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LPW-102

LPWAN-IoT for Smart City Applications

Chad Steider | August 2023

Agenda

01 Growth in Smart Cities

02 Long-Range Wireless

03 LPWAN Applications

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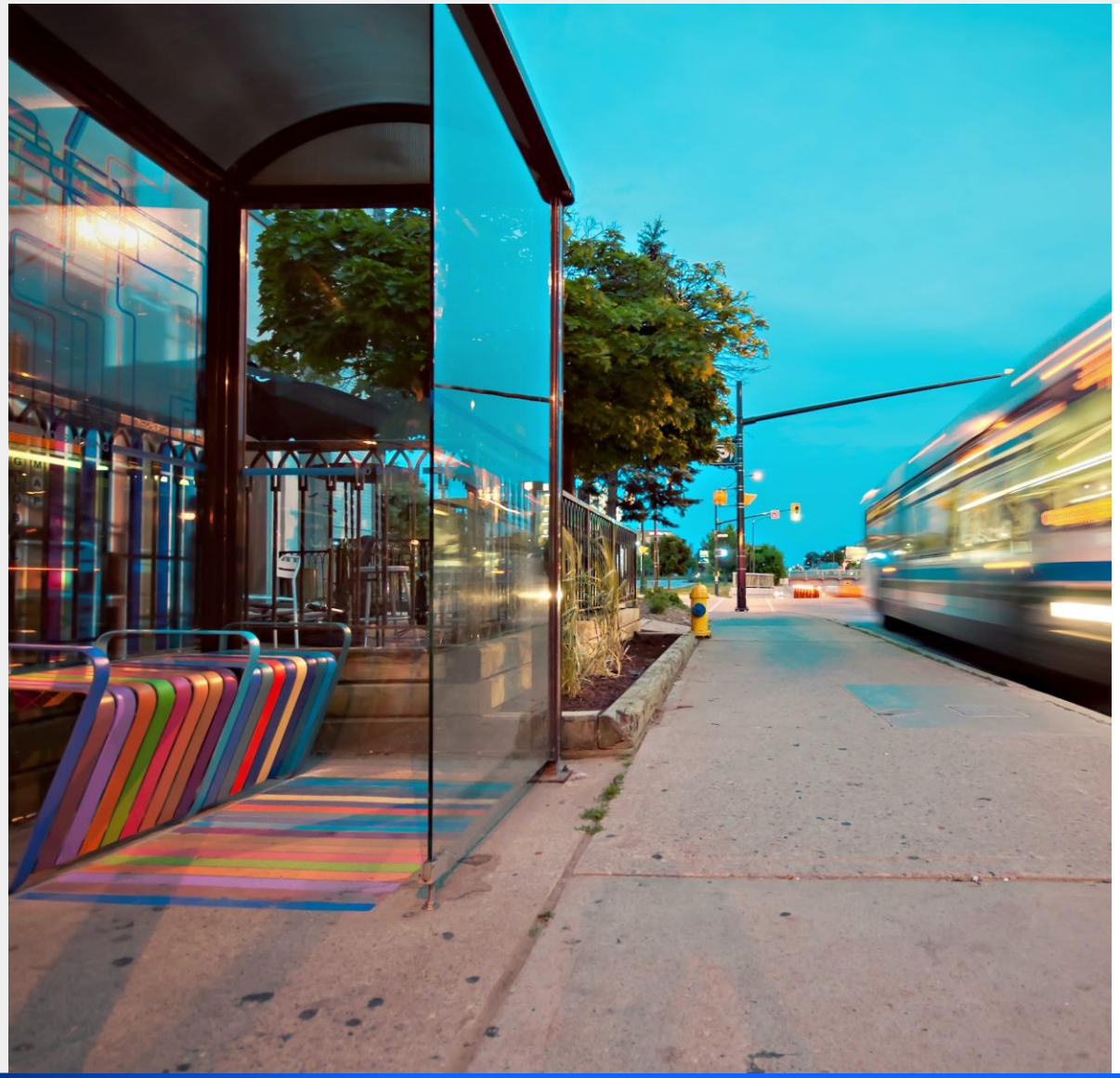
Automation Drives Growth in Smart Cities and Beyond



