

Tech Talks LIVE Schedule – Presentation will begin shortly



Wireless Connectivity Tech Talks



Thursday, July 15 th	Get to Know OpenThread Resources and Examples
Thursday, August 26 th	Understand the Benefits of Wi-SUN for Long Range Industrial Applications
Wednesday, September 29 th	Learn to use Machine Learning for Predictive Maintenance

Recording and slides will be posted to:
www.silabs.com/training

We will begin in **3:00**



Speaker



高山 毅 (Takeshi Takayama)
Staff FAE, Japan



WELCOME

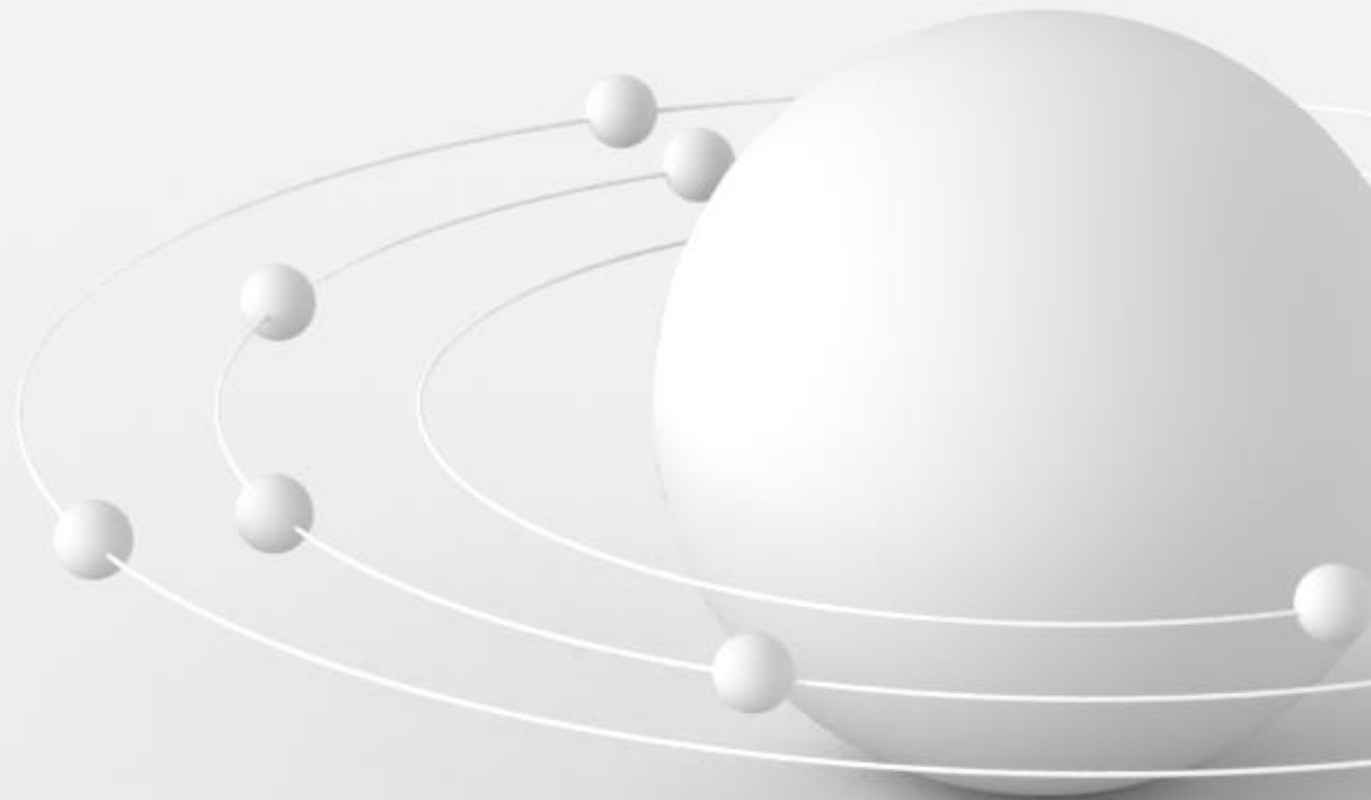
Understand the Benefits of Wi-SUN for Long Range Industrial Applications

Takeshi Takayama





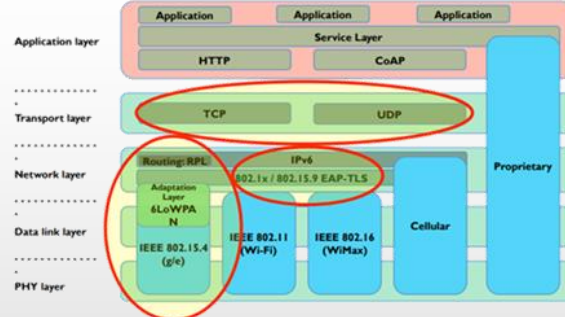



Wi-SUN



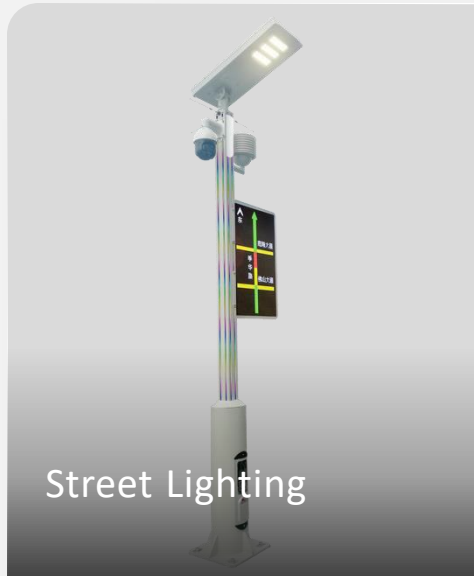
Presented by: Takeshi Takayama

Wi-SUN, Wireless Smart Ubiquitous Network

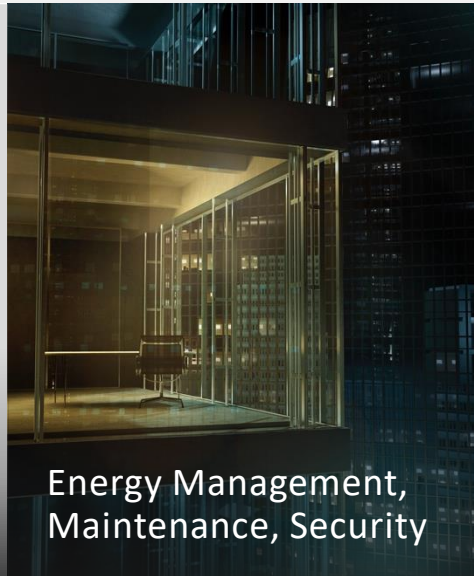
SMART CITY MKT PROBLEM	SOLUTION : WI-SUN ALLIANCE	SOLUTION: WI-SUN	SOLUTION : CERTIFICATION
			
