



BLE OTA Hands on

APAC RA | August 2022



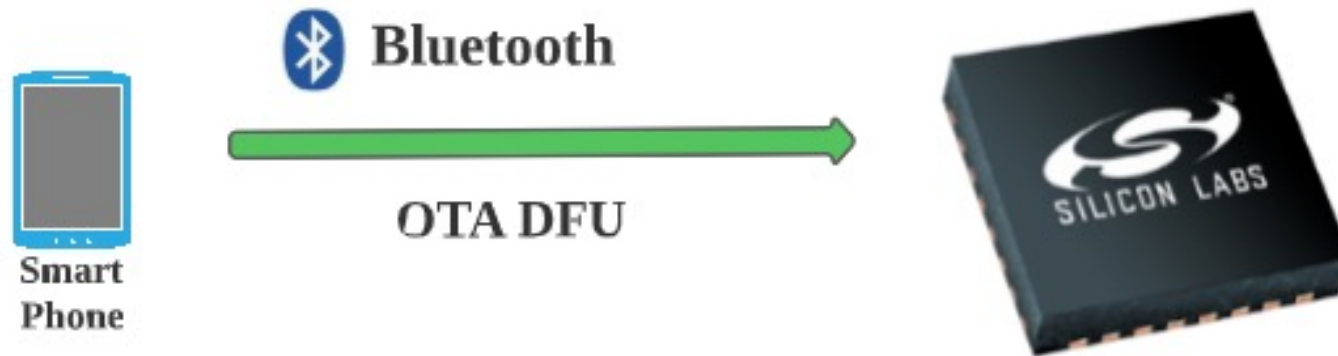
Agenda

- **Overview**
- **Bootloader Introduction**
- **Bluetooth OTA Upgrade**
 - **Implementing DFU with AppLoader**
 - **Implementing DFU in the User Application**
 - **Silicon Labs OTA GATT service**
- **Lab**
 - **Lab Introduction**
 - **Lab Requirements**
 - **In-Place OTA Lab Steps**
 - **User Application DFU Lab Steps**

Overview

This tutorial explains how to perform a Device Firmware Upgrade (DFU) with Bluetooth Over-The-Air (OTA) update.

Any chip that has OTA-updates enabled in their GATT profile can have an OTA upgrade. Most of the example applications provided in the Bluetooth SDK already have OTA support built into the code.



Bootloader Introduction

- The Silicon Labs Gecko Bootloader is a common bootloader for all the newer MCUs and wireless MCUs from Silicon Labs. It can be configured to perform a variety of bootload functions, from device initialization to firmware upgrades.
- The Gecko Bootloader uses a proprietary format for its upgrade images, called GBL (Gecko Bootloader file).

Bluetooth OTA Upgrade

- Implementing Device Firmware Update with Apploader(In-Place OTA)
- Implementing Device Firmware Update in the User Application

AppLoader Introduction

A Bluetooth application developed comprises two parts:

- AppLoader
- User application.

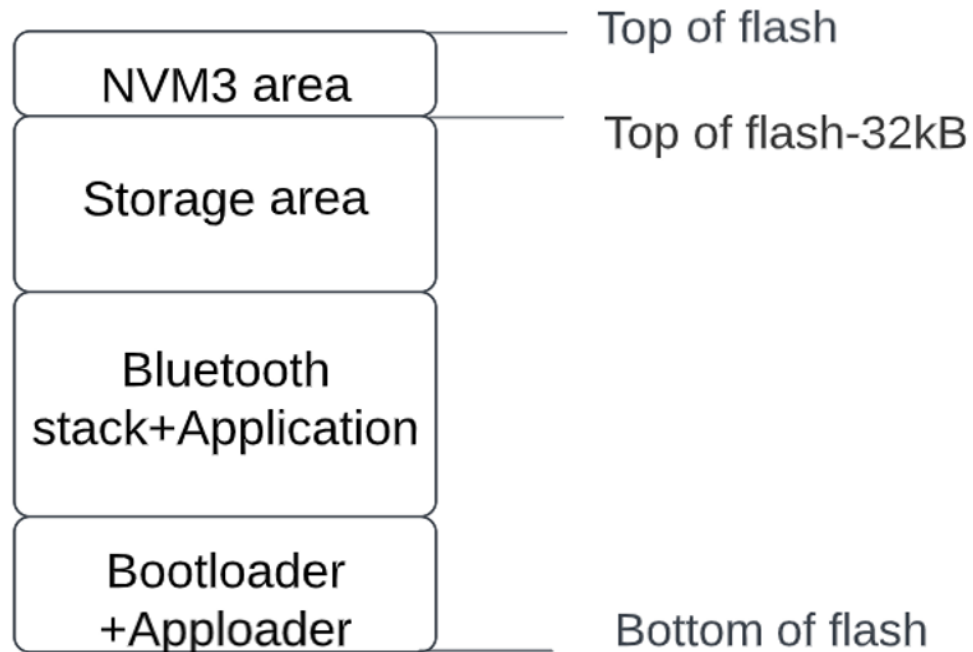
AppLoader introduction:

