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INTERNATIONAL STANDARD

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Digital living network alliance (DLNA) home networked device interoperability guidelines
Part 1-2: Architecture and protocols – Extended Digital Media Renderer

IEC 62481-1-2:2017-07(en)

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DIGITAL LIVING NETWORK ALLIANCE (DLNA) HOME NETWORKED DEVICE INTEROPERABILITY GUIDELINES

Part 1-2: Architecture and protocols – Extended Digital Media Renderer

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International Standard IEC 62481-1-2 has been prepared under technical area 8: Multimedia home systems and applications for end-user network IEC technical committee 100: Audio, video and multimedia systems and equipment.

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

CDV	Report on voting
100/2736/CDV	100/2885/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

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

A list of all parts of IEC 62481 series, published under the general title *Digital Living Network Alliance (DLNA) home networked device interoperability guidelines,* can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

Consumers are acquiring, viewing, and managing an increasing amount of digital media (photos, music, and video) on devices in the consumer electronics (CE), mobile, and personal computer (PC) domains. As such, they want to conveniently enjoy the content, regardless of the source, across different devices and locations in the home. The digital home vision integrates the Internet, mobile, and broadcast networks through a seamless, interoperable network, which will provide a unique opportunity for manufacturers and consumers alike. In order to deliver on this vision, a common set of industry design guidelines is needed that allows vendors to participate in a growing marketplace, leading to more innovation, simplicity, and value for consumers. This document serves that purpose and provides vendors with the information needed to build interoperable networked platforms and devices for the digital home.

DIGITAL LIVING NETWORK ALLIANCE (DLNA) HOME NETWORKED DEVICE INTEROPERABILITY GUIDELINES

Part 1-2: Architecture and protocols – Extended Digital Media Renderer

1 Scope

The DLNA Guidelines Parts 1 to 3 introduce a number of device classes to identify specific roles that connected endpoints implement in the network. Devices can act as content sources (e.g., Digital Media Servers, Push Controllers), and as content sinks (Digital Media Renderers or Digital Media Players).

Having two types of content sinks has been a useful strategy to accelerate the initial deployment phase. However, many of the modern receiver devices now include both types. Consequently, there is a need to define a receiver device that combines both types. This document addresses this issue and, specifically, it describes a device class for an Extended Digital Media Renderer (XDMR) and implementation guidelines for combining a Digital Media Renderer and a UPnP Media Server Control Point.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62481-1-1:2017, *Digital living network alliance (DLNA) Guidelines – Part 1-1: Architecture and protocols*

IEC 62481-2:2017, *Digital living network alliance (DLNA) Guidelines – Part 2: Media format profiles*

IEC 62481-3:2017, *Digital living network alliance (DLNA) Guidelines – Part 3: Link Protection*

IEC 62481-4:2017, *Digital living network alliance (DLNA) Guidelines – Part 4: DRM Interoperability Solutions*

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

ISO/IEC 29341-3-10, *Information Technology – UPnP Device Architecture – Part 3-10: Audio Video Device Control Protocol – Audio Video Transport Service*

ISO/IEC 29341-3-11, *Information Technology – UPnP Device Architecture – Part 3-11: Audio Video Device Control Protocol – Connection Manager Service*

ISO/IEC 29341-3-13, *Information Technology – UPnP Device Architecture – Part 3-13: Audio Video Device Control Protocol – Rendering Control Service*

3 Terms, definitions and conventions

For the purposes of this document, the terms and definitions given in IEC 62481-1-1:2017 and the following 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 General terms

3.1.1
comply
conform
be in accordance with referenced requirements

Note 1 to entry: Where the reference includes both mandatory and optional requirements, only the mandatory elements are considered necessary for compliance.

Note 2 to entry: "Comply with" can be used interchangeably with "conform to" (includes the variations of complies, complying, compliant, compliance; conforms, conforming, conform, conformant).

Note 3 to entry: Optional requirements continue to be optional. Any variation from these expectations shall be specifically noted.

3.1.2
Extended Digital Media Renderer
XDMR
Digital Media Renderer (DMR) that also implements a Media Server Control Point (MSCP); this device class defines the combined implementation of a Digital Media Renderer and a Digital Media Player

Note 1 to entry: The guidelines established in this document define the requirements for implementing an Extended Digital Media Renderer (XDMR) device class.

