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

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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 1 of a multi-part deliverable for the Mirrorlink® Specifications:

Part 1: "Connectivity";

Part 2: "Virtual Network Computing (VNC) based Display and Control";

Part 3: "Audio";

Part 4: "Device Attestation Protocol (DAP)";

Part 5: "Common Data Bus (CDB)";

Part 6: "Service Binary Protocol (SBP)";

Part 7: "GPS Data Service";

Part 8: "Location Data Service";

Part 9: "UPnP Application Server Service";

Part 10: "UPnP Client Profile Service";

Part 11: "UPnP Notification Server Service";

Part 12: "UPnP Server Device";

Part 13: "Core Architecture";

Part 14: "Application Certificates";

Part 15: "Application Programming Interface (API) Level 1 & 2";

Part 16: "Application Developer Certificates";

Part 17: "MirrorLink over Wi-Fi Display (WFD)";

Part 18: "IEEE 802.11™ Car Connectivity Consortium (CCC) Information Element";

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Part 19: "Network Information Data Service";

Part 20: "Internet Accessibility";

Part 21: "High Speed Media Link (HSML)";

Part 22: "Android-Specific Specifications";

Part 23: "Bluetooth® Out-of-Band Pairing Data Service";

Part 24: "Media Meta Data Service";

Part 25: "Navigation Meta Data Service";

Part 26: "Consumer Experience Principles and Basic Features";

Part 27: "Basic Meta Data Service";

Part 28: "Weather Data Service";

Part 29: "Schedule Data Service".

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.

The connectivity between the MirrorLink Server and Client is the basis to provide interoperability between both. The Connectivity stack is specified in the following, starting from the low layer and going up the protocol stack.

It is not the objective of the present document to provide a detailed overview of the different protocols. Instead the present document highlights the components and parameters required to ensure proper connectivity. The connectivity solution is built purely on existing wireless and wired standards. Therefore, detailed information is available in the respective documents.

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] USB 2.0: "Universal Serial Bus Specification", Revision 2.0, April 27, 2000.

NOTE: Available at https://www.usb.org/sites/default/files/usb_20_20190524.zip.

[2] USB-IF: "Universal Serial Bus Communications Class Subclass Specifications for Network Control Model Devices", Revision 1.0, November 24, 2010.

NOTE: Available at https://www.usb.org/sites/default/files/NCM10_012011.zip.

[3] Wi-Fi Alliance Technical Committee, P2P Task Group: "Wi-Fi Peer-to-Peer (P2P) Technical Specification", Revision 1.7, July 6, 2016.

[4] IETF RFC 791: "Internet Protocol", September 1981.

NOTE: Available at https://tools.ietf.org/html/rfc791.

[5] IETF RFC 2131: "Dynamic Host Configuration Protocol", March 1997.

NOTE: Available at https://tools.ietf.org/html/rfc2131.

[6] IETF RFC 826: "An Ethernet Address Resolution Protocol: Or Converting Network Protocol Addresses to 48.bit Ethernet Address for Transmission on Ethernet Hardware", November 1982.

NOTE: Available at https://tools.ietf.org/html/rfc826.

[7] IETF RFC 5227: "IPv4 Address Conflict Detection", July 2008.

NOTE: Available at https://tools.ietf.org/html/rfc5227.

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[8] ETSI TS 103 544-18 (V1.3.1): " Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 18: IEEE 802.11TM Car Connectivity Consortium (CCC) Information Element".

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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.

Not applicable.

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

pointer event: used to describe 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.

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3.2 Symbols

Void.

3.3 Abbreviations

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

AP	Access Point
ARP	Address Resolution Protocol
CDC	Communications Device Class

NOTE: Specified from USB Device Working Group.

DHCP	Dynamic Host Configuration Protocol
GO	Group Owner
IE	Information Element
IP	Internet Protocol
LAN	Local Area Network
LLC	Logical Link Control
MTU	Maximum Transmission Unit
NCM	Network Control Model

NOTE: Part of the CDC device class.

NDP	NCM Datagram Pointers

NTB	NCM Transfer Block:
NTH	NTB Header
PID	Packet IDentifier
RFB	Remote Framebuffer
SNAP	Subnetwork Access Protocol
SSID	Service Set IDentifier
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UPnP	Universal Plug and Play
USB	Universal Serial Bus
VGA	Video Graphics Array
VNC	Virtual Network Computing
WLAN	Wireless LAN
WPA	Wi-Fi Protected Access
WSVGA	Wide Super VGA
WVGA	Wide VGA

4 Physical & Link Layer

4.1 General

In principle, the present document does not intend to limit the use of any wireless and wired technology. Nevertheless, the connectivity solution should provide reasonable high bandwidth. Minimum bandwidth on link layer cannot be given, as the user experience depends on the networking & transport layer performance, as well as on the parameters of the display (resolution and colour format).