<ul style="list-style-type: none"> ➤ Proprietary Protocols ➤ Lack Of Interoperability ➤ Non-IP Based ➤ Limited Security 	<ul style="list-style-type: none"> ➤ Global Organization ➤ Silicon Labs Promoter Member ➤ 46 Countries ➤ 300+ Members ➤ ~100 Million Devices 	<ul style="list-style-type: none"> ➤ OPEN Standards Based ➤ Interoperable ➤ IPv6/6LoWPAN ➤ Mandatory Security ➤ FSK, OFDM ➤ FAN 1.0 and FAN 1.1 	<ul style="list-style-type: none"> ➤ PHY Certification ➤ FAN Profile Certification ➤ 6 Independent Test Houses ➤ ~50 FAN Certified Products

WI-SUN : A GLOBAL STANDARD DELIVERING INTEROPERABLE CONNECTIVITY & SCALABILITY

Wi-SUN Field Area Network Applications



Street Lighting



Energy Management,
Maintenance, Security



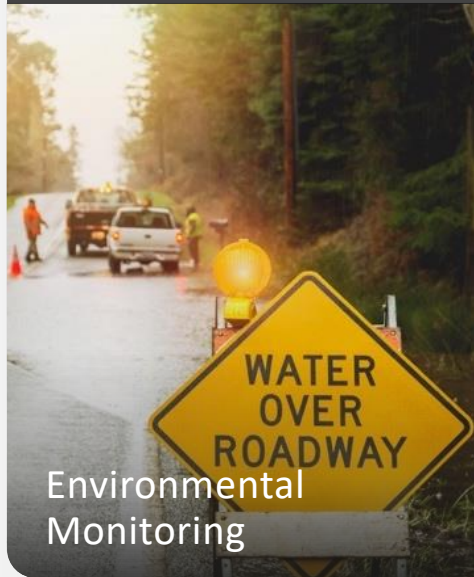
Traffic Control/Lights,
Parking Meters



Oil/Gas
Production



Utility Meters



Environmental
Monitoring



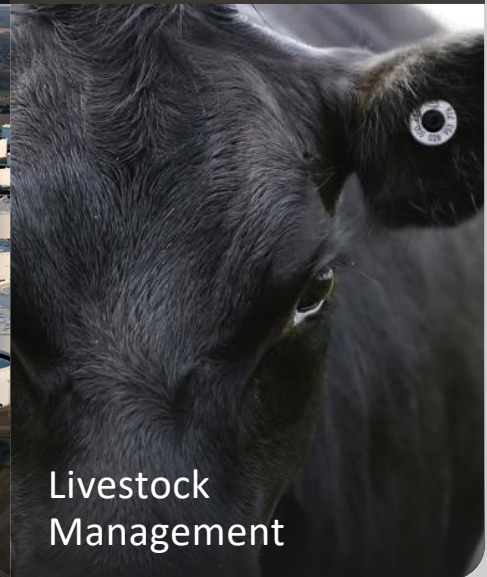
Waste
Management



Consumption, Flow
rate, Valve Control

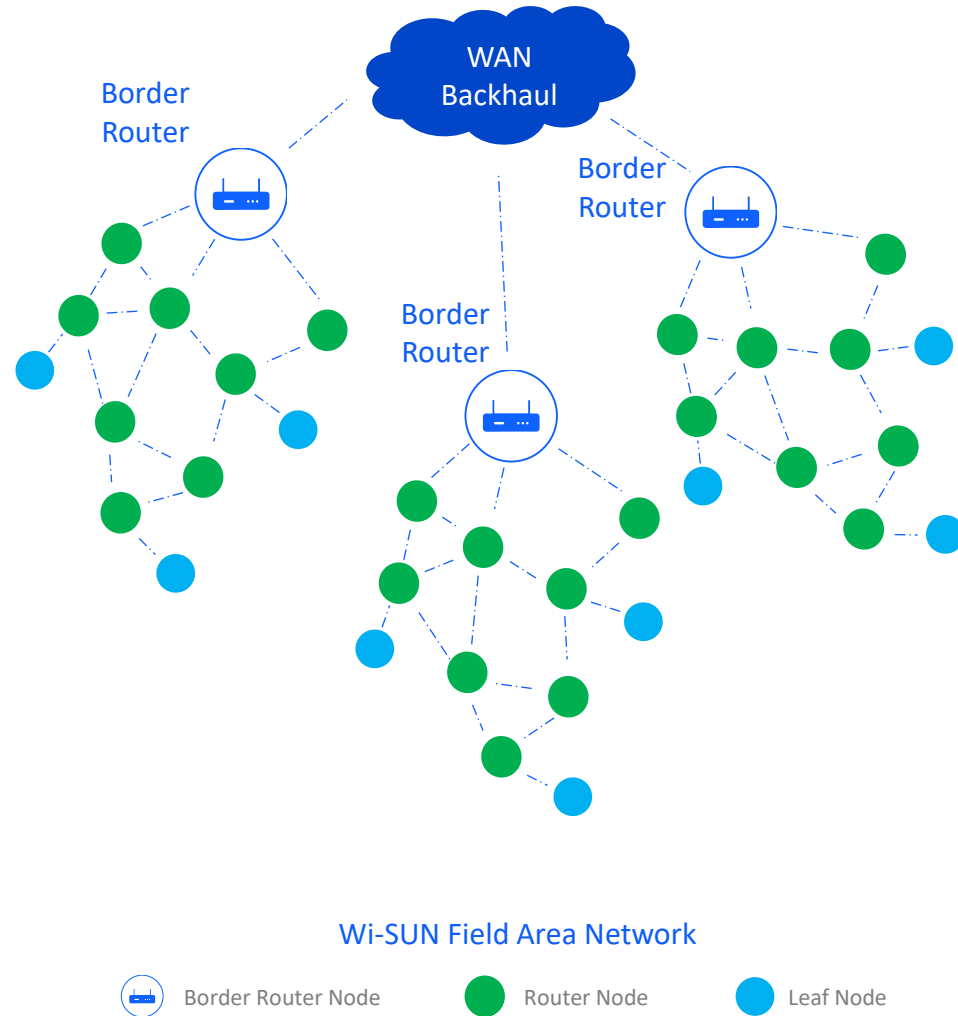


Storage &
Distribution



Livestock
Management

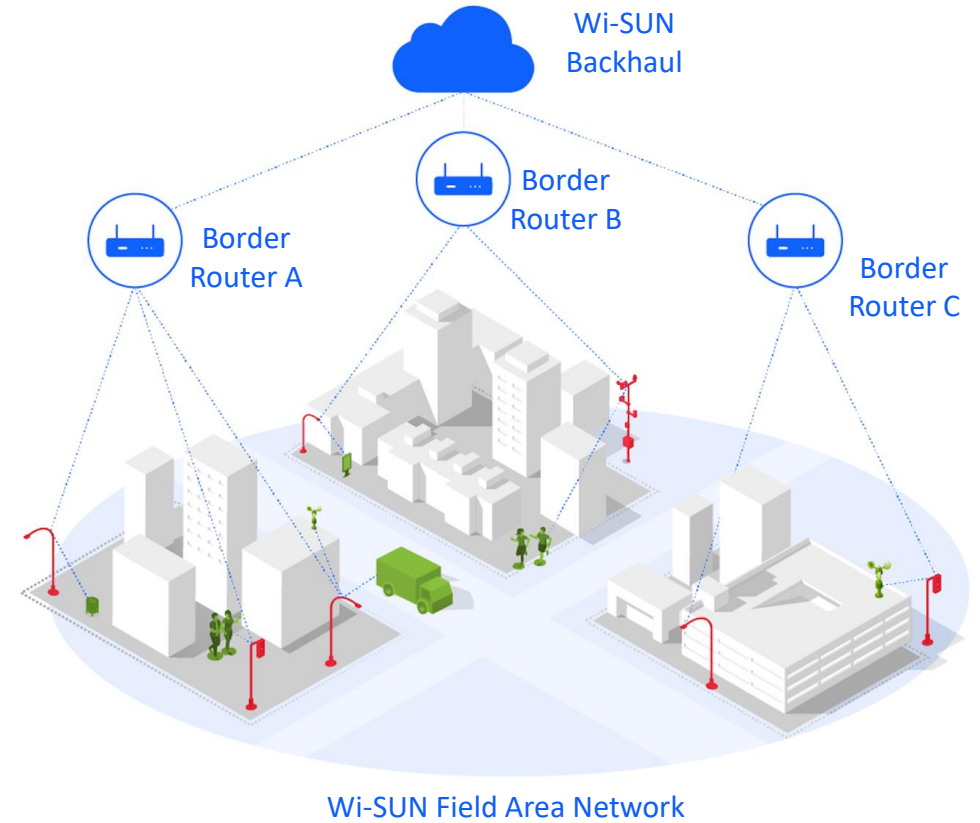
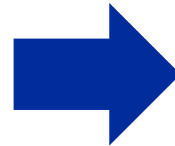
Wi-SUN Key Words



System Elements:

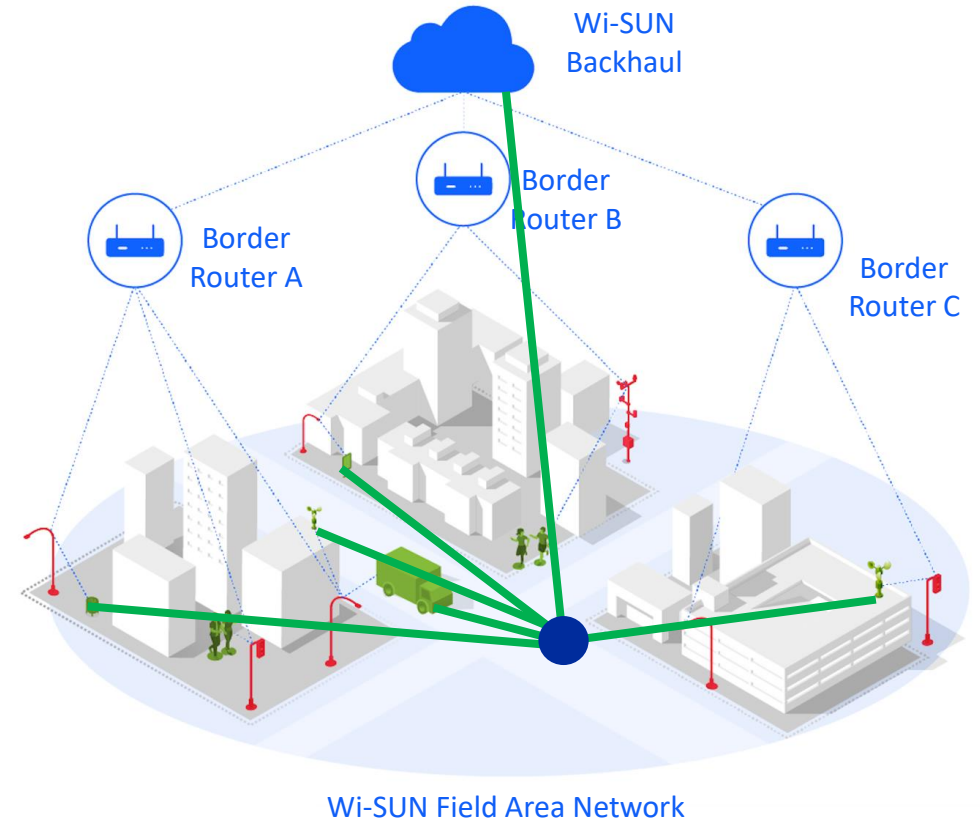
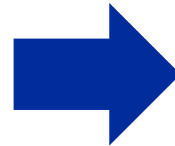
- Wi-SUN Network
- Border Router
- Router/Node
- Leaf Node
- IPV6/6LoWPAN

How Wi-SUN works....



-  Border Router Node
-  Router Node
-  Leaf Node

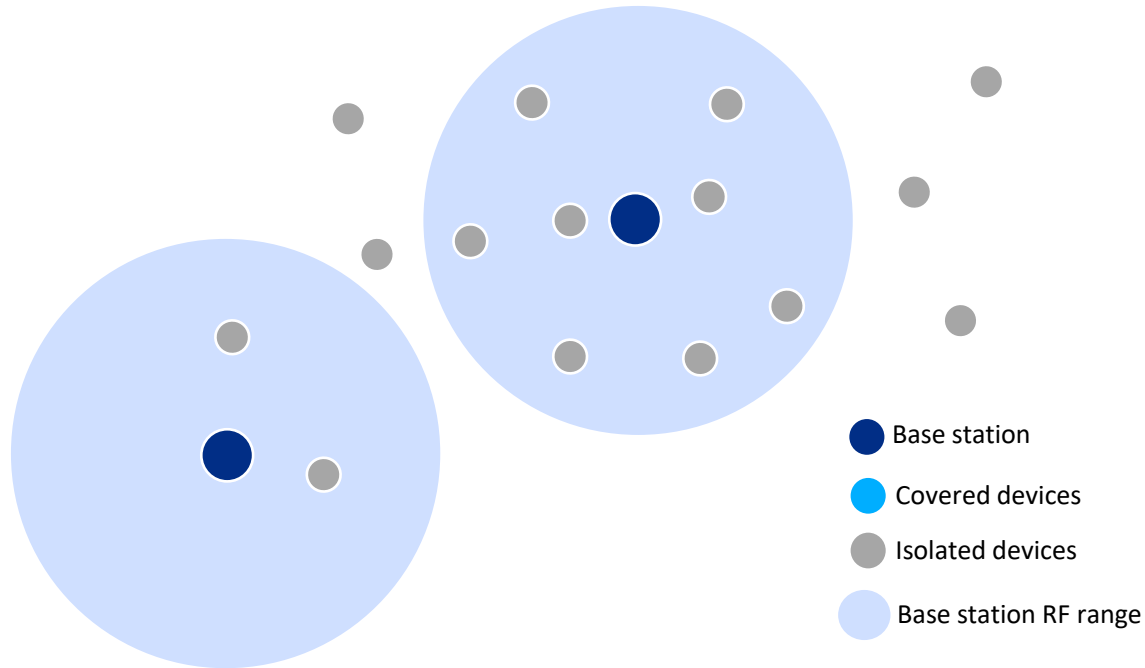
How Wi-SUN works....



