



Silicon Labs OpenThread SDK 2.4.1.0 GA

Gecko SDK Suite 4.4

February 14, 2024

Thread is a secure, reliable, scalable, and upgradeable wireless IPv6 mesh networking protocol. It provides low-cost bridging to other IP networks while optimized for low-power / battery-backed operation. The Thread stack is designed specifically for Connected Home applications where IP-based networking is desired, and a variety of application layers may be required.

OpenThread released by Google is an open-source implementation of Thread. Google has released OpenThread to accelerate the development of products for the connected home and commercial buildings. With a narrow platform abstraction layer and a small memory footprint, OpenThread is highly portable. It supports system-on-chip (SoC), network co-processor (NCP), and radio co-processor (RCP) designs.

Silicon Labs has developed an OpenThread-based SDK tailored to work with Silicon Labs hardware. The Silicon Labs OpenThread SDK is a fully tested enhanced version of the GitHub source. It supports a broader range of hardware than does the GitHub version, and includes documentation and example applications not available on GitHub.

These release notes cover SDK version(s):

- 2.4.1.0 GA released on February 14, 2024
- 2.4.0.0 GA released on December 13, 2023



KEY FEATURES

OpenThread

- Thread 1.3.0 certification compliance with Thread Test Harness v59.0 for SoC and Host-RCP architectures
- Thread 1.3.1 feature support - Experimental
- Crash Handler support
- TrustZone Evaluation support
- MR21 support for OpenThread RCP – Production

Multi-Protocol

- Concurrent Listening support (RCP) – MG21 and MG24
- Concurrent Multiprotocol (CMP) Zigbee NCP + OpenThread RCP – production quality
- Dynamic Multiprotocol Bluetooth + Concurrent Multiprotocol (CMP) Zigbee and OpenThread support on SoC

Compatibility and Use Notices

For information about security updates and notices, see the Security chapter of the Gecko Platform Release notes installed with this SDK or on the TECH DOCS tab on <https://www.silabs.com/developers/thread>. Silicon Labs also strongly recommends that you subscribe to Security Advisories for up-to-date information. For instructions, or if you are new to the Silicon Labs OpenThread SDK, see [Using This Release](#).

Compatible Compilers:

GCC (The GNU Compiler Collection) version 12.2.1, provided with Simplicity Studio.

Contents

1	New Items	3
1.1	New Components	3
1.2	New Features	3
1.3	New APIs	3
1.4	New Radio Board Support	4
2	Improvements	5
3	Fixed Issues	6
4	Known Issues in the Current Release	7
5	Deprecated Items	8
6	Removed Items	9
7	Multiprotocol Gateway and RCP	10
7.1	New Items	10
7.2	Improvements	10
7.3	Fixed Issues	10
7.4	Known Issues in the Current Release	11
7.5	Deprecated Items	11
7.6	Removed Items	11
8	Using This Release	12
8.1	Installation and Use	12
8.2	OpenThread GitHub Repository	12
8.3	OpenThread Border Router GitHub Repository	12
8.4	Using the Border Router	12
8.5	NCP/RCP Support	13
8.6	Security Information	13
8.7	Support	14
8.8	Thread Certification	14

1 New Items

This release of the Gecko SDK (GSDK) will be the last with combined support for all EFM and EFR devices, except for patches to this version as needed. Starting in mid-2024 we will introduce separate SDKs:

- The existing Gecko SDK will continue with support for Series 0 and 1 devices.
- A new SDK will cater specifically to Series 2 and 3 devices.

The Gecko SDK will continue to support all Series 0 and 1 devices with no change to the long-term support, maintenance, quality, and responsiveness provided under our software policy.

The new SDK will branch from Gecko SDK and begin to offer new features that help developers take advantage of the advanced capabilities of our Series 2 and 3 products.

This decision aligns with customer feedback, reflecting our commitment to elevate quality, ensure stability, and enhance performance for an exceptional user experience across our software SDKs.

1.1 New Components

Added in release 2.4.0.0

- `ot_crash_handler` - This component provides a set of APIs for printing crash info. In the case of a crash, this component captures the details and prints them on the next reboot.
- `ot_rtt_log` - This component adds support for RTT logging, which is the mechanism used for the platform defined logging interface.

