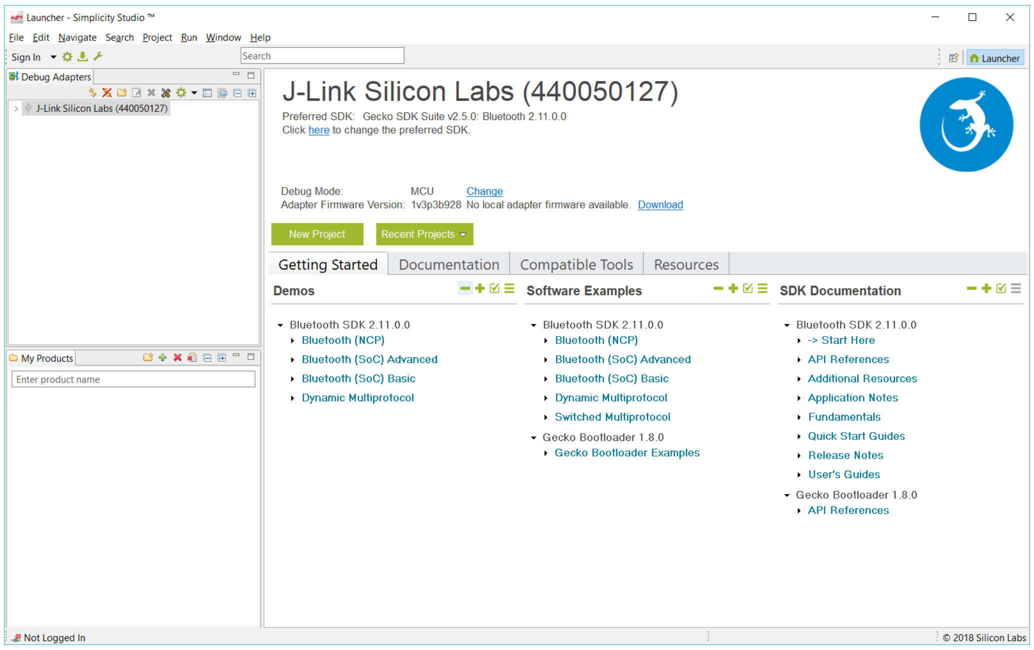
QSG139: *Bluetooth*® SDK v2.x Quick Start Guide

This document describes how to get started with Bluetooth development using the Bluetooth software development kit (SDK) and Simplicity Studio with a compatible wireless starter kit (WSTK). If you have purchased a Blue Gecko Bluetooth Wireless Starter Kit you can first experiment with precompiled demos and an Android or iOS smartphone app before continuing with your own application development.

KEY POINTS

- Introducing the Bluetooth development environment.
- Using the Blue Gecko Wireless Starter Kit demos and Android or iOS smartphone app to demonstrate Bluetooth features.
- Installing the Bluetooth SDK in Simplicity Studio.
- Starting application development for Bluetooth devices with Simplicity Studio.



J-Link Silicon Labs (440050127)

Preferred SDK: Gecko SDK Suite v2.5.0: Bluetooth 2.11.0.0
Click here to change the preferred SDK.

Debug Mode: MCU Change
Adapter Firmware Version: 1v3p3b928 No local adapter firmware available. Download

Demos
- Bluetooth SDK 2.11.0.0
  - Bluetooth (NCP)
  - Bluetooth (SoC) Advanced
  - Bluetooth (SoC) Basic
  - Dynamic Multiprotocol

Software Examples
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- Gecko Bootloader 1.8.0
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SDK Documentation
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1 Introduction

This document describes how to get started with Bluetooth development using Silicon Labs products. It introduces the features of the Silicon Labs Bluetooth stack and the resources available to help with development. Application development is started using the Silicon Labs development environment Simplicity Studio and the Bluetooth Software Development Kit (SDK). The SDK comes with a number of example application that you can then modify to create your own applications. If you are developing with an EFR32BG device and have purchased a Blue Gecko Bluetooth Wireless Starter Kit, you can use precompiled demos and an Android or iOS smartphone app to demonstrate Bluetooth software features.

This document describes the following:

- Bluetooth Stack features and components (see section 2 About the Bluetooth Stack)
- Installing Simplicity Studio and the Bluetooth SDK (see section 3 Getting Started with Simplicity Studio and the Bluetooth SDK
- A description of the precompiled demos and example code available in the SDK (see section 4 About Demos and Examples)
- How to test prebuilt demo software with either an iOS or Android smartphone app (see section 5 Getting Started with Bluetooth Demo Software)
- How to develop your own applications in Simplicity Studio (see section 6 Starting Application Development)
- A description of other section 7 Development Tools that are useful in the development process

1.1 Prerequisites

As well as Simplicity Studio v4, you should have the following before beginning application development:

- A basic understanding of Bluetooth technology and terminology. *UG103.14: Bluetooth LE Fundamentals* provides a good starting point if you have not yet learned about Bluetooth.
- A compatible compiler:
  - Simplicity Studio comes with a free GCC C-compiler.
  - IAR Embedded Workbench for ARM (IAR-EWARM) can also be used as the compiler for all Silicon Labs protocols. See the Bluetooth SDK's release notes for the compatible IAR-EWARM version.
- A registered account at Silicon Labs is required in order to download the Silicon Labs Bluetooth SDK.
  - You can register at https://siliconlabs.force.com/apex/SL_CommunitiesSelfReg?form=short.

To get a 30-day evaluation license for IAR:

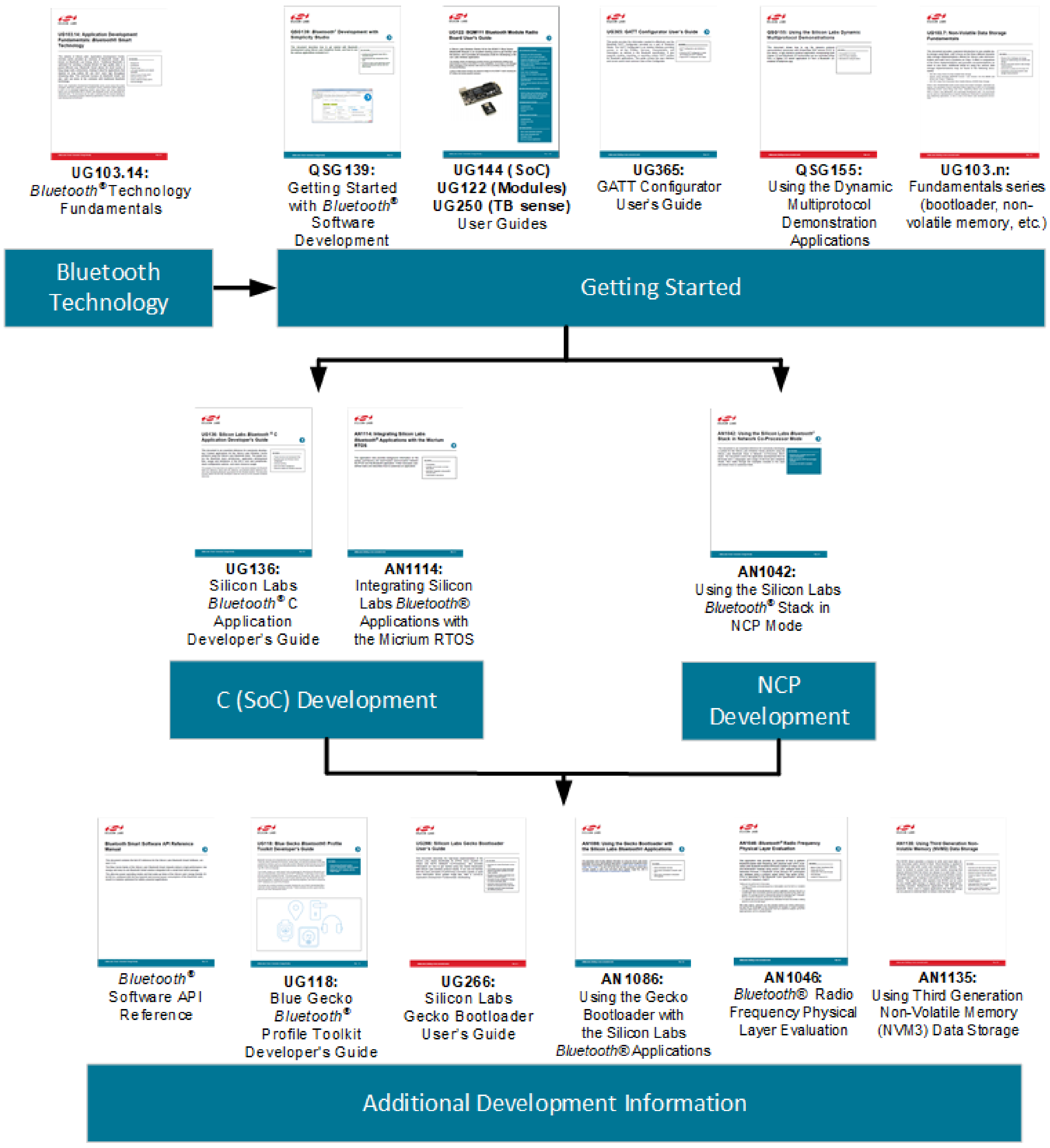
- Go to the Silicon Labs support portal at https://www.silabs.com/support.
- Scroll down to the bottom of the page, and click **Contact Support**
- If you are not already signed in, sign in.
- Click the Software Releases tab. In the View list select **Development Tools**. Click **Go**. In the results is a link to the IAR-EWARM version named in the release notes.
- Download the IAR package (takes approximately 1 hour).
- Install IAR.
- In the IAR License Wizard, click **Register with IAR Systems to get an evaluation license**.
- Complete the registration and IAR will provide a 30-day evaluation license.
- Once IAR-EWARM is installed, the next time Simplicity Studio starts it will automatically detect and configure the IDE to use IAR-EWARM.

1.2 Support

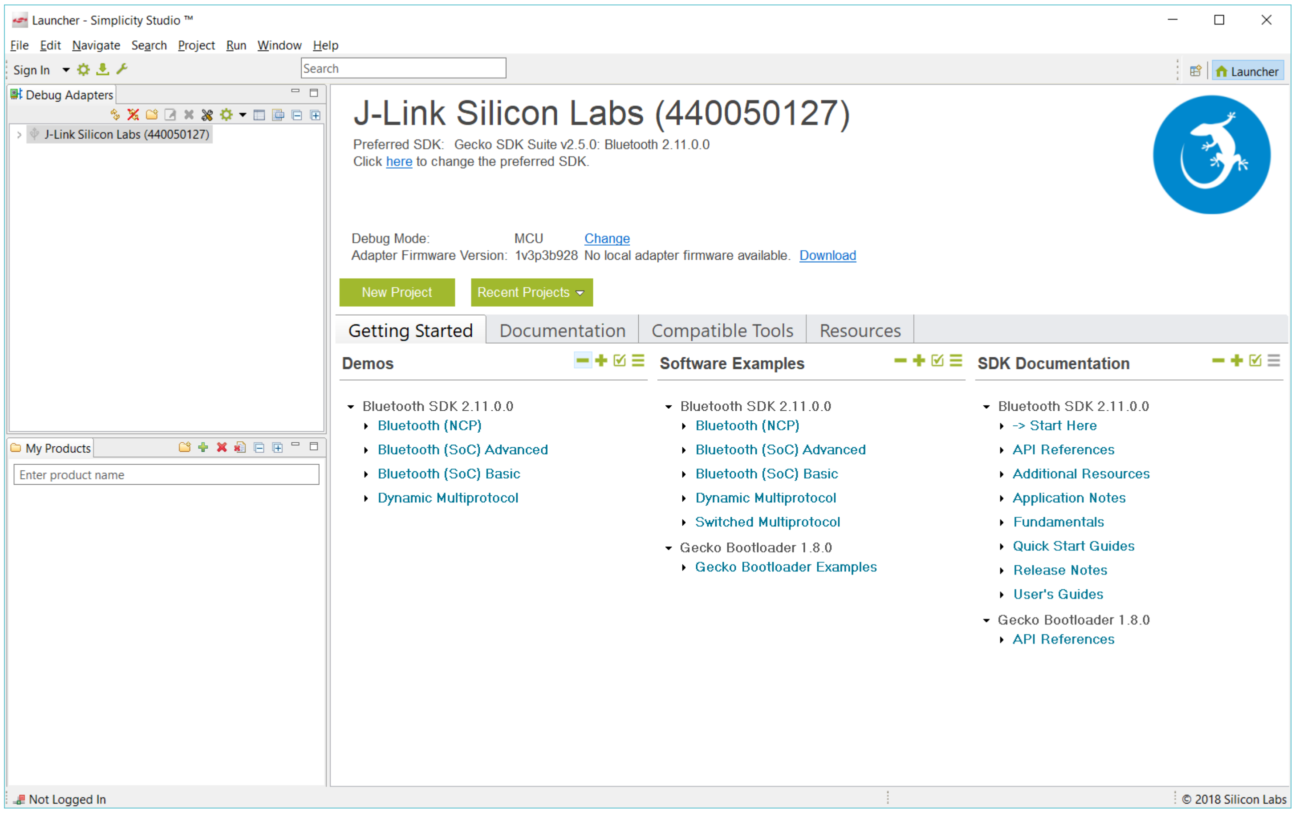
You can access the Silicon Labs support portal at https://www.silabs.com/support through Simplicity Studio's Resources tab, as described in section 3.7 Accessing Documentation and Other Resources. Use the support portal to contact Customer Support for any questions you might have during the development process.

1.3 Documentation

Documentation for the Bluetooth SDK is summarized in the following figure.


UG103.14: Bluetooth® Technology Fundamentals
QSG139: Getting Started with Bluetooth® Software Development
UG144 (SoC) UG122 (Modules) UG250 (TB sense) User Guides
UG365: GATT Configurator User's Guide
QSG155: Using the Dynamic Multiprotocol Demonstration Applications
UG103.n: Fundamentals series (bootloader, non-volatile memory, etc.)
Bluetooth Technology
Getting Started
UG136: Silicon Labs Bluetooth® C Application Developer's Guide
AN1114: Integrating Silicon Labs Bluetooth® Applications with the Micrium RTOS
AN1042: Using the Silicon Labs Bluetooth® Stack in NCP Mode
C (SoC) Development
NCP Development
Bluetooth® Software API Reference
UG118: Blue Gecko Bluetooth® Profile Toolkit Developer's Guide
UG266: Silicon Labs Gecko Bootloader User's Guide
AN1086: Using the Gecko Bootloader with the Silicon Labs Bluetooth® Applications
AN1046: Bluetooth® Radio Frequency Physical Layer Evaluation
AN1135: Using Third Generation Non-Volatile Memory (NVM3) Data Storage
Additional Development Information

SDK documentation is accessed through Simplicity Studio, as described in section 3.7 Accessing Documentation and Other Resources. Other resources available include Knowledge Base Articles (KBAs) and Hardware documentation. All may be accessed through links in Simplicity Studio.


Launcher - Simplicity Studio ™
File Edit Navigate Search Project Run Window Help
Sign In
Search
Launcher
Debug Adapters
J-Link Silicon Labs (440050127)
My Products
Enter product name
Not Logged In
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New Project | Recent Projects

Getting Started | Documentation | Compatible Tools | Resources

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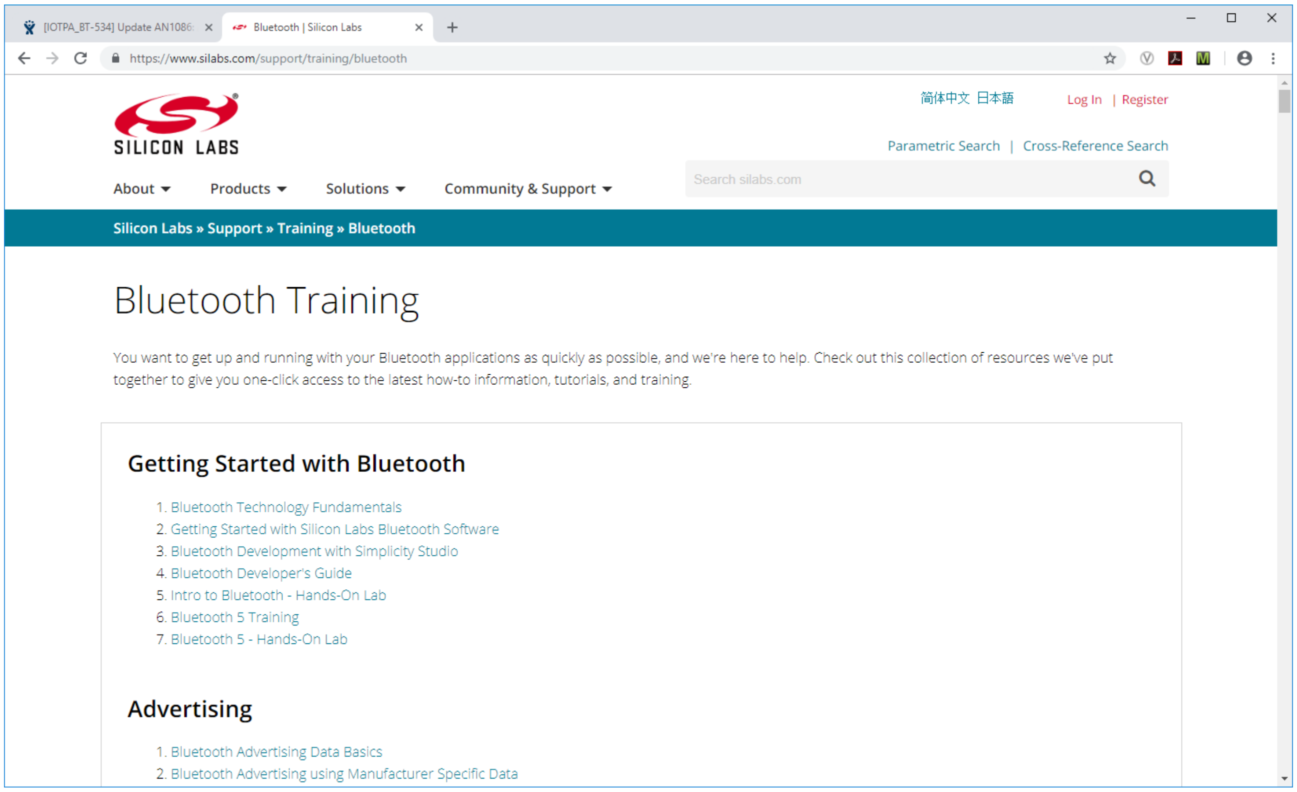
Training materials are available on the Silicon Labs website at https://www.silabs.com/support/training/bluetooth and on https://docs.silabs.com/bluetooth/latest/.



Silicon Labs » Support » Training » Bluetooth

Bluetooth Training

You want to get up and running with your Bluetooth applications as quickly as possible, and we're here to help. Check out this collection of resources we've put together to give you one-click access to the latest how-to information, tutorials, and training.

Getting Started with Bluetooth

1. Bluetooth Technology Fundamentals
2. Getting Started with Silicon Labs Bluetooth Software
3. Bluetooth Development with Simplicity Studio
4. Bluetooth Developer's Guide
5. Intro to Bluetooth - Hands-On Lab
6. Bluetooth 5 Training
7. Bluetooth 5 - Hands-On Lab

Advertising

1. Bluetooth Advertising Data Basics
2. Bluetooth Advertising using Manufacturer Specific Data

1.4 Gecko Platform

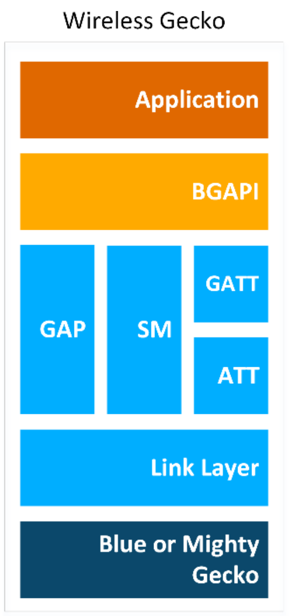
The Gecko Platform is a set of drivers and other lower layer features that interact directly with Silicon Labs chips and modules. Gecko Platform components include EMLIB, EMDRV, RAIL Library, NVM3, and mbedTLS. For more information about Gecko Platform, see release notes that can be found in Simplicity Studio’s Launcher Perspective, under **SDK Documentation > Bluetooth SDK n.n.n.n > Release Notes**.

2 About the Bluetooth Stack

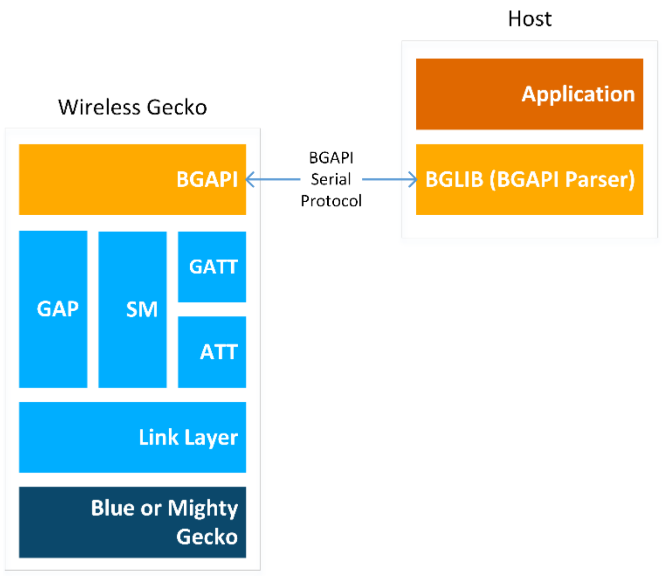
The Silicon Labs Bluetooth stack is an advanced Bluetooth 5-compliant protocol stack implementing the Bluetooth low energy standard. It supports multiple connections, concurrent central, peripheral, broadcaster, and observer roles. The Silicon Labs Bluetooth stack is meant for Silicon Labs Wireless Gecko SoCs and modules.

The Silicon Labs Bluetooth stack provides multiple APIs for the developer to access the Bluetooth functionality. Two modes are supported:

1. Standalone mode, where both the Bluetooth stack and the application run in a Wireless Geckos SoC or module. The application can be developed with C programming language.



2. Network Co-Processor (NCP) mode, where the Bluetooth stack runs in a Wireless Gecko and the application runs on a separate host MCU. For this use case, the Bluetooth stack can be configured into NCP mode where the API is exposed over a serial interface such as UART.



2.1 Bluetooth Stack Features

The features of the Silicon Labs Bluetooth stack are listed in the following table.

Feature	Value and comments
Bluetooth version	Bluetooth 5.2
Bluetooth features	Bluetooth 5.2 GATT caching Bluetooth 5 2M PHY (EFR32[B|M]G12, EFR32[B|M]G13, EFR32[B|M]G21, and EFR32[B|M]G22) Bluetooth 5 LE Long Range (EFR32[B|M]G13, EFR32[B|M]G21, and EFR32[B|M]G22) Bluetooth 5 advertisement sets and scan event reporting Bluetooth 5 extended advertisements (EFR32[B|M]G12, EFR32[B|M]G13, EFR32[B|M]G21, and EFR32[B|M]G22) • Anonymous advertisement • Periodic advertisement • Extended advertisement packet size: up to 1650 B Concurrent central, peripheral, broadcaster and observer modes LE secure connections LE Privacy 1.2 (peripheral) LE packet length extensions LE dual topology Whitelisting (central side only)
Simultaneous connections	Up to 8 simultaneous connections regardless of role (master or slave)
Maximum throughput	1300 kbps over 2M PHY 700 kbps over 1M PHY
Encryption	AES-128
Pairing modes	Just works Man-in-the-Middle with numeric comparison and passkey Out-Of-Band
Number of simultaneous bondings	EFR32[B|M]G1, EFR32[B|M]G12 and EFR32[B|M]G13: Up to 13 when using PS, up to 32 with NVM3 EFR32[B|M]G21, EFR32[B|M]G22: Up to 32
Link Layer packet size	Up to 251 B
ATT protocol packet size	Up to 250 B
Supported Bluetooth profiles and services	All GATT based profiles and services are supported
Apple HomeKit	Apple HomeKit R15-compliant implementation (EFR32[B|M]12, EFR32[B|M]13, EFR32[B|M]21, and EFR32[B|M]G22) Implements all Apple HomeKit profiles and services Available separately for Apple MFi licensees
Host (NCP) interfaces	4-wire UART with RTS/CTS control or 2-wire UART without RTS/CTS GPIOs for sleep and wake-up management
Wi-Fi Coexistence	Using Packet Trace Arbitration (PTA)
Bootloaders	Secure Gecko Bootloader supporting authenticated and encrypted updates over OTA or UART and Secure Boot. The Gecko Bootloader also supports flash partitioning and both internal and external (SPI) flash.
Non-volatile memory	EFR32[B|M]G1, EFR32[B|M]G12, EFR32[B|M]G13: NVM3 or Persistent Store (PS)* EFR32[B|M]G21, EFR32[B|M]G22: NVM3

* Example applications in the SDK that are generated for these platforms will use PS by default.

2.2 Bluetooth Qualification

All products using Bluetooth technology must go through the Bluetooth SIG's Qualification Process, even if the product does not have the Bluetooth logo or Bluetooth is not mentioned in the packaging and the documentation. In practice this means that, before you can sell a Bluetooth-enabled product, the product must be qualified as an End Product through the Bluetooth SIG. The qualification listing has a Declaration Fee. There are online resources to learn more about the Bluetooth Qualification Process as well as tutorials on the Launch Studio, which is the online tool used to complete the Bluetooth Qualification Process. If you need assistance to qualify your device you can consider reaching out to your nearest Bluetooth Qualification Consultant.

