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Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 26: Consumer Experience Principles and Basic Features

CAUTION

The present document has been submitted to ETSI as a PAS produced by CCC and approved by the ETSI Technical Committee Intelligent Transport Systems (ITS).

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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 26 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 colour display, audio input/output and user input mechanisms.

MirrorLink is a single protocol that defines how a MirrorLink enabled Client device (typically the consumer's in-vehicle infotainment system) and a MirrorLink enabled Server device (typically the consumer's mobile device) communicate and provide an integrated consumer experience, where the MirrorLink Server is creating the consumer experience, running MirrorLink applications, whose user interfaces are presented via the MirrorLink Client. Consumers will only interact with the MirrorLink Client device, leaving the MirrorLink Server device stored away, allowing for responsible interactions, while the vehicle is in motion.

The MirrorLink protocol enables mobile device's consumer experience to be projected on the in-vehicle infotainment system. It enables the consumer to use the controls of the infotainment system to manipulate the mobile device. By using applications, following application-level requirements, either for use in drive or non-drive situations, consumers will see an experience optimized for the current situation.

Whereas the MirrorLink protocol specifies a consumer experience, it is open to implementation specific decisions and variations from Client and Server manufacturers. Differentiation in the consumer experience and supported features is encouraged. However, MirrorLink does need to be predictable and recognizable to the consumer. It is also critical for a MirrorLink brand recognition.

The present document specifies the basic consumer experience, for which MirrorLink stands for and many of the features MirrorLink enables. The present document intends to focus on the consumer experience level and does not intend to replace any requirements of the other technical specifications. Whether or not a MirrorLink Client or Server device follow the requirements defined within the present document will be mainly evaluated and tested through IOP testing, as outlined in more detail in the IOP test specification [1].

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] ETSI TS 103 544-2 (V1.3.0): "Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 2: Virtual Network Computing (VNC) based Display and Control".

[2] ETSI TS 103 544-9 (V1.3.0): "Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 9: UPnP Application Server Service".

[3] ETSI TS 103 544-10 (V1.3.0): "Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 10: UPnP Client Profile Service".

[4] ETSI TS 103 544-12 (V1.3.0): "Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 12: UPnP Server Device".

[5] Car Connectivity Consortium CCC-RQ-005: "Application Requirements for Drive Certification".

NOTE: Available at http://www.carconnectivity.org/MirrorLink%20Documents.

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 (V1.3.0): "Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 1: Connectivity".

3 Abbreviations

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

BT	Bluetooth
ML	MirrorLink
RFB	Remote Framebuffer
UPnP	Universal Plug and Play
USB	Universal Serial Bus
VNC	Virtual Network Computing

4 Consumer Experience Principles

The MirrorLink consumer experience is guided by a set of principles. Those principles are not strictly enforceable, as they are described on a high-level. Therefore, no obligation language is used in their description. But devices failing those principles will typically violate one or more of the MirrorLink technical requirements, as defined in the separate functional specification, or of the basic feature requirements as outlined in clause 5 of the present document.

The MirrorLink set of consumer experience principles are:

1) Starting MirrorLink is simple.

2) Paired MirrorLink certified devices just work.

3) Consumers are provided with a consistent and predictable MirrorLink consumer experience.

4) Consumers are at no time expected to interact with the MirrorLink Server device, after initial MirrorLink connectivity has been established.

5) Consumers are only provided with visual and audio content appropriate for the driving mode and local region, the MirrorLink Client device is currently in.

6) Consumers are provided with a responsive MirrorLink consumer experience.

7) Consumers are provided with a clear visual user interfaces, with minimal or no stretching and distortion, showing legible graphics and text.

8) Consumers are provided with a clear audio playback experience, free from pops, crackles and hisses on the MirrorLink Client's speakers. Latencies in controlling the audio stream are minimal.

9) Consumers are provided with consumer-friendly prompts, only when necessary.

10) Consumers are provided with appropriate notifications in case something goes wrong or a consumer's action cannot be completed as expected (`"No Silent Failure"`).

11) Consumers are provided with an uninterrupted MirrorLink experience until MirrorLink is ended.

12) Ending MirrorLink is simple and does not lead to unresponsive devices.

13) The use of MirrorLink functionality is described in respective consumer documentation or made available otherwise.

14) The consumer can easily recognize whether MirrorLink functionality is available.

5 Basic MirrorLink Features

5.1 Introduction

This clause summarizes the consumer experience related requirements for the various MirrorLink features, which are available using the MirrorLink protocol. Requirements provided within this clause are complementary to requirements in the detailed MirrorLink protocol specifications. Nevertheless, in case of a contradicting requirement or a contradicting obligation, the device vendor should apply the MirrorLink consumer experience principles as guidance as to which requirement to use.

The following clauses address features, which are either relevant to the consumer or which will message with the consumer.

5.2 First-Use Experience

The consumer installing MirrorLink on a supported mobile device is expecting an immediate first use experience, when connecting the device to a MirrorLink enabled in-vehicle infotainment system.

The following consumer experience requirements are defined:

- If no MirrorLink certified application, installed on the MirrorLink Server, can be presented on the MirrorLink Client, the MirrorLink Client shall inform the consumer about this fact. The MirrorLink Client should point to a location from where MirrorLink enabled compatible applications can be downloaded.

- If installed MirrorLink enabled applications are missing certificates, preventing their usage within MirrorLink, the requirements in clause 5.3 shall apply.

5.3 Download, Installation and Update of Applications

The consumer is able to download, install and update a suitable CCC or Member-certified application from any available application marketplace or via side-loading. In order to enable the consumer to use the application, e.g. while driving, the MirrorLink Server will need to evaluate the certification status prior first use. This validation requires the consumer to have the device connected to the Internet.

Failing to validate the certification status will not allow the consumer to use the application.

NOTE: Usability of an application refers to the application's expected use, as recorded in the certificate of the application. E.g. while a drive certified application may still be usable in park-mode, after the certificate cannot be validated for drive anymore, the application is not usable as expected in drive-mode.