-  Border Router Node
-  Router Node
-  Leaf Node

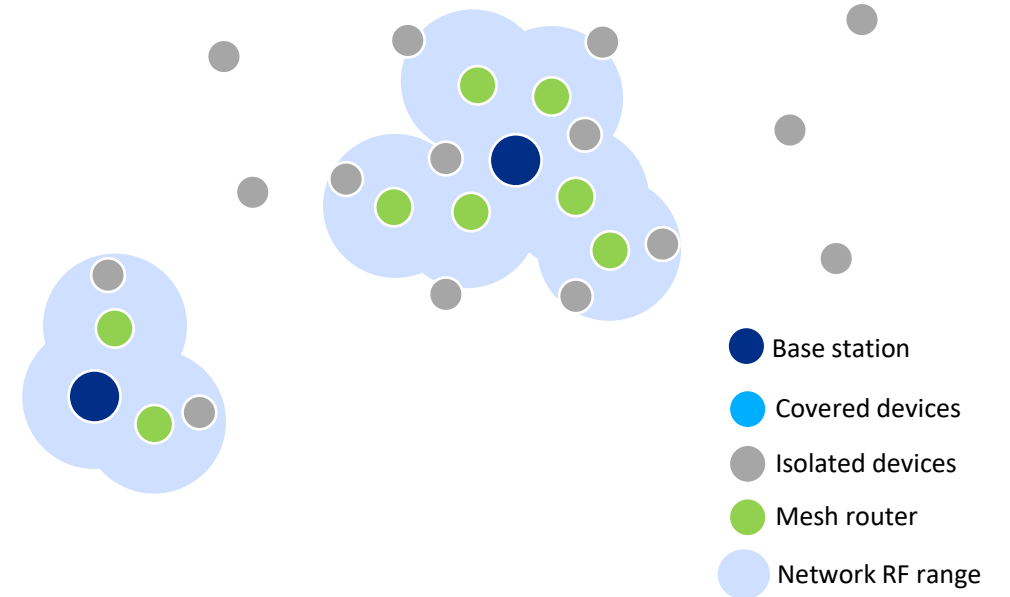
Mesh Network vs Long-Range IoT Protocols

NB-LPWA : Long-range IoT Protocol



- Star topology (LoRa, Sigfox, NB-IoT...)
- Base station able to cover several km² with a data rate which can go below 1 Kbps
- One isolated device requires a new base station implantation

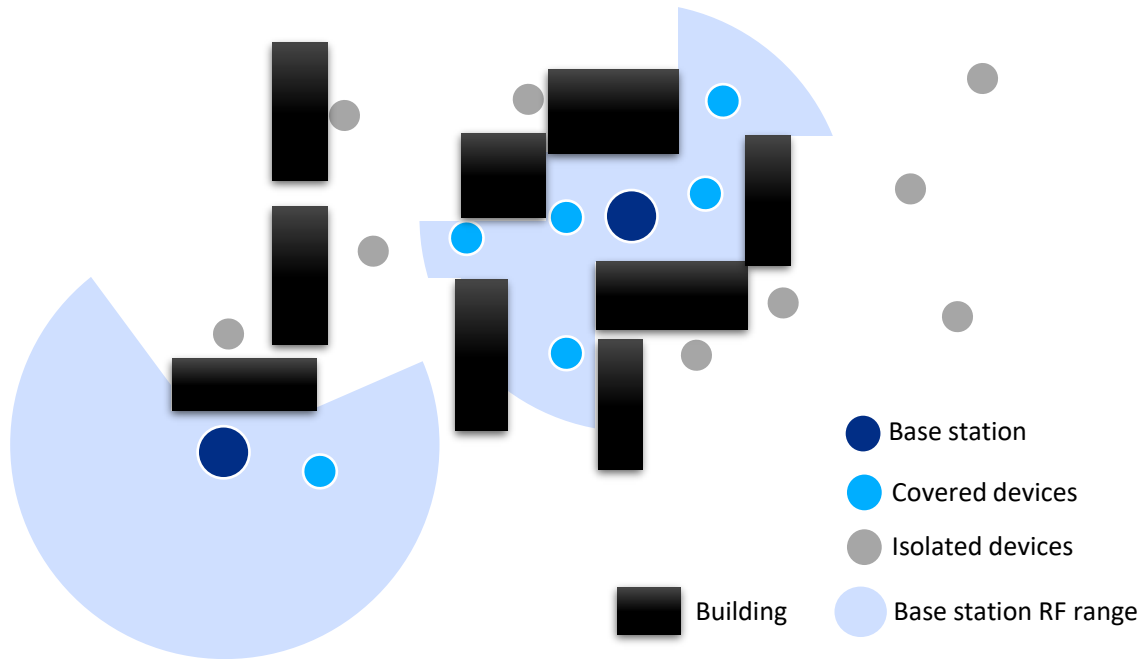
LPWA : Mesh Network Protocol



- Mesh topology (Wi-SUN/Thread/Bluetooth Mesh...)
- Device range is around 700-800m in the lowest data rate (50 Kbps FSK)
- Due the higher data rate used, the battery life of the devices is extended for similar use cases

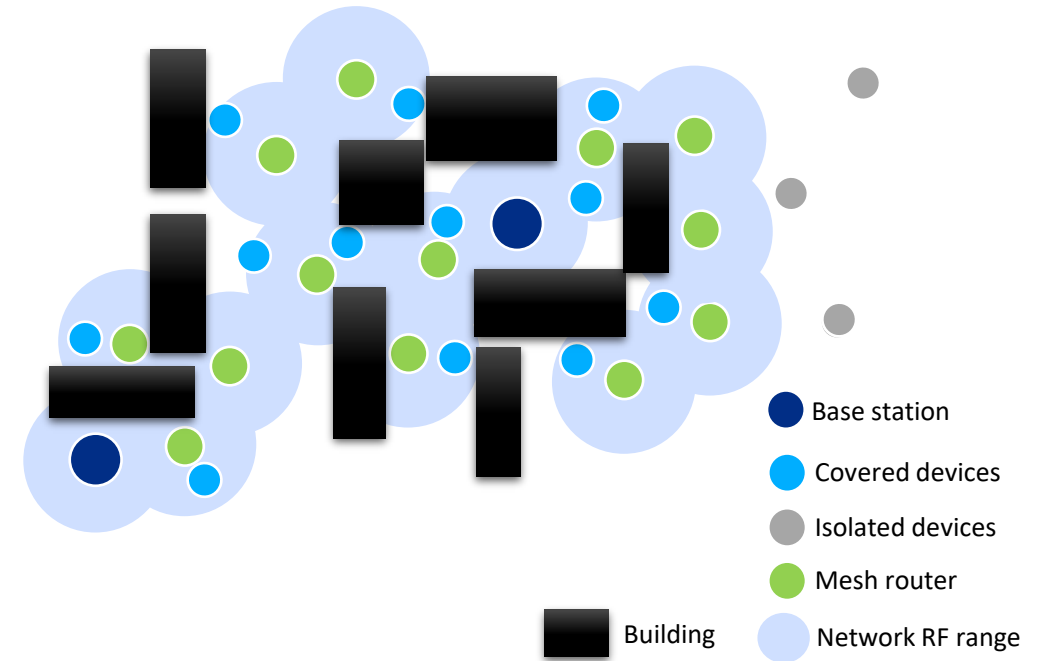
Mesh Network vs Long-Range IoT Protocols

