



Bluetooth Headset Profile Software Interface Specification

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Table of Contents

1.	Introduction	1
2.	Profile Application Interface	2
3.	Headset Service	3
3.1.	Registering/De-registering Headset Service	3
3.1.1.	Registering	3
3.1.2.	De-registering	4
3.1.3.	Create Headset Service Record	4
3.1.4.	Delete Headset Service Record	5
3.2.	Connecting/Disconnecting Audio Gateway Service	5
3.2.1.	Connecting	5
3.2.2.	Ring	6
3.2.3.	Audio Connected	6
3.2.4.	Disconnect Audio Gateway	6
3.3.	Remote Audio Volume Control	7
3.3.1.	Set Microphone Gain	7
3.3.2.	Set Speaker Gain	7
3.4.	HS Parameter Definition	7
3.5.	HS Configurable Definitions	8
3.6.	Errors/Status	8
3.7.	Headset Examples	9
3.7.1.	Registering Headset	9
3.7.2.	Outgoing Call	9
3.7.3.	Incoming Call	10
3.7.4.	Remote Audio Volume Control	11
3.7.5.	Disconnecting	11
3.7.6.	De-registering Headset	11
4.	Audio Gateway Service	12
4.1.	Registering/De-registering Audio Gateway	12
4.1.1.	Registering	12
4.1.2.	De-registering	13
4.1.3.	Create Audio Gateway Service Record	13
4.1.4.	Delete Audio Gateway Service Record	14
4.2.	Connecting/Disconnecting Headset	14
4.2.1.	Headset Service Check	14
4.2.2.	Connect Headset	15
4.2.3.	Ring	15
4.2.4.	Audio Connected	16
4.2.5.	Disconnect Headset	16
4.3.	Remote Audio Volume Control	16
4.3.1.	Set Microphone Gain	16
4.3.2.	Set Speaker Gain	17
4.4.	AG Parameter Definition	17
4.5.	AG Configurable Definitions	18

4.6.	AG Errors/Status	18
4.7.	AG Examples	19
4.7.1.	Registering Audio Gateway	19
4.7.2.	Outgoing Call	19
4.7.3.	Incoming Call	19
4.7.4.	Remote Audio Volume Control	21
4.7.5.	Disconnecting	21
4.7.6.	De-registering Audio Gateway	21
5.	Reference Documents	22
6.	Contact Information.	23
6.1.	Tality.	23
6.1.1.	What can Tality do for you?	23
6.1.2.	About Tality.	23

1. Introduction

This document defines the interfaces that will be supported by Tality's Bluetooth Headset Profile. Tality's implementation of the profile supports both the Headset (HS) role and the Audio Gateway (AG) role.

Tality profile software operates in Tality's Bluetooth software kernel environment using a pure message-passing mechanism. This kernel is designed to be small in size for efficiency in embedded systems and has the following features:

- portable across different processors
- low ROM and RAM usage
- simple in operation
- directly handles SDL features such as timers, finite state machines (FSMs) and message-based events to simplify the coding of SDL diagrams
- contains buffer and message management

Tality's Bluetooth kernel does not support features found in more generic real-time operating systems, such as semaphores and signals.

The software architecture for this design is defined in Software Architecture Specification (Ref 1).

Bluetooth Specification, Version 1.1 (Ref 2) has been adopted for the software architecture for this design.

This document is for public information and is an abridged version of the software specification for this design. For further details, please contact Tality Corporation.

2. Profile Application Interface

The profile application interface for the headset profile is message based, with each message possibly consisting of requests, confirmations, indications and responses. It follows the convention that messages from an upper to a lower layer are called requests and the corresponding replies are called confirmations. Events originating from a remote system, or a lower layer and passed on to an upper layer are called indications and the corresponding replies are called responses. Generally, all requests result in a corresponding confirmation, however indications do not always require responses.

Additionally certain services must be issued in sequence for correct operation. Message sequence charts (MSC) are included where necessary to show these operations.

Interfaces exported by the headset profile are shown in tables in the following sections for the headset and audio gateway. Columns represent the request, confirmation, indication and response parts of the message. If a column is greyed out, then the request, confirmation, indication or response part of the message is not supplied. Each row represents the interface parameter that may or may not be required by the message. Ticks indicate which parameters are available in each message.

For example, the HSP_REGISTER_HS interface has request and confirmation messages, but no indication and response messages. Parameters for HSP_REGISTER_HS_REQ are server channel, BD_ADDR, security and volume. Parameters supplied by HSP_REGISTER_AG_CONF are server channel and status.

Some request messages require identity of the originator so that confirmation and other related messages may be sent to the correct task. This is indicated by the *italicised parameter originator*. This parameter does not appear in the payload portion of the message. It is stored in the originator field of the kernel message header. A kernel function vKNL_SET_ORIGINATOR is available to set this field before the message is sent.