3.1.3
AVT
AVTransport Service
UPnP service that provides network-based control for common transport operations such as play, stop, pause, next, previous, and seek

Note 1 to entry: The AVTransport Service specification is a standard UPnP DCP.

3.1.4
CDS
ContentDirectory Service
UPnP service that provides network-based discovery of content

Note 1 to entry: The ContentDirectory Service specification is a standard UPnP Device Control Protocol.

3.1.5
CMS
ConnectionManager Service
UPnP service that provides information about the supported transport protocols and media formats of a UPnP device

Note 1 to entry: The ConnectionManager Service specification is a standard UPnP Device Control Protocol.

3.1.6
DMP
Digital Media Player
DLNA Device Class having home network environmental characteristics with the role of finding content exposed by a DMS and rendering the content locally

3.1.7
DMR
Digital Media Renderer
DLNA Device Class having home network environmental characteristics, with the role of rendering content it receives after being setup by another network entity

3.1.8
DMS
Digital Media Server
DLNA Device Class having home network environmental characteristics, with the role of exposing and distributing content throughout the home

3.1.9
DNS
Domain Name System
protocol that enables hierarchical names for Internet domains and addresses

Note 1 to entry: The protocol includes the means to translate between numerical IP addresses and text host names.

3.1.10
MRCP
MediaRenderer Control Point
UPnP control point that issues actions to a DMR or and XDMR

3.1.11
MSCP
MediaServer Control Point
UPnP AV control point that issues actions to a DMS

3.1.12
RCS
RenderingControl Service
UPnP service that provides network-based control for the adjustment of rendering attributes such as volume, brightness, contrast, and mute

Note 1 to entry: The RenderingControl Service specification is a standard UPnP Device Control Protocol.

3.1.13
XDMR
Extended DMR
device class defined to combine the functionality of a Digital Media Renderer (DMR) and a Media Server Control Point (MSCP)

Note 1 to entry: This device class is equivalent to combining previous device classes known as a DMR and a DMP.

3.2 Conventions

In this document, a number of terms, conditions, mechanisms, sequences, parameters, events, states, or similar terms are printed with the first letter of each word in uppercase and the rest in lowercase (e.g., Move). Any lowercase uses of these words have the normal technical English meaning.

4 Networking architecture, device models and guideline conventions

4.1 DLNA home networking architecture

See Clause 4 in IEC 62481-1-1:2017 for a full description of the DLNA home networking architecture, which is augmented in this document as follows.

This document describes a device model referred to as an Extended Digital Media Renderer (XDMR) matching the following DLNA classification.

– An XDMR is a Device Class that belongs to the Home Network Device (HND) category.

– The XDMR Device Class unifies previous Device Classes known as Digital Media Renderer (DMR) and Digital Media Player (DMP). Consequently, an XDMR behaves as a Content Receiver for the following system usages: 2-box Pull, 2-box Push, and 3-box. These system usages are defined in 5.7 of IEC 62481-1-1:2017. See Annex A regarding the evolution of DMR and DMP device classes into XDMR.

The XDMR Device Class includes the following functionality.

– A UPnP AV MediaRenderer combined with a UPnP AV MediaServer control point. Sub-clause 5.2 specifies the corresponding implementation guidelines.

– A DNS Client that resolves domain names into IPv4 addresses as defined in IEC 62481-1-1:2017.

– Support for HTTP protocol messages to request and receive media resources from servers internal or external to the home network as defined in IEC 62481-1-1:2017.

– Support for the AVT:SetNextAVTransportURI action as defined in IEC 62481-1-1:2017.

Because an XDMR implements a UPnP AV MediaRenderer, any UPnP Control Point can send AVT, RCS, and CMS actions to the XDMR and transfer URIs (and HTTP URLs) for playback. Because an XDMR implements a UPnP AV MediaServer Control Point, an XDMR can send CDS actions to UPnP AV MediaServers. Using terminology defined in IEC 62481-1-1:2017, an XDMR integrates previous functionality from the DMR device class and from the DMP device class. Figure 1 shows the main components that characterize the XDMR device class.

Because an XDMR implements a DNS Client, the XDMR can process HTTP URLs that include textual domain names. The DNS Client is used to resolve domain names into IPv4 addresses. As defined in IEC 62481-1-1:2017, an XDMR is capable of using generic HTTP URLs that identify media resources located inside or outside the home network.

