



Silicon Labs OpenThread SDK 2.3.1.0 GA

Gecko SDK Suite 4.3

July 26, 2023

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 in order 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):

2.3.1.0 GA released on July 26, 2023

2.3.0.0 GA released on June 7, 2023



KEY FEATURES

OpenThread

- Thread 1.3.1 (experimental)
 - IPv4/v6 public internet connectivity: NAT64 improvements, optimization of published routes and prefixes in network data
 - DNS enhancements for OTBR
 - Thread over Infrastructure (TREL)
- Network Diagnostics (experimental)
 - Child supervision by parent
 - Additional link quality information in child table
 - Uptime for routers

Multiprotocol

- Zigbee/OpenThread Concurrent Multiprotocol SoC sample app
- CPC GPIO expander module
- Zigbee enhancements

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 10.3-2021.10, provided with Simplicity Studio.

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1 New Items

1.1 New Components

Added in release 2.3.1.0

- `ot_ncp_vendor_extension` - This component extends the behavior of the OpenThread NCP controller to allow the processing and handling of vendor-defined Spinel attributes.

1.2 New Features

Added in release 2.3.0.0

- The versions of OpenThread and the OpenThread Border Router have been updated. See sections 8.2 and 8.3.
- Thread 1.3.1 (experimental)
 - IPv4/v6 public internet connectivity: NAT64 improvements, optimization of published routes and prefixes in network data
 - DNS enhancements for OTBR
 - Thread over Infrastructure (TREL)
- Network Diagnostics Improvements (experimental)
 - Child supervision by parent
 - Additional link quality information in child table
 - Uptime for routers
- Support for the `ot-cli` sample application with CPC on Android Host
 - The `ot-cli` sample application can now be used with CPC on an Android host. To build, download the Android NDK toolchain, define the environment variable "NDK" to point to the toolchain, and run the `script/cmake-build-android` script instead of `script/cmake-build`.

1.3 New APIs

Added in release 2.3.1.0

- `otPlatRadioExtensionGetTxAntennaMode` - Get the antenna diversity transmit antenna mode.
- `otPlatRadioExtensionSetTxAntennaMode` - Set the antenna diversity transmit antenna mode.
- `otPlatRadioExtensionGetRxAntennaMode` - Get the antenna diversity receive antenna mode.
- `otPlatRadioExtensionSetRxAntennaMode` - Set the antenna diversity receive antenna mode.
- `otPlatRadioExtensionGetActivePhy` - Get the antenna diversity active phy state.
- `otPlatRadioExtensionGetDpState` - Get the coexistence directional priority state and pulse width.
- `otPlatRadioExtensionSetDpState` - Set the coexistence directional priority state and pulse width.
- `otPlatRadioExtensionGetGpioInputOverride` - Get the override input value of a GPIO.
- `otPlatRadioExtensionSetGpioInputOverride` - Set the override input value of a GPIO.
- `otPlatRadioExtensionGetActiveRadio` - Get the coexistence active phy state.
- `otPlatRadioExtensionGetPhySelectTimeout` - Get the coexistence phy select state and timeout.
- `otPlatRadioExtensionSetPhySelectTimeout` - Set the coexistence phy select state and timeout.
- `otPlatRadioExtensionGetCoexOptions` - Get the coexistence bitmask of features.
- `otPlatRadioExtensionSetCoexOptions` - Set the coexistence bitmask of features.
- `otPlatRadioExtensionGetCoexConstantOptions` - Get the coexistence bitmask of constant PTA features that can not be modified using public APIs.
- `otPlatRadioExtensionIsCoexEnabled` - Get the coexistence enabled status.