When qualifying your end-product based on Silicon Labs' Bluetooth stack you will integrate the pre-qualified components listed in the table below, depending on which SDK version was used to build your application.

Bluetooth SDK version	Component	QDID
v2.10.x up to 2.13.x	Link Layer (Bluetooth 5.1)	127618
	Host stack (Bluetooth 5.1) [*]	126252
v2.13.x and above v3.0.x and above	Link Layer (Bluetooth 5.2)	147971
	Host stack (Bluetooth 5.2)	146950

[*] Launch Studio: For end-product qualifications based on this component, you must check the items 21/19 and 34/15 and uncheck the items 21/17 and 34/13 in the "Summary ICS" and upload the Erratum 11838 Test Evidences, which can be requested through the support portal.

Note: According to Bluetooth SIG Qualification Program Reference Document (PRD), the Assessment Date of the tested Component must be less than three years old at the time it is being imported into a Launch Studio project for a new End Product Listing (EPL). After the expiration of a Component QDID (Qualified Design ID), a newer SDK version than the one used for the outdated QDID should be used in order to qualify your product. There can be also newer QDIDs than the ones listed in the table above if there are newer Component versions. You can browse our valid Qualified Components and their Assessment Date by inserting Silicon Laboratories in the search bar of Launch Studio. Contact technical support if there is a need to use an older SDK version.

The above software-based pre-qualified components are two out of the three components to integrate when proceeding with the "Qualification Process with Required Testing". Despite the “Required Testing", customers do not need to do any additional testing, given that the test reports are embedded in the pre-qualified components for the SIG to review.

In addition to these two software components you must also have integrated a qualified RF-PHY component in your end-product listing. If you are designing with one of Silicon Labs' Bluetooth modules then refer to the module datasheet for the appropriate component QDID to use. If you are designing with an SoC, then you may need to obtain your own RF-PHY qualification with the Bluetooth SIG, depending on your hardware design. In the latter case, consult your nearest Bluetooth Qualification Consultant, or Silicon Labs through the support portal, to understand if an existing Silicon Labs RF-PHY pre-qualification could be used.

Silicon Labs does not provide prequalified profiles. Customers must provide these with their end applications that implement the functionality as per the SIG profile specification.

2.3 The Bluetooth Stack APIs

This section briefly describes the different software APIs available for the developer.

2.3.1 The BGAPI Bluetooth API

The BGAPI is the Bluetooth API provided by the Silicon Labs Bluetooth stack. It provides access to all the Bluetooth functionality implemented by the Bluetooth stack, such as: the Generic Access Profile (GAP), connection manager, the security manager (SM), and GATT client and server.

In addition to the Bluetooth APIs, the BGAPI also provides access to a few other functions like the Direct Test Mode (DTM) API for RF testing purposes, the Persistent Store (PS) API for reading and writing keys to and from the devices flash memory, the DFU (Device Firmware Update) API for field firmware updates, and the System API for various system level functions.

2.3.2 CMSIS and emlib

The Cortex Microcontroller Software Interface Standard (CMSIS) is a common coding standard for all ARM Cortex devices. The CMSIS library provided by Silicon Labs contains header files, defines (for peripherals, registers and bitfields), and startup files for all devices. In addition, CMSIS includes functions that are common to all Cortex devices, like interrupt handling, intrinsic functions, etc. Although it is possible to write to registers using hard-coded address and data values, it is recommended to use the defines to ensure portability and readability of the code.

To simplify programming Wireless Geckos, Silicon Labs developed and maintains a complete C function library called emlib that provides efficient, clear, and robust access to and control of all peripherals and core functions in the device. This library resides within the em_xxx.c (for example, em_dac.c) and em_xxx.h files in the SDK.

The emlib documentation is available on the Silicon Labs' website.

2.3.3 The BGAPI Serial Protocol and BGLIB Host API

When configured in NCP (network co-processor) mode, the Bluetooth stack also implements the BGAPI serial protocol. This allows the Bluetooth stack to be controlled over a serial interface such as UART from a separate host like an EFM32 microcontroller. The BGAPI serial protocol provides exactly the same Bluetooth APIs over UART as the BGAPI API when used in a standalone mode.

The BGAPI serial protocol is a lightweight, binary protocol that carries the BGAPI commands from the host to the Bluetooth stack and responses and events from the Bluetooth stack back to the host.

The Bluetooth SDK delivers a ready-made BGAPI serial protocol parser implementation, called BGLIB. It implements the serial protocol parser and C language function and events for all the APIs provided by the Bluetooth stack. The host code developed on top of BGLIB can be written to be identical to the code for the Wireless Gecko, which allows easy porting of the application code from the Wireless Gecko to a separate host or vice versa.

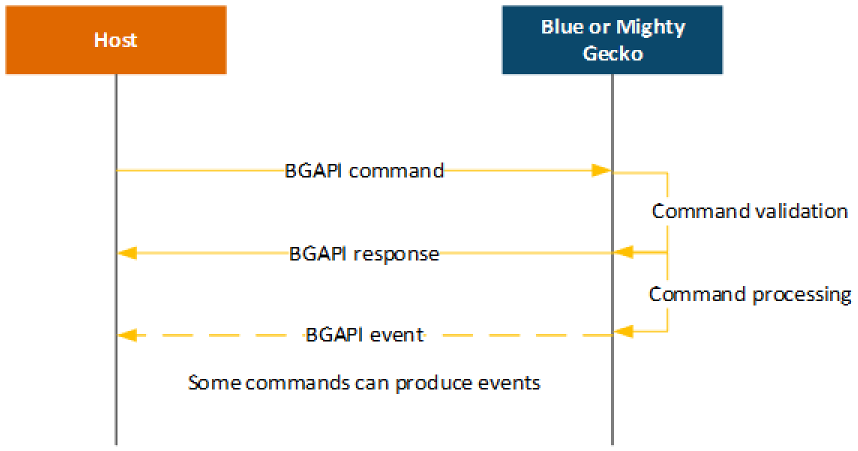


Figure 2-1. BGAPI Serial Protocol Message Exchange

The BGAPI serial protocol packet structure is described below.

Table 2-1. BGAPI Packet Structure

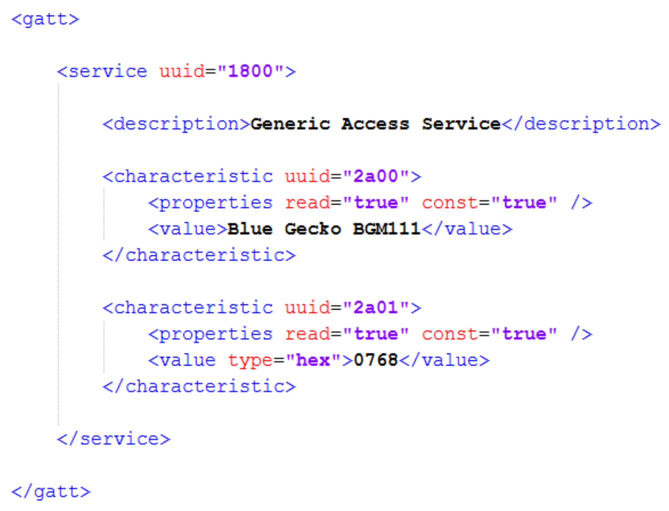
Byte	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4-255
Explanation	Message type	Minimum payload length	Message class	Message ID	Payload
Values	0x20: command 0x20: response 0xA0: event	0x00 - 0xFF	0x00 - 0xFF	0x00 - 0xFF	Specific to command, response, or event

2.3.4 The Bluetooth Profile Toolkit GATT Builder

The Bluetooth Profile Toolkit is a simple XML-based API and description language used to describe the GATT-based service and characteristic easily without the need to write them in code. The XML files can be easily written by hand based on the information contained in *UG118: Blue Gecko Bluetooth® Profile Toolkit Developer Guide*. Use the Profile Toolkit GATT Builder if you are developing outside of Simplicity Studio.

Within Simplicity Studio, we provide the GATT Configurator, a tool that allows building the GATT in a visual way, without hand editing the XML file. See section 7.1, The GATT Configurator for summary information, and UG365: GATT Configurator User's Guide for details.

The GATT database developed with the Profile Toolkit is converted to a .c file and a .h file and included in the application project as a pre-build step when the firmware is compiled. Then the GATT can be accessed with the Bluetooth stack GATT APIs or by a remote Bluetooth device.



```
<gatt>

    <service uuid="1800">

        <description>Generic Access Service</description>

        <characteristic uuid="2a00">
            <properties read="true" const="true" />
            <value>Blue Gecko BGM111</value>
        </characteristic>

        <characteristic uuid="2a01">
            <properties read="true" const="true" />
            <value type="hex">0768</value>
        </characteristic>

    </service>

</gatt>
```

Figure 2-2. Example of a Generic Access Service

2.4 About the Bluetooth SDK

The Bluetooth SDK is a full software development kit that enables you to develop applications on top of the Bluetooth stack using C programming language. The SDK also supports making standalone applications, where the Bluetooth stack and the application both run in the Wireless Gecko, or the network co-processor (NCP) architecture, where the application runs on an external host and the Bluetooth stack runs in the Wireless Gecko. SDK contents and folder structure are described in the following sections.

2.4.1 Libraries

The following libraries are delivered with the Bluetooth SDK and must be included in C application projects.

Library	Explanation	Mandatory
libbluetooth.a	Bluetooth stack library	Yes
librail_efr32xg1_gcc_release.a	RAIL library for GCC	Yes for GCC projects on EFR32xG1 platform
librail_efr32xg12_gcc_release.a	RAIL library for GCC	Yes for GCC projects on EFR32xG12 platform
librail_efr32xg13_gcc_release.a	RAIL library for GCC	Yes for GCC projects on EFR32xG13 platform
librail_efr32xg14_gcc_release.a	RAIL library for GCC	Yes for GCC projects on EFR32xG14 platform
librail_efr32xg21_gcc_release.a	RAIL library for GCC	Yes for GCC projects on EFR32xG21 platform
librail_efr32xg22_gcc_release.a	RAIL library for GCC	Yes for GCC projects on EFR32xG22 platform
librail_efr32xg1_iar_release.a	RAIL library for IAR	Yes for IAR projects on EFR32xG1 platform
librail_efr32xg12_iar_release.a	RAIL library for IAR	Yes for IAR projects on EFR32xG12 platform
librail_efr32xg13_iar_release.a	RAIL library for IAR	Yes for IAR projects on EFR32xG13 platform
librail_efr32xg14_iar_release.a	RAIL library for IAR	Yes for IAR projects on EFR32xG14 platform

Library	Explanation	Mandatory
librail_efr32xg21_iar_release.a	RAIL library for IAR	Yes for IAR projects on EFR32xG21 platform
librail_efr32xg22_iar_release.a	RAIL library for IAR	Yes for IAR projects on EFR32xG22 platform
libmbedtls.a	mbedtls library	Yes
libpsstore.a	PSStore library	Yes, on series 1
binapploader.o	Apploader for OTA updates	No
libcoex.a	Wi-Fi and Bluetooth coexistence	No
libnvm3_CM33_gcc.a		Yes, on series 2

2.4.2 Include Files

The following files are delivered with the Bluetooth SDK and must be included in C application projects.

Library	Explanation	When needed
native_gecko.h	Bluetooth stack API for standalone applications without Micrium RTOS	Must be included in standalone C applications where both Bluetooth stack and application run in a Wireless Gecko.
rtos_gecko.h	Bluetooth stack API for standalone applications with Micrium RTOS	Required when the Bluetooth stack is used together with Micrium RTOS.
ncp_gecko.h	Bluetooth stack API for NCP applications	Must be included in NCP applications where the host controls the device via BGAPI protocol over UART
gecko_configuration.h	Bluetooth stack configuration	Included automatically.
bg_errorcodes.h	Error codes produced by the Bluetooth stack	Included automatically.
bg_gattdb_def.h	Bluetooth GATT database structure definition	Included automatically.
bg_types.h	Simple data type definitions and structures	Included automatically.
gecko_bglib.h	An adaptation layer between host application and BGAPI serial protocol	Must be included in C applications developed for external hosts.
host_gecko.h	Bluetooth API for host (NCP) applications	Must be included in C applications developed for external hosts.

2.4.3 Platform Components

The following components are delivered with the Bluetooth SDK. The platform components are under the platform folder.

Folder	Explanation
bootloader	Gecko Bootloader source code and project files.
CMSIS	Silicon Laboratories CMSIS-CORE device headers. Documentation
common	Silicon Labs status codes
Device	EFR32BG and EFR32MG device files. Documentation

Folder	Explanation
emdrv	A set of function-specific high-performance drivers for EFR32 on-chip peripherals. Drivers are typically DMA based and are using all available low-energy features. For most drivers, the API offers both synchronous and asynchronous functions. Documentation
emlib	A low-level peripheral support library that provides a unified API for all EFM32, EZR32 and EFR32 MCUs and SoCs from Silicon Laboratories. Documentation
Halconfig	Peripheral configuration
Hwconf_data	Gather chip-specific hardware configuration
middleware	Display driver for WSTK development kits Documentation
radio	Silicon Labs RAIL (Radio Abstraction Interface Layer) library
service	Sleeptimer driver and configuration file. Used by the BLE stack.

3 Getting Started with Simplicity Studio and the Bluetooth SDK

Simplicity Studio is a free Eclipse-based Integrated Development Environment (IDE) and a collection of value-add tools provided by Silicon Labs. Developers can use Simplicity Studio to develop, debug and analyze their Bluetooth and other Silicon Labs SDK (Software Development Kit) applications. Its main goal is to reduce development time so that you can focus on your application instead of researching the Bluetooth specification and hardware reference manuals. See section 3.3 Functionality in the Launcher Perspective for a review of Simplicity Studio's features.

If you have already installed Simplicity Studio with a different protocol stack, see section 3.4 Updating Software/New Elements for instructions on updating the installation with the Bluetooth stack.

3.1 Connect your Hardware

Connect your WSTK using a USB cable to the PC on which you will install Simplicity Studio. By having it connected when Simplicity Studio installs, Simplicity Studio will automatically obtain the relevant additional resources it needs.

Note: For best performance in Simplicity Studio, be sure that the power switch on your WSTK is in the Advanced Energy Monitoring or "AEM" position as shown in the following figure.

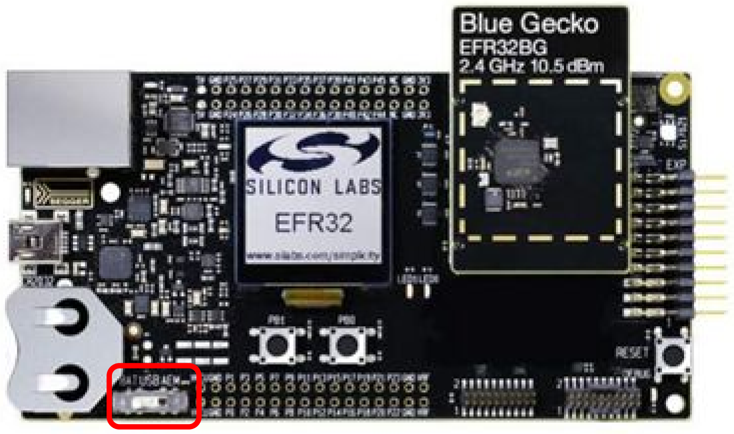
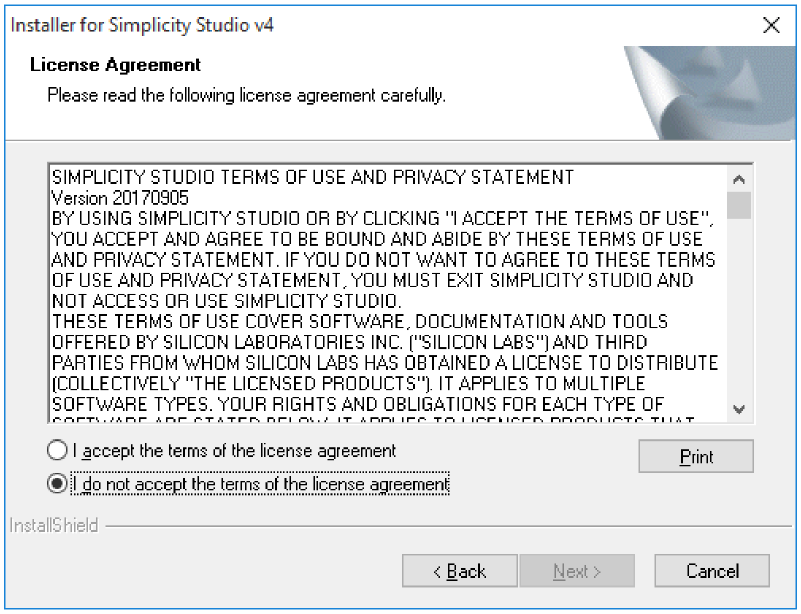


Figure 3-1. EFR32BG12 on a WSTK

3.2 Installing Simplicity Studio and the Gecko Suite with the Bluetooth Stack

1. Run the Simplicity Studio installation application.
2. When Simplicity Studio first launches, it presents a License Agreement dialog. Accept the terms of the agreement and click **Nex**t.



Installer for Simplicity Studio v4

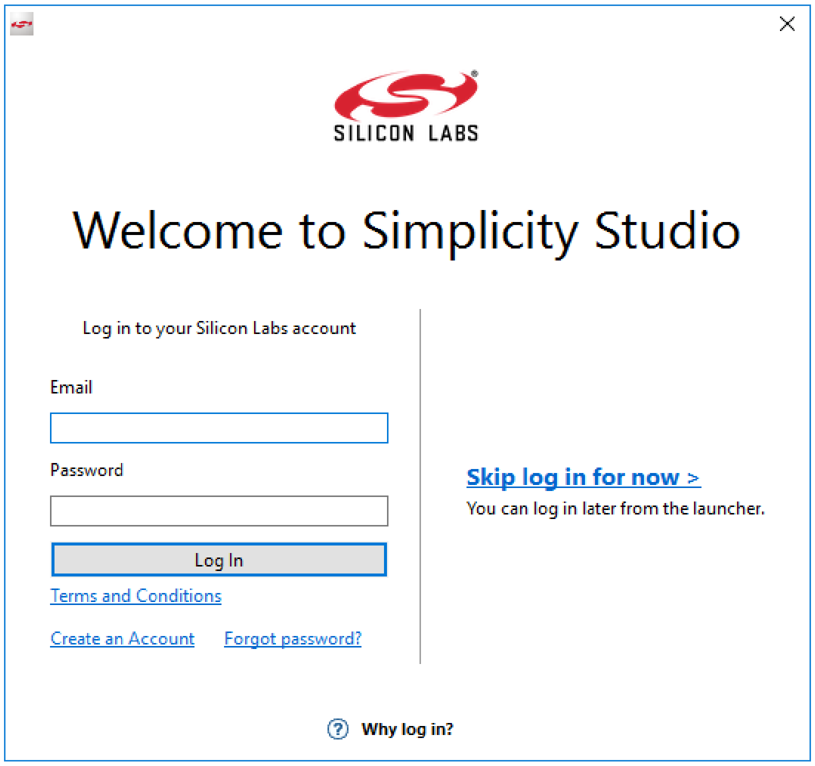
License Agreement

Please read the following license agreement carefully.

SIMPLICITY STUDIO TERMS OF USE AND PRIVACY STATEMENT
Version 20170905
BY USING SIMPLICITY STUDIO OR BY CLICKING "I ACCEPT THE TERMS OF USE", YOU ACCEPT AND AGREE TO BE BOUND AND ABIDE BY THESE TERMS OF USE AND PRIVACY STATEMENT. IF YOU DO NOT WANT TO AGREE TO THESE TERMS OF USE AND PRIVACY STATEMENT, YOU MUST EXIT SIMPLICITY STUDIO AND NOT ACCESS OR USE SIMPLICITY STUDIO.
THESE TERMS OF USE COVER SOFTWARE, DOCUMENTATION AND TOOLS OFFERED BY SILICON LABORATORIES INC. ("SILICON LABS") AND THIRD PARTIES FROM WHOM SILICON LABS HAS OBTAINED A LICENSE TO DISTRIBUTE (COLLECTIVELY "THE LICENSED PRODUCTS"). IT APPLIES TO MULTIPLE SOFTWARE TYPES. YOUR RIGHTS AND OBLIGATIONS FOR EACH TYPE OF

I accept the terms of the license agreement [✓ I do not accept the terms of the license agreement]

3. Choose a destination location, click **Next >** and then click **Install**.
4. When the application launches, you are invited to log in. Log in using your support account username and password. Although you can skip log in here, you must be logged in to access protected content.



Welcome to Simplicity Studio

Log in to your Silicon Labs account

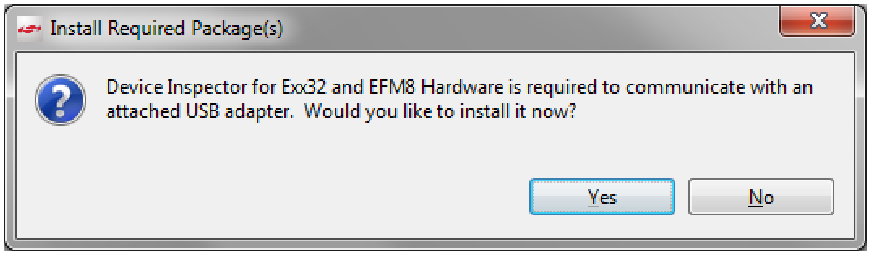
Email

Password

Skip log in for now >

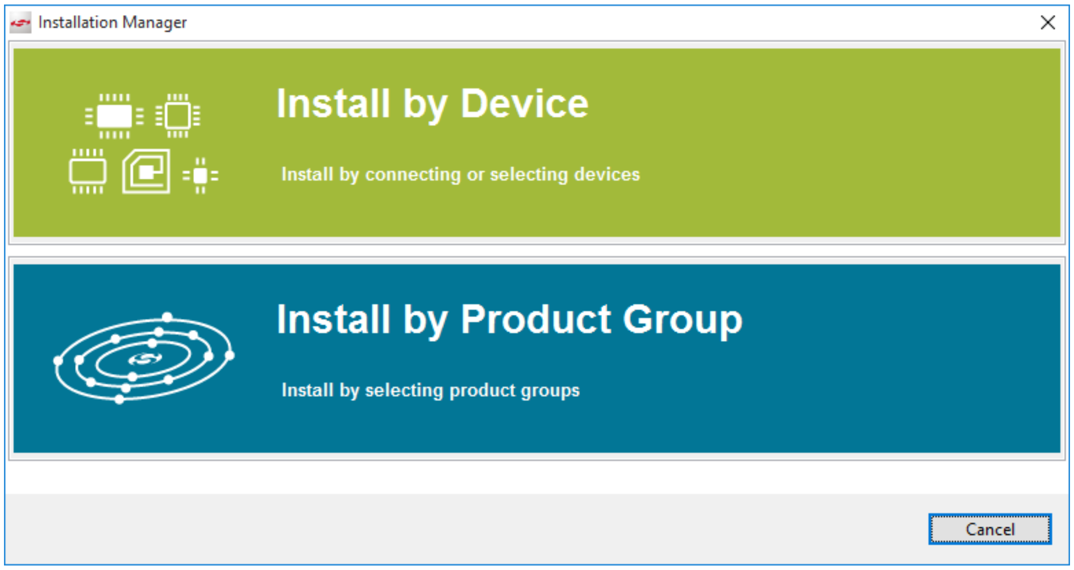
You can log in later from the launcher.

5. After login, Simplicity Studio adds software information. Once initial software installation is complete, Simplicity Studio checks for connected hardware. If you have the WSTK connected by USB cable, Simplicity Studio will detect the USB cable and prompt you to download a Device Inspector. Click **Yes**.


Install Required Package(s)

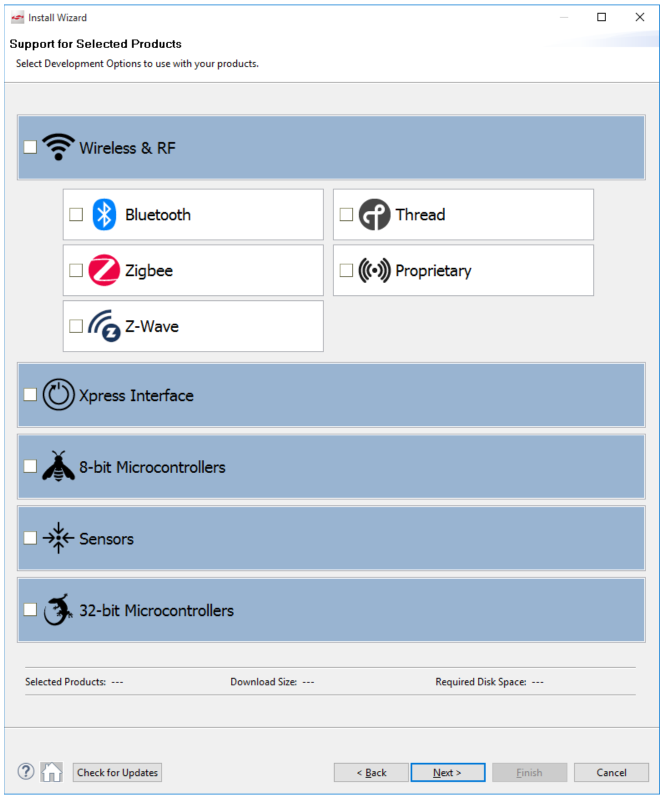
Device Inspector for Exx32 and EFM8 Hardware is required to communicate with an attached USB adapter. Would you like to install it now?

