



**Presentation
Will Begin
Shortly**

tech **talks** UPCOMING SESSIONS

FEB 2ND | Wi-Fi 6 Benefits for IoT Applications

MAR 2ND | Designing Low-Power Applications with Wi-Fi 6

MAR 30TH | Fast Track Your Wi-Fi 6 Device Certification

APR 27TH | Hardware Design with Silicon Labs' Multiprotocol
Wi-Fi SoCs & Modules

MAY 25TH | Building Smart Home Devices with Always-On Wi-Fi 6

JUN 22ND | Developing Wi-Fi 6 Sensors Using SiWx917 and Matter

We will begin in:

0:00



Welcome

Building Smart Home Devices with
Always On Wi-Fi 6

Scott Farester



Agenda

- Introduction
- Wi-Fi 6 key feature review
- Always On Wi-Fi 6 – what does it mean
- Wi-Fi 6 Power Saving Features for Smart Home Devices
- Always On Smart Lock
- Always On Battery Powered Camera
- Q&A

What is a Smart Home Device?



- A product that can be automatically controlled remotely from anywhere with an internet connection using a mobile or other networked device.
- Allows you to control functions - turn on / off, adjust or monitor the status and performance through your smartphone or voice assistant
- Includes automation through pre-set triggers or timed events to change setting or status of the device
- Full-scale home automation through interconnectivity between devices based on rules, scenes and schedules

Wi-Fi – Key Enabler in the evolution of the Smart Home



- **Global Standard – interoperable technology**
- **Proven security**
- **User provided infrastructure – no specialized gateway required**
- **Local Network and Cloud Support**
- **Reliable**
- **Matter compatible**

Requirements of Wi-Fi in Smart Home Devices



- **Traditional Wi-Fi is better for PC/smartphone/Multimedia**
 - Meant for infrastructure, high bandwidth, or mains-powered devices
 - Used with highly resourced hardware (CPU, memory) running Linux/Android/iOS/Windows
- **Wi-Fi for Smart Home Devices is different**
 - Limited device resources (MCU, memory etc.)
 - Wireless, networking stack integration
 - Cost and size-constrained devices
 - Low power consumption
 - Challenges from crowded RF spectrum
 - Cloud connectivity to multiple cloud providers
 - Security from online and physical attacks
 - Coexistence and Interoperability
 - Limited user interface options
 - Longer product time use cases

Wi-Fi 6 Addresses Smart Home IoT Device Requirements

4x

BETTER IN DENSE ENVIRONMENTS

Improve average throughput per user in dense or congested environments



FASTER THROUGHPUT

Deliver higher peak data rates for a single client device



INCREASE NETWORK EFFICIENCY

Support large number of devices



EXTEND BATTERY LIFE

Of client devices



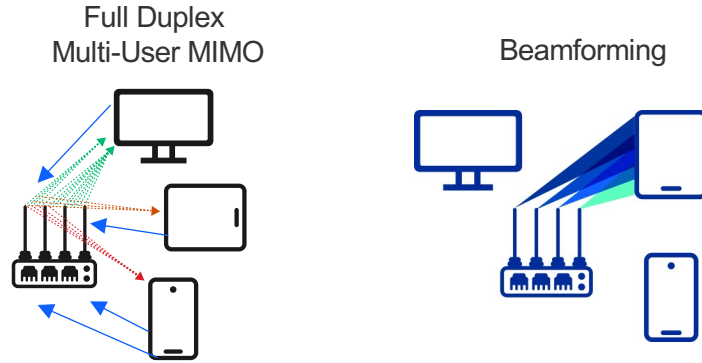
Users demand more efficient, reliable, and secure connectivity

The time is NOW to utilize Wi-Fi 6 for Best Performance and User Satisfaction

Wi-Fi 6 Key Features and Benefits for IoT Devices

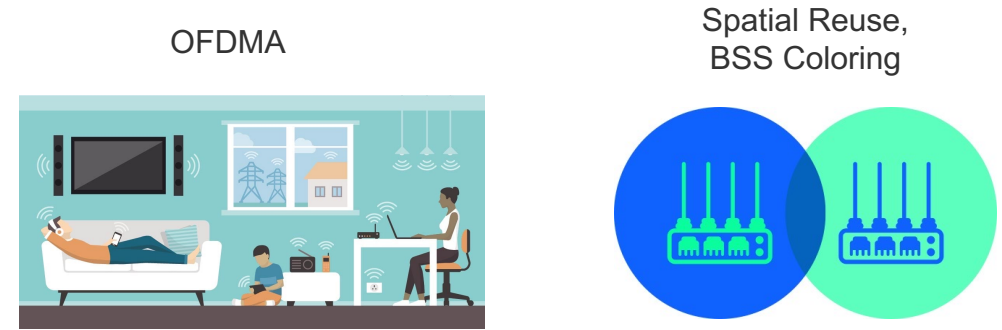


Better Performance



Higher Throughput, Reduced Overhead

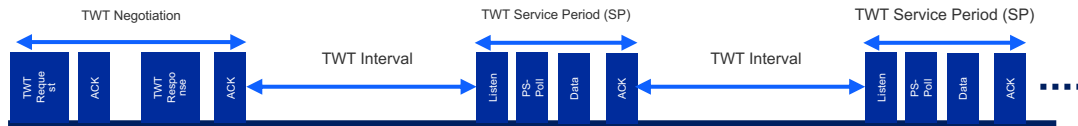
Support Denser Environments



Network Efficiency

Longer Battery Life

Target Wake Time



2.4GHz, 20 MHz Channel

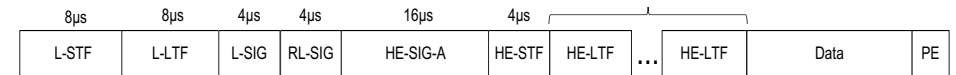


BSS Max Idle



Improved coverage/Longer Range

Extended range packet structure



Enhanced delay spread protection-long guard interval

0.8 μ s

1.6 μ s 11ax

3.2 μ s 11ax

Wi-Fi 6E – additional bandwidth for Multimedia Products



- Wi-Fi 6E extends Wi-Fi Certified into 6 GHz Band
- Wide Channels provides higher throughput but reduce range compared to 2.4GHz
- Intended for bandwidth intensive applications
- Not fully supported globally as several nations are still to make 6 GHz available for unlicensed use
- Use Case Applications –
 - High-definition video streaming
 - Virtual reality
 - Unified communications
 - Cloud computing

Wi-Fi 6E assists smart home by moving high bandwidth devices out of 2.4 GHz

What is Always On Wi-Fi?

