



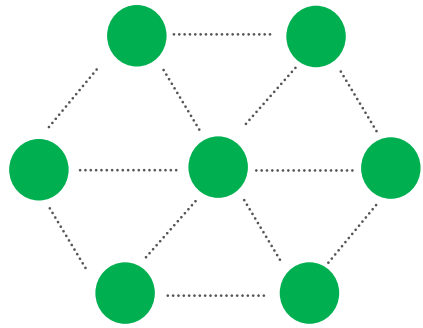
# WELCOME



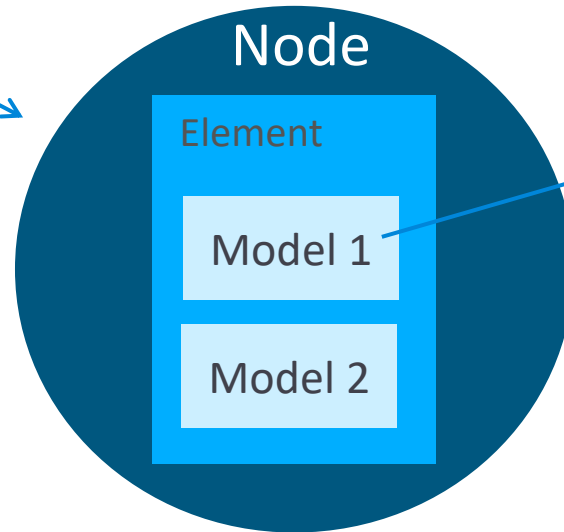
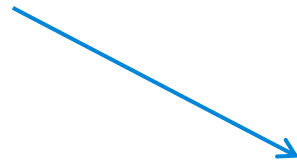
Silicon Labs LIVE:  
Wireless Connectivity  
Tech Talks

A blue background featuring a repeating pattern of white circuit board traces and components. Interspersed within the pattern are snippets of code, including C and C++ syntax such as 'void init()', 'BOARD\_INIT()', 'BITTON\_INIT()', 'cb\_init\_getCircularBuf()', 'static const', '#if defined', '#else', and '#endif'.

# Bluetooth Mesh, Nodes, Models

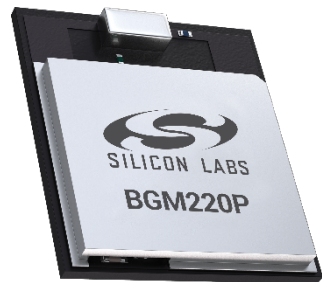


Bluetooth Mesh



## Model

- States
- Messages
- Behavior

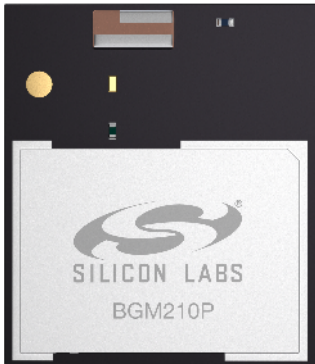
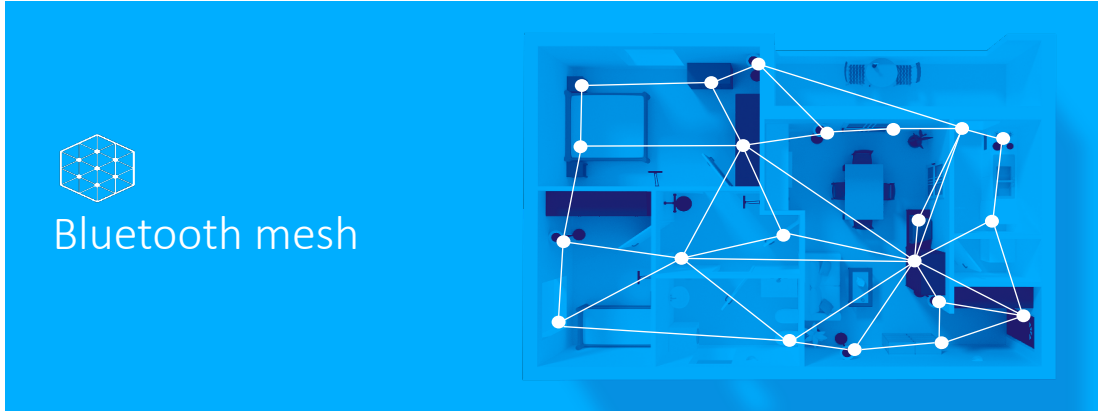