6. After some additional items are installed, you are offered the option of installing by device (step 13) or installing by product group (step 12). **Install by Product Group** will give you a more targeted set of installation options.

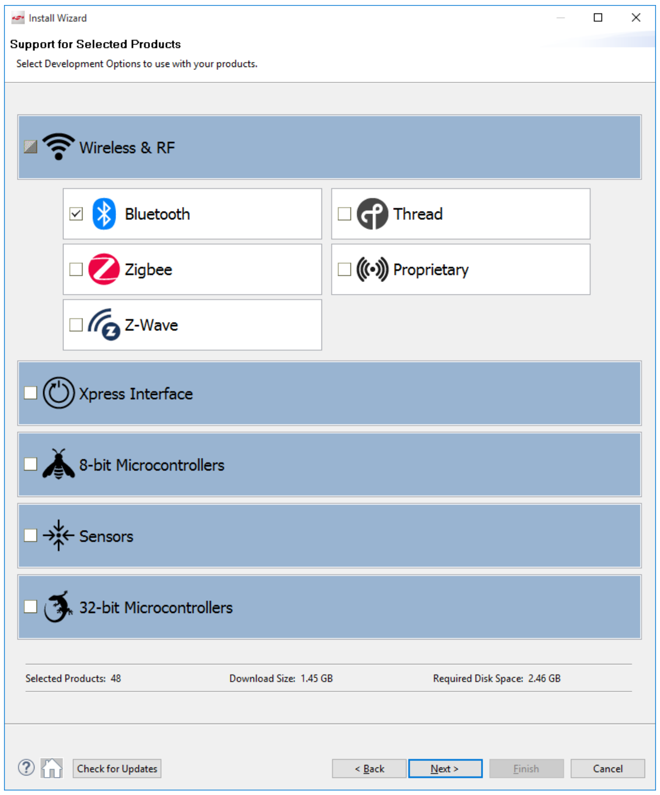

Installation Manager
Install by Device
Install by connecting or selecting devices
Install by Product Group
Install by selecting product groups
Cancel

Throughout these procedures at any time you can click Home (🏠) to return to this dialog.

7. If you click **Install by Product Group** you are offered a list of product groups. Click the SDKs you want to install, or click Wireless & RF to check all. If you plan to work on the RAIL/Bluetooth Dynamic Multiprotocol examples, select both Bluetooth and Proprietary groups. Click **Next** and go to step 10.



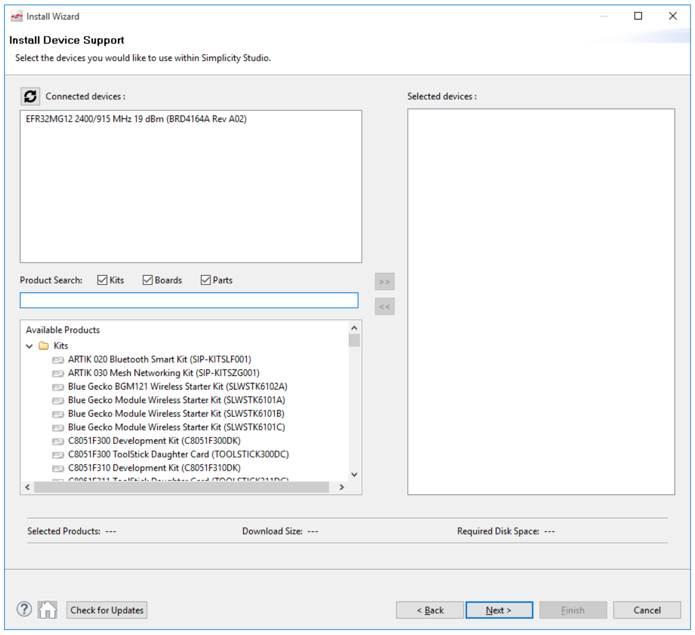
Selected Products: --- Download Size: --- Required Disk Space: ---



[✓ Bluetooth]

Selected Products: 48 Download Size: 1.45 GB Required Disk Space: 2.46 GB

8. If you click Install by Devices, an Install Device Support dialog appears. After a short delay, it shows your connected device. If the connected device does not show, click **Refresh**. Select either a connected device, or search for a product and select it. When a product is selected click **>>** to add it to the Selected Device pane. Simplicity Studio calculated available space required for installation. You can also click a selected device and click **<<** to remove it. Click **Next** to continue.

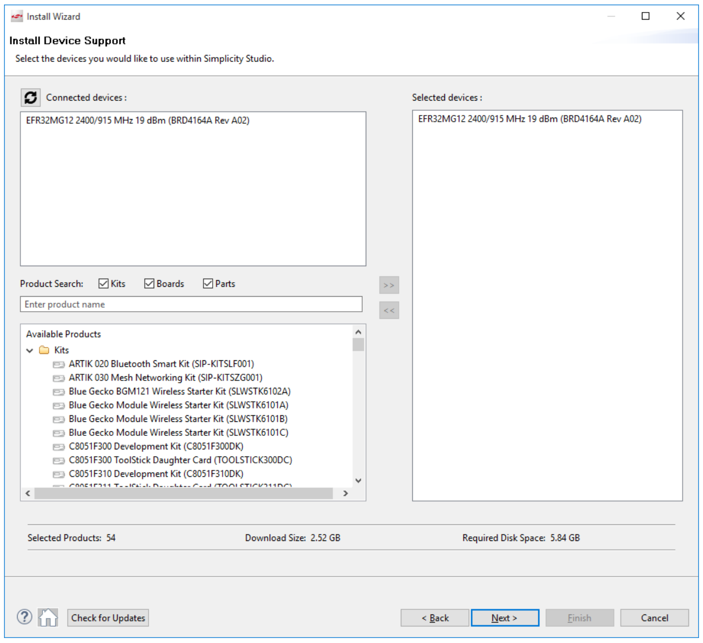


Connected devices: EFR32MG12 2400/915 MHz 19 dBm (BRD4164A Rev A02)

Product Search: [✓ Kits] [✓ Boards] [✓ Parts]

ARTIK 020 Bluetooth Smart Kit (SIP-KITSLF001)
ARTIK 030 Mesh Networking Kit (SIP-KITSZG001)
Blue Gecko BGM121 Wireless Starter Kit (SLWSTK6102A)
Blue Gecko Module Wireless Starter Kit (SLWSTK6101A)
Blue Gecko Module Wireless Starter Kit (SLWSTK6101B)
Blue Gecko Module Wireless Starter Kit (SLWSTK6101C)
C8051F300 Development Kit (C8051F300DK)
C8051F300 ToolStick Daughter Card (TOOLSTICK300DC)
C8051F310 Development Kit (C8051F310DK)

Selected Products: --- Download Size: --- Required Disk Space: ---



Connected devices: EFR32MG12 2400/915 MHz 19 dBm (BRD4164A Rev A02)

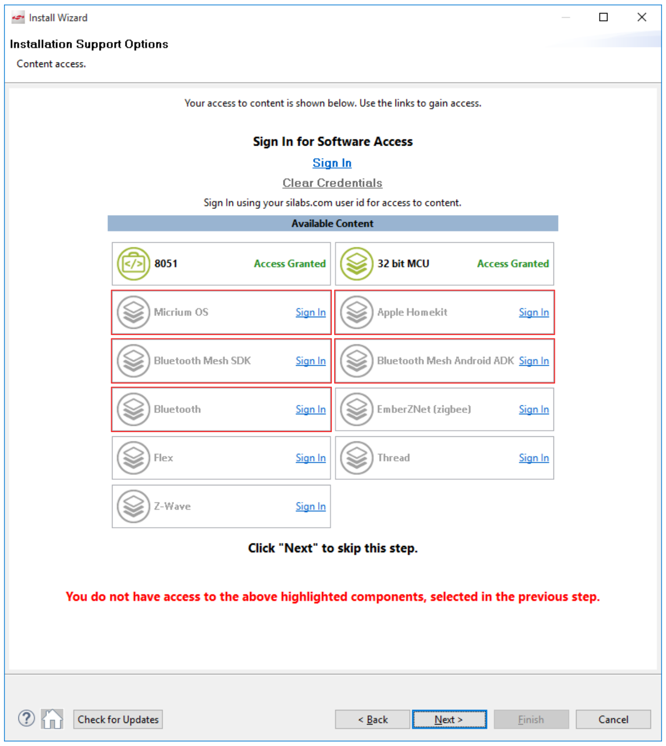
Selected devices: EFR32MG12 2400/915 MHz 19 dBm (BRD4164A Rev A02)

Product Search: [✓ Kits] [✓ Boards] [✓ Parts]

ARTIK 020 Bluetooth Smart Kit (SIP-KITSLF001)
ARTIK 030 Mesh Networking Kit (SIP-KITSZG001)
Blue Gecko BGM121 Wireless Starter Kit (SLWSTK6102A)
Blue Gecko Module Wireless Starter Kit (SLWSTK6101A)
Blue Gecko Module Wireless Starter Kit (SLWSTK6101B)
Blue Gecko Module Wireless Starter Kit (SLWSTK6101C)
C8051F300 Development Kit (C8051F300DK)
C8051F300 ToolStick Daughter Card (TOOLSTICK300DC)
C8051F310 Development Kit (C8051F310DK)

Selected Products: 54 Download Size: 2.52 GB Required Disk Space: 5.84 GB

9. The next dialog varies depending on whether or not you have signed in. If you have not signed in, you have no access to restricted content and must sign in first. Once you have signed in and see Bluetooth SDK on the list of available content, click **Next**.



Install Wizard

Installation Support Options

Content access.

Your access to content is shown below. Use the links to gain access.

Sign In for Software Access

Sign In

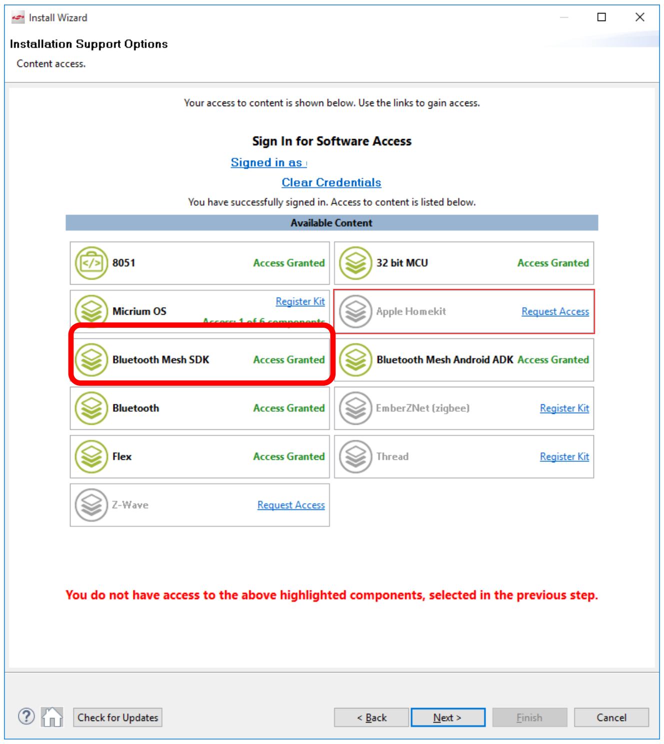
Clear Credentials

Sign In using your silabs.com user id for access to content.

Available Content			
8051	Access Granted	32 bit MCU	Access Granted
Micrium OS	Sign In	Apple Homekit	Sign In
Bluetooth Mesh SDK	Sign In	Bluetooth Mesh Android ADK	Sign In
Bluetooth	Sign In	EmberZNet (zigbee)	Sign In
Flex	Sign In	Thread	Sign In
Z-Wave	Sign In		

Click "Next" to skip this step.

You do not have access to the above highlighted components, selected in the previous step.



Install Wizard

Installation Support Options

Content access.

Your access to content is shown below. Use the links to gain access.

Sign In for Software Access

Signed in as

Clear Credentials

You have successfully signed in. Access to content is listed below.

Available Content			
8051	Access Granted	32 bit MCU	Access Granted
Micrium OS	Register Kit Access: 1 of 6 components	Apple Homekit	Request Access
Bluetooth Mesh SDK	Access Granted	Bluetooth Mesh Android ADK	Access Granted
Bluetooth	Access Granted	EmberZNet (zigbee)	Register Kit
Flex	Access Granted	Thread	Register Kit
Z-Wave	Request Access		

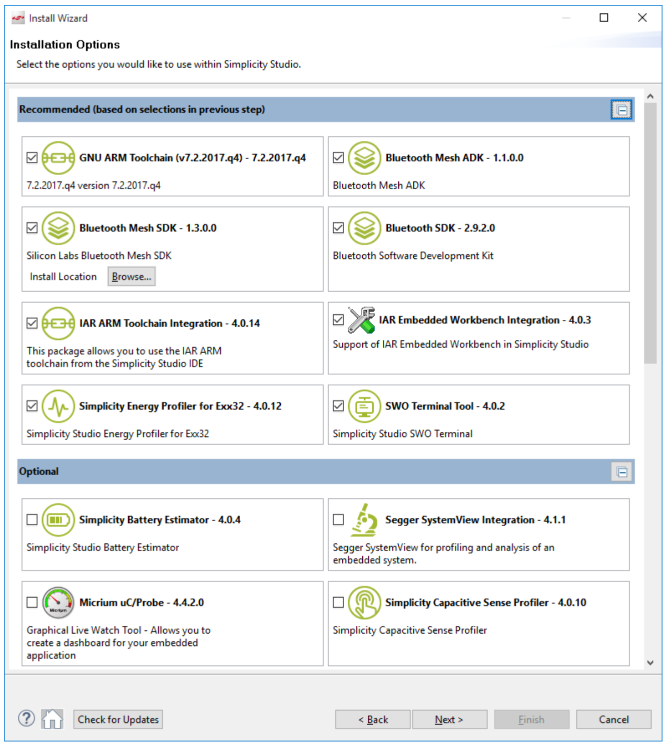
You do not have access to the above highlighted components, selected in the previous step.

10. The **Installation Options** dialog shows the tools and software packages that can be installed (your versions may be different). The following shows Installation options after selecting the Bluetooth product group (a), and after selecting an EFR32MG device (b). In both views you can uncheck anything you don't want to install. If you have installed by Product Group, the selection is filtered more specifically to your needs than if you have installed by device, and installing all checked options is recommended. If you have installed by device, and are unchecking items:

- If you plan to use GCC, leave GNU ARM Toolchain checked.
- If you plan to work on the RAIL/Bluetooth Dynamic Multiprotocol examples, leave Micrium OS Kernel and the Flex SDK checked.

Click **Next**.

a)



Installation Options

Select the options you would like to use within Simplicity Studio.

Recommended (based on selections in previous step)

☑ GNU ARM Toolchain (v7.2.2017.q4) - 7.2.2017.q4
7.2.2017.q4 version 7.2.2017.q4

☑ Bluetooth Mesh ADK - 1.1.0.0
Bluetooth Mesh ADK

☑ Bluetooth Mesh SDK - 1.3.0.0
Silicon Labs Bluetooth Mesh SDK
Install Location Browse...

☑ Bluetooth SDK - 2.9.2.0
Bluetooth Software Development Kit

☑ IAR ARM Toolchain Integration - 4.0.14
This package allows you to use the IAR ARM toolchain from the Simplicity Studio IDE

☑ IAR Embedded Workbench Integration - 4.0.3
Support of IAR Embedded Workbench in Simplicity Studio

☑ Simplicity Energy Profiler for Exx32 - 4.0.12
Simplicity Studio Energy Profiler for Exx32

☑ SWO Terminal Tool - 4.0.2
Simplicity Studio SWO Terminal

Optional

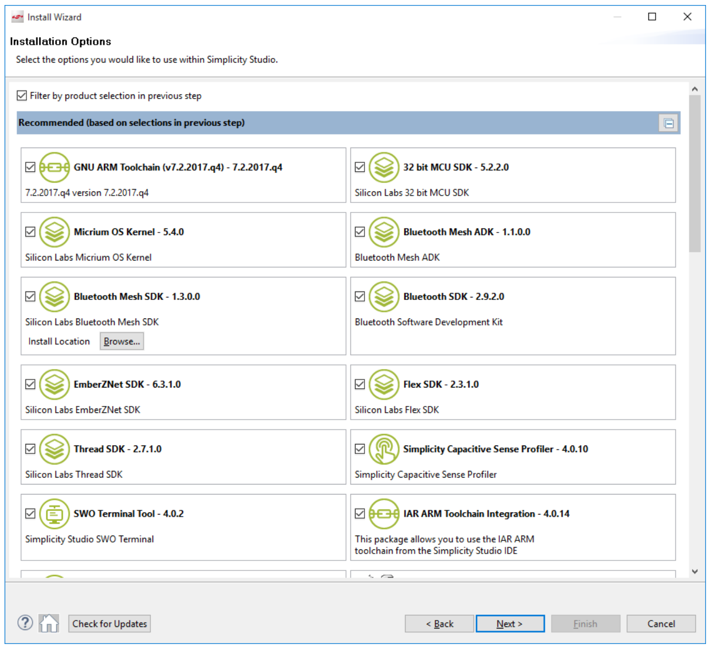
☐ Simplicity Battery Estimator - 4.0.4
Simplicity Studio Battery Estimator

☐ Segger SystemView Integration - 4.1.1
Segger SystemView for profiling and analysis of an embedded system.

☐ Micrium uC/Probe - 4.4.2.0
Graphical Live Watch Tool - Allows you to create a dashboard for your embedded application

☐ Simplicity Capacitive Sense Profiler - 4.0.10
Simplicity Capacitive Sense Profiler

b)



Installation Options

Select the options you would like to use within Simplicity Studio.

☑ Filter by product selection in previous step

Recommended (based on selections in previous step)

☑ GNU ARM Toolchain (v7.2.2017.q4) - 7.2.2017.q4
7.2.2017.q4 version 7.2.2017.q4

☑ 32 bit MCU SDK - 5.2.2.0
Silicon Labs 32 bit MCU SDK

☑ Micrium OS Kernel - 5.4.0
Silicon Labs Micrium OS Kernel

☑ Bluetooth Mesh ADK - 1.1.0.0
Bluetooth Mesh ADK

☑ Bluetooth Mesh SDK - 1.3.0.0
Silicon Labs Bluetooth Mesh SDK
Install Location Browse...

☑ Bluetooth SDK - 2.9.2.0
Bluetooth Software Development Kit

☑ EmberZNet SDK - 6.3.1.0
Silicon Labs EmberZNet SDK

☑ Flex SDK - 2.3.1.0
Silicon Labs Flex SDK

☑ Thread SDK - 2.7.1.0
Silicon Labs Thread SDK

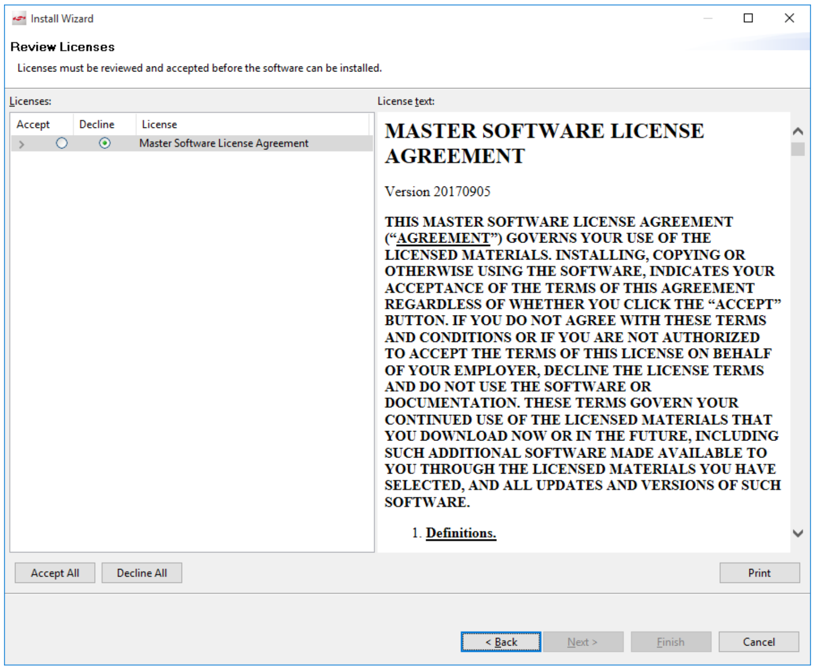
☑ Simplicity Capacitive Sense Profiler - 4.0.10
Simplicity Capacitive Sense Profiler

☑ SWO Terminal Tool - 4.0.2
Simplicity Studio SWO Terminal

☑ IAR ARM Toolchain Integration - 4.0.14
This package allows you to use the IAR ARM toolchain from the Simplicity Studio IDE

Note: Previous stack versions are shown under **Other Options**.

11. Studio displays a Review Licenses dialog. Accept the licenses shown and click **Finish**. Note that this dialog will present again if in the future you install a component with a separate license.


Install Wizard

Review Licenses

Licenses must be reviewed and accepted before the software can be installed.

Licenses:

Accept	Decline	License
○	●	Master Software License Agreement

License text:

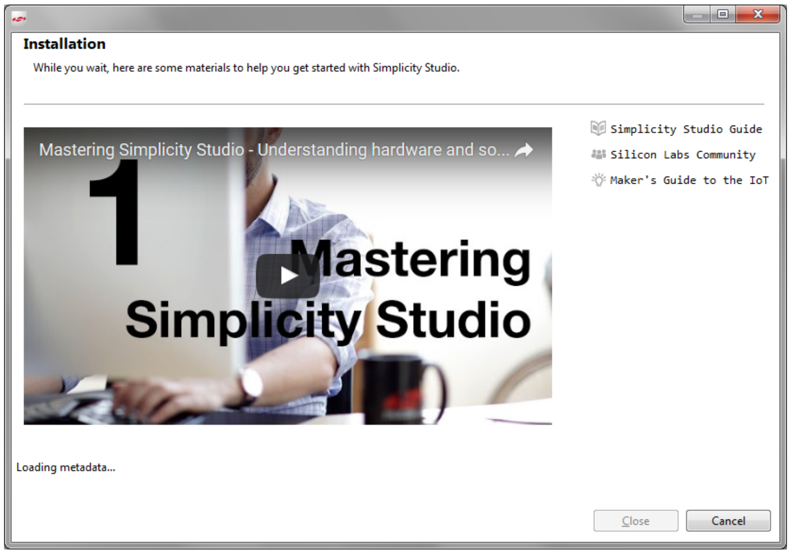
MASTER SOFTWARE LICENSE AGREEMENT

Version 20170905

THIS MASTER SOFTWARE LICENSE AGREEMENT ("AGREEMENT") GOVERNS YOUR USE OF THE LICENSED MATERIALS. INSTALLING, COPYING OR OTHERWISE USING THE SOFTWARE, INDICATES YOUR ACCEPTANCE OF THE TERMS OF THIS AGREEMENT REGARDLESS OF WHETHER YOU CLICK THE "ACCEPT" BUTTON. IF YOU DO NOT AGREE WITH THESE TERMS AND CONDITIONS OR IF YOU ARE NOT AUTHORIZED TO ACCEPT THE TERMS OF THIS LICENSE ON BEHALF OF YOUR EMPLOYER, DECLINE THE LICENSE TERMS AND DO NOT USE THE SOFTWARE OR DOCUMENTATION. THESE TERMS GOVERN YOUR CONTINUED USE OF THE LICENSED MATERIALS THAT YOU DOWNLOAD NOW OR IN THE FUTURE, INCLUDING SUCH ADDITIONAL SOFTWARE MADE AVAILABLE TO YOU THROUGH THE LICENSED MATERIALS YOU HAVE SELECTED, AND ALL UPDATES AND VERSIONS OF SUCH SOFTWARE.

1. Definitions.

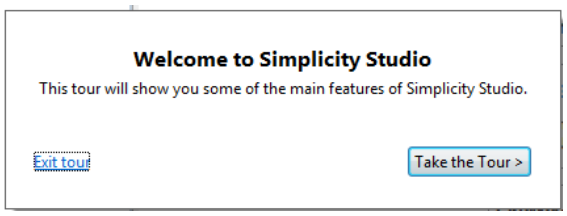
Installation takes several minutes. During installation, Simplicity Studio offers you viewing and reading options to learn more about the environment.


Installation

While you wait, here are some materials to help you get started with Simplicity Studio.