- AppLoader is a small standalone application that is required to support in-place OTA updates.
- AppLoader can run independently of the user application.
- It contains a minimal version of the Bluetooth stack, including only those features that are necessary to perform the OTA update.

The AppLoader features and limitations are summarized below:

- Enables OTA updating of user application.
- The AppLoader itself can also be updated.
- Only one Bluetooth connection is supported, GATT server role only.
- Encryption and other security features such as bonding are not supported.
- PTI is not enabled so it is not possible to use the Network Analyzer with the AppLoader

Gecko Bootloader Configuration from SDK version 4.0



The picture on the left shows an example of this new layout:

Note: This is not possible in Series 1 devices, So combine the AppLoader to bootloader can only be used for Series 2 devices.

In-Place OTA Process

Most of the OTA functionality is handled independently by the AppLoader

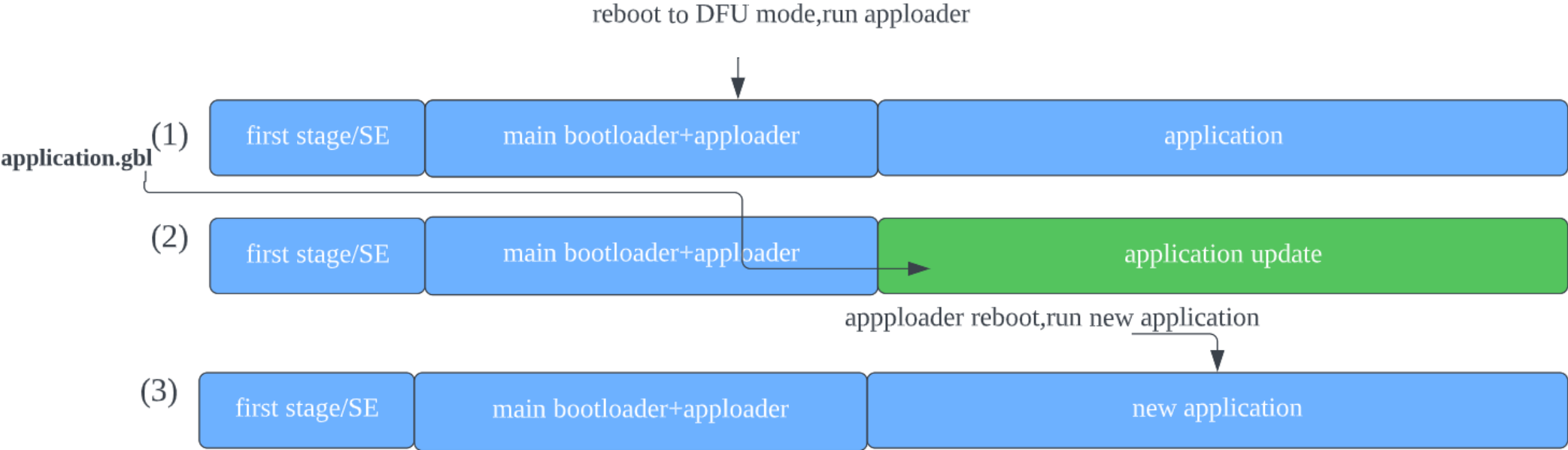
- The user application need a way to trigger a reboot into DFU mode.
- After the device is reset, the AppLoader is run instead of the user application.
- After the upload is complete, AppLoader will reboot the device back into normal mode.

