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TECHNICAL SPECIFICATION

Publicly Available Specification (PAS); Intelligent Transport Systems (ITS); MirrorLink®; Part 23: Bluetooth® Out-of-Band Pairing Data 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 23 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.

The purpose of the Automatic Bluetooth Pairing feature is to eliminate the complexity of Bluetooth Pairing an IVI with a the MirrorLink connected phone by utilizing the trusted MirrorLink connection as a Bluetooth Out of Band (OOB) pairing transport. Some potential benefits include:

- Single connection (USB or Wi-Fi) user configuration of a complete MirrorLink connection.
- Obfuscation of protocol/transport complexity from the user (USB/Wi-Fi + Bluetooth).
- More security around information used for link key generation due to OOB information exchange.
- Net-neutral cost to enable OOB pairing on head units that already include USB ports.

The MirrorLink Secure Bluetooth Out-of-Band pairing using MirrorLink CDB/SBP is modelled after Bluetooth Out-of-Band pairing using NFC.

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] NFC Forum, Bluetooth SIG: "Bluetooth Secure Simple Pairing Using NFC", Application Document, NFC Forum™, NFCForum-AD-BTSSP-1.0, 2011-10-18.

[2] Bluetooth SIG, "Bluetooth Specification version 4.2 ", December 04, 2014.

NOTE: Available at https://www.bluetooth.com/specifications/bluetooth-core-specification.

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

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

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:

CDB	Common Data Bus
LMP	Link Management Protocol
OOB	Out of Band
SBP	Service Binary Protocol
SSP	Secure Simple Pairing

