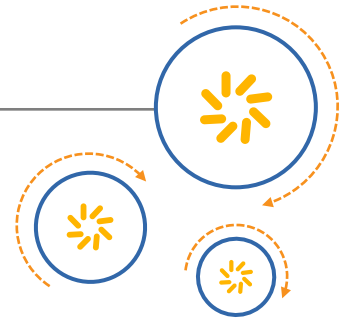




Qualcomm Technologies International, Ltd.



ADK Voice Assistant

User Guide

80-CG032-1 Rev. AB

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Revision	Date	Description
AA	February 2018	Initial release. Alternative document number CS-00408782-UG.
AB	February 2018	Refactoring of contents page.

Contents

1 Voice Assistant overview	5
2 Voice Assistant architecture	6
3 Voice Assistant configuration	7
3.1 Supported QTI devices	7
3.2 Build Property settings to enable VA	7
3.2.1 ADK4.x	7
3.2.2 DSP build definition in ADK4.x	7
3.2.3 ADK6.x	7
3.3 Voice Assistant user and system events	7
3.3.1 User events	7
3.3.2 System events	8
3.4 Microphone configuration for Voice Assistant	9
4 Voice Assistant session setup	10
5 Voice Assistant limitations and co-existence with other ADK features	11
5.1 Limitations of voice assistant feature	11
5.2 VA co-existing with ADK features	11
6 Audio path	12
6.1 CSR 867x series chipsets	12
6.2 CSRA68100 and QCC5100 series chipsets	12
7 Streams for voice assistant	13
7.1 Streams for CSR 867x series chipsets	13
7.2 Streams for CSRA68100 and QCC5100 series chipsets	13
8 GAIA VA protocol summary	14
8.1 GAIA VA protocol commands	14
8.2 GAIA VA protocol sequence diagram for single VA session	15
8.3 GAIA VA protocol sequence diagram for multi VA session	16
9 Troubleshooting VA	17
9.1 Scenario: VA session not established	17
9.2 Scenario: VA session is not working	17

Figures

Figure 1-1 Voice Assistant overview	5
Figure 2-1 Voice Assistant architecture diagram	6
Figure 3-1 Build Property for ADK4.x	7

Figure 3-2 Example Configuration for VA user events	8
Figure 3-3 VA Microphone Configuration	9
Figure 6-1 Forward (voice data towards mobile device) Audio Path for Voice Assistant in CSR 867x series chipsets	12
Figure 6-2 Forward (voice data towards mobile device) Audio Path for Voice Assistant in CSRA68100 and QCC5100 series chipsets	12
Figure 8-1 Single VA session sequence	15
Figure 8-2 Multi session VA sequence	16

Tables

Table 8-1 GAIA VA protocol commands	14
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1 Voice Assistant overview

The Voice Assistant (VA) feature supports interactions with a Voice Service Provider (VSP) via a suitable headset using Bluetooth technology. Voice Service Providers cloud service is accessed through a mobile device. The user activates the Voice Assistant using a button press, and after a ready tone the user can start speaking to the VSP cloud service.

The Voice Assistant can interact with an independent VSP without interrupting any music playback over the A2DP channel. Independent VSPs are not built in the mobile device platform, and are instead accessed directly.

This document describes how to configure and use the Voice Assistant feature in an ADK sink application headset project.



Figure 1-1 Voice Assistant overview

2 Voice Assistant architecture

The VA uses two different Bluetooth channels to interact with user devices. For communicating captured voice to mobile devices, it uses the RFCOMM channel. For receiving VSP responses back to the headset, it uses the A2DP channel.

The VA applies an SBC encoder algorithm to compress captured voice, then sends it to the mobile device over Bluetooth.