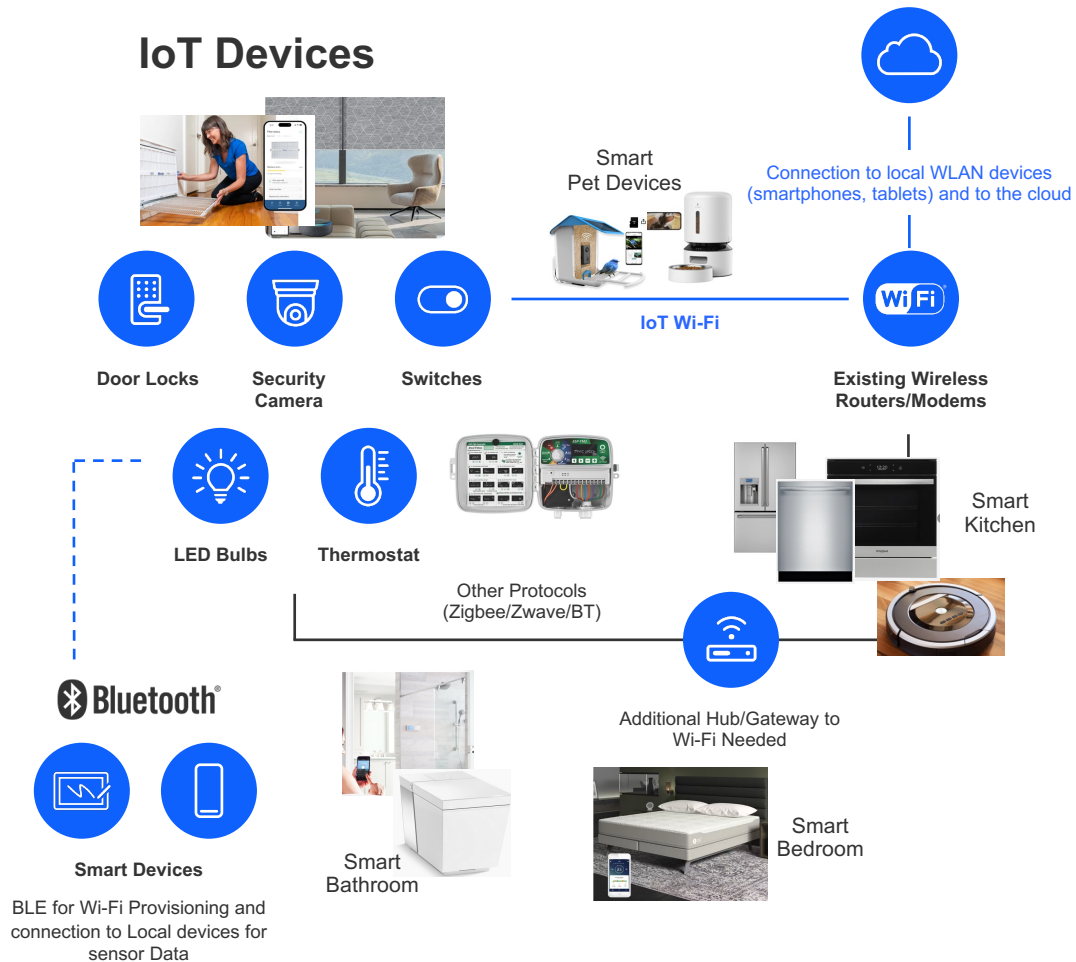
- What is Always On Wi-Fi
 - Smart Home Device maintains connection to the AP and does not have to re-establish connectivity to send and receive data
- Why Is Always On Wi-Fi Important
 - Smart Home Devices are “reachable”
 - Minimize the delay to receive or send packets
 - Increases performance
- Traditionally a feature for Line Powered Devices Wi-Fi-6 and Silicon Labs enable battery powered devices with Always On Wi-Fi mode

Smart Home Market Product Segmentation



Smart Home Devices and Home Network performance improves with Wi-Fi 6

Wi-Fi Usage in Smart Home Applications



■ Simplified installations and cost reductions:

- Use existing Wi-Fi router/modem
- Native IP protocol for internet communication
- No additional Hub/Gateway required

■ Extended range, battery life, throughput

- Energy efficient and longer range 2.4GHz single-band
- Power saving capabilities
- Higher data rate support

■ Improve user experience and interoperability with

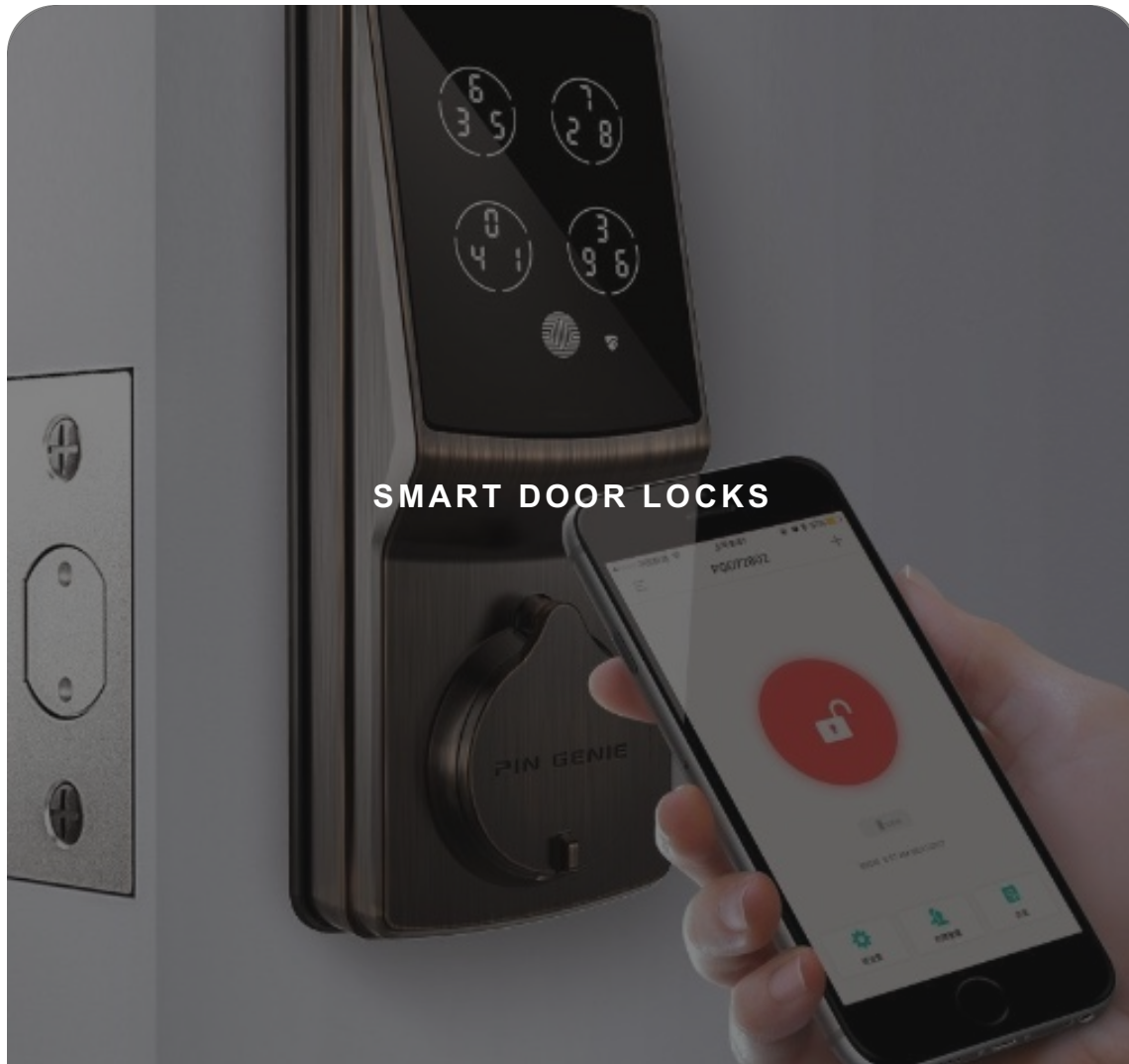
- The new Matter protocol
- Ecosystem cloud integration and connectivity
- Local area network connectivity