AppLoader supports two types of update:

- Full update: both Bootloader and the user application are updated
- Partial update: only the user application is updated

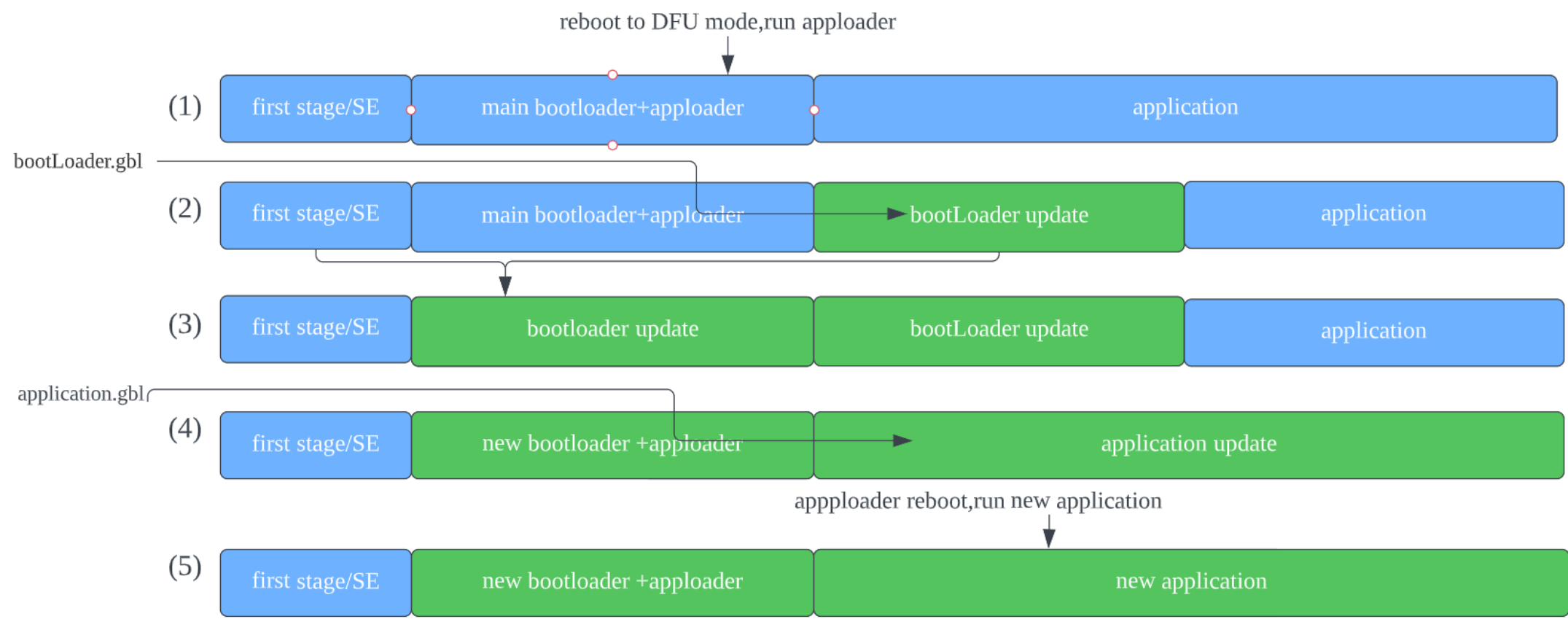
Basic Steps to Partial Update Firmware from the AppLoader