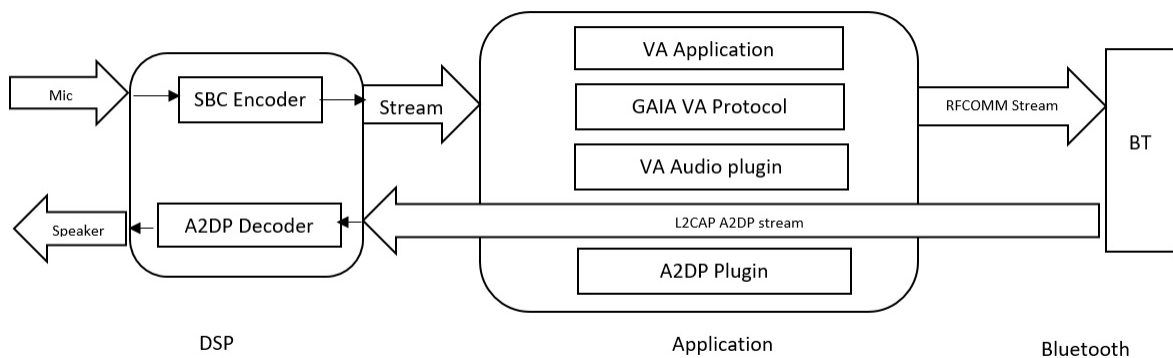


Figure 2-1 Voice Assistant architecture diagram

3 Voice Assistant configuration

3.1 Supported QTIL devices

Voice Assistant setup is built into a headset variant of sink application. It is supported by QTIL CSR867x, CSRA68100, and QCC5100 series hardware. The Voice Assistant feature is supported from ADK 4.3.1 and ADK 6.2 onwards.

3.2 Build Property settings to enable VA

Voice assistant feature is disabled by default in ADK. Enable it with the following steps:

3.2.1 ADK4.x

Enable the **VOICE ASSISTANT** option from the **Project Property** menu.

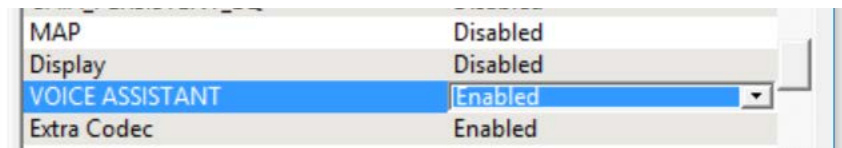


Figure 3-1 Build Property for ADK4.x

3.2.2 DSP build definition in ADK4.x

DSP builds are enabled by default in the headset project for VA. `ENABLE_VA_BACK_CHANNEL` defines DSP capabilities for handling VA in a DSP.

This configuration is available under **Extra defines** of project properties of DSP projects. Only SBC, AAC, MP3, and aptX DSP projects support VA.

3.2.3 ADK6.x

In ADK6.x, the Voice Assistant is not added to project properties. Enable the VA by adding `ENABLE_VOICE_ASSISTANT` to **Projects** → **Build settings DEFS** in Qualcomm MDE.

3.3 Voice Assistant user and system events

The *VA Start* user event triggers Voice Assistant activation in the sink application. Once the VA protocol (see section 8) is successfully established with a mobile device, a tone plays as an indication to start speaking over the configured microphone (see section 3.4). An active VA session is canceled with the *VA Cancel* event.

3.3.1 User events

There are two user events provided to start and stop VA.

- VA Start (`EventUsrVoiceAssistantStart`): Initiate a VA session
- VA Cancel (`EventUsrVoiceAssistantCancel`): Cancels existing VA session

These events are configurable using the ADK configuration tool for PIOs as follows:

Navigate to **ADK Configuration Tool > User Interfaces > User Events** and configure *VA Start* and *VA Cancel* events to PIO (See *Audio Sink Application Configuration*). The *VA Start* and *VA Cancel* events can be set to **SHORT** and **VERY LONG** presses of a single PIO button; see [Figure 3-2](#).

