LPWAN SERIES

Presentation Will Begin Shortly

tech talks UPCOMING SESSIONS

FEB 16TH	Amazon Sidewalk: Using Battery-Powered Sensors
MAR 16TH	Getting Started with Amazon Sidewalk
APR 13TH	Introducing FG25 for Wi-SUN FAN 1.1
MAY 11TH	Optimizing FG23 for Battery Life & Performance
JUN 8TH	Designing Long Range Devices with Amazon Sidewalk

We will begin in: 0:00

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2023 tech talks
WEBINAR SERIES

Welcome

Introducing FG25 for Wi-SUN FAN 1.1

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Kris Young
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Introducing EFR32FG25 and Wi-SUN FAN 1.1

- **EFR32FG25**
  - Optimized solution for longest range Sub-GHz performance
  - Multi-rate OFDM, FSK, O-QPSK, and (G)MSK modulations
  - Integrated PA with up to +16 dBm (Sub- GHz) TX power
  - More Flash, RAM and IOs for better system integration
  - Secure Vault™ - Industry's highest-level of security
- **Wi-SUN FAN 1.1**
  - OFDM Modulation addition allows for up to 2.4 Mbps data rates and achieve low latency
  - Complete solution including Border router, Router, Line-powered End Nodes (including sleepy end devices)
  - Concurrent operation of OFDM and FSK
  - Modulation and data rate switching to enable more robust networks

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FG25 Key Differentiators

- **OFDM Support**
  - First Silicon Labs device to support SUN OFDM PHYs
  - Up to 3.6 Mbps data rates
  - Significant range and data rate improvements over FSK type modulations
- **Concurrent Detection (Optimized set of PHYs)**
  - Can detect both FSK and OFDM messages simultaneously
  - Provides additional network flexibility and optimization
- **High Performance MCU**
  - ARM Cortex®-M33 – Up to 97.5 MHz
- **Available Memory and Peripherals**
  - Up to 1920 kB Flash and 512 kB RAM
  - Inclusion of USB device functionality
  - Up to 37 GPIO

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OFDM

- **Invented in 1980's for DAB**
- **Became popular in 1990's with Digital TV (Europe and Japan), then in Wi-Fi (802.11g/n)**
- **Multi-carrier modulation**
- **Main benefits:**
  - Robustness to multipath
  - Carriers dedicated to synchronization, others to data
  - OFDM has built-in flexibility/scalability
    - For a given OFDM option, same synchronization for all MCS modes -> easy switch between modes without configuration (in- packet signaling)
    - Example for Wi-SUN Option 3:
      - From robust modes (-115 dBm, 25 kbps)
      - to very efficient modes (-101 dBm, 600 kbps)

- **Wi-SUN OFDM adds much higher bit rates than available in FSK**
  - Up to 300kbps (EU), 1.2Mbps (JP) and 2.4 Mbps (US)
  - Increased throughputs
  - Reduced on-air time for same payload, thus improved network performance
  - Despite consumption of OFDM Tx is higher than FSK Tx, the much shorter OFDM bursts reduce power consumption

