Call Control Profile

Bluetooth® **Profile Specification**

- **Revision:** v1.0
- **Revision Date:** 2021-03-09
- **Group Prepared By:** Generic Audio Working Group

Abstract:

This profile defines the roles and procedures that are used to interact with a remote device that implements the Generic Telephone Bearer Service (GTBS), and optionally and additionally, the Telephone Bearer Service (TBS).

Revision History

Revision Number	Date	Comments
v1.0	2021-03-09	Adopted by the Bluetooth SIG Board of Directors.

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Contents

1   Introduction

This profile defines the roles and procedures that are used to interact with a remote device that implements the Generic Telephone Bearer Service (GTBS) and/or the Telephone Bearer Service (TBS).

1.1   Profile dependencies

This profile requires the Generic Attribute Profile (GATT).

1.2   Conformance

If conformance to this specification is claimed, all capabilities indicated as mandatory for this specification shall be supported in the specified manner (process-mandatory). This also applies for all optional and conditional capabilities for which support is indicated.

1.3   Bluetooth Core Specification release compatibility

This specification is compatible with the Bluetooth Core Specification version 5.2 or later [1].

1.4   Language

1.4.1   Language conventions

The Bluetooth SIG has established the following conventions for use of the words *shall*, *must*, *will*, *should*, *may*, *can*, *is*, and *note* in the development of specifications:

shall	is required to – used to define requirements.
must	is used to express: a natural consequence of a previously stated mandatory requirement. OR an indisputable statement of fact (one that is always true regardless of the circumstances).
will	it is true that – only used in statements of fact.
should	is recommended that – used to indicate that among several possibilities one is recommended as particularly suitable, but not required.
may	is permitted to – used to allow options.
can	is able to – used to relate statements in a causal manner.
is	is defined as – used to further explain elements that are previously required or allowed.
note	Used to indicate text that is included for informational purposes only and is not required in order to implement the specification. Each note is clearly designated as a "Note" and set off in a separate paragraph.

For clarity of the definition of those terms, see Core Specification Volume 1, Part E, Section 1.

1.4.2   Reserved for Future Use

Where a field in a packet, Protocol Data Unit (PDU), or other data structure is described as "Reserved for Future Use" (irrespective of whether in uppercase or lowercase), the device creating the structure shall

set its value to zero unless otherwise specified. Any device receiving or interpreting the structure shall ignore that field; in particular, it shall not reject the structure because of the value of the field.

Where a field, parameter, or other variable object can take a range of values, and some values are described as "Reserved for Future Use," a device sending the object shall not set the object to those values. A device receiving an object with such a value should reject it, and any data structure containing it, as being erroneous; however, this does not apply in a context where the object is described as being ignored or it is specified to ignore unrecognized values.

When a field value is a bit field, unassigned bits can be marked as Reserved for Future Use and shall be set to 0. Implementations that receive a message that contains a Reserved for Future Use bit that is set to 1 shall process the message as if that bit was set to 0, except where specified otherwise.

The acronym RFU is equivalent to Reserved for Future Use.

1.4.3　Prohibited

When a field value is an enumeration, unassigned values can be marked as "Prohibited." These values shall never be used by an implementation, and any message received that includes a Prohibited value shall be ignored and shall not be processed and shall not be responded to.

Where a field, parameter, or other variable object can take a range of values, and some values are described as "Prohibited," devices shall not set the object to any of those Prohibited values. A device receiving an object with such a value should reject it, and any data structure containing it, as being erroneous.

"Prohibited" is never abbreviated.

1.5　Terminology

Table 1.1 defines terms that are useful when using this profile.

Term	Definition
Caller ID	Defined in [2]
Client	Defined in [2]
Local	Defined in [2]
Local Hold	Defined in [2]
Local Retrieve	Defined in [2]
Remote	Defined in [2]
Server	Defined in [2]

Table 1.1: Terminology

2   Configuration

2.1   Roles

This specification defines two roles: the Call Control Server role and the Call Control Client role.

The Call Control Server role resides on devices that can handle calls on one or more telephone call bearers such as cell phones or tablets. The Call Control Client resides on devices that can make requests to the server to make, receive, and manage calls. Examples of devices that support a Call Control Client are headsets and speakers that have microphones, or devices like a watch that might not have a speaker or microphone but can manage telephony calls.

The Call Control Server shall be a GATT Server.

The Call Control Client shall be a GATT Client.