Therefore, the following consumer experience requirements are defined:

- The consumer shall be able to install and update a MirrorLink application via the same mechanisms, as with any other regular non-MirrorLink application. Potential mechanisms include the download and installation from an application store or via side-loading.

- The consumer shall be able to install and update a MirrorLink application outside a MirrorLink session. The consumer shall be able to install and update a MirrorLink application inside a MirrorLink session, unless driving mode and/or geographic limitations apply (e.g. of the App Store application).
- The consumer shall be able to use a newly installed or updated MirrorLink application as expected, within a few seconds, unless the validation of the application certificate is not possible.
- The consumer shall be notified, when an installed or updated application cannot be used as expected, within MirrorLink within a few seconds. The consumer should not be notified, when the application can be used as expected. The notification should point out that internet connectivity is required to resolve the issue.
- A MirrorLink application, which is uninstalled from a MirrorLink Server device shall be immediately removed from the MirrorLink Server's application listings.
- Download, installation and update behaviour shall be independent of whether the device is new (i.e. after a factory reset) or used.

5.4 Listing of MirrorLink Applications

The consumer is able to launch application via listings of MirrorLink applications. Application listings are provided from the MirrorLink Client, via native MirrorLink Client user-interfaces or from the MirrorLink Server, via dedicated Home Screen applications. Latter one is accessible only via a MirrorLink session.

The following consumer experience requirements are defined:

- The order of the MirrorLink application list shall be consistent across multiple MirrorLink sessions.
- The MirrorLink Server's home screen application (if available), shall be listed first.
- The MirrorLink Server shall advertise drive-certified applications first in its application listing.
- The MirrorLink Client should show drive certified applications first in its application listing.
- The MirrorLink Server and the MirrorLink Server's home screen application shall not reorder the application list without explicit consumer interaction.
- The MirrorLink Server shall not change the order of the application listings within a MirrorLink session.
- The MirrorLink Server may offer an easily accessible mechanism that allows the consumer to control the sorting of the application listed. This mechanism should allow the consumer to sort the application list by frequency of use, name, install date, or other properties and to manually reorder the list.
- If a MirrorLink Client lists MirrorLink base certified applications in drive mode, those applications shall be clearly identifiable by the consumer (in drive mode) as not being available, e.g. graying them out. The consumer shall be able to distinguish a drive-certified application from a non-drive-certified application without any consumer interaction or launching the application. This requirement applies to drive and park mode. Note, the MirrorLink Client may only list drive-certified applications in drive mode.

5.5 Management of Certified Applications

In order to enable the consumer to use the application, e.g. while driving, the MirrorLink Server will need to continuously evaluate the certification status on a regular basis. This validation requires the consumer to have the device connected to the Internet.

- The consumer shall have access to certified applications as long as the application is installed on the MirrorLink Server device and the certification status can be regularly validated by the MirrorLink Server.
- The consumer should not be notified, when the certification status of a MirrorLink application can be regularly validated.
- The consumer should not be notified, when the certification status of a MirrorLink application cannot be regularly validated, while the application is still usable as expected within MirrorLink.

- The consumer should be notified, when an application will soon become unusable as expected within MirrorLink. Advanced notice should be given at least 24h prior.
- The consumer shall be notified, when a MirrorLink certified application became unusable within MirrorLink, for certification related reason. The notification should point out that internet connectivity may be required to resolve the issue.

In case the consumer has to be notified, the MirrorLink Server shall provide the notification.

Notifications should be provided outside a MirrorLink session or via separate notification/setting pages. Notification may be deferred, if needed (e.g. as the device is currently in drive mode and visual notification is not possible). Notification should be provided outside a MirrorLink session as well, when applicable (e.g. expiration of a certificate).

The MirrorLink Server should provide a "Certificate dashboard" application, which displays a list of all installed MirrorLink application. The application should allow the consumer to trigger the validation of the application certificates. This application may be not-MirrorLink enabled.

The MirrorLink Server should allow MirrorLink drive-certified applications, to call other driver certified applications, implementing a specific intend, e.g. to launch navigation or phone call functionality. This shall not cause uncertified content to become visible in the foreground of the MirrorLink screen.

5.6 Interacting with MirrorLink Applications

The consumer is able to interact with MirrorLink applications via Voice or Physical interaction with the Client devices user input controls, like the Client's touch screen, soft or hard buttons around the Client's screen or on the steering wheel.

The following consumer experience requirements are defined:

- All **soft** buttons, rendered by the MirrorLink Client around the MirrorLink Application's user interface, shall be usable and shall be consistent with the user's expectation of the underlying control event. I.e. a home button shall have home functionality.
- All **soft** buttons, rendered by the MirrorLink Server around the MirrorLink Application's user interface, shall be usable and shall be consistent with the user's expectation of the underlying control event. I.e. a home button shall have home functionality.
- All device key events, the MirrorLink Server is advertising in its Key Event Configuration message, shall be supported from the MirrorLink Server and/or respective MirrorLink applications.
- All **hard** buttons, supported by the MirrorLink Client within MirrorLink, shall be usable and shall be consistent with the user's expectation of the underlying control event. I.e. a home button shall have home functionality.
- Dedicated buttons, available within MirrorLink, it shall have the same semantics within MirrorLink as in the native context outside of MirrorLink.

5.7 Listening to Entertainment and Navigation Audio

The consumer has access to his/her favourite entertainment and navigation applications, either run remotely from the MirrorLink Server or locally from the MirrorLink Client. The MirrorLink Server is responsible for mixing all remote audio sources into a single audio stream, which is streamed to the MirrorLink Client. The MirrorLink Client is responsible for mixing the MirrorLink audio stream with other local audio streams, and output the mixed audio stream via its speaker system.

NOTE: Local audio in the context of the MirrorLink Client is referring to audio sources, which are handled outside of MirrorLink, like FM radio.

