



**Publicly Available Specification (PAS);
Intelligent Transport Systems (ITS);
MirrorLink®;
Part 3: Audio**

*ITeH STANDARD PREVIEW
(Standard Under Review)
Full and complete text available at:
<https://standards.iteh.ai/catalog/standards/sist/103-544-3-v1-3-1-2019-10>
4e7f-bd0a-093bb645d9d/etsi-ts-103-544-3-v1-3-1-2019-10*

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Reference

RTS/ITS-98-3

Keywords

interface, ITS, PAS, smartphone

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Full standard:
<https://standards.iteh.ai/catalog/standards/sist/069adf67-adee-4e7f-bd0a-093bb645d9d/etsi-ts-103-544-3-v1.3.1-2019-10>

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Intelligent Transport Systems (ITS).

The present document is part 3 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.1].

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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1 Scope

The present document is part of the MirrorLink® specification which specifies an interface for enabling remote user interaction of a mobile device via another device. The present document is written having a vehicle head-unit to interact with the mobile device in mind, but it will similarly apply for other devices, which provide a color display, audio input/output and user input mechanisms.

The present document defines the MirrorLink Audio architecture, based on an RTP forward and back channel, plus an possible Bluetooth HFP and A2DP setup.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

The following referenced documents are necessary for the application of the present document.

[1] IETF RFC 3550: "RTP: A Transport Protocol for Real-Time Applications", July 2003.

NOTE: Available at <http://tools.ietf.org/html/rfc3550>.

[2] Bluetooth Specification: "Hands-free Profile", Audio, Telephony, and Automotive Working Group, Revision 1.7.2, January 21, 2019.

NOTE: Available at https://www.bluetooth.org/docman/handlers/downloaddoc.ashx?doc_id=457090.

[3] Bluetooth Specification: "Headset Profile", Car Working Group, Revision V12r00, December 18, 2008.

NOTE: Available at https://www.bluetooth.org/DocMan/handlers/DownloadDoc.ashx?doc_id=158743.

[4] Bluetooth Specification: "Advanced Audio Distribution Profile", Audio, Telephony, and Automotive Working Group, Revision 1.3.2, January 21, 2019.

NOTE: Available at https://www.bluetooth.org/docman/handlers/downloaddoc.ashx?doc_id=457083.

[5] IETF RFC 2190: "RTP Payload Format for H.263 Video Streams", September 1997.

NOTE: Available at <http://tools.ietf.org/html/rfc2190>.

[6] IETF RFC 3551: "RTP Profile for Audio and Video Conferences with Minimal Control", July 2003.

NOTE: Available at <http://tools.ietf.org/html/rfc3551>.

[7] ETSI TS 103 544-12 (V1.3.1): "Intelligent Transport Systems (ITS); MirrorLink®; Part 12: UPnP Server Device".

[8] ETSI TS 103 544-9 (V1.3.1): "Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 9: UPnP Application Server Service".

[9] ETSI TS 103 544-10 (V1.3.1): "Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 10: UPnP Client Profile Service".

- [10] ETSI TS 103 544-15 (V1.3.1): "Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink® ; Part 15: Application Programming Interface (API) Level 1 & 2".
- [11] ETSI TS 103 544-2 (V1.3.1): "Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink® ; Part 2: Virtual Network Computing (VNC) based Display and Control".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI TS 103 544-1 (V1.3.1): "Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 1: Connectivity".

[i.2] ITU-T Recommendation G.114 (05/2003): "One-way transmission time", May 6, 2003.

NOTE: Available at <https://www.itu.int/rec/T-REC-G.114-200305-I/en>.

[i.3] ITU-T Recommendation P.1100 (03/2017): "Narrowband hands-free communication in motor vehicles", March 1, 2017.

NOTE: Available at <https://www.itu.int/rec/T-REC-P.1100-201703-S/en>.

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

pointer event: touch screen action in which the user touches the screen with one (virtual) finger only at a single location

touch event: touch screen action in which the user touches the screen with two or more separate fingers at different locations

NOTE: Touch events are used to describe more complex touch action, like pinch-open or pinch-close.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

A2DP	Bluetooth Advanced Audio Distribution Profile
API	Application Programming Interface
BT	Bluetooth
BTA2DP	Bluetooth Advanced Audio Distribution Profile
BTHFP	Bluetooth Hands Free Profile

BVRA	Bluetooth Voice Recognition Activation
CC	CSRC Count
CE	Consumer Electronics

NOTE: CE devices are referred to as mobile devices within the present document.

CSRC	Contributing SouRCe
HFP	Bluetooth Hands-free Profile
HS	Head-Set
HSP	Bluetooth Headset Profile
HU	Head-Unit

NOTE: This term is used interchangeably with the MirrorLink Client.