2.2   Role/service relationships

Figure 2.1 shows the relationship between services and profile roles, where the profile roles are represented by gray boxes and the services are represented by yellow boxes. Within the Call Control Server, there can be zero or multiple instances of TBS and there is a single, mandatory instance of GTBS.
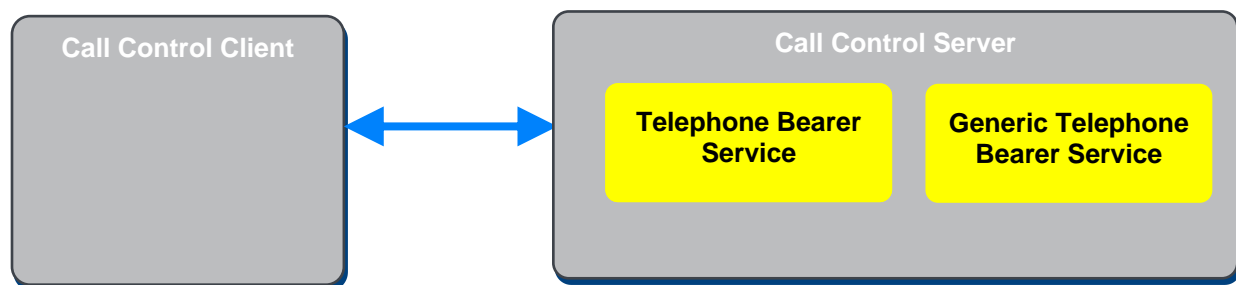
Figure 2.1: Relationship between services and profile roles

Call Control Clients can access TBS, GTBS, or both on a Call Control Server. A lightweight Call Control Client implementation that does not need to access and control all capabilities of each individual TBS on a Call Control Server can use GTBS and have a single point of access for call control activities. Richer Call Control Client implementations that require more control over telephony functions can access and control each TBS individually if exposed by the Call Control Server.

For detailed descriptions of the characteristics referenced in this profile, see TBS [2].

2.3   Concurrency limitations or restrictions

There are no concurrency limitations or restrictions for the Call Control Client or Call Control Server imposed by this profile.

2.4   Topology limitations or restrictions

There are no topology limitations or restrictions.

The Generic Access Profile (GAP) roles for the Call Control Server and Call Control Client should be defined by a higher-layer specification.

2.5   Transport dependencies

There are no transport restrictions imposed by this profile specification. However, a higher-layer specification may impose additional requirements.

Commands with GATT are considered unreliable when used with an unenhanced attribute protocol (ATT) bearer as stated in Volume 3, Part F, Section 3.3.2 in [1]. Therefore, if the unenhanced ATT bearer is used, buffer overflows can occur.

3 Call Control Server role requirements

The Call Control Server may instantiate zero or more instances of TBS and shall instantiate a single GTBS, as shown in Table 3.1.

Requirements in this section are defined as "Mandatory" (M), "Optional" (O), "Excluded" (X), and "Conditional" (C.*n*). Conditional statements (C.*n*) are listed directly below the table in which they appear.

Service	Call Control Server
Telephone Bearer Service	O
Generic Telephone Bearer Service	M

Table 3.1: Service requirements for the Call Control Server

4   Call Control Client role requirements

This section lists the Call Control Client role requirements in Table 4.1. A higher-layer profile may specify additional profile role requirements.

Requirements in this section are defined as "Mandatory" (M), "Optional" (O), "Excluded" (X), and "Conditional" (C.*n*). Conditional statements (C.*n*) are listed directly below the table in which they appear.

	Profile Requirement	Section	Support in Call Control Client
1	GATT sub-procedures	4.1	M
2	Service Discovery	4.2	M
3	Characteristic Discovery	4.3	M
4	Call Control Client procedures	4.4	M

Table 4.1: Profile requirements for the Call Control Client

4.1   GATT sub-procedures

Requirements in this section represent a minimum set of requirements for a Call Control Client. Other GATT sub-procedures may be used if supported by both the client and server.

Table 4.2 summarizes additional GATT sub-procedure requirements beyond those required by all GATT clients.

	GATT Sub-Procedure	Call Control Client Requirements
1	Discover All Primary Services	C.1
2	Discover Primary Services by Service UUID	C.2
3	Find Included Services	O
4	Discover All Characteristics of a Service	C.3
5	Discover Characteristics by UUID	C.4
6	Discover All Characteristic Descriptors	M
7	Notifications	M
8	Read Characteristic Value	M
9	Read Long Characteristic Values	M
10	Write Characteristic Value	C.5

	GATT Sub-Procedure	Call Control Client Requirements
11	Write Without Response	C.5
12	Read Characteristic Descriptors	M
13	Write Characteristic Descriptors	M

Table 4.2: Additional GATT sub-procedure requirements

C.1:   Mandatory if the Discover Primary Services by Service UUID sub-procedure is not supported, otherwise Optional.

C.2:   Mandatory if the Discover All Primary Services sub-procedure is not supported, otherwise Optional.