Partial update: only the user application is updated

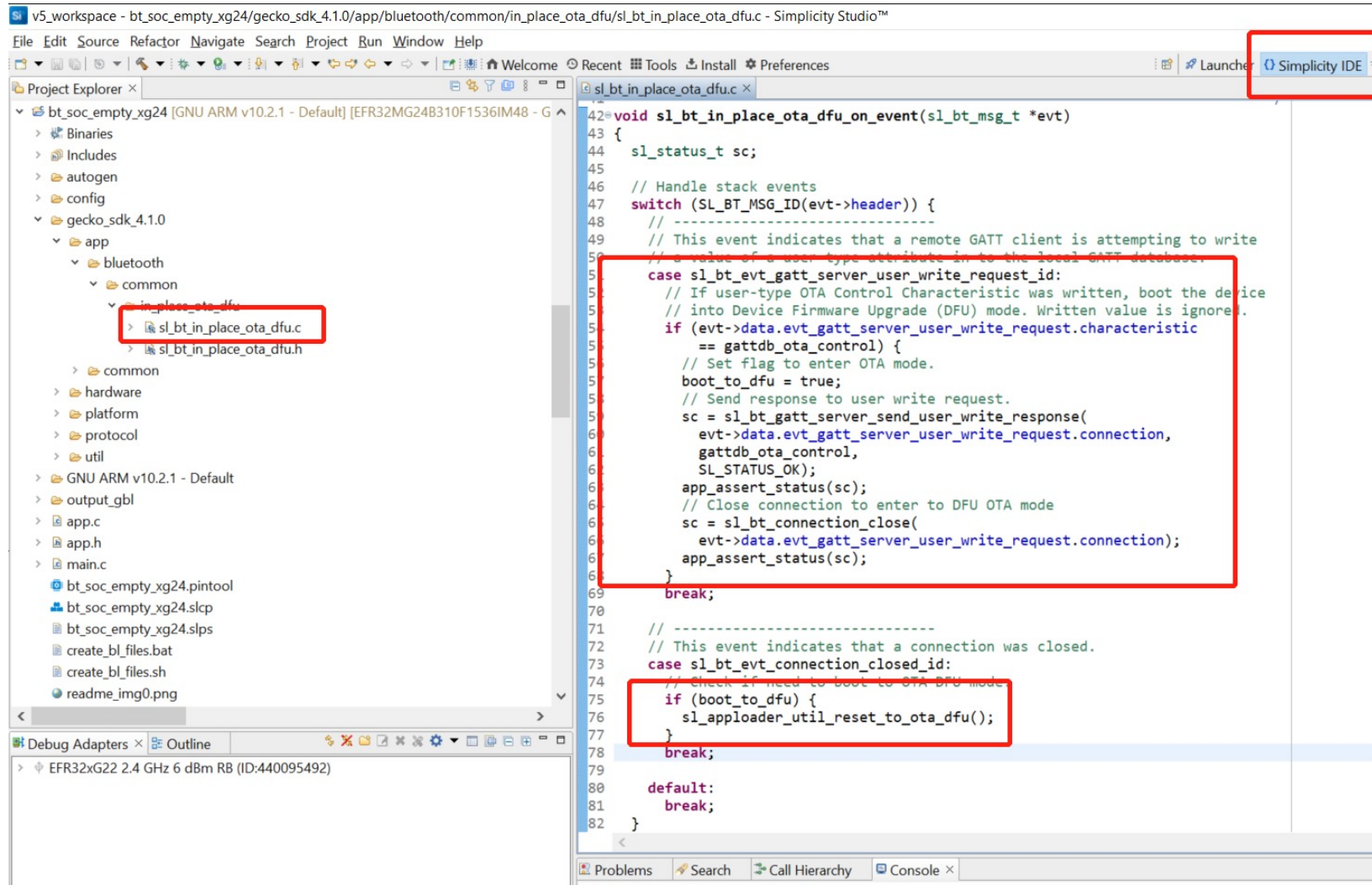


Basic Steps to Full Update Firmware from the AppLoader

Full update: both Bootloader and the user application are updated



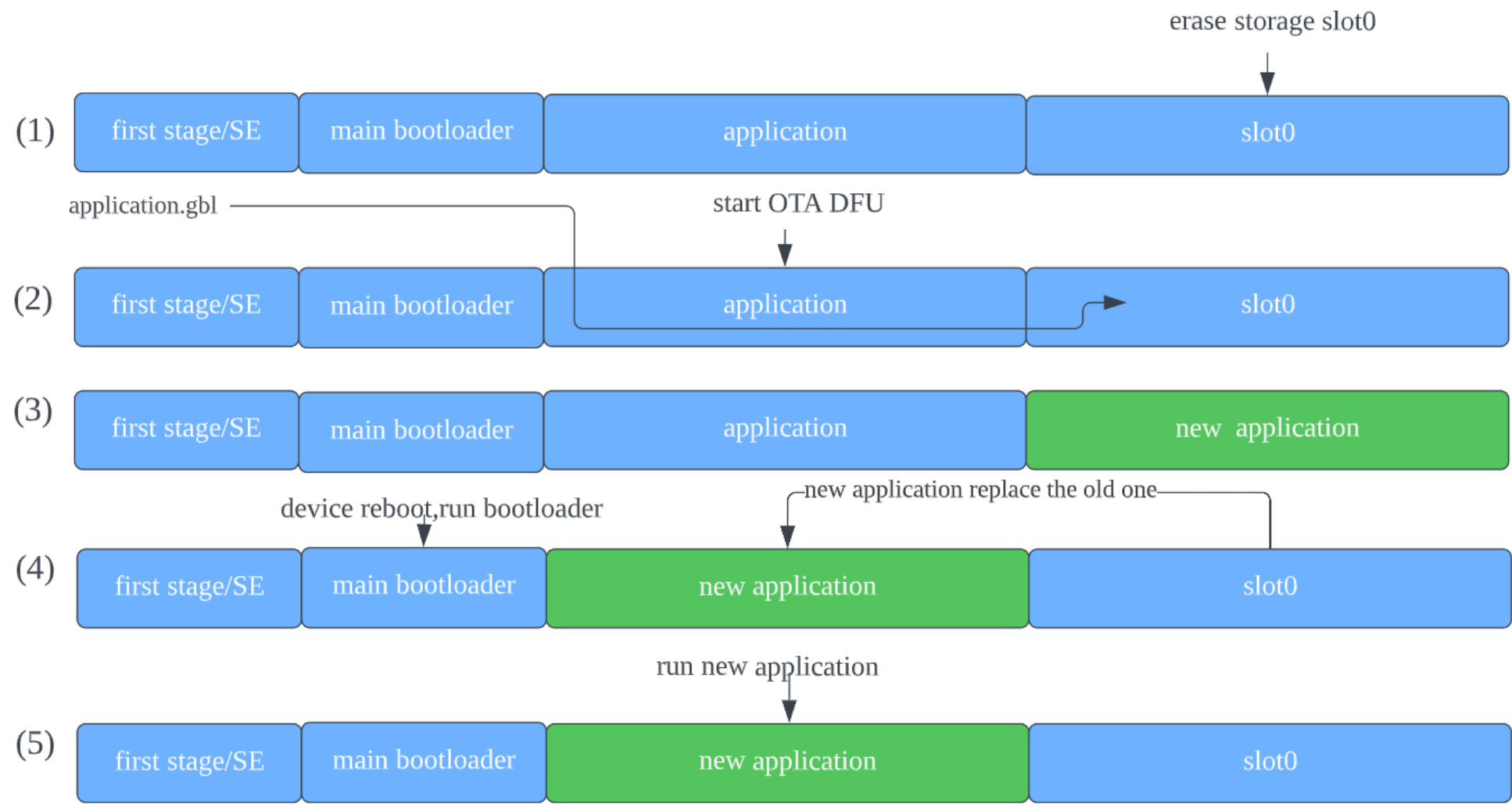
Triggering Reboot into DFU Mode from the User Application



Implementing Device Firmware Update in the User Application

- This makes it possible to use a custom GATT service instead of the Silicon Labs OTA service. To use this update mechanism, any application bootloader configuration may be used, using internal or external storage.
- At least one download area must be defined and the area must be large enough to fit the full GBL file. The download area must not overlap with the user application.