4 Data Service Definition

4.1 Bluetooth Out-of-Band Pairing over MirrorLink Version 1.0

```
/** The present document defines data objects for the Bluetooth out-of-
 *  band pairing using SBP is modelled after the Bluetooth out-of-band
 *  pairing using NFC as described in [1]. Objects and data structures
 *  are similar to the ones defined in that document.
 *  @version 1.0
 */
SERVICE com.mirrorlink.ml_bt_oob_pairing {
/** STRUCTURE holding the static Bluetooth configuration of the
 *  MirrorLink device. Details shall not change during a MirrorLink
 *  session.
 */
STRUCTURE StaticConfig {
  /** Bluetooth MAC address, as a UTF-8 encoded string representing an
   *  unsigned 48-bit integer in hexadecimal format (without any ‘0x'
   *  prefix). The value shall be identical to the value in the Device
   *  XML [3] or Client Profile [4].
   *  @mandatory, @uid 0xbb96bbf8
   */
  BYTES bdAddr;
  /** Flag, specifying whether the device supports Out-of-Band Pairing.
   *  @mandatory, @uid 0x7fbf046b
   */
  BOOLEAN oobPairing;
  /** Boolean flag, specifying whether the Bluetooth connection can be
   *  initiated from the device. The value shall be identical to the
   *  value in the Device XML [3] or Client Profile [4].
   *  @mandatory, @uid 0x979f16fb
   */
  BOOLEAN startConnection;
  };
/** STRUCTURE holding the dynamic Bluetooth configuration of the
 *  MirrorLink device. Details may change during a MirrorLink session.
 */
STRUCTURE DynamicConfig {
  /** Flag, specifying whether the Bluetooth radio is switched on
   *  @mandatory, @uid 0x6d93ffa8
```

```
    */
   BOOLEAN radioStatus;
   /** Flag, specifying whether the Bluetooth radio is paired. If set to
    *  "true", the MirrorLink device has a Bluetooth pairing (linkkey);
    *  i.e. the other MirrorLink device's Bluetooth MAC address is in the
    *  known device list. If the element is not available, the pairing
    *  status is unknown.
    *  @optional, @uid 0xe44a0455
    */
   BOOLEAN pairingStatus;
   };
/** STRUCTURE holding the optional EIR_data.
 *  The structure of the data is defined in [2] Volume 3, Part C, Figure
 *  8.1. The SBP Sink/Source shall be prepared to receive all possible
 *  EIR data type values, including values that are currently reserved
 *  for future use, in any order. Any EIR data type that is not supported
 *  by an implementation is ignored without inspecting the associated
 *  EIR data.
 */
STRUCTURE EIR_data {
   /** EIR data length
    *  @mandatory, @uid 0xd24a72a5
    */
   BYTE EIR_data_Length;
   /** EIR data type
    *  the following data types are of interest for the OOB procedure:
    *  - 0x09, 0x08: Bluetooth logical name
    *  - 0x0E: Simple Pairing Hash C
    *  - 0x0F: Simple Pairing Randomizer R
    *  - 0x02-0x07: Service Class UUID
    *  - 0x0D: Class of Device
    *  The MirrorLink device requesting a Bluetooth handover shall set the
    *  following EIR data types:
    *  - Simple Pairing Hash C
    *  - Simple Pairing Randomizer R
    *  @mandatory, @uid 0x80f03299
    */
   BYTE EIR_data_type;
   /** EIR data payload
    *  @mandatory, @uid 0xc99c15af
    */
   BYTES EIR_data_payload;
   };
/** Object holding the static Bluetooth configuration of the MirrorLink
 *  Server.
 *  @mandatory, @configurable, @uid 0xb748c238
 */
OBJECT StaticServerConfig {
   /** Static Bluetooth configuration of the MirrorLink Server
    *  @mandatory, @uid 0xe648cc95
    */
   STRUCTURE<StaticConfig> StaticConfig;
   };
/** Object holding the static Bluetooth configuration of the MirrorLink
 *  Client.
 *  @mandatory, @readable, @uid 0xdaefdf40
 */
OBJECT StaticClientConfig {
   /** Static Bluetooth configuration of the MirrorLink Client
    *  @mandatory, @uid 0xe648cc95
    */
   STRUCTURE<StaticConfig> StaticConfig;
   };
/** Object holding the dynamic Bluetooth configuration of the MirrorLink
 *  Server.
 *  @mandatory, @configurable, @uid 0x0694d67f
 */
OBJECT DynamicServerConfig {
   /** Dynamic Bluetooth configuration of the MirrorLink Server
    *  @mandatory, @uid 0x959a7b5c
    */
   STRUCTURE<DynamicConfig> DynamicConfig;
   };
/** Object holding the dynamic Bluetooth configuration of the MirrorLink
 *  Client.
 *  @mandatory, @readable, @uid 0x2a3bf387
 */
OBJECT DynamicClientConfig {
  /** Dynamic Bluetooth configuration of the MirrorLink Client
    *  @mandatory, @uid 0x959a7b5c
    */
  STRUCTURE<DynamicConfig> DynamicConfig;
  };
/** Bluetooth handover request message;
 *  @mandatory, @configurable, @uid 0x43c8eb11
 */
OBJECT Bluetooth_Handover_Request_Message {
  /** Out-of-Band Data Length
    *  @mandatory, @configurable, @uid 0x0c7bcb6b
    */
  INT length;
  /** Bluetooth MAC address; the Bluetooth MAC address is 48-bit unsigned
    *  integer; it shall be put into the LSB of the 64-bit BD_ADDR variable;
    *  i.e. the MSBs 49-63 shall be zero.
    *  @mandatory, @writable, @uid 0xe47ae6e9
    */
  LONG BD_ADDR;
  /** Optional OOB data, in EIR format
    *  @mandatory, @writable, @uid 0x206e1427
    */
  STRUCTURE_ARRAY<EIR_data> OOB_Optional_Data;
  };
/** Bluetooth handover request message
 *  @mandatory, @readable, @uid 0xee9231ea
 */
OBJECT Bluetooth_Handover_Select_Message {
  /** Out-of-Band Data Length;
    *  @mandatory, @uid 0x0c7bcb6b
    */
  INT length;
  /** Bluetooth MAC address; the Bluetooth MAC address is 48-bit unsigned
    *  integer; it shall be put into the LSB of the 64-bit BD_ADDR variable;
    *  i.e. the MSBs 49-63 shall be zero.
    *  @mandatory, @uid 0xe47ae6e9
    */
  LONG BD_ADDR;
  /** Optional OOB data, in EIR format
    *  @mandatory, @uid 0x206e1427
    */
  STRUCTURE_ARRAY<EIR_data> OOB_Optional_Data;
  };
/** MirrorLink Server confirmation; the MirrorLink Server should set
 *  this object to TRUE; the MirrorLink Client shall not initiate the
 *  pairing prior the Server has set the value to TRUE. The MirrorLink
 *  Server need not set the object value, if it is expected to start the
 *  pairing;
 *  @mandatory, @configurable, @uid 0xb965fef8
 */
OBJECT serverConfirm {
  /** Confirmation that MirrorLink Server is ready to start the pairing;
    *  @mandatory, @uid 0x003400db
    */
  BOOLEAN confirm;
  };
};
```