C.3:   Mandatory if the Discover Characteristics by UUID sub-procedure is not supported, otherwise Optional.

C.4:   Mandatory if the Discover All Characteristics of a Service sub-procedure is not supported, otherwise Optional.

C.5:   Mandatory to support at least one.

If the client receives a Value Changed During Read Long ATT application error code while performing a Read Long Characteristic Values sub-procedure, the parts of the value read during the Read Long Values Characteristic sub-procedure are no longer valid. The client should restart a Characteristic Value Read procedure to read the new value. When performing the Read Long Characteristic Value sub-procedure, the client shall start with a value offset of 0.

4.2   Service Discovery

To discover GTBS, the Call Control Client shall use either the GATT Discover All Primary Services sub-procedure or the GATT Discover Primary Services by Service UUID sub-procedure.

To discover the instances of TBS, the Call Control Client shall use either the GATT Discover All Primary Services sub-procedure or the GATT Discover Primary Services by Service UUID sub-procedure.

4.3   Characteristic Discovery

As required by GATT, the Call Control Client shall be tolerant of additional optional characteristics in the service records of services that are used with this profile.

If a characteristic that can be indicated or notified is discovered, the Call Control Client shall also discover the associated Client Characteristic Configuration descriptor.

4.4   Call Control Client procedures

This section defines procedures that are used to enable TBS and GTBS features. The procedures describe common user scenarios and how to implement specified sequences to support these scenarios.

This profile does not restrict the mentioned services (see Table 3.1) from being used in other ways; a higher-layer profile may define additional procedures. However, if a procedure requirement for the client listed in Table 4.3 is supported, then the procedure shall be implemented by applying the requirements provided in this profile specification.

Procedures	Reference	Call Control Client Requirement
Read Bearer Provider Name	4.4.1	O
Read Bearer UCI	4.4.2	O
Read Bearer Technology	4.4.3	O
Read Bearer URI Schemes Supported List	4.4.4	O
Read Bearer Signal Strength	4.4.5	O
Read Bearer Signal Strength Reporting Interval	4.4.6	O
Set Bearer Signal Strength Reporting Interval	4.4.7	O
Read Bearer List Current Calls	4.4.8	O
Read Content Control ID	4.4.9	O
Read Incoming Call Target Bearer URI	4.4.10	O
Read Status Flags	4.4.11	O
Read Call State	4.4.12	M
Call Control Point Procedures	4.4.13	–
• Answer Incoming Call	4.4.13.1	O
• Terminate Call	4.4.13.2	O
• Move Call To Local Hold	4.4.13.3	O
• Move Locally Held Call To Active Call	4.4.13.4	O
• Move Locally And Remotely Held Call To Remotely Held Call	4.4.13.5	O
• Originate Call	4.4.13.6	O
• Join Calls	4.4.13.7	O
Read Call Control Point Optional Opcodes	4.4.14	O
Read Incoming Call	4.4.15	O
Read Call Friendly Name	4.4.16	O

Table 4.3: Procedure requirements for the Call Control Client

When the Call Control Client uses any of the read procedures in this section or handles a Characteristic Notification, it shall take suitable actions to maintain correct operation if either the Uniform Resource

Identifier (URI) or Friendly Name is being Withheld for one or more reasons as indicated by the Call_Flags field of the Call State characteristic. If the Withheld by Server bit is set, it can be because of a security policy configuration on the Server, which requires a higher level of authentication.

4.4.1　　Read Bearer Provider Name procedure

The Read Bearer Provider Name procedure is used by a Call Control Client to discover the bearer provider name on a Call Control Server.

The Call Control Client shall read the characteristic value of the Bearer Provider Name characteristic. The Bearer Provider Name characteristic is described in [2].

The Call Control Client may configure notifications of the Bearer Provider Name characteristic (enabling notification by using the Client Characteristic Configuration descriptor), so that the Call Control Client can be alerted if the current bearer provider name changes. This name change can happen, for example, when cellular devices roam between networks.

If the Bearer Provider Name characteristic value is greater than (ATT_MTU-3) octets in length, the Characteristic Value Notification contains the first (ATT_MTU-3) octets of the characteristic value, and the Read Long Characteristic Value procedure can be used if the rest of the characteristic value is required.

4.4.2　　Read Bearer UCI procedure

The Read Bearer UCI procedure is used by a Call Control Client to discover the bearer Uniform Caller Identifier (UCI) on a Call Control Server.

The Call Control Client shall read the characteristic value of the Bearer UCI characteristic. The Bearer UCI characteristic is described in [2].

4.4.3　　Read Bearer Technology procedure

The Read Bearer Technology procedure is used by a Call Control Client to discover the bearer technology on a Call Control Server.