## Generic OnOff Model

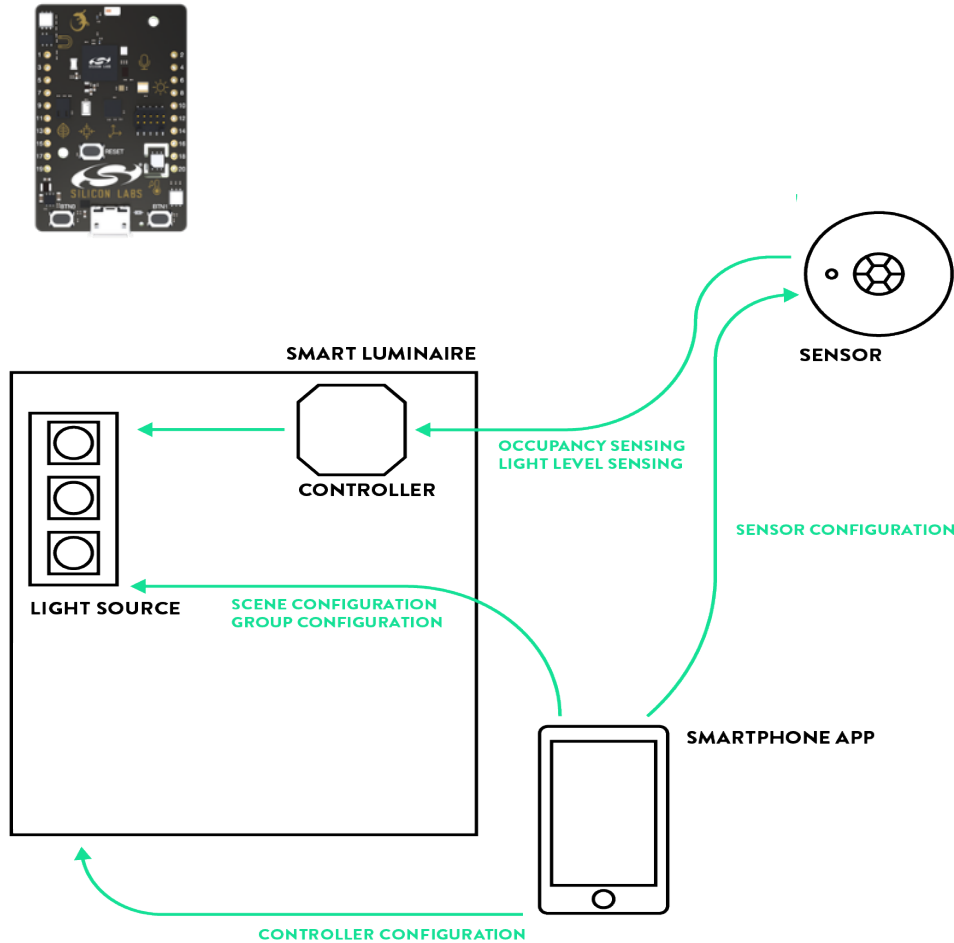
- Generic OnOff Client
- Generic OnOff Server

# Supported Bluetooth Mesh Models

Model Group	Model	Stack/APIs	
<b>Vendor</b>	Any vendor model	✓	
<b>Generic</b>	OnOff	✓	
	Level	✓	
	Default Transition Time	✓	
	Power OnOff	✓	
	Power Level	✓	
	Battery	✓	
	Location	✓	
	Admin property	✓	
	Manufacturer property	✓	
	User property	✓	
	Client property	✓	
	Property	✓	
	<b>Lighting</b>	Lightness	✓
		CTL	✓
LC		✓	
HSL			
xYL			
<b>Sensors</b>	Sensor	✓	
<b>Time and Scenes</b>	Scene	✓	
	Time	✓	
	Scheduler	✓	