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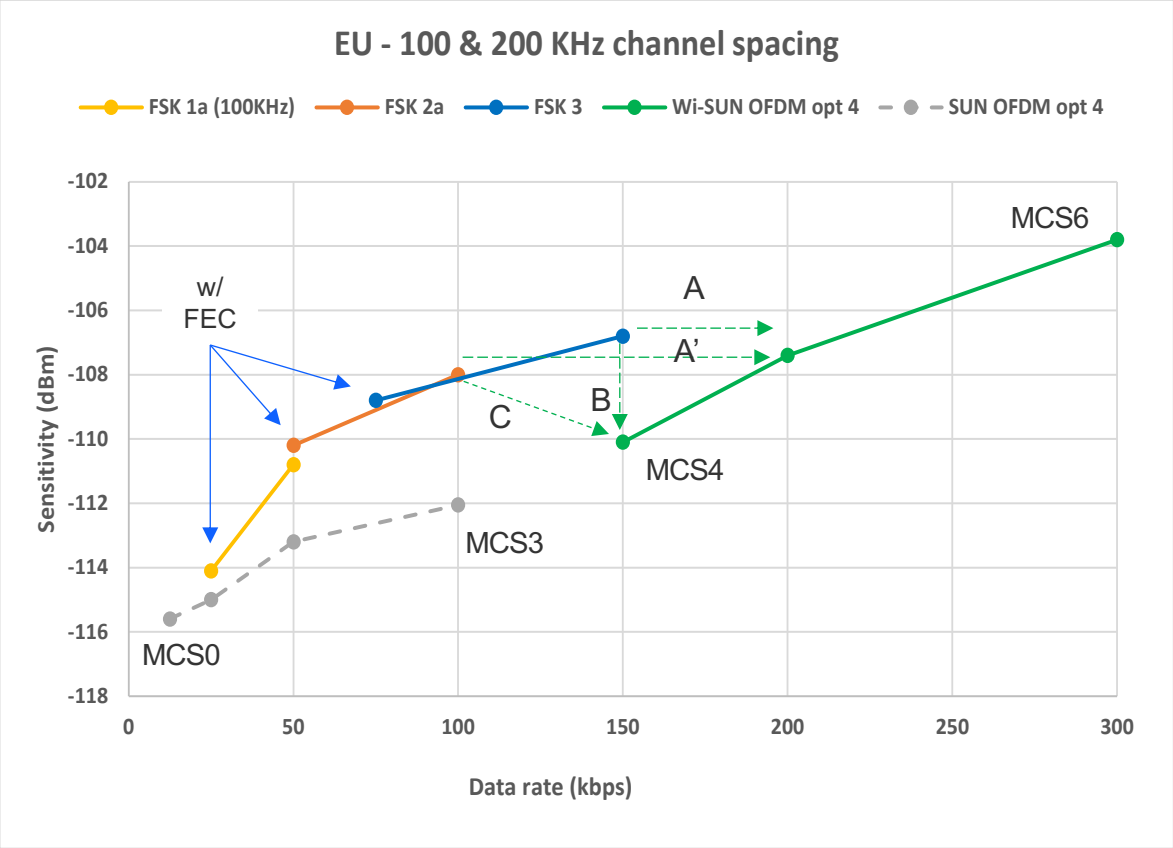
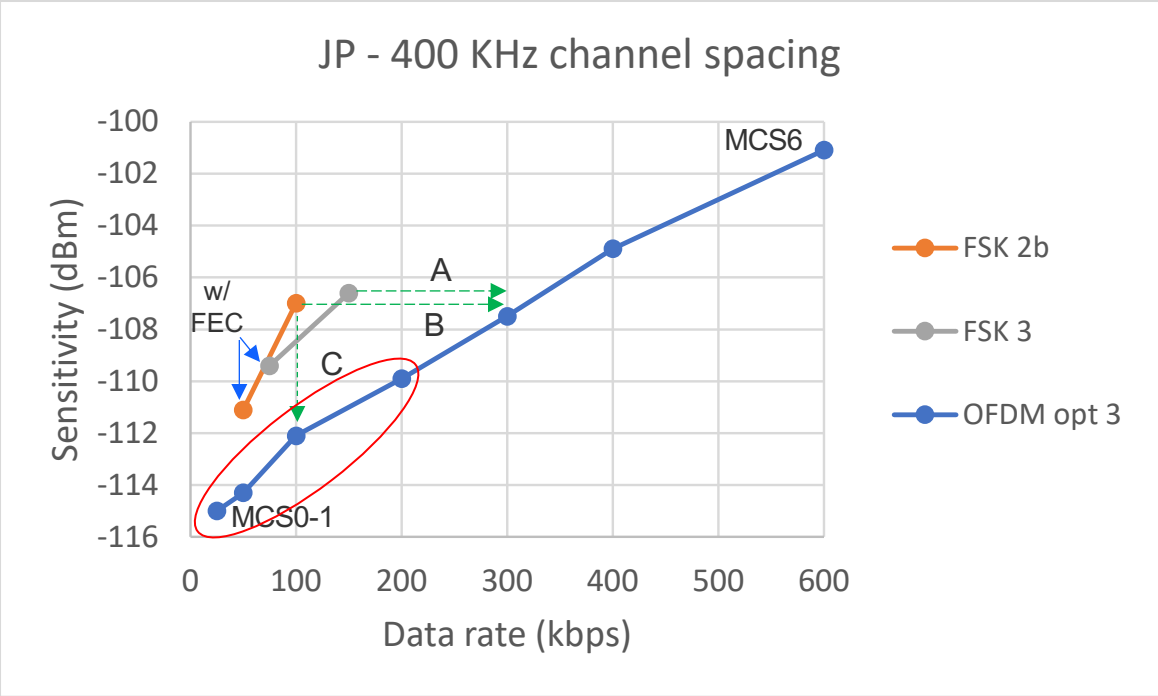
Wi-SUN OFDM benefits – Europe, India & Singapore