3. Headset Service

3.1. Registering/De-registering Headset Service

The messages in the following sections allow an application to register and de-register as a headset service. Currently, applications are restricted to registering one headset service and cannot register an audio gateway and headset service at the same time. Messages are provided to create and remove service records for the headset service.

3.1.1. Registering

Registers an application's support of a headset service. The application may specify an RFCOMM server channel to use. If the server channel is already registered for use by another service, registration fails with the error HSP_STATUS_CHANNEL_ALREADY_REGISTERED. The application will use a different server channel if it tries to register again.

Alternatively, the application can allow the SPP to select a server channel by using the constant SPP_SERVER_CHANNEL_FREE as the server channel argument. If no channels are available, registration fails with the error HSP_STATUS_NO_FREE_CHANNELS. Otherwise, the server channel chosen is returned in the confirmation message.

Service	HSP_REGISTER_HS				
Function	Register a headset.				
Parameter	Description	Request	Confirm	Indication	Response
Present:	---	✓	✓		
<i>Originator</i>	<i>Identification of service requester</i>	✓			
Server Channel	1 to 30, server channel free	✓	✓		
BD_ADDR	Bluetooth address	✓			
Security	Authentication and encryption requirements for incoming connections	✓			
Volume	Remote audio volume control supported	✓			
Status	OK, already registered, no free channels, error		✓		

3.1.2. De-registering

De-register the application's support of a headset service. The application must have successfully registered otherwise de-registration fails with the error HSP_STATUS_NOT_REGISTERED.

Service	HSP_DEREGISTER_H				
Function	De-register a headset.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓		
<i>Originator</i>	<i>Identification of service requester.</i>	✓			
Status	OK, not registered, error		✓		

3.1.3. Create Headset Service Record

Creates a service record in the local SDP database. The service record contains the entries specified in Table 5.1, Section 5.3 in Specification of the Bluetooth System (Ref 3). The name and volume arguments are used to fill the values of the service name and remote audio volume control attributes respectively. The server channel allocated during registration, either by the application or the SPP, is used to fill the RFCOMM server channel attribute. The service name attribute is an optional entry in the service record and, if the length argument has the value zero, the attribute is not created.

The use of this operation is not mandatory. Instead, the application may use the SDP interface directly to create the service record. However, it is the application's responsibility to ensure that the service record conforms to the required format and that the server channel attribute has the value assigned during registration, either by the application or the SPP.

Service	HSP_CREATE_HS_SERVICE_RECORD				
Function	Create service record for the headset.				
Parameter	Description	Request	Confirm	Indication	Response
Present:	---	✓	✓		
Volume	Remote audio volume control supported	✓			
Length	Service name length in bytes	✓			
Name	Service name	✓			
SRH	SDP service record handle		✓		
Status	OK, error		✓		

3.1.4. Delete Headset Service Record

Deletes the service record associated with the audio gateway service. In order to use this operation, the service record must have been created using the Create Headset Service Record. Otherwise the application must use the SDP interface directly.

Service	HSP_DELETE_HS_SERVICE_RECORD				
Function	Delete the service record for the server channel.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓		
Status	OK, no service record, error		✓		

3.2. Connecting/Disconnecting Audio Gateway Service

3.2.1. Connecting

Connect to the audio gateway service on the specified remote device. Before sending this message, the HS application must have performed an SDP service search on the remote device to ensure the device supports the audio gateway service and to obtain the service record handle or server channel for the service.

If the HS application obtains the server channel, it supplies this value in the server channel field of the request message. In this case, the connect handle and SRH fields are not used.

Alternatively, if the HS application obtains the SRH, the headset searches the service record for the server channel. In this case, the HS application leaves its SDP connection to the remote device in place while the message is processed. The SDP connection handle and SRH are supplied in the connect handle and SRH fields with the server channel field set to the value SPP_SERVER_CHANNEL_SEARCH. The headset reuses the SDP connection to perform its own attribute search of the service record. The HS application terminates the SDP link when it receives the confirmation message.

Service	HSP_CONNECT				
Function	Remote audio gateway is attempting to establish a connection.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓	✓	
BD_ADDR	Bluetooth address of remote device	✓		✓	
Server Channel	1 to 30, server channel search	✓			
Connect Handle	SDP connection handle to remote device	✓			
SRH	Service record handle of chosen service	✓			
Security	Security requirements	✓			
Status	OK, error, reject		✓		

3.2.2. Ring

A ring indication has been received from the audio gateway indicating an incoming call. The application notifies the user. Upon receiving a response from the user, the application sends a response message. Note that the application may receive multiple indications until it responds.

The ring may be accompanied by an audio signal. If this is the case, the application first receives a HSP_AUDIO_CONNECT_IND message indicating establishment of an SCO link.

Service	HSP_RING				
Function	Ring indication.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---			✓	✓

3.2.3. Audio Connected

Service	HSP_AUDIO_CONNECT				
Function	Audio link between headset and audio gateway established.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---			✓	

3.2.4. Disconnect Audio Gateway

Terminates the connection between the audio gateway and the headset. The disconnection procedure can be initiated by either side. Receipt of the confirmation and indication messages is taken to mean that the audio link between the two devices has been disconnected. There is no separate audio disconnected indication.