- `otPlatRadioExtensionSetCoexEnable` - Set the coexistence enabled status.
- `otPlatRadioExtensionGetRequestPwmArgs` - Get the coexistence PWM configuration.
- `otPlatRadioExtensionSetRequestPwmArgs` - Set the coexistence PWM configuration.
- `otPlatRadioExtensionClearCoexCounters` - Clear the coexistence counters.
- `otPlatRadioExtensionGetCoexCounters` - Get the coexistence counters.
- `otPlatRadioExtensionSetRadioHoldoff` - Set the coexistence radio holdoff status.

1.4 New Radio Board Support

Added in release 2.3.1.0

Support has been added for the following radio boards:

- BRD4186Z - EFR32xG24

Added in release 2.3.0.0

Support has been added for the following radio boards:

- BRD4196B - EFR32xG21B
- BRD2704A - Sparkfun Thing Plus MGM240P

2 Improvements

Changed in release 2.3.1.0

With regard to the OpenThread border router, `radio_url` can now take a list of IIDs. This is to control IIDs a host can accept spinel frames from other than its own IID. RCP uses IID zero for the received broadcast packet to deliver a spinel frame to all the connected hosts/end-points. An example of the new `radio_url` is `'spinel+cpc://cpcd_0?iid=1&iid-list=0'`.

Changed in release 2.3.0.0

- Support for “diag cw” and “diag stream”
 - `diag cw start` - Start transmitting continuous carrier wave
 - `diag cw stop` - Stop transmitting continuous carrier wave
 - `diag stream start` - Start transmitting a stream of characters.
 - `diag stream stop` - Stop transmitting a stream of characters.
- Bootloader support for sample applications
 - The `bootloader_interface` component has been added to the Thread sample apps. The component introduces support for bootloaders and also results in the creation of GBL files when building.
- Reduction to code size of Certified OpenThread Libraries
 - The pre-built certification libraries no longer include JOINER functionality.

3 Fixed Issues

Fixed in release 2.3.1.0

ID #	Description
754514	Fixed an issue where a double ping reply was observed for OTBR ALOC address.
1041112	Fixed an issue where the OTBR / EFR32 RCP can miss forwarding packets from a CSL child if it configures an alternate channel for CSL communication.
1085737	Fixed an issue where a Matter SSED over Thread is unreachable with CSL.
1132004	Fixed an issue where the RCP can become unresponsive when receiving excessive beacon requests.
1156792	Fixed a bug that caused SSED devices to lose buffer during long runs.

Fixed in release 2.3.0.0

ID #	Description
1023725	Fixed an issue where detached MTDs on the Thread network hit an assert while re-attaching to the OTBR after the OTBR is rebooted.
1079667	Fixed an issue where devices can no longer communicate after reporting transient out-of-buffers condition.
1084368	Fixed failing HomeKit HCA test when using board 4186c and the DMP application.
1095059	Added openthread 'diag stream' and 'diag cw' CLI commands. See Improvements section for additional details.
1113046	Radio PAL now maintains max channel power table.
1126570	Addressed a memory leak associated with PSA keys which occurs when otInstanceFinalise() is called without power cycling.
1133240	Fixed a bug in setting link parameters in the meshcop forwarding layer.
1139318	Request to Reduce Codesize of Certified OpenThread Library. See Improvements section for additional details.
1139449	Fixed an issue where devices stopped receiving during Tx storm.
1142231	Radio SPINEL no longer asserts when no entries are available in source match table.

