

Resource Management

This document describes common CarPlay use cases with flow diagrams and recommended mode changes. For more details, see *Resource Management in Accessory Interface Specification CarPlay Addendum*.

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How to use this document

The following sections describe resource management for a variety of use cases. Each use case is presented as a diagram with an initial state, one or more additional states, and detailed information on the `changeModes/modesChanged` commands that are exchanged between your CarPlay accessory and the Apple device.

This describes the `changeModes` request sent from your accessory to the Apple device.

It indicates the `resourceID` (`MainScreen` or `MainAudio`), `transferType` (`Take`, `Untake`, `Borrow`, or `Unborrow`), and `transferPriority` (`Nice-to-have` or `User Initiated`).

If `transferType` is `Take` then `takeConstraint` and `borrowConstraint` will also be shown. If `transferType` is `Borrow` then `unborrowConstraint` and `borrowID` will be shown. If `transferType` is `Unborrow` then `borrowID` will be shown.

In some cases `appStates` (`Speech`, `PhoneCall`, `TurnByTurn`) is shown. If `appStates` (`NA`) is used no update is needed for the particular use case. The accessory may update `appStates` as needed for additional use cases.

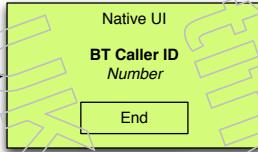
The initial state for this use case. Green indicates your accessory's native UI.



What the user will see in CarPlay or on the Apple device. Orange indicates Apple UI.



The end state for this use case. Green indicates your accessory's native UI.



This describes the `modesChanged` response from the Apple device to your accessory.

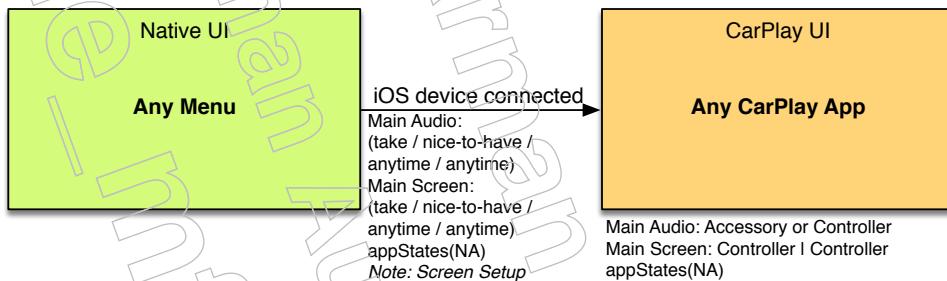
It indicates the `resourceID` (`MainScreen` or `MainAudio`), the current `entity` (`Controller` or `Accessory`) and the `permanentEntity` (`Controller` or `Accessory`).

In some cases `appStates` (`Speech`, `PhoneCall`, `TurnByTurn`) is shown.

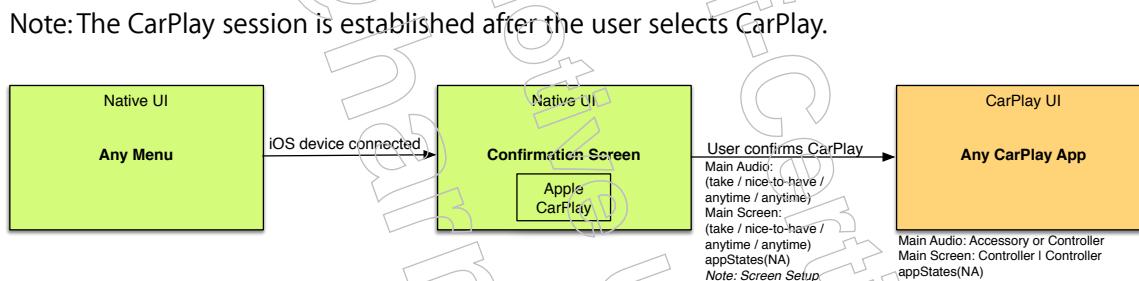
1. First Time Connection

The following use cases describe resource management when the user connects an Apple device to your CarPlay accessory for the first time.

- 1.1 Connect to an Apple device for the first time and **immediately show CarPlay** on the car's display. Your accessory is playing FM radio.



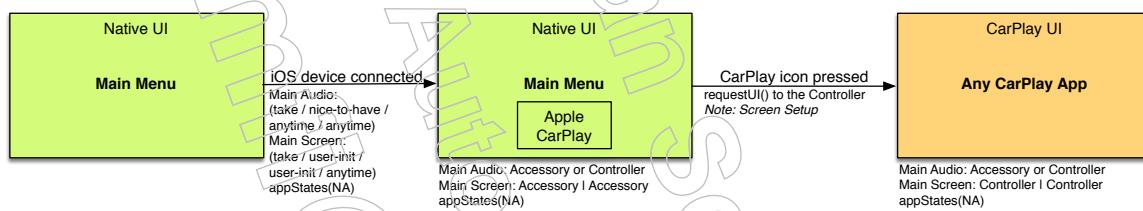
- 1.2 Connect to an Apple device for the first time and show a **confirmation screen**. After the confirmation is accepted connect CarPlay and immediately show CarPlay on the car's display. Your accessory is playing FM radio.



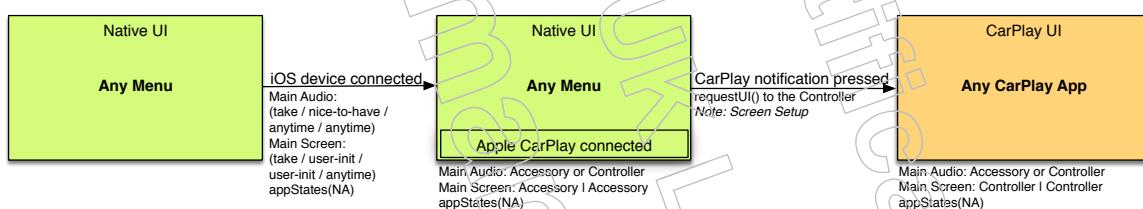
2. Reconnection

The following use cases describe resource management when the user connects a known Apple device to your CarPlay accessory.