- **Europe - India - Singapore:**
  - 100 KHz channel spacing for FSK #1a
  - 200 KHz spacing for FSK #2a, #3 and OFDM option 4



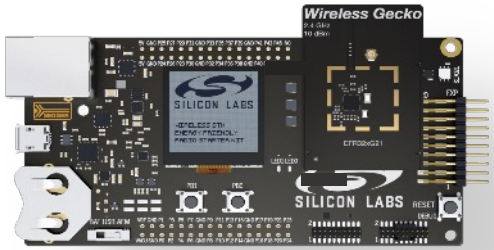
- **OFDM brings**
  - Much higher throughputs when budget link allows
    - Up to 300 kbps vs 100 (#2a) or 150 (#3)
  - Higher bitrate for similar range
    - A: +30% bitrate (FSK #3 to MCS5)
    - A': doubled bitrate (FSK #2a to MCS5)
  - Or better range for a given bitrate
    - B: 3 dB improvement (FSK#3 to MCS4)
  - Or both
    - C: + 50% bitrate and 2 dB better sensitivity
  - Considering 100KHz channel spacing
    - OFDM MCS4 brings tripled bit rate for twice the BW
- **Much better channel usage**
  - Shorter burst times given higher data rate
  - Important in India and Singapore where the band is narrow (2 & 3 MHz)

Example: Wi-SUN OFDM benefits - Japan



- **Example for 400 KHz BW**
- **OFDM brings higher bitrate for similar range (sensitivity)**
  - A: doubled bit rate
  - B: tripled bit rate
- **OFDM brings better range for a given bit rate**
  - C: 5 dB improvement
- **Note: only MCS4, MCS5 and MCS6 are specified in Wi-SUN for the time being**

Getting Started with FG25 Development: End Nodes & Border Routers



EFR32FG25 and Wi-SUN Pro Kits

Kit Contents

Wi-SUN Pro Kits	FG25 Pro Kits
3x BRD4002A WSTK main boards	1x BRD4002A WSTK main boards
3x FG25 +16 dBm	1x FG25 +16 dBm
3x BRD8016 Expansion board	1x BRD8016 Expansion board
3x Antenna	1x Antenna
Wi-SUN-PK6015A – 863-870 MHz + 16 dBm	FG25-PK6012A – 863-870 MHz +16 dBm
Wi-SUN-PK6016A – 902-928 MHz + 16 dBm	FG25-PK6011A – 902-928 MHz + 16 dBm

Available Radio Boards

FG25-RB4272A – 470MHz +16 dBm
FG25-RB4271A – 868MHz +16 dBm
FG25-RB4270B – 915MHz +16 dBm