# Sensor Model

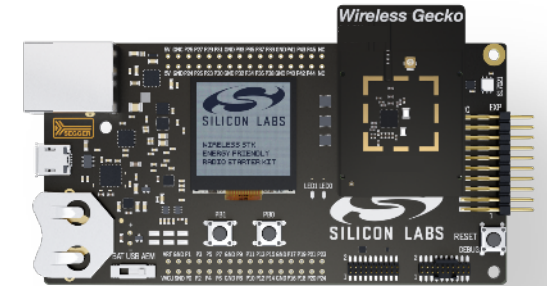


## Sensor Model

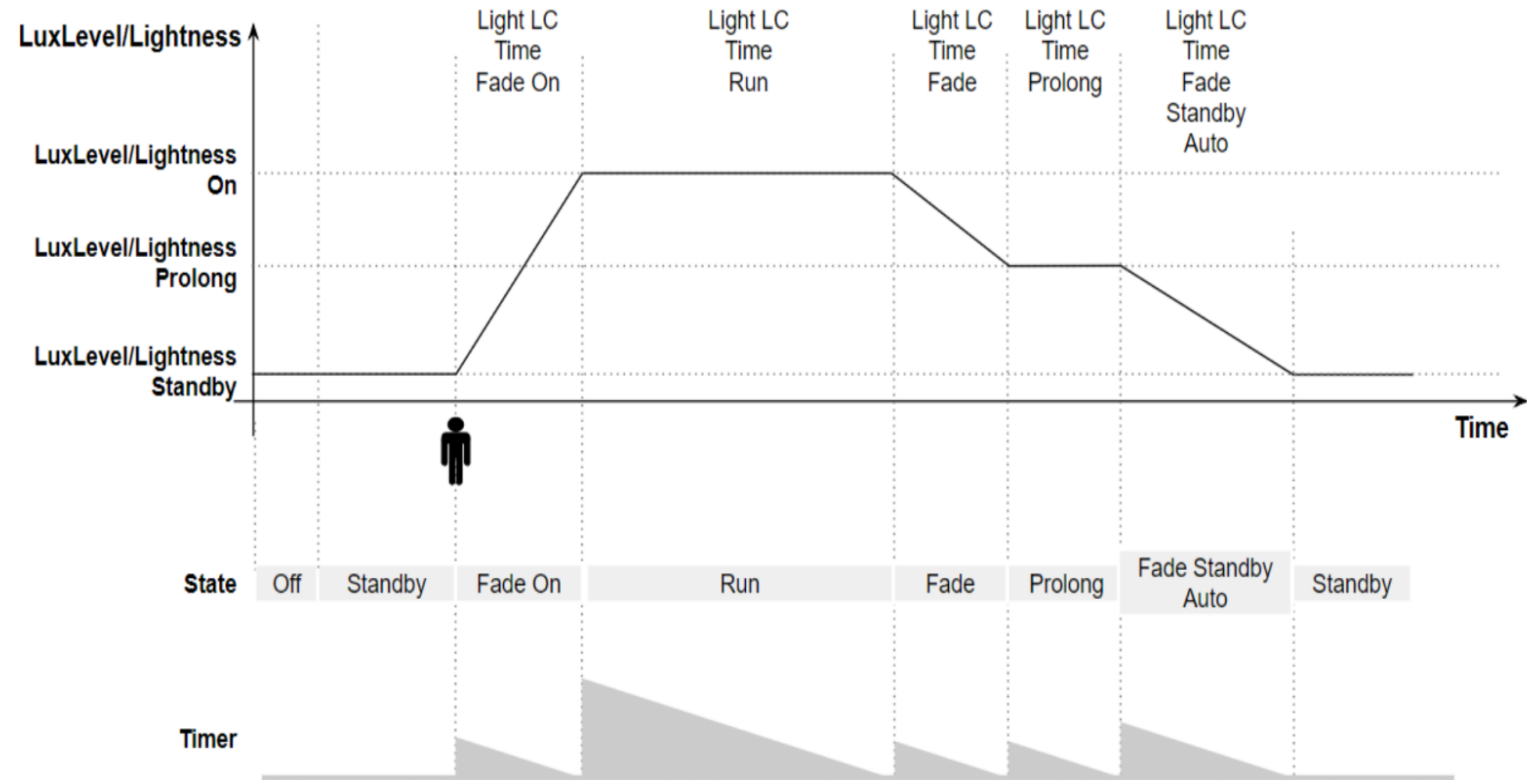
- States
- Messages

## Sensor Model

- Sensor Client
- Sensor Server
- Sensor Setup Server
- Configuration

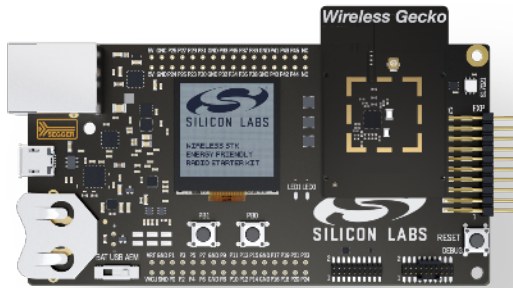


# Light Lightness Controller (LC) Model



- Light LC Client
- Light LC Server
- Light LC Setup Server

# Development Kits



## BG21 SoC Starter Kit

SLWSTK6006A  
SLWSTK6023A



## Thunderboard

SLTB010A



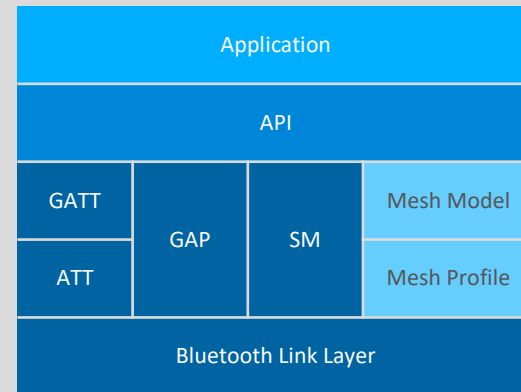
# A Complete Solution for Enabling Bluetooth Products

## SoCS AND MODULES



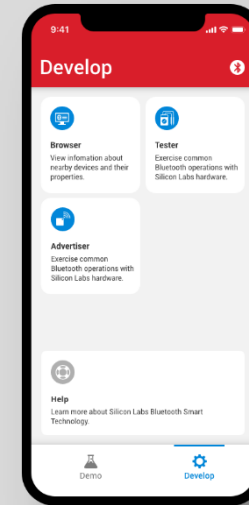
Industry leading Bluetooth 5.1 and 5.2 SoCs and pre-certified modules

## STACK SOFTWARE



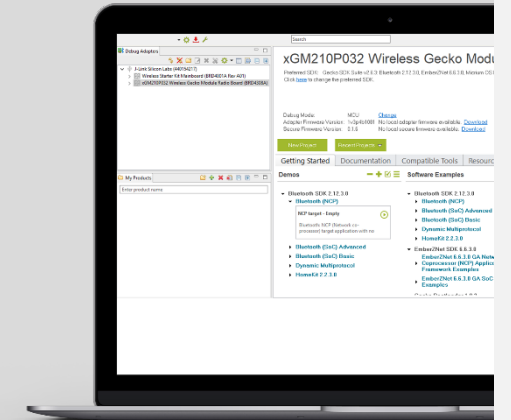
In-house developed stacks with latest Bluetooth 5.2 and mesh features

## MOBILE APPLICATIONS



Reference applications and source code for iOS and Android

## DEVELOPMENT TOOLS



Free-of-charge development and protocol analysis tools to boost productivity



# Network Analyzer

The screenshot displays a network analyzer interface with three main sections:

- Network Topology:** A grid of nodes with a red dashed circle highlighting a specific node labeled '00:04:40:09:83:34'.
- Transactions:** A table showing network transactions with columns for Time, Duration, Summary, NWK Src, NWK Dest, P#, M#, E#, and Status.
- Event Detail:** A detailed view of a BLE Advertisement packet, including fields like Advertisement Header, Rx Address, Tx Address, PDU Type, Length, Advertiser Address, Adv Len, Adv Type, and BT Mesh Beacon details.