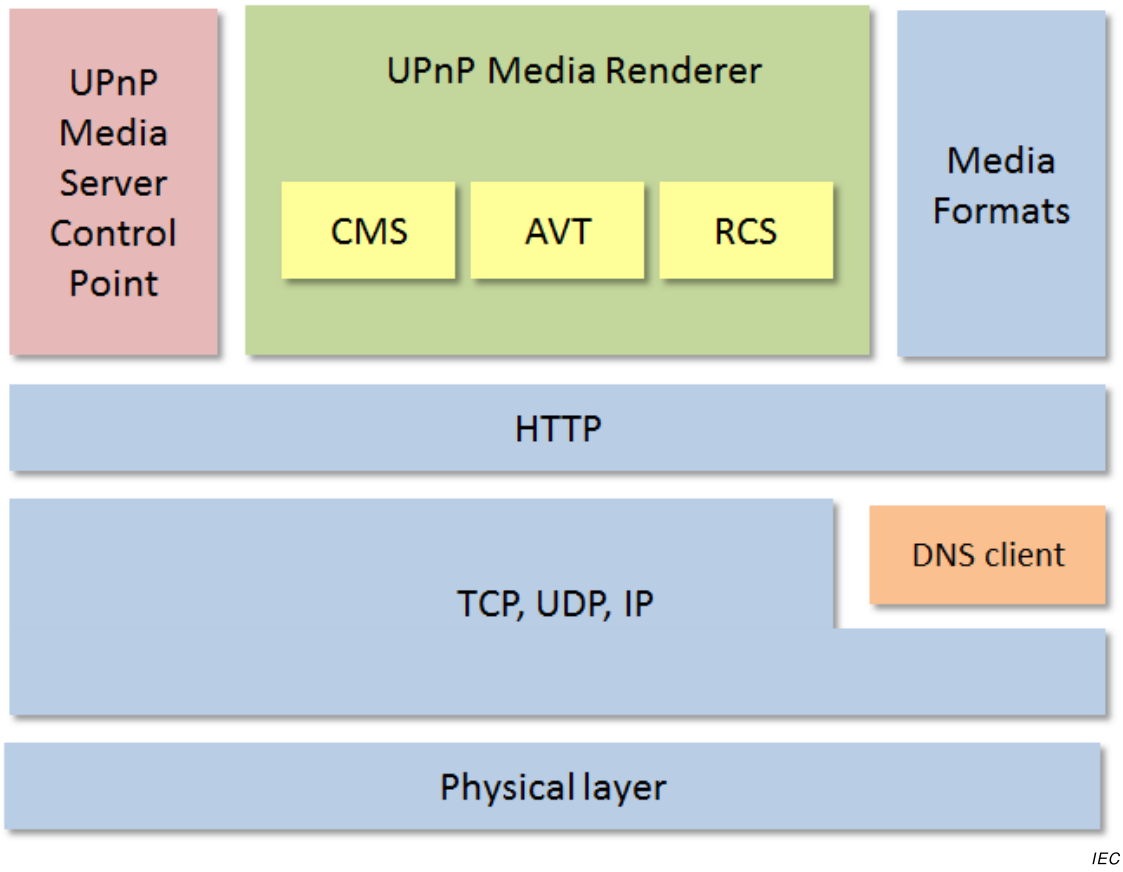
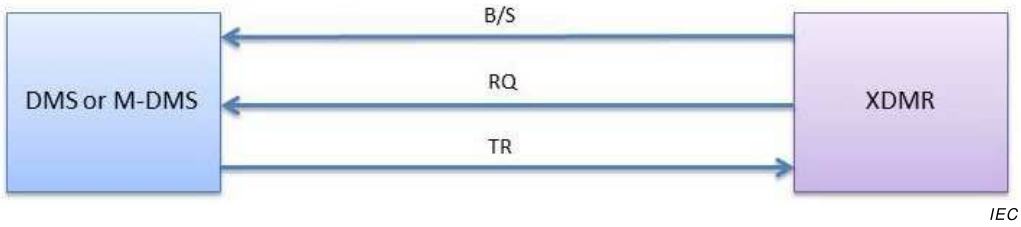


Figure 1 – Main components in the XDMR Device Class

4.2 DLNA system usages

Figure 2, Figure 3, and Figure 4 illustrate the XDMR Device Class interactions with other Device Classes according to the 2-box Pull, 2-box Push, and 3-box system usages respectively and as defined in 5.7 of IEC 62481-1-1:2017.