IOP	InterOPerability
IP	Internet Protocol
IPL	Initial Playback Latency
LSS	Latency Switching Sources
MAC	Mediaum Access Control
ML	MirrorLink
MPL	Maximum Playback Latency
PT	Payload Type
RFB	Remote Framebuffer
RTP	Real-time Transport Protocol
SCO	Synchronous Connection-Oriented
SOAP	Simple Object Access Protocol
SSRC	Synchronization SouRCe
UDP	User Datagram Protocol
UI	User Interface
UIBC	User Interface Back Channel
UPnP	Universal Plug and Play
URI	Uniform Resource Identifier
VC	Voice Control
VNC	Virtual Network Computing
WFD	Wi-Fi Display
XML	eXtensible Markup Language

4 Introduction

The present document defines how the MirrorLink Client selects the transport media that the MirrorLink Server shall use to route audio streams. The MirrorLink Server distinguishes between two audio streams, namely phone and application audio. It advertises available transport options, using UPnP *TmServerDevice:1* services. Audio streams are specified for the following remote access protocols:

- RTP Real-Time Transport Protocol
- BTA2DP Bluetooth Advanced Audio Distribution Profile
- BTHFP Bluetooth Hands Free Profile

It is the MirrorLink Client's responsibility to select from the advertised audio transport mechanisms how the MirrorLink Server shall stream the different audio sources. The audio link selection is done according the following priorities (highest priority first):

- 1) Keep existing Bluetooth HFP or A2DP connection to another external device, which is not a MirrorLink Client, if overriding the resource assignment is not allowed.
- 2) Follow audio link selection using the mechanism described in this clause.
- 3) Manual Bluetooth pairing (same behaviour as in non-MirrorLink use cases).

MirrorLink Server's speaker shall not be used for audio output.

MirrorLink Server's microphone shall not be used, for voice input if the MirrorLink Client indicates support for voice command within its UPnP Client Profile.

The present document allows for different transport mechanisms based on the selections the MirrorLink Client has taken.

The MirrorLink audio architecture, as shown in Figure 1, allows using the Real-time Transport Protocol for streaming audio captured from the mobile device, to the MirrorLink Client. The audio output from the mobile device is streamed in an application agnostic manner so that it does not require re-design or modification of existing applications running on the device.

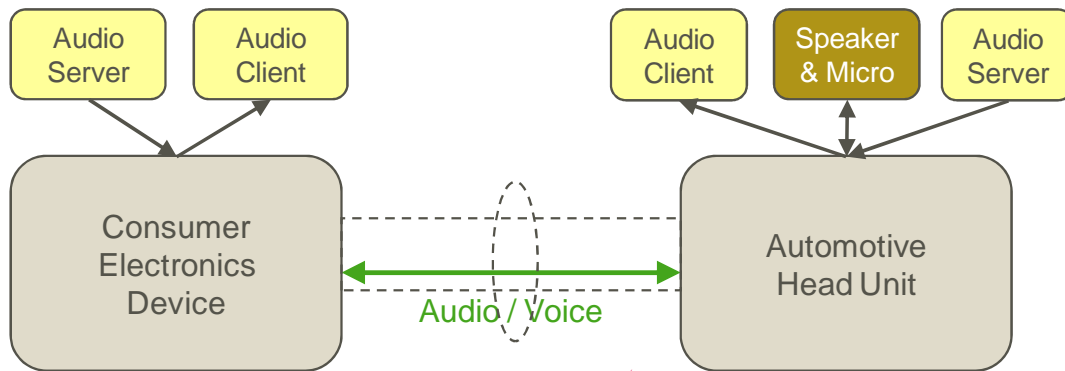


Figure 1: Audio Setup

The present document covers both audio output from and audio input to the MirrorLink Server device. Unless otherwise stated, the present document applies for the audio server and the audio client in the same way:

- The audio output will be handled from the audio server on the MirrorLink Server and the audio client on the MirrorLink Client.
- The audio input will be handled from the audio client on the MirrorLink Server and the audio server on the MirrorLink Client.

In addition to RTP, the MirrorLink specification allows regular Bluetooth audio connectivity for both phone and media audio streams.

5 Audio Link Options

MirrorLink allows the MirrorLink Client and Server to use the following audio features:

- Media - Streaming of media audio from the MirrorLink Server to the MirrorLink Client; media audio feature includes navigation audio.
- Phone - Bidirectional streaming of conversational audio, including in-band ringing.
- VC - Streaming of voice command (VC) audio from the MirrorLink Client to the MirrorLink Server.