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.
1094232	Intermittently, <code>ot-ctl</code> terminates after a factoryreset when using a CPCd connection.	No known workaround
1064242	OpenThread prefix commands sometimes fail to add prefix for OTBR over CPC.	No known workaround
1117447	Outgoing key index can be set to 0 under unknown circumstances.	No known workaround
1143008	The OTBR can sometimes fail to transmit a CSL packet with the error "Handle transmit done failed: Abort". This could happen if <code>OPENTHREAD_CONFIG_MAC_CSL_REQUEST_AHEAD_US</code> is set too low and/or the baud rate is not set to a high value.	<p>Set <code>OPENTHREAD_CONFIG_MAC_CSL_REQUEST_AHEAD_US</code> to 5000.</p> <p>For the OTBR, you can either:</p> <ol style="list-style-type: none"> 1. Modify the value of <code>OPENTHREAD_CONFIG_MAC_CSL_REQUEST_AHEAD_US</code> in <code>ot-br-posix/third_party/openthread/repo/src/core/config/mac.h</code> or 2. Pass the value during setup as follows: <pre>sudo OTBR_OPTIONS="-DCMAKE_CXX_FLAGS='-DOPENTHREAD_CONFIG_MAC_CSL_REQUEST_AHEAD_US=5000'" ./script/setup</pre> <p>Also follow instructions in AN1256 for setting the higher baud rate (460800) for OTBR and RCP</p>
1148720	Intermittently, SED current draw is too high.	No known workaround
1171933	When using Bluetooth with the FreeRTOS kernel, the FreeRTOS timer task priority needs to be configured to be higher than the link layer task priority. This is needed to ensure correct task scheduling for radio operations, and to avoid a FreeRTOS race condition that may corrupt heap and cause a hard fault.	Modify <code>configTIMER_TASK_PRIORITY</code> (found in <code>FreeRTOSConfig.h</code>) to ensure it has a higher priority than <code>SL_BT_RTOS_LINK_LAYER_TASK_PRIORITY</code> (found in <code>sl_bt_rtos_config.h</code>).

5 Deprecated Items

None.

6 Removed Items

Removed in release 2.3.0.0

- The ot-remote-cli component has been removed. There is no replacement for this component because the functionality provided by the component is no longer required.
- The Silicon Labs HomeKit extension is no longer included with this release.

7 Multiprotocol Gateway and RCP

7.1 New Items

Added in release 2.3.0.0

Added a new application `z3-light_ot-ftd_soc` that demonstrates Zigbee and OpenThread Concurrent Multiprotocol functionality. It features a router on the Zigbee side and a Full Thread Device (FTD) on the OpenThread side. See the project description or [app/framework/scenarios/z3/z3-light_ot-ftd_soc/readme.html](https://github.com/SiliconLabs/z3-light_ot-ftd_soc/blob/master/README.md) for details.

First GA-quality release of CPC GPIO Expander module. The Co-Processor Communication (CPC) General Purpose Input/Output (GPIO) Expander is a software component designed to enable a Host device to utilize a Secondary device's GPIOs as if they were its own. With the CPC GPIO Expander, the Host device can seamlessly integrate with the Secondary device and make use of its GPIO capabilities. See <https://github.com/SiliconLabs/cpc-gpio-expander/README.md> for documentation.

Added antenna diversity and coex EZSP command support to Zigbeed.

Added better assert reporting to Zigbeed.

Added `bt_host_empty` application (option: `-B` for the `run.sh` script) to the multiprotocol docker container.

Zigbeed now includes an implementation of `emberGetRestoredEui64()` which loads the `CREATOR_STACK_RESTORED_EUI64` token from the `host_token.nvm` file.

The multiprotocol container now sets the size of syslog to 100 MB by default. Users are able to change the size by modifying the `/etc/logrotate.d/rsyslog` and `/etc/rsyslog.d/50-default.conf` files and restarting the rsyslog service inside the container.

7.2 Improvements

Changed in release 2.3.1.0

`Radio_url` can now take a list of IIDs. This is to control IIDs a host can accept spinel frames from other than its own IID. RCP uses IID zero for the received broadcast packet to deliver a spinel frame to all the connected hosts/endpoints. An example of the new `radio_url` is `'spinel+cpc://cpcd_0?iid=1&iid-list=0'`.

CLI commands used by `z3-light_ot-ftd_soc` sample application have been moved from the project into a new component called `ot_up_cli`.

Changed in release 2.3.0.0

Reduced CPC Tx and Rx queue sizes to fit the DMP NCP on the MG13 family.