Key

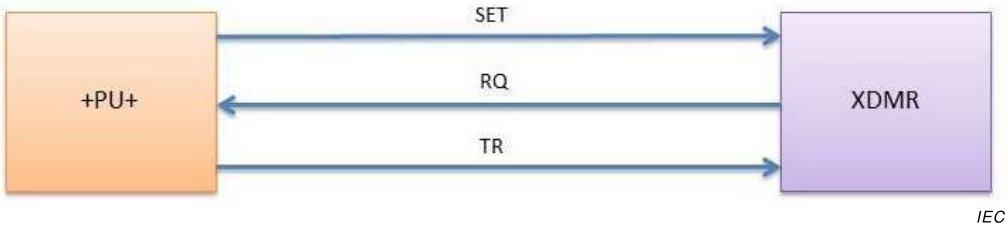
B/S Invoke UPnP actions to browse and/or search for content.

RQ Request content for playback.

TR Transfer the content binary data to the XDMR.

SET Invoke UPnP actions to determine the XDMR supported formats and to set up a playback session.

Figure 2 – 2-box Pull usage model for an XDMR



Key

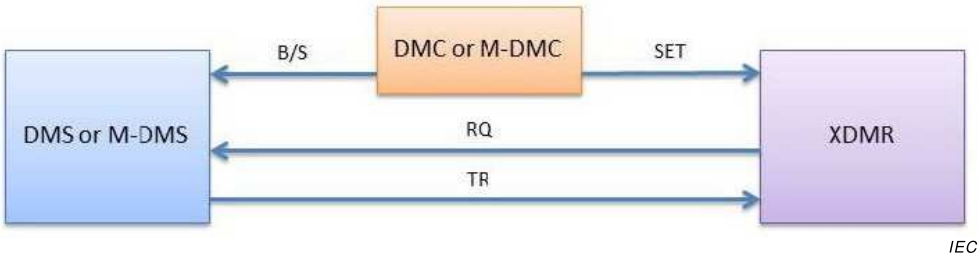
B/S Invoke UPnP actions to browse and/or search for content.

RQ Request content for playback.

TR Transfer the content binary data to the XDMR.

SET Invoke UPnP actions to determine the XDMR supported formats and to set up a playback session.

Figure 3 – 2-box Push usage model for an XDMR



Key

B/S Invoke UPnP actions to browse and/or search for content.

RQ Request content for playback.

TR Transfer the content binary data to the XDMR.

SET Invoke UPnP actions to determine the XDMR supported formats and to set up a playback session.

Figure 4 – 3-box usage model for an XDMR

4.3 Document conventions and conventions

See Clause 6 in IEC 62481-1-1:2017 for a full description of the DLNA document conventions.

5 XDMR guidelines

5.1 General

See 7.1 in IEC 62481-1-1:2017, for guideline and attribute table layout descriptions.

5.2 Combined renderer-player functionality

5.2.1 Architecture and protocols

5.2.1.1 Baseline rendering functionality

[GUIDELINE] An Extended Digital Media Renderer shall comply with all the guidelines for the DMR Device Class defined in IEC 62481-1-1:2017, IEC 62481-2:2017, IEC 62481-3:2017, and IEC 62481-4:2017.

[ATTRIBUTES]

M	R	XDMR	n/a	n/a	IEC 62481-1-1:2017 IEC 62481-2:2017 IEC 62481-3:2017 IEC 62481-4:2017	8ARO3	

[COMMENT] An Extended DMR Device Class is simply a DMR as defined in IEC 62481-1-1:2017 that additionally implements an AV Media Server Control Point (MSCP). The MSCP component brings the ability to do browse/search operations to the DMR. The original DLNA Guidelines IEC 62481-1-1:2017 leave the MSCP component as an optional function for any DMR. This document simply clarifies the expected behaviour for DMR devices that implement the MSCP component.

5.2.1.2 Baseline Control Point functionality

[GUIDELINE] An Extended Digital Media Renderer shall comply with all the guidelines for a UPnP control point and UPnP AV MediaServer control point defined in IEC 62481-1-1:2017, IEC 62481-2:2017, IEC 62481-3:2017, and IEC 62481-4:2017.