Within the scope of the present document, the mixing of two or more audio streams will result in either one audio stream being in the foreground and the others being in background, or one audio stream being heard and the others being silenced. The audio source of a silenced audio stream may be muted, paused or stopped, dependent on the type of audio source (application specific).

The following consumer experience requirements are defined:

- The MirrorLink Server shall give the same priority for its entertainment and navigation audio sources within MirrorLink as it gives outside a MirrorLink session.
- The MirrorLink Client shall give MirrorLink navigation audio a higher priority than local entertainment audio. The MirrorLink Client shall automatically switch back to local entertainment audio, after the MirrorLink navigation audio completes. The MirrorLink Client shall automatically resume local entertainment audio playback in this case, unless higher-priority activities are preventing this for the MirrorLink Client.
- The MirrorLink Client shall give local navigation audio a higher priority than MirrorLink entertainment audio. The MirrorLink Client shall automatically switch back to MirrorLink entertainment audio, after the local navigation audio completes, unless higher-priority activities are preventing this for the MirrorLink Client. The MirrorLink application should automatically resume MirrorLink entertainment audio playback in this case.

NOTE: CCC's application certification program may add specific requirements regarding automatic resume after audio unblocking.

- The MirrorLink Client shall give the MirrorLink entertainment or the local entertainment audio source, which had been selected by the user last, a higher priority. Switch back to the other entertainment source shall happen only based on consumer action.
- The MirrorLink Client may give unknown MirrorLink audio, while MirrorLink is in the foreground on the MirrorLink Client, a higher priority than local entertainment audio. The MirrorLink Client may then automatically resume local entertainment audio playback, once the unknown MirrorLink audio finishes.

NOTE: Within the present document unknown audio refers to the audio stream, for which the audio context is either missing or the application category is set to `0x00`.

- The MirrorLink Client may treat unknown MirrorLink audio differently, depending on whether MirrorLink is in the foreground or in the background on the MirrorLink Client.
- The MirrorLink Client shall playback MirrorLink audio, if no local audio is playing, unless the consumer has specifically muted MirrorLink audio.
- The MirrorLink Client shall not stop playback of local audio, just because MirrorLink audio is getting blocked.

EXAMPLE: A MirrorLink Client is playing local FM radio while it suddenly receives uncertified/unknown audio content from the MirrorLink Server. If the MirrorLink Client does not support unknown audio content, it will be blocked. In this case, the MirrorLink Client is not expected to stop or pause the local FM radio playback, leaving the consumer with a sudden disappearance of the audio experience for no obvious reason.

- The MirrorLink Client should give local driver safety related audio, higher priority than MirrorLink audio.
- The MirrorLink Client shall prioritize remote and local audio sources, independent of whether the respective application is in the foreground or in the background on the MirrorLink Server or Client.
- The MirrorLink Server shall provide an entertainment audio stream free of crackles, distortions or other artefacts over a long period of time (> 1 h), while a VNC session is ongoing.
- The MirrorLink Client shall playback the received entertainment audio stream free of cackles, distortions or other artefacts over a long period of time (> 1 h), while a VNC session is ongoing.

5.8 Transferring Audio to and from a MirrorLink Session

The consumer is using the mobile device with different audio accessories, like a Bluetooth or analogue audio connector. When connecting an audio accessory, entertainment audio is typically automatically transferred to the accessory and continues playing. When disconnecting the accessory, the entertainment audio is typically automatically stopped. Navigation audio is typically automatically routed to the accessory on connection and back to the mobile on disconnection, so that no turn-by-turn guidance is missed. Phone call behaviour is typically similar.

In case of MirrorLink, the consumer will expect a similar known behaviour. On the one hand the consumer will expect the connected MirrorLink enabled head-unit to behave like any other audio accessory, while not disrupting the preference for the local head-set.

The following consumer experience requirements are defined:

- When the consumer starts a MirrorLink session, the MirrorLink Server shall transition the audio connection to the MirrorLink Client. The MirrorLink Client shall establish an audio connection to the MirrorLink Server, when the MirrorLink session is established. The MirrorLink Server shall inform MirrorLink audio applications about the connection.
- When the consumer ends a MirrorLink session, while MirrorLink entertainment audio is playing, the MirrorLink application shall transition the audio stream back to the MirrorLink Server's speaker. The MirrorLink Server shall inform MirrorLink audio application about the disconnection.
- When the consumer connects a Bluetooth or an analogue headset to the MirrorLink Server device, while MirrorLink audio is playing, the MirrorLink Server shall transition the audio stream to the newly connected accessory, if this is consistent with connecting the same audio accessory outside a MirrorLink session.
- When the consumer disconnects a Bluetooth or an analogue headset from the MirrorLink Server device, while MirrorLink audio is playing, the MirrorLink Server shall transition the audio stream back to the MirrorLink session, if this is consistent with disconnecting the same audio accessory outside a MirrorLink session.
- Consistency in above statements shall be achieved across various MirrorLink sessions. The behaviour is platform specific, but it should be in line with other projected experiences on that platform.
- Entertainment audio applications should not pause, when transitioning audio to an audio accessory, while in a MirrorLink session or to a MirrorLink session, without a connected audio accessory.
- Entertainment audio applications should pause, when transitioning audio from an audio accessory, while in a MirrorLink session or from a MirrorLink session, without a connected audio accessory.
- Telephony and navigation audio applications shall not pause, when transitioning audio to and from an audio accessory, while in a MirrorLink session, or to and from a MirrorLink session without a connected audio accessory.

5.9 MirrorLink Consistency, Robustness & Ease of Use

The consumer is using the mobile device within a MirrorLink session, it expects that whenever a connection is established, he/she has the same consistent experience as within the last session.