Time	Duration	Summary	NWK Src	NWK Dest	P#	M#	E#	Status
801,547989	0,001	BLE Adv - Scan Request/Response	67 1E C3 B1 34 1F	00 0B 57 B5 F1 B7	2			
801,746363	0,001	BLE Adv - Scan Request/Response	43 7F 76 E3 ED EF	00 0B 57 B5 F1 B7	2			
801,946341	0,001	BLE Adv - Scan Request/Response	43 7F 76 E3 ED EF	00 0B 57 B5 F1 B7	2			
802,322274	0,001	BLE LL - Adv Scan Request	61 51 F0 E9 C7 48	A0 9E 1A 1D 68 54	1			Missing packets
802,711594	0,001	BLE LL - Adv Scan Request	67 1E C3 B1 34 1F	A0 9E 1A 1D 68 54	1			Missing packets
802,947180	0,001	BLE Adv - Scan Request/Response	43 7F 76 E3 ED EF	00 0B 57 B5 F1 B7	2			
803,043813	0,001	BLE LL - Adv Scan Request	67 1E C3 B1 34 1F	A0 9E 1A 1D 68 54	1			Missing packets
803,321964	0,001	BLE LL - Adv Scan Request	67 1E C3 B1 34 1F	A0 9E 1A 1D 68 54	1			Missing packets
804,295331	0,001	BLE LL - Adv Scan Request	61 51 F0 E9 C7 48	A0 9E 1A 1D 68 54	1			Missing packets
805,327263	0,001	BLE LL - Adv Scan Request	61 51 F0 E9 C7 48	A0 9E 1A 1D 68 54	1			Missing packets

Time	Type	Summary	MAC Src	MAC Dest	Status
805,735067	Packet	BLE LL - Adv Indication	00 07 80 02 6D B4		
805,746790	Packet	BLE LL - Adv Indication	7C 64 56 A7 21 25		
805,748867	Packet	BLE LL - Adv Indication	00 0B 57 B5 F3 14		
805,749783	Packet	BLE LL - Adv Indication	00 07 80 02 66 4A		
805,758879	Packet	BLE LL - Adv Indication	7C 64 56 A7 21 25		
805,798914	Packet	BLE LL - Adv Indication	00 07 80 02 6E 14		
805,801455	Packet	BLE LL - Adv Indication	00 07 80 02 66 55		
805,802973	Packet	BLE LL - Adv Indication	00 07 80 02 6E 17		
805,805292	Packet	BLE LL - Adv Indication	00 0B 57 B5 F1 7D		
805,818266	Packet	BLE LL - Adv Indication	00 0B 57 B5 F1 6D		

```
Hex Dump [42 bytes]
F8 02 1B 95 2C 49 57 0B 00 14 2B 00 53
69 6C 61 62 73 44 65 76 2D 95 2C 49 57
0B 00 00 00 B5 E7 9C F9 AB D6 DE 89 8E
00 03 68
```

## Network Analyzer captures and decodes Bluetooth LE and mesh packets

- Understand the network traffic easily
- Debug connectivity or protocol issues

## Packets are received from a dedicated PTI interface on EFR32

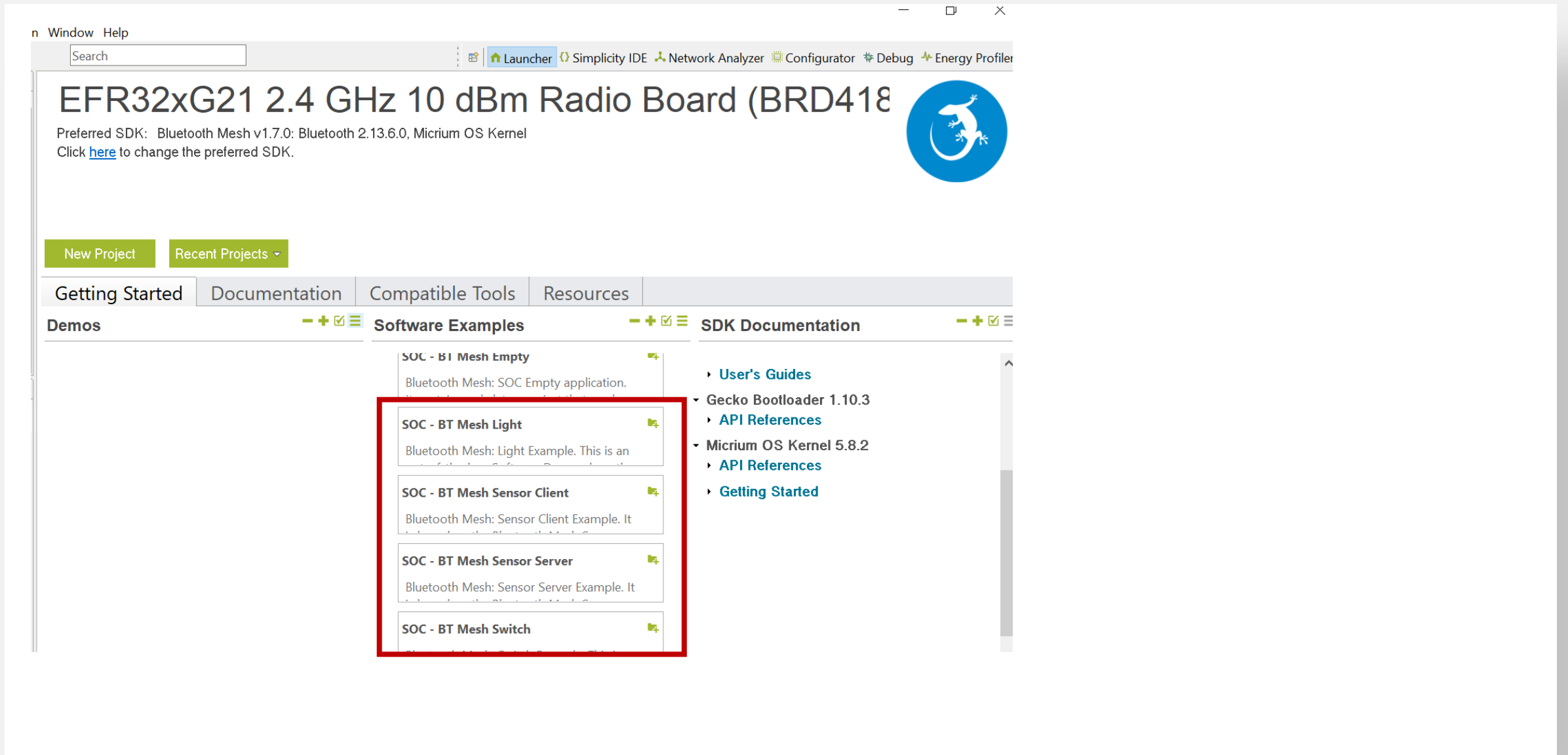
- PTI accurately captures what a device transmits or receives
- A Bluetooth sniffer only captures what it hears