Service	HSP_DISCONNECT				
Function	Terminate the connection between the headset and audio gateway.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓	✓	
Status	OK, error		✓		

3.3. Remote Audio Volume Control

3.3.1. Set Microphone Gain

If the headset supports the remote audio volume control feature, the audio gateway sends microphone gain indication messages to control the microphone gain. If the gain can also be adjusted locally on the HS device, the HS application sends microphone gain requests to inform the audio gateway of changes in gain.

Service	HSP_MICROPHONE_GAIN				
Function	Remote audio volume control for headset microphone.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓	✓	
Gain	Microphone gain value	✓		✓	
Status	OK, error		✓		

3.3.2. Set Speaker Gain

If the headset supports the remote audio volume control feature, the audio gateway sends speaker gain indication messages to control the speaker volume. If the volume can also be adjusted locally on the HS device, the HS application sends speaker gain requests to inform the audio gateway of changes in volume.

Service	HSP_SPEAKER_GAIN				
Function	Remote audio volume control for headset speaker.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓	✓	
Gain	Speaker gain value	✓		✓	
Status	OK, error		✓		

3.4. HS Parameter Definition

This section defines the parameters associated with the service primitives supported by the HS interface.

Definition	Description	Type / Length
BD_ADDR	Bluetooth address.	Unsigned integer (48 bits)
Connect Handle	SDP Connection Handle	SDC_CONNECT_HANDLE
Gain	Microphone/speaker gain value	Unsigned integer (8 bits)
Name	Service Name	Unsigned bytes
Name Length	Service Name length in bytes	Unsigned integer (8 bits)
Security	Security requirements: none, authentication, encryption.	Unsigned integer (8 bits)
Server Channel	RFCOMM Server Channel Number (1-30)	Unsigned integer (8 bits)

Definition	Description	Type / Length
SRH	SDP Service Record Handle	Unsigned integer (32 bits)
Status	Status information.	See section on errors.
Volume	Remote audio volume control supported?	Boolean

3.5. HS Configurable Definitions

Definition	Value	Filename	Description
BSFTR_HSP_ADD_BROWSE_ATTRIBUTE	None	cfgbprof.h	If defined, then when a headset SDP record is created, the headset adds a browse group list attribute.
BSFTR_HSP_ADD_LANGUAGE_BASE_ATTRIBUTE	None	cfgbprof.h	If defined, then when a headset SDP record is created, the headset profile adds a language base attribute ID list attribute, which contains information about the language coding.
BSCFG_HSP_MAX_NAME_LENGTH	128 bytes	cfgbprof.h	Maximum number of bytes allowed for the name of a service.
BSCFG_HSP_FRAME_SIZE_OPTIMAL	1024	cfgbprof.h	Preferred maximum frame size to negotiate for an RFCOMM connection.
BSCFG_HSP_FRAME_SIZE_MINIMAL	23	cfgbprof.h	Minimum acceptable maximum frame size for an RFCOMM connection.

3.6. Errors/Status

This section defines the errors that can occur within the audio gateway. The HS application is informed of the errors through the status field within individual messages.

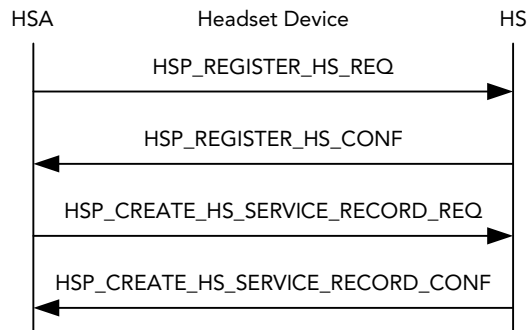
Definition Name/Error	Description
HSP_STATUS_OK	Operation completed without error.
HSP_STATUS_ERROR	Unspecified error.
HSP_STATUS_SCO_ERROR	Operation failed when interacting with SCO.
HSP_STATUS_SDP_ERROR	Operation failed when interacting with SDP.
HSP_STATUS_SPP_ERROR	Operation failed when interacting with SPP.
HSP_STATUS_INVALID_SERVER_CHANNEL	The application supplied an invalid server channel.
HSP_STATUS_ALREADY_REGISTERED	Application has already registered.
HSP_STATUS_CHANNEL_ALREADY_REGISTERED	Server channel has already been registered by another service.
HSP_STATUS_NO_FREE_CHANNELS	There are no free server channels available.
HSP_STATUS_NOT_REGISTERED	The application is not registered.
HSP_STATUS_NO_SUCH_SERVICE_RECORD	No service record was found.
HSP_STATUS_REJECT	This value can also be used in a HSP_CONNECT_RESP message to reject a connection from an audio gateway.