The following consumer requirements are defined:

- The application icons, presented to the consumer shall match the application, in particular after a reconnect or an application install. In particular, potential caching of the application's icon on the MirrorLink Client side, shall maintain the match.
- Powering on & off the MirrorLink Client, even repeatable, shall be consistent and shall provide repeatable experience. It shall not cause the MirrorLink Server or Applications to crash, reboot or otherwise misbehave. This includes any visible or audible glitch.
- Connecting and disconnecting the MirrorLink Server, even repeatable, shall be consistent and shall provide repeatable experience. It shall not cause the MirrorLink Client or Applications to crash, reboot or otherwise misbehave. This includes any visible or audible glitch.
- Switching the MirrorLink Client from park into drive mode and back to park mode shall provide consistent consumer experience, where the drive/park mode setting, is in line with MirrorLink application settings.

5.10 Phone Call Functionality

Consumers with MirrorLink enabled Server devices supporting phone call functionality, are expecting the same to be available via MirrorLink. Specifically, in coming phone calls, which may come in at any point in time during a MirrorLink session, need to be gracefully handled from the MirrorLink Server.

The following consumer requirements are defined:

- The consumer shall be able to receive and accept or reject a phone call, while being in a MirrorLink session.
- A MirrorLink Server shall support telephony functionality over Bluetooth HFP alongside MirrorLink, if telephony is supported.
- A driver-facing MirrorLink Client shall support telephony functionality over Bluetooth HFP alongside MirrorLink.
- The Bluetooth HFP connection shall be offered or automatically reconnected when the consumer establishes the MirrorLink session within park and drive mode. Initial Bluetooth pairing may require manual steps from the consumer.
- The MirrorLink Server should maintain an existing Bluetooth HFP connection, when a MirrorLink session is being established.

The control of the Phone Call experience can be provided natively from the MirrorLink Client as well as from the MirrorLink Server via a dedicated (Immersive) Phone Call application. On an incoming phone call, i.e. when receiving HFP Ring SCO, the MirrorLink Client has to decide, whether to launch its own phone call UI (Classic MirrorLink), or whether to use the MirrorLink Server's phone call UI (Immersive MirrorLink).

The following consumer requirements are defined:

- A MirrorLink Client shall use its native call UI to handle HFP/telephony functionality in case the MirrorLink Server is not connected via BT HFP.

NOTE: This applies, when a non-MirrorLink device is connected to the MirrorLink Client via BT HFP.

- A MirrorLink Client in Classic Mode shall use its native phone call UI to handle HFP/telephony functionality.
- A MirrorLink Client shall not overlay the MirrorLink Link Server's Immersive Phone application with its native call UI.

NOTE: Overlay in this regard means, that the MirrorLink Client's native call UI is partially or fully overlaying the MirrorLink Server's remote framebuffer.

- A MirrorLink Server in Immersive MirrorLink Mode shall bring the Immersive Phone Call application into foreground, and announce it to the MirrorLink Client, updating the Context Information, not later than 1 000 ms after sending HFP Ring SCO.

5.11 MirrorLink Logo Use

Consumers with MirrorLink enabled devices, need to be aware that MirrorLink is available. The Car Connectivity Consortium has trademarked a MirrorLink logo and a MirrorLink Design-only icon for this purpose.

The following consumer requirements are defined:

- If the consumer is able to manually activate MirrorLink functionality (e.g. when MirrorLink functionality can be switched on using a button) the UI element should bear the MirrorLink logo or the MirrorLink Design-only icon.
- When connecting a MirrorLink Client and Server, both product should announce to the consumer that MirrorLink capability is available or automatically establish the MirrorLink session.
- If the MirrorLink Server is displaying a static screen, while being in a MirrorLink session, it should contain the MirrorLink logo or the MirrorLink Design-only icon.

CCC has a dedicated trademark and logo usage guidelines. Use of the MirrorLink Logo and the Design-only icon are limited to certified products.

To increase consumer awareness of MirrorLink support within MirrorLink enabled devices, the following recommendations are provided. Note that below recommendations are not included in any testing within CCC's device certification program:

- The MirrorLink product should bear the MirrorLink logo or the MirrorLink Design-only icon on the packaging.
- The MirrorLink product should describe the MirrorLink functionality in the user manual.
- The MirrorLink functionality should be advertised under the brand name MirrorLink as opposed to a self-defined brand name.

5.12 Classic, Immersive and Legacy MirrorLink Mode

The consumer is expecting a seamless experience, when interacting with individual MirrorLink applications, switching between those and allowing to go back and forth to a native MirrorLink Client experience.

MirrorLink aims to provide a user experience, where navigation mechanisms (e.g. buttons to switch between applications) are not redundant, e.g. rendered from both Clients and Servers as part of the user interface. Yet all functionality to interact with applications, to navigate between applications and to leave the MirrorLink experience is available to consumers at all time.

The MirrorLink experience is referring to three main events, which need to be either handled from the MirrorLink, the MirrorLink Server and/or MirrorLink Client, as specified in later in this clause.

- The *Device_Backward*, or *Back* event allows the consumer to navigate within applications. The behaviour is platform specific. Application may ignore the event, or consume it with or without responding to the event. MirrorLink applications, requiring support for a *Back* event, shall provide their own mechanisms within the application, in case the event is not available from the MirrorLink Server or Client.

NOTE: This information is available through the MirrorLink API.

- The *Device_Home* or *AppList* event allows the consumer to switch back to the application listing, either on the MirrorLink Server's Home Screen application or on the MirrorLink Client. Dependent on the MirrorLink Mode, the MirrorLink Server or MirrorLink Client shall provide a mechanism for the consumer to trigger this event.
- The *Switch to Native UI* event allows the consumer to leave the MirrorLink experience and switch to a MirrorLink Client native experience. The MirrorLink Client shall provide a mechanism for the consumer to trigger this event, in case the MirrorLink Client has a native experience.

MirrorLink defines two target experiences, one cantered around the MirrorLink Client (Classic MirrorLink Mode) and one immersed into the MirrorLink Server experience (Immersive MirrorLink Mode). Applications running within a Classic or Immersive MirrorLink Mode experience will not see any difference with the way consumer are viewing them and interacting with them.