## Capture directly from WSTK's USB or Ethernet

- Live capture from multiple Ethernet networked WSTKs from a single PC
- No need to be in the range of all devices in a network



# Simplicity Studio Mesh Model Examples




n Window Help

Search

Launcher Simplicity IDE Network Analyzer Configurator Debug Energy Profiler

## EFR32xG21 2.4 GHz 10 dBm Radio Board (BRD418)

Preferred SDK: Bluetooth Mesh v1.7.0: Bluetooth 2.13.6.0, Micrium OS Kernel  
Click [here](#) to change the preferred SDK.



New Project Recent Projects

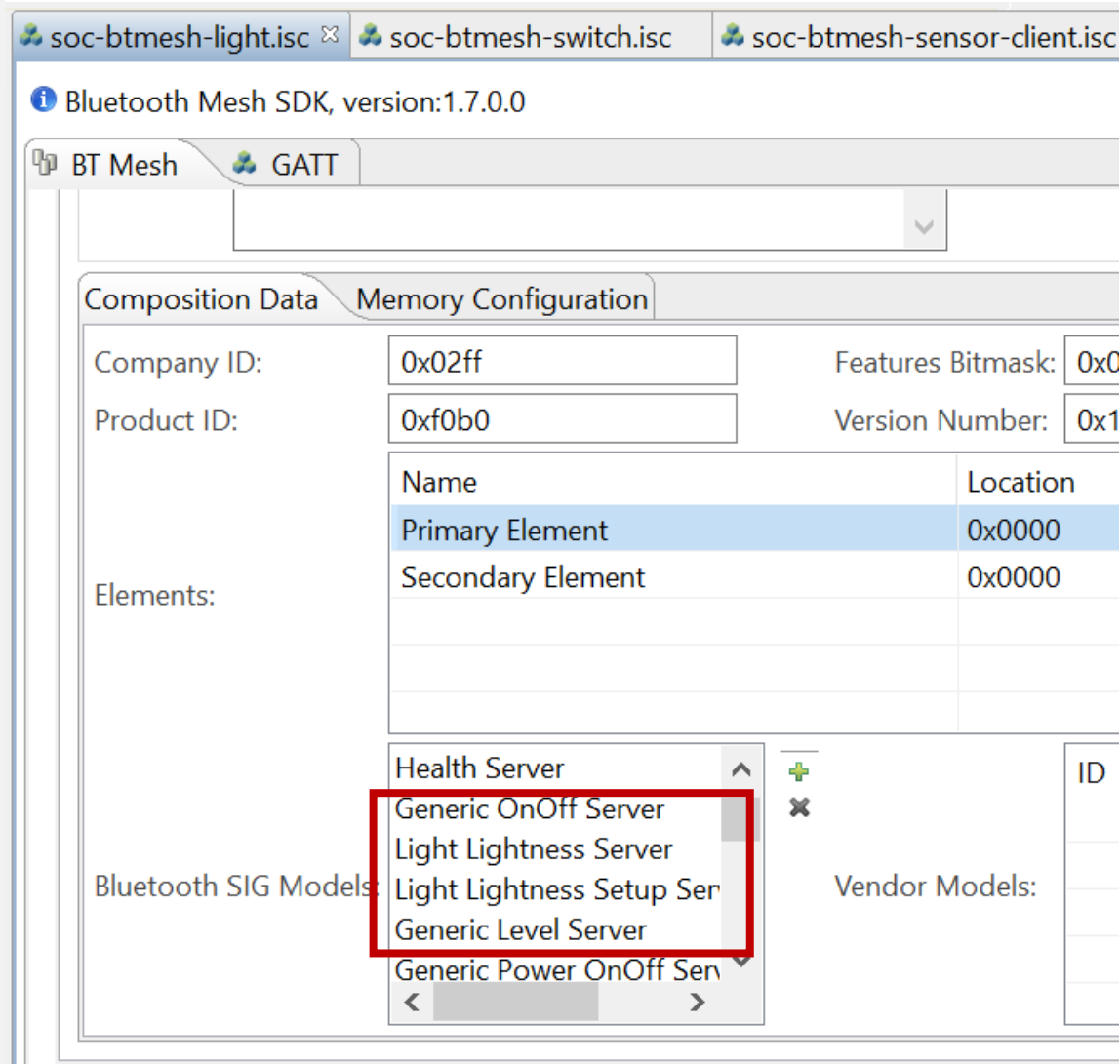
Getting Started Documentation Compatible Tools Resources