- **Efficient energy routing via grid edge intelligence and distribution automation**
- **Need to increase efficiency in maintenance and operations**
- **Growing need for increased edge intelligence in both smart city and agriculture applications**

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Long-Range Wireless for Smart Cities Deployments

Proprietary or standards based long-range wireless

- Vendor specific proprietary networks
- Standards based networks (Wi-SUN, WM-Bus, ZigBee)
- Wide area public/private network

Applications with unique requirements drive need for varied solutions

- No one solution can address all challenges of smart city or smart agriculture

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LPWAN Deployment Options

	LICENSED RADIO SPECTRUM	UNLICENSED RADIO SPECTRUM
	Exclusive spectrum access Guaranteed QoS and reliability No duty cycle limitations	Free spectrum access No guaranteed QoS and reliability Duty cycle limitations
PUBLIC NETWORKS Managed network No upfront costs Subscription fees	NB-IoT, LTE-M	LoRaWAN, sigfox, amazon sidewalk
PRIVATE NETWORKS Full network control High upfront costs No subscription fees	NB-IoT, LTE-M	Wi-SUN, Z-Wave PLUS LR, mioty, LoRaWAN

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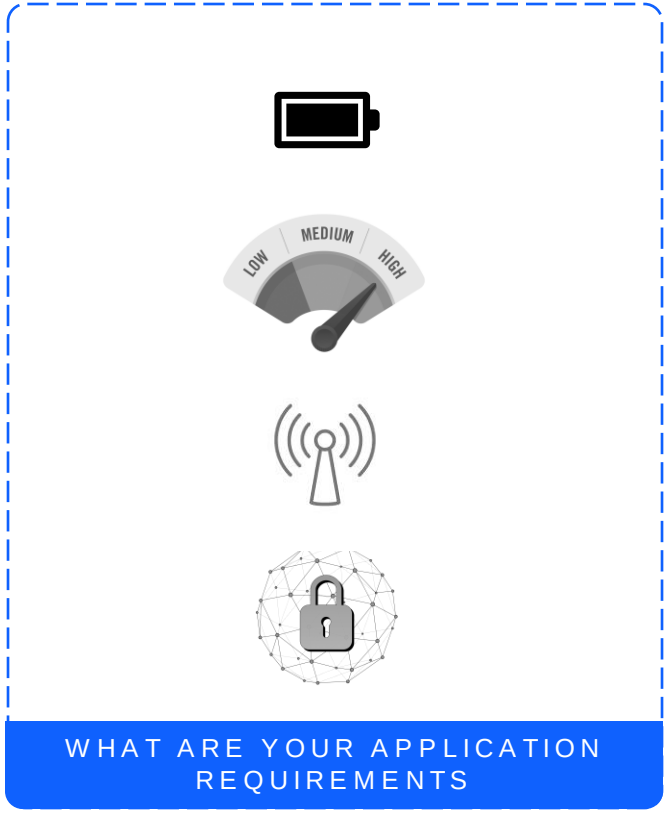
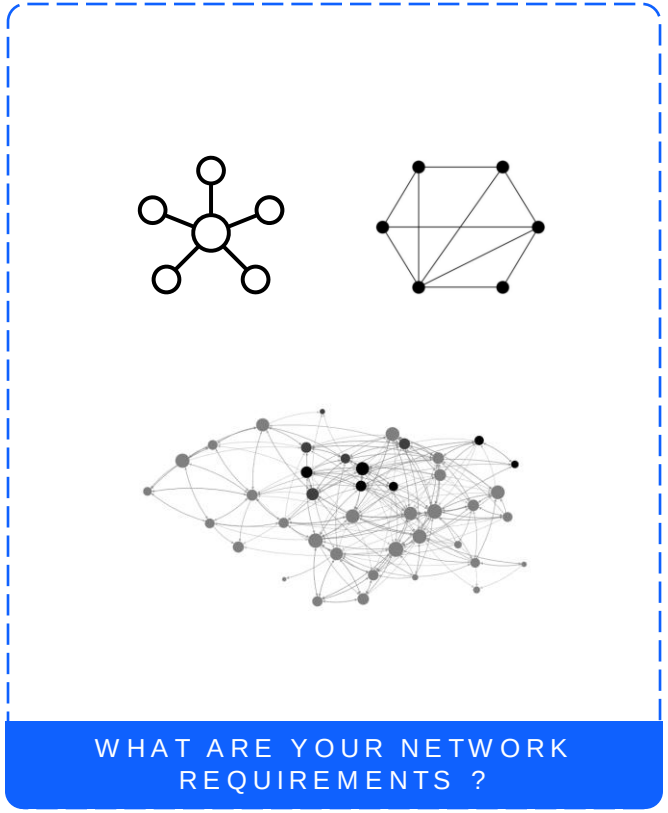
How do you select the right LPWAN

