Bluetooth®
SPECIAL INTEREST GROUP

SPECIFICATION OF THE *BLUETOOTH* SYSTEM

Experience More

Supplement to the Bluetooth Core Specification

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Supplement to Bluetooth Core Specification
Part A

DATA TYPES SPECIFICATION

CONTENTS

1 DATA TYPES DEFINITIONS AND FORMATS

This part defines the basic data types used for Extended Inquiry Response (EIR), Advertising Data (AD), and OOB data blocks. All data types defined here may be used for EIR or AD data types unless stated otherwise. Additional data types may be defined in profile specifications.

The values for the data types are listed in the Bluetooth Assigned Numbers document.

All numerical multi-byte entities and values associated with the following data types shall use little-endian byte order.

1.1 SERVICE UUID

1.1.1 Description

The Service UUID data type is used to include a list of Service or Service Class UUIDs.

There are six data types defined for the three sizes of Service UUIDs that may be returned:

- 16-bit Bluetooth Service UUIDs
- 32-bit Bluetooth Service UUIDs
- Global 128-bit Service UUIDs

Two Service UUID data types are assigned to each size of Service UUID. One Service UUID data type indicates that the Service UUID list is incomplete and the other indicates the Service UUID list is complete.

An extended inquiry response or advertising data packet shall not contain more than one instance for each Service UUID data size. If a device has no Service UUIDs of a certain size, 16, 32, or 128 bit, the corresponding field in the extended inquiry response or advertising data packet shall be marked as complete with no Service UUIDs. An omitted Service UUID data type shall be interpreted as an empty incomplete-list.

The Service UUID data types corresponding to 32-bit Service UUIDs shall not be sent in advertising data packets.

1.1.2 Format

Data Type	Description
<<Incomplete List of 16-bit Service UUIDs>>	More 16-bit Service UUIDs available
<<Complete List of 16-bit Service UUIDs>>	Complete list of 16-bit Service UUIDs
<<Incomplete List of 32-bit Service UUIDs>>	More 32-bit Service UUIDs available Note**:** Not used in advertising packets.
<<Complete List of 32-bit Service UUIDs>>	Complete list of 32-bit Service UUIDs Note: Not used in advertising packets.

Table 1.1: Service UUID Data Types

Data Type	Description
<<Incomplete List of 128-bit Service UUIDs>>	More 128-bit Service UUIDs available
<<Complete List of 128-bit Service UUIDs>>	Complete list of 128-bit Service UUIDs

Table 1.1: Service UUID Data Types

1.2 LOCAL NAME

1.2.1 Description

The Local Name data type shall be the same as, or a shortened version of, the local name assigned to the device. The Local Name data type value indicates if the name is complete or shortened. If the name is shortened, the complete name can be read using the remote name request procedure over BR/EDR or by reading the name characteristic after the connection has been established over LE.

An extended inquiry response packet or advertising data packet shall not contain more than one instance of the Local Name data type.

A shortened name shall only contain contiguous characters from the beginning of the full name. For example, if the device name is ‘BT_Device_Name’ then the shortened name could be ‘BT_Device’ or ‘BT_Dev’.

1.2.2 Format

Data Type	Description
<<Shortened Local Name>>	Shortened local name
<<Complete Local Name>>	Complete local name

Table 1.2: Local Name Data Types

1.3 FLAGS

1.3.1 Description

The Flags data type contains one bit Boolean flags. The Flags data type shall be included when any of the Flag bits are non-zero, otherwise the Flags data type may be omitted. All octets that are 0x00 are not transmitted as long as all other octets after that octet are also 0x00.

Flags used over the LE physical channel are:

- Limited Discoverable Mode
- General Discoverable Mode
- BR/EDR Not Supported
- Simultaneous LE and BR/EDR to Same Device Capable (Controller)
- Simultaneous LE and BR/EDR to Same Device Capable (Host)

The LE Limited Discoverable Mode and LE General Discoverable Mode flags shall be ignored when received over the BR/EDR physical channel. The ‘BR/EDR Not Supported’ flag shall be set to 0 when sent over the BR/EDR physical channel.