■ Bluetooth Low Energy usage with Wi-Fi

- Simplified provisioning
- Proximity detection
- Sensor connectivity

Prior to Wi-Fi-6, Smart Home Devices face a challenging and congested Wi-Fi environment

Battery Powered Smart Home Products benefit from Wi-Fi-6



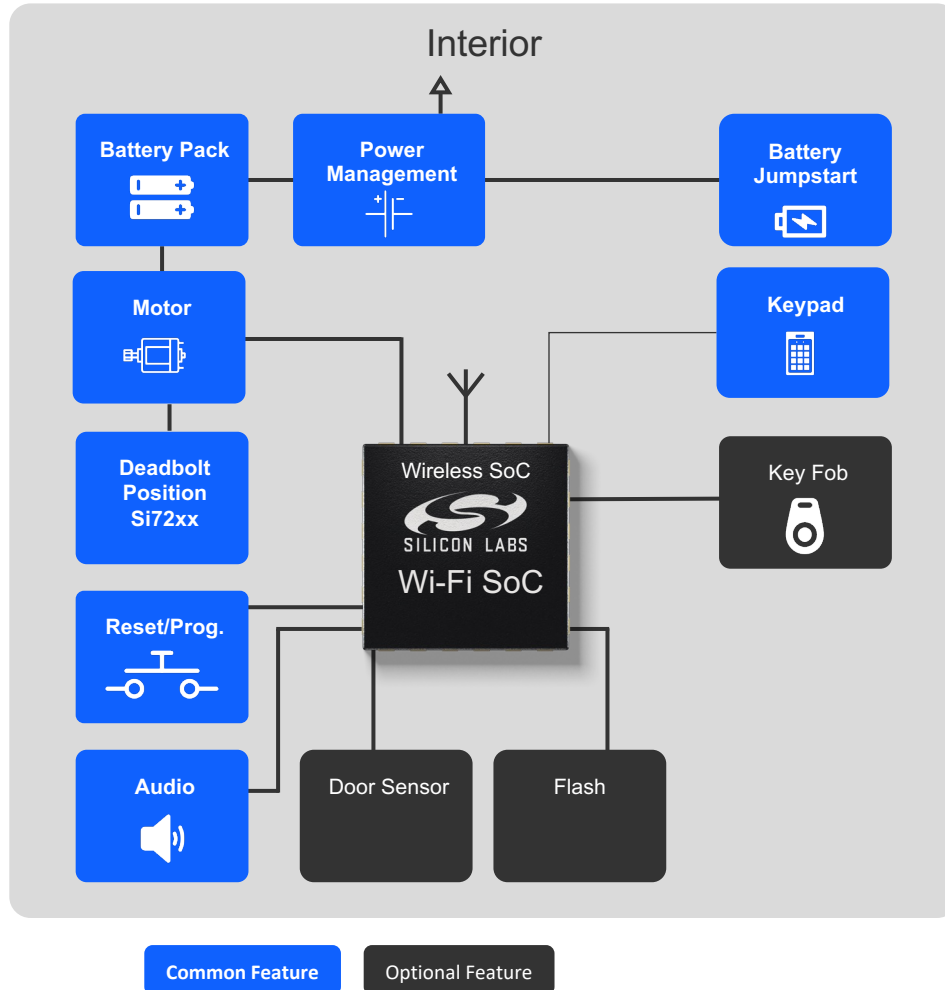
SMART DOOR LOCKS



VIDEO DOORBELLS AND SECURITY CAMERAS

Congestion and Interference have a major impact on the user experience

Building Smart Home Devices with Always On Wi-Fi 6 – Smart Door Lock



Network Efficiency

- OFDMA – High Density Network performance Improvement
- MU-MIMO
- BSS Coloring

Power Efficiency

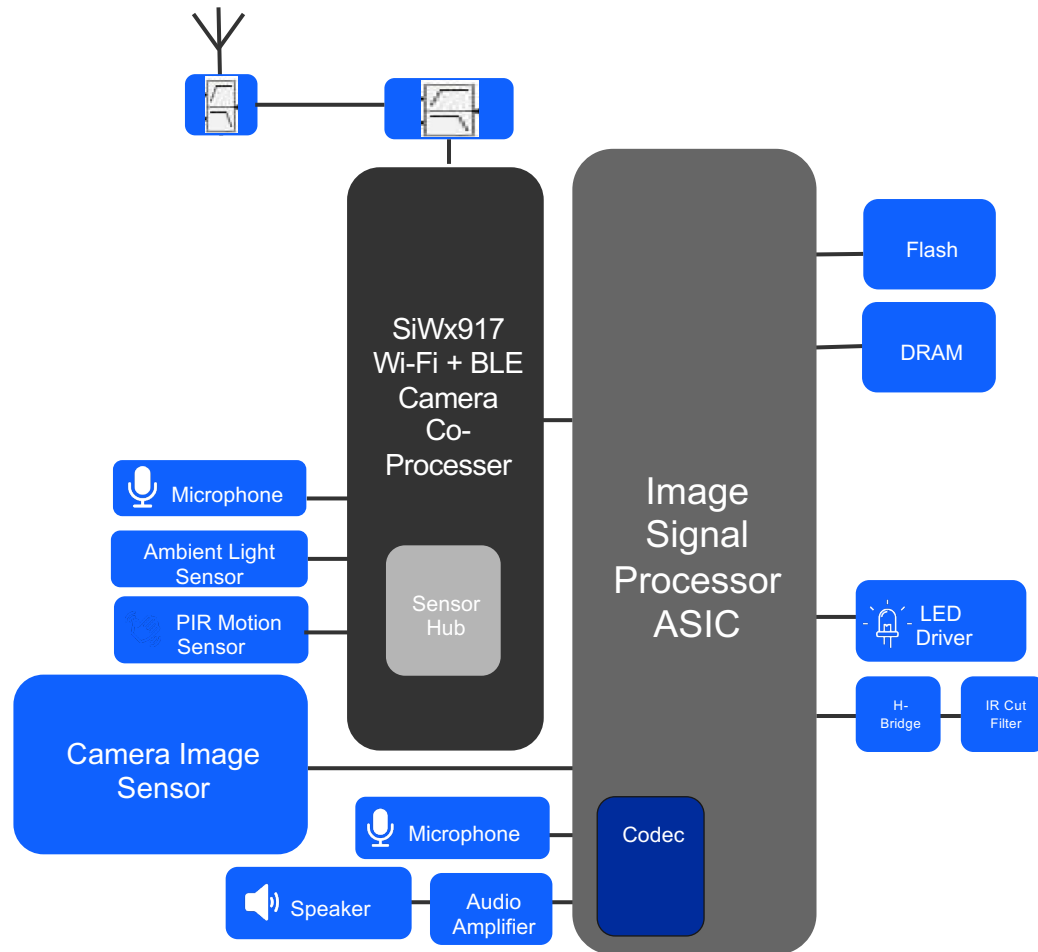
- Target Wake Time (TWT)
 - ▶ Reduce Product Size
 - ▶ Improve Battery life
- BSS Max Idle

Improve Range and Throughput

- TWT - training AP's steering matrix (beamforming weights) to optimize channel usage

Wi-Fi 6 Smart Home devices contribute to better home network operation

Building Smart Home Devices Always On Wi-Fi 6 – Battery Security Camera



Network Efficiency

- 2.4Ghz advantageous due to distance and environmental factors