3.7. Headset Examples

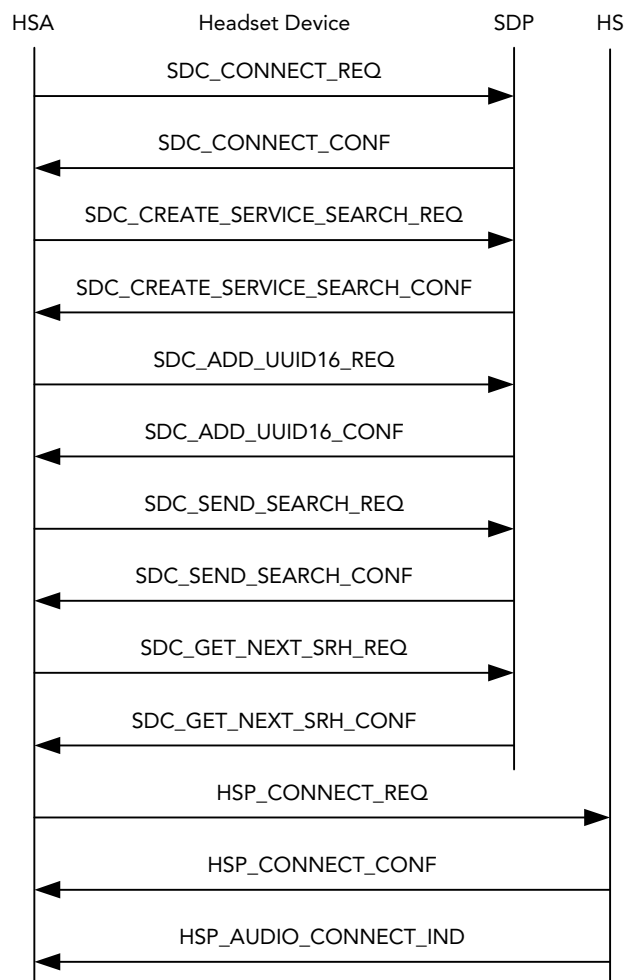
This section shows in more detail some examples of usage. These examples are intended to complement rather than replace the MSCs and other design documents that are supplied with the software.

3.7.1. Registering Headset

This example shows HS registration. After registration, the HSA creates a service record for the headset service.



3.7.2. Outgoing Call



An outgoing call scenario typically involves the user pressing the headset button to initiate a call, i.e. connection is initiated by the headset.

Before connecting to the audio gateway, the HS application performs a service search of the device to verify that it supports the audio gateway service. After the connection request and confirmation messages have been exchanged, it receives an audio connect indication message. This indicates that an SCO link has been established between the two devices. The application takes any necessary action to connect the SCO link to the device's audio hardware.

The call is now established and proceeds until disconnected by either device.

3.7.3. Incoming Call

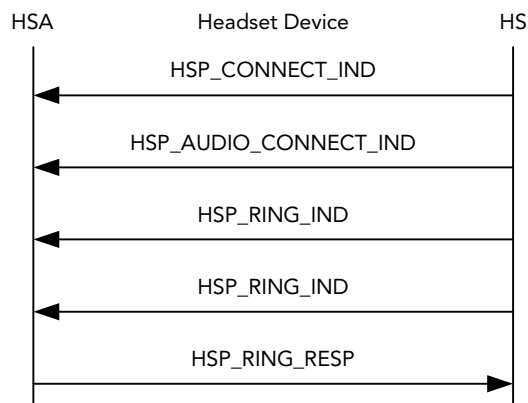
An incoming call scenario involves the audio gateway initiating a connection to the headset. This example shows the scenario where the audio gateway is a telephone and it receives an incoming call from the telephone network.

After receiving and responding to the connection indication from the audio gateway, the HS application receives an audio connect indication message. This indicates that an SCO link has been established between the two devices. The application takes any necessary action to connect the SCO link to the device's audio hardware.

The HS application receives a ring indication message. At this point, the HS application notifies the user of the incoming call. This may be helped by an audio signal from the audio gateway since an SCO link has already been established. When the user has decided to answer the call, the application sends a ring response message. The audio gateway may send further ring indications until the headset responds.

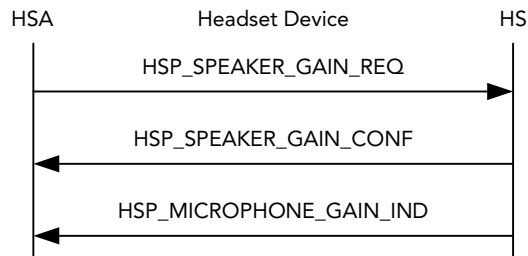
The call is now established and proceeds until disconnected by either device.

Note that the ring indications may not be accompanied by an audio signal. In this case, the audio connect indication is not received until after the call has been answered, i.e. the HS application sends a ring response message.