Long-range IoT Protocol



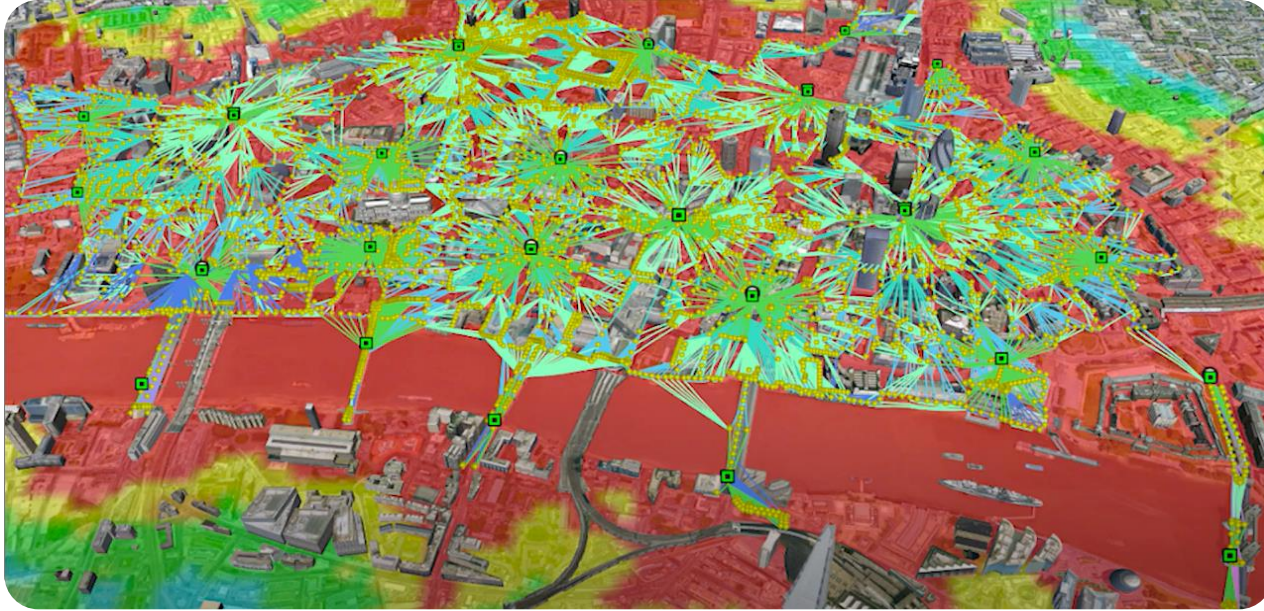
- Star topology includes expensive base stations
- In an urban environment or RF challenging layout, deploying enough base stations to cover the entirety of an area is tedious.

Mesh Network Protocol



- Mesh topology is more flexible
- Mesh routers can be deployed on grid powered devices (electric meters, streetlights...)
- Having a complete RF coverage of such an area becomes possible

Deployment Example: London



- **Control Management System (CMS)**

- Street lighting
- Utilities
- Parking

- **15,000 connected Wi-SUN devices**

- **12 Wi-SUN border routers**

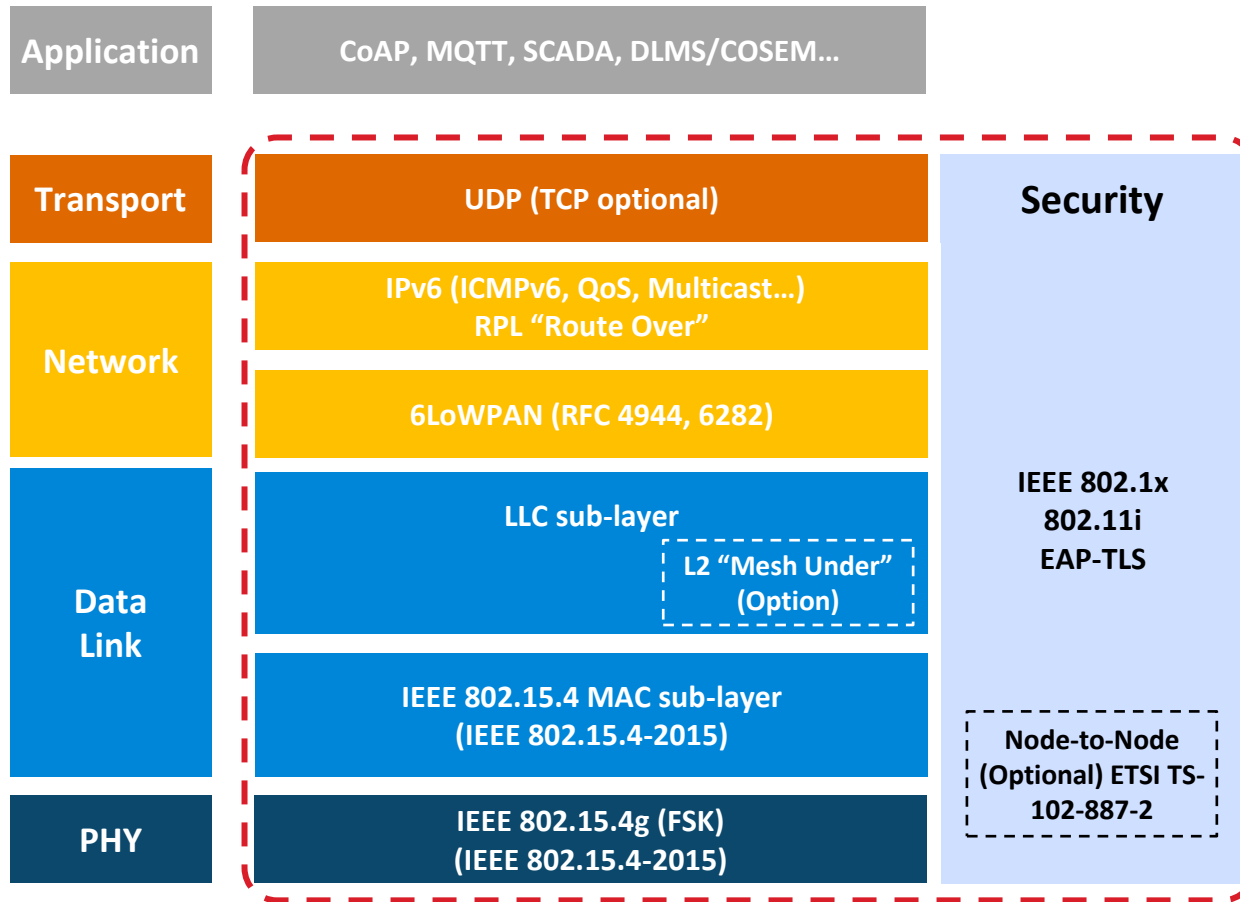
- **Major benefits**

- Enables real-time remote management
- Reduces electrical energy usage
- Automatically generates maintenance service orders
- Future proof system that can scale as the city converts old infrastructure to new