1.2 New Features

Added in release 2.4.1.0

- Support added for factory diagnostic channel and transmit power CLI commands.

Added in release 2.4.0.0

- Crash Handler support - With this release, a crash handler component has been introduced for use with OpenThread applications. By including it in an OpenThread project, it will automatically capture detailed information about core registers, information about the C stack, and reset information. On the next boot-up, this data is printed using the OpenThread logging system.
- TrustZone evaluation support - Added evaluation workspaces to enable TrustZone for OpenThread CLI applications.
- Features introduced with OpenThread up to and including commit 7074a43e4. This includes support for ongoing Thread 1.3.1 features. The default setting for Silicon Labs sample applications is still 1.3.0.

1.3 New APIs

Added in release 2.4.1.0

- `otPlatDiagChannelSet` - This function sets the channel to use for factory diagnostics.
- `otPlatDiagTxPowerSet` - This function sets the transmit power to use for factory diagnostics.

Added in release 2.4.0.0

- `otPlatResetToBootloader` - reset to bootloader mode. Users can either call this API directly in code or via the CLI command "reset bootloader".

1.4 New Radio Board Support

Added in release 2.4.0.0

Support has been added for the following radio boards:

- BRD4198A - EFR32MG24B210F1536IM48-B

2 Improvements

Changed in release 2.4.0.0

- Logging - Default log mechanism is changed from RTT to UART. RTT logging and associated libraries are removed from ot_third-party and added to a new component, ot_rtt_log.
- Posix vendor extension options:
 - Changed OT_POSIX_CONFIG_RCP_VENDOR_DEPS_PACKAGE value from SilabsRcpDeps to posix_vendor_rcp.cmake.
 - Removed CMAKE_MODULE_PATH option.
- NCP sample applications - Prebuilt NCP sample applications are considered experimental and are no longer packaged as prebuilt demos.
- SL_OPENTHREAD_CSL_TX_UNCERTAINTY, SL_OPENTHREAD_LFXO_ACCURACY, SL_OPENTHREAD_HFXO_ACCURACY, are now configurable.
- Improvements introduced with OpenThread up to and including commit 7074a43e4.
 - The OT_CONFIG CMake option has been replaced in favor of two new options: OT_PLATFORM_CONFIG and OT_PROJECT_CONFIG.
 - Changes and clarifications in CSL APIs. The major CLI/API change is that now csl period requires microsecond value instead of 10 symbol units.
 - Changes in the Spinel Interface. The Spinel interface is now created based on radio URL protocol to support multiple interfaces (hdlc/spi/vendor) at the same time. Silicon Labs CPC builds will continue to support only one interface, which is the vendor interface (CPC).
 - During build time, setting OT_POSIX_CONFIG_RCP_BUS is now deprecated. Instead turn on one or more of OT_POSIX_RCP_HDLC_BUS, OT_POSIX_RCP_SPI_BUS, or OT_POSIX_RCP_VENDOR_BUS as needed.

3 Fixed Issues

Fixed in release 2.4.1.0

ID #	Description
1208578	Added support for linking the CPC library to Posix host apps by using provided paths, and by using pkg-config.
1235923	Fixed a wrapping bug in calls to otPlatAlarmMilliStartAt and otPlatAlarmMicroStartAt.
1243597	Removed extra ot-ble-dmp-no-buttons sample apps from demos folder.
1251932	Increased OPENTHREAD_CONFIG_CSL_RECEIVE_TIME_AHEAD to 750 μ sec for default FTD and MTD certification libraries for use with devices under test using library-based certification.

Fixed in release 2.4.0.0

ID #	Description
1124161	High traffic environments will no longer cause buffers containing received packet payloads to be overwritten before being processed.
1148720	SED current draw has been improved.
1169011	Increased the stack size of OpenThread task to 4608 bytes (SL_OPENTHREAD_OS_STACK_TASK_SIZE) for DMP applications to avoid stack overflow while joining the thread network.
1193597	OpenThread Radio PAL now maintains Max channel power table.
1227529	Fixed the typo in OPENTHREAD_SPINEL_CONFIG_TX_WAIT_TIME_SECS to OPENTHREAD_SPINEL_CONFIG_RCP_TX_WAIT_TIME_SECS in lower-mac-spinel-config header.