Classic MirrorLink Mode

Within Classic MirrorLink Mode, the MirrorLink Client is responsible for giving consumers access and control over MirrorLink applications, i.e. providing application listings, mechanisms to launch (and potentially terminate) applications, mechanisms to switch between them and mechanisms to leave and return to the MirrorLink experience.

The following requirements are describing the experience in more details:

- The MirrorLink Client shall present and give consumers access to the list of available, launchable MirrorLink applications and shall allow launching those.
- The MirrorLink Client should provide a mechanism allowing the consumer to trigger a *Back* event.

NOTE: A MirrorLink Client with a non-touch display shall provide support for a *Back* event.

- In case of a framebuffer blocking event, the MirrorLink Client and Server shall follow the steps specified in [1]. Any MirrorLink related consumer notification shown in drive mode, shall follow the respective application guidelines as defined in [5].

- The MirrorLink Client shall provide a mechanism allowing the consumer to switch to the MirrorLink application list (*AppList* event) from which the consumer shall be able to launch individual MirrorLink applications. This event shall not be send to the MirrorLink Server.

- When receiving a *Device_Home* key event, the MirrorLink Server shall either switch to a MirrorLink Legacy Home Screen application or send a *FramebufferUpdate* message containing context information with at least one *applicationCategory* set to `"Switch to MirrorLink Client native UI"`.

- The MirrorLink Client shall provide a mechanism allowing the consumer to switch between applications. Switching between applications shall not terminate ongoing VNC or WFD sessions, unless specifically intended from the consumer.

- MirrorLink Clients, which provide native non-MirrorLink experiences, shall make a mechanism available, allowing consumers to leave the MirrorLink experience (*Switch to Native UI* event), and to return to it later. Switching to a native non-MirrorLink experience shall not terminate ongoing VNC or WFD sessions, unless specifically intended from the consumer.

- The MirrorLink Client shall switch to the MirrorLink application list in response to receiving a *FramebufferUpdate* message containing context information with at least one *applicationCategory* set to `"Switch to MirrorLink Client native UI"`. This shall not terminate ongoing VNC or WFD sessions, unless specifically intended from the consumer.

- The MirrorLink Server shall not reduce the MirrorLink Client's screen real estate, available to MirrorLink applications by rendering any additional decorations, buttons, status bar or other elements.

- In case the MirrorLink Server shows a consumer notification during a MirrorLink session, it shall reference a separate, advertised CCC or Member certified application within the respective VNC/WFD context information messages (e.g. an application identifier of 0x00 is not allowed). Any consumer notification, shown in drive mode, shall be compliant with the respective driver distraction guidelines.

Example Classic MirrorLink Mode Experiences:

An example Classic MirrorLink Mode experience is shown in Figure 1; green frame decorations indicate user interface elements rendered from the MirrorLink Server, red frame decorations MirrorLink Client ones. The middle image shows MirrorLink Client experience, presenting and giving consumers access to the list of available, launchable MirrorLink applications (3 applications in this example). Launching application, e.g. via touching the application icon, presents the MirrorLink application user interface (left image), as provided from the MirrorLink Server. In Classic MirrorLink Mode, the MirrorLink Client provides a mechanism (a hard button in this case), allowing the consumer to switch back to the application listing (middle image). Additionally, the MirrorLink Client provides a mechanism (a hard button in this case), allowing the consumer to switch to a native MirrorLink Client experience, like FM radio (right image). The MirrorLink Client enables the consumer to return to the application listing.

Figure 1: Basic Classic MirrorLink Mode

A Classic MirrorLink Mode Client can allow consumers to directly switch from the application experience (left image) to the native experience (right image), without an application listing step.

Figure 2 shows example experiences, where the MirrorLink Client display is exceeding the definitions of the MirrorLink Reference Display. It can either allow the MirrorLink Server to use the excess area, making the application bigger (left image), or use it itself rendering own status or navigation bars (right image), or a combination of the two (not shown).

Figure 2: Classic MirrorLink Mode for Bigger Client Displays

Figure 3 shows an example experience, where the MirrorLink Client is switching from Park Mode, with a non-drive certified application in foreground (left image) to Drive Mode. The MirrorLink Client is showing a notification, informing the consumer of the reason for blocking (middle image), and allowing him to switch to the application listing (right image). The consumer may decide to stay on that notification screen, waiting for the MirrorLink Client to go back to Park Mode (left image). This is a valid experience, when the consumer is using a non-drive certified application, within a Stop-and-Go traffic situation.

Figure 3: Switching from Park to Drive Mode in Classic MirrorLink Mode

Immersive MirrorLink Mode

Within Immersive MirrorLink Mode, the MirrorLink Server is responsible for giving consumers access and control over MirrorLink applications, i.e. providing application listings, mechanisms to launch (and potentially terminate) applications, mechanisms to switch between them and mechanisms to leave the MirrorLink experience.

The following requirements are describing the experience in more details:

- The MirrorLink Server shall present and give consumers access to the list of available, launchable MirrorLink applications via an Immersive Home Screen application. The Immersive Home Screen application shall not list or allow the launch of applications not included in the list of allowed applications provided from the MirrorLink Client in the UPnP *SetAllowedApplicationsList* actions [2], within the respective drive/park mode. All allowed applications shall be listed and shall be launchable.

- The MirrorLink Client shall automatically launch the MirrorLink Server's Home Screen application, when a MirrorLink session is established, disregarding of the foreground/background status of MirrorLink on the Client's screen. The MirrorLink Client may immediately block the Home Screen application with reason `"UI not visible on remote display"`.

- The MirrorLink Server should provide a mechanism allowing the consumer to trigger a *Back* event.

- In case of a framebuffer blocking event, the MirrorLink Client and Server shall follow the steps specified in [1]. Any MirrorLink related consumer notification shown in drive mode, shall follow the respective application guidelines as defined in [5].

- The MirrorLink Server shall provide a mechanism allowing the consumer to switch from any MirrorLink application back to the MirrorLink Immersive Home Screen application (*AppList* event).