 - OFDMA
 - MU-MIMO
 - BSS Coloring

Power Efficiency

- Target Wake Time (TWT)
 - Reduce Product Size
 - Improve Battery life
- BSS Max Idle

Improve Range and Through put

- TWT - training AP's steering matrix (beamforming weights) to optimize channel usage
- Guard Interval Duration

Wi-Fi Connected IoT Devices require fast demand response

Optimizing Power for Always On Wi-Fi 6

- **Optimized Instruction Set w/ single cycle**
- **Optimal power vs performance trade off capabilities**
- **Wi-Fi Standby Associated mode current**
- **Wi-Fi listen current**
- **Low MCU Sub-system active current – (LP mode and HP mode)**
- **Deep sleep mode**
- **WLAN Rx sensitivity**

Ultra Low Power – more than a marketing tag line

Calculating your Smart Home Device Power Consumption

1. Time spent Sensing
2. Time spent in Wi-Fi
3. Time spent in deep sleep

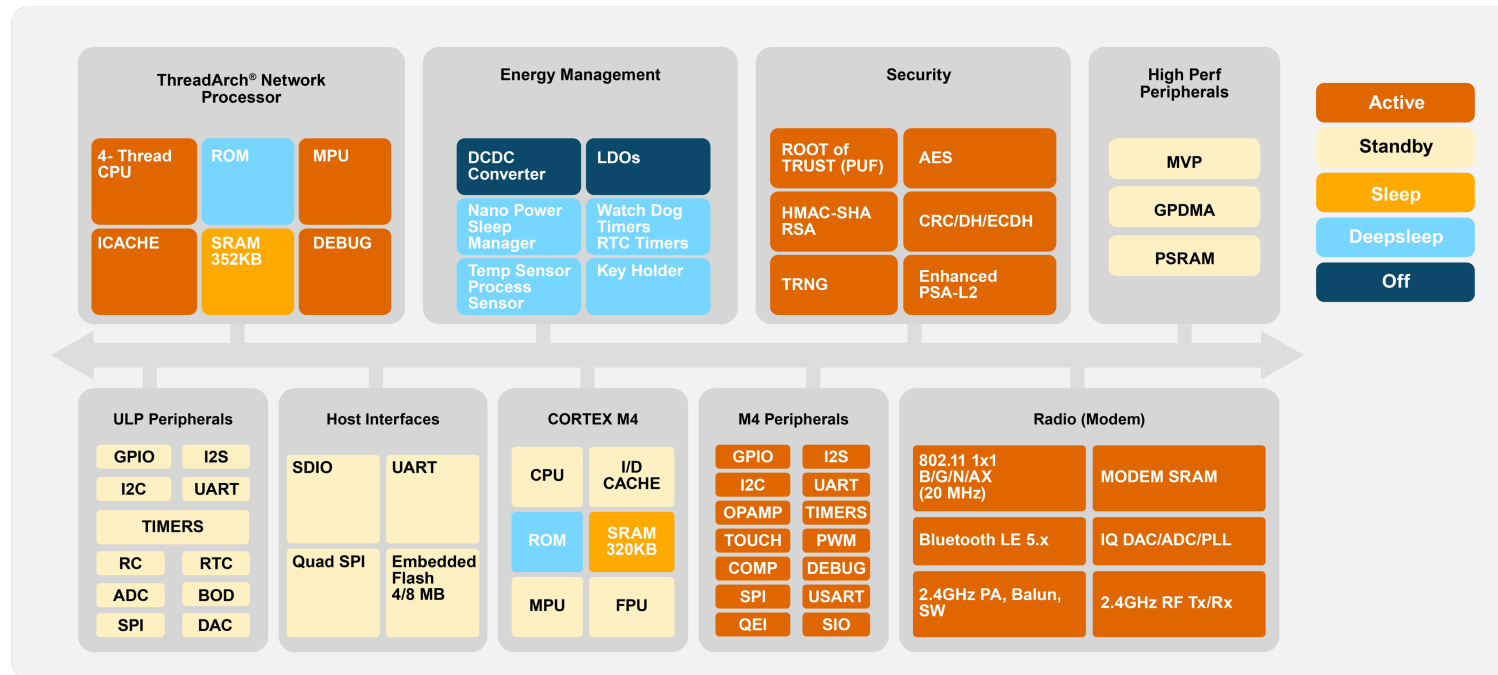
Power Calculator Parameters

- ~~1. Deep Sleep current Standby Associated (Deep Sleep + Beacon Listen)~~
2. Initialization time and current
3. Rx at start
4. Tx
5. Interpacket gap
6. Return to sleep