4 Known Issues in the Current Release

Issues in bold were added since the previous release. If you have missed a release, recent release notes are available on <https://www.silabs.com/developers/thread> in the Tech Docs tab.

ID #	Description	Workaround
482915 495241	A known limitation with the UART driver can cause characters to be lost on CLI input or output. This can happen during particularly long critical sections that may disable interrupts, so it can be alleviated by repeating the CLI or waiting long enough for state changes.	No known workaround
815275	Ability to modify the Radio CCA Modes at compile-time using a configuration option in Simplicity Studio is currently not supported.	Use the <code>SL_OPENTHREAD_RADIO_CCA_MODE</code> configuration option defined in <code>openthread-core-efr32-config.h</code> header file included with your project.
1177718	MG24 Hangs when <code>otInstanceErasePersistentInfo()</code> is run in <code>app_init()</code>	No known workaround
1163281 1196499	The OTBR DUTs that need to pass Thread Certification Test "5.10.2 MATN-TC-02: Multicast listener registration and first use" need to enable the 'REFERENCE_DEVICE' flag during OTBR bootstrap and setup. This issue will be addressed in a later release with a newer OpenThread stack that fixes this issue.	Compile with <code>REFERENCE_DEVICE</code> .
1249492	FactoryReset and Reset commands via dBus cause OTBR-agent to exit unexpectedly.	No known workaround
1251926	Crash Handler sends crash log before host is ready.	No known workaround
1251952	<code>otInstanceResetToBootloader</code> undefined when building with the openthread certification libraries and including the <code>bootloader_interface</code> component.	<p>Modify the logic in <code>openthread-core-efr32-config.h</code> to disable <code>OPENTHREAD_CONFIG_PLATFORM_BOOTLOADER_MODE_ENABLE</code>.</p> <p>For example,</p> <pre>#if defined(SL_CATALOG_GECKO_BOOTLOADER_INTERFACE_PRESENT) #define OPENTHREAD_CONFIG_PLATFORM_BOOTLOADER_MODE_ENABLE 0 #endif</pre>

5 Deprecated Items

Deprecated in release 2.4.0.0

- The `ot_thirdparty` component has been deprecated.

6 Removed Items

None

7 Multiprotocol Gateway and RCP

7.1 New Items

Added in release 2.4.0.0

Concurrent listening, the ability for the Zigbee and OpenThread stacks to operate on independent 802.15.4 channels when using an EFR32xG24 or xG21 RCP, is released. Concurrent listening is not available for the 802.15.4 RCP/Bluetooth RCP combination, the Zigbee NCP/OpenThread RCP combination, or for the Zigbee/OpenThread system-on-chip (SoC). It will be added to those products in a future release.

The OpenThread CLI vendor extension has been added to the OpenThread host apps of multiprotocol containers. This includes the coex cli commands.

7.2 Improvements

Changed in release 2.4.0.0

The Zigbee NCP/OpenThread RCP multiprotocol combination is now production quality.

7.3 Fixed Issues

Fixed in release 2.4.1.0

ID #	Description
1213701	zigbeed didn't allow a source match table entry to be created for a child if MAC indirect queue has data already pending for that child. This behavior could lead to application layer transactions between the child and some other device failing due to lack of APS Ack or app-layer response, most notably the disruption and unexpected termination of ZCL OTA Upgrades targeting the child device.
1244461	Source match table entry for child being could be removed despite messages pending.