Basic Steps to Update Firmware from the User Application



Example Implementation of Bluetooth OTA Update under Application Control

Simply add the "Application OTA DFU" component to the project:

The screenshot shows the 'SOFTWARE COMPONENTS' tab for a project named 'bt_soc_empty_xg24_ota'. The interface includes a filter bar with options for 'Configurable', 'Installed', 'Installed by you', and 'SDK extensions'. A search bar contains the text 'ota'. In the left sidebar, the 'Bluetooth' category is expanded, and the 'OTA' sub-category is also expanded. The 'Application OTA DFU' component is highlighted with a red rectangle. To its right, a 'Configure' button is visible. The main panel displays the component's details, including a description: 'specialized OTA state to update, and no AppLoader utility required.', and a 'Quality' section with the value 'PRODUCTION'.

bt_soc_empty_xg24_ota OVERVIEW **SOFTWARE COMPONENTS** CONFIGURATION TOOLS

Filter components by Configurable ☐ Installed ☐ Installed by you ☐ SDK extensions ☐ ota

▼ Bluetooth

▼ OTA

☑ Application OTA DFU

In-Place OTA DFU

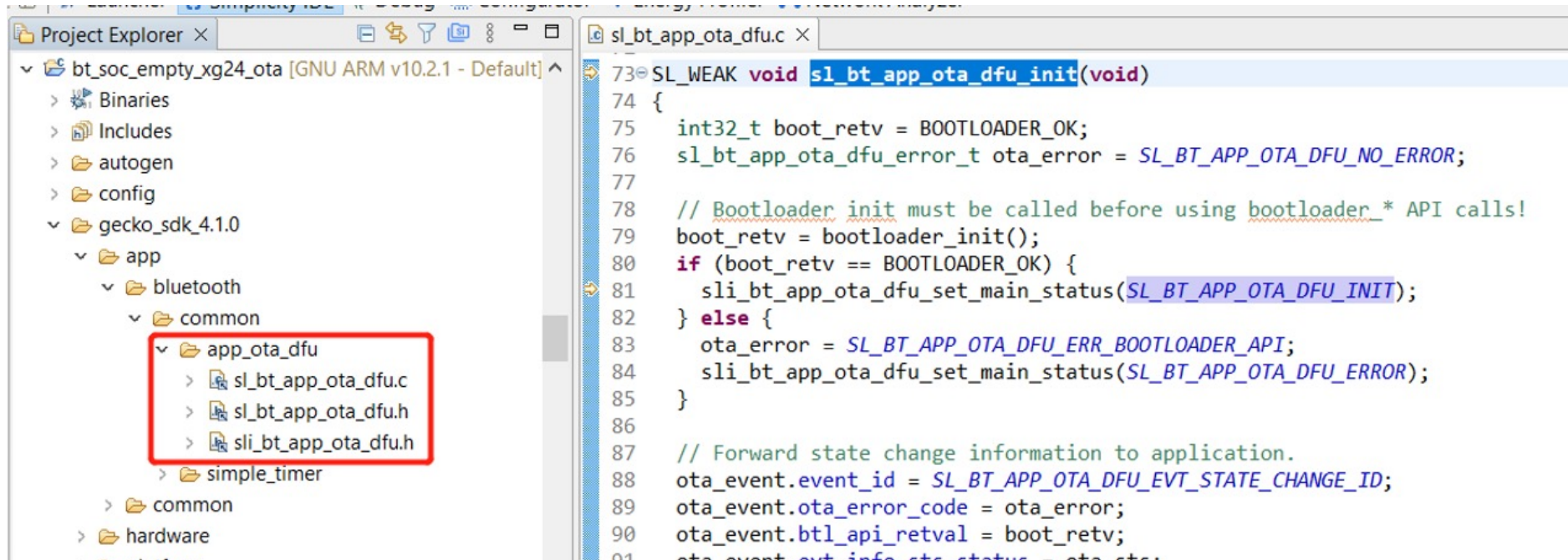
Application OTA DFU **Configure**

specialized OTA state to update, and no AppLoader utility required.

Quality
PRODUCTION

Example Implementation of Bluetooth OTA Update under Application Control

Then "app_ota_dfu" folder will be automatically generated.