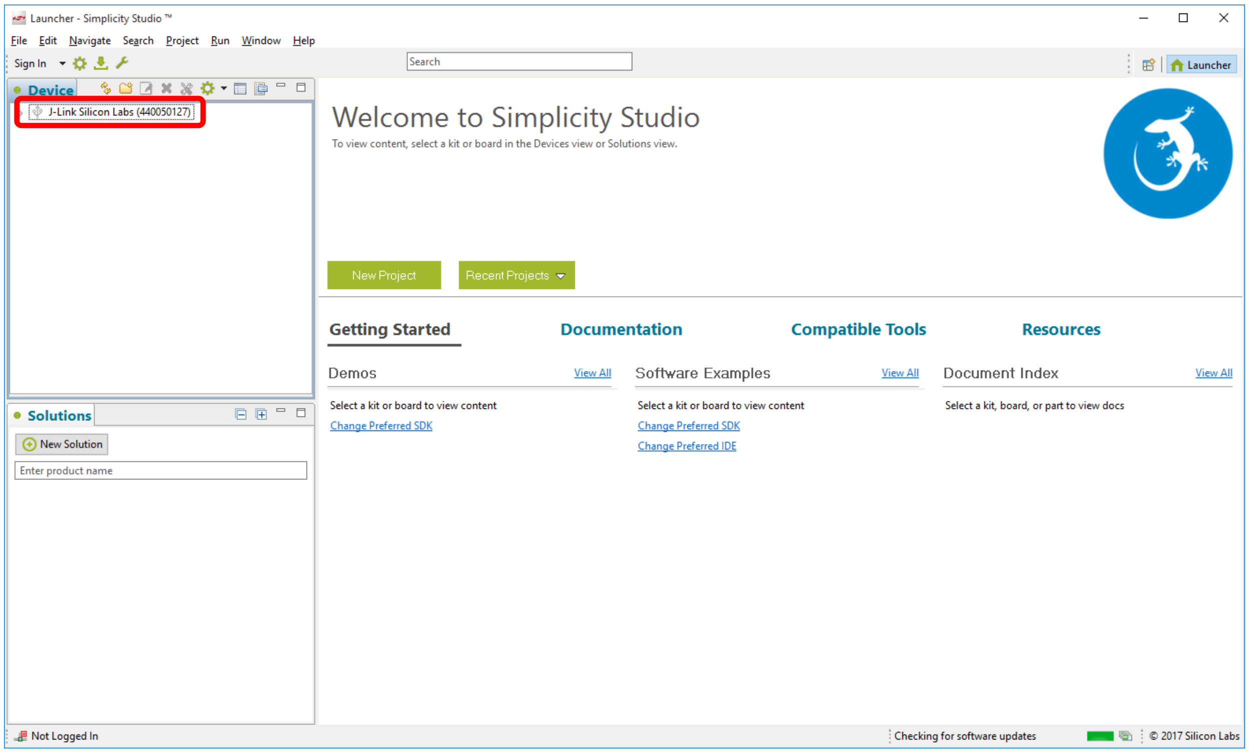
Loading metadata...

12. After installation is complete, restart Simplicity Studio.
13. When Simplicity Studio restarts, you are invited to take a tour. To clear this option now or at any time during or after the tour, click **Exit tour**.


Welcome to Simplicity Studio

This tour will show you some of the main features of Simplicity Studio.

14. The Launcher perspective opens, but it is not yet fully populated. Click the connection entry in the devices tab or a part in the solutions tab to populate it. Note that USB-connected WSTK devices are identified as J-Link devices as shown.



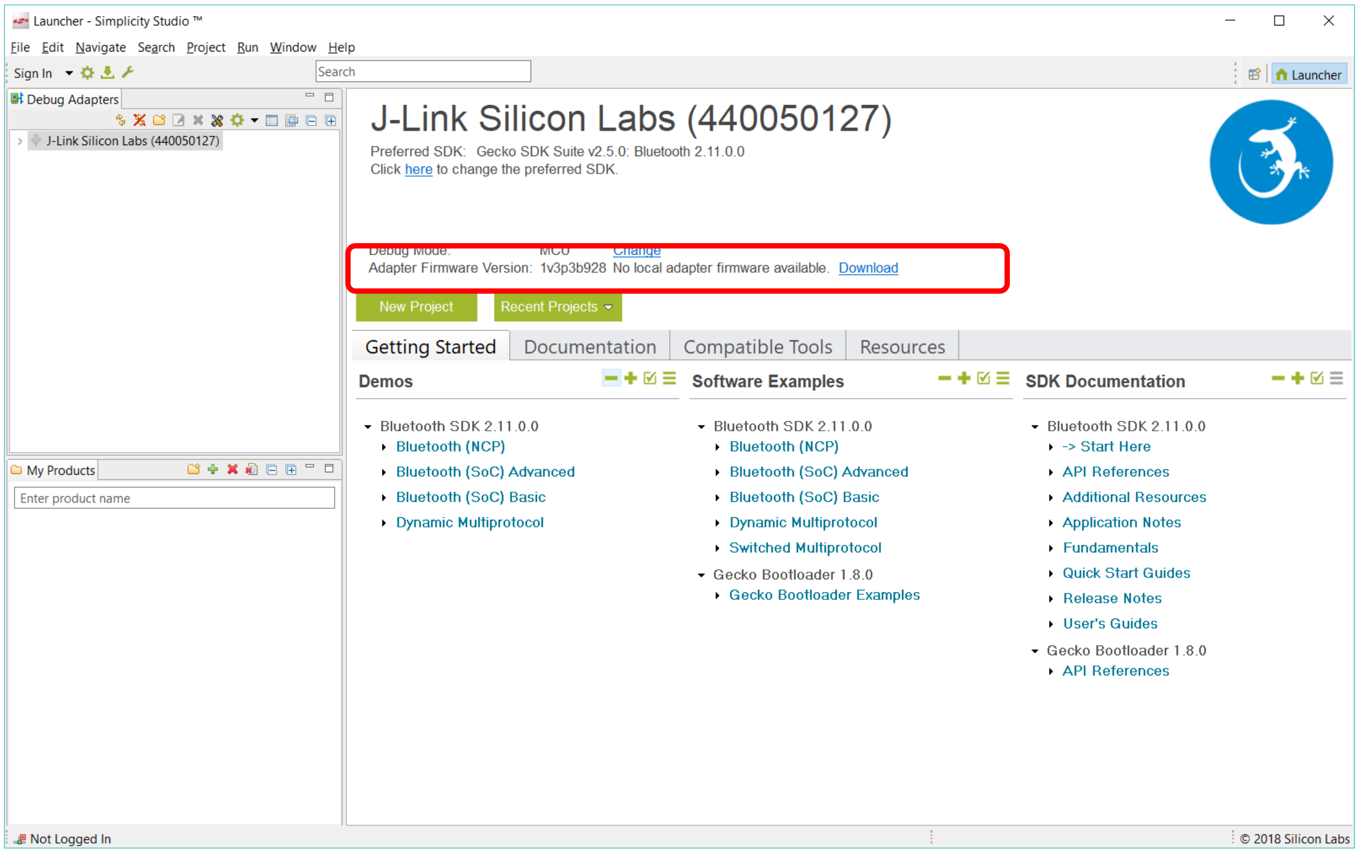
Welcome to Simplicity Studio

To view content, select a kit or board in the Devices view or Solutions view.

Select a kit or board to view content

Select a kit, board, or part to view docs

15. The Launcher perspective then is populated with the software components and functionality associated with your hardware and installed SDKs. Before proceeding, if you have a device connected update your device firmware as described in section 3.6 Updating Adapter Firmware.



J-Link Silicon Labs (440050127)

Preferred SDK: Gecko SDK Suite v2.5.0: Bluetooth 2.11.0.0

Click here to change the preferred SDK.

Debug Mode: MCU Change

Adapter Firmware Version: 1v3p3b928 No local adapter firmware available. Download

3.3 Functionality in the Launcher Perspective

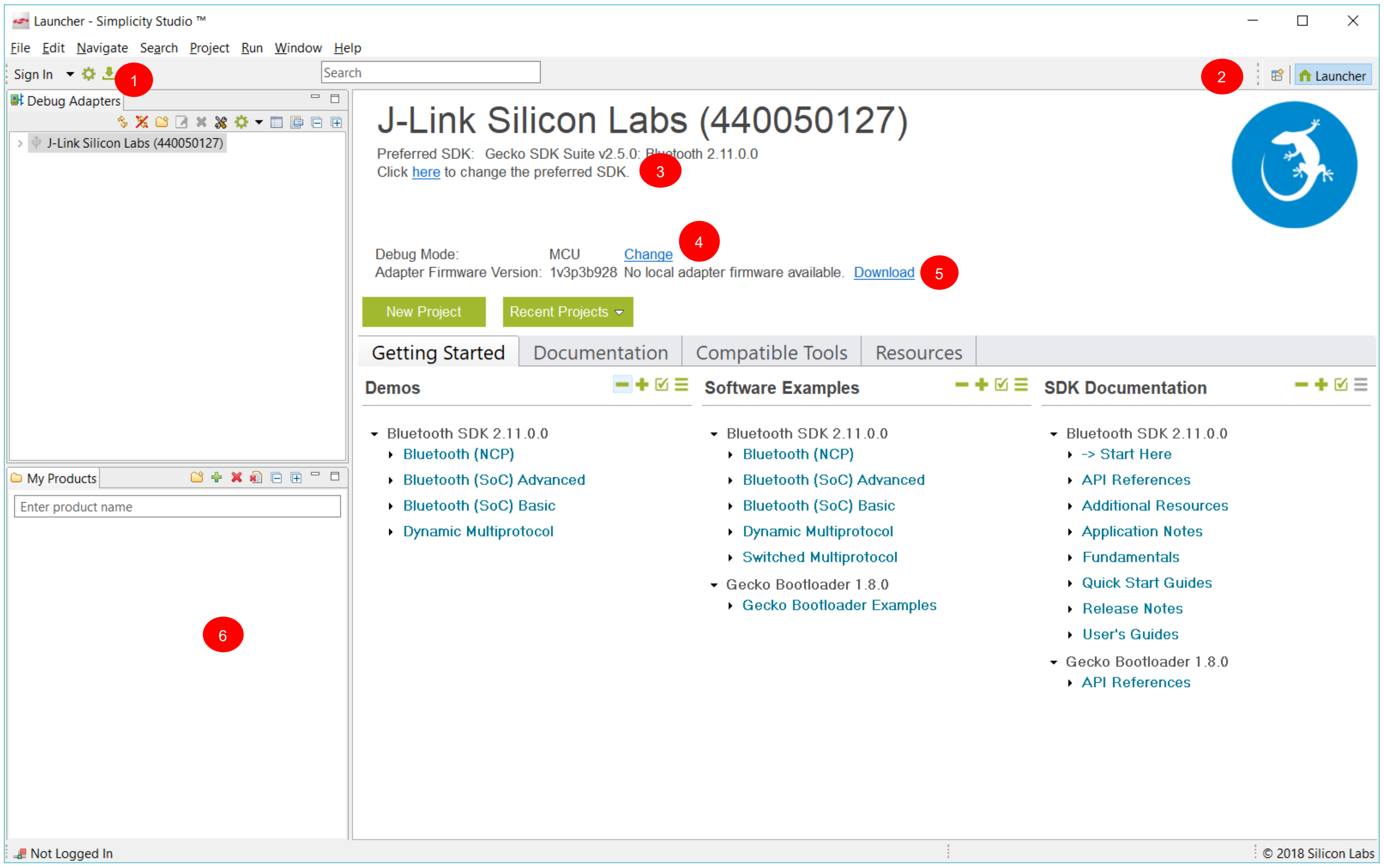
Perspectives are made up of a number of tiles or panes, called views, as well as the content in those views. You can perform a number of functions in the Launcher Perspective, as shown in the following figure. Additional information on some of these is provided later in the section. Note: Your installed version may be different than the version shown in the graphics in this section.

On the toolbar (1) you can:

- Sign in or out
- Open application settings ( )
- Update your software (, see section 3.4 Updating Software/New Elements for more information)
- Open the Tools menu ( ) to access tools such as Simplicity Commander or Energy Profiler.
- Search for information including entries in the Community forums.
- Change perspectives (2). As you open the Simplicity IDE or other tools, buttons for their perspectives are displayed in the upper right. Use those buttons to easily navigate back to the Launcher perspective or to other perspectives. You can change the layouts of various perspectives by expanding or relocating views, or adding or removing views. To return to the default layout, right-click the perspective button in the upper right and select **Reset**.

In the main view you can:

- Change your preferred SDK (3, see section 3.5 Changing the Preferred SDK for more information).
- Change debug mode (4) (displayed only if a device is connected).
- Update adapter firmware (5, displayed only if a device is connected, see section 3.6 Updating Adapter Firmware for more information).
- Create solutions of multiple parts (6). If you are developing for complex networks with a number of different parts involved, you can add them all to the solution and then select the one you are working on from the list. You do not need to have the hardware connected to your computer.
- Access demos, examples, documentation, and other resources from the Getting Started and other tabs (see section 3.7 Accessing Documentation and Other Resources for more information).



Preferred SDK: Gecko SDK Suite v2.5.0: Bluetooth 2.11.0.0
Click here to change the preferred SDK.

Debug Mode: MCU Change
Adapter Firmware Version: 1v3p3b928 No local adapter firmware available. Download

Demos
- Bluetooth SDK 2.11.0.0
  - Bluetooth (NCP)
  - Bluetooth (SoC) Advanced
  - Bluetooth (SoC) Basic
  - Dynamic Multiprotocol

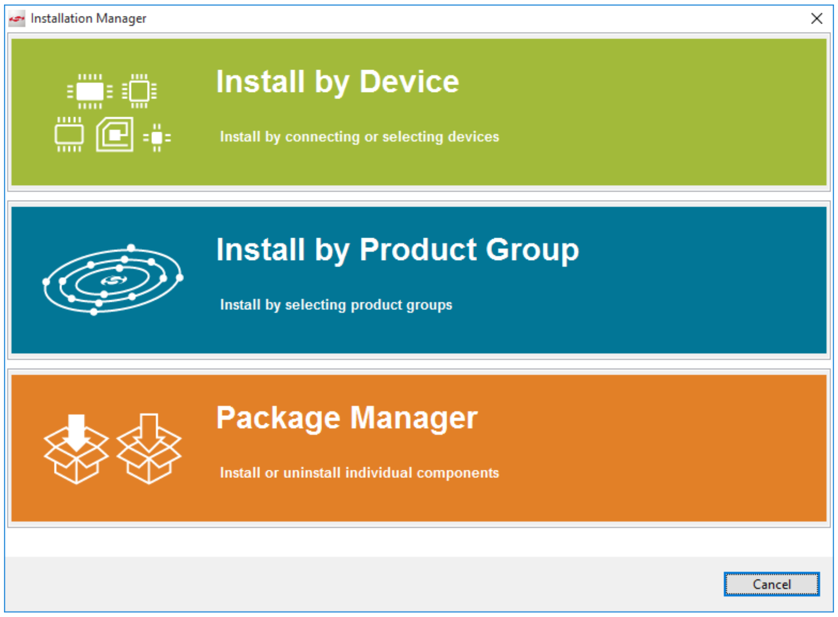
Software Examples
- Bluetooth SDK 2.11.0.0
  - Bluetooth (NCP)
  - Bluetooth (SoC) Advanced
  - Bluetooth (SoC) Basic
  - Dynamic Multiprotocol
  - Switched Multiprotocol
- Gecko Bootloader 1.8.0
  - Gecko Bootloader Examples

SDK Documentation
- Bluetooth SDK 2.11.0.0
  - -> Start Here
  - API References
  - Additional Resources
  - Application Notes
  - Fundamentals
  - Quick Start Guides
  - Release Notes
  - User's Guides
- Gecko Bootloader 1.8.0
  - API References

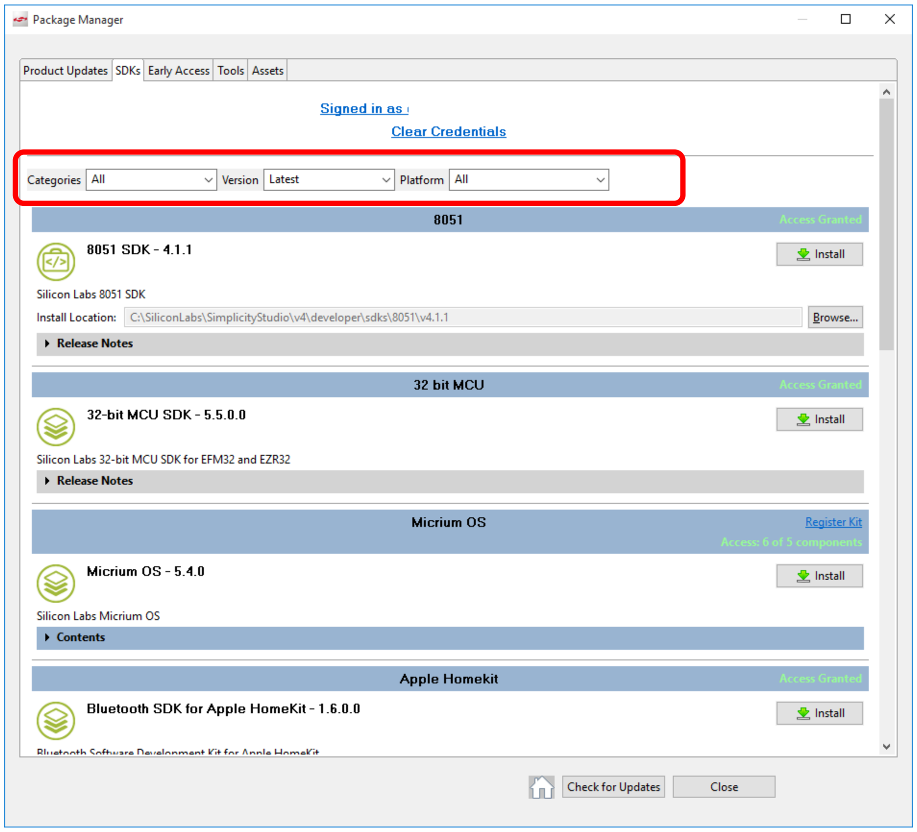
3.4 Updating Software/New Elements

The Update Software icon will be red if updates to installed components are available. If Simplicity Studio detects an available update, and you are in another perspective, you will be notified that an update is available.

To download a new or updated component, click the Update Software icon. Click Package Manager. Note: If you are installing based on a new device, or want to install a new product group, you can do so through this dialog as well. In subsequent dialogs, click Home (🏠) to return to this dialog. Note that Studio does not show you options, such as the GNU ARM Toolchain, that have already been installed.


Installation Manager
Install by Device
Install by connecting or selecting devices
Install by Product Group
Install by selecting product groups
Package Manager
Install or uninstall individual components
Cancel

Simplicity Studio shows you available updates or SDKs in the Package Manager dialog. You can update all or select individual updates for installation. Click the tabs in the Package Manager dialog to see other components available for installation. Use the filters to reduce long lists.



Categories: All | Version: Latest | Platform: All

8051 Access Granted
8051 SDK - 4.1.1
Silicon Labs 8051 SDK
Install Location: C:\SiliconLabs\SimplicityStudio\v4\developer\sdks\8051\v4.1.1

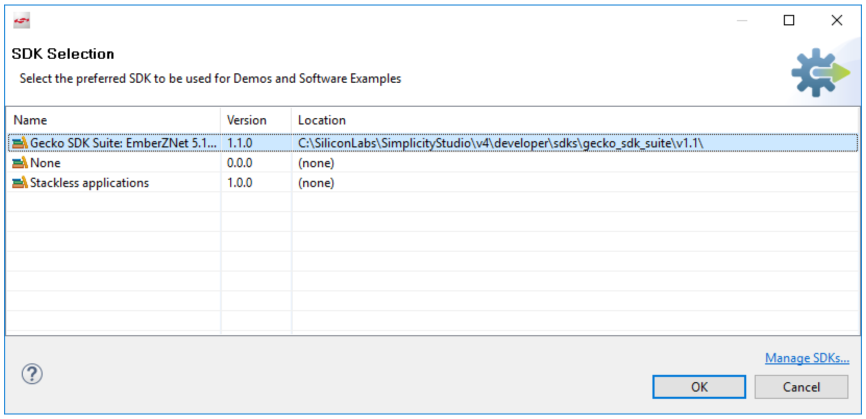
32 bit MCU Access Granted
32-bit MCU SDK - 5.5.0.0
Silicon Labs 32-bit MCU SDK for EFM32 and EZR32

Micrium OS Access: 6 of 5 components
Micrium OS - 5.4.0
Silicon Labs Micrium OS

Apple Homekit Access Granted
Bluetooth SDK for Apple HomeKit - 1.6.0.0
Bluetooth Software Development Kit for Apple HomeKit

3.5 Changing the Preferred SDK

Use this function if on startup Simplicity Studio defaults to Stackless applications. Otherwise, most Silicon Labs protocol stack users will have one SDK available to them, the Gecko SDK Suite.

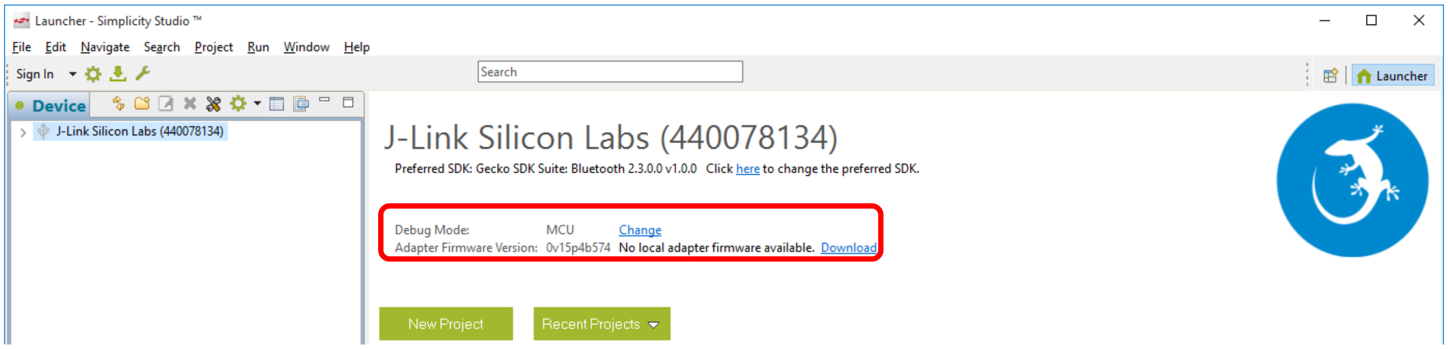

SDK Selection
Select the preferred SDK to be used for Demos and Software Examples

Name	Version	Location
Gecko SDK Suite: EmberZNet 5.1...	1.1.0	C:\SiliconLabs\SimplicityStudio\v4\developer\sdks\gecko_sdk_suite\v1.1\
None	0.0.0	(none)
Stackless applications	1.0.0	(none)

Within that suite you can have multiple protocols installed. The protocol used in any given instance is controlled either by the example you select, or the stack you select if you go through the ‘New Project’ interface. In general, you should add or remove protocol stacks through the Simplicity Studio update manager. If you need to install a stack or the Gecko SDK Suite outside of the normal installation process, you will receive separate instructions.

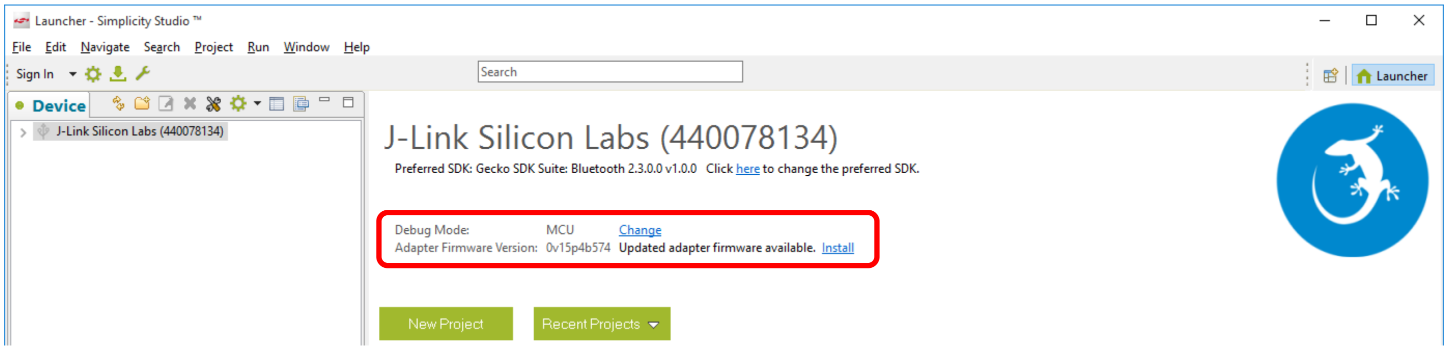
3.6 Updating Adapter Firmware

Initially the Launcher perspective may display “No local adapter firmware available.” Click **Download** to download any updates.


Launcher - Simplicity Studio ™
File Edit Navigate Search Project Run Window Help
Sign In
Search
Launcher
Device
J-Link Silicon Labs (440078134)
New Project
Recent Projects

J-Link Silicon Labs (440078134)
Preferred SDK: Gecko SDK Suite: Bluetooth 2.3.0.0 v1.0.0 Click here to change the preferred SDK.
Debug Mode: MCU Change
Adapter Firmware Version: 0v15p4b574 No local adapter firmware available. Download

If an update is available, click **Install** to install the firmware.