Demos Software Examples SDK Documentation

- SOC - BT Mesh Empty  
Bluetooth Mesh: SOC Empty application.
- SOC - BT Mesh Light**  
Bluetooth Mesh: Light Example. This is an
- SOC - BT Mesh Sensor Client  
Bluetooth Mesh: Sensor Client Example. It
- SOC - BT Mesh Sensor Server  
Bluetooth Mesh: Sensor Server Example. It
- SOC - BT Mesh Switch

- › User's Guides
- › Gecko Bootloader 1.10.3
- › API References
- › Micrium OS Kernel 5.8.2
- › API References
- › Getting Started

# Silicon Labs Light Example



Bluetooth Mesh SDK, version:1.7.0.0

BT Mesh | GATT

Composition Data | Memory Configuration

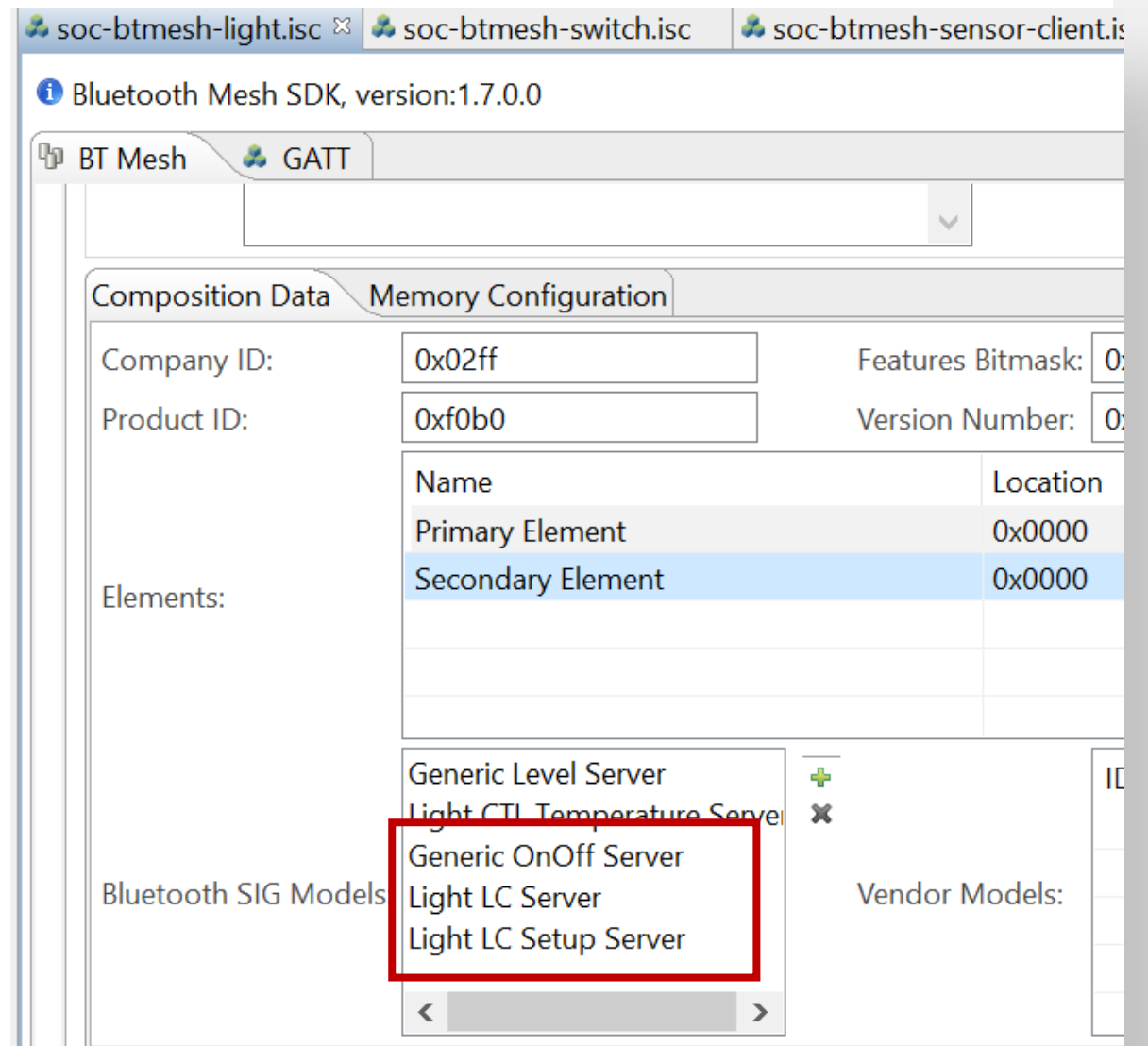
Company ID: 0x02ff | Features Bitmask: 0x00000000  
Product ID: 0xf0b0 | Version Number: 0x10000000

Name	Location
Primary Element	0x0000
Secondary Element	0x0000

Bluetooth SIG Models

- Health Server
- Generic OnOff Server**
- Light Lightness Server
- Light Lightness Setup Ser
- Generic Level Server
- Generic Power OnOff Sen

Vendor Models:



Bluetooth Mesh SDK, version:1.7.0.0

BT Mesh | GATT

Composition Data | Memory Configuration

Company ID: 0x02ff | Features Bitmask: 0x00000000  
Product ID: 0xf0b0 | Version Number: 0x10000000

Name	Location
Primary Element	0x0000
Secondary Element	0x0000

Bluetooth SIG Models

- Generic Level Server
- Light CTL Temperature Server
- Generic OnOff Server**
- Light LC Server
- Light LC Setup Server

Vendor Models:

# Bluetooth Mesh – SOC Options



## **EFR32BG21/13/12**

Support all Bluetooth mesh features  
(Relay, Proxy, Friend etc.)  
768-1024kB flash recommended for OTA