Configured options on the multiprotocol RCP projects to provide ~3.3k in RAM savings, particularly for the MG1 part. This was accomplished by

- Reducing
 - The number of user CPC endpoints to 0
 - Tx CPC queue size to 15 from 20
 - Rx buffer count to 15
- Disabling OpenThread RTT logs

For further savings, customers can look into reducing the Tx and Rx queue sizes further. Note that the downside to this change would be a reduction in message throughput due to added retries. Also, customers can look into reducing the NVM cache size based on need. As a last resort, customers may also choose to disable CPC security on both the RCP and the host. We do not recommend the last option.

Changed `zigbee_ble_event_handler` to print scan responses from legacy advertisements in the `DMPLight(Sed)` app.

The `rcp-xxx-802154` apps now by default support 192 μ sec turnaround time for non-enhanced acks while still using 256 μ sec turnaround time for enhanced acks required by CSL.

7.3 Fixed Issues

Fixed in release 2.3.1.0

ID #	Description
1113498 1135805	Resolved several issues that caused intermittent failures in zigbeed when attempting to join 100 or more Zigbee devices to the network.
1153055	An issue has been fixed that caused failure on the host if a communication error occurred when reading the NCP version.
1171451	An argument parsing issue has been fixed in the CLI command ping_ipaddr of the ot_up_cli component.

Fixed in release 2.3.0.0

ID #	Description
1078323	Resolved issue where Z3GatewayCPC asserts when there is a communication failure with the NCP during address table initialization. We will now try to reconnect to the NCP upon failure.
1080517	Z3GatewayCPC now automatically handles a reset of the NCP (CPC secondary).
1117789	Fixed an issue where modifying OPENTHREAD_CONFIG_PLATFORM_RADIO_SPINEL_RX_FRAME_BUFFER_SIZE caused a linker error when building Zigbeed.
1118077	In the CMP RCP, Spinel messages were being dropped under heavy traffic load due to CPC not keeping up with the incoming packets. Fixed this by bundling all Spinel messages ready to be sent over CPC into one payload on the RCP and unbundling them on the host. This dramatically improves the efficiency of CPC so that it can keep up with the incoming radio traffic.
1129821	Fixed null pointer dereference in Zigbeed in an out-of-buffer scenario while receiving packets.
1139990	Fixed an assert in the OpenThread Spinel code that could be triggered when joining many Zigbee devices simultaneously.
1144268	Fixed an issue where excessive radio traffic can cause the Zigbee-BLE NCP to get into a state where it continually executes the NCP and CPC initialization.
1147517	Fixed an issue with Z3GatewayCPC on startup that could cause the reset handling of the secondary to not work correctly.

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.
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 can become unresponsive in the z3-light_ot-ftd_soc app.	This app is released as experimental quality and the issue will be fixed in a future release.
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.
1129032	Experimental concurrent listening feature on xG24 devices is disabled in this release.	Support is planned in a future release.
1143857	Antenna Diversity is not available on the CMP RCP for xG21 and xG24 parts, since the antenna diversity hardware is used for concurrent listening.	Intended behavior.

7.5 Deprecated Items

None

7.6 Removed Items

None

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/2.1/>.

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 [e6df00dd6](#). 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 [bb565ca01](#). 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"/> Microcontrollers	<input type="checkbox"/> Wireless
<input type="checkbox"/> 8-bit MCUs	<input type="checkbox"/> Bluetooth Classic
<input checked="" type="checkbox"/> 32-bit MCUs	<input type="checkbox"/> Bluetooth Low Energy
<input type="checkbox"/> Timing	<input checked="" type="checkbox"/> Proprietary
<input type="checkbox"/> Clocks	<input type="checkbox"/> Wi-Fi
<input type="checkbox"/> Buffers	<input type="checkbox"/> ZigBee and Thread
<input type="checkbox"/> Oscillators	<input type="checkbox"/> Z-Wave
<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>.

Simplicity Studio

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