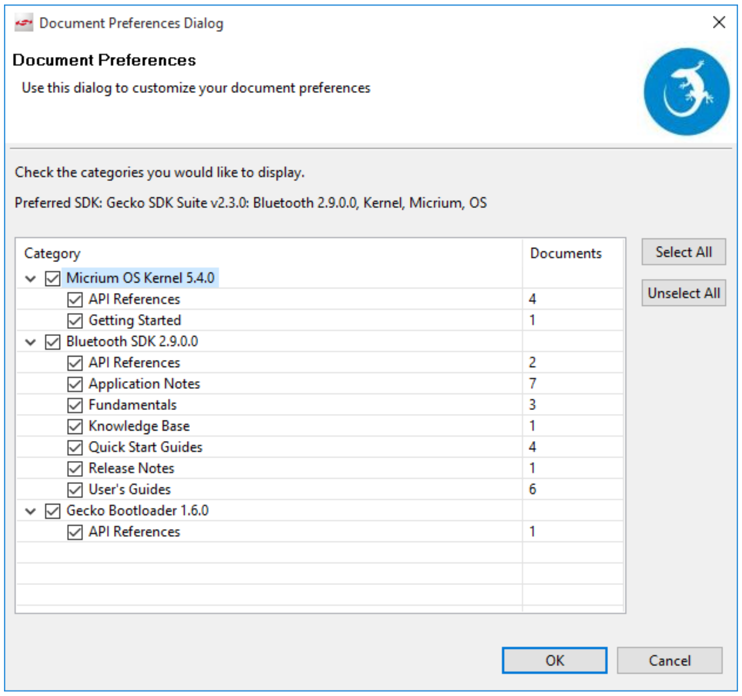

Launcher - Simplicity Studio ™
File Edit Navigate Search Project Run Window Help
Sign In
Search
Launcher
Device
J-Link Silicon Labs (440078134)
New Project
Recent Projects

J-Link Silicon Labs (440078134)
Preferred SDK: Gecko SDK Suite: Bluetooth 2.3.0.0 v1.0.0 Click here to change the preferred SDK.
Debug Mode: MCU Change
Adapter Firmware Version: 0v15p4b574 Updated adapter firmware available. Install

Once you have installed a current update, the version is displayed. Simplicity Studio will notify you if another firmware update is available.

3.7 Accessing Documentation and Other Resources

The **Getting Started** tab provides access to demos, example applications, and stack related documentation. To show/hide specific categories, click Customize (✓). Select or deselect categories, then click **OK**.



Document Preferences Dialog

Document Preferences

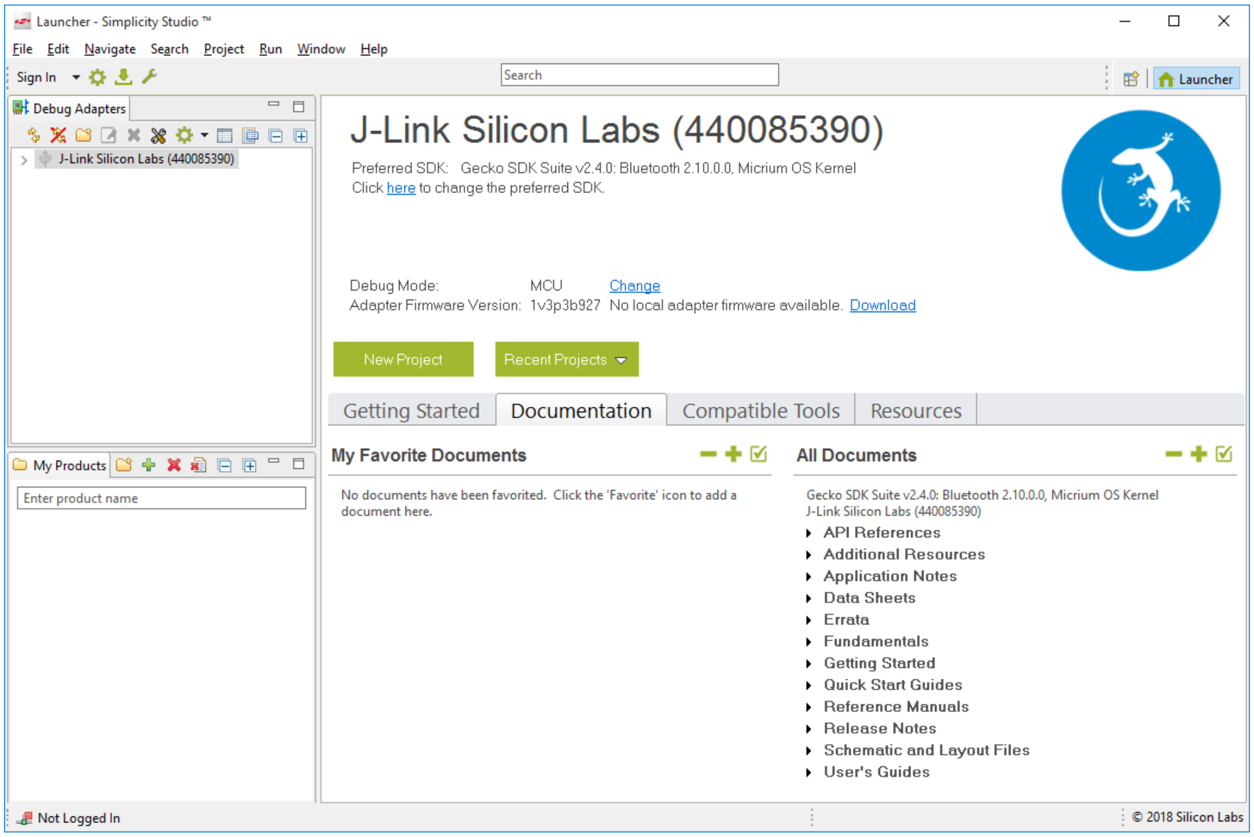
Use this dialog to customize your document preferences

Check the categories you would like to display.

Preferred SDK: Gecko SDK Suite v2.3.0: Bluetooth 2.9.0.0, Kernel, Micrium, OS

Category	Documents
☑ Micrium OS Kernel 5.4.0	
☑ API References	4
☑ Getting Started	1
☑ Bluetooth SDK 2.9.0.0	
☑ API References	2
☑ Application Notes	7
☑ Fundamentals	3
☑ Knowledge Base	1
☑ Quick Start Guides	4
☑ Release Notes	1
☑ User's Guides	6
☑ Gecko Bootloader 1.6.0	
☑ API References	1

The **Documentation** tab lists documentation about the stack and about the hardware on the right, and documents you selected as favorites on the left. Click the star icon on any document to show it in the My Favorite Documents list.



Launcher - Simplicity Studio ™

J-Link Silicon Labs (440085390)

Preferred SDK: Gecko SDK Suite v2.4.0: Bluetooth 2.10.0.0, Micrium OS Kernel
Click here to change the preferred SDK.

Debug Mode: MCU Change
Adapter Firmware Version: 1v3p3b927 No local adapter firmware available. Download

My Favorite Documents

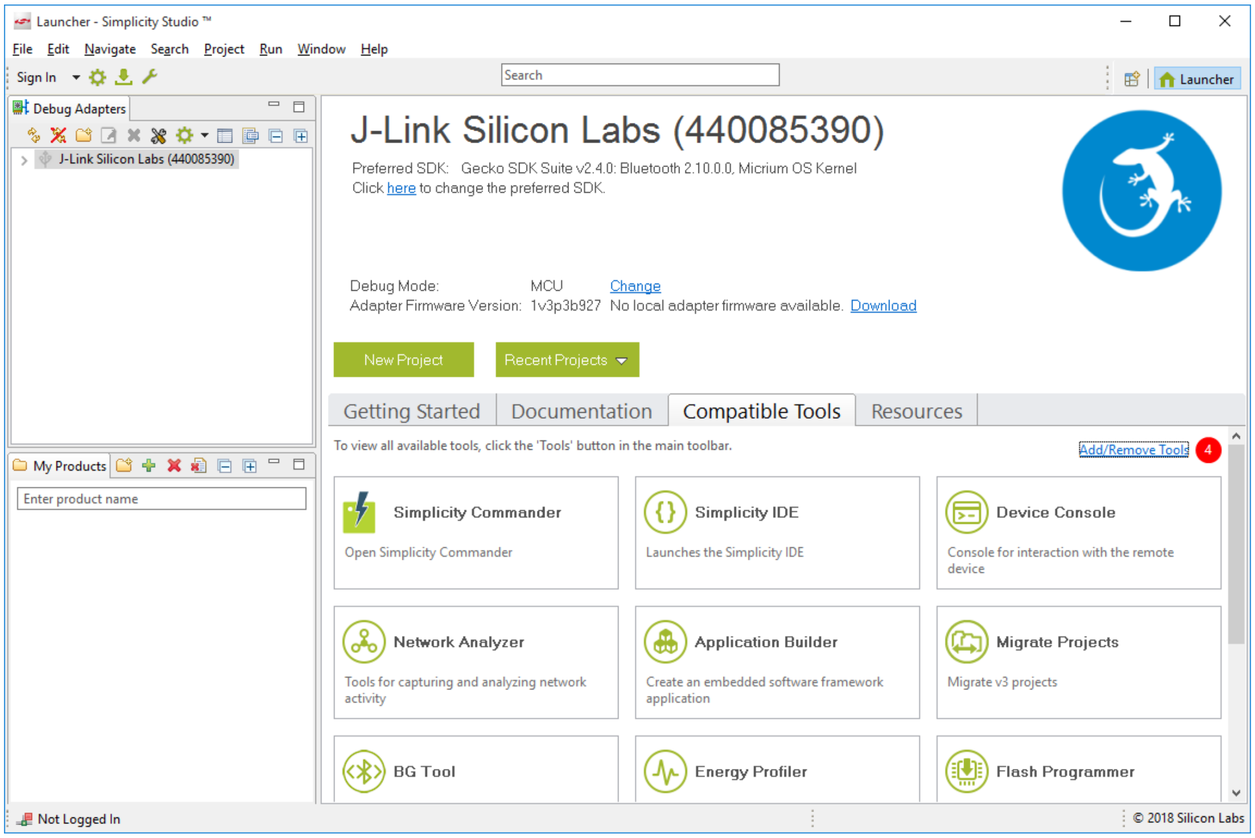
No documents have been favorited. Click the 'Favorite' icon to add a document here.

All Documents

Gecko SDK Suite v2.4.0: Bluetooth 2.10.0.0, Micrium OS Kernel
J-Link Silicon Labs (440085390)

- API References
- Additional Resources
- Application Notes
- Data Sheets
- Errata
- Fundamentals
- Getting Started
- Quick Start Guides
- Reference Manuals
- Release Notes
- Schematic and Layout Files
- User's Guides

The **Compatible Tools** tab is an alternative way to access the tools available through the Tools dropdown.



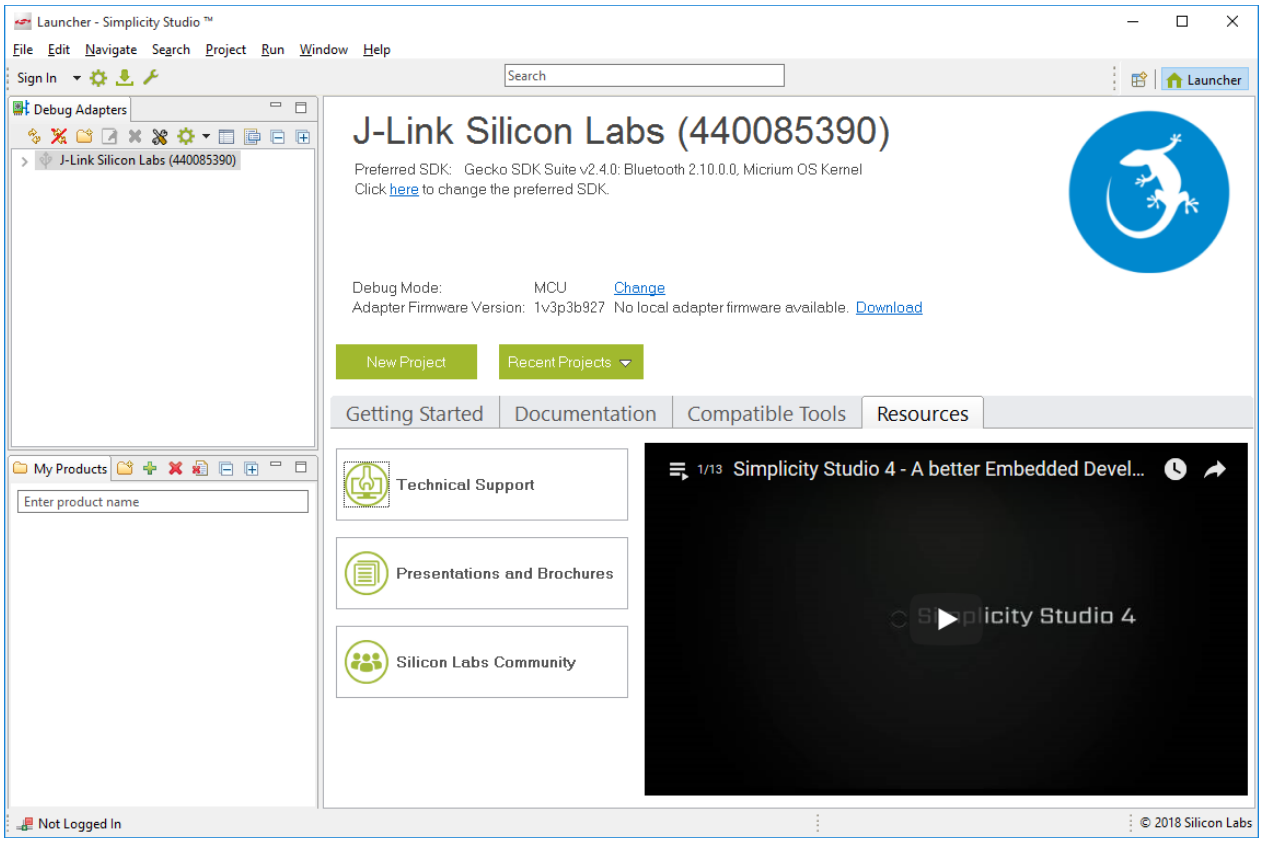
J-Link Silicon Labs (440085390)

Preferred SDK: Gecko SDK Suite v2.4.0: Bluetooth 2.10.0.0, Micrium OS Kernel
Click here to change the preferred SDK.

Debug Mode: MCU Change
Adapter Firmware Version: 1v3p3b927 No local adapter firmware available. Download

To view all available tools, click the 'Tools' button in the main toolbar.

The **Resources** tab provides access to support, marketing collateral, and the Silicon Labs community.



J-Link Silicon Labs (440085390)

Preferred SDK: Gecko SDK Suite v2.4.0: Bluetooth 2.10.0.0, Micrium OS Kernel
Click here to change the preferred SDK.

Debug Mode: MCU Change
Adapter Firmware Version: 1v3p3b927 No local adapter firmware available. Download

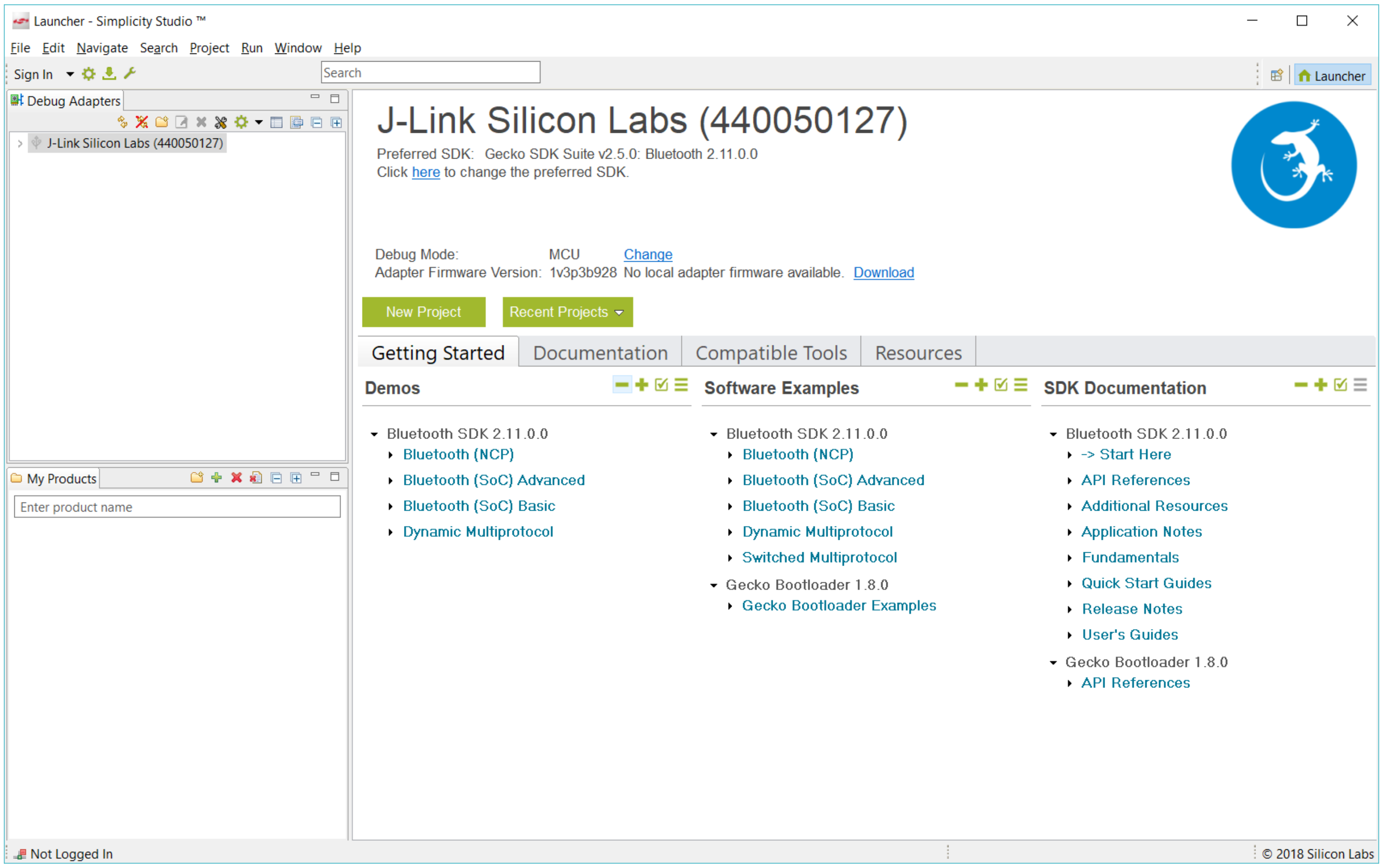
4 About Demos and Examples

Because starting application development from scratch is difficult, the Bluetooth SDK comes with a number of built-in demos and examples covering the most frequent use cases, as shown in the following figure. Demos are pre-built application images that you can run immediately. Software examples can be modified before building the application image. Demos with the same name as software examples are built from their respective example.

Note: The demos and examples you see are determined by the part selected. If you are using a custom solution with more than one part, click on the part you are working with to see only the items applicable to that part.

- To download and run a demo on your device, click the demo. In the Mode drop-down in the next dialog, select Run. Click **Start**. See section 5 Getting Started with Bluetooth Demo Software for more information about testing the demos.
- To import software example code into your workspace as a new project using default project configurations, click the name of the example to open the Simplicity Studio IDE. To build the example project click Debug ( ) in the upper left corner of the Simplicity IDE perspective. The Debug perspective opens. Click Play ( ) to start running you project on the device. To create a project with different configurations, click **New Project** (above the Demos column in the Launcher perspective), and proceed as described in section 6 Starting Application Development.

If an example project closely matches your needs, you need only extend the code with your application code, and rewrite only what must be customized for your needs. Otherwise you should start with the SOC-Empty application as described in section 6 Starting Application Development. Note that the 'SOC-Empty' application is not blank, but rather provides a minimal project that only starts advertising.



J-Link Silicon Labs (440050127)

Preferred SDK: Gecko SDK Suite v2.5.0: Bluetooth 2.11.0.0
Click here to change the preferred SDK.

Debug Mode: MCU Change
Adapter Firmware Version: 1v3p3b928 No local adapter firmware available. Download

Demos	Software Examples	SDK Documentation
Bluetooth SDK 2.11.0.0	Bluetooth SDK 2.11.0.0	Bluetooth SDK 2.11.0.0
Bluetooth (NCP)	Bluetooth (NCP)	-> Start Here
Bluetooth (SoC) Advanced	Bluetooth (SoC) Advanced	API References
Bluetooth (SoC) Basic	Bluetooth (SoC) Basic	Additional Resources
Dynamic Multiprotocol	Dynamic Multiprotocol	Application Notes
	Switched Multiprotocol	Fundamentals
	Gecko Bootloader 1.8.0	Quick Start Guides
	Gecko Bootloader Examples	Release Notes
		User's Guides
		Gecko Bootloader 1.8.0
		API References

4.1 Demo/Example Descriptions

The following examples are provided. Examples with (*) in their names have a matching pre-built demo.

- **Silicon Labs Gecko Bootloader examples** (see UG266: Silicon Labs Gecko Bootloader User Guide and AN1086: Using the Gecko Bootloader with Silicon Labs Bluetooth Applications)
- **Bluetooth Examples**
  - **Bluetooth (NCP)**
    - **NCP – Host**: NCP (Network co-processor) Host example that connects to an NCP target via USART. It demonstrates the usage of BGLib with or without USART flow-control. This example does not have a Bluetooth function over the radio as it uses the EFR32 only as a host device.
    - **NCP target – Empty(*)**: Network co-processor target application with a minimal GATT database. Use this as a starting point to create an NCP firmware. An NCP device can be controlled from another (host) device or directly from your PC with BGTool. This example together with BG Tool provides an easy way to get started and also debug your application by issuing commands to the stack step-by-step.
  - **Bluetooth (SOC – Basic)**
    - **SOC – Empty(*)**: A minimal project structure, used as a starting point for custom applications. The project has the basic functionality enabling peripheral connectivity and contains a minimal GATT database that can be expanded to fit your application requirements.
    - **SOC – iBeacon(*)**: An iBeacon device implementation that sends non-connectible advertisements in iBeacon format. The iBeacon Service gives Bluetooth accessories a simple and convenient way to send iBeacons to iOS devices. This example demonstrates the power consumption at 0 dBm TX power.
    - **SOC – Thermometer – Client**: Implements a Client that discovers and connects up to 4 BLE devices advertising themselves as Thermometer Servers. It displays the discovery process and the temperature values received via UART.
    - **SOC – Thermometer(*)**: Implements the Thermometer (GATT Server) Role of the Health Thermometer Profile, which enables a Collector device to connect and interact with a Thermometer.

      Note: Some radio boards will exhibit random pixels in in the display when this example is running because they have a shared pin for sensor and display enable signals.
  - **Bluetooth (SOC – Advanced)**
    - **SOC – DTM**: Used to run Bluetooth DTM (direct test mode) tests for radio testing. See AN1046: Bluetooth® Radio Frequency Physical Layer Evaluation for more information.
    - **SOC – Thermometer - RTOS**: The SOC - Thermometer example based on Micrium RTOS.
  - **Thunderboard**
    - **SOC - Thunderboard React, - Thunderboard Sense, and - Thunderboard Sense 2(*)**: Examples used to show the applicable Thunderboard features.
    - **SOC - Voice over Bluetooth Low Energy:** Demonstrates how voice capture can be sent over a Bluetooth Low Energy Link.
- **Dynamic Multiprotocol Examples** (see AN1134: Dynamic Multiprotocol Development with Bluetooth and Proprietary Protocols on RAIL for more information)
  - **SOC - Empty - RAIL – DMP(*):** A minimal project structure, used as a starting point for custom Dynamic Multiprotocol applications. The project has the basic functionality enabling peripheral connectivity, without GATT services. It runs on top of Micrium OS RTOS and multiprotocol RAIL.
  - **SOC - Light - RAIL – DMP(*):** Implements the Light (GATT Server) Role, which enables a Switch device to connect to and interact with it. The device acts as a connection Peripheral. This is a Dynamic Multiprotocol reference application, running on top of Micrium OS RTOS and multiprotocol RAIL. To learn how to test this demo see QSG155: Using the Silicon Labs Dynamic Multiprotocol Demonstration Applications.
  - **SOC - Range Test - RAIL - DMP(*)**: Range Test with Bluetooth connectivity. It runs on top of Micrium OS RTOS and multiprotocol RAIL.
- **NCP Host Examples (**located in C:\SiliconLabs\SimplicityStudio\v4\developer\sdks\gecko_sdk_suite\<version>\app\bluetooth\examples_ncp_host)
  - **Empty:** Minimal host-side project structure, used as a starting point for NCP host applications.
  - **ota-dfu:** Demonstrates how to perform an OTA DFU on a Silicon Labs Bluetooth Device. It requires a WSTK with a radio board flashed with an NCP firmware to be used as the GATT client that performs the OTA.
  - **uart-dfu:** Demonstrates how to perform a UART DFU on a Silicon Labs Bluetooth Device running NCP firmware.
  - **Voice over Bluetooth Low Energy:** Client-side application that couples with the “SOC – Voice over Bluetooth Low Energy” for the Thunderboard Sense and Thunderboard Sense 2 kits. It requires a WSTK with a radio board flashed with an NCP firmware. For information on how to test this example see the Knowledge Base Article “How to use Voice over Bluetooth Low Energy example for Thunderboard Sense”.

5 Getting Started with Bluetooth Demo Software

The Blue Gecko Bluetooth Wireless Starter Kit is meant to help you evaluate Silicon Labs' Bluetooth modules and get you started with your own software development. The kits come in different versions with different module radio boards. See https://www.silabs.com/products/development-tools/wireless/bluetooth/bluegecko-bluetooth-low-energy-module-wireless-starter-kit for details on the current configurations.