## **EFR32BG22**

512kB parts support Bluetooth mesh LPN  
No support for Relay, Proxy nor Friend

Feature	Value(s)
<b>Supported features</b>	Relay Proxy Friend Low Power
<b>Provisioning bearers</b>	PB-ADV PB-GATT
<b>GATT services</b>	Proxy Provisioning
<b>Security</b>	OoB authentication Replay protection Key refresh (blacklist) ECDH AES-128 encryption, authentication and obfuscation

# Silicon Labs' Bluetooth Module Families



**BGM13P**



**BGM13S**



**BGM210P**



**BGM210L**



**BGM220P (Q3'20)**



**BGM220S (Q3'20)**

	<b>BGM13P</b>	<b>BGM13S</b>	<b>BGM210P</b>	<b>BGM210L</b>	<b>BGM220P (Q3'20)</b>	<b>BGM220S (Q3'20)</b>
<b>Protocols</b>	5.1 and mesh (1M, 2M, Coded PHY and AE)	5.1 and mesh (1M, 2M, Coded PHY and AE)	5.1 and mesh 1.0 (1M, 2M, Coded PHY and AE)	5.1 and mesh 1.0 (1M, 2M, Coded PHY and AE)	5.2 and mesh 1.0 LPN (1M, 2M, Coded PHY, AE and AoA/D)	5.2 and mesh 1.0 LPN (1M, 2M, Coded PHY, AE and AoA/D)
<b>EFR32 SoC</b>	BG13	BG13	BG21	BG21	BG22	BG22
<b>Antenna</b>	Built-in or U.FL	Built-in or RF pin	Built-in or RF pin	Built-in	Built-in	Built-in or RF pin
<b>Max TX power</b>	+8 / +19 dBm	+8 / +18 dBm	+10 / +20 dBm	+12.5 dBm	+8 dBm	+6 dBm
<b>Sensitivity (1M)</b>	-94.8 dBm	-94.1 dBm	-97 dBm	-97 dBm	-98 dBm	-98 dbm
<b>Flash (kB)</b>	512	512	1024	1024	512	512
<b>RAM (kB)</b>	64	64	96	96	32	32
<b>GPIO</b>	25	30	20	12	24,25	25
<b>Operating Voltage</b>	1.8V – 3.6V	1.8V – 3.6V	1.8 – 3.8V	1.8 – 3.8V	1.71V – 3.8V	1.71V – 3.8V
<b>Operating Temp.</b>	-40 to +85C	-40 to +85C	-40 to +125C	-40 to +125C	-40 to +105C	-40 to +105C
<b>Dimensions W x L x H (mm)</b>	13.0 x 15.0 x 2.2	6.5 x 6.5 x 1.4	13.0 x 15.0 x 2.2	13.0 x 15.0 x 2.2	13.0 x 15.0 x 2.2	6 x 6 x 1.3
<b>Certifications</b>	BT, CE, FCC, ISED, Japan, S-Korea and Taiwan	BT, CE, FCC, ISED, Japan & S-Korea	BT, CE, FCC, ISED, Japan & S-Korea	BT, CE, FCC, ISED, Japan & S-Korea	BT, CE, FCC, ISED, Japan & S-Korea	BT, CE, FCC, ISED, Japan & S-Korea

# Reference Materials

- QSG148: Getting Started with Silicon Labs Bluetooth Mesh – <https://www.silabs.com/documents/public/quick-start-guides/qsg148-bluetooth-mesh-demo-quick-start-guide.pdf>
- AN1098: Understanding the Silicon Labs Bluetooth Mesh Lighting Demonstration - <https://www.silabs.com/documents/public/application-notes/an1098-understanding-bluetooth-mesh-lighting-demo.pdf>
- AN1186: Understanding the Silicon Labs Bluetooth Mesh Sensor Model Demonstration - <https://www.silabs.com/documents/public/application-notes/an1186-understanding-bluetooth-mesh-sensor-model-demo.pdf>
- Silicon Labs Bluetooth Mesh Software API Reference Manual - <https://www.silabs.com/documents/public/reference-manuals/bluetooth-le-and-mesh-software-api-reference-manual.pdf>
- Bluetooth SIG Mesh Model Specification







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# Q & A Session

WENDY WARNE : JULY 2020





Thank you

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# Development Hardware

Radio pin access headers for prototyping

Radio card header for easy swapping

Integrate J-Link debugger  
Connect via USB or Ethernet  
Virtual Com Port support  
Packet Trace  
Energy Profiler