Configurable/Variable Parameters

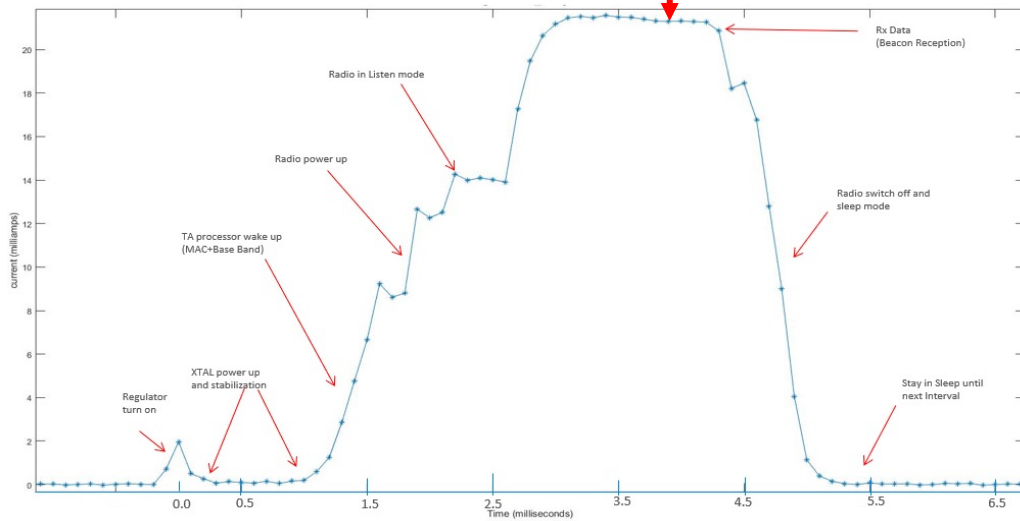
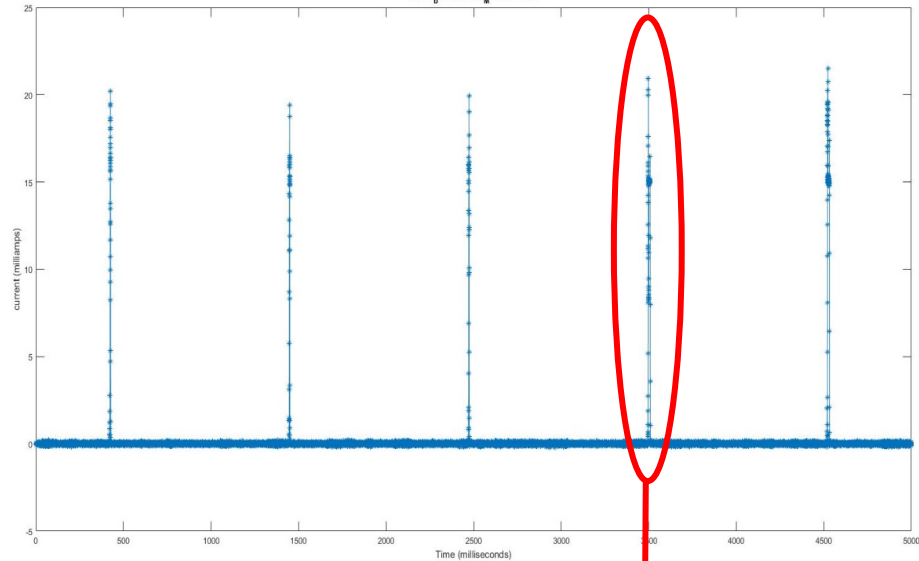
1. Data Size (Number of packets)
2. Wake-up interval (Send / Receive)
3. Computations / Sensing

In addition to Wi-Fi 6 - SiWx917 Power Save Capabilities



- Big Little Radio Design (listen/Beacon)
- Dynamic voltage scaling
- Clock Scaling
- High performance and ultra-low-power MCU peripherals and buses
- Hardware based wakeup from Standby/Sleep/Shutdown states
- Using low leakage cells
- Multiple voltage domains
- Fine grained power-gating including buses and pads
- Two integrated buck switching regulators
- Multiple Active states using “gear-shifting” approach based on processing requirements

Power Saving Enabled by Silabs Wi-Fi SoCs



- **Multiple Low Power Modes and embedded stack enable ultra low system power consumption**
- **Wi-Fi Standby associated with automatic periodic wake-up**
 - DTIM, listen interval or TWT based
 - Device remains associated to AP
- **Low power optimized at each device wake-up**

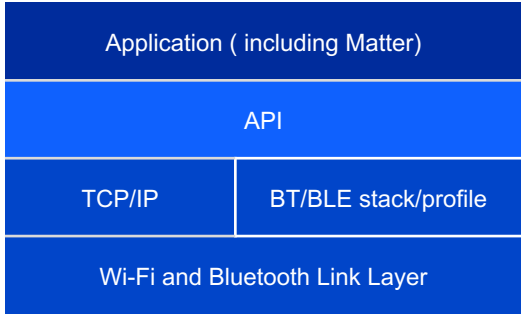
Description	Comments
Sleep Time Between Wakeup	Micro-amp drain
Fast Boot Up times	WLAN still asleep
Wake up Wireless to listen for Beacons using low power receiver	Reduced radio power consumption
Transmit only if needed	Lower average current

Silicon Labs - Complete Solution for Enabling Wi-Fi Smart Home Devices



SOCS AND MODULES

Industry leading Ultra Low Power Wi-Fi 4 and Wi-Fi 6 SoCs and pre-certified modules



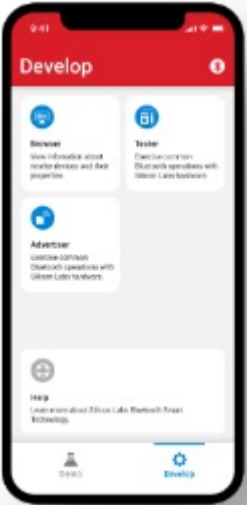
EMBEDDED SOFTWARE

Wi-Fi SDK with Integrated Wi-Fi, BT/BLE and IP networking stacks and Matter Support