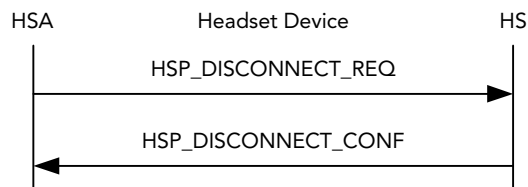
3.7.4. Remote Audio Volume Control

In this example, the speaker volume has been adjusted locally on the headset device. As a result, the headset sends a notification of the new gain value to the audio gateway, which is the HSP_SPEAKER_GAIN message pair. After this, the audio gateway adjusts the microphone gain on the headset, which is the HSP_MICROPHONE_GAIN_IND message.



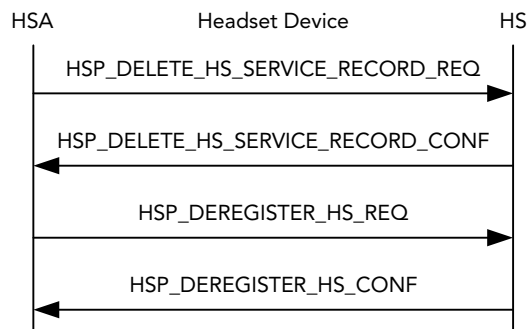
3.7.5. Disconnecting

Either the headset or audio gateway devices can initiate disconnection. In this case it is the headset.



3.7.6. De-registering Headset

Before de-registering the headset, the application removes its service record from the local SDP database. In this case, the application used the profile layer's service to create the service record so is able to use its service record deletion message. If the application had created the service record directly by using the SDP, it would use the SDP interface directly to delete the service record.



4. Audio Gateway Service

4.1. Registering/De-registering Audio Gateway

The messages in the following sections allow an application to register and de-register as an audio gateway service. Currently, applications are restricted to registering one audio gateway service, and cannot register an audio gateway and headset service at the same time. Messages are provided to create and remove service records for the audio gateway service.

4.1.1. Registering

Register the application's support of an audio gateway service. The application may specify an RFCOMM server channel to use. If the server channel is already registered for use by another service, registration fails with the error HSP_STATUS_CHANNEL_ALREADY_REGISTERED. The application should use a different server channel if it tries to register again.

Alternatively, the application can allow the SPP to select a server channel by using the value SPP_SERVER_CHANNEL_FREE in the server channel field. This channel must not be in use by any other service. If no free server channels are available, registration fails with the error HSP_STATUS_NO_FREE_CHANNELS. If successful, the chosen channel is returned in the confirmation message.

Service	HSP_REGISTER_AG				
Function	Register audio gateway server.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓		
<i>Originator</i>	<i>Identification of service requester.</i>	✓			
Server Channel	Server channel number (1 to 30 server channel free)	✓	✓		
Security	Authentication and encryption requirements for incoming connections	✓			
Status	OK, already registered, channel already registered, no free channels, error		✓		

4.1.2. De-registering

De-register an application's support of an audio gateway service. The application must have successfully registered otherwise de-registration fails with the error HSP_STATUS_NOT_REGISTERED.

Service	HSP_DEREGISTER_AG				
Function	De-register audio gateway server.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓		
<i>Originator</i>	<i>Identification of service requester.</i>	✓			
Status	OK, not registered, error		✓		

4.1.3. Create Audio Gateway Service Record

Creates a service record in the local SDP database. The format of the service record conforms to that defined in Table 5.2, Section 5.3 in Specification of the Bluetooth System (Ref 3). The name argument is used to fill the value of the service name attribute. The server channel allocated during registration, either by the application or the SPP, is used to fill the RFCOMM server channel attribute. The service name attribute is an optional entry in the service record and, if the length argument has the value zero, the attribute is not created.

The use of this operation is not mandatory. Instead, the application may use the SDP interface directly to create the service record. However, it is the application's responsibility to ensure that the service record conforms to the required format and that the server channel attribute has the value assigned during registration, either by the application or the SPP.

Service	HSP_CREATE_AG_SERVICE_RECORD				
Function	Create service record for the audio gateway.				
Parameter	Description	Request	Confirm	Indication	Response
Present:	---	✓	✓		
Name Length	Service name length in bytes	✓			
Name	Service name	✓			
SRH	SDP service record handle		✓		
Status	OK, error		✓		

4.1.4. Delete Audio Gateway Service Record

Deletes the service record associated with the audio gateway service. In order to use this operation, the service record must have been created using the Create Audio Gateway Service Record. Otherwise the application must use the SDP interface directly.

Service	HSP_DELETE_AG_SERVICE_RECORD				
Function	Delete the service record for the audio gateway.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓		
Status	OK, no service record, error		✓		

4.2. Connecting/Disconnecting Headset

4.2.1. Headset Service Check

Determines whether the specified headset service supports the remote audio volume control feature. After performing a device discovery or inquiry, the application performs an SDP service search on any devices it is interested in connecting to. This verifies that the device supports a headset service. If the device does support the headset service, the application can use this operation to determine if it supports the remote audio volume control feature and obtain the values of other key attributes in its service record. The application leaves its SDP connection to the remote device in place while the message is processed so that the profile layer can reuse it to perform its own SDP search. The application terminates the SDP link once the confirmation message is received.