To get started with Bluetooth demo software, you should have downloaded Simplicity Studio and the Bluetooth SDK as described in section 3 Getting Started with Simplicity Studio and the Bluetooth SDK. The Bluetooth SDK comes with some prebuilt demos that can be flashed to your EFR32 device, and tested using a Smartphone. This section describes how to test three prebuilt demos on both Android and iOS devices:

- SoC – Empty demo
- iBeacon demo
- Health Thermometer demo

5.1 Prepare the WSTK

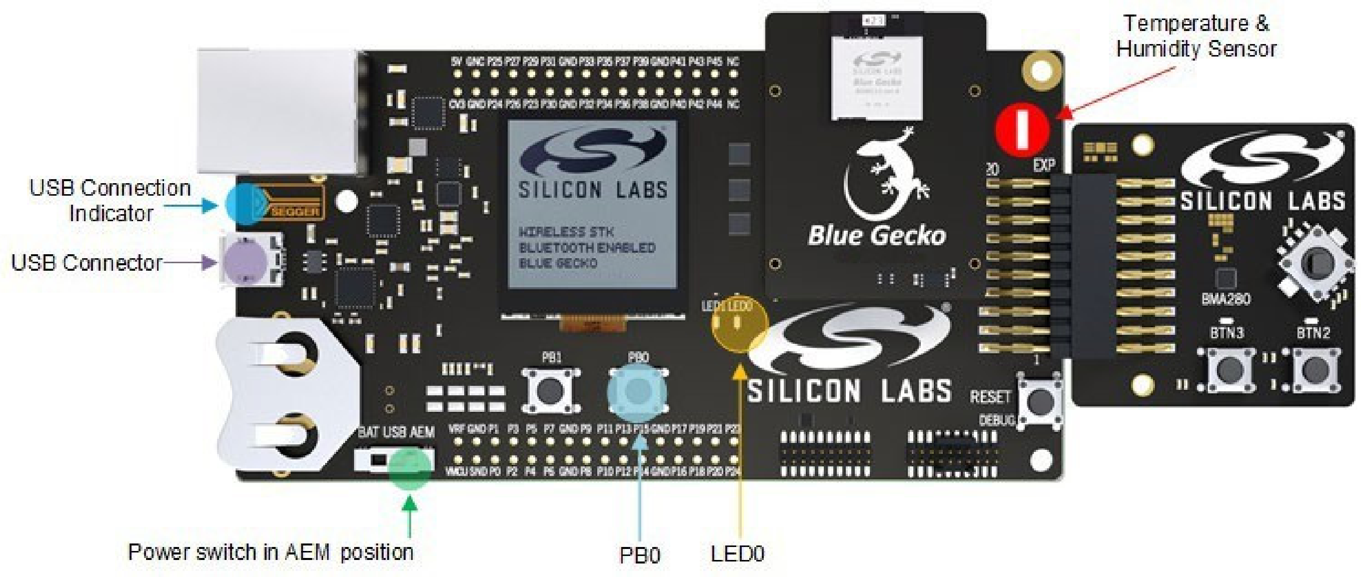
1. Connect a Bluetooth Module Radio Board to the WSTK Main Board as shown in the following figure.
2. Connect the WSTK to a PC using the **Main Board USB** connector.
3. Turn the **Power switch** to **"AEM"** position.

Note: At this stage you might be prompted to install the drivers for the WSTK Main Board but you can skip this for now.

4. Check that the blue **USB Connection Indicator** LED turns on or starts blinking.
5. Check that the Main Board LCD display turns on and displays a Silicon Labs logo.

Before starting to test the demo application note the following parts on the WSTK Main Board

- Temperature & Humidity Sensor
- PB0 button
- LED0



5.2 Flash the Demo

- With your device connected as described above, open Simplicity Studio.
- Select your device in the Debug Adapters pane.
- Under the Demos column, open the Bluetooth (SoC) Basic group and select the desired demo.

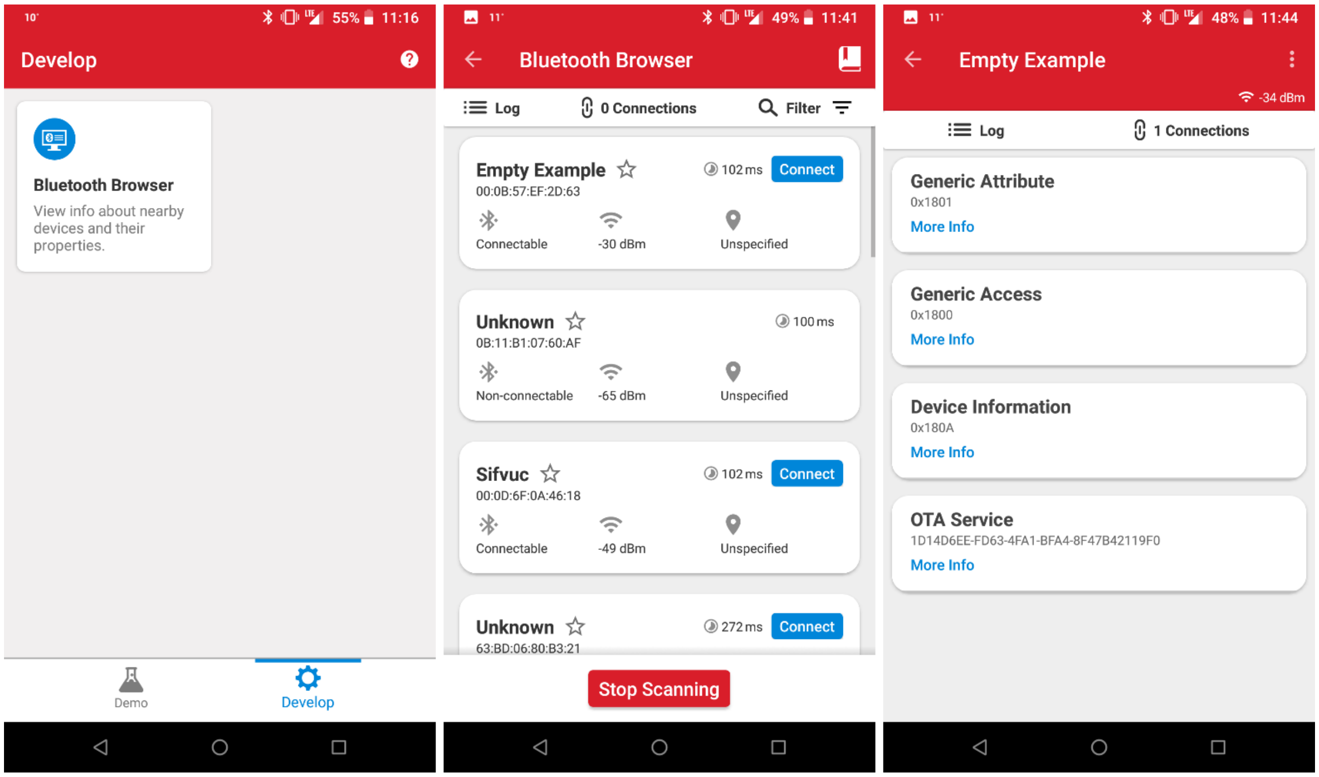
- In the Mode drop-down in the next dialog, select Run. Click **Start.**

5.3 Test the Bluetooth Demos Using an Android Smartphone

5.3.1 Testing the SoC - Empty Demo

After flashing SoC - Empty demo to your device, the device automatically starts advertising itself as "Empty Example", and makes it possible to connect to it by other Bluetooth devices.

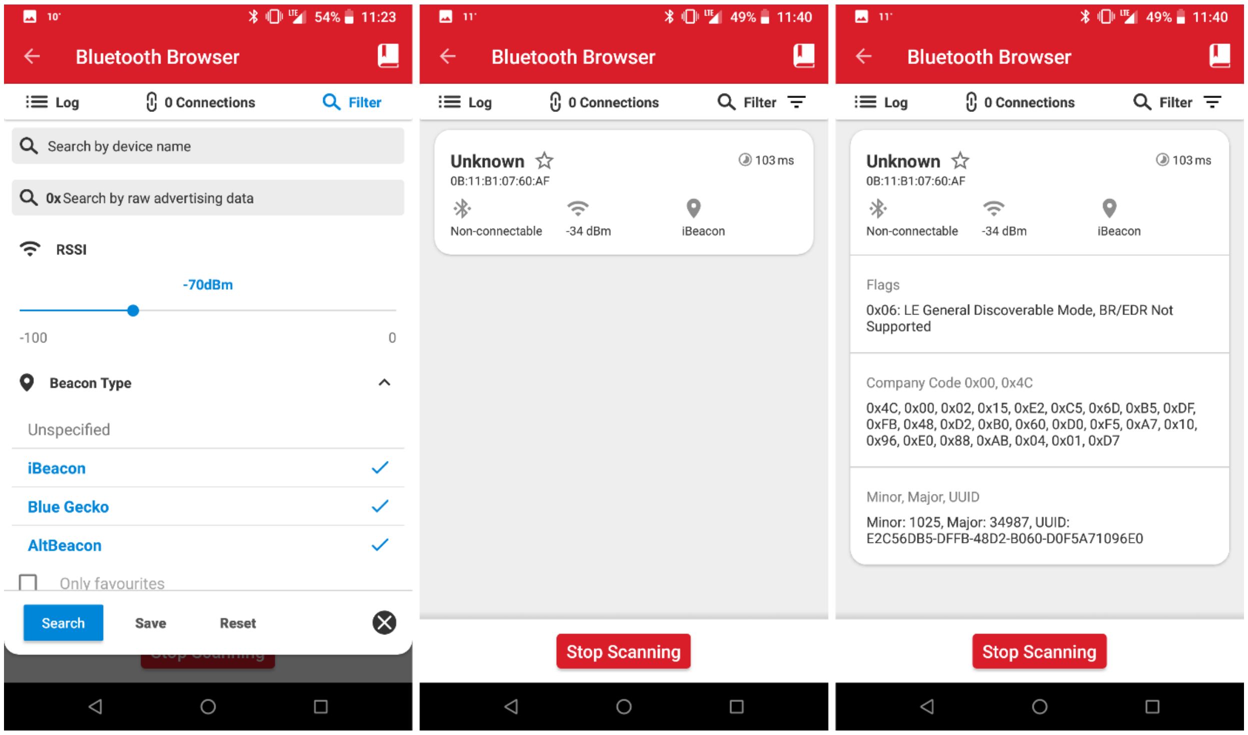
Install the **EFR Connect** app from Google Play Store, and open it. To find your advertising device, tap the Develop tab, and tap **Bluetooth Browser**. This shows all advertising devices nearby. Connect to your device by tapping **Connect** next to "Empty Example". Its GATT database is automatically discovered and displayed. Tap any service to list its characteristics and tap any characteristic to read its value.



5.3.2 Testing the iBeacon Demo

Bluetooth beacons are unconnectable advertisements that help you locate a device, determine your own position, or get minimal information about an asset the beaconing device is attached to.

After flashing the **iBeacon** demo to your device, you can find the beacon signal with the **Bluetooth Browser** in the **EFR Connect** app. Start **EFR Connect**, tap the Develop tab, and tap **Bluetooth Browser**. To filter beacons, tap Filter, and select the beacon types you want to be displayed. The app provides you with basic information about the beacon, like RSSI - which can help determine the distance of the beacon. Tap the beacon to get more information about the data it provides.



Unknown
0B:11:B1:07:60:AF
103 ms
Non-connectable
-34 dBm
iBeacon

Flags
0x06: LE General Discoverable Mode, BR/EDR Not Supported

Company Code 0x00, 0x4C
0x4C, 0x00, 0x02, 0x15, 0xE2, 0xC5, 0x6D, 0xB5, 0xDF, 0xFB, 0x48, 0xD2, 0xB0, 0x60, 0xD0, 0xF5, 0xA7, 0x10, 0x96, 0xE0, 0x88, 0xAB, 0x04, 0x01, 0xD7

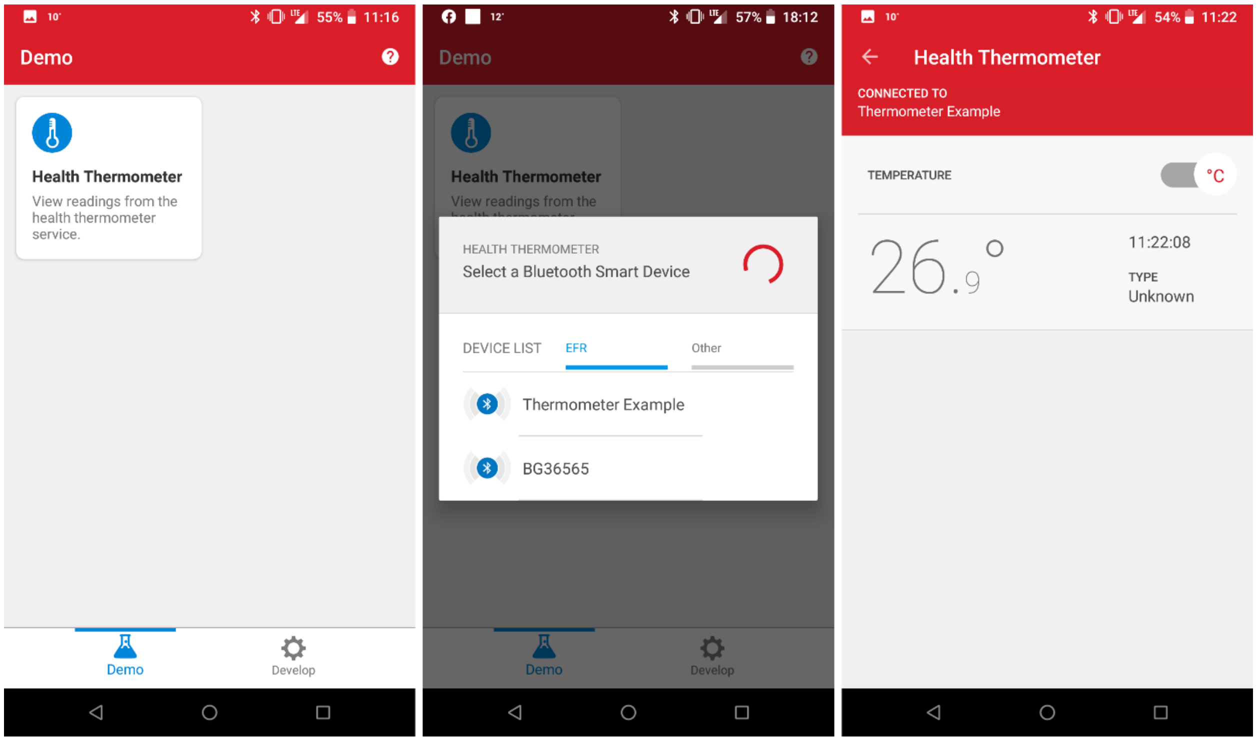
Minor, Major, UUID
Minor: 1025, Major: 34987, UUID: E2C56DB5-DFFB-48D2-B060-D0F5A71096E0

5.3.3 Testing the Health Thermometer Demo

While the SoC - Empty demo implements a minimal GATT database with basic static information like device name, the Health Thermometer demo extends this database with live temperature measurements.

After flashing the **Health Thermometer** demo to your device, start **EFR Connect**, tap the Demo tab, and tap **Health Thermometer**. Find your device advertising as Thermometer Example in the device list, and tap it to connect. The smartphone app automatically finds the Temperature measurement characteristic of the device, reads its value periodically, and displays the value on the screen of the phone.

Try touching the temperature sensor located on the WSTK (see section 5.1 Prepare the WSTK). You should be able to see the temperature changing.

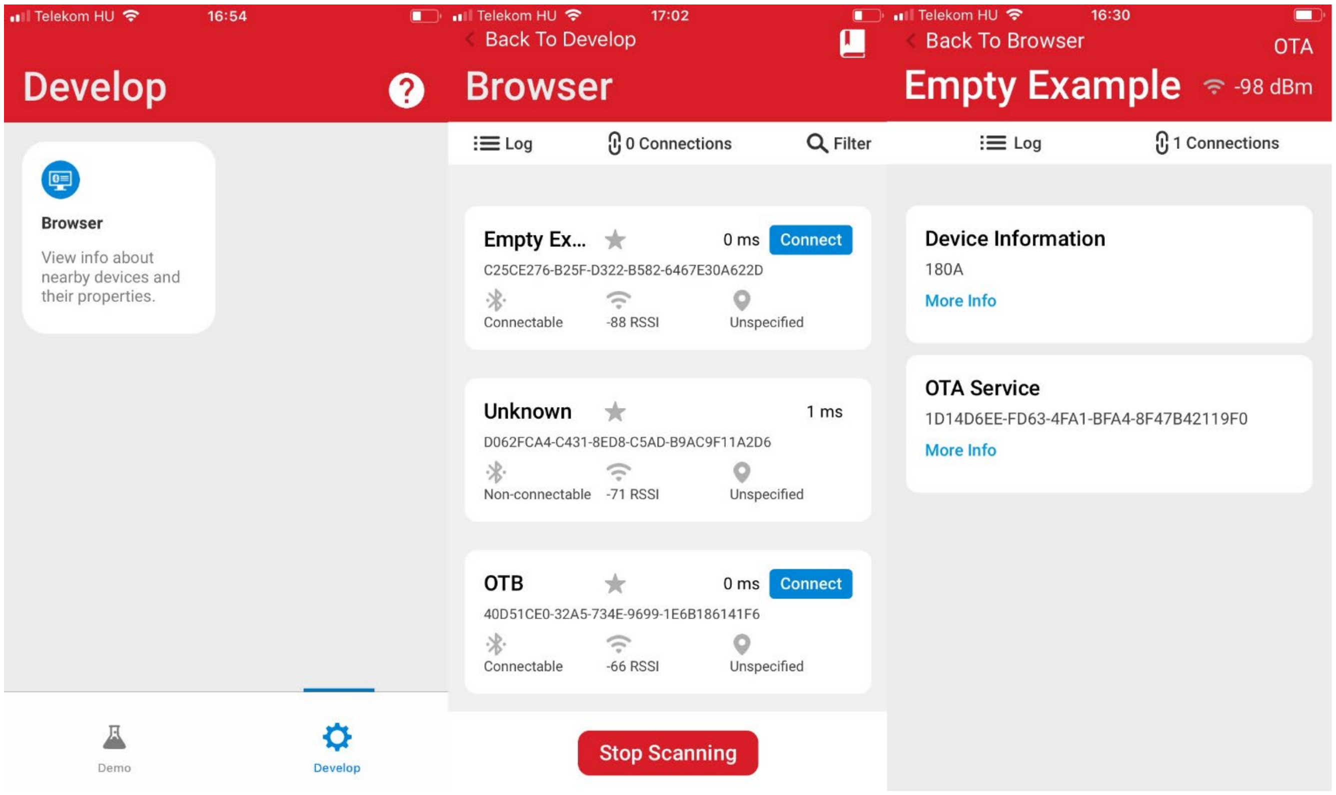


5.4 Testing the Bluetooth Demos Using an iOS Smartphone

5.4.1 Testing the SoC - Empty Demo

After flashing SoC - Empty demo to your device, the device automatically starts advertising itself as "Empty Example", and makes it possible to connect to it by other Bluetooth devices.

Install the **EFR Connect** app from the Apple App Store, and open it. To find your advertising device, tap the Develop tab, and tap **Bluetooth Browser**. This shows all advertising devices nearby. Connect to your device by tapping **Connect** next to "Empty Example". Its GATT database is automatically discovered and displayed. Tap any service to list its characteristics and tap any characteristic to read its value.



Empty Ex...	0 ms	Connect	
C25CE276-B25F-D322-B582-6467E30A622D			
Connectable	-88 RSSI	Unspecified	
Unknown	1 ms		
D062FCA4-C431-8ED8-C5AD-B9AC9F11A2D6			
Non-connectable	-71 RSSI	Unspecified	
OTB	0 ms	Connect	
40D51CE0-32A5-734E-9699-1E6B186141F6			
Connectable	-66 RSSI	Unspecified	

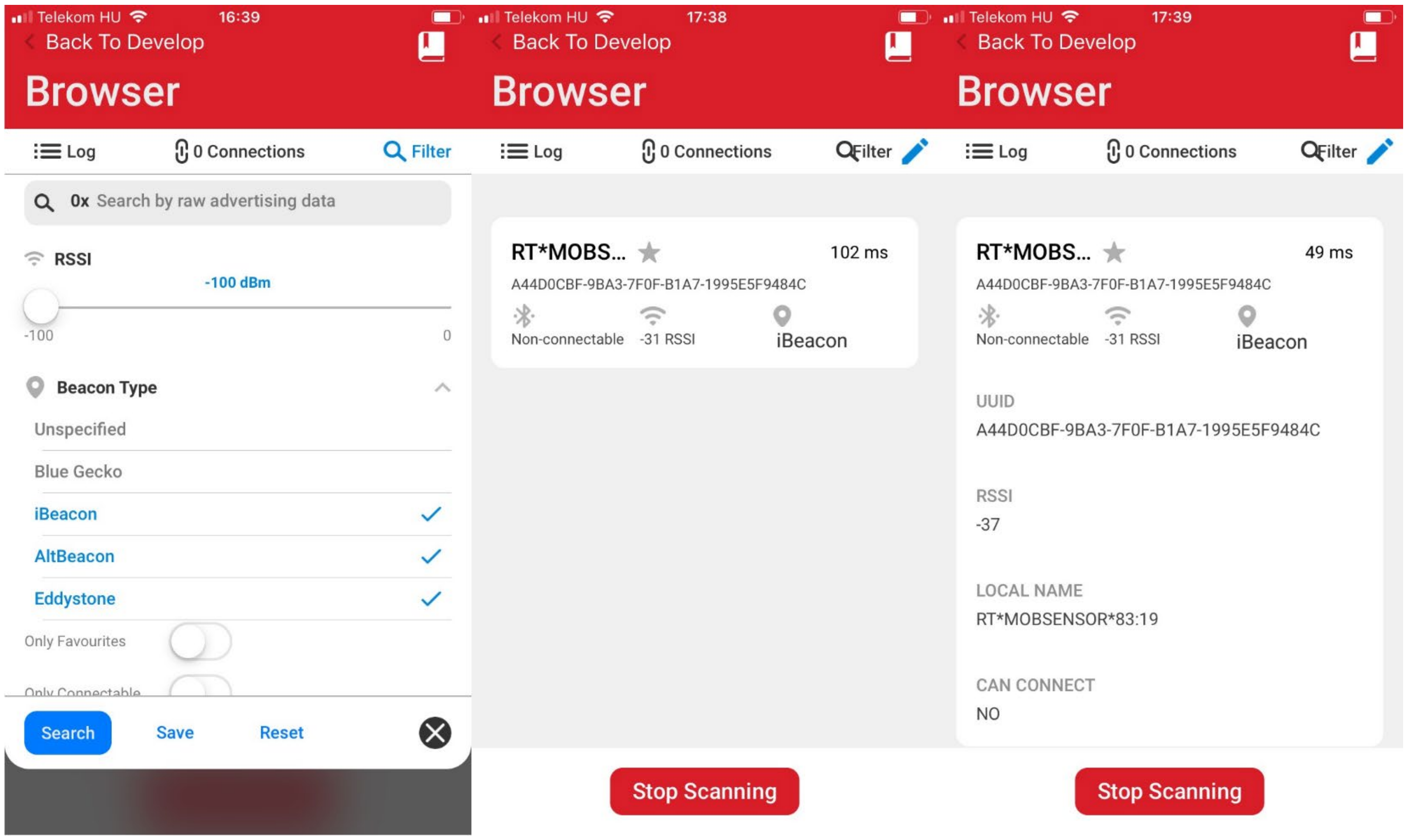
Device Information
180A
More Info

OTA Service
1D14D6EE-FD63-4FA1-BFA4-8F47B42119F0
More Info

5.4.2 Testing the iBeacon Demo

Bluetooth beacons are unconnectable advertisements that help you locate a device, determine your own position, or get minimal information about an asset the beaconing device is attached to.

After flashing the **iBeacon** demo to your device, you can find the beacon signal with the **Bluetooth Browser** in the **EFR Connect** app. Start **EFR Connect**, tap the Develop tab, and tap **Bluetooth Browser**. To filter beacons, tap Filter , and select the beacon types you want to be displayed. The app provides you with basic information about the beacon, like RSSI - which can help determine the distance of the beacon. Tap the beacon to get more information about the data it provides.



UUID
A44D0CBF-9BA3-7F0F-B1A7-1995E5F9484C

RSSI
-37

LOCAL NAME
RT*MOBSENSOR*83:19

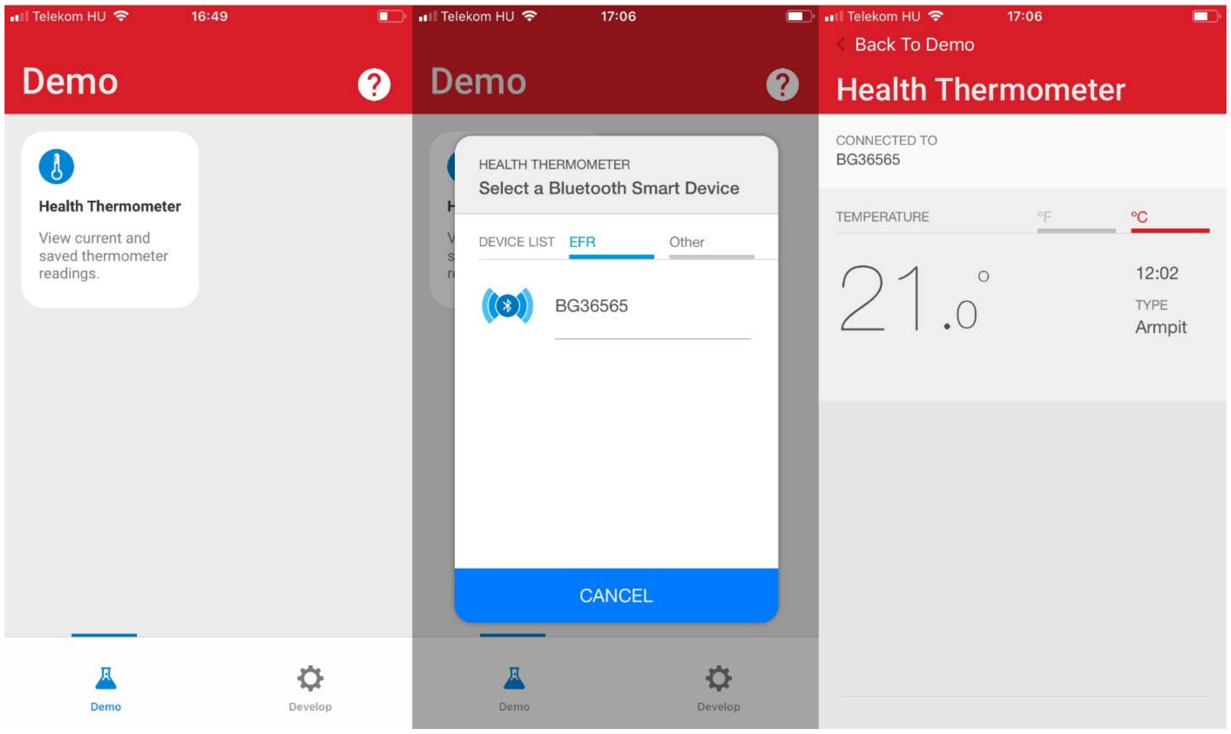
CAN CONNECT
NO

5.4.3 Testing the Health Thermometer Demo

While the SoC - Empty demo implements a minimal GATT database with basic static information like device name, the Health Thermometer demo extends this database with live temperature measurements.