ST	File			Event	Event Name	Event Type	Action
32	10.	<input type="checkbox"/>	<input type="checkbox"/>	3FFF	Analogue Audio Connected	FALLING	Delete
33	10.	<input type="checkbox"/>	<input type="checkbox"/>	3FFF	Analogue Audio Disconnected	RISING	Delete
34	0.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1FFF	Reset Paired Device List	VVLONG	Delete
35	3.,4.	<input type="checkbox"/>	<input type="checkbox"/>	7F7E	VA Start	SHORT	Delete
36	3.,4.	<input type="checkbox"/>	<input type="checkbox"/>	7F7E	VA Cancel	VLONG	Delete
37		<input type="checkbox"/>	<input type="checkbox"/>	0000	Delete
38		<input type="checkbox"/>	<input type="checkbox"/>	0000	Delete

Figure 3-2 Example Configuration for VA user events

3.3.2 System events

There are two system events provided for VA to configure indications to user:

- Voice Assistant Start Voice Capture(`EventSysVAStartVoiceCapture`): For tone indication to start speaking.
- Voice Assistant Session Error(`EventSysVASessionError`): For error indications.

3.4 Microphone configuration for Voice Assistant

The Voice Assistant uses a single microphone to capture voice data.

Example configuration for analog microphone A:

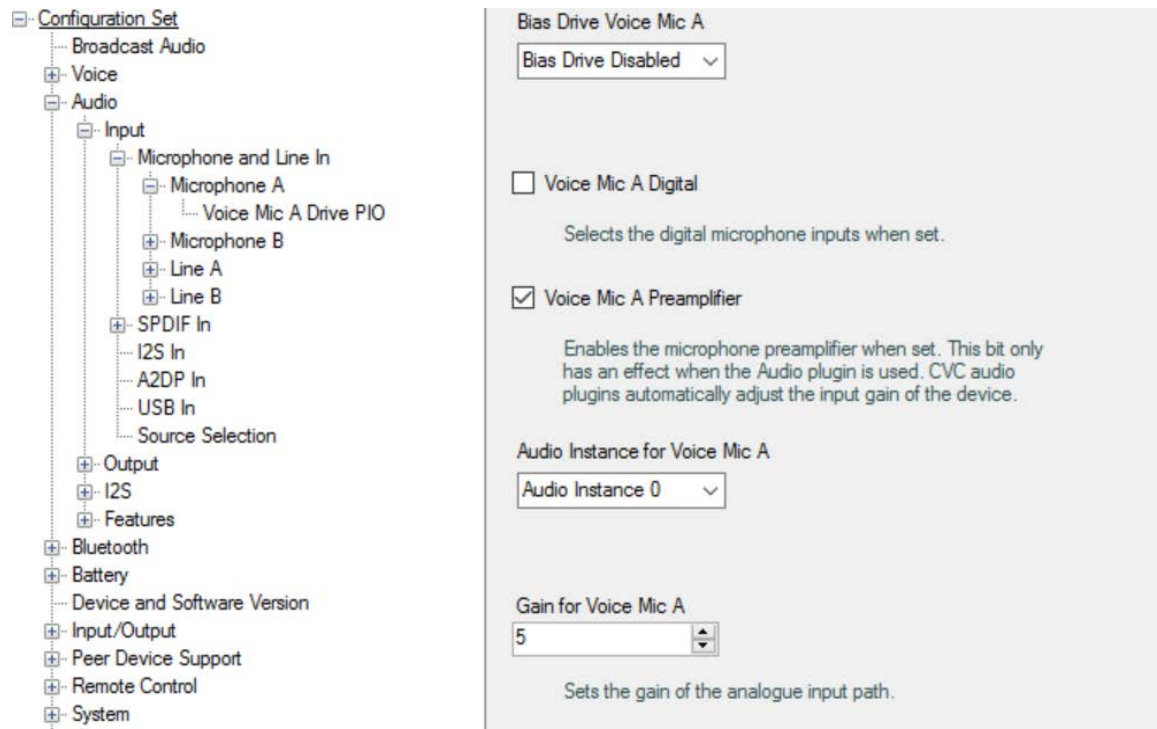


Figure 3-3 VA Microphone Configuration

4 Voice Assistant session setup

An example Voice Assistant mobile application is provided. This app demonstrates how VA commands are sent to the mobile device, processed on the mobile device, and returned through the A2DP connection to the headset application.

To implement the full voice assistant functionality, you must modify the mobile application to send VA commands to the VSP, and route responses from the VSP to the A2DP connection to the headset. The ADK sink application supports the *Voice Assistant* mobile application and VSP.