[ATTRIBUTES]

M	R	XDMR	n/a	n/a	IEC 62481-1-1:2017 IEC 62481-2:2017 IEC 62481-3:2017 IEC 62481-4:2017	6B5AM	

[COMMENT] An Extended DMR includes functionality for a DMR and for a Media Server Control Point (MSCP). The MSCP allows an XDMR to communicate with DMS or M-DMS devices using the Content Directory and Connection Manager Services.

5.2.1.3 Root device

[GUIDELINE] The root device in a device description document may describe an Extended Digital Media Renderer.

[ATTRIBUTES]

O	R	XDMR	n/a	n/a	IEC 62481-1-1:2017 ISO/IEC 29341-1	IRWDP	

[COMMENT] An Extended DMR is simply a more complex DMR. An implementation can declare a DMR or an XDMR as the root device in the device description document.

5.2.1.4 Embedded device

[GUIDELINE] An embedded device in a device description document may describe an Extended Digital Media Renderer.

[ATTRIBUTES]

O	R	XDMR	n/a	n/a	IEC 62481-1-1:2017 ISO/IEC 29341-1	LRQAA	

[COMMENT] An Extended DMR is simply a more complex DMR. An implementation can declare a DMR or an XDMR as one of the embedded devices in the device description document.

5.2.1.5 Identifier in device description document

[GUIDELINE] An XDMR shall advertise a DMR implementation using <dlna:X_DLNADOC> in the device description document with a value of DMR-1.50.

In addition, an XDMR shall use a second instance of the same element to advertise the implementation of the guidelines described in this document with a value of XDMR-1.50.

[ATTRIBUTES]

M	A	XDMR	n/a	n/a	IEC 62481-1-1:2017 ISO/IEC 29341-1	EQ5D7	

[COMMENT] An Extended DMR advertises the implementation of a DMR in the device description document. This is necessary for backward compatibility. Control Points access the device description document to determine essential device characteristics. In addition to advertising the DMR function, an Extended DMR advertises adherence to the XDMR guidelines. Hence, the XDMR includes the following XML fragment in its device description document:

```
<dlna:X_DLNADOC xmlns:dlna="urn:schemas-dlna-org:device-1-0">DMR-1.50</dlna:X_DLNADOC>

<dlna:X_DLNADOC xmlns:dlna="urn:schemas-dlna-org:device-1-0">XDMR-1.50</dlna:X_DLNADOC>
```

5.2.1.6 Value of protocolInfo for selected content

[GUIDELINE] An XDMR shall be able to play any content with a protocolInfo value matching one of the values listed in the CMS.SinkProtocolInfo instance state variable.

[ATTRIBUTES]

M	A	XDMR	n/a	n/a	IEC 62481-1-1:2017 ISO/IEC 29341-3-11	JGNTH	

[COMMENT] An Extended DMR obtains content for playback using two methods. In one method, the XDMR receives an action request to play content from a UPnP Control Point. In the second method, the XDMR can browse or search for external content using the UPnP AV MediaServer Control Point component. This guideline indicates that regardless of the method used to obtain content, the CMS.SinkProtocolInfo state variable describes the complete list of playable protocolInfo values in an XDMR.

5.2.1.7 CMS state variables

[GUIDELINE] The XDMR shall describe, expose, and update the CMS instance state variables as a result of interactions in either mode of operation:

– the state variables are updated if the XDMR is externally controlled by a UPnP control point;

– the state variables are updated if the XDMR uses its UPnP AV MediaServer control point to browse/search for content and then acquire the content directly from a UPnP AV MediaServer.

[ATTRIBUTES]

M	A	XDMR	n/a	n/a	IEC 62481-1-1:2017 ISO/IEC 29341-3-11	LL5G6	

5.2.1.8 AVT state variables

[GUIDELINE] The XDMR shall describe, expose, and update the AVT instance state variables as a result of interactions in either mode of operation:

– the state variables are updated if the XDMR is externally controlled by a UPnP control point;

– the state variables are updated if the XDMR uses its UPnP AV MediaServer control point to browse/search for content and then acquire the content directly from a UPnP AV MediaServer.