Silicon Labs OTA GATT service

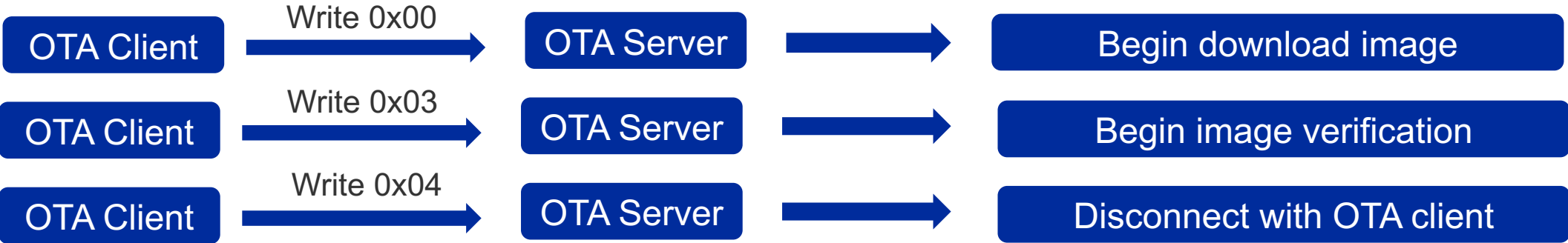
The following table representation defines the Silicon Labs OTA service. It is a custom service using 128-bit UUID values.

Characteristic	UUID	Type	Length	Support	Properties
OTA Control Attribute	F7BF3564-FB6D-4E53-88A4-5E37E0326063	Hex	1 byte	Mandatory	Write
OTA Data Attribute (1)	984227F3-34FC-4045-A5D0-2C581F81A153	Hex	Variable; max 244 bytes	Mandatory	Write without response; Write
AppLoader version (2) (Blue-tooth stack version) (2,3)	4F4A2368-8CCA-451E-BFFF-CF0E2EE23E9F	Hex	8	Optional	Read
OTA version (2)	4CC07BCF-0868-4B32-9DAD-BA4CC41E5316	Hex	1	Optional	Read
Gecko Bootloader version (2)	25F05C0A-E917-46E9-B2A5-AA2BE1245AFE	Hex	4	Optional	Read
Application version	0D77CC11-4AC1-49F2-BFA9-CD96AC7A92F8	Hex	4	Optional	Read