This section explains how to set up a Voice Assistant session between the ADK and Voice Assistant mobile application.

Precondition

A mobile device with the Voice Assistant app is required. See the *Voice Assistant Demo Application User Guide*, available in Android and iOS variants.

ADK setup

1. Configure the ADK sink application for the VA; see section 3.2.
2. The VA may not work with some of the existing features of ADK. Disable unsupported features; see section 5.
3. Build and flash the ADK sink application to one of the supported QTI devices; see section 3.1.
4. Configure VA user events to button PIOs using the ADK configuration tool. For user events and configurations, see section 3.3.
5. Pair and connect with a mobile device that has the *Voice Assistant* mobile application installed.
6. Launch and configure the *Voice Assistant* mobile application.
7. Once the *Voice Assistant* app is ready, press the PIO button configured for *VA Start*.
8. Communication with mobile device uses a GAIA voice assistant protocol.
9. After hearing a 'tone' indication, speak to the connected assistant.
10. Response/Loop back audio is heard over the headset's earphones.
11. Current session ends automatically when a conversation is completed.
12. Cancel the session by pressing the *VA Cancel* button. If silence is detected, the app may also cancel the session.
13. Start a new session by pressing the *VA Start* button again.

5 Voice Assistant limitations and co-existence with other ADK features

5.1 Limitations of voice assistant feature

- The Voice Assistant feature is only enabled in the headset project. Enabling it in other applications may cause problems such as the application or feature failing to work properly
- VA works only with A2DP audio
 - Supported Codec: SBC, AAC, MP3, and aptX
- When using the *Voice Assistant* mobile application, the volume of the audio sent back to the headset is quiet. This is because the headset uses a default microphone gain and the *Voice Assistant* app does not further amplify audio on playback to the headset. To hear the looped back audio better, increase the ADK system volume, microphone gain, or mobile device Bluetooth volume as required. This problem does not occur when a real VSP is used on the mobile application, as the audio sent back to the headset comes from the VSP.

5.2 VA co-existing with ADK features

- VA does not work with wired audio such as Analogue/I2S/SPDIF and USB inputs
- VA does not work with aptX-HD codec
- VA only works with single microphone solution
- VA does not work with Qualcomm TrueWireless™ Stereo and ShareMe features
- VA does not work while ANC is enabled and shares the microphone
- VA does not work with multipoint solutions
- VA does not work along with multiple GAIA connection (only one GAIA connection is supported)
- There is no intelligent mechanism to choose AoV (*supported only in QCC5100 series*) or VA for voice assign features. Select only one of these features while building the project (applicable to ADK6.x projects)
- HFP call and A2DP audio take priority over the VA. For additional information, see section [9.2](#).

6 Audio path

6.1 CSR 867x series chipsets

In CSR 867x chipsets, SBC encoder is enabled in existing decoder .kap files of SBC/AAC/MP3 and aptX. The encoder is configured as 16 kHz and 16-bit mono channel. SBC encoded voice packets are transferred to VA application using Managed Pipe streams from DSP. These voice packets are pushed to GAIA RFCOMM channels by adding GAIA VA protocol headers. Voice data is transferred as 64 Kbps over RFCOMM channel. VSP response path uses normal A2DP channel.

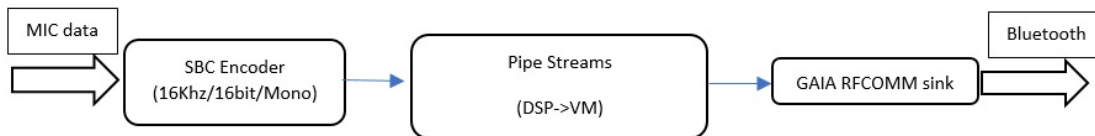


Figure 6-1 Forward (voice data towards mobile device) Audio Path for Voice Assistant in CSR 867x series chipsets

6.2 CSRA68100 and QCC5100 series chipsets

In these chipsets, an audio chain is created using Kymera capabilities. This chain starts by encoding the captured voice using the SBC encoder operator (16 kHz and 16-bit mono channel). The encoded voice samples are transferred to the VA application using timestamped streams.