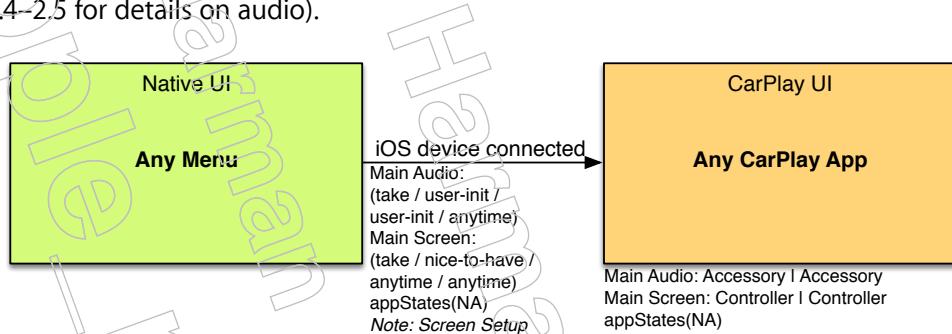
- 2.1** Connect to a known Apple device when the **last user mode for the screen was the native UI**. The last user mode for the screen is the native UI if (1) the native UI was on the screen when the Apple device was disconnected, or (2) the native UI was used at any time between the Apple device being disconnected and reconnected. When the last user mode for the screen is the native UI, the display shows the native UI when the Apple device is reconnected. The native screen contains an Apple CarPlay entry point. In this example, the last user mode for audio is CarPlay (see use cases 2.4–2.5 for details on audio).



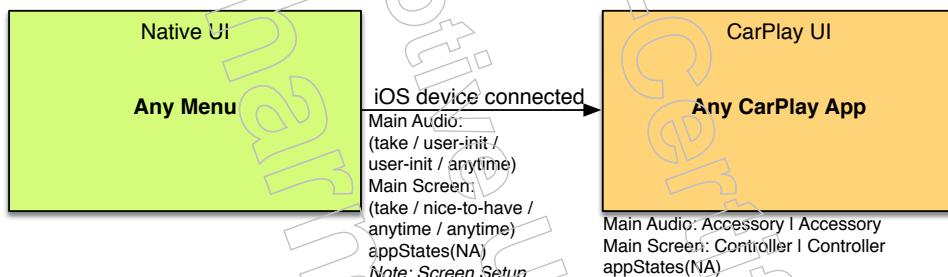
- 2.2** Connect to a known Apple device when the **last user mode for the screen was the native UI**. The last user mode for the screen is the native UI if (1) the native UI was on the screen when the Apple device was disconnected, or (2) the native UI was used at any time between the Apple device being disconnected and reconnected. When the last user mode for the screen is the native UI, the display shows the native UI when the Apple device is reconnected. The native screen does not contain an Apple CarPlay entry point, and a notification is shown. In this example, the last user mode for audio is CarPlay (see use cases 2.4–2.5 for details on audio).



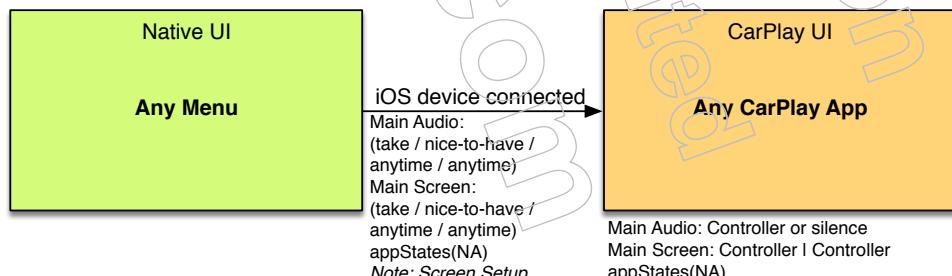
- 2.3** Connect to a known Apple device when the **last user mode for the screen was CarPlay**. The last user mode for the screen is CarPlay if CarPlay was on the screen when the Apple device was disconnected. When the last user mode for the screen is CarPlay, the display shows CarPlay when the Apple device is reconnected. In this example, the last user mode for audio is FM radio (see use cases 2.4–2.5 for details on audio).



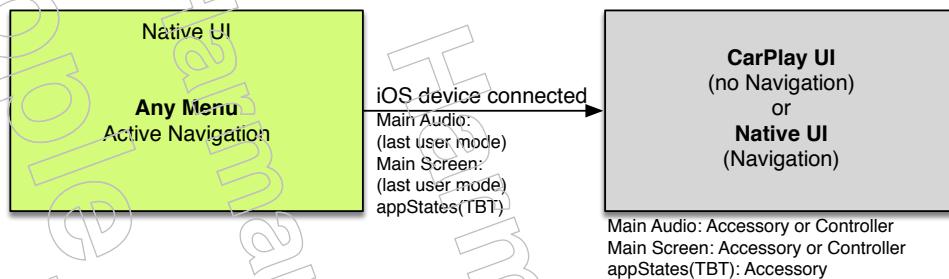
- 2.4** Connecting to a known Apple device, and the **last user mode for audio was FM radio**. The last user mode for audio is FM radio if (1) FM radio was playing when the Apple device was disconnected, or (2) the user actively switched to FM radio at any time between the Apple device being disconnected and reconnected. When the last user mode for the audio is FM radio, FM radio plays through the car's speakers when the Apple device is reconnected. In this example, the last user mode for screen is CarPlay (see use cases 2.1–2.3 for details on screen).



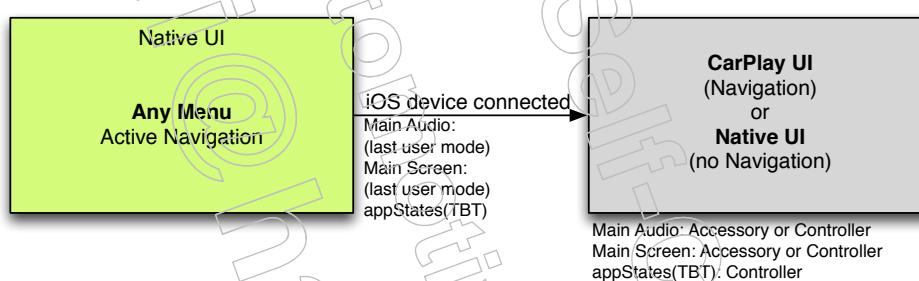
- 2.5** Connecting to a known Apple device, and the **last user mode for audio was CarPlay**. The last user mode for audio is CarPlay, if CarPlay was playing media when the Apple device was disconnected. When the last user mode for audio is CarPlay, playback is determined by the Apple device (media or silence). In this example, the last user mode for screen is CarPlay (see use cases 2.1–2.3 for details on screen).