Service	HSP_SERVICE_CHECK				
Function	Initiate a connection to the headset.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓		
Connect Handle	SDP connection handle to remote device	✓			
SRH	Service record handle of service to check	✓			
Status	OK, error		✓		
Volume	Remote audio volume control supported		✓		
Server Channel	1 to 30		✓		
Name Length	Service name length in bytes		✓		
Name	Service name		✓		

4.2.2. Connect Headset

Connects the headset service on a specified remote device. Before sending this message, the AG application must have performed an SDP service search on the remote device to ensure the device supports the headset service and obtain the service record handle (SRH) or server channel for the service.

If the AG application obtains the server channel, it supplies this value in the server channel field of the request message. In this case, the connect handle and SRH fields are not used.

Alternatively, if the AG application obtains the SRH, the AG searches the service record for the server channel. In this case, the AG application leaves its SDP connection to the remote device in place while the message is processed. The SDP connection handle and SRH are supplied in the connect handle and SRH fields with the server channel field being set to the value SPP_SERVER_CHANNEL_SEARCH. The AG reuses the SDP connection to perform its own attribute search of the service record. The AG application terminates the SDP link when it receives the confirmation message.

Service	HSP_CONNECT				
Function	Initiate a connection to the headset.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓	✓	
BD_ADDR	Bluetooth address of remote device	✓		✓	
Server Channel	1 to 30, server channel search	✓			
Connect Handle	SDP connection handle to remote device	✓			
SRH	Service record handle of chosen service	✓			
Security	Security requirements	✓			
Status	OK, error, reject		✓		

4.2.3. Ring

Sends a ring indication to the headset. If in-band ringing is required, the INBAND parameter should be set to TRUE. The headset AG establishes an SCO link to the headset if one has not already been established. The AG application sends as many ring indications as it requires to the headset until the HSP_RING confirmation message is received.

Service	HSP_RING				
Function	Sends ring indication to headset.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓		
In-band	In-band ringing flag	✓			

4.2.4. Audio Connected

Service	HSP_AUDIO_CONNECT				
Function	Audio link between headset and audio gateway established.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---			✓	

4.2.5. Disconnect Headset

Terminates the connection between the audio gateway and the headset. The disconnection procedure can be initiated by either side. Receipt of the confirmation and indication messages means that the audio link between the two devices has already been disconnected. There is no separate audio disconnected indication.

Service	HSP_DISCONNECT				
Function	Terminate the connection between the headset and audio gateway.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓	✓	
Status	OK, error		✓		

4.3. Remote Audio Volume Control

4.3.1. Set Microphone Gain

If the headset supports the remote audio volume control feature, the AG application can control the gain of its microphone using this message when there is an active audio connection. The application also receives indication messages to inform it of the new setting when the microphone gain is adjusted locally on the headset device.

Service	HSP_MICROPHONE_GAIN				
Function	Set the gain of the microphone of the headset.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓	✓	
Gain	Microphone gain value	✓		✓	
Status	OK, error		✓		

4.3.2. Set Speaker Gain

If the headset supports the remote audio volume control feature, the AG application can control the volume of its speaker using this message when there is an active audio connection. The application also receives indication messages to inform it of the new setting when the speaker volume is adjusted locally on the headset device.

Service	HSP_SPEAKER_GAIN				
Function	Set the gain of the speaker of the headset.				
Parameter	Description	Request	Confirm	Indication	Response
Present	---	✓	✓	✓	
Gain	Speaker gain value	✓		✓	
Status	OK, error		✓		

4.4. AG Parameter Definition

This section defines the parameters associated with the service primitives supported by the AG interface.

Definition	Description	Type / Length
BD_ADDR	Bluetooth address.	Unsigned integer (48 bits)
Connect Handle	SDP connection handle	SDC_CONNECT_HANDLE
Gain	Microphone/speaker gain value	Unsigned integer (8 bits)
Inband	Inband ringing required	Boolean
Name	Service name	Unsigned bytes
Name Length	Service name length in bytes	Unsigned integer (8 bits)
Security	Security requirements: none, authentication, encryption.	Unsigned integer (8 bits)
Server Channel	RFCOMM server channel number (1 to 30)	Unsigned integer (8 bits)
SRH	SDP service record handle	Unsigned integer (32 bits)
Status	Status information.	See section on errors.
Volume	Remote audio volume control supported?	Boolean

4.5. AG Configurable Definitions

Definition	Value	Filename	Description
BSFTR_HSP_ADD_BROWSE_ATTRIBUTE	None	cfgbprof.h	If defined, then when an audio gateway SDP record is created, the data gateway add a browse group list attribute.
BSFTR_HSP_ADD_LANGUAGE_BASE_ATTRIBUTE	None	cfgbprof.h	If defined, then when an audio gateway SDP record is created, the AG adds a language base attribute ID list attribute, which contains information about the language coding.
BSCFG_HSP_MAX_NAME_LENGTH	128 bytes	cfgbprof.h	Maximum number of bytes allowed for the name of a service.
BSCFG_HSP_FRAME_SIZE_OPTIMAL	1024	cfgbprof.h	Preferred maximum frame size to negotiate for an RFCOMM connection.
BSCFG_HSP_FRAME_SIZE_MINIMAL	23	cfgbprof.h	Minimum acceptable maximum frame size for an RFCOMM connection.