An extended inquiry response packet or advertising data packet shall not contain more than one instance of the Flags data type.

The Flags AD type shall not be included in the scan response data.

1.3.2 Format

The Flags field may be zero or more octets long. This allows the Flags field to be extended while using the minimum number of octets within the data packet.

Data Type	Octet	Bit	Description
<<Flags>>	0	0	LE Limited Discoverable Mode
	0	1	LE General Discoverable Mode
	0	2	BR/EDR Not Supported. Bit 37 of LMP Feature Mask Definitions (Page 0)
	0	3	Simultaneous LE and BR/EDR to Same Device Capable (Controller). Bit 49 of LMP Feature Mask Definitions (Page 0)
	0	4	Simultaneous LE and BR/EDR to Same Device Capable (Host). Bit 66 of LMP Feature Mask Definitions (Page 1)
	0	5..7	Reserved

Table 1.3: Flags Data Types

1.4 MANUFACTURER SPECIFIC DATA

1.4.1 Description

The Manufacturer Specific data type is used for manufacturer specific data. The first two data octets shall contain a company identifier code from the Assigned Numbers - Company Identifiers document. The interpretation of any other octets within the data shall be defined by the manufacturer specified by the company identifier.

1.4.2 Format

Data Type	Description
<<Manufacturer Specific Data>>	Size: 2 or more octets The first 2 octets contain the Company Identifier Code followed by additional manufacturer specific data

Table 1.4: Manufacturer Specific Data Type

1.5 TX POWER LEVEL

1.5.1 Description

The TX Power Level data type indicates the transmitted power level of the packet containing the data type. The TX Power Level data type may be used to calculate path loss on a received packet using the following equation:

pathloss = Tx Power Level – RSSI

where “RSSI” is the received signal strength, in dBm, of the packet received.

For example, if Tx Power Level = +4 (dBm) and the RSSI on the received packet is -60 (dBm) then the total path loss is +4 – (-60) = +64 dB. If a second packet were received at -40 dBm with a Tx Power Level data type = +15 dBm the resulting pathloss would be +55 dB. An application could use these path-loss values to choose which device it thinks might be closer (the one with the lower pathloss value).

Unfortunately, due to fading and varying antenna, circuit, and chip characteristics, these resulting pathloss values will have uncertainty. Some of the uncertainty (for example, due to fading) may be able to be removed if multiple packets are received from the same device.

Note: When the TX Power Level data type is not present, the TX power level of the packet is unknown.

1.5.2 Format

Data Type	Description
<<TX Power Level>>	Size: 1 octet 0xXX: -127 to +127 dBm

Table 1.5: TX Power Level Data Type

1.6 SECURE SIMPLE PAIRING OUT OF BAND (OOB)

1.6.1 Description

The Secure Simple Pairing Out of Band data types enable an out of band mechanism to communicate discovery information as well as other information related to the pairing process.

The Secure Simple Pairing Out of Band data types shall not be used in EIR or AD packets over the BR/EDR or LE transports and shall be only used over an out-of-band mechanism.

1.6.2 Format

The Secure Simple Pairing Out of Band data types shall be encapsulated in a OOB data block as defined in Volume 3, Part C, section 5.2.2.7 and Figure 5.6 of that section. The OOB data block consists of the mandatory part with fields SSP OOB Length and BD_ADDR as described in Table 1.6, followed by optional data types described in Table 1.7.