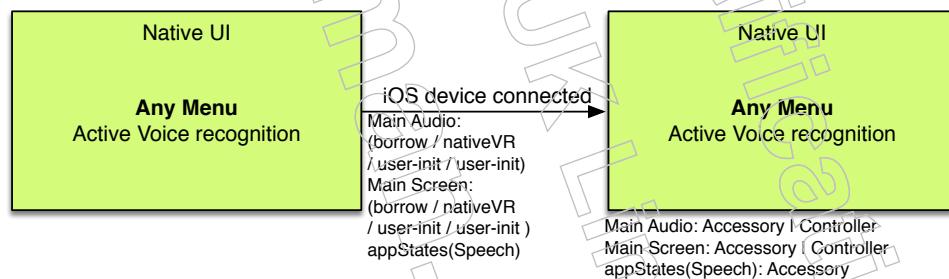
- 2.6** Your accessory is providing **turn-by-turn guidance** and the user connects an Apple device. The connected Apple device *is not providing* turn-by-turn guidance so your accessory continues to provide turn-by-turn guidance. Last user mode for audio and screen is valid.



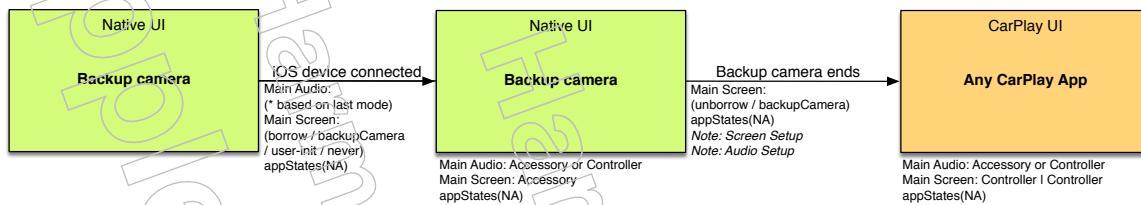
- 2.7** Your accessory is providing **turn-by-turn guidance** and the user connects an Apple device. The connected Apple device *is providing* turn-by-turn guidance so your accessory ends turn-by-turn guidance. Last user mode for audio and screen is valid.



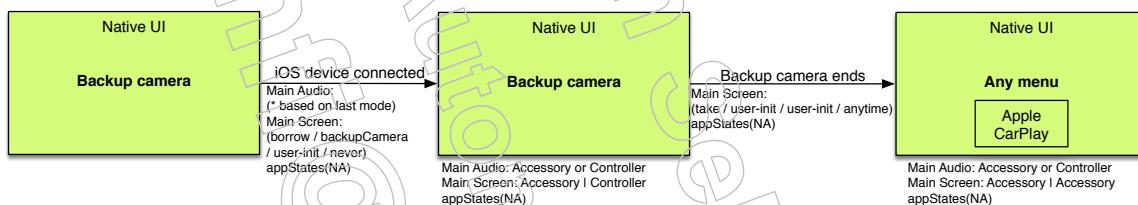
- 2.8** Your accessory is in a **voice recognition session** and the user connects an Apple device. *Siri is not active* on the connected Apple device so your accessory continues the voice recognition session.



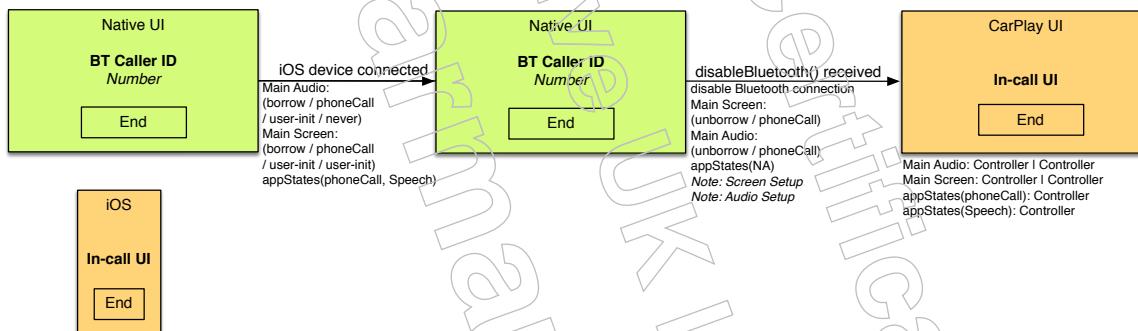
2.9 Your accessory is **showing backup camera** and the user connects an Apple device. Last user mode for screen is CarPlay. Backup camera stays visible on the screen until the user disengages the reverse gear. Then the accessory restores the valid last user mode.



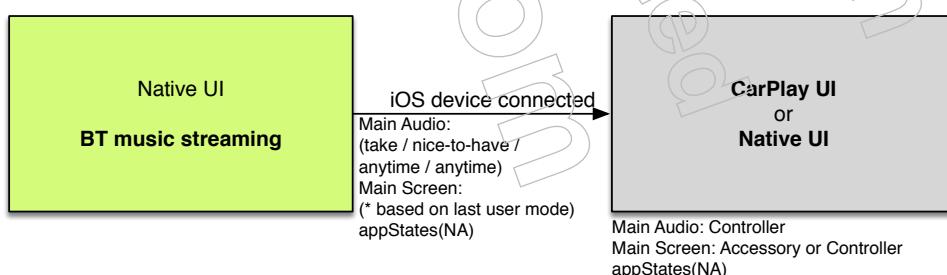
2.10 Your accessory is **showing backup camera** and the user connects an Apple device. Last user mode for screen is native UI. Backup camera stays visible on the screen until the user disengages the reverse gear. Then the accessory restores the valid last user mode.



2.11 The Apple device is on an **active phone call** with your accessory using Bluetooth Hands-Free Profile (HFP). The user connects the Apple device to your accessory.