WHICH ECOSYSTEM YOU WANT TO PARTICIPATE ?



WHAT ARE YOUR APPLICATION REQUIREMENTS



WHAT ARE YOUR NETWORK REQUIREMENTS ?

There is no silver bullet. Selection comes down to ecosystem, application, network and several other factors

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Silicon Labs LPWAN Offerings

	Hardware	Stack/API	Partnership
Wi-SUN	Yes	Stack	N/A
Amazon Sidewalk	Yes	Stack	Amazon
Z-Wave Long Range	Yes	Yes	N/A
WM-BUS	Yes	Stack	Stackforce
MIOTY	Yes	No	MIOTY/Fraunhofer
Proprietary	Yes	FLEX SDK, CONNECT Stack	N/A

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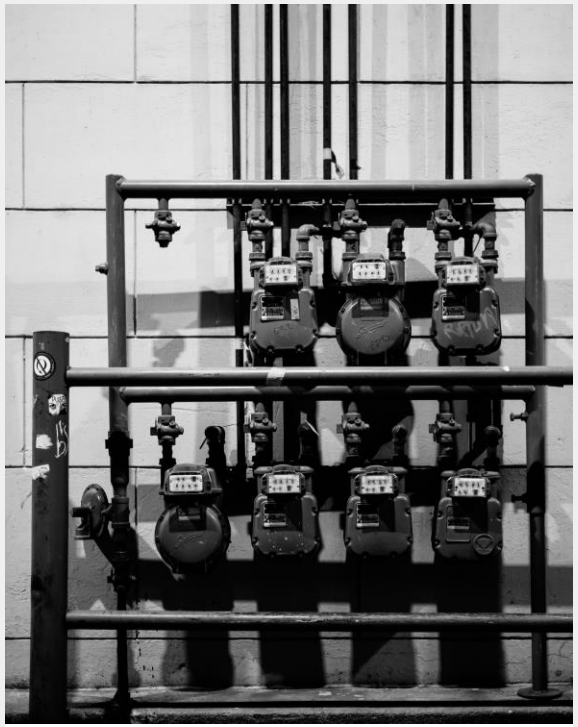
LPWAN Growth Applications