- The MirrorLink Server shall switch to the MirrorLink Immersive Home Screen application, when receiving a *Device_Home* key event.
- The MirrorLink Server shall make a mechanism available, allowing consumers to leave the MirrorLink experience (*Switch to Native UI* event). This mechanism shall trigger the MirrorLink Server to send context information set to `"Switch to MirrorLink Client native UI"`. Switching to a native MirrorLink experience shall not terminate ongoing VNC or WFD sessions, unless specifically intended from the consumer.
- The MirrorLink Client shall switch to their native Home Screen, or a previously used native screen, in response to receiving a *FramebufferUpdate* message containing context information with at least one *applicationCategory* set to `"Switch to MirrorLink Client native UI"`. This shall not terminate ongoing VNC or WFD sessions, unless specifically intended from the consumer.
- The MirrorLink Client shall provide a mechanism allowing the consumer to return to the MirrorLink screen.
- The MirrorLink Client shall not render soft buttons, replicating the MirrorLink Server's immersive experience.
- The MirrorLink Client shall provide screen real estate in excess of the Reference Screen Display to the MirrorLink Server, to allow to render an additional navigation bar of at least 1 cm width.
- The MirrorLink Server shall provide screen real estate not smaller than the Reference Screen Display to the MirrorLink applications. The MirrorLink Server shall not render any decorations, buttons, status bar or other elements, within the provided screen real estate.
- The MirrorLink Server may use any available screen real estate in excess of the Reference Screen Display, as rendering area for additional elements, like a server status bar.
- In case the MirrorLink Server shows a consumer notification during a MirrorLink session, it shall reference the Immersive Home Screen application within the respective VNC/WFD context information messages. Any consumer notification, shown in drive mode, shall be compliant with the respective driver distraction guidelines.

Example Immersive MirrorLink Mode Experiences:

An example Immersive MirrorLink Mode experience is shown in Figure 4; green frame decorations indicate user interface elements rendered from the MirrorLink Server, red frame decorations MirrorLink Client ones. The middle image shows MirrorLink Home Screen experience, as provided from the MirrorLink Server, presenting and giving consumers access to the list of available, launchable MirrorLink applications (3 applications in this example). Launching application, e.g. via touching the application icon, presents the MirrorLink application user interface (left image), as provided from the MirrorLink Server. In Immersive MirrorLink Mode, the MirrorLink Server provides a mechanism (a soft button in this case), allowing the consumer to switch back to the Home Screen (middle image). Additionally, the MirrorLink Server provides a mechanism (a soft button in this case), allowing the consumer to switch to a native MirrorLink Client experience, like FM radio (right image). The MirrorLink Client enables the consumer to return to the application listing.

Figure 4: Basic Immersive MirrorLink Mode

An Immersive MirrorLink Mode Server can allow consumers to directly switch from the application experience (left image) to the native experience (right image), without a Home Screen step.

Figure 5 shows an example experience, where the MirrorLink Client display is exceeding the definitions of the MirrorLink Reference Display. This allows the MirrorLink Server to use the excess area for increase navigation bar, an optional status bar, or giving the MirrorLink application more than the Reference Screen Display area, or all of the above.

Figure 5: Immersive MirrorLink Mode for Bigger Client Displays

Figure 6 shows an example experience, where the MirrorLink Client is switching from Park Mode, with a non-drive certified application in foreground (left image) to Drive Mode. The MirrorLink Server is showing a notification, informing the consumer of the reason for blocking (middle image), and allowing him to switch to the application listing (right image). The consumer may decide to stay on that notification screen, waiting for the MirrorLink Client to go back to Park Mode (left image). This is a valid experience, when the consumer is using a non-drive certified application, within a Stop-and-Go traffic situation.

Figure 6: Switching from Park to Drive Mode in Immersive MirrorLink Mode

Legacy MirrorLink Mode

MirrorLink 1.3 devices shall not implement Legacy MirrorLink Mode.

Within Legacy MirrorLink Mode, devices are implementing a mixture of Immersive and Classic MirrorLink Mode. This may lead to duplicating navigation control and status information, providing possible confusion to consumers. MirrorLink 1.1 and 1.2 devices only implement Legacy MirrorLink Mode. Therefore, devices supporting the Immersive and Classic MirrorLink Mode, shall work with legacy devices.

The following requirements are describing the experience in more details:

- The MirrorLink Client shall present and give consumers access to the list of available, launchable MirrorLink applications.
- The MirrorLink Client shall provide a mechanism allowing the consumer to switch to the MirrorLink application list (*AppList* event) from which the consumer shall be able to launch individual MirrorLink applications. This event shall not be send to the MirrorLink Server.
- The MirrorLink Server may provide a mechanism allowing the consumer to switch back to the MirrorLink Home Screen application (*AppList* event).

- The MirrorLink Server may make a mechanism available, allowing consumers to leave the MirrorLink experience (*Switch to Native UI* event). This mechanism shall trigger the MirrorLink Server to send context information set to `"Switch to MirrorLink Client native UI"`. The MirrorLink Client shall support this mechanism.

A MirrorLink Client, connected to a MirrorLink Server, which is signalling neither Immersive nor Classic MirrorLink Mode support, shall default to Classic MirrorLink Mode, assuming the MirrorLink Server to be a legacy device. No default is defined for a MirrorLink Server, connected to a legacy MirrorLink Client. Legacy MirrorLink Mode shall not be used otherwise from a MirrorLink 1.3 device. These options are shown in Table 1.

The MirrorLink Client shall support Classic MirrorLink Mode. The MirrorLink Client shall support Immersive MirrorLink Mode, in case it has a physical display, which provides at least 1 cm horizontally in excess of the Reference Screen Display. The MirrorLink Server shall support Classic MirrorLink Mode and may support Immersive MirrorLink Mode. Based on the available MirrorLink Modes, the MirrorLink Server shall select the MirrorLink Mode it will enable.