After flashing the **Health Thermometer** demo to your device, start **EFR Connect**, tap the Demo tab, and tap **Health Thermometer**. Find your device advertising as Thermometer Example in the device list, and tap it to connect. The smartphone app automatically finds the Temperature measurement characteristic of the device, reads its value periodically, and displays the value on the screen of the phone.

Try touching the temperature sensor located on the WSTK (see section 5.1 Prepare the WSTK). You should be able to see the temperature changing.



6 Starting Application Development

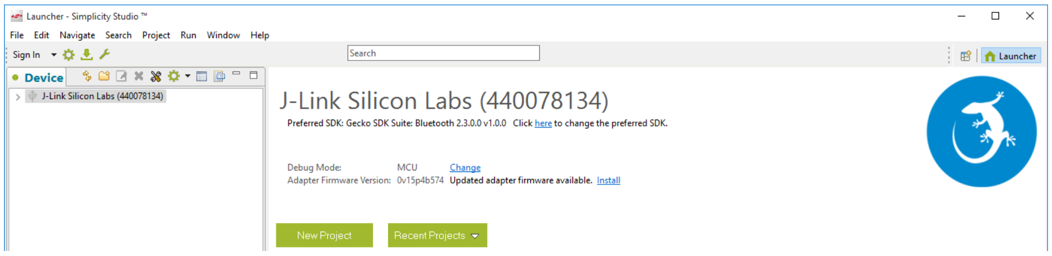
Developing a Bluetooth application consists of two main steps: defining the GATT database structure, and defining the event handlers for events such as `connection_opened`, `connection_closed`, and so on.

The most common starting point for application development is the **SOC – Empty** example. This project contains a simple GATT database (including the Generic Access service, Device Information service, and OTA service) and a while loop that handles some events raised by the stack. You can extend both the GATT database and the event handlers of this example according to your needs.

Note: Beginning with Bluetooth SDK version 2.7.0.0, all devices must be loaded with the Gecko Bootloader as well as the application. While you are getting started, the easiest way to do this is to load any of the precompiled demo images, which come with the bootloader configured as part of the image. When you flash your application it overwrites the demo application, but the bootloader remains. Subsequently you may wish to build your own bootloader, as described in *UG266: Silicon Labs Gecko Bootloader User Guide*. The first bootloader loaded on a clean device should always be the combined bootloader.

To start developing your application, follow these steps (illustrated in the following figure). **Note:** Your SDK version may be later than the version shown in the procedure illustrations. :

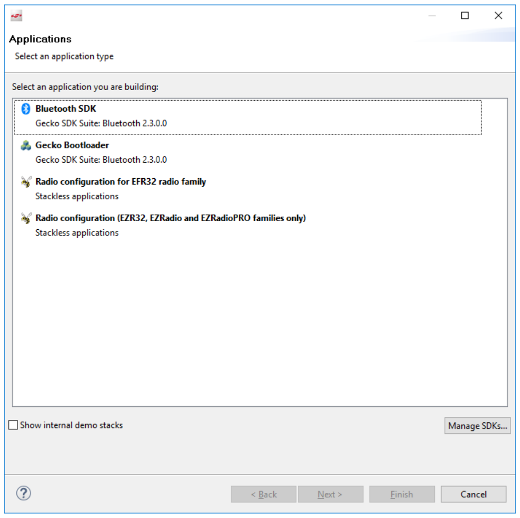
1. Click **New Project** in the Launcher perspective.
2. Select Bluetooth SDK and click **Next**.
3. Select **SoC – Empty** and click **Next**.
4. Name your project and click **Next**.
5. Verify that your selected part is shown, and select your preferred toolchain. Note: You should only select one toolchain. If you are using GCC, you must uncheck IAR. Otherwise the system will revert to IAR when you generate your files. Click **Finish**.



J-Link Silicon Labs (440078134)

Preferred SDK: Gecko SDK Suite: Bluetooth 2.3.0.0 v1.0.0 Click here to change the preferred SDK.

Debug Mode: MCU Change
Adapter Firmware Version: 0v15p4b574 Updated adapter firmware available. Install



Applications
Select an application type

Select an application you are building:

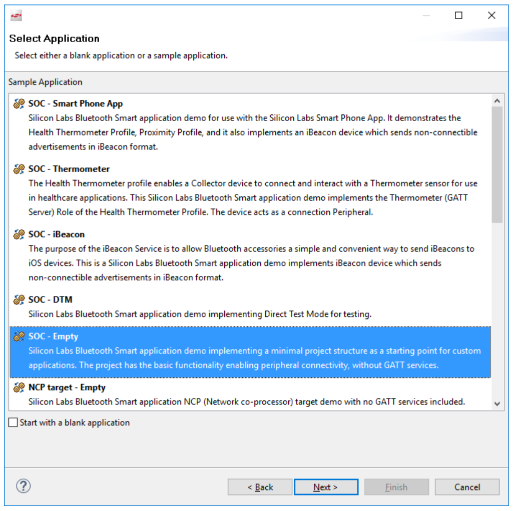
Bluetooth SDK
Gecko SDK Suite: Bluetooth 2.3.0.0

Gecko Bootloader
Gecko SDK Suite: Bluetooth 2.3.0.0

Radio configuration for EFR32 radio family
Stackless applications

Radio configuration (EZR32, EZRadio and EZRadioPRO families only)
Stackless applications

☐ Show internal demo stacks



Select Application
Select either a blank application or a sample application.

Sample Application

SOC - Smart Phone App
Silicon Labs Bluetooth Smart application demo for use with the Silicon Labs Smart Phone App. It demonstrates the Health Thermometer Profile, Proximity Profile, and it also implements an iBeacon device which sends non-connectible advertisements in iBeacon format.

SOC - Thermometer
The Health Thermometer profile enables a Collector device to connect and interact with a Thermometer sensor for use in healthcare applications. This Silicon Labs Bluetooth Smart application demo implements the Thermometer (GATT Server) Role of the Health Thermometer Profile. The device acts as a connection Peripheral.

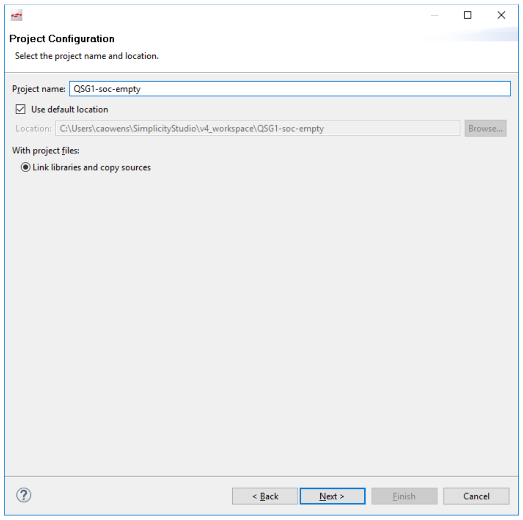
SOC - iBeacon
The purpose of the iBeacon Service is to allow Bluetooth accessories a simple and convenient way to send iBeacons to iOS devices. This is a Silicon Labs Bluetooth Smart application demo implements iBeacon device which sends non-connectible advertisements in iBeacon format.

SOC - DTM
Silicon Labs Bluetooth Smart application demo implementing Direct Test Mode for testing.

SOC - Empty
Silicon Labs Bluetooth Smart application demo implementing a minimal project structure as a starting point for custom applications. The project has the basic functionality enabling peripheral connectivity, without GATT services.

NCP target - Empty
Silicon Labs Bluetooth Smart application NCP (Network co-processor) target demo with no GATT services included.

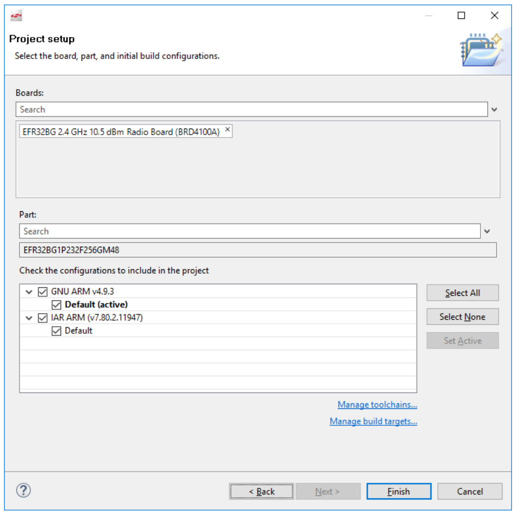
☐ Start with a blank application



Project Configuration
Select the project name and location.

Project name: QSG1-soc-empty
☑ Use default location
Location: C:\Users\caowens\SimplicityStudio\v4_workspace\QSG1-soc-empty

With project files:
● Link libraries and copy sources



Project setup
Select the board, part, and initial build configurations.

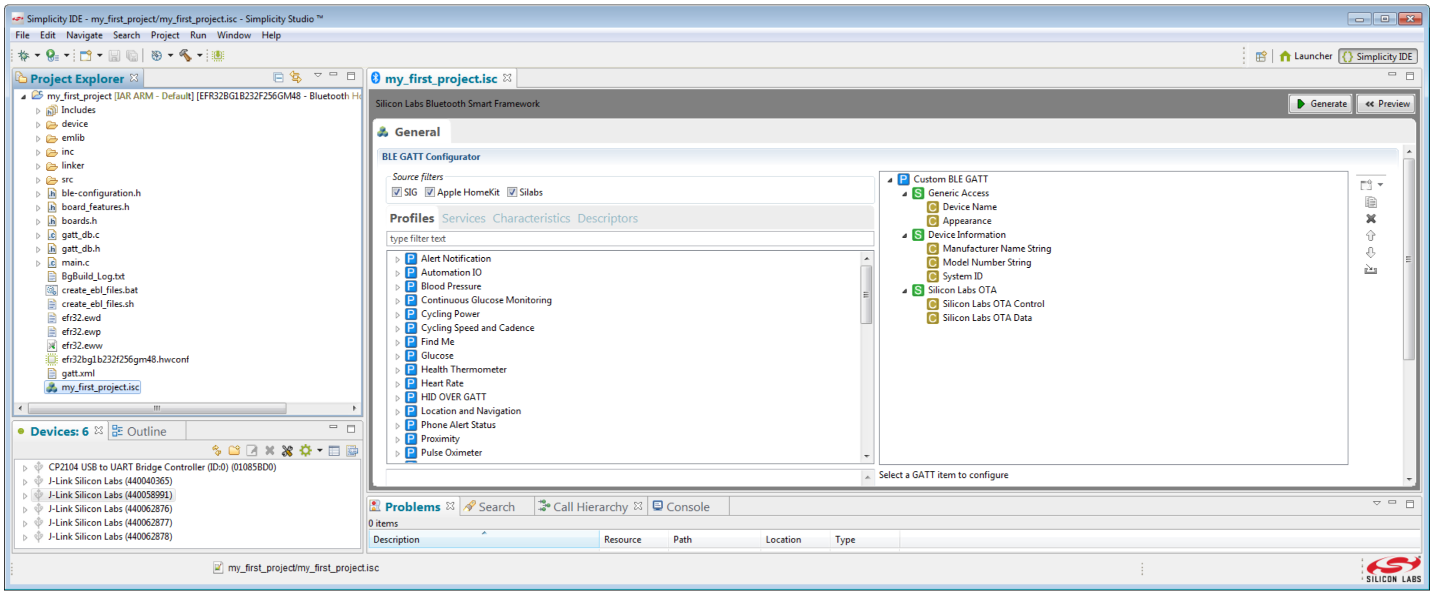
Boards:
EFR32BG 2.4 GHz 10.5 dBm Radio Board (BRD4100A)

Part:
EFR32BG1P232F256GM48

Check the configurations to include in the project
☑ GNU ARM v4.9.3
☑ Default (active)
☑ IAR ARM (v7.80.2.11947)
☑ Default

A visual GATT Configurator automatically appears after creating the project, to help you create your own GATT database with a few clicks. Note that a Simplicity IDE perspective button is now included in the upper right of the screen.

You can create your own database at this point, or return to it later by clicking the .isc file in the Project Explorer pane on the left. For more information, see section 7.1 The GATT Configurator.



Simplicity IDE - my_first_project/my_first_project.isc - Simplicity Studio ™

Project Explorer
my_first_project [IAR ARM - Default] [EFR32BG1B232F256GM48 - Bluetooth
Includes
device
emlib
inc
linker
src
ble-configuration.h
board_features.h
boards.h
gatt_db.c
gatt_db.h
main.c
BgBuild_Log.txt
create_ebl_files.bat
create_ebl_files.sh
efr32.ewd
efr32.ewp
efr32.eww
efr32bg1b232f256gm48.hwconf
gatt.xml
my_first_project.isc

Devices: 6
CP2104 USB to UART Bridge Controller (ID:0) (01085BD0)
J-Link Silicon Labs (440040365)
J-Link Silicon Labs (440058991)
J-Link Silicon Labs (440062876)
J-Link Silicon Labs (440062877)
J-Link Silicon Labs (440062878)

my_first_project.isc
Silicon Labs Bluetooth Smart Framework
General
BLE GATT Configurator
Source filters
☑ SIG ☑ Apple HomeKit ☑ Silabs
Profiles Services Characteristics Descriptors

Alert Notification
Automation IO
Blood Pressure
Continuous Glucose Monitoring
Cycling Power
Cycling Speed and Cadence
Find Me
Glucose
Health Thermometer
Heart Rate
HID OVER GATT
Location and Navigation
Phone Alert Status
Proximity
Pulse Oximeter

Custom BLE GATT
Generic Access
Device Name
Appearance
Device Information
Manufacturer Name String
Model Number String
System ID
Silicon Labs OTA
Silicon Labs OTA Control
Silicon Labs OTA Data

Select a GATT item to configure

Problems
0 items
Description Resource Path Location Type

my_first_project/my_first_project.isc

A reference for each characteristic is generated and defined in gatt_db.h. You can use this references in your code to read / write the values of the characteristics in the GATT database with `gecko_cmd_gatt_server_read_attribute_value()` / `gecko_cmd_gatt_server_write_attribute_value()` commands.

You will find the event handlers in the main loop in app.c. You can extend this list with further event handlers. The full list of events – and stack commands – can be found in the *Bluetooth Software API Reference Manual*.

To build and debug your project click Debug ( ) in the upper left corner of the Simplicity IDE perspective. It will build and download your project, and open up the Debug perspective. Click Play ( ) to start running you project on the device.

6.1 Enabling Field Updates

Deploying new firmware for devices in the field can be done by UART DFU (Device Firmware Update) or, for SoC applications, OTA DFU. For more information on each of these methods refer to AN1086: Using the Gecko Bootloader with the Silicon Labs Bluetooth Applications.

7 Development Tools

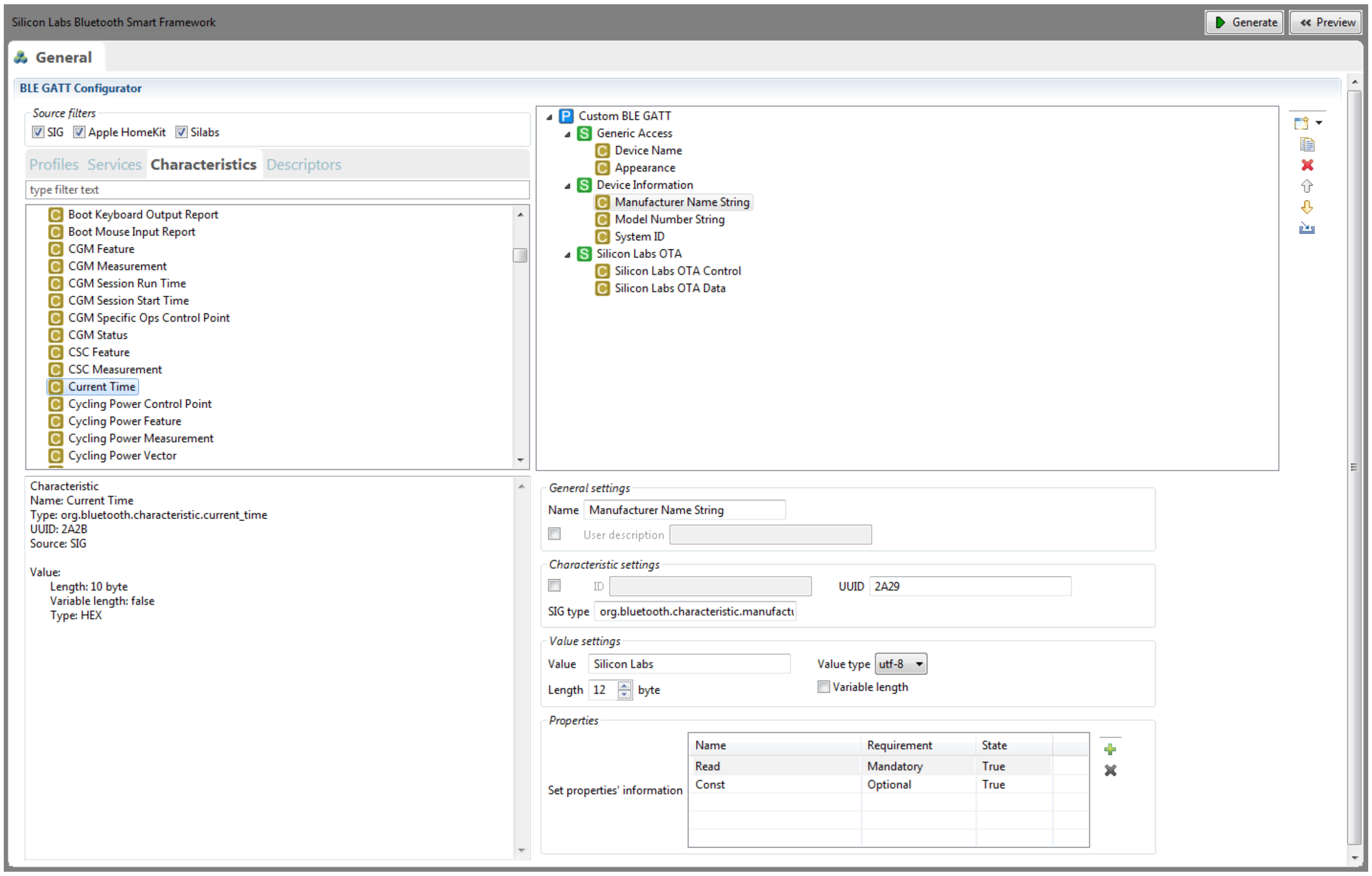
7.1 The GATT Configurator

Every Bluetooth connection has a GATT client and a GATT server. The server holds a GATT database: a collection of *Characteristic*s that can be read and written by the client. The Characteristics are grouped into *Services*, and the group of Services determines a *Bluetooth Profile*.

If you are implementing a GATT server (typically on the peripheral device), you have to define a GATT database structure. This structure cannot be modified during runtime, so it has to be designed in advance. Clients (typically the central device) can also have a GATT database, even if no device will query it, so you can keep the default database structure in your code.

The GATT Configurator is a simple-to-use tool to help you build your own GATT database. A list of predefined Profiles/Services/Characteristics/Descriptors is shown in a pane in the upper left and your current GATT database structure is shown in a pane in the upper right. An options menu is provided to the right of the Database pane.

Click an item in the Database pane to see and modify its settings in a pane in the lower right. To add a Profile/Service/Characteristic/Descriptor to your database, simply drag and drop it from the list to your database.



Boot Keyboard Output Report
Boot Mouse Input Report
CGM Feature
CGM Measurement
CGM Session Run Time
CGM Session Start Time
CGM Specific Ops Control Point
CGM Status
CSC Feature
CSC Measurement
Current Time
Cycling Power Control Point
Cycling Power Feature
Cycling Power Measurement
Cycling Power Vector

Custom BLE GATT
- Generic Access
  - Device Name
  - Appearance
- Device Information
  - Manufacturer Name String
  - Model Number String
  - System ID
- Silicon Labs OTA
  - Silicon Labs OTA Control
  - Silicon Labs OTA Data

Characteristic
Name: Current Time
Type: org.bluetooth.characteristic.current_time
UUID: 2A2B
Source: SIG

Value:
Length: 10 byte
Variable length: false
Type: HEX

General settings
Name: Manufacturer Name String
User description

Characteristic settings
ID
UUID: 2A29
SIG type: org.bluetooth.characteristic.manufactu

Value settings
Value: Silicon Labs
Value type: utf-8
Length: 12 byte
Variable length

Properties
Set properties' information

Name	Requirement	State
Read	Mandatory	True
Const	Optional	True

To get more information about a Profile/Service/Characteristic/Descriptor, click it either in the list or in your database. The description is displayed in the lower-left pane. You can find a detailed description of any Profile/Service/Characteristic/Descriptor on https://www.bluetooth.com/specifications/gatt.

Characteristics are generally complex structures of fields. The GATT Configurator currently does not list the fields within a characteristic. If you want to know what fields a characteristic has, visit https://www.bluetooth.com/specifications/gatt/characteristics.

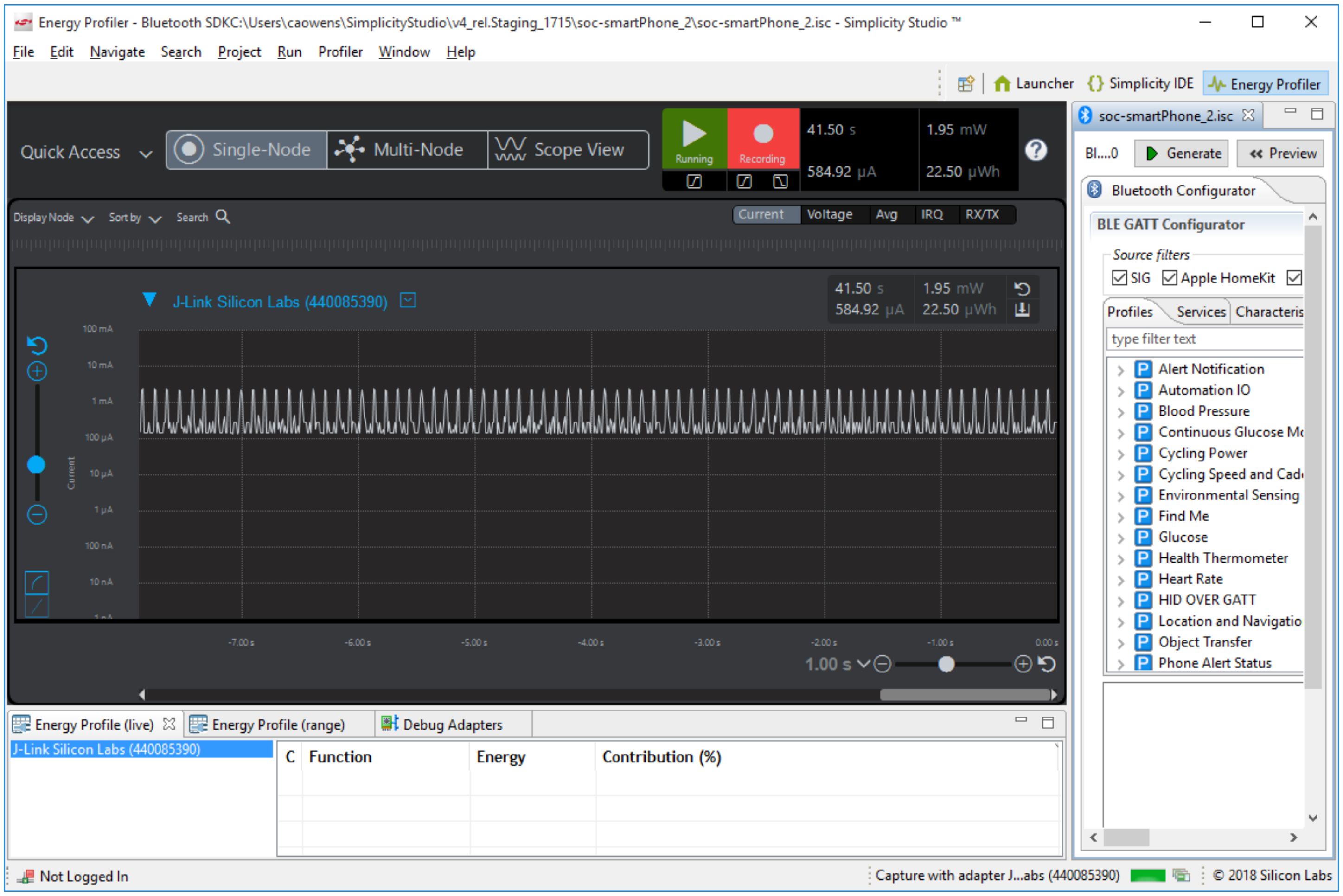
More information about the GATT Configurator can be found in *UG365: GATT Configurator User's Guide*.