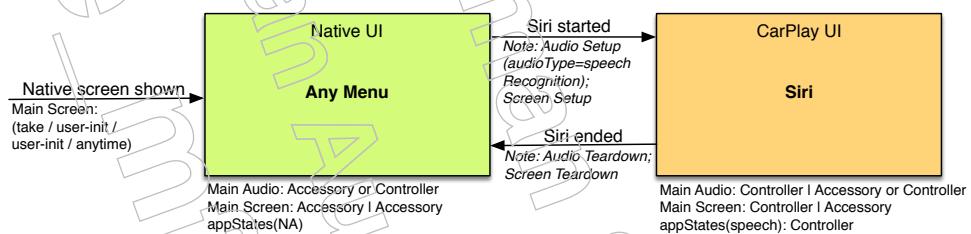
2.12 The Apple device is **streaming audio** to your accessory using Bluetooth Advanced Audio Distribution Profile (A2DP). The user connects the Apple device to your accessory. Audio continues to play over CarPlay.



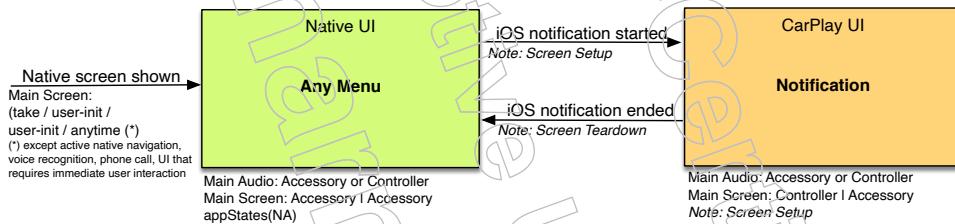
3. User Interaction with your Accessory

The following use cases describe resource management during user interactions with your accessory.

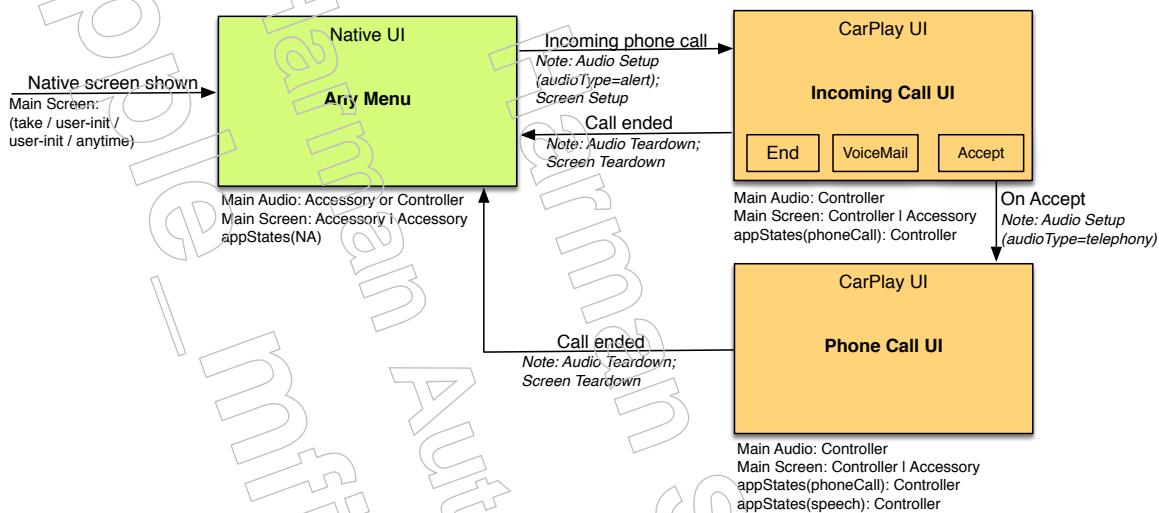
- 3.1** Your native UI is shown on the Main Screen. The user starts **Siri** using your steering wheel button or the Home button on the Apple device. The CarPlay UI is shown. After the Siri session ends, the Main Screen returns to your accessory, except when Siri is used to trigger an application which requires UI (e.g. Maps).



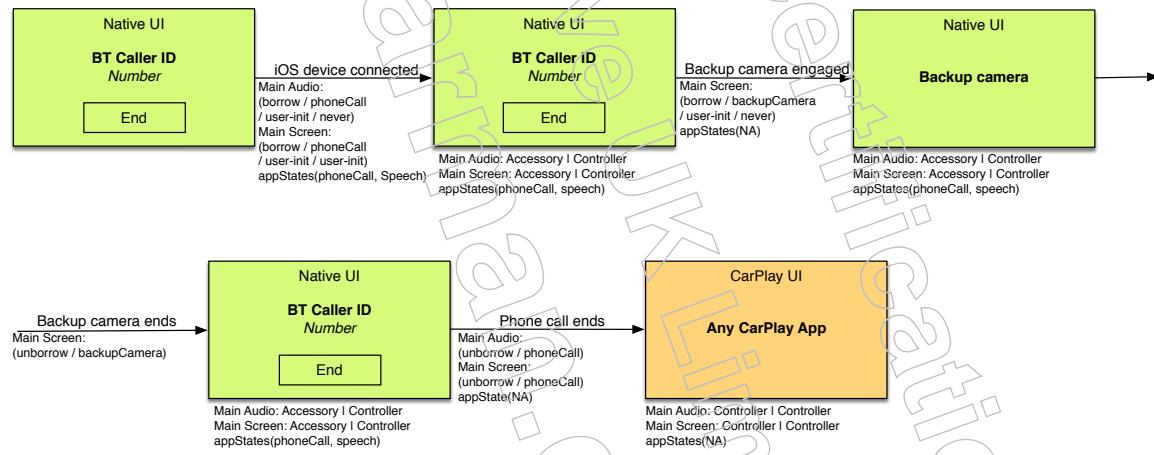
- 3.2** Your native UI is shown on the Main Screen. The Apple device triggers a **notification** which is shown on the Main Screen. The Main Screen returns to your accessory.