4.6. AG Errors/Status

This section defines the errors that can occur within the audio gateway. The AG application is informed of the errors through the status field within individual messages.

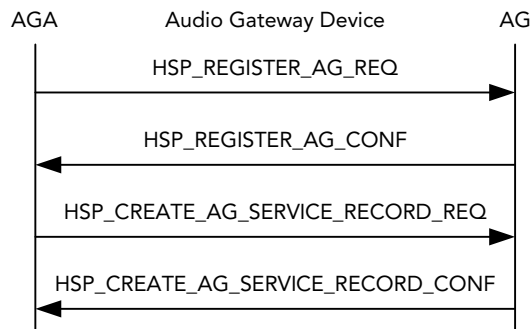
Definition Name/Error	Description
HSP_STATUS_OK	Operation completed without error.
HSP_STATUS_ERROR	Unspecified error.
HSP_STATUS_SCO_ERROR	Operation failed when interacting with SCO.
HSP_STATUS_SDP_ERROR	Operation failed when interacting with SDP.
HSP_STATUS_SPP_ERROR	Operation failed when interacting with SPP.
HSP_STATUS_INVALID_SERVER_CHANNEL	The application supplied an invalid server channel.
HSP_STATUS_ALREADY_REGISTERED	Application has already registered.
HSP_STATUS_CHANNEL_ALREADY_REGISTERED	Server channel has already been registered by another service.
HSP_STATUS_NO_FREE_CHANNELS	There are no free server channels available.
HSP_STATUS_NOT_REGISTERED	The application is not registered.
HSP_STATUS_NO_SUCH_SERVICE_RECORD	No service record was found.
HSP_STATUS_REJECT	This value can also be used in a HSP_CONNECT_RESP message to reject a connection from a headset.

4.7. AG Examples

This section shows in more detail some examples of usage. These examples are intended to complement rather than replace the MSCs and other design documents that are supplied with the software.

4.7.1. Registering Audio Gateway

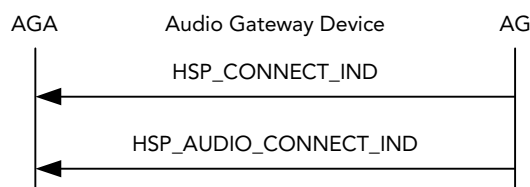
This example shows an audio gateway registration. After registration, the AG application creates a service record for the audio gateway service.



4.7.2. Outgoing Call

An outgoing call scenario typically involves the user of the headset device pressing the device's button to initiate a call, i.e. connection is initiated by the headset.

After the HSP_CONNECT_IND message is received indicating an outgoing call, the application receives an HSP_AUDIO_CONNECT_IND. This indicates that an SCO link between the two devices has been established. The application then performs any actions necessary to feed the SCO link with audio.



4.7.3. Incoming Call

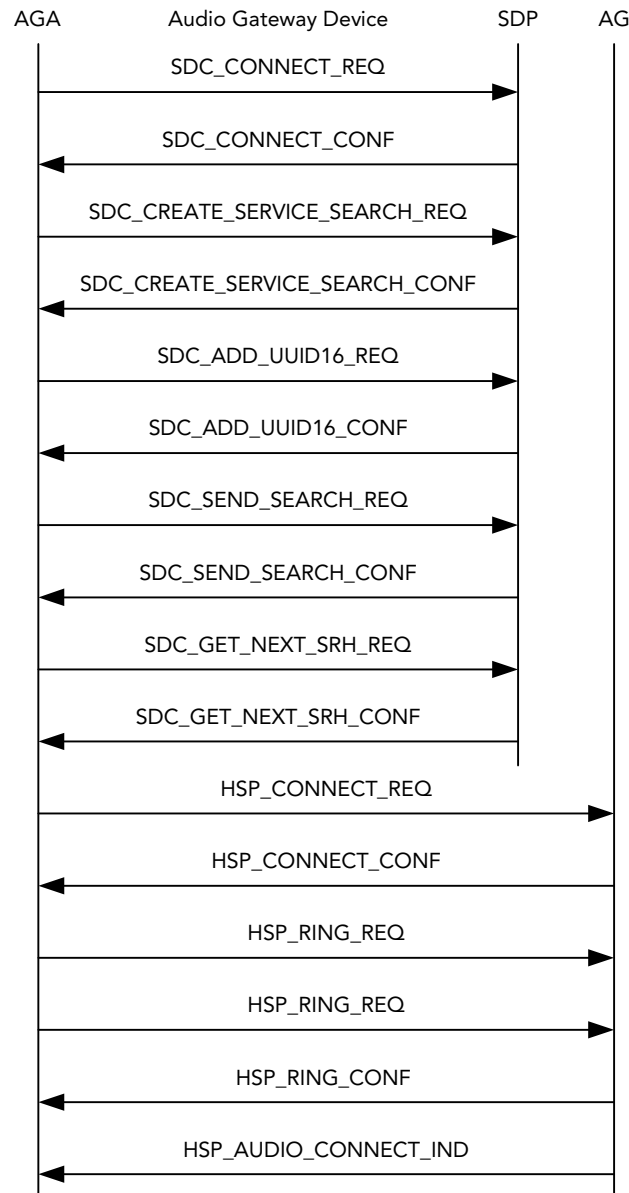
An incoming call scenario involves the audio gateway initiating a connection to the headset. This example shows the scenario when the audio gateway is a telephone and it receives an incoming call from the telephone network.