DEVELOPMENT TOOLS

Evaluation Kit hardware and Studio software simplify development and speed time to market



MOBILE APPLICATIONS

EFR Connect for Wi-Fi Provisioning using BLE

Silicon Labs' Wi-Fi Portfolio Summary

Features	WF200  	RS9116  	SiWx917  
Wi-Fi	Wi-Fi 4	Wi-Fi 4	Wi-Fi 6
BT Low Energy (LE)		✓	✓
BT Classic (Audio)		✓	
Low Power Modes	PS-POLL	PS-POLL, Listen Interval	PS-POLL, Listen Interval, TWT
Wi-Fi Features	OFDM	ODFM	OFDM, OFDMA, MU-MIMO
Wi-Fi WPA3 Security	✓	✓	✓
Co-processor Modes (RCP, NCP)	✓	✓	✓
SoC Mode (ARM® Apps MCU)			✓
ML Accelerator, PSRAM Interface, MCU Security (PSA-L2)			✓
Ultra Low Power		✓	✓
Modules	✓	✓	✓
Matter over Wi-Fi	✓	✓	✓

Q&A



WI-FI SERIES



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2023

tech **t**lks

WEBINAR SERIES

Thank You

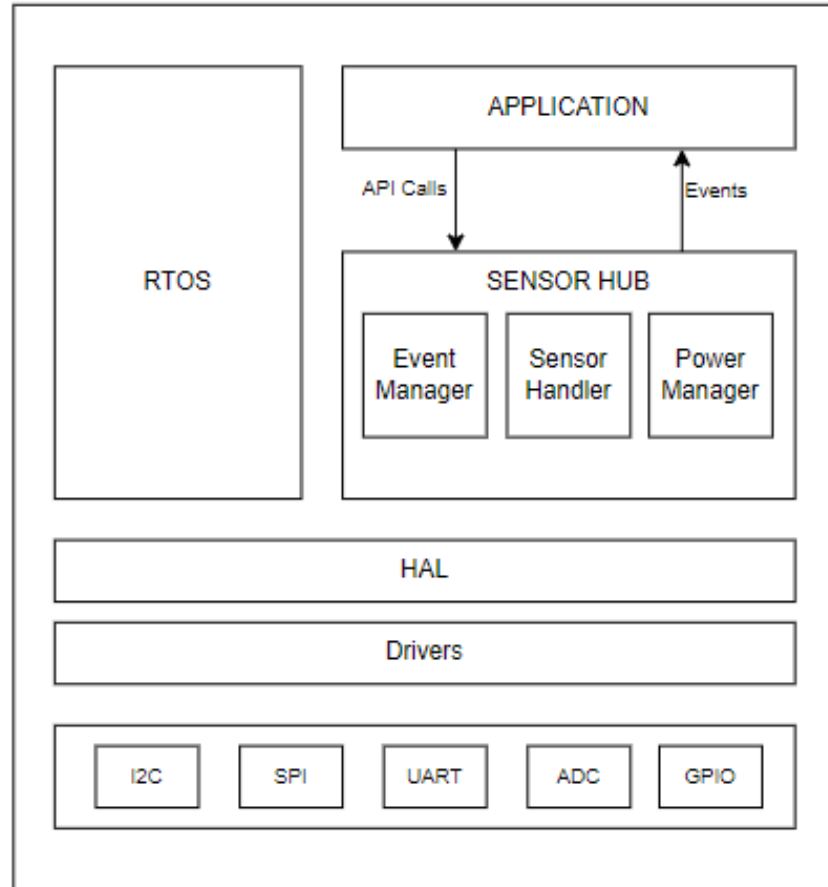


WI-FI SERIES

Watch **ON DEMAND**

917 Sensor Hub

Sensor Hub Architecture



Three Components to Sensor Hub

1) Event Manager

- Process the event and notify the application

2) Sensor Handler

- Responsible for sensor control
- Data acquisition from the sensor
- Posting the event to the Event Manager

3) Power Manager

tag line

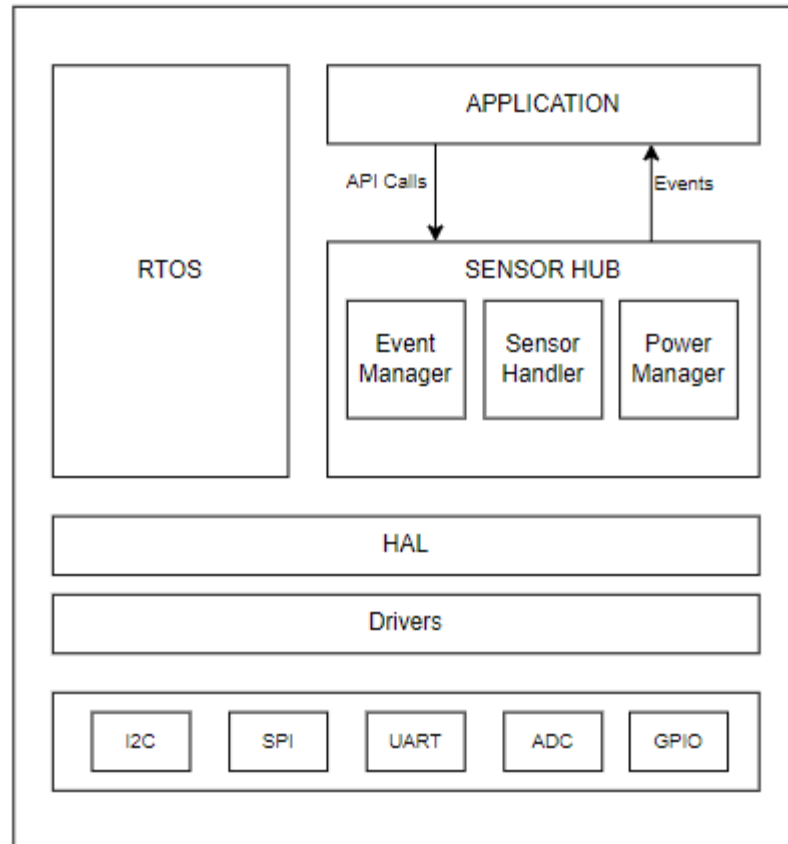
917 Sensor Hub

- **User defines the sensor data sample timeout.**
- **Collect the data and store the data**
- **Three Data Attributes (when the Sensor Hub should hand over the data to the application)**
 1. Based on user defined threshold for that specific sensor
 2. Time out
 3. Number of samples
- **Data Attributes created and maintained for each individual sensor**
- **Example:**
 1. Temperature – monitor up to a threshold
 2. Ambient Light – continuous over period of time – set as a time out

