



**Publicly Available Specification (PAS);
Intelligent Transport Systems (ITS);
MirrorLink®;
Part 9: UPnP Application Server Service**

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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 9 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 *TmApplicationServer* service is a UPnP service that allows UPnP Control Points to remotely launch and terminate applications on MirrorLink Server devices. Through this service, UPnP control points can provide more fine-grained control and access to specific remote applications.

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] UPnP™ Forum: "UPnP™ Device Architecture 1.1", 15 October 2008.

NOTE: Available at <http://upnp.org/specs/arch/UPnP-arch-DeviceArchitecture-v1.1.pdf>.

[2] IETF RFC 3986: "Uniform Resource Identifier (URI): Generic Syntax", January 2005.

NOTE: Available at <http://tools.ietf.org/html/rfc3986>.

[3] W3C Recommendation 11 April 2013: "XML Signature Syntax and Processing Version 1.1".

NOTE: Available at <http://www.w3.org/TR/xmldsig-core/>.

[4] ETSI TS 103 544-26 (V1.3.1): "Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 26: Consumer Experience Principles and Basic Features".

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.

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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".

3 Definition of terms, symbols and abbreviations

3.1 Terms

Void.

3.2 Symbols

Void.

3.3 Abbreviations

Void.

4 Service Modeling Definitions

4.1 Service Type

The following service type identifies a service that is compliant with the present document:

- **urn:schemas-upnp-org:service:TmApplicationServer:1.**

TmApplicationServer service is used herein to refer to this service type. The *TmApplicationServer* service shall follow defined UPnP behaviour within the UPnP Device Architecture 1.1 [1].

4.2 State Variables

4.2.1 State Variable Overview

Table 4-1: Service State Variables

Variable Name	Req. or Opt.	Data Type	Allowed Value	Default Value	Eng. Units
AppStatusUpdate	R	string	Undefined	Empty string	N/A
AppListUpdate	R	string	Undefined	Empty string	N/A
A_ARG_TYPE_AppStatus	R	string	Undefined	Empty string	N/A
A_ARG_TYPE_AppID	R	string	Undefined	Empty string	N/A
A_ARG_TYPE_ProfileID	R	ui4	Undefined	0	N/A
A_ARG_TYPE_URI	R	string	Undefined	Empty string	N/A
A_ARG_TYPE_AppList	R	string	Undefined	Empty string	N/A
A_ARG_TYPE_String	R	string	Undefined	Empty string	N/A
A_ARG_TYPE_Bool	R	string	true false	false	N/A
A_ARG_TYPE_INT	R	ui4	Undefined	0	N/A
A_ARG_TYPE_AppCertificateInfo	R	string	Undefined	Empty string	N/A
R = REQUIRED. O = OPTIONAL. X = Non-standard.					

4.2.2 AppStatusUpdate

A string formatted as UTF-8 represents the list of application identifiers (*appIDs*) of applications whose status has changed. The string consists of a comma-separated list of *appIDs* identifying applications whose status has changed. Each entry in the list is of the type *A_ARG_TYPE_AppID*.

This state variable is evented, implying that clients can subscribe to receive notifications every time the variable changes using UPnP standardized eventing mechanisms. It is important to note that this variable only contains the *appIDs* of those applications, whose status has changed since the last time an event notification was sent out.

On receiving an *AppStatusUpdate* event, the MirrorLink UPnP Control Point can query the application status of specific applications in the list by invoking the *GetApplicationStatus* action.

AppStatusUpdate value will consist of a comma separated list of all application identifiers (*appIDs*) of applications listed in *A_ARG_TYPE_AppList* when the event is issued by the *TmApplicationServer* service for the first time.

After an application launch, the MirrorLink Server shall only send the *AppStatusUpdate* event, once the application is running and in foreground. The *AppStatusUpdate* shall be send only after the response to the UPnP *LaunchApplication* or *TerminateApplication* action has been sent for UI applications.

The MirrorLink Server will provide information of the current foreground framebuffer also via the VNC/WFD context information. During an application launch or termination action, this information can be temporarily out of sync with the UPnP application status, e.g. the UPnP information might be trailing the VNC context info in case of an application launch. In case the framebuffer transfers have been paused, e.g. due to the MirrorLink application being in the background on the MirrorLink Client screen, the VNC context information will not be updated until the framebuffer transfer is resumed.

4.2.3 AppListUpdate

A string formatted as UTF-8 represents a list of application identifiers (*appIDs*) of applications whose entries have changed in the application listing. The string consists of a comma-separated list of *appIDs* identifying applications whose status has changed. Each entry in the list is of the type *A_ARG_TYPE_AppID*.

