UG435.01: About the Connect v3.x User's Guide

The Connect stack is delivered as part of the Silicon Labs Proprietary Flex SDK v3.0 and higher. The *Connect v3.x User's Guide* assumes that you have already installed the Simplicity Studio® 5 development environment and the Flex SDK, and that you are familiar with the basics of configuring, compiling, and flashing Connect-based applications. If you are new to Connect and the Proprietary Flex SDK, see *QSG168: Proprietary Flex SDK v3.x Quick-Start Guide*.

The *Connect v3.x User's Guide* is a series of documents that provides in-depth information for developers who are using the Silicon Labs Connect Stack for their application development. This chapter of the *Connect v3.x User's Guide* describes how to use Connect components, callbacks, and events to provide developer-configurable features and application behavior.

Proprietary is supported on all EFR32FG devices. For others, check the device's data sheet under Ordering Information > Protocol Stack to see if Proprietary is supported. In Proprietary SDK version 2.7.n, Connect is not supported on EFR32xG22.

KEY POINTS

- Introduces the *Connect v3.x User's Guide* and its contents.
- Describes available software and hardware tools.
- Provides an overview for Silicon Labs Connect application development.
- Describes the Silicon Labs Connect Application Framework.

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1. Introducing the Silicon Labs *Connect v3.x User's Guide*

Silicon Labs recommends that you review the *Simplicity Studio 5 User's Guide* (available in Simplicity Studio 5 and online at https://docs.silabs.com) and *QSG168: Proprietary Flex SDK v3.x Quick-Start Guide* before proceeding with the more focused discussion presented in the *Connect v3.x User's Guide* series. For an overview of Connect and its features, see *UG103.12: Application Development Fundamentals: Silicon Labs Connect*. For the Connect API documentation, go to https://docs.silabs.com/connect-stack/latest. If you previously worked with the Silicon Labs Flex v2.x SDK and Simplicity Studio 4, Silicon Labs recommends reading *AN1254: Transitioning from the v2.x to the v3.x Proprietary Flex SDK*.

The *Connect v3.x User's Guide* series provides in-depth guidance in the following chapters:

- *UG435.01: Developing Code with Silicon Labs Connect v3.x*—Introduces the *Connect v3.x User's Guide* and provides a general overview of the code development process for Connect-based applications, and the hardware and software tools that support it.
- *UG435.02: Using Silicon Labs Connect with IEEE 802.15.4 v3.x*—Connect is based on the IEEE 802.15.4-2011 standard which defines various Physical (PHY) and Media Access Control (MAC) layer modes designed for short-range communication in Personal Area Networks (PANs). UG235.02 gives a short introduction to the IEEE 802.15.4 features that are used in Connect, suitable to understand the Silicon Labs Connect MAC layer without reading the full specification.
- *UG435.03: Architecture of the Silicon Labs Connect Stack v3.x*—Presents a complete review of the Connect stack architecture and capabilities: available modes of operation, supported network topologies, stack layers (PHY, MAC, Network), and features applicable to each configuration.
- *UG435.04: Customizing Applications with Silicon Labs Connect v3.x*—Simplicity Studio 5's Project Configurator selectively enables/disables/configures components, callbacks, and events on top of the Application Framework to provide a developer-configurable sophisticated state machine for complex features and application behavior. UG235.04 describes how to apply this Connect Application Framework to develop firmware optimized for your target application.
- *UG435.05: Using Real Time Operating Systems with Silicon Labs Connect v3.x*—*Describes the process to implement a Connect-based application on top of one of the supported Real Time Operating Systems (RTOS)*.
- *UG435.06: Bootloading and OTA with Silicon Labs Connect v3.x*—Explains the bootloader options (standalone, application, and Over the Air (OTA)) available for use within Connect-based applications.
- *UG435.07: Energy Saving with Silicon Labs Connect v3.x*—Discusses techniques to reduce power consumption of network applications based on the Silicon Labs Connect Stack.

The Connect stack has a modular design, optional functionality blocks can be enabled or disabled. These software modules are called components. An Application Framework is layered on top of the Connect stack, consumes the stack handler interfaces, and exposes its own more highly abstracted and application-specific interface to developers. The Connect Application Framework is also structured in components.

Provided as either a standalone pre-compiled library or a set of source code, each component adds a specific feature set to the project. Unnecessary features can be disabled by removing the associated component(s), which removes the code from the build and reduces the project's resource footprint. A component can have options, depend on other components, can provide callbacks, subscribe to, and implement callbacks.

Connect stack APIs can be invoked directly by the application. Stack callbacks are implemented by the associated component and dispatched to the application and subscribing components using the Application Framework bookkeeping functionality.

2. Connect Overview

The Silicon Labs Connect stack provides a fully-featured, easily-customizable wireless networking solution optimized for devices that require low power consumption and are used in a simple network topology. Connect is configurable to be compliant with regional communications standards worldwide. Each RF configuration is designed for maximum performance under each regional standard.