[ATTRIBUTES]

M	A	XDMR	n/a	n/a	IEC 62481-1-1:2017 ISO/IEC 29341-3-10	3NKWF	

5.2.1.9 RCS state variables

[GUIDELINE] The XDMR shall describe, expose, and update the RCS instance state variables as a result of interactions in either mode of operation:

– the state variables are updated if the XDMR is externally controlled by a UPnP control point;

– the state variables are updated if the XDMR uses its UPnP AV MediaServer control point to browse/search for content and then acquire the content directly from a UPnP AV MediaServer.

[ATTRIBUTES]

M	A	XDMR	n/a	n/a	IEC 62481-1-1:2017 ISO/IEC 29341-3-13	7IR4T	

5.2.1.10 Current track URI

[GUIDELINE] As a corollary of Guideline 5.2.1.8, the AVT.CurrentTrackURI instance state variable shall describe the URI of the track currently playing in an XDMR. The XDMR obtains the URI from a UPnP AV MediaRenderer control point or from a UPnP AV MediaServer.

[ATTRIBUTES]

M	A	XDMR	n/a	n/a	IEC 62481-1-1:2017 ISO/IEC 29341-3-10	FOQQM	

[COMMENT]

The AVT.CurrentTrackURI state variable always includes the URI of the track that is currently playing. This guideline simply clarifies that, for an XDMR, the URI could have been obtained from interactions with a UPnP AV MediaRenderer Control Point or from interactions with a UPnP AV MediaServer.

If an XDMR interacts with a UPnP AV MediaRenderer control point, the track URI is obtained from action arguments included in AVT:SetAVTransportURI and AVT:SetNextAVTransportURI. The track URI can also be obtained from entries in media collections. If an XDMR interacts with a DMS or M-DMS, the Media Server control point (MSCP) component in an XDMR makes CDS:Browse or CDS:Search requests against the server. The track URI is obtained from <res> elements included in the response to CDS:Browse or CDS:Search actions.

5.2.2 Media Format profiles

[GUIDELINE] An XDMR shall select content for playback with a Media Format Profile value that matches one of the values included in the CMS.SinkProtocolInfo instance state variable.

[ATTRIBUTES]

M	R	XDMR	n/a	n/a	IEC 62481-1-1:2017 IEC 62481-2:2017 IEC 62481-3:2017 ISO/IEC 29341-3-11	LANIR	

[COMMENT] An Extended DMR obtains content for playback using two methods. In one method, the XDMR receives an action request to play content from a UPnP Control Point. In the second method, the XDMR can browse or search for external content using the UPnP AV MediaServer Control Point component. This guideline indicates that regardless of the method used to obtain content, the CMS.SinkProtocolInfo state variable describes the complete list of playable Media Format Profiles in an XDMR.

This guideline applies to all Media Format Profiles including those defined for Link Protection.

Annex A
(informative)

Evolution of DMR and DMP device classes into an XDMR

The DLNA Guidelines define two Device Classes that act as media sinks for the Device Category of Home Networked Devices (HND). These two Device Classes are a Digital Media Renderer (DMR) and a Digital Media Player (DMP).

Implementing a DMP is less complex than implementing a DMR. This is the reason why DLNA Guidelines define two separate Device Classes for media sinks. However, after several years of successful deployments, it is now common that many devices implement both Device Classes. There are several strategies that can be used to combine DMR and DMP devices, but not all strategies lead to interoperable solutions. This document describes the preferred strategy: defining solutions that interoperate with legacy and future devices.

A DMP implementation uses the protocol layers shown in Figure A.1. Similarly, a DMR implementation uses the protocol layers shown in Figure A.2. Notice that the two Device Classes share many common components.

Figure A.3 shows a diagram of the combined DMP/DMR device described in this document. Notice that this combined device includes a single instance for each of the common components (blue boxes in Figures A.1 to A.3) plus all the specific components that belong exclusively to the DMP or DMR.

If you compare the DMR (Figure A.2) with the combined DMP/DMR (Figure A.3), it is easy to notice that they are very similar. In fact, the two figures show that the combined DMP/DMR can be formed as follows: combined DMP/DMR = DMR + MSCP.

For this reason, in this document the combined DMP/DMR is called an Extended DMR (XDMR) described as follows: XDMR = DMR + MSCP.

The published DLNA Guidelines IEC 62481-1-1:2017 already acknowledge that DMRs can optionally implement an MSCP component. Consequently, an XDMR is simply a DMR for which the MSCP component becomes mandatory.