It is evented, implying that clients can subscribe to receive notifications every time the variable changes using UPnP standardized eventing mechanisms. It is important to note that this variable only contains the *appIDs* of those applications, whose entries in the application list have changed since the last time an event notification was sent out.

On receiving an *AppListUpdate* event, a MirrorLink UPnP Control Point can retrieve the application list by invoking the *GetApplicationList* action and specifying the appropriate filter using the *appListingFilter* input argument.

AppListUpdate value will consist of a comma separated list of all application identifiers (*appIDs*) of applications listed in *A_ARG_TYPE_AppList* when the event is issued by the *TmApplicationServer* service for the first time.

The MirrorLink Client shall follow the *AppListUpdate* event. This will ensure that a revocation of an application certificate, specifically for drive-certified applications, will take immediate effect. Additionally, newly installed applications or applications for which an application certificate has been successfully downloaded from the ACMS, are immediately available, without reconnecting the MirrorLink session.

Implementation Note:

Older MirrorLink 1.1 Clients may either ignore *AppListUpdate* events or do not subscribe to them. Consumers will need to reestablish a MirrorLink session, in order to see a MirrorLink application available on the MirrorLink Client, if it has been installed from within a MirrorLink session.

The MirrorLink Server shall send an *AppListUpdate* event only in case a change to an application entry or to the certification status happened. The MirrorLink Server should combine changes to multiple applications into a single event.

Implementation Note:

Older MirrorLink 1.1 Servers may send an *AppListUpdate*, even in case nothing has changed in the application list. It is recommended, that MirrorLink Clients check the application listing as they cannot distinguish the MirrorLink Server's behavior.

4.2.4 A_ARG_TYPE_AppStatus

A string formatted as UTF-8 XML represents the status of a specific application or alternatively providing the status of all applications, which can be controlled remotely. Its structure is given in Table 4-2.

Table 4-2: Structure of A_ARG_TYPE_AppStatus

Element	Description	Parent	Availability
appStatusList	Indicates list of application status updates	-	Required
appStatus*	Indicates status record corresponding to an application	appStatusList	Required
appID	Unique ID of the application (A_ARG_TYPE_AppID)	appStatus	Required
status*	Entry corresponding to an instance of the application running under a specific client profile	appStatus	Required
profileID	Profile Identifier of the client profile (A_ARG_TYPE_ProfileID)	status	Required
statusType	String representing status of application: {Foreground Background Notrunning} (A_ARG_TYPE_String)	status	Required

The elements marked with a (*) can have multiple instances.

4.2.5 A_ARG_TYPE_AppID

A UTF-8 encoded string represents an unsigned 32-bit integer in hexadecimal format (with '0x' prefix) which denotes the unique application identifier.

The MirrorLink Server shall use the unsigned integer value of a variable of this type within any action. I.e. comparing the values of two A_ARG_TYPE_AppID variables shall be done based on the unsigned integer value and not based on a specific character representation.

Therefore, the following two A_ARG_TYPE_AppID values are identical:

- 0x45ab and 0x45AB (case insensitivity of the hexadecimal numbers).
- 0x45ab and 0X45ab (case insensitivity of the 0x).
- 0x00001234 and 0x001234 (leading zeros do not matter).

NOTE: The application identifier should be the same over time for the same application (e.g. should survive a reboot or MirrorLink reconnect), to allow the MirrorLink Client to implement a Last-Mode behavior.

An A_ARG_TYPE_AppID value may be identical to the wildcard "*", but it shall not be used, unless its usage is specifically stated in the definition of the respective UPnP actions and/or events.

4.2.6 A_ARG_TYPE_ProfileID

An unsigned 32-bit integer greater than or equal to 0, represents a unique profile identifier. Its value is set equal to 0 by default.

4.2.7 A_ARG_TYPE_AppList

A string formatted as UTF-8 XML represents the list of all applications that are available for remote control and access through the TmApplicationServer service. Its structure is given in Table 4-3. Server devices shall be able to support values of A_ARG_TYPE_AppList up to 10 KiloBytes in length.