Field	Description
<<SSP OOB Length>>	Size: 2 octets 0xXXXX: 8 to 65535 bytes This field contains the length of the entire OOB data block including the length field itself.
<<BD_ADDR>>	Size: 6 octets Format defined in [Vol. 2, Part B] Section 1.2 on page 68

Table 1.6: Fields for OOB Data Block Mandatory Part

Data Type	Description
<<Class of Device>>	Size: 3 octets Format defined in Assigned Numbers
<<Simple Pairing Hash C>>	Size: 16 octets Format defined in [Vol. 2], Part H Section 7.2.2

Table 1.7: Data Types for OOB Data Block Optional Parts

Data Type	Description
<<Simple Pairing Randomizer R>>	Size: 16 octets Format defined in [Vol. 2], Part H Section 7.2.2

Table 1.7: Data Types for OOB Data Block Optional Parts

1.7 SECURITY MANAGER OUT OF BAND (OOB)

1.7.1 Description

The Security Manager Out of Band data type allows an out of band mechanism to be used by the Security Manager to communicate discovery information as well as other information related to the pairing process.

The Security Manager Out of Band data type shall not be used in EIR or AD packets over the BR/EDR or LE transports and may only be sent over an out-of-band mechanism.

1.7.2 Format

The Security Manager Out of Band data type size is 1 octet.

Data Type	Bit	Description
<<Security Manager Out of Band Flag>>	0	OOB Flags Field (0 = OOB data not present, 1 = OOB data present)
	1	LE supported (Host) (i.e. bit 65 of LMP Extended Feature bits Page 1
	2	Simultaneous LE and BR/EDR to Same Device Capable (Host) (i.e. bit 66 of LMP Extended Feature bits Page 1)
	3	Address type (0 = Public Address, 1 = Random Address)
	4..7	Reserved

Table 1.8: Security Manager OOB Flags Data Type

1.8 SECURITY MANAGER TK VALUE

1.8.1 Description

The Security Manager TK Value data type allows an out of band mechanism to be used by the Security Manager to communicate the TK value.

The Security Manager TK Value data type shall not be used in EIR or AD packets over the BR/EDR or LE transports and may only be sent over an out-of-band mechanism.

1.8.2 Format

Data Type	Description
<<Security Manager TK Value>>	Size: 16 octets Value as used in pairing over LE Physical channel. Format defined in [Vol. 3], Part H Section 2.3

Table 1.9: Security Manager TK Value Data Type

1.9 SLAVE CONNECTION INTERVAL RANGE

1.9.1 Description

The Slave Connection Interval Range data type contains the Peripheral's preferred connection interval range, for all logical connections.

Note: The minimum value depends on the battery considerations of the Peripheral and the maximum connection interval depends on the buffers available on the Peripheral.

The Central should use the information from the Peripheral's Slave Connection Interval Range data type when establishing a connection.

This data type shall not be sent over EIR.

Note: Central and Peripheral are GAP roles as defined in Vol.3, Part C, Section 2.2.2.

1.9.2 Format

Data Type	Description
<<Slave Connection Interval Range>>	Size: 4 Octets The first 2 octets defines the minimum value for the connection interval in the following manner: $connInterval_{min}$ = Conn_Interval_Min * 1.25 ms Conn_Interval_Min range: 0x0006 to 0x0C80 Value of 0xFFFF indicates no specific minimum. Values not defined above are reserved. The second 2 octets defines the maximum value for the connection interval in the following manner: $connInterval_{max}$ = Conn_Interval_Max * 1.25 ms Conn_Interval_Max range: 0x0006 to 0x0C80 Conn_Interval_Max shall be equal to or greater than the Conn_Interval_Min. Value of 0xFFFF indicates no specific maximum. Values outside the range are reserved (excluding 0xFFFF)

Table 1.10: Slave Connection Interval Range Data Type

1.10 SERVICE SOLICITATION

1.10.1 Description

A Peripheral device may send the Service Solicitation data type to invite Central devices that expose one or more of the services specified in the Service Solicitation data to connect. The Peripheral device should be in the undirected connectable mode and in one of the discoverable modes. This enables a Central device providing one or more of these services to connect to the Peripheral device, so that the Peripheral device can use the services on the Central device.

The Service Solicitation data type shall not be sent over EIR.

Note: Central and Peripheral are GAP roles as defined in Vol.3, Part C, Section 2.2.2.