The Call Control Client shall read the characteristic value of the Bearer Technology characteristic. The Bearer Technology characteristic is described in [2].

The Call Control Client may configure notifications of the Bearer Technology characteristic (enabling notification by using the Client Characteristic Configuration descriptor), so that the Call Control Client can be alerted if the bearer technology changes.

4.4.4　　Read Bearer URI Schemes Supported List procedure

The Read Bearer URI Schemes Supported List procedure is used by a Call Control Client to discover the list of URI schemes that is supported by the bearer on a Call Control Server.

The Call Control Client shall read the characteristic value of the Bearer URI Schemes Supported List characteristic. The Bearer URI Schemes Supported List characteristic is described in [2].

The Call Control Client may configure notifications of the Bearer URI Schemes Supported List characteristic (enabling notification by using the Client Characteristic Configuration descriptor), so that the Call Control Client can be alerted if the URI schemes list changes.

If the Bearer URI Schemes Supported List characteristic value is greater than (ATT_MTU-3) octets in length, the Handle Value notification contains the first (ATT_MTU-3) octets of the characteristic value, and the Read Long Characteristic Value procedure can be used if the rest of the characteristic value is required.

4.4.5   Read Bearer Signal Strength procedure

The Read Bearer Signal Strength procedure is used by a Call Control Client to discover the bearer signal strength on a Call Control Server.

If the Bearer Signal Strength characteristic is exposed by the Call Control Server, the Call Control Client shall read the characteristic value of the Bearer Signal Strength characteristic. The Bearer Signal Strength characteristic is described in [2].

The Call Control Client may configure notifications of the Bearer Signal Strength characteristic (enabling notification by using the Client Characteristic Configuration descriptor), so that the Call Control Client can be alerted if the signal strength changes. The frequency of notifying the characteristic is controlled by the value of the Bearer Signal Strength Reporting Interval characteristic. If the client does not want to receive notifications when the signal strength changes, then this characteristic shall not be configured for notifications.

4.4.6   Read Bearer Signal Strength Reporting Interval procedure

The Read Bearer Signal Strength Reporting Interval procedure is used by a Call Control Client to discover the Bearer Signal Strength Reporting Interval on a Call Control Server.

If the Bearer Signal Strength Reporting Interval characteristic is exposed by the Call Control Server, the Call Control Client shall read the characteristic value of the Bearer Signal Strength Reporting Interval characteristic. The Bearer Signal Strength Reporting Interval characteristic is described in [2].

4.4.7   Set Bearer Signal Strength Reporting Interval procedure

The Set Bearer Signal Strength Reporting Interval procedure is used by a Call Control Client to set the signal strength reporting interval on a Call Control Server, which defines how frequently the signal strength is reported to the client.

The Call Control Client shall write the characteristic value of the Bearer Signal Strength Reporting Interval characteristic with the reporting interval expressed in seconds. The Bearer Signal Strength Reporting Interval characteristic is described in [2].

The value that is written to this characteristic controls the behavior of the reporting of the signal strength through the Bearer Signal Strength characteristic.

4.4.8   Read Bearer List Current Calls procedure

The Read Bearer List Current Calls procedure is used by a Call Control Client to discover the Bearer List Current Calls on a Call Control Server.

The Call Control Client shall read the characteristic value of the Bearer List Current Calls characteristic. The Bearer List Current Calls characteristic is described in [2].

The Call Control Client may configure notifications of the Bearer List Current Calls characteristic (enabling notification by using the Client Characteristic Configuration descriptor), so that the Call Control Client can be alerted if the Bearer List Current Calls changes.

If the Bearer List Current Calls characteristic value is greater than (ATT_MTU-3) octets in length, the Handle Value notification contains the first (ATT_MTU-3) octets of the characteristic value, and the Read Long Characteristic Value procedure can be used if the rest of the characteristic value is required.

4.4.9   Read Content Control ID procedure

The Read Content Control ID procedure is used by a Call Control Client to discover the Content Control ID (CCID) on a Call Control Server.

The Call Control Client shall read the characteristic value of the CCID characteristic. The CCID characteristic is described in [2].

4.4.10   Read Incoming Call Target Bearer URI procedure

The Read Incoming Call Target Bearer URI procedure is used by a Call Control Client to discover the incoming call target bearer URI on a Call Control Server.

If the Incoming Call Target Bearer URI characteristic is exposed by the Call Control Server, the Call Control Client shall read the characteristic value of the Incoming Call Target Bearer URI characteristic. The Incoming Call Target Bearer URI characteristic is described in [2].