These streams are pushed to RFCOMM channels by adding GAIA VA protocol headers. Voice data is transferred as 64 Kbps over the RFCOMM channel. The VSP response path uses the normal A2DP channel.

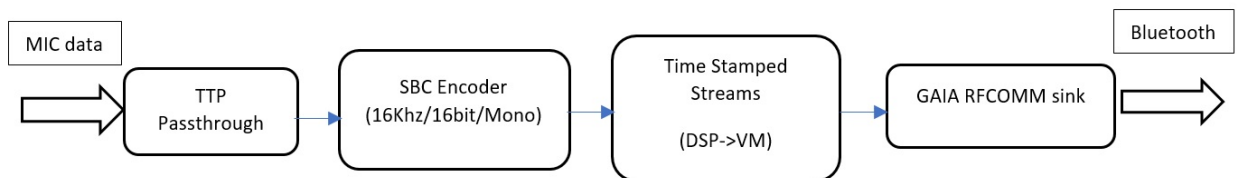


Figure 6-2 Forward (voice data towards mobile device) Audio Path for Voice Assistant in CSRA68100 and QCC5100 series chipsets

7 Streams for voice assistant

7.1 Streams for CSR 867x series chipsets

For CSR867x, VA uses pipe streams (See *Implementing Streams in BlueCore Applications*) to get voice data from DSP to VA application. These streams are provided by the CSR 867x firmware.

7.2 Streams for CSRA68100 and QCC5100 series chipsets

For CSRA68100 and QCC5100 series chipsets, the VA uses timestamped streams to get voice data from DSP to VA application. This framework is provided by the firmware and Kymera.

8 GAIA VA protocol summary

Voice Assistant uses a new set of GAIA commands to interact with a mobile application. Use these GAIA Voice Assistant commands to interact with a mobile application that communicates with the VSP for voice processing.

8.1 GAIA VA protocol commands

GAIA VA protocol commands are defined in [Table 8-1](#). These GAIA commands are used to establish and manage a VA session and transfer voice data.

Command	Command ID	Direction
GAIA VA Start	0x1000	DH
GAIA VA Data Request	0x1001	HD
GAIA VA Voice Data	0x1002	DH
GAIA VA Voice End	0x1003	Both
GAIA VA Voice Cancel	0x1004	Both
GAIA VA Check Version	0x1005	DH
GAIA VA Answer Start	0x1006	HD
GAIA VA Answer End	0x1007	HD

Table 8-1 GAIA VA protocol commands

Command: Command reference name

Command ID: Unique ID used by GAIA to recognize the command

Direction: HD- Host to Device. DH- Device to Host

8.2 GAIA VA protocol sequence diagram for single VA session

A single VA session is a voice assistant session that has a single voice command to mobile application and a single response from VSP. The sequence to set up a single VA session with a mobile application that could communicate with the VSP follows.

For example:

Ask: Set an alarm at five past three in the morning.

Response: An alarm has been set at five past three in the morning.