Pro Kit can be used for the development of End Nodes and Border Routers

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Featured FG25 Case Studies

View Recording for FG25 Unboxing

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Q&A

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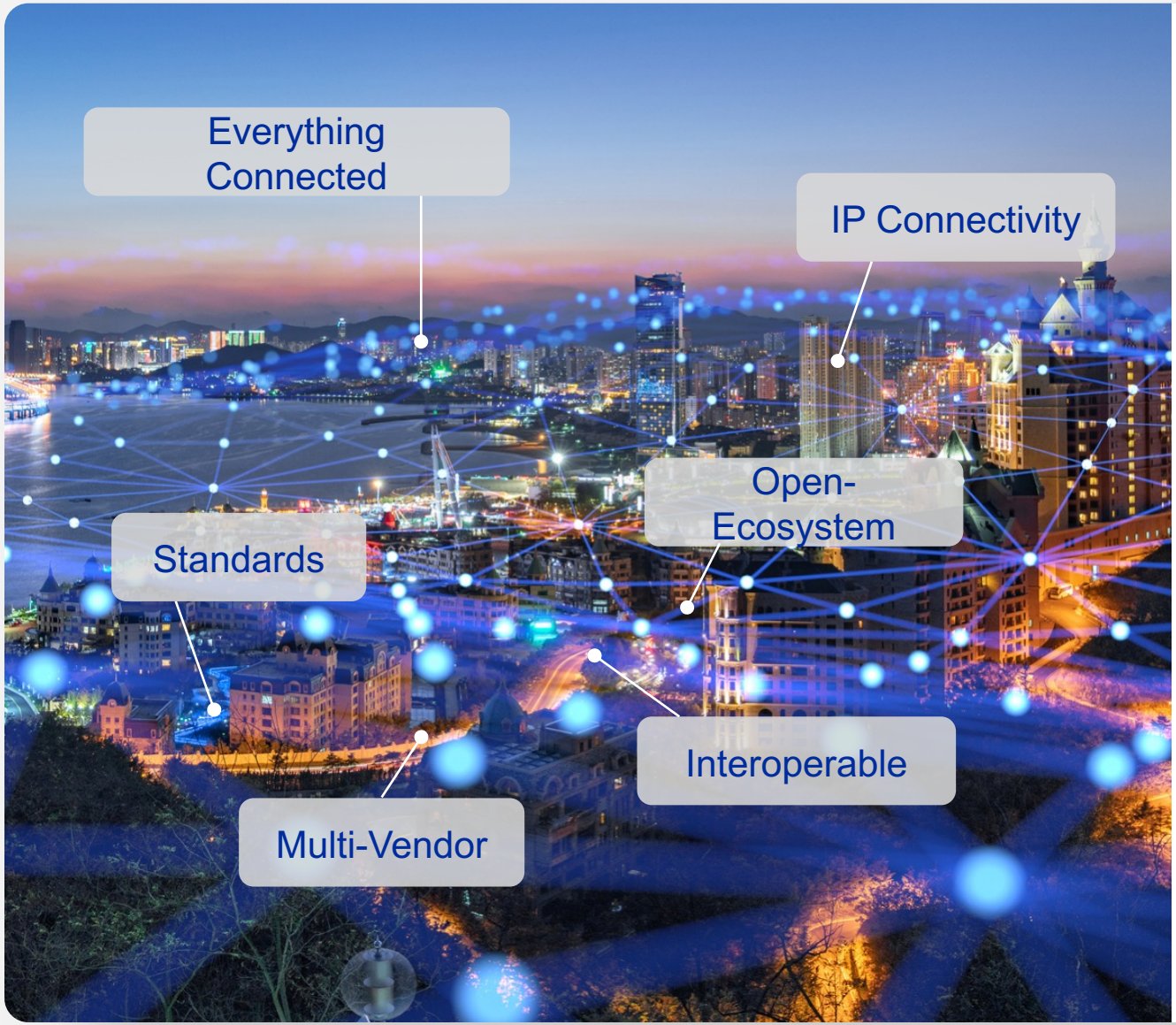
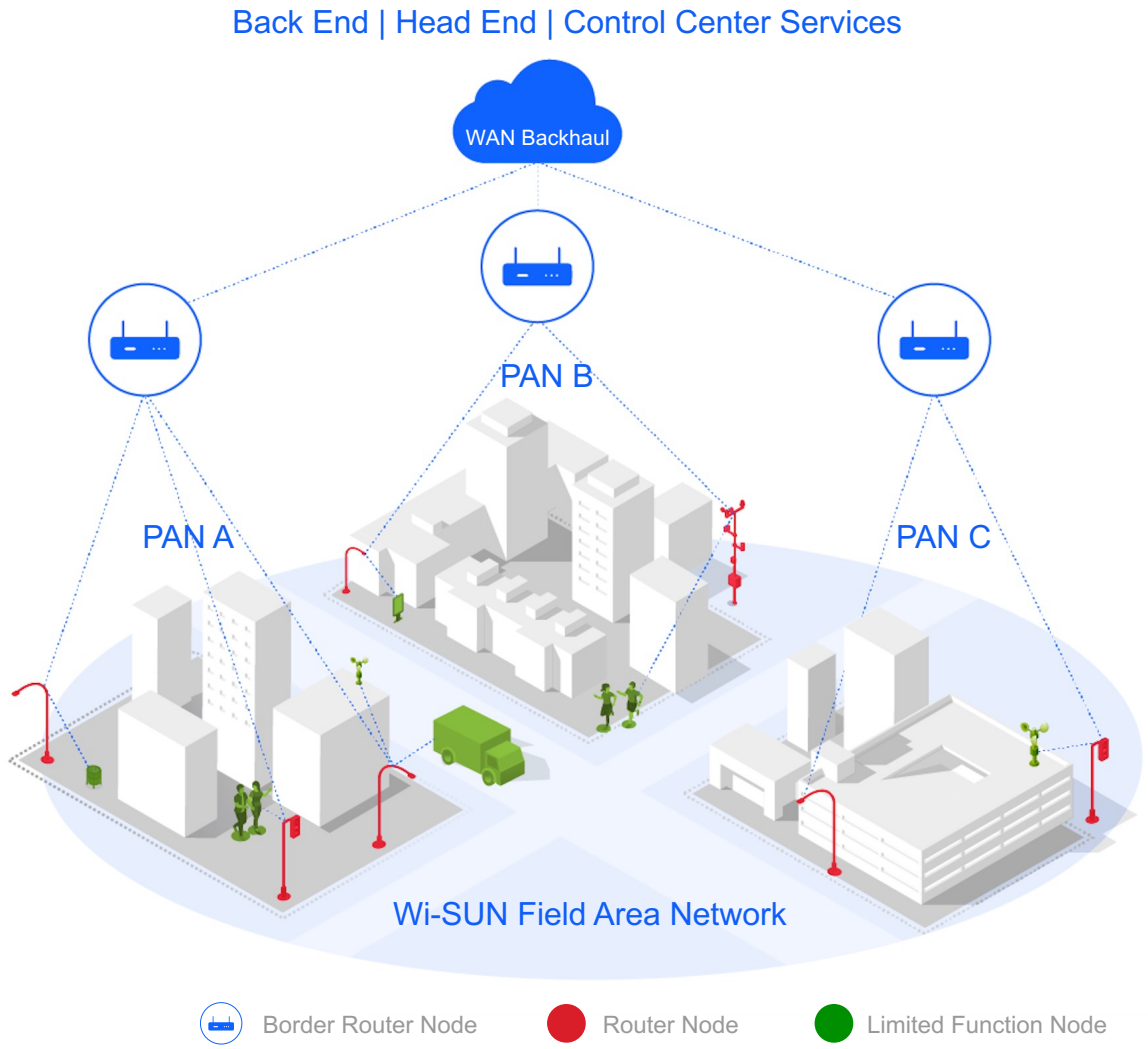
Field Area Network Evolution