The Call Control Client may configure notifications of the Incoming Call Target Bearer URI characteristic (i.e., via the Client Characteristic Configuration descriptor), so that the Call Control Client can be alerted if the Incoming Call Target Bearer URI changes.

If the Incoming Call Target Bearer URI characteristic value is greater than (ATT_MTU-3) octets in length, the Handle Value notification contains the first (ATT_MTU-3) octets of the characteristic value, and the Read Long Characteristic Value procedure can be used if the rest of the characteristic value is required.

4.4.11   Read Status Flags procedure

The Read Status Flags procedure is used by a Call Control Client to discover the Status Flags characteristic on a Call Control Server.

The Call Control Client shall read the characteristic value of the Status Flags characteristic. The Status Flags characteristic is described in [2].

The Call Control Client may configure notifications of the Status Flags characteristic (enabling notification by using the Client Characteristic Configuration descriptor), so that the Call Control Client can be alerted if the Status Flags characteristic changes.

4.4.12   Read Call State procedure

The Read Call State procedure is used by a Call Control Client to discover the Call State for all active calls on a Call Control Server.

The Call Control Client shall read the characteristic value of the Call State characteristic. The Call State characteristic is described in [2].

The Call Control Client may configure notifications of the Call State characteristic (i.e., via the Client Characteristic Configuration descriptor), so that the Call Control Client can be alerted if the call state changes.

If the Call State characteristic value is greater than (ATT_MTU-3) octets in length, the Handle Value notification contains the first (ATT_MTU-3) octets of the characteristic value, and the Read Long Characteristic Value procedure can be used if the rest of the characteristic value is required.

4.4.13   Call Control Point procedures

The sub-procedures defined in the following sub-sections act on the Call Control Point that is exposed by the Call Control Server.

The Call Control Client may configure notifications of the Call Control Point Notification characteristic (via enabling notification by using the Client Characteristic Configuration descriptor), so that the Call Control Client can be alerted with the response to a Call Control Point write.

4.4.13.1   Answer Incoming Call sub-procedure

The Answer Incoming Call sub-procedure is used by a Call Control Client to answer an incoming call and make the call active on a Call Control Server.

The Call Control Client shall write the characteristic value of the Call Control Point characteristic with the Accept opcode and the Call_Index field of the incoming call. The Call Control Point characteristic and Call_Index field are described in [2].

4.4.13.2   Terminate Call sub-procedure

The Terminate Call sub-procedure is used by a Call Control Client to end a call that is in any state on a Call Control Server.

The Call Control Client shall write the characteristic value of the Call Control Point characteristic with the Terminate opcode and the Call_Index field of the call to be terminated. The Call Control Point characteristic and Call_Index field are described in [2].

4.4.13.3   Move Call To Local Hold sub-procedure

The Move Call To Local Hold sub-procedure is used by a Call Control Client to place an active call or an alerting call on local hold on a Call Control Server.

The Call Control Client shall write the characteristic value of the Call Control Point characteristic with the Local Hold opcode and the Call_Index field of the call to be moved to locally held. The Call Control Point characteristic and Call_Index field are described in [2].

4.4.13.4   Move Locally Held Call To Active Call sub-procedure

The Move Locally Held Call To Active Call sub-procedure is used by a Call Control Client to move a call that is being locally held to an active call on a Call Control Server.

The Call Control Client shall write the characteristic value of the Call Control Point characteristic with the Local Retrieve opcode and the Call_Index field of the call to be retrieved. The Call Control Point characteristic and Call_Index field are described in [2].

4.4.13.5   Move Locally And Remotely Held Call To Remotely Held Call sub-procedure

The Move Locally And Remotely Held Call To Remotely Held Call sub-procedure is used by a Call Control Client to move a call that is being locally and remotely held to a remotely held call on a Call Control Server.

The Call Control Client shall write the characteristic value of the Call Control Point characteristic with the Local Retrieve opcode and the Call_Index field of the call to be retrieved. The Call Control Point characteristic and Call_Index field are described in [2].

4.4.13.6 Originate Call sub-procedure

The Originate Call sub-procedure is used by a Call Control Client to make an outgoing call on a Call Control Server.

The Call Control Client shall write the characteristic value of the Call Control Point characteristic with the Originate opcode and the desired outgoing URI. The Call Control Point characteristic and Call_Index field are described in [2].

4.4.13.7 Join Calls sub-procedure

The Join Calls sub-procedure is used by a Call Control Client to join multiple calls on the Call Control Server.

The Call Control Client shall write the characteristic value of the Call Control Point characteristic with the Join opcode and a list of all calls to be joined. The list of Call_Index fields provided in the Join opcode write shall not include any Call_Index fields with the Call State of Incoming.

The Call Control Point characteristic, Call_State field, and Call_Index field are described in [2].

