the media code format, resolution and frame rate of the media contents sent by the HMG,
- 698 • the media transport protocol of the HMG,
- 699 • the URI for the media source sent by HMG.

700 d) The HMRec requests the converted media content from the HMG.

701 e) The HMG requests the original media content from the HMSou.

702 f) The HMSou transmits media streams to the HMG.

703 g) The HMG converts media streams and sends them to the HMRec.

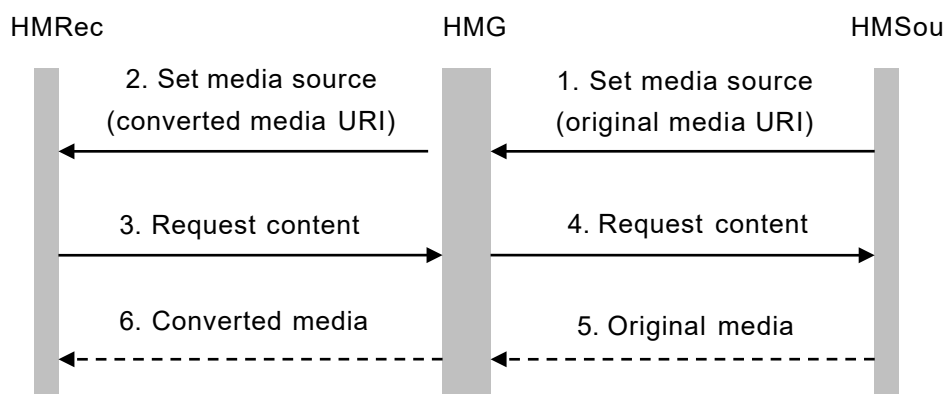


Figure 6 - HMSou actively sends media to HMRec

The HMSou and the HMRec might be located in different home networks. As a result, the HMG can be in the same home network as the HMSou or the HMRec. In case the HMG and the HMSou are in the same home network, the HMSou can know the HMG address through automatic discovery or configurations. In case the HMG and the HMSou are in different home networks, the HMRec shall notify the HMSou of the HMG address.

In order to support the HMSou requests media conversion workflow, HMG shall follow:

- The HMG shall support to convert the media format and expose all of them in the CDS.
- In the case of the HMG cannot fulfill the conversion process, it shall notify the HMSou that the conversion service cannot be fulfilled.

In order to support the HMSou requests media conversion workflow, HMSou should follow:

The HMSou should send a Set Media Source request to the HMG when transmitting media contents. The request message from the HMSou may include the media code format, resolution and frame rate of the transmitted media contents, as well as the transport protocols used by the HMSou.

In order to support the HMSou requests media conversion workflow, HMRec should follow:

The HMRec should receive and interpret Set Media Source request properly and send Request Content to HMG accordingly.

6.2.2.2 Video clip

Video clip is to clip some parts from high-resolution video pictures and transmit them to a low-resolution media terminal. For example, in video surveillance, the resolution of the pictures provided by a camera might be 720×480. When a user views a picture taken by the designated cameras through a hand-held device, for example his mobile phone, the user needs to zoom out the picture, as the screen of the hand-held device is quite small; otherwise, the user can only see part of the picture. Besides, the media source does not need to send all original data to the hand-held device. The user can view part of the picture taken by the cameras to keep the high definition of the picture. If so, the system can clip the expected part of the original video picture and encode it before transmitting to the hand-held device. As a result, the quantity of data transmitted can be reduced. The user can move the picture on the terminal and send commands to the HMG to update the coordinates of the clipped picture. When a camera is fixed, the user