The MirrorLink Server may choose the MirrorLink Mode for the actual MirrorLink session based on the connected MirrorLink Client. For example, the MirrorLink Server may choose to limit *Immersive MirrorLink Mode* to touch-enabled MirrorLink Clients and default to *Classic MirrorLink Mode* when connected to MirrorLink Clients with rotary-knob controls; also, the MirrorLink Server may choose to limit *Immersive MirrorLink Mode* to specific MirrorLink Client manufacturers and otherwise default to *Classic MirrorLink Mode*.

The MirrorLink Server shall choose the appropriate MirrorLink Mode to ensure that the connected MirrorLink Client is supported.

Table 1: Immersive vs. Classic MirrorLink Mode and Support for Legacy Devices

	MirrorLink Server	
MirrorLink Client	Legacy Mode Only (ML 1.0 – 1.2)	Classic & Immersive Mode (ML 1.3)
Legacy Mode Only (ML 1.0 – 1.2)	Client: Legacy Mode Server: Legacy Mode	Client: Legacy Mode Server: Classic Mode
Classic Mode Only (ML 1.3)	Client: Classic Mode Server: Legacy Mode	Client: Classic Mode Server: Classic Mode
Classic & Immersive Mode (ML 1.3)	Client: Classic Mode Server: Legacy Mode	Client: Follow Server's selection Server: Classic or Immersive Mode

The MirrorLink Client shall signal support for Immersive and Classic MirrorLink to the MirrorLink Server, as specified in the UPnP Client Profile service specification [3]. The MirrorLink Server shall signal support for Immersive or Classic MirrorLink to the MirrorLink Client, as specified in the UPnP Device [4] specification. The MirrorLink Server shall select the MirrorLink Mode in the beginning of a MirrorLink session and adjusts its UPnP application listings. The MirrorLink mode shall not change during a MirrorLink session.

The MirrorLink Client and Server shall not overlay the MirrorLink application with any content, as the consumer will otherwise not be able to use the application within the limits of the respective drive certification guidelines, unless one of the following conditions apply:

NOTE: This restriction does not apply to overlays from certified applications.

- The overlay automatically disappears without user intervention, not later than 10 s.
- Safety related features, with higher priorities, require such an overlay.
- User action causes the overlay, and user action will remove the overlay, e.g. a rear-view camera, when the user switches into the reverse gear.
- Notifications, which require user attention, e.g. incoming call notification.

The following requirements apply to all UI elements rendered by a MirrorLink Server and Client outside of the MirrorLink application's UI (e.g. a navigation bar, a notification):

- UI elements shall be compliant with the requirements listed in the application requirements for drive certification [5].
- UI elements shall be functional.
- Interaction with UI elements shall not lead to uncertified content in drive mode.
- UI element shall be accessible via the connected MirrorLink Client's touch or rotary-knob controller.

Any status or navigation bar, a MirrorLink Server is additionally rendering shall not contain MirrorLink Server status information, which is already shown from the MirrorLink Client separately and independently of the MirrorLink remoted framebuffer.

NOTE: This requirement does not apply to MirrorLink application's user interfaces, i.e. a MirrorLink certified application can still present time or battery status, as long as its presentation is in line with application certification requirements.

The information shown from the MirrorLink Client shall be included in the UPnP Client Profile's *serverInfo* element, as defined in [3].

6 Minimum Baseline Performance

6.1 General

All performance requirements are measured with no local applications running additionally on the target devices, unless those applications are needed for the correct operations of MirrorLink on those devices.

6.2 User Interface Performance

6.2.1 VNC RAW/RLE Performance

In order to allow for a more optimized use of the available bandwidth for the VNC framebuffer transfer, the following requirements apply. The use case for these performance requirements is a map panning.

- The MirrorLink Server shall be able to provide on average the full framebuffer update performance listed below, for MirrorLink Client screen resolution of 800x480.
- The MirrorLink Client shall be able to provide on average the full framebuffer update performance listed below, for a MirrorLink Server screen resolution of 800x480.

NOTE: The MirrorLink Client may support only one of the two pixel formats.

Table 2: VNC Performance Requirements

Pixel Format	Full framebuffer performance
Any supported	12 FB updates/second

The VNC performance shall be measured, while RTP streaming with payload type 99 is ongoing.

6.2.2 HSML Performance

In order to allow for a more optimized use of the available bandwidth for the HSML framebuffer transfer, the following requirements HSML performance requirements apply:

- The MirrorLink Server shall be able to provide on average the streaming performance listed below, for MirrorLink Client screen resolution of 800x480.
- The MirrorLink Client shall be able to provide on average the streaming performance listed below, for a MirrorLink Server screen resolution of 800x480.

NOTE: The MirrorLink Client may support only one of the two pixel formats.

Table 3: HSML Performance Requirements

Pixel Format	Full framebuffer performance
Any supported	24 FB updates/second

The HSML performance shall be measured, while RTP streaming with payload type 99 is ongoing.

6.2.3 VNC VA H.264 Performance

In order to allow for a more optimized use of the available bandwidth for the VA H.264 framebuffer transfer, the following requirements VA H.264 performance requirements apply:

- The MirrorLink Server shall be able to provide on average the streaming performance listed below, for MirrorLink Client screen resolution of 800x480.
- The MirrorLink Client shall be able to provide on average the streaming performance listed below, for a MirrorLink Server screen resolution of 800x480.

NOTE: The MirrorLink Client may support only one of the two pixel formats.

Table 4: VA H.264 Performance Requirements

Pixel Format	Full framebuffer performance
Any supported	30 FB updates/second

The VA H.264 performance shall be measured, while RTP streaming with payload type 99 is ongoing.

6.3 Round Trip Latency

- The round-trip latency, i.e. the time from the consumer doing a touch or key event on the MirrorLink Client until a response from the MirrorLink applications is visible on the MirrorLink Client's display shall be less than 200 ms.

NOTE: The round-trip latency is measured with a responsive test application.