Additional information here:

<https://wi-sun.org/latest-news/wi-sun-technology-provides-the-platform-for-city-of-london-smart-city-initiative/>

Wi-SUN FAN, Field Area Network



Wi-SUN FAN 1.0

IPv6 Protocol suite

- UDP (TCP only optional)
- 6LoWPAN Adaptation + Header Compression
- DHCPv6 for IP address management
- Routing using RPL
- ICMPv6
- Unicast and Multicast forwarding

Security

- 802.1X/EAP-TLS/PKI Authentication
- 802.11i Group Key Management
- Optional ETSI-TS-102-887-2 Node-to-Node Key Management

MAC based on IEEE802.15.4e + IE extensions

- Frequency hopping
- Discovery/Join
- Optional Mesh Under routing (L2 Mesh)

PHY based on 802.15.4g

- FSK modulations, various data rates and regions

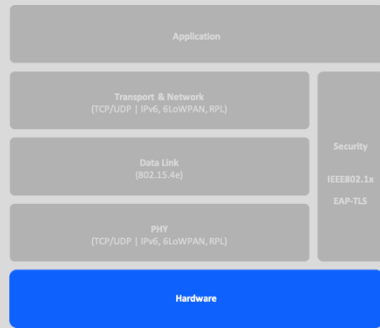
Wi-SUN: Frequency Bands and Operating Modes

Region (regulatory domain)	470	510	779	787	863	870	876	902	907.5	915	917	918	919	920	923	925	928	2400	2483.5																									
China (0x04)	[470-510] 1b/2a/3 F1		[779-787] 1b/2a F2	3/4a/5 F3										[920.5-924.5] 1b/2a/3 F4																														
Europe (0x03)					[863-870] F5	1a	1a																																					
					F6	2a/3	2a/3	F7-[870-876]	F8																																			
India (0x05)					[865-867]	1a F9																																						
						2a/3 F10																																						
Singapore (0x0D)					[866-869]	1a F11								[920-925]	1b/2a F14																													
						2a/3 F12									3/4a/5 F15																													
						4a/5 F13																																						
Mexico (0x06)								[902-928]																																				
North America (0x01)	Table 2 - PHY Operating Modes and Symbol Rates <table border="1"> <thead> <tr> <th>PHY Operating Modes</th> <th>Symbol Rate (ksymbol/s)</th> <th>Modulation Index</th> </tr> </thead> <tbody> <tr> <td>Operating Mode# 1a</td> <td>50</td> <td>0.5</td> </tr> <tr> <td>Operating Mode# 1b</td> <td>50</td> <td>1.0</td> </tr> <tr> <td>Operating Mode# 2a</td> <td>100</td> <td>0.5</td> </tr> <tr> <td>Operating Mode# 2b</td> <td>100</td> <td>1.0</td> </tr> <tr> <td>Operating Mode# 3</td> <td>150</td> <td>0.5</td> </tr> <tr> <td>Operating Mode# 4a</td> <td>200</td> <td>0.5</td> </tr> <tr> <td>Operating Mode# 4b</td> <td>200</td> <td>1.0</td> </tr> <tr> <td>Operating Mode# 5</td> <td>300</td> <td>0.5</td> </tr> </tbody> </table>								PHY Operating Modes	Symbol Rate (ksymbol/s)	Modulation Index	Operating Mode# 1a	50	0.5	Operating Mode# 1b	50	1.0	Operating Mode# 2a	100	0.5	Operating Mode# 2b	100	1.0	Operating Mode# 3	150	0.5	Operating Mode# 4a	200	0.5	Operating Mode# 4b	200	1.0	Operating Mode# 5	300	0.5	[902-928]	1b/2a F16							
PHY Operating Modes									Symbol Rate (ksymbol/s)	Modulation Index																																		
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Operating Mode# 4b									200	1.0																																		
Operating Mode# 5									300	0.5																																		
Brazil (0x07)								[902-907.5]	1b/2a F19a	[915-928]	1b/2a F19b																																	
									3/4a F20a		3/4a F20b																																	
									5 F21a		5 F21b																																	
Australia/New Zealand (0x08)										[915-928]	1b/2a F22																																	
											3/4a/5 F23																																	
South Korea (0x09)										[917-923.5]	1b/2a F24																																	
											3/4a/5 F25																																	
Philippines (0x0A)										[915-918]	1b/2a F26																																	
											3/4a/5 F27																																	
Malaysia (0x0B)										[919-923]	1b/2a F28																																	
											3/4a/5 F29																																	
Hong Kong (0x0C), Thailand (0x0E), Vietnam (0x0F)														[920-925]	1b/2a F14																													
															3/4a/5 F30																													
Japan (0x02)														[920-928]	1b F31																													
															2b/3 F32																													
															4b/5 F33																													
Worldwide (0x00)																		[2400-2483.5]	1b/2a F34																									
																			3/4a/5 F35																									

Operating class:				
1	2	3	4	5

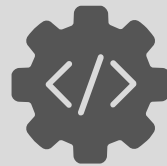
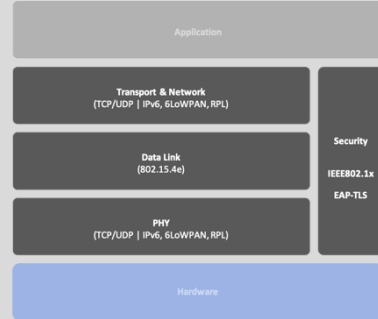
Regulatory domain, operating class and operating mode are provided by the stack, together with network name . The Operating Class (OC) field is an 8-bit unsigned integer which is used to achieve the desired data rate and channel plan within the Regulatory Domain