- **A move from Proprietary to standards-based solutions**
  - Ease of use
  - Flexibility
  - Avoid vendor lock-in
- **Wi-SUN is a Sub-GHz IPv6 mesh solution for smart infrastructure that provides**
  - Scalable self-healing mesh
  - High performance long range
  - Interoperable & secure

Wi-SUN Solution Architecture



- **Border Router**
  - Provides WAN connectivity
  - Maintains source routing tables
  - Provides node authentication and key mgmt.
  - Relay PAN wide information such as broadcast schedules
- **Router Nodes**
  - Upward and downward packet forwarding within a PAN
  - Relay security & address mgmt. protocols
- **Limited Function Nodes (LFN)**
  - Discover and join a PAN
  - Send/receive IPv6 packets
  - Introduced in FAN 1.1

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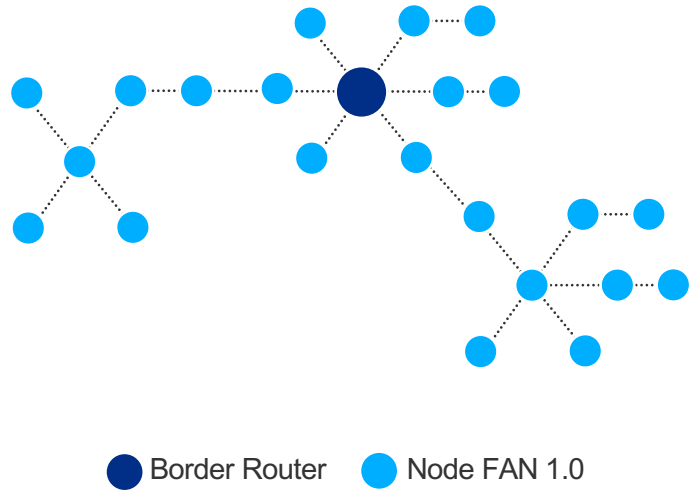
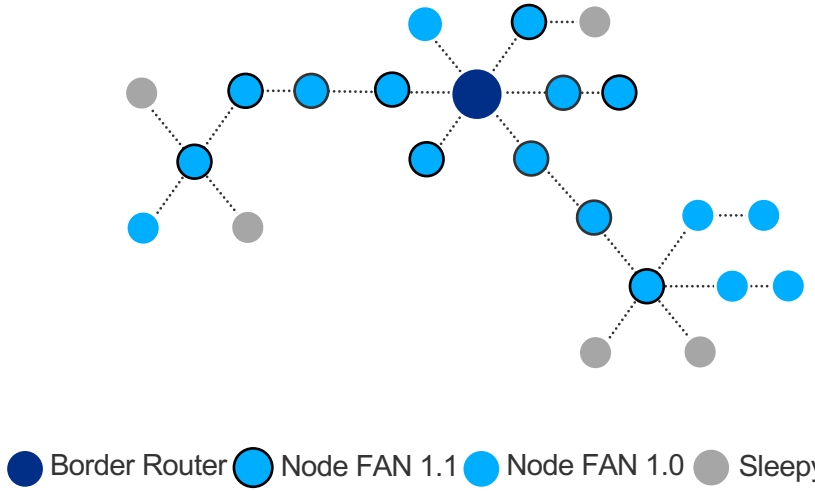
Wi-SUN FAN 1.0 vs FAN 1.1

Wi-SUN FAN 1.0



- Deploy a mesh network with up to several thousands' nodes
- Native IPv6 communication through 6LoWPAN
- Based on FSK PHYs (up to 300 kbps)
- Interoperable
- Secure