1.10.2 Format

Data Type	Description
<<List of 16 bit Service Solicitation UUIDs>>	List of 16 bit Service Solicitation UUIDs
<<List of 128 bit Service Solicitation UUIDs>>	List of 128 bit Service Solicitation UUIDs

Table 1.11: Service Solicitation UUID Data Types

1.11 SERVICE DATA

1.11.1 Description

The Service Data data type consists of a service UUID with the data associated with that service.

The Service Data data type shall not be sent over EIR.

1.11.2 Format

Data Type	Description
<<Service Data>>	Size: 2 or more octets The first 2 octets contain the 16 bit Service UUID followed by additional service data

Table 1.12: Service Data

1.12 APPEARANCE

1.12.1 Description

The Appearance data type defines the external appearance of the device. The Appearance data type shall exist only once. It may be sent in either the Advertising or Scan Response data, but not both.

This value shall be the same as the Appearance characteristic, as defined in Vol. 3, Part C, Section 12.2.

The Appearance data type shall not be sent over EIR.

1.12.2 Format

Data Type	Description
<<Appearance>>	The Appearance value shall be the enumerated value as defined by Bluetooth Assigned Numbers.

Table 1.13: Appearance

1.13 PUBLIC TARGET ADDRESS

1.13.1 Description

The Public Target Address data type defines the address of one or more intended recipients of an advertisement when one or more devices were bonded using a public address. This data type is intended to be used to avoid a situation where a bonded device unnecessarily responds to an advertisement intended for another bonded device.

This data type shall exist only once. It may be sent in either the Advertising or Scan Response data, but not both.

This data type shall not be sent over EIR.

1.13.2 Format

Data Type	Description
<<Public Target Address>>	Size: Multiples of 6 octets The format of each 6 octet address is the same as the Public Device Address defined in Vol. 6, Part B, Section 1.3. The Public Target Address value shall be the enumerated value as defined by Bluetooth Assigned Numbers.

Table 1.14: Public Target Address

1.14 RANDOM TARGET ADDRESS

1.14.1 Description

The Random Target Address data type defines the address of one or more intended recipients of an advertisement when one or more devices were bonded using a random address. This data type is intended to be used to avoid a situation where a bonded device unnecessarily responds to an advertisement intended for another bonded device.

This data type shall exist only once. It may be sent in either the Advertising or Scan Response data, but not both.

This data type shall not be sent over EIR.

1.14.2 Format

Data Type	Description
<<Random Target Address>>	Size: Multiples of 6 octets The format of each 6 octet address is the same as the Random Device Address defined in Vol. 6, Part B, Section 1.3. The Random Target Address value shall be the enumerated value as defined by Bluetooth Assigned Numbers.

Table 1.15: Random Target Address

2 EXAMPLES

The following sections include examples of EIR and Advertising Data Types.

2.1 EXAMPLE EXTENDED INQUIRY RESPONSE

This is an example extended inquiry response for a phone with PANU and Hands-free Audio Gateway:

Value	Notes
0x06	Length of this Data
0x09	<<Complete Local Name>>
0x50	'P'
0x68	'h'
0x6F	'o'
0x6E	'n'
0x65	'e'
0x05	Length of this Data
0x03	<<Complete list of 16-bit Service UUIDs>>
0x15	PANU service class UUID
0x11	
0x1F	Hands-free Audio Gateway service class UUID
0x11	
0x01	Length of this data
0x05	<<Complete list of 32-bit Service UUIDs>>
0x01	Length of this data
0x07	<<Complete list of 128-bit Service UUIDs>>
0x00	End of Data (Not transmitted over the air)

Table 2.1: Example extended inquiry response

2.2 EXAMPLE ADVERTISING DATA

This is an example of advertising data with AD types:

Value	Notes
0x02	Length of this Data
0x01	<<Flags>>
0x01	LE Limited Discoverable Flag set
0x0A	Length of this Data
0x09	<<Complete local name>>
0x50	‘P’
0x65	‘e’
0x64	‘d’
0x6F	‘o’
0x6D	‘m’
0x65	‘e’
0x74	‘t’
0x65	‘e’
0x72	‘r’

Table 2.2: Example advertising data