The above listed audio features are available over the following connectivity options:

- Bluetooth (BT).
- RTP.

The MirrorLink Server shall advertise the audio features and connectivity options it supports within the UPnP *A_ARG_TYPE_AppList* application listings. The MirrorLink Server shall advertise individual audio components, with all combinations of the supported audio content categories.

EXAMPLE: If the MirrorLink supports an RTP Server for Media and Phone Audio, it shall advertise three RTP Servers, one showing Media, one Phone, and one Media & Phone support.

This will allow the MirrorLink Client to specifically inform the MirrorLink Server, which feature it is going to use. The possible audio content categories for the different audio components are listed below:

- RTP Client: Phone Audio, Voice Command In, Phone Audio + Voice Command In.
- RTP Server: Media Audio Out, Phone Audio + Media Audio Out.
- BT A2DP: Media Audio Out.
- BT HFP: Phone Audio, Phone Audio + Voice Command In.

The MirrorLink Server shall include the RTP Server with a value of *audioInfo@contentCategory* equaling *Media Audio Out (0x01)* first in the list of advertised RTP Servers for the same RTP payload types (*A_ARG_TYPE_AppList*).

If the MirrorLink Server supports Voice Command over RTP, it shall include the RTP Client with a value of *audioInfo@contentCategory* equaling *Voice Command In (0x10)* first in the list of advertised RTP Clients for the same RTP payload types (*A_ARG_TYPE_AppList*).

The MirrorLink Client shall select the audio features and their connectivity option, which the MirrorLink Client is going to use. The MirrorLink Client shall use the UPnP Application Server service's Launch Application action to inform the MirrorLink Server about its selection. The MirrorLink Client shall not launch more than one RTP Client, RTP Server, BT HFP, and BT A2DP component.

Based on the set of audio components, launched from the MirrorLink Client, the MirrorLink Server and Client shall use specific audio links for Media, Phone and Voice Command use cases. Table 1 lists the possible combinations of audio features and their underlying connectivity options on the left side. For each combination, the required audio components are listed, which shall be launched from the MirrorLink Client to enable it. Note, that some Audio Feature Set combinations are not possible. The below table shall not be used in case a WFD session, introduced in MirrorLink 1.2, is established.

Table 1: UPnP Negotiation for Audio Selection (Non-WFD Case)

Audio Feature Combinations and underlying Connectivity			Audio Components launched from the MirrorLink Client to enable the Audio Feature Combination			
Media	Phone	VC	BT HFP	BT A2DP	RTP Server	RTP Client
-	-	-	-	-	-	-
-	-	RTP	-	-	-	VC
-	-	BT	Not possible			
-	RTP	-	-	-	Phone	Phone
-	RTP	RTP	-	-	Phone	Phone + VC
-	RTP	BT	Not possible			
-	BT	-	Phone	-	-	-
-	BT	RTP	Phone	-	-	VC
-	BT	BT	Phone + VC	-	-	-
RTP	-	-	-	-	Media	-
RTP	-	RTP	-	-	Media	VC
RTP	-	BT	Not possible			
RTP	RTP	-	-	-	Phone + Media	Phone
RTP	RTP	RTP	-	-	Phone + Media	Phone + VC
RTP	RTP	BT	Not possible			
RTP	BT	-	Phone	-	Media	-
RTP	BT	RTP	Phone	-	Media	VC
RTP	BT	BT	Phone + VC	-	Media	-
BT	-	-	-	Media	-	-
BT	-	RTP	-	Media	-	VC
BT	-	BT	Not possible			

Audio Feature Combinations and underlying Connectivity			Audio Components launched from the MirrorLink Client to enable the Audio Feature Combination			
Media	Phone	VC	BT HFP	BT A2DP	RTP Server	RTP Client
BT	RTP	-	-	Media	Phone	Phone
BT	RTP	RTP	-	Media	Phone	Phone + VC
BT	RTP	BT	Not possible			
BT	BT	-	Phone	Media	-	-
BT	BT	RTP	Phone	Media	-	VC
BT	BT	BT	Phone + VC	Media	-	-

NOTE: Entries marked as *Not possible* in these tables are meant to describe combinations, which are out of scope from the MirrorLink specification. Behaviour, if supported, is implementation dependent. Entries should not be used.

BT HFP and BT A2DP may be connected outside the MirrorLink session, i.e. without specifically using the UPnP mechanisms to launch those. In that case the MirrorLink Client and Server shall make the selection based on the following table. Components marked with *Legacy* shall not be launched using the UPnP *TmApplicationServer* service's *LaunchApplication* action. The setup of the legacy Bluetooth connection is outside the scope of the MirrorLink specifications. The below table shall not be used in case a WFD session, introduced in MirrorLink 1.2, is established.