Information is passed to the Event Manager vs Interrupting Application Processor

917 Sensor Hub

Sensor Hub Architecture



Framework and API for efficient management and allocation of ULP memory

- Sensor Data RAM mapped to ULP memory
- API to confirm RAM is available

Sensor Implementation utilizes the HAL

HAL interface for all developer defined sensors

Sensor_Hal.c file stores the information of the HAL

Information is passed to the Event Manager vs Interrupting Application Processor

Silicon Labs' Wi-Fi SoC Portfolio Summary

Features

WF200



RS9116

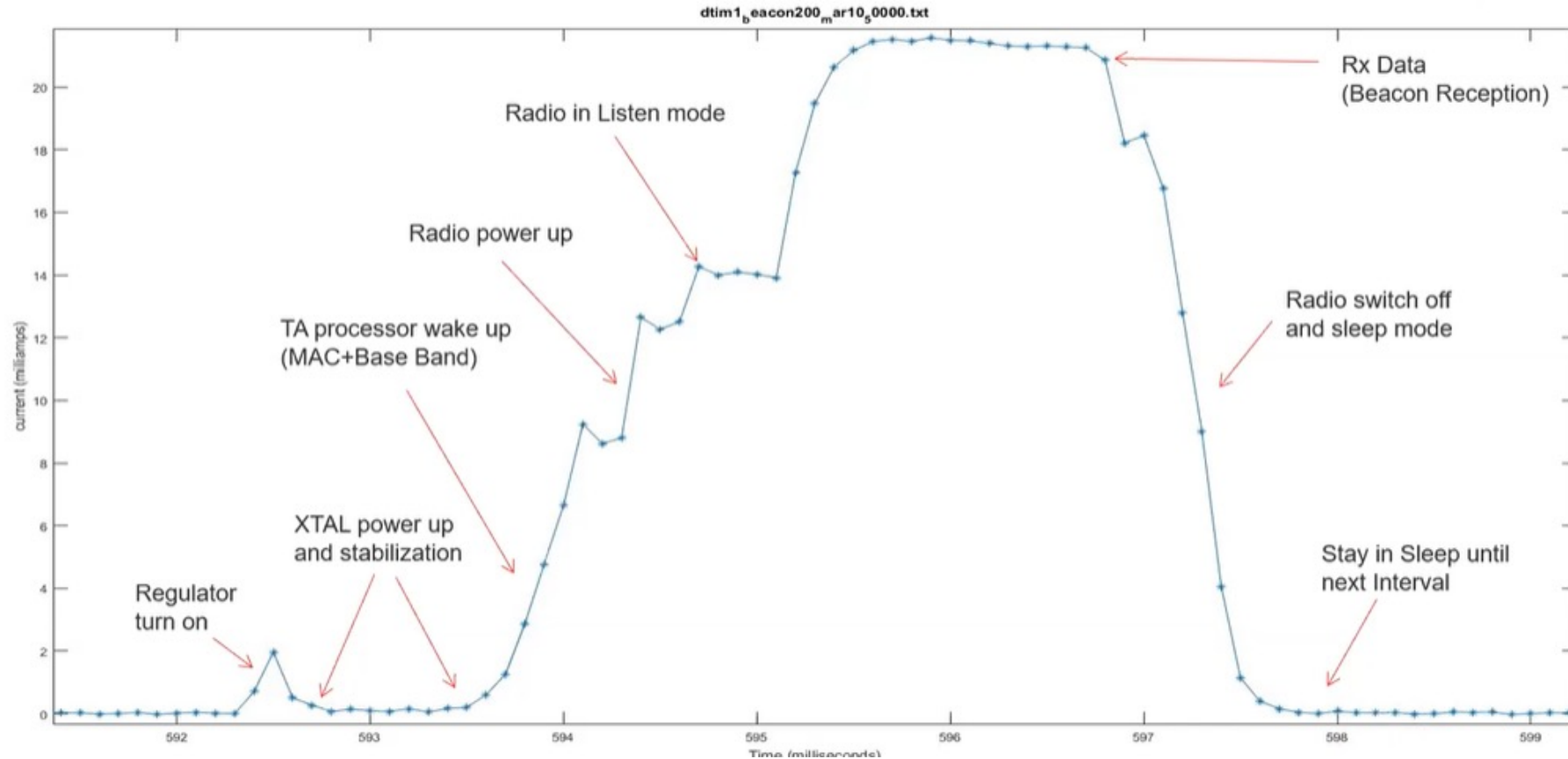


SiWx917



	Wi-Fi 4	Wi-Fi 4	Wi-Fi 6
Wi-Fi (2.4 GHz)			
BT Low Energy (LE)		✓	✓
BT Classic (Audio)		✓	
Low Power Modes	PS-POLL	PS-POLL, Listen Interval	PS-POLL, Listen Interval, TWT
Wi-Fi Features	OFDM	ODFM	OFDM, OFDMA, MU-MIMO
Wi-Fi WPA3 Security	✓	✓	✓
ARM® Apps MCU (SoC Mode)			✓
ML Accelerator, PSRAM Interface, MCU Security (PSA-L2)			✓
Ultra Low Power		✓	✓
Matter	✓	✓	✓

Power is further optimized at each device wake-up



- Multiple power domains support segregating Applications, High Speed Interfaces and Peripherals to achieve lower current consumption
- SRAM Domains can be power down unused SRAM sections