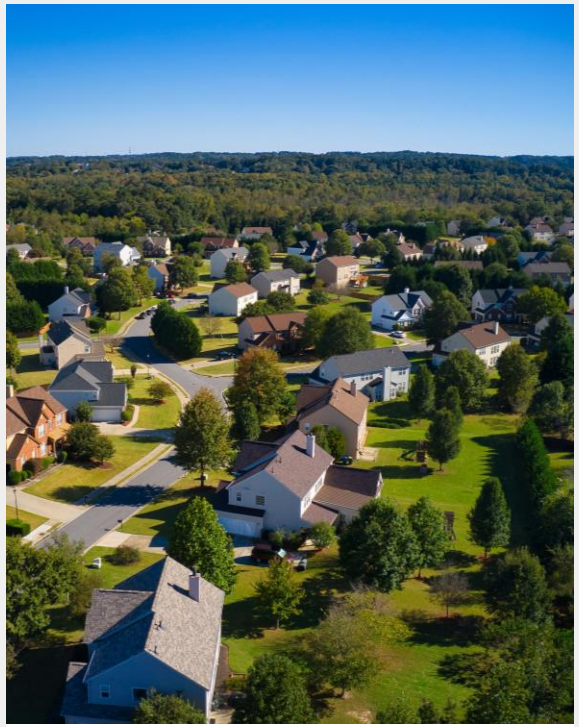


UTILITY AUTOMATION

Smart Metering
Distribution Automation
Solar Trackers
Commercial Charging Infrastructure

MUNICIPAL INFRASTRUCTURE

Street Lighting
Waste Management
Traffic Lights Infrastructure
Parking Monitoring



SMART NEIGHBORHOOD

Pet Trackers
Security Sensors
Access Control
Environmental Monitoring

AGRICULTURE

Livestock Management
Equipment Automation
Irrigation Sensors

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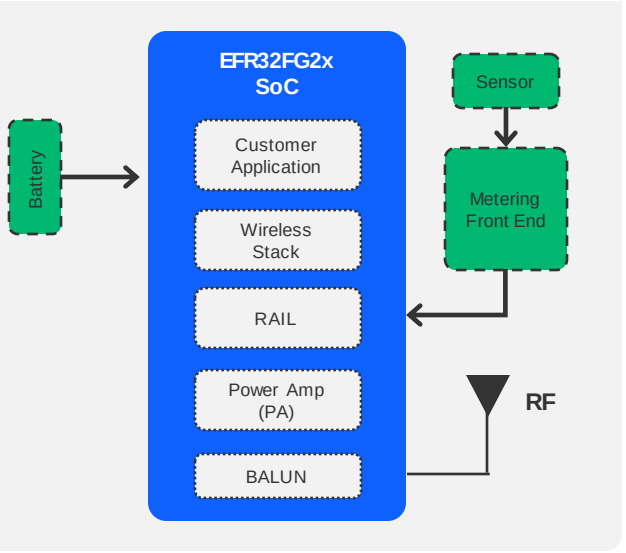
Battery Powered Metering



DESIGN CONSIDERATIONS

- Battery Life
- Robust Connectivity
- Environmental Conditions
- Security
- Total System Cost

HARDWARE SOLUTIONS

- **FG23**
  - Superior RF Performance (Link budget of ~146 dB)
  - Lower cost BOM with integrated DC/DC power supply, PA and BALUN
  - Low power consumption via Preamble Sense Mode, LESENSE
  - Can operate temperatures up to +125 °C
  - Secure Vault™ (certified PSA Level 3)
- **FG28**
  - High GPIO count (49)
  - Superior RF Performance (Link budget of ~146 dB)
  - AI/ML Accelerator for battery power consumption
  - Suitable for Wi-SUN battery-powered LFN nodes
  - Dual band support (Sub-GHz, 2.4GHz BLE)

RECOMMENDED KITS

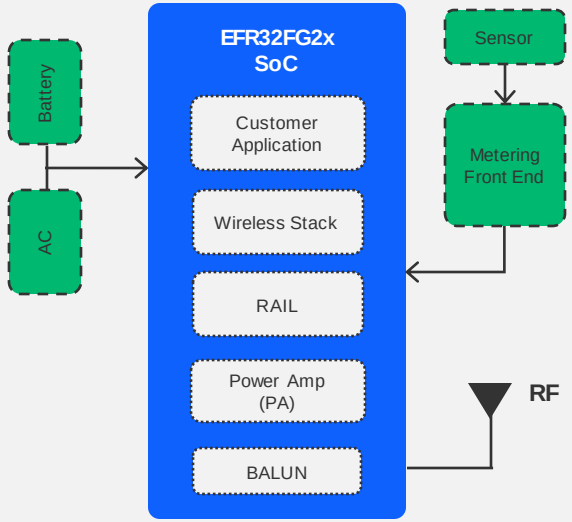
- **FG23**
  - xG23-PK6068A - EFR32xG23 Pro Kit
- **FG28**
  - FG28-PK6025A Pro kit (+20 dBm)
  - xG28-EK2705A Explorer Kit