Silicon Labs Wi-SUN Solution



HARDWARE

Field Proven SoC xG12
Low-Power Silicon
Sub-GHz FSK PHYs



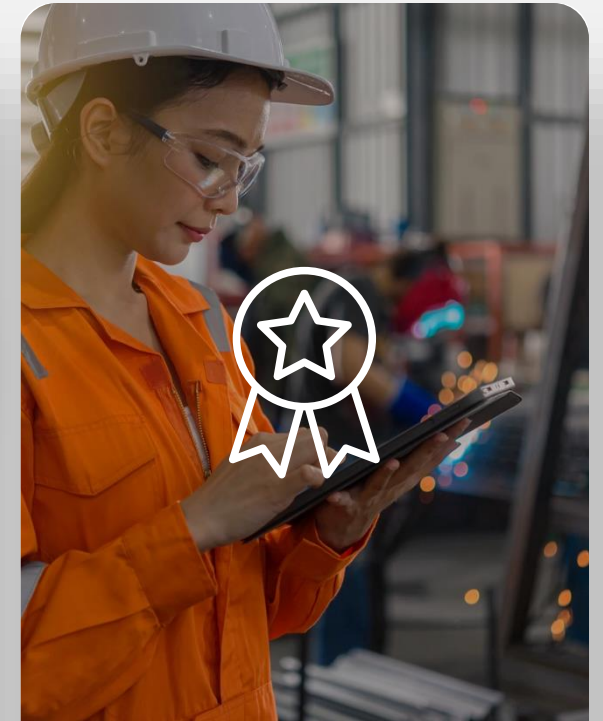
WI-SUN STACK & OS

IPv6/6LoWPAN
Runs w/ FreeRTOS and Micrium
Full featured Stack



TOOLS

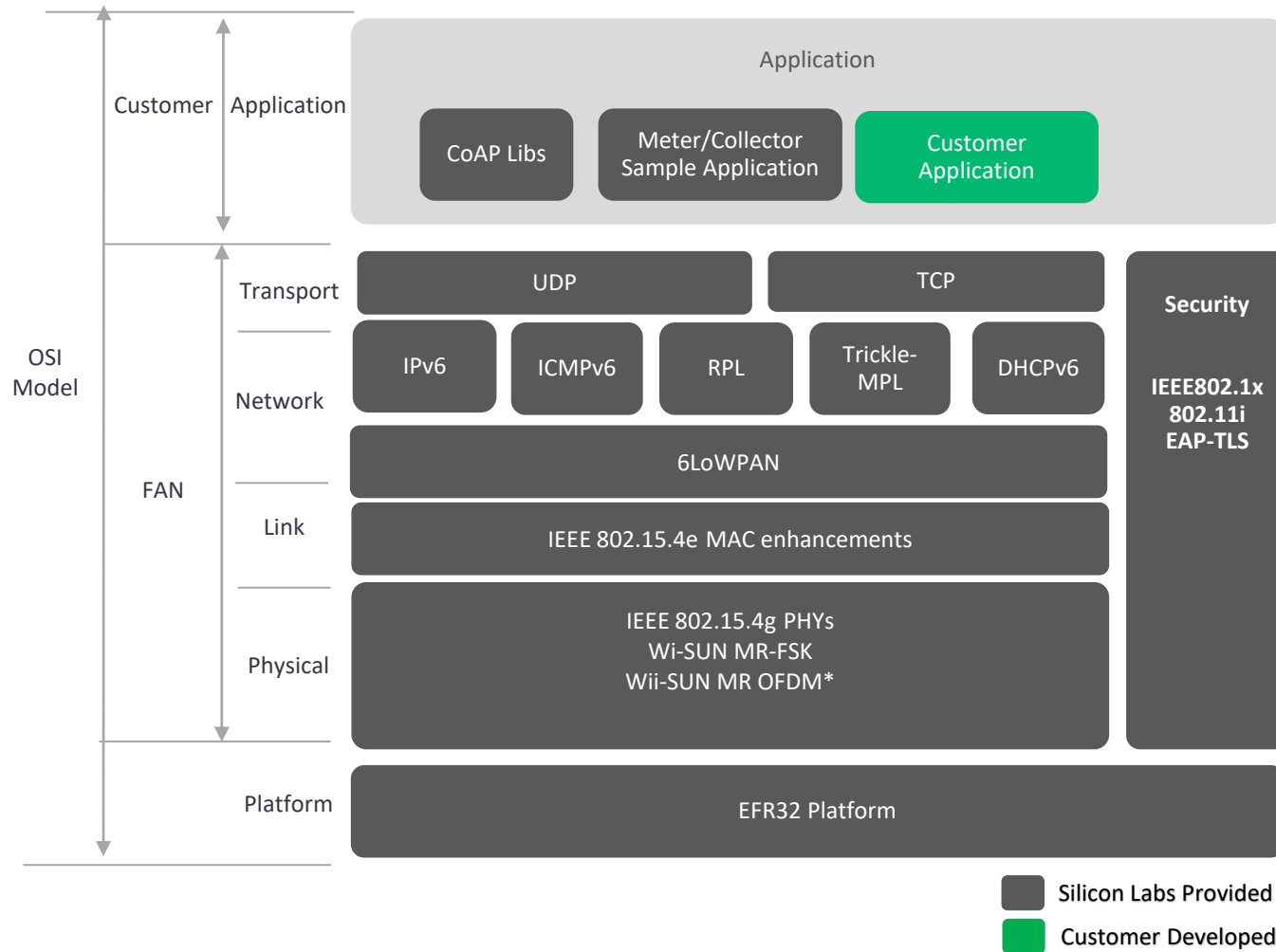
Reference Applications
(Including Border Router Demo)
Command Line Interface support



CERTIFICATION

Certified PHY
Certified FAN 1.0 stack
(FAN 1.1 when specification ratified)

Stack and Sample Apps



Wi-SUN Sample Apps

- SoC CLI
- SoC CoAP Collector
- SoC CoAP Meter
- SoC Collector
- SoC Empty
- SoC Meter
- SoC Ping
- SoC TCP Client
- SoC TCP Server
- SoC UDP Client
- SoC UDP Server

PHY (802.15.4g)

- FSK (xG12) modulations, data rates, and regions
- *OFDM Support Coming Soon

Simplicity Studio 5 – Wi-SUN Application Examples

The screenshot displays the Simplicity Studio 5 interface for the product EFR32FG12P232F1024GL125. The main content area is titled "EFR32FG12P232F1024GL125" and includes tabs for "OVERVIEW", "EXAMPLE PROJECTS & DEMOS", "DOCUMENTATION", and "COMPATIBLE TOOLS". Below the tabs, there is a prompt: "Run a pre-compiled demo or create a new project based on a software example." A search bar "Filter on keywords" is present. On the left, there are filters for "Demos" (enabled), "Example Projects" (enabled), "Technology Type" (with a "Clear Filter" button), and "Quality" (with a "Clear Filter" button). The "Technology Type" filter shows "Wi-SUN (11)" selected. The "Quality" filter shows "PRODUCTION (11)" selected. The main area displays 11 resources found, each with a description and a "CREATE" button. The resources are:

- Wi-SUN - SoC CLI**: The Wi-SUN CLI (Command-Line Interface) sample application allows developers to easily evaluate the Wi-SUN stack APIs. The Wi-SUN command line interface provides a serial interface to a number of the Wi-SUN stack functions. For example, it can be used to connect the Wi-SUN device to a Wi-SUN border router and exchange IP packets. [View Project Documentation](#)
- Wi-SUN - SoC CoAP Collector**: The Wi-SUN CoAP Collector sample application demonstrates the use of the CoAP (Constrained Application Protocol) to emulate a metering-like application. The CoAP Collector purpose is to retrieve measurements from the devices running the Wi-SUN CoAP Meter application in the same Wi-SUN network. [View Project Documentation](#)
- Wi-SUN - SoC CoAP Meter**: The Wi-SUN CoAP Meter sample application demonstrates the use of the CoAP (Constrained Application Protocol) protocol to emulate a metering-like application. The CoAP Meter purpose is to send sensor measurements to a CoAP Collector device in the same Wi-SUN network. [View Project Documentation](#)
- Wi-SUN - SoC Collector**: The Wi-SUN Collector sample application demonstrates a data collector implementation on top of a UDP client socket to emulate a metering-like application. [View Project Documentation](#)
- Wi-SUN - SoC Empty**: The Wi-SUN Empty sample application is a bare-bones application. This application can be used as a template to develop a Wi-SUN application. [View Project Documentation](#)
- Wi-SUN - SoC Meter**: The Wi-SUN Meter sample application demonstrates the use of a UDP socket to emulate a metering-like application. The Meter sends sensor measurements (temperature and relative humidity from the SI7021 I2C sensor and dummy lux values) to a Collector device in the same Wi-SUN network. [View Project Documentation](#)
- Wi-SUN - SoC Ping**
- Wi-SUN - SoC TCP Client**