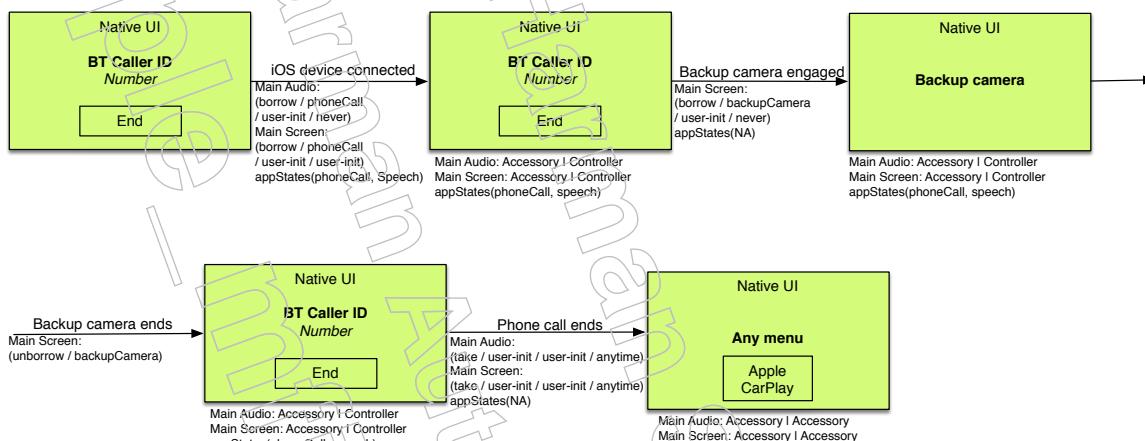
- 3.3** Your native UI is shown on the Main Screen. The user receives a **phone call** from CarPlay. The CarPlay UI is shown on the Main Screen. At the end of the phone call, the Main Screen returns to your accessory.



- 3.4** Your accessory is on a phone call using a second phone connected using Bluetooth Hands-Free Profile (HFP) and the user connects an Apple device. Then the user engages backup camera. Backup camera stays visible on the screen until the user disengages the reverse gear. The user ends the Bluetooth phone call. Then the accessory restores the valid last user mode. In this example, the last user mode for audio and screen is CarPlay.



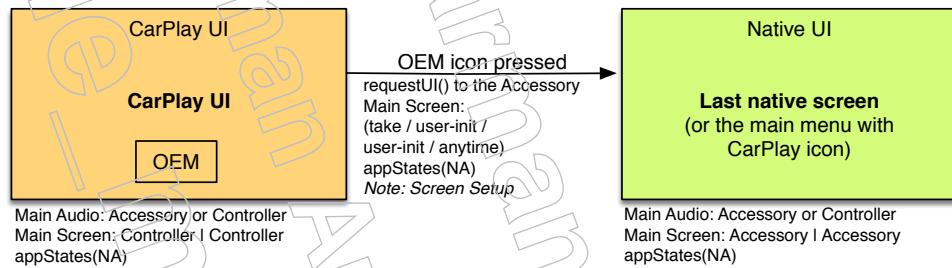
3.5 Your accessory is on a phone call using a second phone connected using Bluetooth Hands-Free Profile (HFP) and the user connects an Apple device. Then the user engages backup camera. Backup camera stays visible on the screen until the user disengages the reverse gear. The user ends the Bluetooth phone call. Then the accessory restores the valid last user mode. In this example, the last user mode for audio and screen is native.



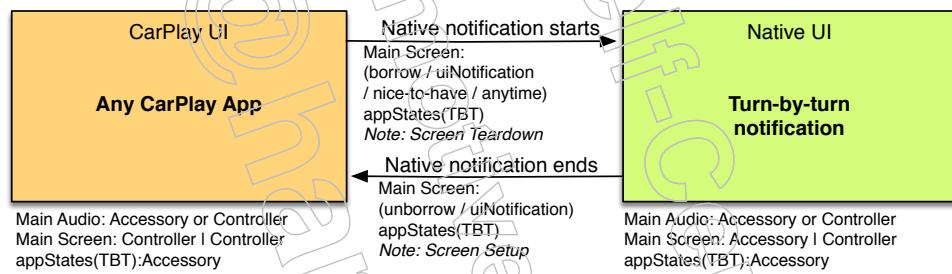
4. User Interaction with CarPlay

The following use cases describe resource management during user interactions with CarPlay.

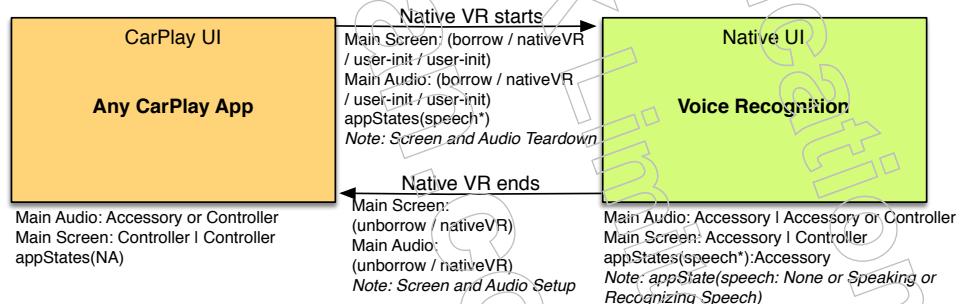
4.1 The CarPlay UI is shown on the Main Screen. The user **transitions to your accessory's UI**.



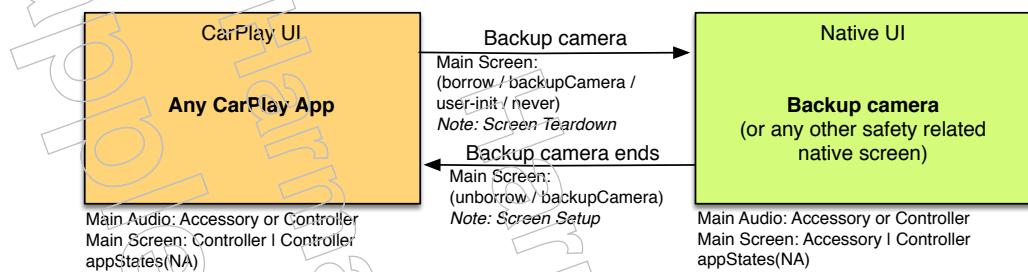
4.2 The CarPlay UI is shown on the Main Screen. Your accessory displays a **turn-by-turn notification**. The Main Screen returns to CarPlay after the notification ends.