SOFTWARE SOLUTIONS

- **Wi-SUN (FG28)**
  - Certified stack
  - Certified PHYs[1]
  - Complete integration into GSDK
  - Reference designs for all node types
- **Power management solutions for low power consumption**
  - Option to turn off the power to unused RAM blocks
  - Voltage Scaling
  - Peripheral Reflex System (PRS)
  - Low Energy Sensor Interface (LESENSE)
- **Custom Part Manufacturing Service**
  - Custom programming and security services
  - Security certificate injection
  - Encryption key management and programming

1 – FG28 PHY certification scheduled to be completed in 23Q4

Smart Electric Metering



DESIGN CONSIDERATIONS

- Interoperability
- Higher levels of system integration
- Robust Connectivity
- Latency
- Security

HARDWARE SOLUTIONS

- **FG25 (FSK, OFDM)**
  - OFDM support for high bandwidth
  - FSK and OFDM concurrent detection and mode switch
  - Large memory footprint (1920kB Flash, 512kB RAM)
  - Certified Wi-SUN PHYs
  - Suitable for Wi-SUN BR & Router nodes
- **FG28 (FSK only)**
  - High GPIO count (49)
  - Superior RF performance (Link budget ~146 dBm)
  - AI/ML Accelerator
  - Suitable for Wi-SUN battery-powered LFN nodes
  - Dual band support (Sub-GHz, 2.4GHz BLE)

RECOMMENDED KITS

- **FG25**
  - FG25-PK6011A – EFR32FG25 Pro Kit
  - Wi-SUN-PK6016A – Wi-SUN Pro Kit
- **FG28**
  - FG28-PK6025A Pro kit (+20 dBm)
  - xG28-EK2705A Explorer Kit

SOFTWARE FEATURES / SOLUTIONS

- **Wi-SUN (FG25, FG28)**
  - Certified stack
  - Certified PHYs (FG12, FG25)[1]
  - Integration into GSDK
  - Reference designs for all node types
- **Proprietary (FG23, FG25, FG28)**
  - Complete software development suite for proprietary wireless applications (Flex SDK)
  - Simplified Developer Experience - (Simplicity Studio 5)
- **Custom Part Manufacturing Service**
  - Custom programming and security services
  - Security certificate injection
  - Encryption key management and programming

1 – FG28 PHY certification scheduled to be completed in 23Q4

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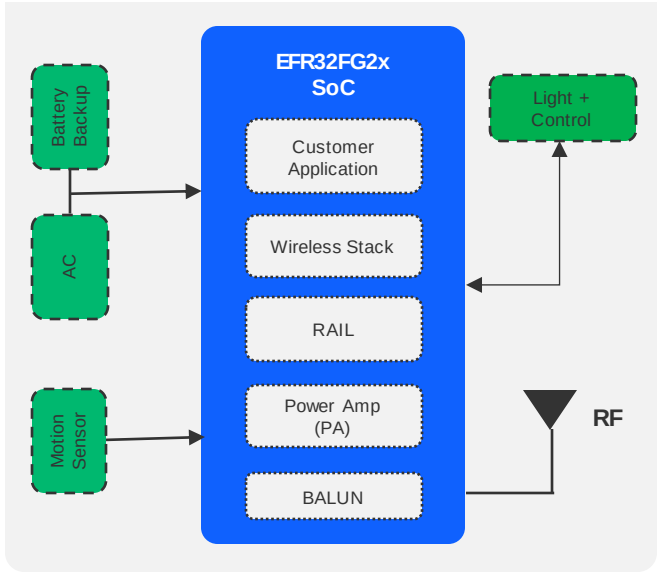
Street Lighting and Municipal Infrastructure