Table 4-3: Structure of A_ARG_TYPE_AppList

Element	Description	Parent	Availability
appList	List of all available remote applications	-	Required
app*	Entry describing one remote application	appList	Optional
appID	Unique application ID. Shall be non-zero (A_ARG_TYPE_AppID)	app	Required
name	Application name (A_ARG_TYPE_String)	app	Required
variant	Unique application ID (<i>appID</i>) of the parent application, presented in the UPnP application listing (A_ARG_TYPE_String)	app	Optional
provider Name	Name of the application provider (A_ARG_TYPE_String)	app	Optional
provider URL	URL of the application provider's website (A_ARG_TYPE_URI)	app	Optional
description	Text description of application (A_ARG_TYPE_String)	app	Optional
iconList	List of available application icons. First icon shall be either <i>mimetype=image/png</i> , <i>width=128</i> , <i>height=128</i> and <i>depth=24</i> (default), or identical to values set in the client icon preferences as specified using the <i>TmClientProfileServer.1</i> service's <i>SetClientProfile</i> action The MirrorLink Client shall support displaying icons with <i>mimetype=image/png</i> , <i>width=128</i> , <i>height=128</i> and <i>depth=24</i>	app	Optional
icon*	Describes an application icon. The MirrorLink Server shall include an icon for all applications with the following <i><protocolID></i> values: <ul style="list-style-type: none"> • VNC • WFD (MirrorLink ≥ 1.2) 	iconList	Optional
mimetype	Type of icon image (A_ARG_TYPE_String)	icon	Required
width	Width of icon (A_ARG_TYPE_INT)	icon	Required
height	Height of icon (A_ARG_TYPE_INT)	icon	Required
depth	Color depth of icon (A_ARG_TYPE_INT)	icon	Required
url	URL where icon is available. If the icon of an application changes, the MirrorLink Server should change the icon's url. MirrorLink Client shall use HTTP-GET to access the icon behind the URL. (A_ARG_TYPE_URI)	icon	Required
allowed ProfileIDs	Reserved for future use Deprecated	app	Deprecated
remoting Info	Information about the remoting protocol used to interact with the application after it is launched	app	Required
protocolID	Protocol Identifier of the remoting protocol that will be used to access the application (see Table 4-4 for list of supported protocols) (A_ARG_TYPE_String)	remoting Info	Required
format	Format of data being transferred using the remoting protocol (see Table 4-5 for details) (A_ARG_TYPE_String)	remoting Info	Optional

Element	Description	Parent	Availability
direction	Direction of the content stream. A_ARG_TYPE_String with one of the following values: <ul style="list-style-type: none"> "out" - Content streaming from the MirrorLink server device to the client "in" - Content streaming from the MirrorLink client to the server "bi" - Content streaming in both directions between the MirrorLink server and client Default: "out"	remoting Info	Optional
audioIPL	Audio Initial Playback Latency (A_ARG_TYPE_INT) Default: "4800"	remoting Info	Optional
audioMPL	Audio Maximum Playback Length (A_ARG_TYPE_INT) Default: "9600"	remoting Info	Optional
app Certificate URL	URL where application certificate is available. The MirrorLink Client uses the certificate for information purpose. The MirrorLink Client shall not validate the certificate's trust chain MirrorLink Client shall use HTTP-GET to access the certificate behind the URL (A_ARG_TYPE_URI)	app	Optional
appInfo	Information about the listed application	app	Optional
app Category	Application category (A UTF-8 encoded string representing an unsigned 32-bit integer in hexadecimal format (with '0x' prefix).) Values are defined in Annex A Default: "0x00000000"	appInfo	Optional
trustLevel	Trust level of the contents of the appInfo element (A UTF-8 encoded string representing an unsigned 16-bit integer in hexadecimal format (with '0x' prefix).) Values are defined in Annex A Default: "0x0000"	appInfo	Optional
displayInfo	Information about display content of the listed application, in case it provides a displayable user interface	app	Optional
content Category	Visual content categories used (A UTF-8 encoded string representing an unsigned 32-bit integer in hexadecimal format (with '0x' prefix).) Values are defined in Annex A. Default: "0x00000000"	display Info	Optional
content Rules	Visual content rules followed Deprecated	display Info	Deprecated
orientation	Display orientations supported. Deprecated	display Info	Deprecated
trustLevel	Trust level of the displayInfo element. Value shall match <i>appInfo/trustLevel</i> . Default: "0x0000"	display Info	Optional
audioInfo	Information about audio content of the listed application, in case it provides an audio interface	app	Optional(++)