Table 2: UPnP Negotiation for Audio Selection with Legacy Bluetooth (Non-WFD Case)

Audio Feature Set and underlying Connectivity			Audio Components launched from the MirrorLink Client to enable the Audio Feature Set			
Media	Phone	VC	BT HFP	BT A2DP	RTP Server	RTP Client
-	BT	-	Legacy	-	-	-
-	BT	RTP	Legacy	-	-	VC
-	BT	BT	Legacy	-	-	-
RTP	BT	-	Legacy	-	Media	-
RTP	BT	RTP	Legacy	-	Media	VC
RTP	BT	BT	Legacy	-	Media	-
BT	-	-	-	Legacy	-	-
BT	-	RTP	-	Legacy	-	VC
BT	-	BT	Not possible			
BT	RTP	-	-	Legacy	Phone	Phone
BT	RTP	RTP	-	Legacy	Phone	Phone + VC
BT	RTP	BT	Not possible			
BT	BT	-	Legacy	Legacy	-	-
BT	BT	RTP	Legacy	Legacy	-	VC
BT	BT	BT	Legacy	Legacy	-	-

If an audio use feature is not covered from the audio component selection, done by the MirrorLink Client, the MirrorLink Server shall fallback to its default configuration.

MirrorLink 1.2 introduces Wi-Fi Display (WFD) based audio/video streaming for MirrorLink. The use of WFD removes the need to setup a separate RTP forward channel to carry media audio. The MirrorLink Server shall stream media audio via WFD RTP streaming.

Based on the set of audio components, launched from the MirrorLink Client, the MirrorLink Server and Client shall use specific audio links for additional Phone and Voice Command use cases. Table 1 lists the possible combinations of audio features and their underlying connectivity options on the left side. For each combination, the required audio components are listed, which shall be launched from the MirrorLink Client to enable it. Note, that some Audio Feature Set combinations are not possible.

Table 3: UPnP Negotiation for Audio Selection (WFD Case)

Audio Feature Combinations and underlying Connectivity			Audio Components launched from the MirrorLink Client to enable the Audio Feature Combination			
Media	Phone	VC	BT HFP	BT A2DP	RTP Server	RTP Client
-	{ -, WFD, BT }	{ -, RTP, BT }	Not possible			
WFD	-	-	-	-	{ -, Media }	-
WFD	-	RTP	-	-	{ -, Media }	VC
WFD	-	BT	Not possible			
WFD	WFD	-	-	-	{ -, Media }	Phone
WFD	WFD	RTP	-	-	{ -, Media }	Phone + VC
WFD	WFD	BT	Not possible			
WFD	BT	-	Phone	-	{ -, Media }	-
WFD	BT	RTP	Phone	-	{ -, Media }	VC
WFD	BT	BT	Phone + VC	-	{ -, Media }	-
BT	{ -, WFD, BT }	{ -, RTP, BT }	Not possible			

The MirrorLink Server shall not stream media audio content via a separate RTP Server, even if that RTP Server has been individually launched from the MirrorLink Client. The MirrorLink Client may launch the MirrorLink Server's RTP Server to allow for a faster handover from a WFD to a Non-WFD based audio streaming.

The MirrorLink Server shall transition media audio content to the RTP Server, if it has been launched from the MirrorLink Client, when the WFD session is disconnected. The MirrorLink Server shall transition media audio content from a launched RTP Server (or BT A2DP) to WFD, once the WFD session is established.

BT HFP may be connected outside the MirrorLink session, i.e. without specifically using the UPnP mechanisms to launch those. In that case the MirrorLink Client and Server shall make the selection based on the following table. Components marked with Legacy shall not be launched using the UPnP Application Server service's Launch Application action. The setup of the legacy Bluetooth connection is outside the scope of the MirrorLink specifications.

Table 4: UPnP Negotiation for Audio Selection with Legacy Bluetooth (WFD Case)

Audio Feature Set and underlying Connectivity			Audio Components launched from the MirrorLink Client to enable the Audio Feature Set			
Media	Phone	VC	BT HFP	BT A2DP	RTP Server	RTP Client
-	{ -, WFD, BT }	{ -, RTP, BT }	Not possible			
WFD	BT	-	Legacy	-	{ -, Media }	-
WFD	BT	RTP	Legacy	-	{ -, Media }	VC
WFD	BT	BT	Legacy	-	{ -, Media }	-
BT	{ -, WFD, BT }	{ -, RTP, BT }	Not possible			

BT A2DP shall not be used in a WFD session. A legacy BT A2DP connection shall be disconnected.