5 SBP Binding

5.1 Service Registry

The Bluetooth Out-of-Band Data Services uses the following objects and their access capabilities.

Table 1

Object Name	Access Type	Subscription Type
StaticClientConfig	READABLE	NONE
StaticServerConfig	CONFIGURABLE	NONE

Object Name	Access Type	Subscription Type
DynamicClientConfig	READABLE	ON_CHANGE
DynamicServerConfig	CONFIGURABLE	NONE
Bluetooth_Handover_Request_Message	CONFIGUABLE	NONE
Bluetooth_Handover_Select_Message	READABLE	NONE
serverConfirm	CONFIGURABLE	NONE

6 Theory of Operation

6.1 General

The obligation for this feature is CONDITIONAL. A MirrorLink Client and Server, supporting Bluetooth within a MirrorLink session, shall support this feature. The user may disable/enable the automatic pairing feature.

MirrorLink Clients and Servers shall both support sending OOB information to enable *OOB authentication where both devices have some OOB information to use* per [2] [Vol 2] Part F, clause 4.2.16 *Figure 4.20*.

The MirrorLink device requesting a Bluetooth handover shall set the following EIR data types:

- Simple Pairing Hash C.
- Simple Pairing Randomizer R.

6.2 SBP Protocol

6.2.1 General

The MirrorLink Client shall include the *ml_bt_oob_pairing* Service into the CDB service listing, prior to launching any Bluetooth module via an UPnP launch application action, unless the MirrorLink Client is already paired with the MirrorLink Server.

The MirrorLink Client shall include the *ml_bt_oob_pairing* Service into the CDB service listing, immediately after a MirrorLink session setup, if the Client uses legacy Bluetooth connection mechanisms (i.e. no UPnP launch application action), unless the MirrorLink Client is already paired with the MirrorLink Server.

The MirrorLink Server shall launch the service immediately when it becomes available.

The MirrorLink Client shall keep the service alive as long as the Bluetooth connection is not terminated via an UPnP terminate application action or the legacy Bluetooth connection is used.

6.2.2 Bluetooth Radio Status Monitoring

Once the CDB Service has been launched, the following steps shall be executed:

1) The MirrorLink Server shall do a SET operation for the *StaticServerConfig* object.
2) The MirrorLink Server shall do a GET operation for the *StaticClientConfig* object.
3) The MirrorLink Server shall do a SET operation for the *DynamicServerConfig* object.
4) The MirrorLink Server shall do a SUBSCRIBE on-change operation for the *DynamicClientConfig* object.

The MirrorLink Server shall do another SET operation for the *DynamicServerConfig* object, if any of values changes later.