4.4.14 Read Call Control Point Optional Opcodes procedure

The Read Call Control Point Optional Opcodes procedure is used by a Call Control Client to discover the opcodes that are optionally supported for the Call Control Point on a Call Control Server.

The Call Control Client shall read the characteristic value of the Call Control Point Optional Opcodes characteristic. The Call Control Point Optional Opcodes characteristic is described in [2].

4.4.15 Read Incoming Call sub-procedure

The Read Incoming Call sub-procedure is used by a Call Control Client to discover the Incoming Call information on a Call Control Server.

The Call Control Client shall read the characteristic value of the Incoming Call characteristic. The Incoming Call characteristic is described in [2].

The Call Control Client may configure notifications of the Incoming Call characteristic (enabling notification by using the Client Characteristic Configuration descriptor), so that the Call Control Client can be alerted when an Incoming Call is available.

If the Incoming Call characteristic value is greater than (ATT_MTU-3) octets in length, the Handle Value notification contains the first (ATT_MTU-3) octets of the characteristic value, and the Read Long Characteristic Value procedure can be used if the rest of the characteristic value is required.

4.4.16 Read Call Friendly Name sub-procedure

The Read Call Friendly Name sub-procedure is used by a Call Control Client to discover the Call Friendly Name information on a Call Control Server.

If the Call Friendly Name characteristic is exposed by the Call Control Server, the Call Control Client shall read the characteristic value of the Call Friendly Name characteristic. The Call Friendly Name characteristic is described in [2].

The Call Control Client may configure notifications of the Call Friendly Name characteristic (enabling notification by using the Client Characteristic Configuration descriptor), so that the Call Control Client can be alerted when a Call Friendly Name is available.

If the Call Friendly Name characteristic value is greater than (ATT_MTU-3) octets in length, the Handle Value notification contains the first (ATT_MTU-3) octets of the characteristic value, and the Read Long Characteristic Value procedure can be used if the rest of the characteristic value is required.

4.5   Call Control Client Receipt of Notifications

TBS and GTBS support characteristics that are Notify only. The Call Control Client shall configure the notifications (enabling notification by using the Client Characteristic Configuration descriptor) of TBS or GTBS. The Call Control Client shall be able to receive multiple notifications of the TBS or GTBS characteristics from the Call Control Server.

4.5.1   Termination Reason notification

The Call Control Client shall control the configuration of notifications (enabling notification by using the Client Characteristic Configuration descriptor) of the Termination Reason characteristic of TBS or GTBS.

5 Security considerations

This section describes the security requirements for devices implementing the profile roles defined in Section 2.1. Unless otherwise stated in this specification, the behavior of TBS and GTBS is identical. Table 5.1 captures the security requirements for the Call Control Server and Call Control Client.

	Security Requirement	Call Control Client Requirements	Section	Call Control Server Requirements	Section
1	Security Mode 1 Level 1 (SM1 L1)	X	5.1.1	X	5.1, 5.1.2
2	Security Mode 1 Level 2 (SM1 L2)	O	5.1.1	C.2	5.1, 5.1.2
3	Security Mode 1 Level 3 (SM1 L3)	O	5.1.1	C.2	5.1, 5.1.2
4	Security Mode 1 Level 4 (SM1 L4)	O	5.1.1	C.2	5.1, 5.1.2
5	128b Key Entropy	C.1	5.1.1	C.1	5.1, 5.1.2

Table 5.1: Security requirements for Call Control Client and Call Control Server

C.1: Mandatory if SM1 L2 or SM1 L3 is supported, otherwise not applicable

C.2: Mandatory to support at least one of SM1 L2 or SM1 L3 or SM1 L4

5.1 Security Requirements for Low Energy

This section describes the security requirements for the Bluetooth Low Energy (LE) transport in terms of the Call Control Client role and the Call Control Server role.

The security requirements for all characteristics defined in the TBS specification [2] shall satisfy Security Mode 1 Level 2, defined in Volume 3, Part C, Section 10.2.1 in [1].

Access to all characteristics defined in the Call Control Service shall require an encryption key with at least 128 bits of entropy, derived from either:

- LE Secure Connections

- If cross-transport key derivation is used, from BR/EDR Secure Connections

- An out-of-band (OOB) method

Link Layer Privacy, defined in Volume 6, Part B, Section 6 in [1], should be used.

5.1.1 Call Control Client security requirements for Low Energy

The Call Control Client shall support bondable mode, defined in Volume 3, Part C, Section 9.4.3 in [1].

The Call Control Client shall support the bonding procedure defined in Volume 3, Part C, Section 9.4.4 in [1].

The Call Control Client should accept the LE Security Mode and LE Security Level combination that is requested by the Call Control Server.