This document defines implementation guidelines for an XDMR Device Class. This document also describes certain functionalities applicable to controllers that interact with an XDMR. Most of the functionality in an XDMR can be inferred from existing DLNA Guidelines and UPnP specifications; hence this document mainly clarifies such behaviour.

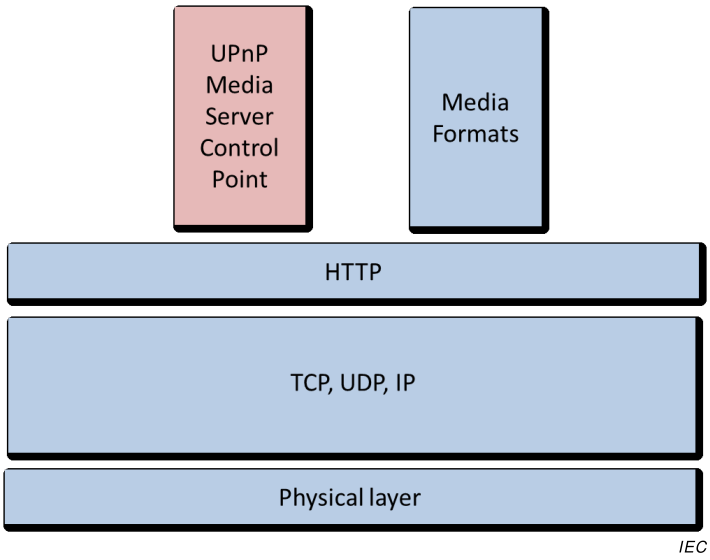


Figure A.1 – DMP protocol layers

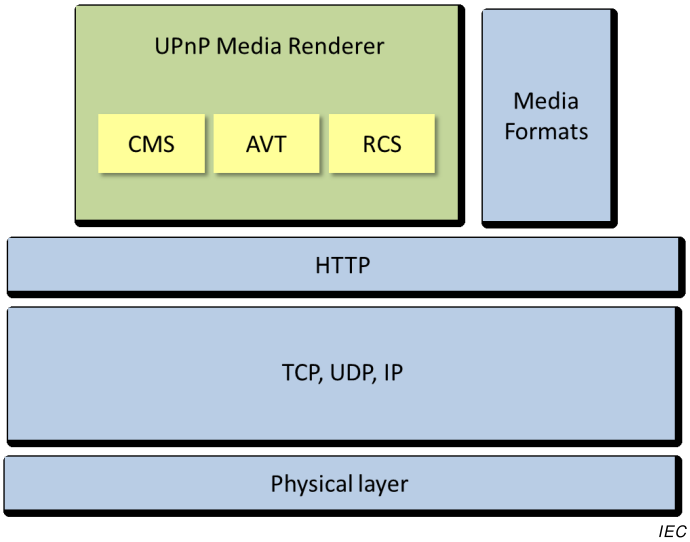


Figure A.2 – DMR protocol layers

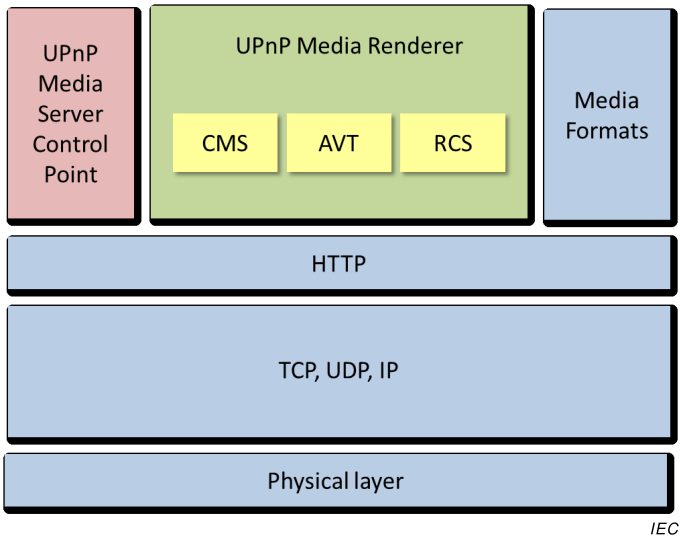


Figure A.3 – Protocols layers for the XDMR

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