7.2 Multi-Node Energy Profiler

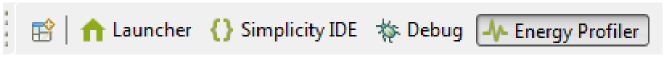
Multi-Node Energy profiler is an add-on tool, with which you can easily measure the energy consumption of your device in runtime. You can easily find peak and average consumption, and check for sleep mode current.

Note: The SDK sample apps for EFR32BG22 enable EM2 debug (see init_mcu.c), which adds current consumption overhead compared to the datasheet values.

To profile the current project, drop down the Profile as menu ( ) in the Simplicity IDE perspective and select **Profile as / Simplicity Energy Profiler target**. This automatically builds your project, uploads it to the device, and starts Energy Profiler. A new Energy Profiler perspective appears, shown in the following figure.

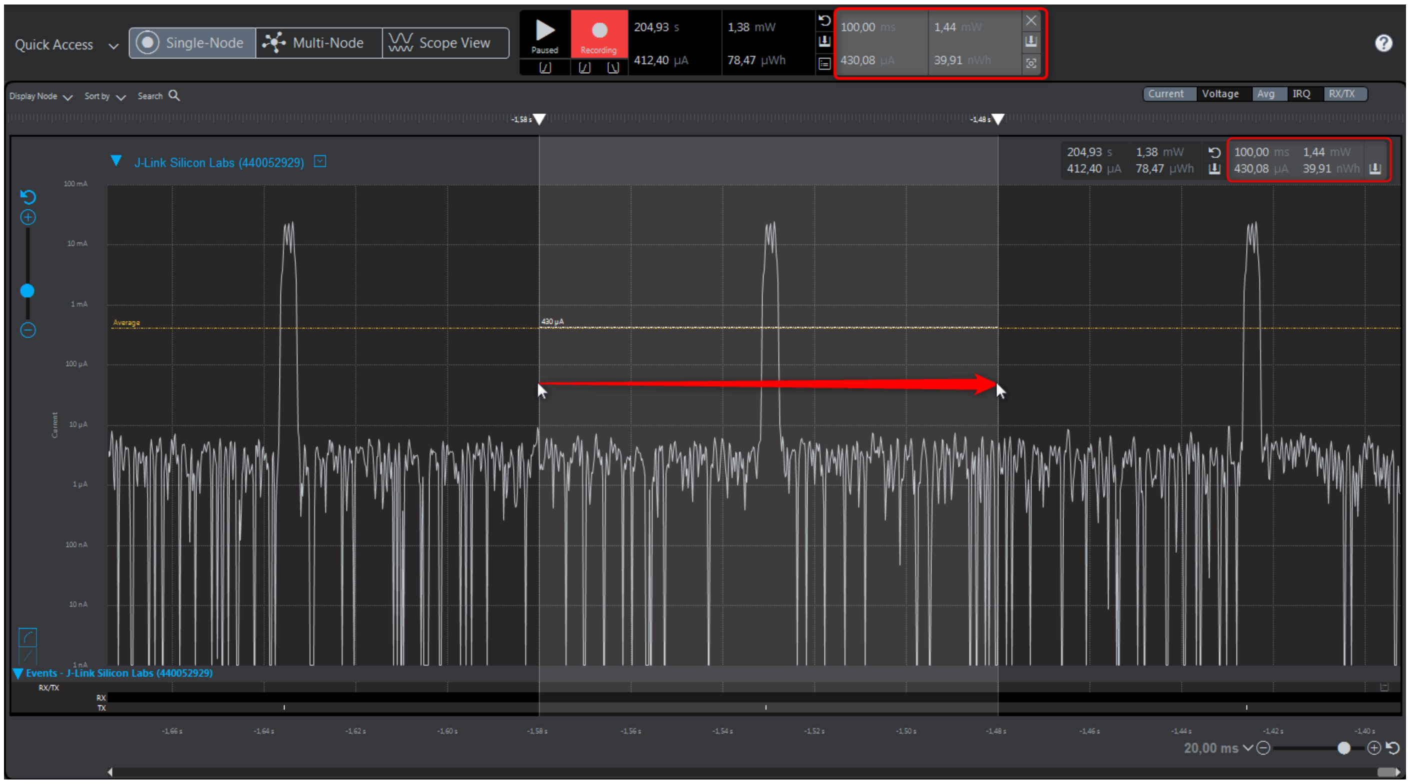


See *UG343: Multi-Node Energy Profiler User's Guide* for details on how to use this tool. You can switch easily between Simplicity IDE and Energy Profiler perspectives using the Perspective buttons in the upper right corner of your current perspective.

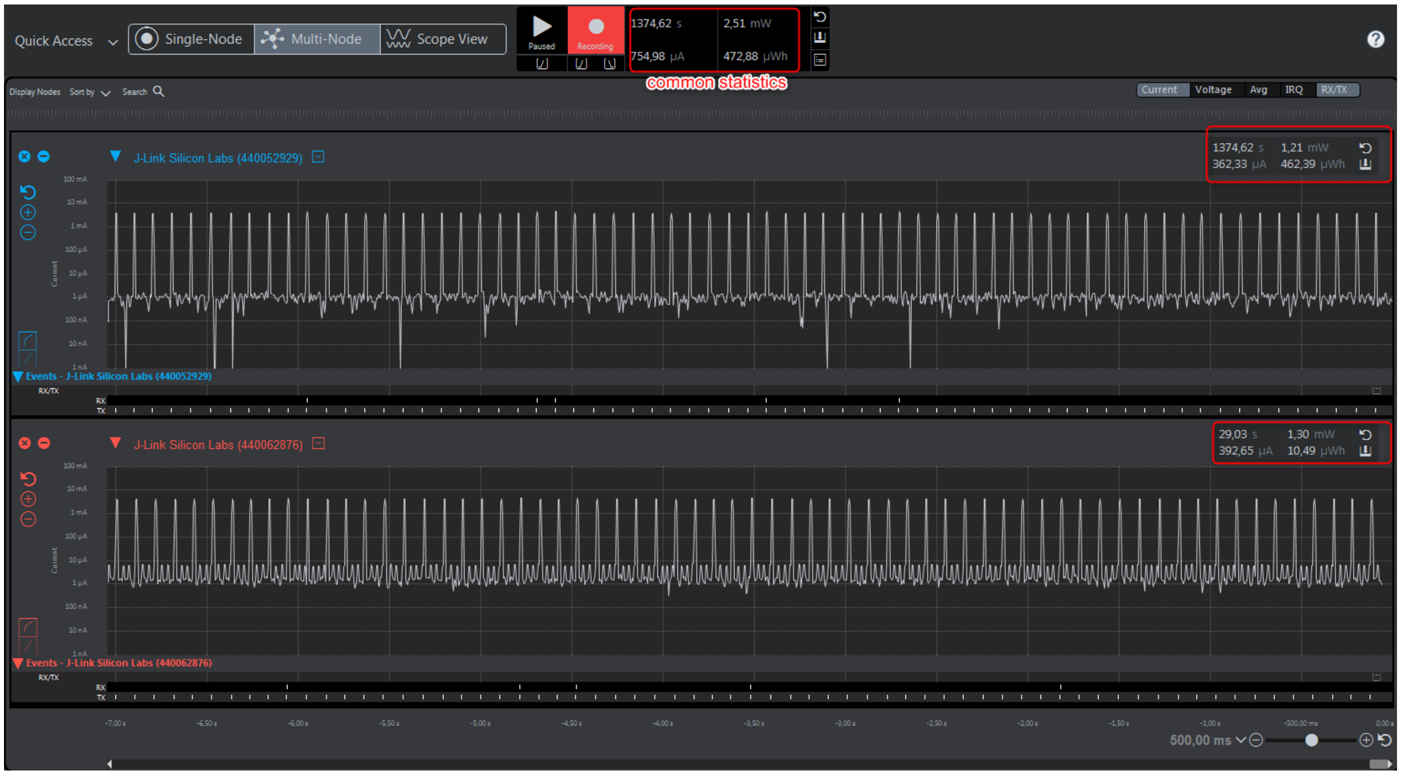


You can see peaks in the energy consumption diagram. Pause profiling by clicking Play , click one of the peaks, and zoom in with time axis (y-axis) zoom until you see three distinguishable peaks. These represent the three advertisement packets sent on the three advertisement channels. You can also see the three corresponding Tx events in the Rx/Tx bar below, provided that you enabled Rx/Tx view in the upper right corner. Note that the maximum consumption may now be greater than it appeared on the diagram before you zoomed in. This is because in zoomed-out mode, the displayed values are averaged. If you need exact values, always zoom in.

To measure average consumption, simply click and drag your mouse over a time interval. A new window appears in the upper right corner showing consumption information for the given interval. Bluetooth communication typically has a periodicity: the advertisement or the connection interval. It is recommended to measure average over an advertisement or connection interval to obtain a proper average consumption. Overall average is measured as well, but this is influenced by transient events.



Multi-node Energy Profiler is also able to simultaneously measure the consumption of multiple devices. To start measuring a new device click the Quick Access menu (upper left corner) and select **Start Energy Capture**. To stop measuring, click the Quick Access menu, and select **End/Save session**.

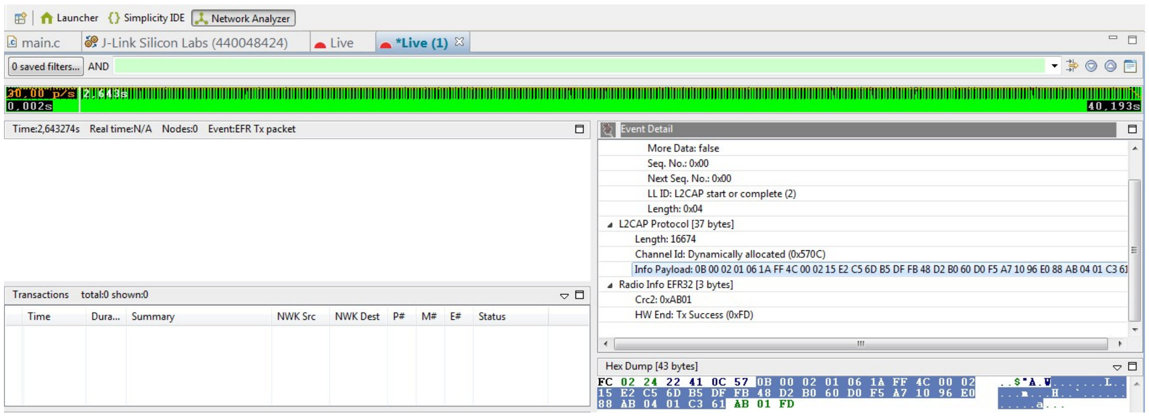


To learn more about how to use this tool, see *UG343: Multi-Node Energy Profiler User's Guide*.

7.3 Network Analyzer

Silicon Labs Network Analyzer is a free-of-charge packet capture and debugging tool that can be used to debug Bluetooth connectivity between Wireless Geckos and other Bluetooth devices. It significantly accelerates the network and application development process with graphical views of network traffic, activity, and duration.

The Packet Trace application captures the packets directly from the Packet Trace Interface (PTI) available on the Wireless Gecko SoCs and modules. It therefore provides a more accurate capture of the packets compared to air-based capture.



Time:2,643274s Real time:N/A Nodes:0 Event:EFR Tx packet

Transactions total:0 shown:0

```
More Data: false
Seq. No.: 0x00
Next Seq. No.: 0x00
LL ID: L2CAP start or complete (2)
Length: 0x04
L2CAP Protocol [37 bytes]
  Length: 16674
  Channel Id: Dynamically allocated (0x570C)
  Info Payload: 0B 00 02 01 06 1A FF 4C 00 02 15 E2 C5 6D B5 DF FB 48 D2 B0 60 D0 F5 A7 10 96 E0 88 AB 04 01 C3 61
Radio Info EFR32 [3 bytes]
  Crc2: 0xAB01
  HW End: Tx Success (0xFD)
```

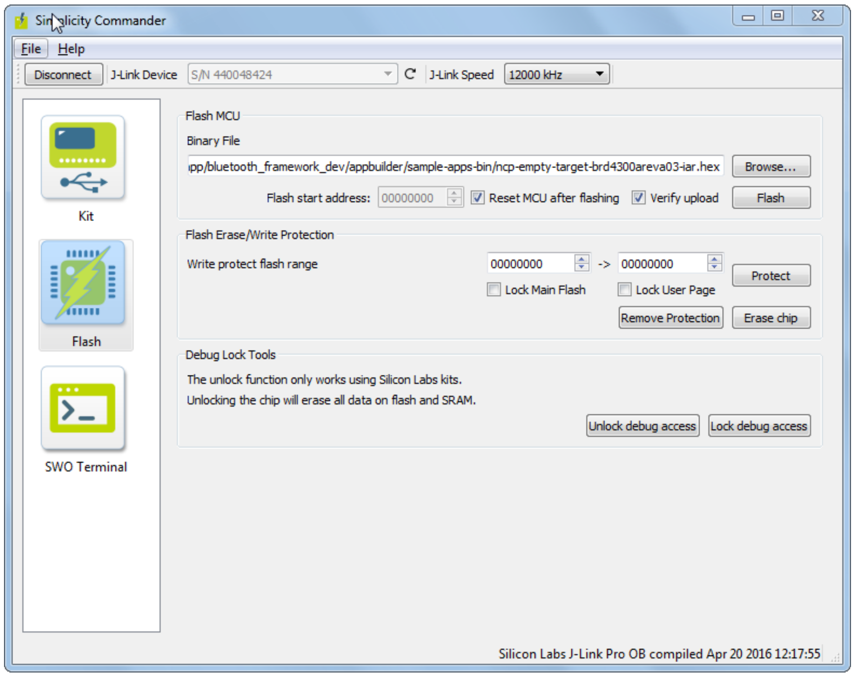
Hex Dump [43 bytes]

```
FC 02 24 22 41 0C 57 0B 00 02 01 06 1A FF 4C 00 02    ..$"A.W.......L..
15 E2 C5 6D B5 DF FB 48 D2 B0 60 D0 F5 A7 10 96 E0    ...m...H..`......
88 AB 04 01 C3 61 AB 01 FD                            .....a...
```

Figure 7-1. Bluetooth Traffic Capture with Packet Trace

7.4 Simplicity Commander

Simplicity Commander is a simple flashing tool, which can be used to flash firmware images, erase flash, lock and unlock debug access, and write-protect flash pages via the J-Link interface. Both GUI and CLI (Command Line Interface) are available. See *UG162: Simplicity Commander Reference Guide* for more information.



J-Link Device: S/N 440048424
J-Link Speed: 12000 kHz

Flash MCU
Binary File: ıpp/bluetooth_framework_dev/appbuilder/sample-apps-bin/ncp-empty-target-brd4300areva03-iar.hex
Flash start address: 00000000 [✓ Reset MCU after flashing] [✓ Verify upload]

Flash Erase/Write Protection
Write protect flash range: 00000000 -> 00000000
Lock Main Flash
Lock User Page

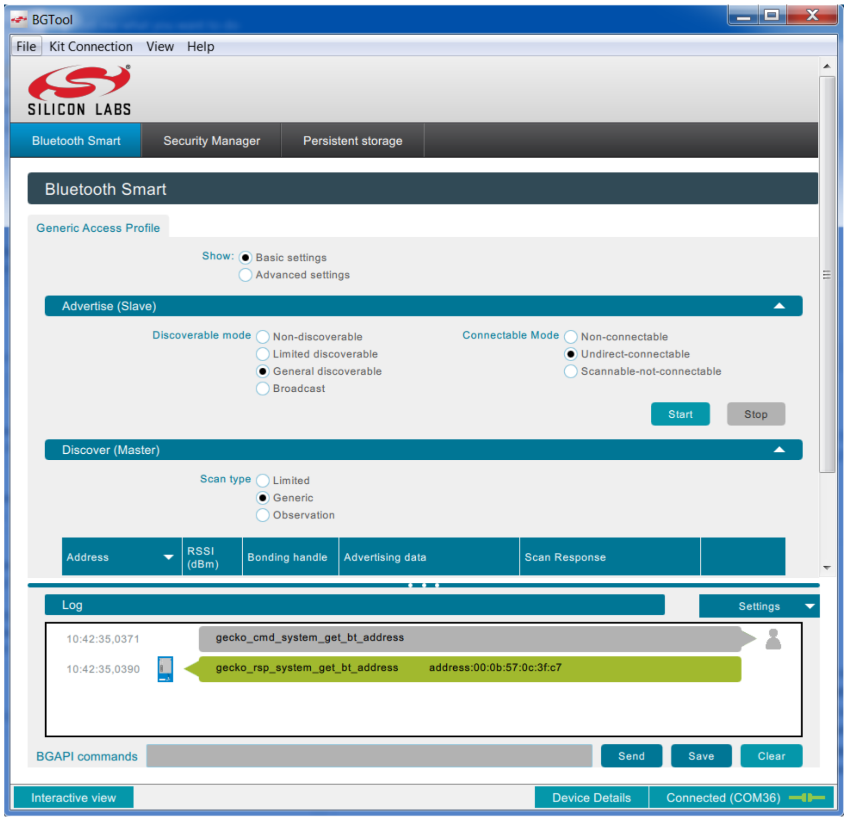
Debug Lock Tools
The unlock function only works using Silicon Labs kits.
Unlocking the chip will erase all data on flash and SRAM.

Silicon Labs J-Link Pro OB compiled Apr 20 2016 12:17:55

Figure 7-2. Simplicity Commander

7.5 BGTool Application

The BGTool application can be used to test and evaluate the Bluetooth SoCs and modules, and it can be used to control the Bluetooth hardware using the BGAPI Serial Protocol (NCP) over a Serial/UART interface.



Show: [✓ Basic settings] Advanced settings

Discoverable mode: Non-discoverable, Limited discoverable, [✓ General discoverable], Broadcast

Connectable Mode: Non-connectable, [✓ Undirect-connectable], Scannable-not-connectable

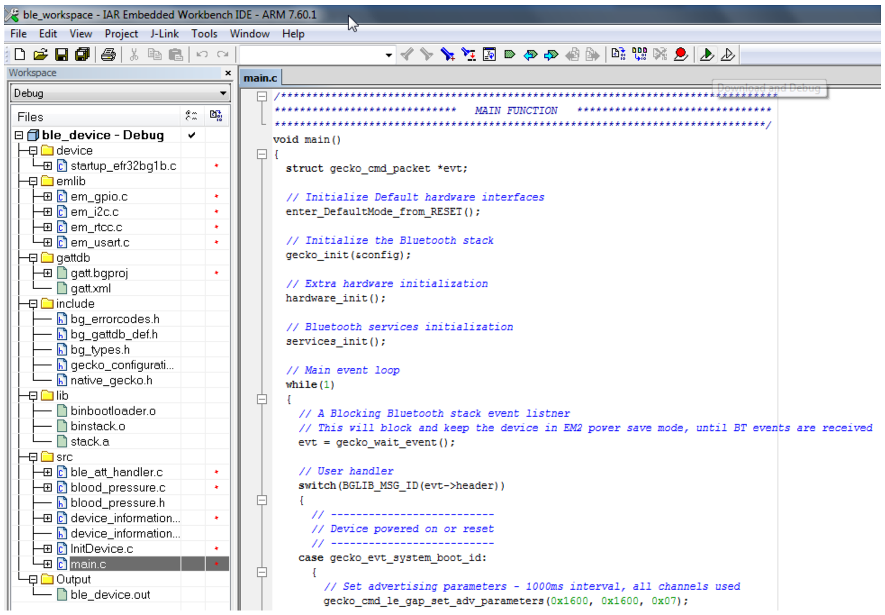
Scan type: Limited, [✓ Generic], Observation

```
10:42:35,0371   gecko_cmd_system_get_bt_address
10:42:35,0390   gecko_rsp_system_get_bt_address    address:00:0b:57:0c:3f:c7
```

Figure 7-3. BGTool Application

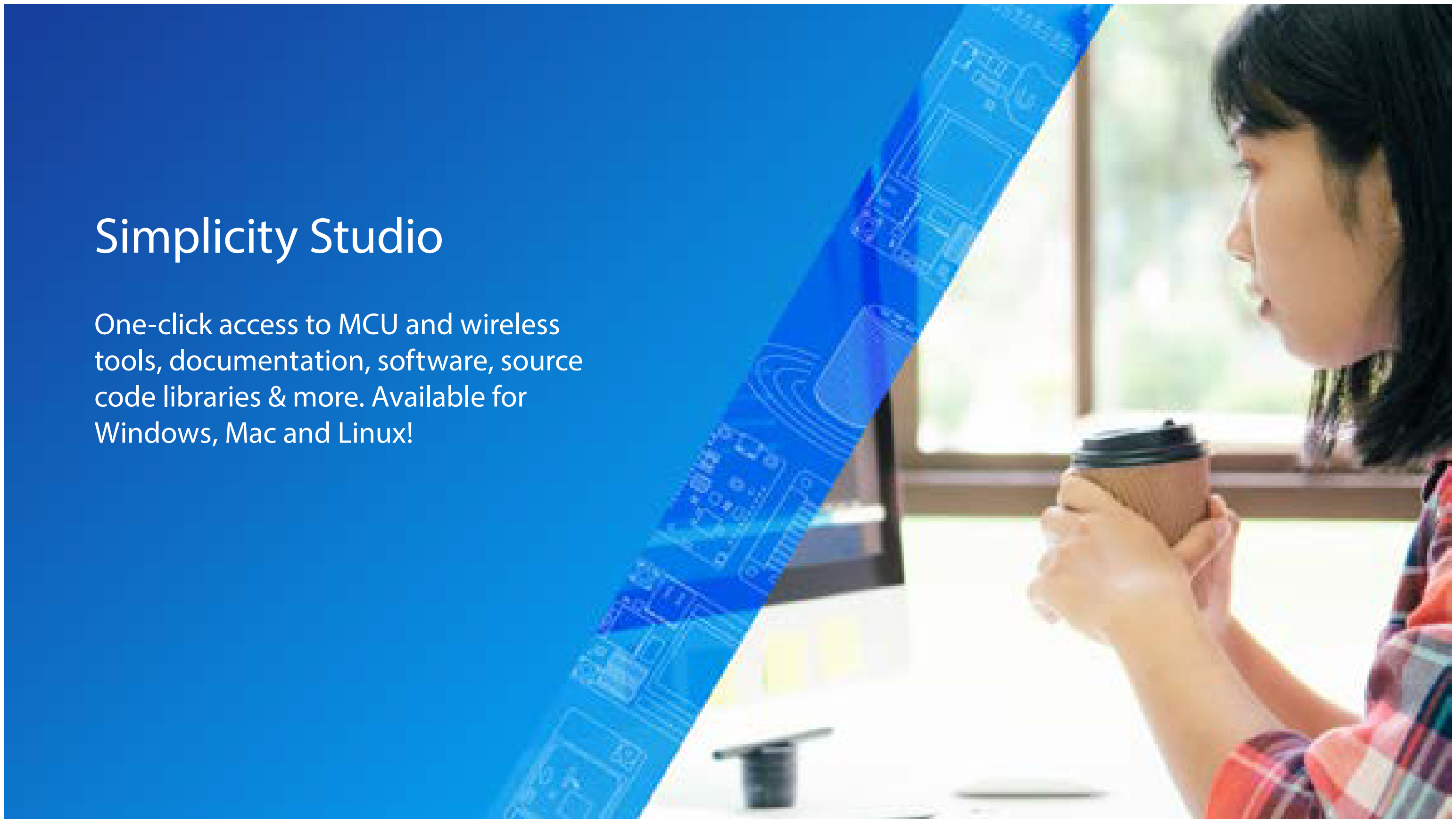
7.6 IAR Embedded Workbench

IAR’s Embedded Workbench can also be used as an IDE for developing and debugging Bluetooth applications. You must use the version of IAR that is compatible with the SDK version. See the SDK's release notes for compatible version information.



```
/***************************************************************************
*****************************   MAIN FUNCTION   *****************************
***************************************************************************/
void main()
{
  struct gecko_cmd_packet *evt;

  // Initialize Default hardware interfaces
  enter_DefaultMode_from_RESET();

  // Initialize the Bluetooth stack
  gecko_init(&config);

  // Extra hardware initialization
  hardware_init();

  // Bluetooth services initialization
  services_init();

  // Main event loop
  while(1)
  {
    // A Blocking Bluetooth stack event listner
    // This will block and keep the device in EM2 power save mode, until BT events are received
    evt = gecko_wait_event();

    // User handler
    switch(BGLIB_MSG_ID(evt->header))
    {
      // -------------------------
      // Device powered on or reset
      // -------------------------
    case gecko_evt_system_boot_id:
      {
        // Set advertising parameters - 1000ms interval, all channels used
        gecko_cmd_le_gap_set_adv_parameters(0x1600, 0x1600, 0x07);
```

Figure 7-4. IAR Embedded Workbench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