The Call Control Client should only use the Security Manager (SM) Peripheral [5] Security Request procedure, defined in Volume 3, Part H, Section 2.4.6 in [1], to inform the Call Control Server of its security requirements if the Call Control Client has bonded with the Call Control Server.

If the Call Control Client is a BR/EDR/LE device, it should support and use cross-transport key derivation, defined in Volume 3, Part C, Section 14.1 in [1].

5.1.2   Call Control Server security requirements for Low Energy

The Call Control Server shall support bondable mode defined in Volume 3, Part C, Section 9.4.3 in [1].

The Call Control Server shall support the bonding procedure defined in Volume 3, Part C, Section 9.4.4 in [1].

The Call Control Server shall only accept the LE Security Mode and LE Security Level combination requested by the Call Control Client if that combination satisfies the security requirements implemented by the Call Control Server for access to characteristics defined in TBS [2].

If the Call Control Server is a BR/EDR/LE device, it should support and use cross-transport key derivation, defined in Volume 3, Part C, Section 14.1 in [1].

The Call Control Server may request the Authorization procedure to be performed before allowing a client to access TBS. See Volume 3, Part C, Section 10.5 in [1].

5.2   Security requirements for BR/EDR

This section describes the security requirements for the BR/EDR transport.

The Call Control Server security requirements for all characteristics defined in TBS shall be Security Mode 4 Level 2, defined in Volume 3, Part C, Section 5.2.2.8 in [1].

Access by a Call Control Client to all characteristics defined in TBS shall require an encryption key with at least 128 bits of entropy, derived from either:

- BR/EDR Secure Connections

- If cross-transport key derivation is used, from LE Secure Connections

- An OOB method

In a connection, the devices should bond.

The device initiating the connection should initiate bonding. Acceptance of bonding should be supported by the device accepting the connection request.

6   Generic Access Profile requirements

Requirements in this section are defined as "Mandatory" (M), "Optional" (O), "Excluded" (X), and "Conditional" (C.*n*). Conditional statements (C.*n*) are listed directly below the table in which they appear.

6.1   Generic Access Profile requirements for Low Energy

This section describes the device discovery and LE Asynchronous Control Link (ACL) connection establishment procedures that are used by a client and a server. These procedures are described in terms of the following roles:

- Peripheral role (defined in Volume 3, Part C, Section 2.2.2 in [1])

- Central role (defined in Volume 3, Part C, Section 2.2.2 in [1])

6.1.1   Peripheral connection establishment

6.1.1.1   Connection procedure to non-bonded devices

The connection procedure to non-bonded devices is used for device discovery and connection establishment when the Peripheral accepts a connection from a Central to which it is not bonded. The connection procedure to non-bonded devices is triggered by user interaction, for example, activating a device by inserting a battery or pushing buttons. To inform the Central that the Peripheral is available for connection establishment, the Peripheral enters one of the following GAP discoverable modes:

- Limited Discoverable mode (as defined in Volume 3, Part C, Section 9.2.3 in [1])

- General Discoverable mode (as defined in Volume 3, Part C, Section 9.2.4 in [1])

The Peripheral shall transmit extended advertising PDUs and, unless otherwise defined by higher-layer specifications, should include the following AD data types:

- Flags Advertising Data (AD) data type (as defined in Part A, Section 1.3 in [3])

- If the Peripheral is in the Call Control Server role and supports TBS and/or GTBS over LE, the Service UUID AD data type (as defined in Part A, Section 1.1 in [3]) containing the TBS and/or the GTBS UUID, as described in [2].

If the Peripheral is a BR/EDR/LE device and is also in a discoverable mode over the BR/EDR transport as defined in Section 6.2.1 and if the Peripheral wants to assist scanning devices to represent the Peripheral as a single device at the scanning device's User Interface (UI), the Peripheral should use its Public Device Address when transmitting extended advertising PDUs as part of the connection procedure to non-bonded devices.

6.1.1.2   Connection procedure to bonded devices

The connection procedure to bonded devices is used by a Peripheral device in the Connectable mode only if the Peripheral has previously bonded with the Central device when using the connection procedure to non-bonded devices defined in Section 6.1.1.1.

When available for a connection to a bonded device, a Peripheral enters one of the following GAP connectable modes:

- Directed Connectable mode (as defined in Volume 3, Part C, Section 9.3.3 in [1])

- Undirected Connectable mode (as defined in Volume 3, Part C, Section 9.3.4 in [1])

The Peripheral should use the advertising filter policy that was configured when bonded using the connection procedure to non-bonded devices in Section 6.1.1.1, unless the Peripheral is in the Directed Connectable mode.