Element	Description	Parent	Availability
audioType	Audio type A_ARG_TYPE_String with one of the following values: <ul style="list-style-type: none"> • "phone" - Phone call audio • "application" - Generic application audio • "all" - Phone and application audio • "none" - no audio 	audiInfo	Required
content Category	Audio content categories used (A UTF-8 encoded string representing an unsigned 32-bit integer in hexadecimal format (with '0x' prefix).) Values are defined in Annex A.	audiInfo	Required
content Rules	Audio content rules followed Deprecated	audiInfo	Deprecated
trustLevel	Trust level of the audiInfo element (A UTF-8 encoded string representing an unsigned 16-bit integer in hexadecimal format (with '0x' prefix).) Values are defined in Annex A. Default: "0x0000"	audiInfo	Optional
resource Status	Application resource status In case the remote application is using a resource, which is subject to access control (e.g. an audio source or sink), this element will define the current status having one of the following values (A_ARG_TYPE_String): <ul style="list-style-type: none"> • "free" - Resource is free. Can be used by the MirrorLink client • "busy" - Resource already used. Resource assignment can be overridden by a client's invocation LaunchApplication action • "NA" - Resource already used. Resource assignment cannot be overridden by a LaunchApplication action invoked by a client Default: "free"	app	Optional
Signature	XML signature over entire contents of the appList element. This is done as specified in [3]. The key used in calculating the signature shall be the private part of the application-specific key which public part was bound to the attestation of UPnP-Server component. (The public part can be used to verify the signature.) The Reference element of the XML signature shall point to appList element. The SignatureMethod shall be RSA with SHA1. The KeyInfo element may be omitted. The mechanism for generation, exchange and maintenance of keys is out of scope for the present document	appList	Required

The elements marked with a (*) can have multiple instances.

(++) The *audiInfo* element shall be included into the advertisement on any RTP Client, RTP Server, BT HFP or BT A2DP module.

For deprecated values, the MirrorLink Server shall not include them into the UPnP application listing. The MirrorLink Client shall ignore any content provided in deprecated elements.

Implementation Note:

MirrorLink 1.0 and 1.1 Servers may not include the *Signature* entry from *A_ARG_TYPE_AppList*. MirrorLink 1.0 and 1.1 Clients may ignore an existing *Signature* entry.

In case the advertised (child) application (e.g. "Musik") is part of a parent application (e.g. "RockScout"), the *variant* element shall define the unique *appID* of that parent application. The parent application shall be separately present in the UPnP application listing.

The parent's application identifier provided in the *variant* element, may then be announced instead of the originally launched child's *appID* within in the framebuffer context information, or through the UPnP application status. This means that a MirrorLink Client may see the parent application getting into the foreground on the MirrorLink Server, even when one of its child applications had been initially launched. The launched (child) application is linked to the announced (parent) foreground application via the *variant* field in the client's application list entry. A parent application shall not be the child of another application, i.e. nesting is not supported.

The *protocolID* element in *A_ARG_TYPE_AppList* is a string formatted as UTF-8 XML represents the remote access protocol of a specific application, which can be controlled remotely. Table 4-4 specifies the supported remote access protocols, supported from the TmApplicationServer:1 service.

Table 4-4: Supported Remote Access Protocols

protocolID	Protocol Name and Description
VNC	Virtual Networking Computing
RTP	Real Time Protocol
BTA2DP	Bluetooth Advanced Audio Distribution Profile
BTHFP	Bluetooth Hands Free Profile
DAP	Device Attestation Protocol
CDB	Common Data Bus
WFD (MirrorLink 1.2)	Wi-Fi Display
NONE	Used to indicate that application does not have any additional out-of-band connection using a remote access protocol
<VendorName-ProtocolName>	Vendor Specific Protocol Name. Note that the vendor name shall be appended in front of the protocol name and separated by an '-' (Hyphen)

The *format* element in *A_ARG_TYPE_AppList* is a string formatted as UTF-8 XML represents additional format information for dedicated remote access protocols. Table 4-5 specifies the *Remote Access Protocol Format* information.

Table 4-5: Remote Access Protocol Format

protocolID	Remote Access Protocol Format description
VNC	Not used
RTP	Comma separated list of supported RTP payload types. Default: "99"
BTA2DP	Not used
BTHFP	Not used
DAP	MirrorLink Version number Allowed Values: "1.0" or "1.1" or "1.2" or "1.3" Default: "1.3"
CDB	Version number of the CDB protocol Allowed Values: "1.1" Default: "1.1"
WFD (MirrorLink 1.2)	Not used
NONE	Not used
<VendorName-ProtocolName>	Vendor Specific

The *A_ARG_TYPE_AppList* contains many optional elements. Elements, which are used for specific remote access protocols, are given in Table 4-6.