DESIGN CONSIDERATIONS

- Security
- Robust connectivity
- Environmental conditions
- Latency
- Interoperability

RECOMMENDED KITS

- **FG25**
  - FG25-PK6011A – EFR32FG25 Pro Kit
  - Wi-SUN-PK6016A – Wi-SUN Pro Kit
- **FG28**
  - FG28-PK6025A Pro kit (+20 dBm)
  - xG28-EK2705A Explorer Kit

HARDWARE SOLUTIONS

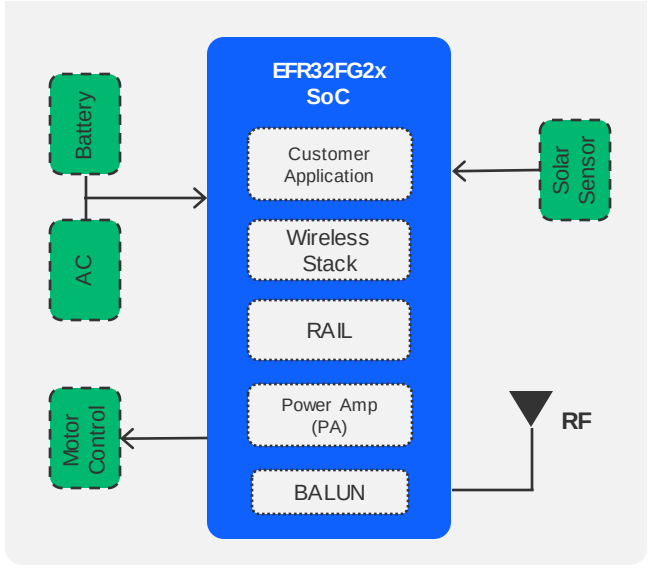
- **FG25**
  - Suitable for Wi-SUN router nodes
  - OFDM support for high bandwidth
  - FSK and OFDM concurrent detection and mode switch
  - Large memory footprint(1920kB Flash, 512kB RAM)
  - Certified Wi-SUN PHYs
- **FG28**
  - High GPIO count (49)
  - Superior RF performance (Link budget of ~146 dBm)
  - AI/ML Accelerator
  - Suitable for Wi-SUN battery-powered LFN nodes
  - Dual band support (Sub-GHz, 2.4GHz BLE)

SOFTWARE SOLUTIONS

- **Wi-SUN (FG25, FG28)**
  - Certified stack
  - Certified PHYs (FG12, FG25)[1]
  - Integration into GSDK
  - Reference designs for all node types
- **Proprietary (FG25, FG28)**
  - Complete software development suite for proprietary wireless applications (Flex SDK)
  - Simplified Developer Experience - (Simplicity Studio 5)

1 – FG28 PHY certification scheduled to be completed in 23Q4

Solar Trackers



DESIGN CONSIDERATIONS

- Massive Area Coverage
- Robust Connectivity
- Challenging Terrain and Environment
- Minimal Network Planning
- AI / ML needed at the edge
- Simple, Integrated Solutions

HARDWARE SOLUTIONS

- **FG23**
  - Good for battery powered applications
  - Great FSK performance (up to +20dBm)
- **FG25**
  - OFDM support for high bandwidth
  - FSK, OFDM switch
  - Large memory footprint (1920kB Flash, 512kB RAM)
- **FG28**
  - High GPIO count (49)
  - Superior RF performance (Link budget of ~146 dBm)
  - AI/ML Accelerator
  - Dual band support (Sub-GHz, 2.4GHz BLE)