6.1.1.3 Link loss reconnection procedure

When a connection is terminated because of link loss, a Peripheral should attempt to reconnect to the Central by using the procedures described in Section 6.1.1.1 or Section 6.1.1.2.

6.1.2 Central connection establishment

6.1.2.1 Device discovery

To discover one or more Peripherals, the Central must use either of the following GAP discovery procedures:

- Limited Discovery procedure (as defined in Volume 3, Part C, Section 9.2.5 in [1])

- General Discovery procedure (as defined in Volume 3, Part C, Section 9.2.6 in [1])

6.1.2.2 Connection procedure

A Central must use one of the following GAP connection establishment procedures based on its connectivity requirements:

- Auto Connection Establishment procedure (as defined in Volume 3 Part C, Section 9.3.5 in [1])

- General Connection Establishment procedure (as defined in Volume 3, Part C, Section 9.3.6 in [1])

- Selective Connection Establishment procedure (as defined in Volume 3, Part C, Section 9.3.7 in [1])

- Direct Connection Establishment procedure (as defined in Volume 3, Part C, Section 9.3.8 in [1])

6.1.2.3 Link loss reconnection procedure

When a connection is terminated because of link loss, a Central should attempt to reconnect to the Peripheral by using any of the GAP connection establishment procedures described in Section 6.1.2.2.

6.1.2.4 Connection interval

The connection interval can affect the latency of Call Control Client procedures. Therefore, to reduce the latency when acting as a Call Control Client, a connection interval should be selected in the range provided in Table 6.1.

Parameter	Value
Range for Connection Interval	10 to 30 milliseconds

Table 6.1: Recommended range for connection interval values

6.2 Generic Access Profile requirements for BR/EDR

This section describes the GAP requirements for BR/EDR.

6.2.1 Modes

Modes are defined in Volume 3, Part C, Section 4 in [1].

Bondable mode should be supported.

Table 6.2 shows the support requirements for GAP modes for BR/EDR devices.

Mode	Support in Call Control Client	Support in Call Control Server
General Discoverable mode	C.1	O
Limited Discoverable mode	C.1	O
Bondable mode	O	O

Table 6.2: GAP BR/EDR mode support requirements

C.1: Mandatory to support at least one of Limited Discoverable mode or General Discoverable mode

6.2.2 Idle Mode procedures

Idle Mode procedures are defined in Volume 3, Part C, Section 6 in [1].

The General Bonding procedure should be supported.

Table 6.3 shows the requirements for GAP Idle Mode procedures for BR/EDR devices.

Procedure	Support in Call Control Client	Support in Call Control Server
General Inquiry	O	M
Limited Inquiry	O	O
General Bonding	O	O

Table 6.3: GAP BR/EDR Idle Mode procedure support requirements

6.2.3 Device discovery

BR/EDR/LE devices implementing either of the Call Control Client or Call Control Server roles shall set the value of the Class of Device (CoD) field Major Service Class bit 14 to 1, as defined in [4].

If a BR/EDR/LE device implementing the Call Control Server role is in a GAP Discoverable mode defined in Volume 3, Part C, Section 4 in [1], then unless otherwise defined by higher-layer specifications, any extended inquiry response (EIR) data sent by the device should include the following EIR data type:

- If the Call Control Server supports TBS over BR/EDR, the Service UUID EIR data type containing the TBS UUID as described in [2]

- If the Call Control Server supports GTBS over BR/EDR, the Service UUID EIR data type containing the GTBS UUID, as described in [2]

7 Acronyms and abbreviations

Acronym/Abbreviation	Meaning
ACL	Asynchronous Connectionless
AD	Advertising Data
ATT	Attribute Protocol
BR/EDR	Basic Rate/Enhanced Data Rate
CCID	Content Control ID
GAP	Generic Access Profile
GATT	Generic Attribute Profile
GTBS	Generic Telephone Bearer Service
LE	Low Energy
MTU	Minimum Transmission Unit
OOB	out-of-band
PDU	Protocol Data Unit
RFU	Reserved for Future Use
SDP	Service Discovery Protocol
SM	Security Manager
TBS	Telephone Bearer Service
UCI	Uniform Caller Identifier
UI	user interface
URI	Uniform Resource Identifier
UUID	universally unique identifier

Table 7.1: Acronyms and abbreviations

8   References

[1]   Bluetooth Core Specification, Version 5.2 or later

[2]   Telephone Bearer Service Specification

[3]   Bluetooth Core Specification Supplement, Version 9 or later

[4]   Bluetooth SIG Assigned Numbers, https://www.bluetooth.com/specifications/assigned-numbers

[5]   Appropriate Language Mapping Table, https://www.bluetooth.com/language-mapping/Appropriate-Language-Mapping-Table