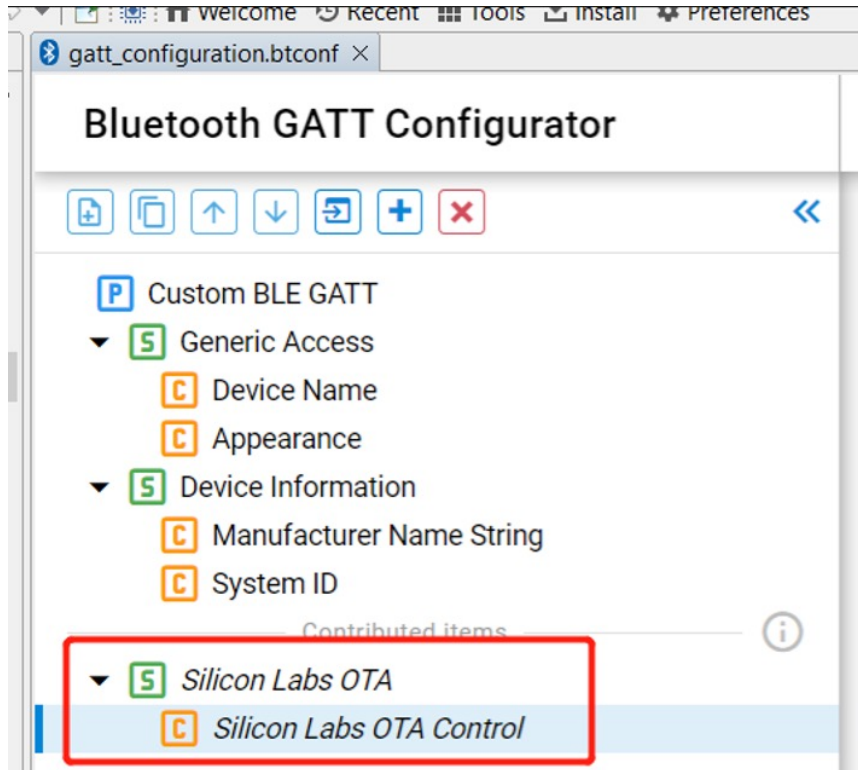
Silicon Labs OTA GATT service

Possible Control Words Written to the OTA Control Characteristic

Hex value	Description
0x00	OTA client initiates the upgrade procedure by writing value 0.
0x03	After the entire GBL file has been uploaded the client writes this value to indicate that upload is finished.
0x04	Request the target device to close connection. Typically the connection is closed by OTA client but using this control value it is possible to request that disconnection is initiated by the OTA target device.
Other values	Other values are reserved for future use and must not be used by application.



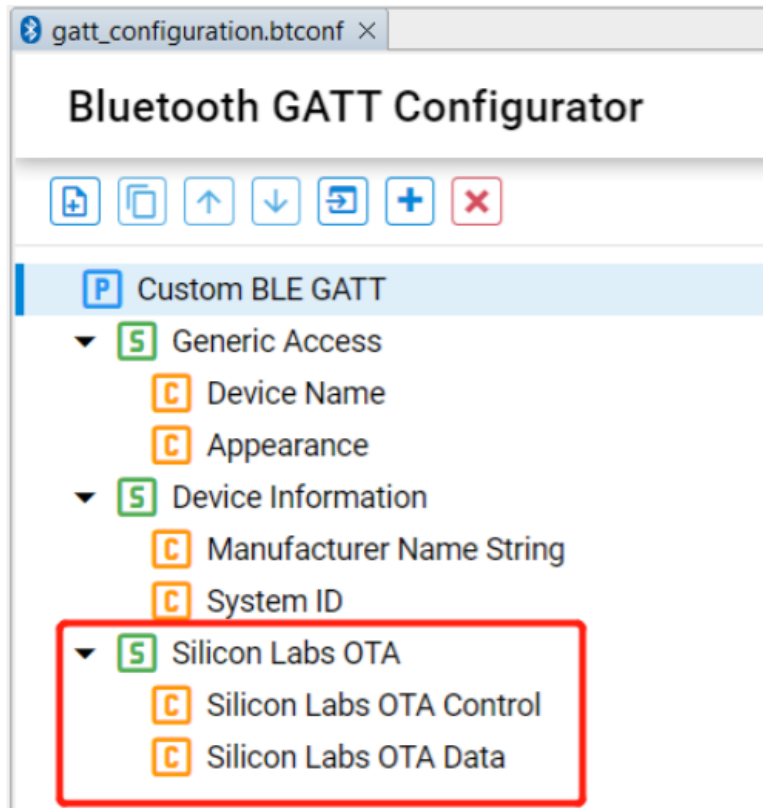
Silicon Labs Gatt_configuration.btconf



In DFU mode, AppLoader uses the full OTA service described above.

The GATT database of the user application includes only a subset of the full OTA service.

Silicon Labs User Application OTA GATT service



If the OTA update is implemented fully in user application code, The minimum application requirement is to include the OTA control and the OTA Data characteristic.

Lab Introduction

In this section, it will show you the specific operation about how to implement the firmware update functionality by AppLoader (In-Place OTA) and the User Application.

In-Place OTA DFU

Bluetooth-SoC Thermometer
Ble name : Thermometer Example



Bluetooth-SoC Empty
Ble name : Empty Example

Application OTA DFU

Bluetooth-SoC Empty
Ble name : Empty Example



Bluetooth-SoC Empty
Ble name :OTA test

Lab Requirement

- Bluetooth-capable radio board (EFR32MG24-BRD2703A)
- Simplicity Studio 5
- Android or iOS mobile device
- Download EFR Connect mobile app, version 2.4 or newer([Android](#) / [iOS](#)),and the source is available on [GitHub](#)

Summary

In-Place OTA DFU can save more flash space ,but apploader has many limitations. So it is convenient for user to develop customized OTA DFU in user application code.

Best OTA DFU solution should be selected according to the user's application scenario.