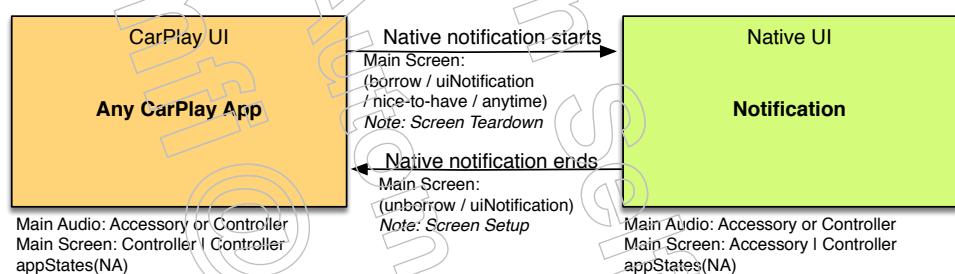
4.3 The CarPlay UI is shown on the Main Screen. Your accessory displays the **native voice recognition UI**. The Main Screen returns to CarPlay after the voice recognition ends.



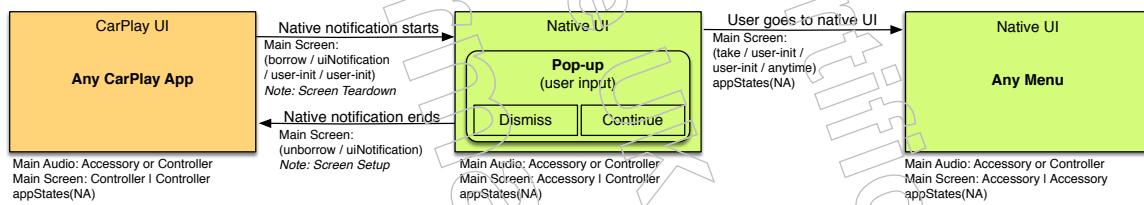
- 4.4** The CarPlay UI is shown on the Main Screen. Your accessory displays images from the **backup camera**. The Main Screen returns to CarPlay after the backup camera ends.



- 4.5** The CarPlay UI is shown on the Main Screen. Your accessory displays a **temporary notification**. The Main Screen returns to CarPlay after the notification ends.



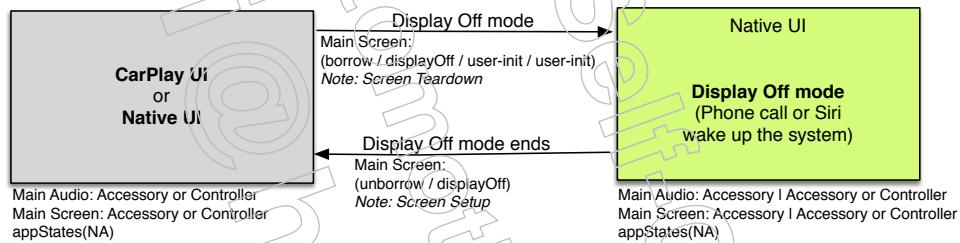
- 4.6** The CarPlay UI is shown on the Main Screen. Your accessory **displays a temporary pop-up which requires user input**. The Main Screen returns to CarPlay when the pop-up is dismissed. The Main Screen transfers to the Native UI when the user requests it.



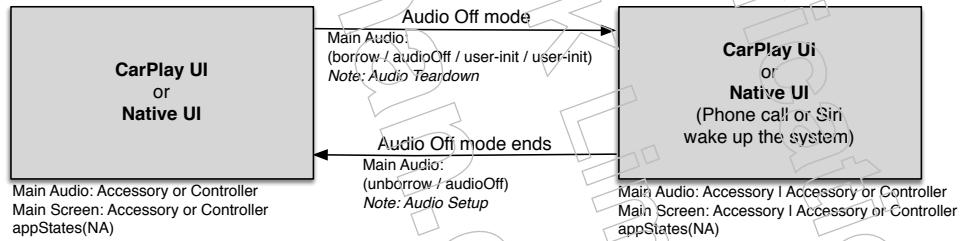
- 4.7** The CarPlay UI is shown on the Main Screen. Your accessory displays the **native voice recognition UI**. The user asks to show the native navigation or any other native UI. Main Screen transfers from a borrow to take to show the native route guidance. The transfer will succeed only if the take priority level is higher or equal than the take constraint specified by iOS.



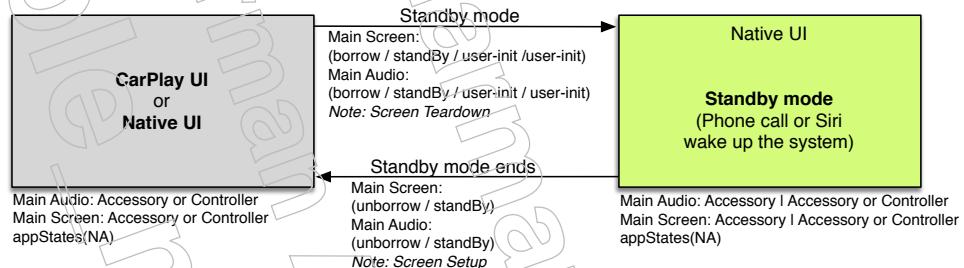
- 4.8** The CarPlay UI is shown on the Main Screen and music is playing on the Apple device. Your accessory enters a **display off mode**. Music continues to play. CarPlay phone calls and Siri interactions can wake up the system and be shown to the user. Main Screen returns to CarPlay after the user exits the display off mode.



- 4.9** The CarPlay UI is shown on the Main Screen and music is playing on the Apple device. Your accessory enters an **audio off mode** and music is paused. CarPlay phone calls and Siri interactions can wake up the system and be shown to the user. Main Audio returns to CarPlay after the user exits the audio off mode.



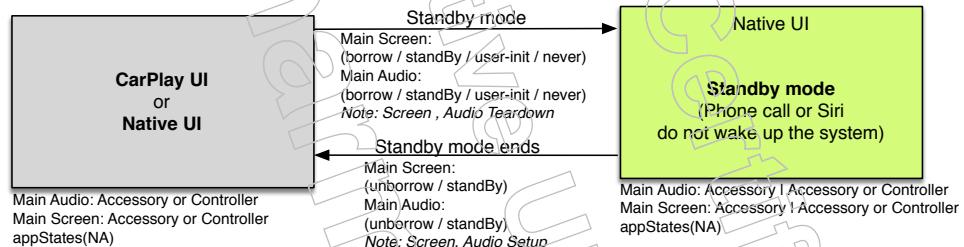
4.10 The CarPlay UI is shown on the Main Screen and music is playing on the Apple device. Your accessory enters a **standby mode (display and audio off)**. The CarPlay UI will no longer be shown and music will pause. CarPlay phone calls and Siri interactions can wake up the system and be shown to the user. Main Screen and Main Audio return to CarPlay after the user exits the standby mode.