Smart Home Product Segmentation

SECURITY CAMERAS



VIDEO DOORBELLS AND DOOR LOCKS



LIGHTING

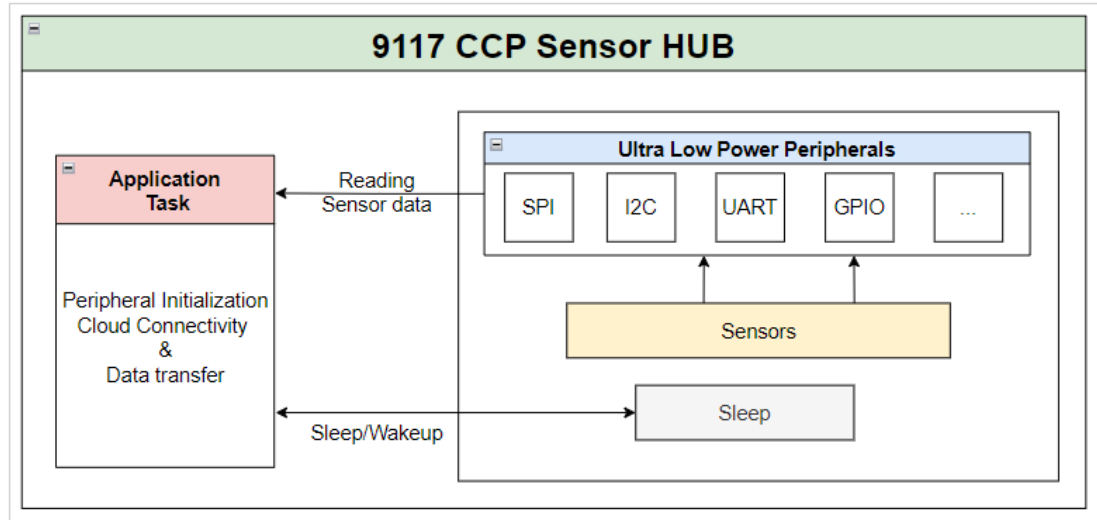
SWITCHES

SHADES AND BLINDS

THERMOSTATS

Smart Home Devices performance improvement with Wi-Fi 6

917 Sensor Hub



Sensor Hub Provides the following:

- Implementation of low power peripherals
- API interface for user Applications
- Interface the sensors to the peripherals
- Configuration of wake-up sources
- Optimization of MCU power performance
- Publish the data to the cloud

tag line

Resources available to create best-in-class Smart Home Devices

Support Case Submission Form
To get started, please tell us what type of question and Part Number you are contacting us about:

* Part Number

Search Part Numbers...

* Type of Request

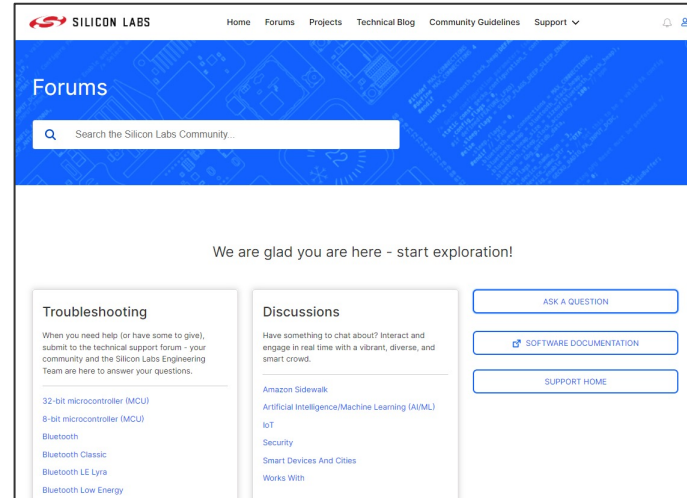
Select the nature of your inquiry...

* Priority

Next

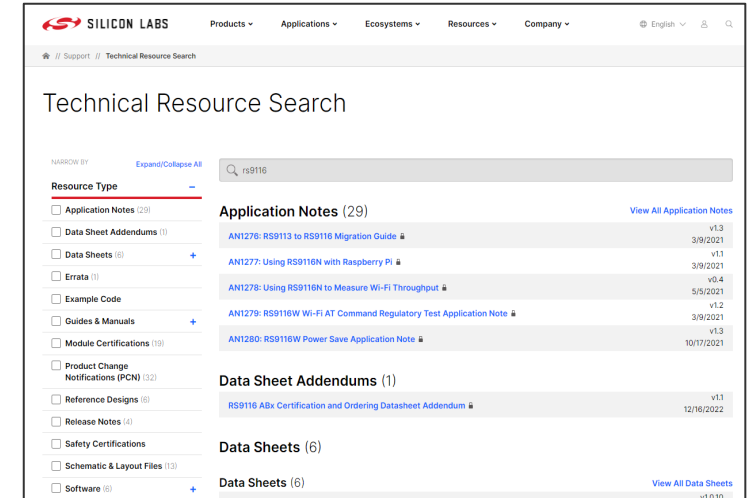
Salesforce Ticketing Support

- Support for technical queries and debugging
- Support for certification and C2PC
- Case routed through Field Application Engineers or Sales team



Silabs Community

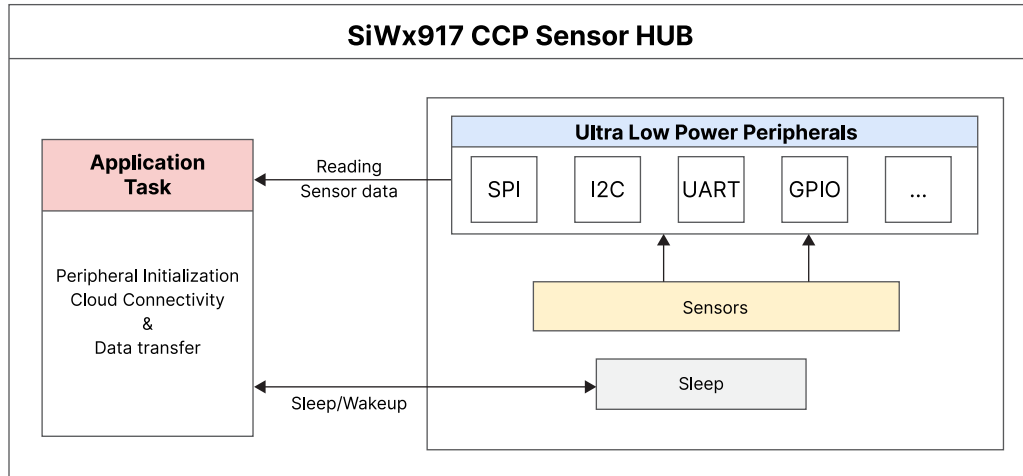
- Support for technical queries and debugging
- Open and accessible to all



Technical Documents

- Datasheets
- Application Notes
- Guides
- Checklists
- Programming Reference Manuals

SiWx-917 Sensor Hub Software Component



Sensor Hub Provides the following:

- Implementation of low power peripherals
- API interface for user Applications
- Interface the sensors to the peripherals
- Configuration of wake-up sources
- Optimization of MCU power performance
- Publish the data to the cloud

What is it? Sensor Hub is a sensor management component

- The Sensor Hub address low power and high-performance sensor applications
- Decouple the software dependencies from peripheral drivers and sensor drivers.
- Reduce complex sensor implementations

Always On Context Aware, Sensor Fusion, Sensor Data Aggregation