Fixed in release 2.4.0.0

ID #	Description
1081828	Throughput issue with FreeRTOS-based Zigbee/BLE DMP sample applications.
1090921	Z3GatewayCpc had trouble forming a network in a noisy environment.
1153055	An assert on the host was caused when there was a communication failure when reading the NCP version from the zigbee_ncp-ble_ncp-uart sample app.
1155676	The 802.15.4 RCP discarded all received unicast packets (after MAC acking) if multiple 15.4 interfaces shared the same 16-bit node ID.
1173178	The host falsely reported hundreds of packets received with mfglib in the Host-RCP setup.
1190859	EZSP error when sending mfglib random packets in the Host-RCP setup.
1199706	Data polls from forgotten end device children were not properly setting a pending frame on the RCP to queue a Leave & Rejoin command to the former child.
1207967	The "mfglib send random" command was sending out extra packets on Zigbeed.
1208012	The mfglib rx mode did not update packet info correctly when receiving on the RCP.
1214359	The coordinator node crashed when 80 or more routers tried to join simultaneously in the Host-RCP setup.

ID #	Description
1216470	After relaying a broadcast for address mask 0xFFFF, a Zigbee RCP acting as a parent device would leave the pending data flag set for each child. This resulted in each child staying awake expecting data after each poll, and required some other pending data transaction to each end device to eventually clear this state.

7.4 Known Issues in the Current Release

Issues in bold were added since the previous release. If you have missed a release, recent release notes are available on <https://www.silabs.com/developers/gecko-software-development-kit>.

ID #	Description	Workaround
811732	Custom token support is not available when using Zigbeed.	Support is planned in a future release.
937562	Bluetoothctl 'advertise on' command fails with rcp-uart-802154-blehci app on Raspberry Pi OS 11.	Use btmgmt app instead of bluetoothctl.
1022972	Coex not working on ZB NCP + OT RCP.	Support is planned for a future release.
1074205	The CMP RCP does not support two networks on the same PAN id.	Use different PAN ids for each network. Support is planned in a future release.
1122723	In a busy environment the CLI may become unresponsive in the z3-light_ot-ftd_soc app.	No known workaround.
1124140	z3-light_ot-ftd_soc sample app is not able to form the Zigbee network if the OT network is up already.	Start the Zigbee network first and the OT network after.
1170052	CMP Zigbee NCP + OT RCP and DMP Zigbee NCP + BLE NCP may not fit on 64KB and lower RAM parts in this current release.	64KB parts not currently supported for these apps.
1209958	The ZB/OT/BLE RCP on Bobcat and Bobcat Lite can stop working after a few minutes when running all three protocols	Will be addressed in a future release
1221299	Mfglib RSSI readings differ between RCP and NCP.	Will be addressed in a future release.
1231021	OTBR can assert when 80+ zigbee devices are joining simultaneously.	Added a fix that may workaround the issue. Will be fully addressed in a future release.

7.5 Deprecated Items

None

7.6 Removed Items

Removed in release 2.4.0.0

The "NONCOMPLIANT_ACK_TIMING_WORKAROUND" macro has been removed. All RCP apps now by default support 192 µsec turnaround time for non-enhanced acks while still using 256 µsec turnaround time for enhanced acks required by CSL.

8 Using This Release

This release contains the following

- Silicon Labs OpenThread stack
- Silicon Labs OpenThread sample applications
- Silicon Labs OpenThread border router

For more information about the OpenThread SDK see [QSG170: Silicon Labs OpenThread QuickStart Guide](#). If you are new to Thread see [UG103.11: Thread Fundamentals](#).

8.1 Installation and Use

The OpenThread SDK is part of the Gecko SDK (GSDK), the suite of Silicon Labs SDKs. To quickly get started with OpenThread and the GSDK, start by installing [Simplicity Studio 5](#), which will set up your development environment and walk you through GSDK installation. Simplicity Studio 5 includes everything needed for IoT product development with Silicon Labs devices, including a resource and project launcher, software configuration tools, full IDE with GNU toolchain, and analysis tools. Installation instructions are provided in the online [Simplicity Studio 5 User's Guide](#).

Alternatively, Gecko SDK may be installed manually by downloading or cloning the latest from GitHub. See https://github.com/SiliconLabs/gecko_sdk for more information.

The GSDK default installation location has changed beginning with Simplicity Studio 5.3.

- Windows: C:\Users\\SimplicityStudio\SDKs\gecko_sdk
- MacOS: /Users/<NAME>/SimplicityStudio/SDKs/gecko_sdk

Documentation specific to the SDK version is installed with the SDK. API references and other information about this release are available on <https://docs.silabs.com/openthread/latest/>. Select your SDK version in the upper right.