Before connecting to the headset device, it performs an SDP search on the device to verify that it supports the headset profile. Note that the application may perform a search on several devices before making a decision on which device to connect to, perhaps by asking the user of the device and by checking whether it supports the remote audio volume control feature. This is not shown in this example. Once the search is complete, the application initiates the connection.

When the connection confirmation message is received, the application sends a number of ring indication messages to the headset to indicate there is an incoming call. The headset notifies the user who responds by pressing the headset's button. At this point, the application receives a ring confirmation message to indicate the user's acceptance of the incoming call. The application may continue to send ring indications until it receives a ring confirmation.

Finally, the application receives an audio connect indication message. This indicates that an SCO link has been established between the headset and audio gateway devices. The application then performs any actions necessary to feed the SCO link with audio.

Note that it is possible to send an audio accompaniment during the ring request phase by setting the in-band flag of the ring request to true. In this case, the SCO link is established and an audio connect indication message is received after the initial ring request. No further audio connect indication messages are received as the SCO link remains connected after the user accepts the call, i.e. after the application receives the ring confirmation.



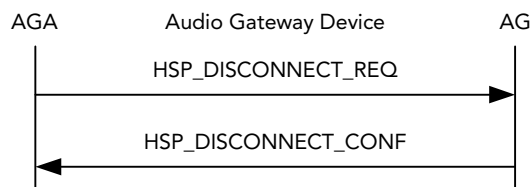
4.7.4. Remote Audio Volume Control

In this example, the speaker volume has been adjusted locally on the headset device. As a result, the headset sends a notification of the new gain value to the audio gateway, which is the HSP_SPEAKER_GAIN_IND message. After this, the audio gateway adjusts the microphone gain on the headset using the HSP_MICROPHONE_GAIN pair of messages.



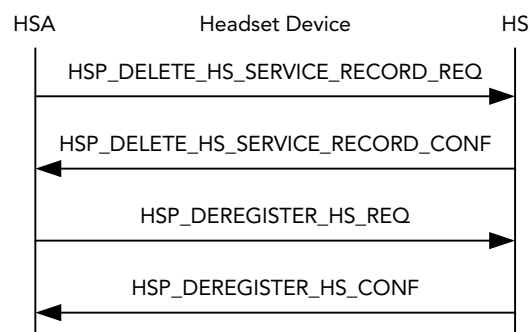
4.7.5. Disconnecting

Either the headset or audio gateway devices can initiate disconnection. In this case it is the audio gateway.



4.7.6. De-registering Audio Gateway

Before de-registering the audio gateway, the application removes its service record from the local SDP database. In this case, the application used the profile layer's service to create the service record so is able to use its service record deletion message. If the application had created the service record directly by using the SDP, it has to use the SDP interface directly to delete the service record.



5. Reference Documents

1. Software Architecture Specification, Tality Document S10347
2. Bluetooth Specification, Version 1.1, Bluetooth SIG Document 1.C.47/1.1
3. Specification of the Bluetooth System, Volume 2 Profiles Ver 1.1, Part K:10 Generic Object Exchange Profile, Telefonaktiebolaget LM Ericsson

6. Contact Information

6.1. Tality

6.1.1. What can Tality do for you?

Tality undertakes all aspects of communications product design, including complete system and sub-system design, and both hardware and software component design. The company focuses primarily on network infrastructure, wireless infrastructure, broadband access devices, and consumer communications and infotainment products. Tality's design services span product conceptualisation through implementation for production manufacturing, enabling our customers to get better products to market faster.

6.1.2. About Tality

Tality Corporation, a subsidiary of Cadence Design Systems, Inc. (NYSE:CDN), is the world's largest electronic product development outsourcing provider. Leading and emerging technology companies around the globe leverage Tality's engineering services and intellectual property for the design of complex electronic systems and integrated circuits. Tality is headquartered in San Jose, California. For more information, contact us at +44 (0) 1506 595094, or e-mail to bluetooth@tality.com, or visit us on the World Wide Web at: <http://www.tality.com>.