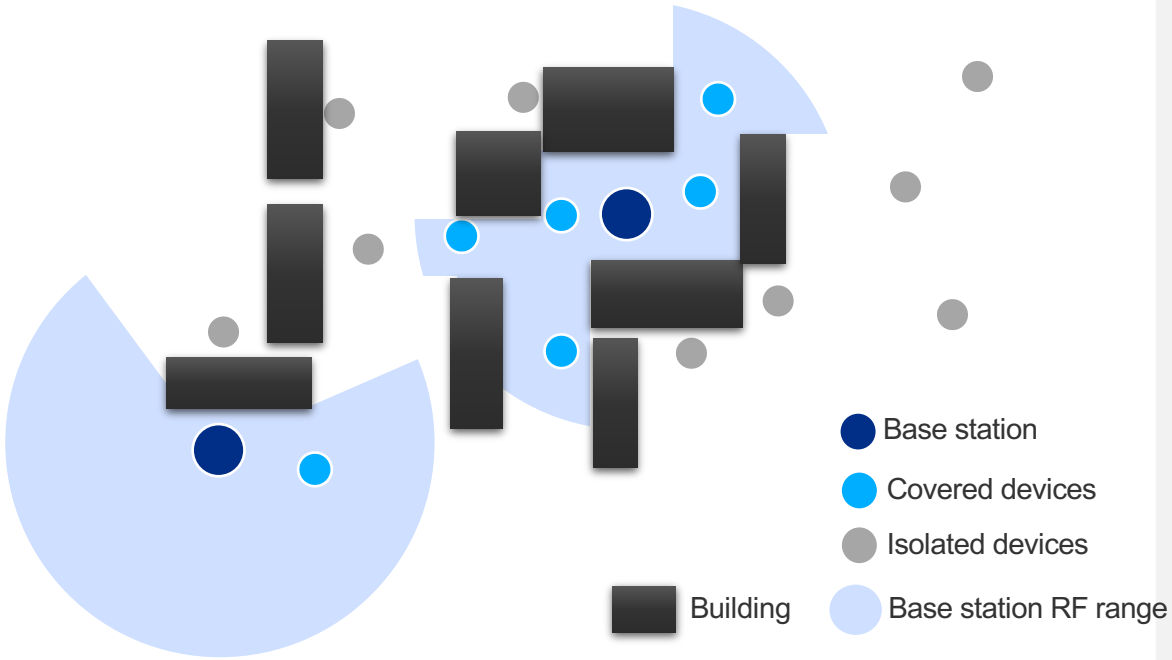
Wi-SUN FAN 1.1



- Enable battery powered devices in the network (water/gas metering, smart city sensing…)
- Expanded global footprint (Japan, Brazil, EU…)
- Introduction of OFDM PHYs (up to 2.4 Mbps) for high performance use cases like distribution automation
- Modulation and data rate negotiation between nodes to make use of the different PHYs for optimum performance