Connect stack supports many combinations of radio modulation, frequency and data rates. The stack provides support for end nodes, coordinators, and range extenders. It includes common wireless MAC layer functions such as scanning and joining, setting up a point-to-point or star network, and managing device types such as sleepy end devices, routers, and coordinators. With all this functionality already implemented in the Connect stack, developers can focus on their end application development and not worry about the lower-level radio and network details.

The Connect stack should be used in applications with simple network topologies, such as a set of data readers feeding information directly to a single central collection point (star or extended star topology) or a set of nodes in the same range exchanging data in a single-hop fashion (direct devices). It does not provide a full mesh networking solution such as that provided by the EmberZNet PRO stack.

The Connect stack supports efficient application development through its building block component design. When used with Simplicity Studio 5's Project Configurator and Component Editor, developers can easily select which functions should be included in their applications. The resulting applications are completely portable—they can be recompiled for different regions, different MCUs, and different radios.

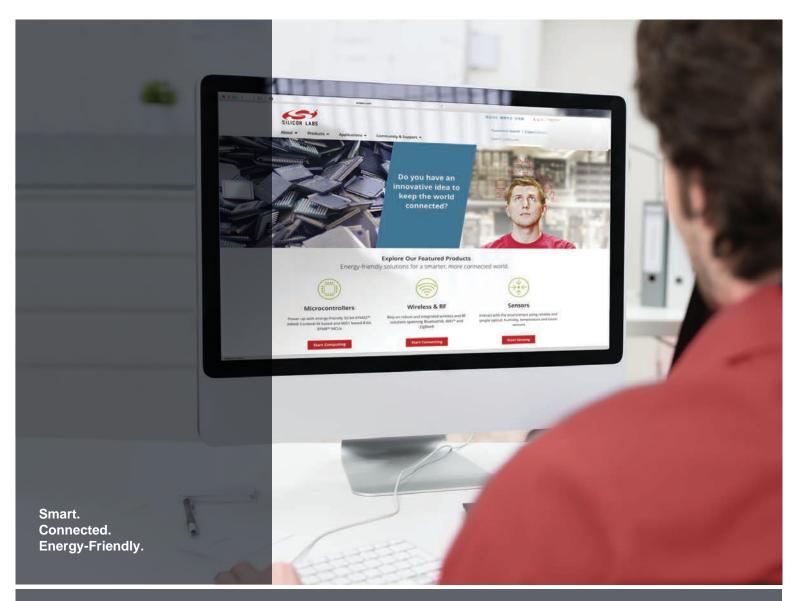### 2.1 Connect Developer Resources

Silicon Labs equips developers with an array of tools to accelerate the code development process for applications based on the Connect stack, reducing time-to-market, and facilitating the creation of robust wireless solutions. These include:

- **Simplicity Studio 5**, featuring:
  - **Eclipse-based Integrated Development Environment (IDE):** Enables code editing, downloading, and debugging for all Silicon Labs EFR32 MCUs.
  - **Flex SDK (contains the Connect Stack):** Supports both GCC (included) and IAR toolchains. Provides pre-compiled stack libraries, fully documented stack API, and full source code for comprehensive and configurable application framework.
  - **Project Configurator / Component Editor / Radio Configurator:** Pivotal utilities that facilitate development of Connect-based applications with a graphical interface for Radio/PHY configuration and a modular application code constructor.
  - **Network Analyzer:** Enables debugging of complex wireless systems by capturing a trace of wireless network activity (such as timestamps, Link Quality Indicator (LQI), Relative Received Signal Strength Indicator (or RSSI), CRC pass/fail results, etc.) that can be examined in detail live or later–all without any software overhead.
  - **Multi-Node Energy Profiler:** Performs Advanced Energy Monitoring (AEM) which enables network power profiling of code in real time by measuring the per-node power consumption. Code correlation links the power consumed with the associated line of code.
  - **Device Console:** Provides a CLI with a powerful way to interact with Connect sample applications and custom applications that implement the serial interface.
- Hardware tools:
  - **Wireless Starter Kit (WSTK):** Provides a common motherboard to support development and debug features for all EFR32 variants. The on-board SEGGER J-Link debugger can target an installed radio board during proof-of-concept phase or an external customer board to support in-system bring-up.
  - **EFR32 Radio Boards:** Tuned for various operational frequencies, transmit powers, etc. The boards contain both a PCB antenna and a U.FL cable connector to support immediate range testing and RF lab measurements.
  - **Easy copy-and-paste reference designs:** Design files for the WSTK and radio boards are accessible from within Simplicity Studio.

For general guidance on how to install, access, and utilize these products, see *QSG168: Proprietary Flex SDK v3.x Quick-Start Guide*.

3. Next Steps

This document provides a general overview of the workflow and resources available to support developers of Connect-based applications. Consult the remaining chapters of the *Connect v3.x User's Guide* series for in-depth guidance on the multiple components to consider when developing Connect-based applications.

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