The left sidebar shows a tree view of "My Products" with the following items:

- My Products 1
 - EFR32GG11 Giant Gecko Starter Kit (SLSTK3701A)
 - EFR32PG12 Pearl Gecko Starter Kit (SLSTK3402A)
 - EFR32BG22 Direction Finding Radio Board (BRD4185A)
 - EFR32FG12P232F1024GL125**
 - EFR32MG12P431F1024GM48
 - EFR32xG21 2.4 GHz 20 dBm Radio Board (BRD4180A)
 - EFR32xG21B 2.4 GHz 10 dBm Radio Board (BRD4181C)
 - Thunderboard EFR32GG12 (SLTB009A)
 - Thunderboard EFR32BG22 (SLTB010A)

Silicon Labs Delivers the Wi-SUN Foundation

Applications & Device Management



Grid intelligence



Distribution automation



Municipal infrastructure



Cloud database management



Enterprise efficiency

.....

SECURITY

Stack (L2-L4)



FAN 1.0



Line powered,
FSK modulations



FAN 1.1



Battery powered,
OFDM modulations



FAN 2.0

.....

SECURITY

Hardware

EFR32xG Series 1



EFR32xG12
1 MB / 256 kB
2.4/sub-GHz



EFR32xG13
512 kB / 64 kB
2.4/sub-GHz

EFR32xG Series 2



EFR32xG21
1 MB / 96 kB
2.4GHz



EFR32xG22
512 kB / 32 kB
2.4GHz



Coming Soon
Sub-GHz

CUSTOMER FOCUSED ON CREATING AND MONETIZING VALUE ON THE APPLICATION LAYER

Simplified Developer Experience

- **Simplicity Studio 5**

- **Interface**

- ▶ Fresh, new & simplified
- ▶ Intuitive out-of-the-box experience
- ▶ Fast access to developer resources
- ▶ Linux, Mac & Windows

- **Tools**

- ▶ Configuration utilities
- ▶ Compiler
- ▶ Error & validation
- ▶ IDE & command line support
- ▶ Graphical hardware configurator
- ▶ Energy Profiler – visual energy analysis
- ▶ Network Analyzer – packet capture & decode



Going further with Wi-SUN

- **GSDK 3.2 release Wi-SUN sample applications**
- **Documentation (QSG, UG and ANs)**
- **Works With sessions**



Your One Connection
to All Things IoT

September 14–15, 2021



<https://workswith.silabs.com/>

[Register Now](#)

- [Wi-SUN FAN Technical Overview](#)
- [QSG181: Silicon Labs Wi-SUN SDK Quick-Start Guide](#)
- [UG495: Silicon Labs Wi-SUN Developer's Guide](#)
- [AN1330: Silicon Labs Wi-SUN Mesh Network Performance](#)
- [AN1332: Silicon Labs Wi-SUN Network Setup and Configuration](#)
- docs.silabs.com
- Documentation inside of SS5
- Works With Wi-SUN sessions (September 2021)

Session ID	Session Name
WSN -101	Introduction to Wi-SUN, It's markets and the Alliance
SMC -102	Smart City Network Management in the Cloud Using Pelion
SMC -103	Why Wi-SUN is Ideal for Smart Street Lighting?
WSN - 300	Building Large Scale Smart City Networks with Wi-SUN

Obtaining Key Information Inside SS5

File Edit Navigate Search Project Run Window Help

Welcome Recent Tools Install Preferences

Launcher Simplicity IDE Configur...

EFR32FG12 2400/915 MHz 19 dBm Dual Band Radio Board (BRD4253A Rev...

OVERVIEW EXAMPLE PROJECTS & DEMOS **DOCUMENTATION** COMPATIBLE TOOLS

Read documentation written for your device

130 resources found

Filter on keywords

Resource Type Clear Filter

- Application Notes (64)
- Data Sheets (1)
- Errata (1)
- Quick Start Guides (2)
- Reference Manuals (10)
- Release Notes (3)
- Schematic and Layout Files (7)
- User's Guides (29)
- White Papers (5)

32-bit MCU SDK Release Notes
A detailed overview of highlights, fixes and improvements in this release of 32-bit MCU SDK.

AN1254: Transitioning from the v2.x to the v3.x Proprietary Flex SDK
Describes the differences between using Proprietary Flex SDK v2.x in Simplicity Studio 4 and using Proprietary Flex SDK v3.x in Simplicity Studio 5.

Flex SDK Release Notes
Lists compatibility requirements and sources for all software components in the development environment. Discusses the latest changes to the SiliconLabs Flex SDK, including added/deleted/deprecated features/API. Reviews fixed and known issues.

My Products

Enter product name

- My Products 1
 - EFM32PG12 Pearl Gecko Starter Kit (SLSTK3402A)
 - EFR32FG12 2400/915 MHz 19 dBm Dual Band Radio Board (BRD4253A Rev...**



works with

BY SILICON LABS

VIRTUAL CONFERENCE



When September 14–15th

Where Accessible live and online from anywhere in the world

Who Developer conference that brings together the biggest names in smart home technology

Why Developer's will learn how to develop and deliver IoT devices directly from the engineers who are building the latest advances

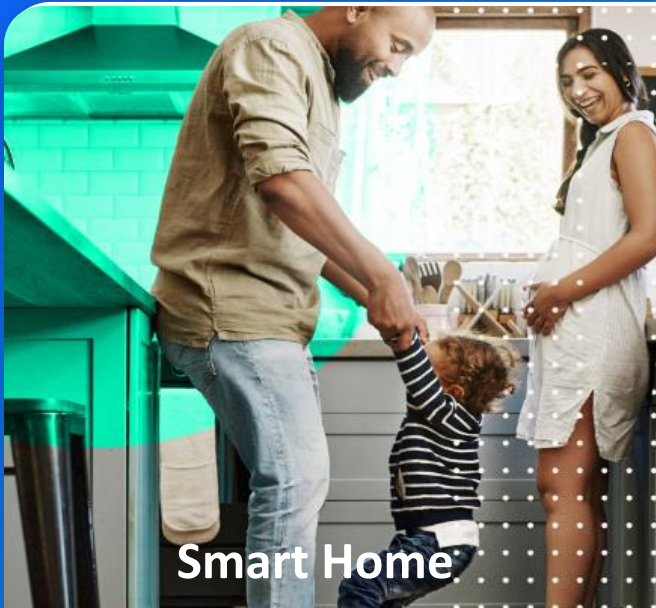
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[View Agenda](#)

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Smart Home



Smart City



Industrial IoT



General IoT



works with

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VIRTUAL CONFERENCE

September 14–15, 2021 (CDT)

Works With 2021
Virtual Conference



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THANK YOU

Recording and slides will be posted to:
www.silabs.com/training