4.11 The CarPlay UI is shown on the Main Screen and music is playing on the Apple device. Your accessory enters one of the following states:

- standby mode (display and audio off)
- a user-perceived off state (part of a power down sequence).

The CarPlay UI will no longer be shown and music will pause. CarPlay phone calls and Siri interactions cannot wake up the system. Main Screen and Main Audio return to CarPlay only after the user exits the standby mode or user-perceived off state.

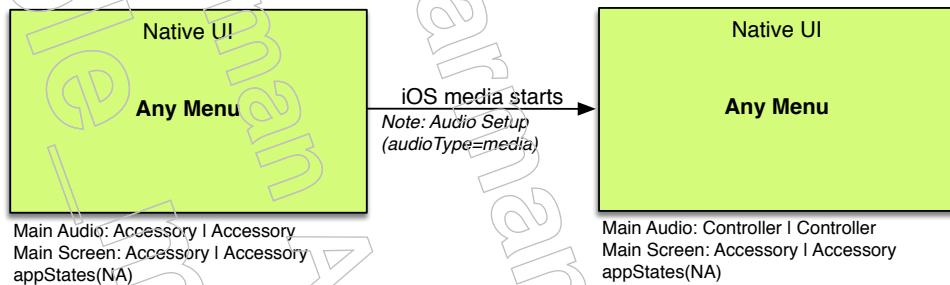


Note: Alternatively, the accessory may simply terminate and activate the CarPlay session instead.

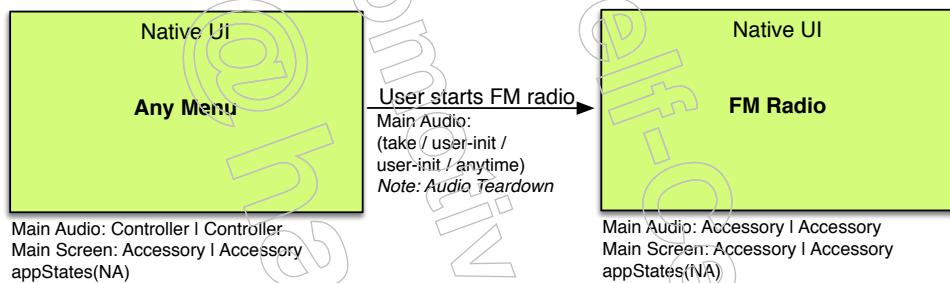
5. Audio Selection

The following use cases describe resource management during audio interactions with CarPlay.

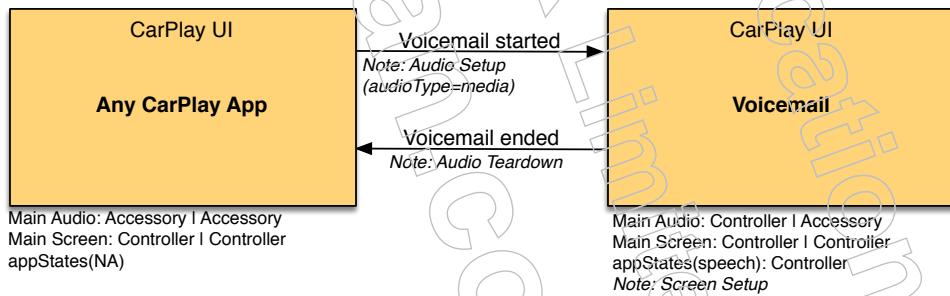
- 5.1 Your accessory is playing FM radio and the user starts **music playback** on the Apple device.



- 5.2 Music is playing on the Apple device and the user starts **FM radio** on your accessory.



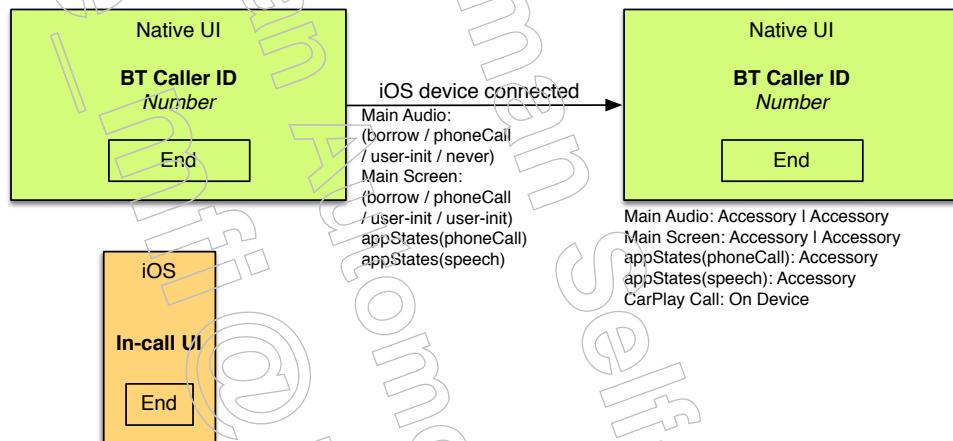
- 5.3 The accessory is playing FM radio and the CarPlay UI is shown on the screen. The user plays **voicemail** using CarPlay. After the voicemail ends, the Main Audio returns to your accessory to resume FM radio.



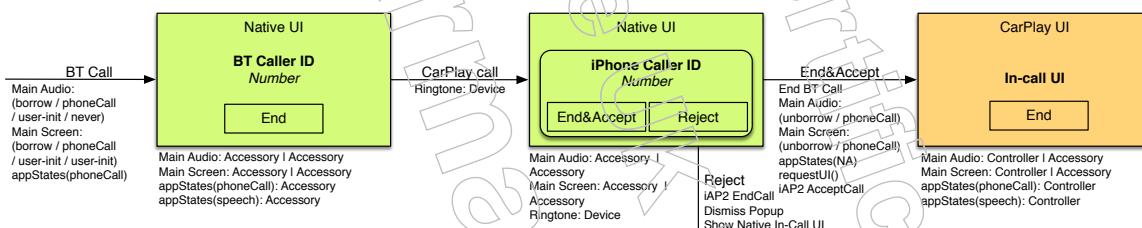
6. Second Phone Connected using Bluetooth

The following use cases describe resource management when a second phone is connected to your accessory using Bluetooth or the accessory executes a call using any additional phone service, e.g. concierge calls, etc.