8.2 OpenThread GitHub Repository

The Silicon Labs OpenThread SDK includes all changes from the OpenThread GitHub repo (<https://github.com/openthread/openthread>) up to and including commit **7074a43e4**. An enhanced version of the OpenThread repo can be found in the following Simplicity Studio 5 GSDK location:

```
<GSDK Installation Location>\util\third_party\openthread
```

8.3 OpenThread Border Router GitHub Repository

The Silicon Labs OpenThread SDK includes all changes from the OpenThread border router GitHub repo (<https://github.com/openthread/ot-br-posix>) up to and including commit **42f98b27b**. An enhanced version of the OpenThread border router repo can be found in the following Simplicity Studio 5 GSDK location:

```
<GSDK Installation Location>\util\third_party\ot-br-posix
```

8.4 Using the Border Router

For ease of use, Silicon Labs recommends the use of a Docker container for your OpenThread border router. Refer to [AN1256: Using the Silicon Labs RCP with the OpenThread Border Router](#) for details on how to set up the correct version of OpenThread border router Docker container. It is available at <https://hub.docker.com/r/siliconlabsinc/openthread-border-router>.

If you are manually installing a border router, using the copies provided with the Silicon Labs OpenThread SDK, refer to [AN1256: Using the Silicon Labs RCP with the OpenThread Border Router](#) for more details.

Although updating the border router environment to a later GitHub version is supported on the OpenThread website, it may make the border router incompatible with the OpenThread RCP stack in the SDK.

8.5 NCP/RCP Support

The OpenThread NCP support is included with OpenThread SDK but any use of this support should be considered experimental. The OpenThread RCP is fully implemented and supported.

8.6 Security Information

Secure Vault Integration

When deployed to Secure Vault High devices, sensitive keys are protected using the Secure Vault Key Management functionality. The following table shows the protected keys and their storage protection characteristics.

Wrapped Key	Exportable / Non-Exportable	Notes
Thread Master Key	Exportable	Must be exportable to form the TLVs
PSKc	Exportable	Must be exportable to form the TLVs
Key Encryption Key	Exportable	Must be exportable to form the TLVs
MLE Key	Non-Exportable	
Temporary MLE Key	Non-Exportable	
MAC Previous Key	Non-Exportable	
MAC Current Key	Non-Exportable	
MAC Next Key	Non-Exportable	

Wrapped keys that are marked as “Non-Exportable” can be used but cannot be viewed or shared at runtime.

Wrapped keys that are marked as “Exportable” can be used or shared at runtime but remain encrypted while stored in flash.

For more information on Secure Vault Key Management functionality, see [AN1271: Secure Key Storage](#).

Security Advisories

To subscribe to Security Advisories, log in to the Silicon Labs customer portal, then select **Account Home**. Click **HOME** to go to the portal home page and then click the **Manage Notifications** tile. Make sure that ‘Software/Security Advisory Notices & Product Change Notices (PCNs)’ is checked, and that you are subscribed at minimum for your platform and protocol. Click **Save** to save any changes.

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<input type="checkbox"/> Timing	
<input type="checkbox"/> Clocks	
<input type="checkbox"/> Buffers	
<input type="checkbox"/> Oscillators	
<input type="checkbox"/> CDR and PHY	

8.7 Support

Development Kit customers are eligible for training and technical support. Use the [Silicon Laboratories Thread web page](#) to obtain information about all Silicon Labs OpenThread products and services, and to sign up for product support.

You can contact Silicon Laboratories support at <http://www.silabs.com/support>.

8.8 Thread Certification

This release has been qualified for Thread 1.3.0 for both the SoC and Host-RCP architectures with Thread Test Harness v59.0 (Member Release). For Thread Product certifications tied to this major release and associated patch releases (with no OpenThread stack updates), Silicon Labs recommends using the above TH version for qualification.

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Silicon Laboratories Inc.
400 West Cesar Chavez
Austin, TX 78701
USA

www.silabs.com