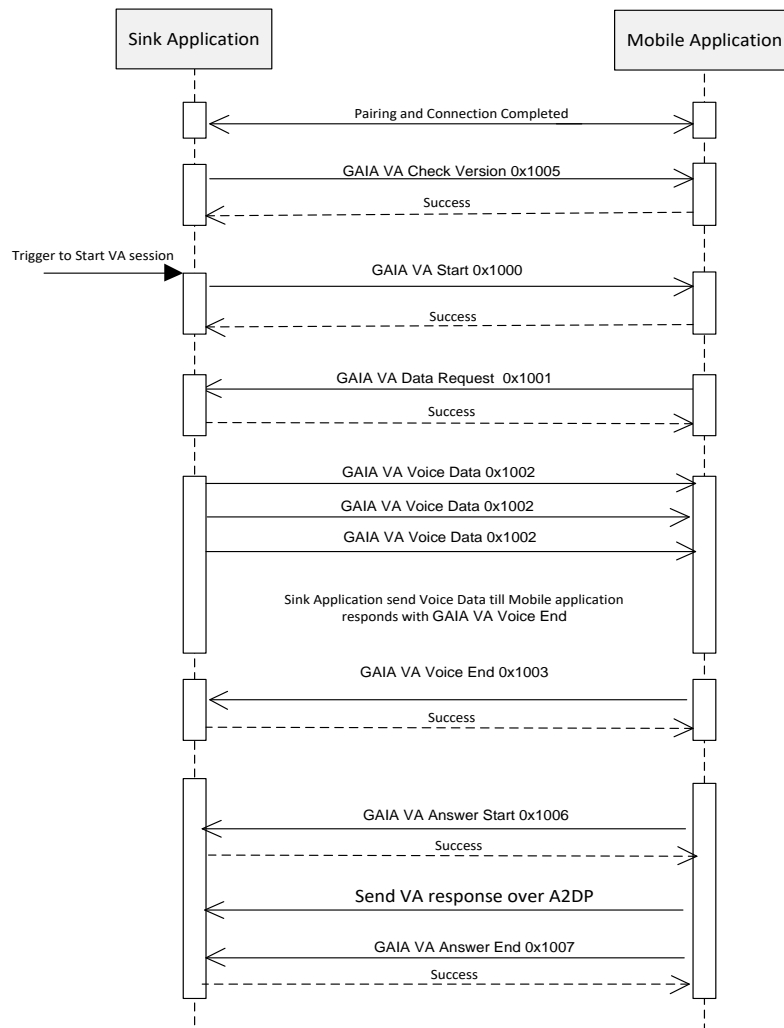


Figure 8-1 Single VA session sequence

8.3 GAIA VA protocol sequence diagram for multi VA session

A multi VA session is a voice assistant session where a conversation happens between the sink application and mobile application. The sequence to set up a multi VA session with a mobile application that could communicate with the VSP follows.

For example:

Ask: Set an alarm.

Response: At what time?

Ask: Five past three.

Response: AM or PM?

Ask: AM.

Response: An alarm has been set at five past three in the morning.