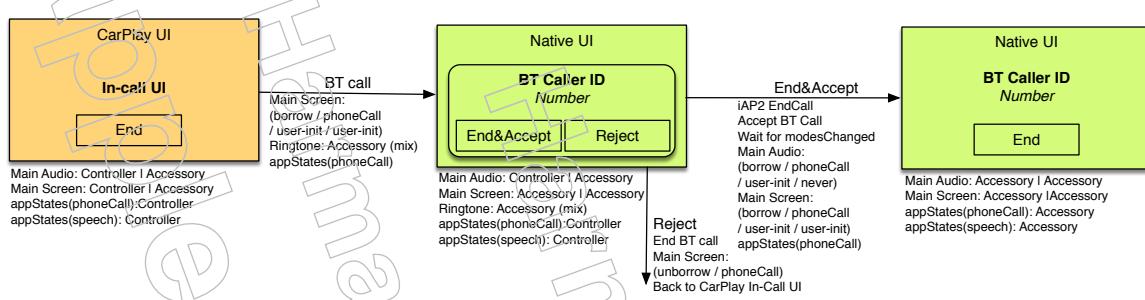
- 6.1 Your accessory is on a phone call using a second phone connected using Bluetooth Hands-Free Profile (HFP) and the user connects an Apple device which is also on an active phone call.



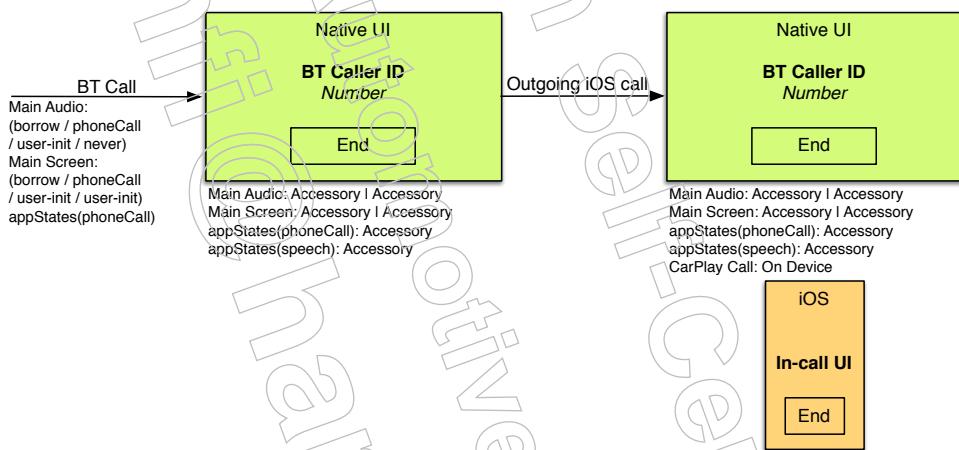
- 6.2 Your accessory is on a phone call using a second phone connected using Bluetooth Hands-Free Profile (HFP). The connected Apple device receives an incoming CarPlay phone call.



- 6.3** CarPlay is on a phone call. Your accessory receives an incoming phone call on a second phone connected using Bluetooth Hands-Free Profile (HFP).



- 6.4** Your accessory is on a phone call using a second phone connected using Bluetooth Hands-Free Profile (HFP). The user places a phone call using the Apple device.



Revision History

This table describes the changes to *Resource Management*.

Release	Notes
2020-02-10 Release R5	Updated figures with <i>borrowIDs</i> as applicable
	Updated figures with <i>permanentOwner</i> as applicable
	Split into chapters 1. <i>First Connection</i> and 2. <i>Reconnection</i>
	Updated <i>borrowIDs</i> to <i>Reconnection 2.8-2.11, User Interaction with CarPlay 4.2-4.11</i>
	Added <i>User Interaction with your Accessory 3.4</i> and <i>3.5</i> to showcase two subsequent borrows
	Updated <i>6. Second Phone Connected using Bluetooth</i> to include <i>borrowID, iAP2 Call Control</i> and <i>remove requestUI</i>
2018-01-22 Release R4.5	Updated <i>Connection 1.13.</i>
	Updated <i>User Interaction with CarPlay 3.2.</i>
2017-09-01 Release R4.4	Added case for transferring Bluetooth audio to CarPlay <i>Connection 1.13.</i>
	Removed <i>User Interaction with CarPlay 3.12.</i> Clarified <i>3.11.</i>
2017-04-24 Release R4.3	Updated <i>Second Phone Connected using Bluetooth 5.2.</i>
2017-04-10 Release R4.2	Updated <i>Connection 3.8</i> to <i>3.12.</i>
	Updated <i>Connection 3.6.</i>
	Updated <i>User Interaction with CarPlay use case 3.</i>
2017-02-10 Release R4.1	Renumbered the use cases to clearly identify which section they belong to.
	Added <i>Connection 1.12.</i>
	Added <i>User Interaction with CarPlay 2.8.</i>
	Added <i>User Interaction with CarPlay 2.9.</i>
	Added <i>User Interaction with CarPlay 2.10.</i>
	Added <i>User Interaction with CarPlay 2.11.</i>
	Added <i>User Interaction with CarPlay 2.12.</i>
	Updated <i>User Interaction with CarPlay 2.3.</i>
	Updated <i>Second Phone Connected using Bluetooth 5.1.</i>

Release	Notes
2016-07-27 Release R4	Updated <i>Second Phone Connected using Bluetooth 5.2.</i>
	Added <i>Connection</i> use case 12.
	Added <i>User Interaction with CarPlay</i> use case 9.
	Updated <i>User Interaction with CarPlay</i> use case 3.
	Updated <i>Second Phone Connected using Bluetooth</i> use case 1.
	Updated <i>Second Phone Connected using Bluetooth</i> use case 2.