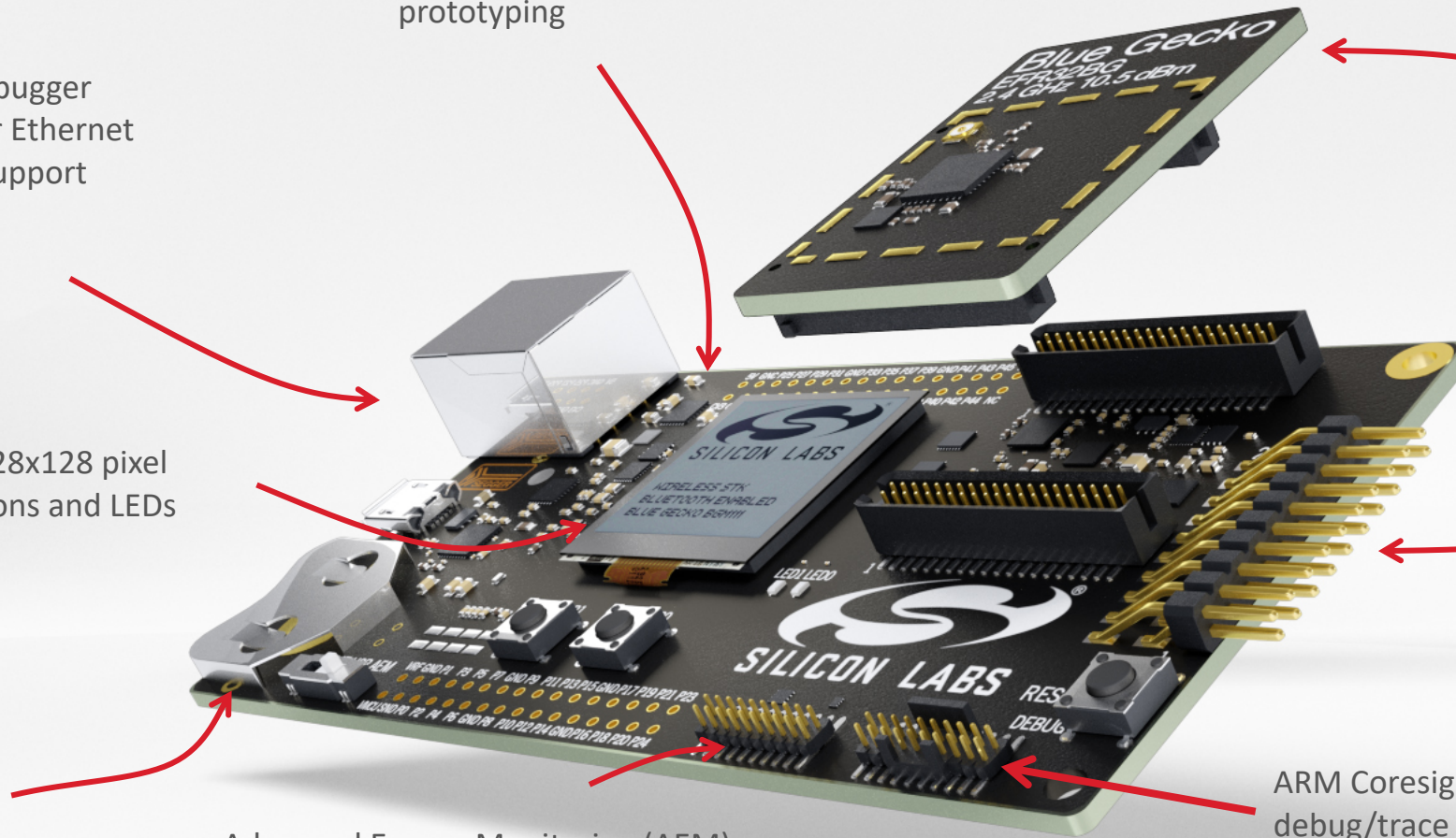
Expansion header for prototyping

Ultra-low power 128x128 pixel  
memory LCD, buttons and LEDs

ARM Coresight 19-pin  
debug/trace header

USB Power or  
Battery Power

Advanced Energy Monitoring (AEM)  
USB Serial Port  
Packet Trace Port

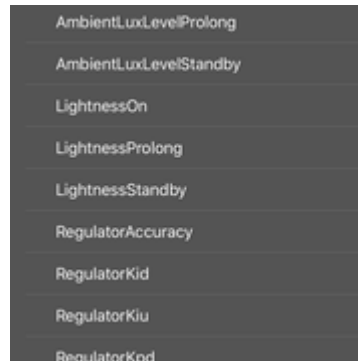
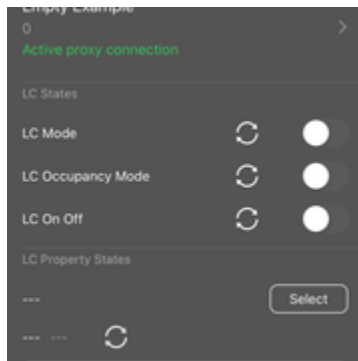


# Light LC Model - Deeper Dive

## LC States

- lc\_state (structure)

Struct Member Name	Description
mode	Current Light LC Mode state
occupancy_mode	Current Light LC Occupancy Mode state
light_off	Current Light LC OnOff state
onoff_current	Current generic state of LC (ON or OFF)
onoff_target	Target generic state of LC (ON or OFF)



## LC Property States

- lc\_property\_state (structure)

Struct Member Name	Description
time_occupancy_delay	Delay between receiving a sensor occupancy message and changing the Light LC Occupancy state
time_fade_on	Transition time from a standby state to a run state
time_run_on	Duration of the run state after last occupancy was detected
time_fade	Transition time from a run state to a prolong state
time_prolong	Duration of the prolong state
time_fade_standby_auto	Transition time from a prolong state to a standby state when the transition is automatic
time_fade_standby_manual	Transition time from a prolong state to a standby state when the transition is triggered by a manual operation
lightness_on	Lightness level in a run state
lightness_prolong	Lightness level in a prolong state
lightness_standby	Lightness level in a standby state
ambient_luxlevel_on	Required Ambient LuxLevel level in the Run state
ambient_luxlevel_prolong	Required Ambient LuxLevel level in the Prolong state
ambient_luxlevel_standby	Required Ambient LuxLevel level in the Standby state
regulator_kiu	Integral coefficient of PI light regulator when increasing output
regulator_kid	Integral coefficient of PI light regulator when decreasing output
regulator_kpu	Proportional coefficient of PI light regulator when increasing output
regulator_kpd	Proportional coefficient of PI light regulator when decreasing output
regulator_accuracy	Accuracy of PI light regulator