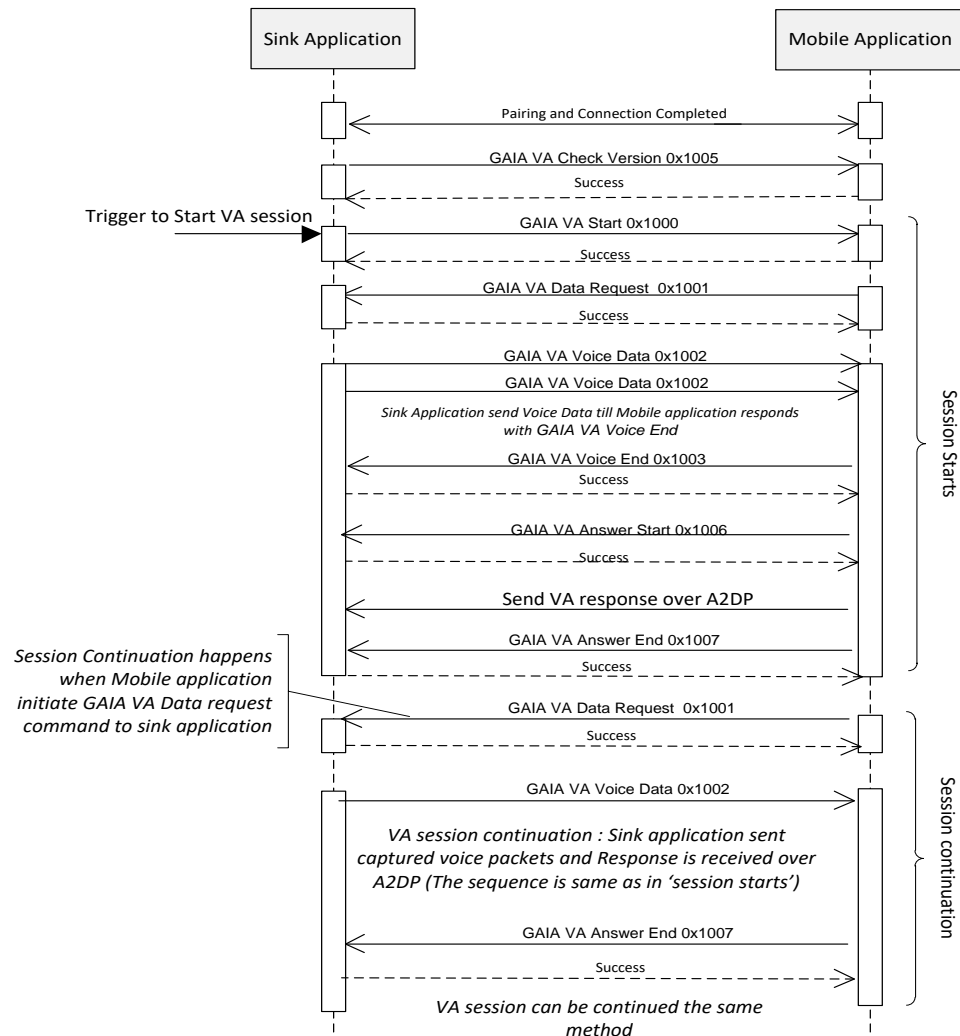


Figure 8-2 Multi session VA sequence

9 Troubleshooting VA

9.1 Scenario: VA session not established

- A VA session is not established if there is no A2DP connection between mobile device and the sink application. Check if A2DP is enabled in the settings of mobile device.
- A VA session is not established if the GAIA connection or GAIA version check fails.
- The VA is by default disabled in CSRA68100 and QCC5100 series chipsets, check it is enabled as per section 3.2.
- VA button events are not configured by default. Check it is configured; see section 3.3
- Ensure that the Voice Assistant mobile application is running.
- Check that only one GAIA application is running in the mobile device that is connected to the same headset you are attempting a VA session from.

9.2 Scenario: VA session is not working

- Check any other features that do not work with the VA are enabled in the project. For more information on this, see section 5.
- HFP calls take priority over VA. A VA session is canceled if an HFP call is active while in a VA session. Ensure that there is no HFP call activity going on while the VA is active.
- A2DP audio takes priority over VA session. If A2DP media playback initiates while the VA is capturing voice input, the VA session cancels and A2DP media plays instead. Ensure that there is no A2DP playback initiated while the VA is capturing voice.
- If the sink application is already playing A2DP media, initiating a VA session blends the VA response with existing A2DP media audio. It is difficult to understand the VA response in this situation.
- If the A2DP media channel is paused or stopped while receiving a VA response, the response is interrupted.
- Ensure the microphone parameters configuration in ADK config tool is correct. For more information on this, see section 3.4.
- Ensure that the Voice Assistant mobile application is working and in the *ready* state.
- If the VA session is canceled, an error tone is. Error tone helps to understand that VA session is canceled due to some of the items described in section 5.
- The loop back volume may be too quiet to hear. For information on increasing volume, see section 5.1.

Document references

Document	Reference
<i>Voice Assistant Demo Application for Android User Guide</i>	80-CF915-1 / CS-00408663-UG
<i>Voice Assistant Demo Application for iOS User Guide</i>	80-CF898-1 / CS-00408450-UG
<i>Voice Assistant Application for iOS v1.0.0 Release Note</i>	80-CG019-1 / CS-00408449-RN
<i>Voice Assistant Demo Application for Android v1.0.0.27 Release Note</i>	80-CF925-1 / CS-00408836-RN
<i>Implementing Streams in BlueCore Applications</i>	80-CT437-1 / CS-00207483-UG
<i>Audio Sink Application Configuration</i>	80-CT451-1 / CS-00334708-UG

Terms and definitions

Term	Definition
A2DP	Advanced Audio Distribution Profile
AAC	Advance Audio Coding
ANC	Active Noise Canceling
AoV	Always on Voice
aptX	QTIL proprietary audio codec
GAIA	Generic Application Interface Architecture
HFP	Hands-free profile
MP3	MPEG-1 Audio Layer III or MPEG-2 Audio Layer III
SBC	Sub-band coding
VA	Voice Assistant
VSP	Voice Service Provider