Table 1 gives some indication of the required bandwidth on the display level, i.e. on top of any transport mechanism. These values assume non-incremental, uncompressed updates.

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Table 1: Example Bandwidth Requirements vs. Display Update Rate

Full Display Update / s	WVGA 800 x 480 x 2	WVGA 800 x 480 x 4	WSVGA 1024 x 600 x 2	WSVGA 1024 x 600 x 4
10	7 680 000 Byte/s	15 360 000 Byte/s	12 288 000 Byte/s	24 576 000 Byte/s
20	15 360 000 Byte/s	30 720 000 Byte/s	24 576 000 Byte/s	49 152 000 Byte/s

Wired technologies have advantages with regards to achievable bandwidth and security over wireless technologies. In addition, wired USB provides charging capabilities and is the preferred charging interface in the mobile industry.

4.2 Universal Serial Bus (USB)

4.2.1 General Requirements

USB provides a high-bandwidth connection while allowing charging of the mobile device at the same time. The MirrorLink Client shall provide a USB host. The MirrorLink Server shall provide USB device functionality.

The USB host and device shall at least support USB 2.0 high-speed.

4.2.2 MirrorLink USB Command

To simplify the user intervention on the MirrorLink Server, it can set the right USB personality automatically, once connected to the MirrorLink Client.

NOTE: A USB personality can include multiple USB device classes, which can be then used from the USB host simultaneously.

To inform the MirrorLink Server about the Client's MirrorLink support, the USB host sends a specific identification message to the USB device, prior to configuring the device.

This MirrorLink USB Command shall be according the following format.

```
bmRequestType = 0x40
bRequest      = 0xF0
wValue[1]     = MirrorLink major version
wValue[2]     = MirrorLink minor version
wIndex        = USB Host vendorID
wLength       = 0
Data          = None
```

USB uses little endian. Therefore, the MirrorLink minor version is in the high byte and the MirrorLink major version in the low byte of *wValue*.

```
MirrorLink 1.0: wValue = 0x0001 (0x01, 0x00)
MirrorLink 1.1: wValue = 0x0101 (0x01, 0x01)
MirrorLink 1.2: wValue = 0x0201 (0x01, 0x02)
MirrorLink 1.3: wValue = 0x0301 (0x01, 0x03)
```

A MirrorLink Server should apply a received MirrorLink version 0.1 as a 1.0 version (for backward compatibility reasons).

The MirrorLink Client, implementing the USB host, shall send the MirrorLink USB command every time, the user intends to start MirrorLink, independent of whether CDC/NCM is enumerated, unless the MirrorLink Server is already advertising itself via *SSDP:alive* messages.

The MirrorLink Server, implementing the USB device, shall enable CDC/NCM and start advertising itself via *SSDP:alive* messages, when receiving the MirrorLink USB command, unless:

a) the consumer has set a different preference; or

b) the MirrorLink Server manufacturer has set a different default preference.

In latter case, the consumer shall be able to change that preference. The USB device shall allow for manual or semi-manual selection of the USB CDC/NCM profile and start of the *SSDP:alive* advertisements.

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The MirrorLink specification does not specify, whether USB CDC/NCM is provided as an individual device class or within a USB personality. In latter case, it is up to the USB device implementation, which other USB device classes may be available under the same personality, where USB CDC/NCM is provided. The USB Host shall support CDC/NCM within a USB personality and as an individual device class.

4.2.3 Managing USB Personalities using the MirrorLink USB Command

If a MirrorLink Client wants to use MirrorLink immediately upon physical connection of the USB port, the client should send the MirrorLink USB command before the end of the USB enumeration, to ask the MirrorLink Server to provide a USB personality supporting MirrorLink (i.e. allowing a USB-CDC/NCM).

If a MirrorLink Client wants to change to MirrorLink from other USB personalities later, the MirrorLink Client should send the MirrorLink USB command at a later time. Alternatively, the MirrorLink Client may reset the USB connection.

NOTE: Resetting the USB connection does not inform the MirrorLink Server, that the MirrorLink Client supports MirrorLink.

If the MirrorLink Server is not able to switch to USB CDC/NCM functionality in response to the MirrorLink USB command, e.g. as the user has a different preference, the USB device shall respond with a STALL PID. If the MirrorLink Server responds with a STALL PID (refer to [1], clause 9.2.7), it shall provide a mechanism for the user to switch to MirrorLink.

Using the MirrorLink USB command, the MirrorLink Client can detect an operating MirrorLink Server connected to it, if all the following conditions are true:

1) The MirrorLink USB command does not return with STALL PID;

2) The USB device descriptor has USB CDC/NCM; and