The Round Trip Latency shall be measured, while RTP streaming with payload type 99 is ongoing.

6.4 Setting Up and Managing the MirrorLink Session

- The consumer shall be able to start MirrorLink from the MirrorLink Client not later than 2 000 ms after the MirrorLink Server has been connected to the MirrorLink Client, i.e. plugging in the USB cable, or after Wi-Fi P2P devices have been paired, or the consumer has executed a manual connection step on the MirrorLink Server and/or Client.

- The MirrorLink Client shall present MirrorLink functionality, e.g. an application list, or an automatically launched application, within 5 000 ms after the consumer launching MirrorLink from the MirrorLink Client.

7 MirrorLink Application

7.1 Introduction

The following clauses define the behavior and functionality for a set of MirrorLink applications, which can be relevant to achieve MirrorLink device certification. Dependent on the implemented MirrorLink Modes, a MirrorLink Server shall have all or some of them installed.

7.2 Immersive & Classic Home Screen Application

A Home Screen application identifies a MirrorLink application, which provides a Home Screen experience, i.e. it allows the consumer to see a list of installed (certified) applications, and allows to launch them.

Classic MirrorLink Mode

A MirrorLink Server may provide a Classic Home Screen application (*application category* `"0x00010001"`), which shall be CCC or Member-drive certified for the connected MirrorLink Client. It's *resourceStatus* shall be set to `"free"`. All applications, available through the Classic Home Screen application, shall be advertised with *resourceStatus* set to `"NA"`.

The Classic Home Screen application may include all or a subset of installed applications, which are CCC or Member-certified for the connected MirrorLink Client. The Classic Home Screen application may include non-certified applications.

A MirrorLink Client should not list applications, which have been advertised with *resourceStatus* set to `"NA"` from the MirrorLink Server.

Immersive MirrorLink Mode

A MirrorLink Server shall provide an Immersive Home Screen application (*application category* `"0x00010006"`), which shall be CCC or Member-drive certified for the connected MirrorLink Client. It's *resourceStatus* shall be set to `"free"`. All other remote user interface applications shall be advertised with *resourceStatus* set to `"NA"`.

The Immersive Home Screen application shall include all installed applications, which are CCC or Member-certified for the connected MirrorLink Client. The Immersive Home Screen application may include non-certified applications.

A MirrorLink Client shall not list applications, which have been advertised with *resourceStatus* set to `"NA"` from the MirrorLink Server.

The following additional requirements apply to the Immersive and Classic Home Screen application:

- In Drive mode, the Home Screen Application shall not make any non-drive certified application accessible; Member-drive certified applications shall not be included, if the MirrorLink Client's *manufacturer name* does not match one of the certifying entities.

NOTE: The MirrorLink Server need not show any non-drive certified application within the Home Screen, or may mark the application as not-accessible.

- In case the *SetAllowedApplicationsList* action is supported from the MirrorLink Client, the Home Screen application shall make only those applications available in drive mode, which are included in the list of allowed applications.

- In case the *SetAllowedApplicationsList* action is not supported from the MirrorLink Client, the Home Screen application shall consider the MirrorLink Client's *AppCertFilter* settings from the *GetCertifiedApplicationsList* and *GetAppCertificationStatus* actions:
  - The MirrorLink Server shall remove applications from the home screen application, or do not allow to launch them from there, during drive mode, when the application is not drive certified in the locales, which are included from the MirrorLink Client in the *restricted* field of the *GetCertifiedApplicationsList* and *GetAppCertificationStatus* action's *AppCertFilter* parameter. Multiple actions shall be considered as an OR connected filtering. Note that the MirrorLink Client may check for multiple locales.
  - If the MirrorLink Client does not use the *AppCertFilter*, the MirrorLink Server shall treat all applications drive certified, which have a non-empty *restricted* entry. In case an application is blocked from the MirrorLink Client during drive mode, the MirrorLink Server may remove that application from the Home Screen during drive mode for this MirrorLink session.
  - A Mirrorlink Server shall not list any Member-certified application with a non-empty *targetList* entry with a *resourceStatus* value `"NA"`.
- All functionality of the Home Screen application shall be usable with the controls of the connected MirrorLink Client (i.e. rotary or touch controls).
- The MirrorLink Client may use any of the specified UPnP actions to control applications with *protocolID* value `"VNC"` or `"WFD"` and *resourceStatus* value `"NA"`. This allows the MirrorLink Client to e.g. provide an application launch short cut, to enable the user to directly launch a navigation application, without having the user going through the Home Screen Application.

7.3 Immersive & Classic Phone Call Application

A Phone Call application identifies a MirrorLink application, which provides a Phone Call experience, i.e. it allows the consumer place an outgoing call, accept/reject an incoming and/or manage an incoming call.

Classic MirrorLink Mode

A MirrorLink Server may provide a Classic Phone Call application (*application category* `"0x00020000`), which shall be CCC or Member-drive certified for the connected MirrorLink Client. The Classic Phone Call application should be provided to support Client's in Legacy MirrorLink Mode.

Immersive MirrorLink Mode

A MirrorLink Server shall provide an Immersive Phone Call application (*application category* `"0x00020003"`), which shall be CCC or Member-drive certified for the connected MirrorLink Client.

In Classic MirrorLink Mode, the MirrorLink Client shall use its native Phone Call UI to handle HFP/telephony. In Immersive MirrorLink Mode, the MirrorLink Server shall use the Immersive Phone Call application to handle HFP/telephony.

The following requirements apply to *Immersive* and *Classic* Phone Call application:

- The Phone Call application shall respond accordingly to the `Device_phone_call` and `Device_phone_end` key events.
- The Phone Call application shall support all Bluetooth HFP features (all versions) that are provided by the MirrorLink Server; this includes features like *merge call* or *conference calls*.
- All functionality of the Phone Call application shall be usable with the controls of the connected MirrorLink Client (i.e. rotary or touch controls).

Annex A (informative): Authors and Contributors

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