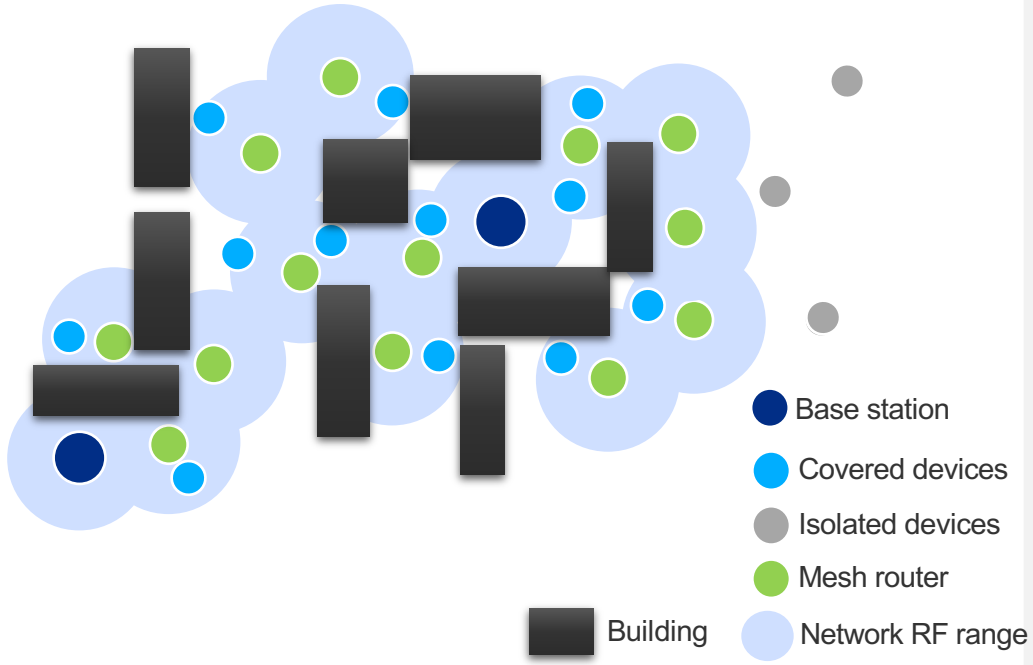
Long Range vs Mesh IoT Protocols

Long-range IoT Protocol



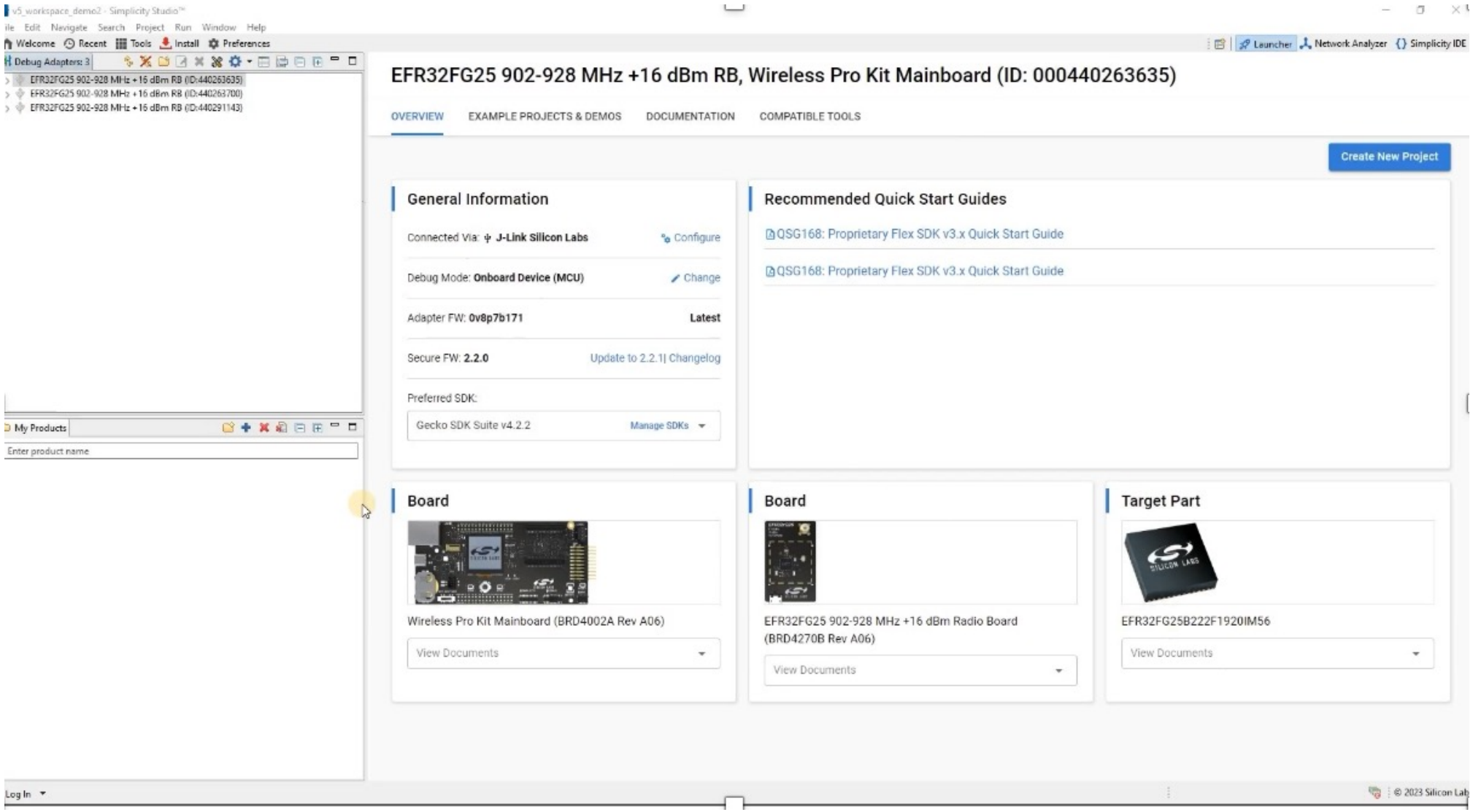
- Star topology includes expensive base stations
- In an urban environment or RF challenging layout, deploying enough base stations to cover the entirety of an area is tedious.

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

View Recording for Wi-SUN Demo



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