6.2.3 Out-of-Band Pairing Configuration

If the Bluetooth radio of both devices is switched on, i.e. *DynamicServerConfig::DynamicConfig.radioStatus* and *DynamicClientConfig::DynamicConfig.radioStatus* are set to TRUE, the following steps shall be executed:

1) The MirrorLink Server shall evaluate its paring status with the MirrorLink Client's Bluetooth device and then shall do a SET operation for the *DynamicServerConfig* object, including the *pairingStatus* element, in case the value has changed.

2) The MirrorLink Server shall do a GET operation for the *DynamicClientConfig* object. The Mirrorlink Client shall respond to the GET operation, only after it has determined the pairing status in response to the *StaticServerConfig* object's MAC address. The *pairingStatus* element shall be included in the GET response.

6.2.4 Handover Request & Selection

If the MirrorLink Server and Client support Bluetooth OOB pairing over SBP and if at least one of both devices are not paired, i.e. either *DynamicClientConfig::StaticConfig::pairingStatus* or *DynamicServerConfig::StaticConfig::pairingStatus* is FALSE, the following steps shall be executed:

1) The MirrorLink Server may delete the MirrorLink Client's Bluetooth pairing from its known device list if it exists.

2) The MirrorLink Server shall enter bondable mode per [2] [Vol 3] Part C, clause 4.3.1.

3) The MirrorLink Server shall do a SET operation for the *Bluetooth_Handover_Request_Message* object.

4) The MirrorLink Client may delete the MirrorLink Server's Bluetooth pairing from its known device list if it exists.

5) The MirrorLink Client shall enter bondable mode per [2] [Vol 3] Part C, clause 4.3.1.

6) The MirrorLink Server shall do a GET operation for the *Bluetooth_Handover_Select_Message* object. The MirrorLink Client shall respond to the GET operation, only after it has filled the *Bluetooth_Handover_Select_Message* object with the necessary data in response to the *Bluetooth_Handover_Request_Message* objects value.

7) The MirrorLink Server shall do a SET operation for the *serverConfirm* object, if the MirrorLink Client is supposed to initiate the Bluetooth pairing. The MirrorLink Server shall do the SET operation only after it is ready for the MirrorLink Client to start the pairing.

6.2.5 SSP Commencement

The MirrorLink Server shall then commence the Bluetooth SSP OOB pairing per the sequence described in BLUETOOTH SPECIFICATION Version 4.1 [Vol 2] clause 4.2.16 and depicted in Figure 4.20.

6.2.6 Post-Pairing Connection

The Bluetooth pairing, after the Bluetooth Handover Request and Select messages have been exchanged shall follow Bluetooth Secure Simple Pairing (BLUETOOTH SPECIFICATION Version 4.1 [Vol 2] clause 4.2, Figure 4.2):

1) The MirrorLink Client shall initiate the pairing, if the MirrorLink Client has set *StaticClientConfig::StaticConfig.startConnection* to `"true"`. The MirrorLink Client shall initiate the Bluetooth pairing only after the MirrorLink Client has set the *confirmServer* object's value to TRUE (step 7). The MirrorLink Client may show a message to the consumer and ask for acceptance of the Bluetooth pairing.

2) The MirrorLink Server shall initiate a Bluetooth pairing, if the MirrorLink Client has set *StaticClientConfig::StaticConfig.startConnection* to `"false"`. The MirrorLink Server should initiate the Bluetooth paring after it has received the *Bluetooth_Handover_Select_Message* object's value (step 6).

6.2.7 Timeout Considerations

In case the MirrorLink Server fails to receive a response from the MirrorLink Client to a GET operation within 10s, it should stop the CDB service and start it again. If the MirrorLink Server fails to succeed, it shall give up latest after the 3rd re-start and shall fallback to manual Bluetooth pairing.

In case the MirrorLink Client fails to receive the expected SET or GET operations from the MirrorLink Server within 10s, it should reset the CDB service. If the MirrorLink Client fails to receive the expected SET or GET operations, it shall terminate the CDB service latest after the 3rd reset and shall fallback to manual Bluetooth pairing.

Annex A (informative): Authors and Contributors

The following people have contributed to the present document:

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