RECOMMENDED KITS

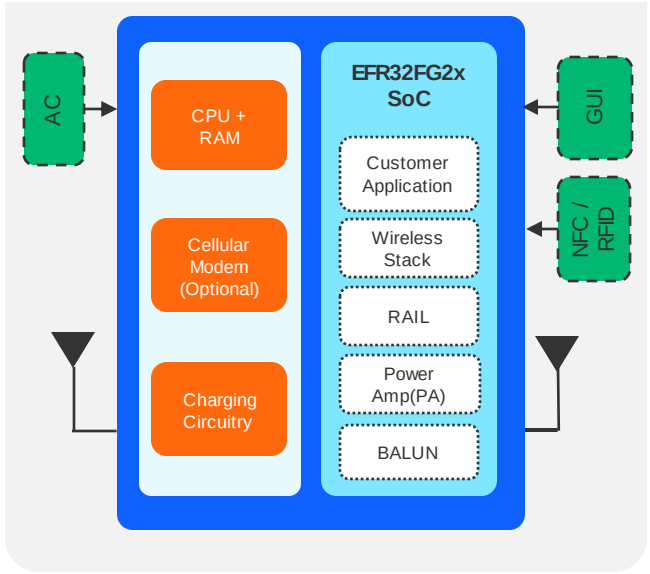
- **FG23**
  - xG23-PK6068A - EFR32xG23 Pro Kit (+20 dBm)
- **FG25**
  - FG25-PK6011A – EFR32FG25 Pro Kit
  - Wi-SUN-PK6016A– Wi-SUN Pro Kit
- **FG28**
  - FG28-PK6025A Pro kit (+20 dBm)
  - xG28-EK2705A Explorer Kit

SOFTWARE SOLUTIONS

- **Wi-SUN (FG12, FG25, FG28)**
  - Certified stack
  - Certified PHYs (FG12, FG25)[1]
  - Integration into GSDK
  - Reference designs for all node types
- **Proprietary (FG23, FG25, FG28)**
  - Complete software development suite for proprietary wireless applications (Flex SDK)
  - Simplified Developer Experience - (Simplicity Studio 5)
- **AI/ML Acceleration (FG28)**
  - Simplify AI/ML applications with hardware libraries
  - Existing partnerships to simplify development

1 – FG28 PHY certification scheduled to be completed in 23Q4

Commercial EV Charging Networks



DESIGN CONSIDERATIONS

- Massive Area Coverage
- Robust Connectivity
- Challenging Terrain and Environment
- Interoperability with Smart City Ecosystems
- Load Control and future V2G Applications
- Simple, Integrated Solutions

RECOMMENDED KITS

- **FG25**
  - FG25-PK6011A – EFR32FG25 Pro Kit
  - Wi-SUN-PK6016A– Wi-SUN Pro Kit
- **FG28**
  - FG28-PK6025A Pro kit (+20 dBm)
  - xG28-EK2705A Explorer Kit

HARDWARE SOLUTIONS

- **FG25**
  - OFDM support for high bandwidth
  - FSK, OFDM switch
  - Large memory footprint (1920kB Flash, 512kB RAM)
  - Wi-SUN FAN 1.1 Support
- **FG28**
  - High GPIO count (49)
  - Superior RF performance (146 dBm)
  - AI/ML Accelerator
  - Dual band support (Sub-GHz, 2.4GHz BLE)
  - Wi-SUN FAN 1.1 Support

SOFTWARE SOLUTIONS

- **Wi-SUN (FG12, FG25, FG28)**
  - Certified stack
  - Certified PHYs (FG12, FG25)[1]
  - Integration into GSDK
  - Reference designs for all node types
- **Proprietary (FG25, FG28)**
  - Complete software development suite for proprietary wireless applications (Flex SDK)
  - Simplified Developer Experience - (Simplicity Studio 5)
- **Custom Part Manufacturing Service**
  - Custom programming and security services
  - Security certificate injection
  - Encryption key management and programming

1 – FG28 PHY certification scheduled to be completed in 23Q4

Smart Agriculture

- **Livestock monitoring**
  - Animal health
  - Location
  - Identification
- **Irrigation**
  - Moisture & soil pH sensors
  - Water values & temperature
- **Crop Monitoring**
  - Temperature & humidity
  - Wind speed & direction
  - Air quality
  - Flood detection & reservoir levels

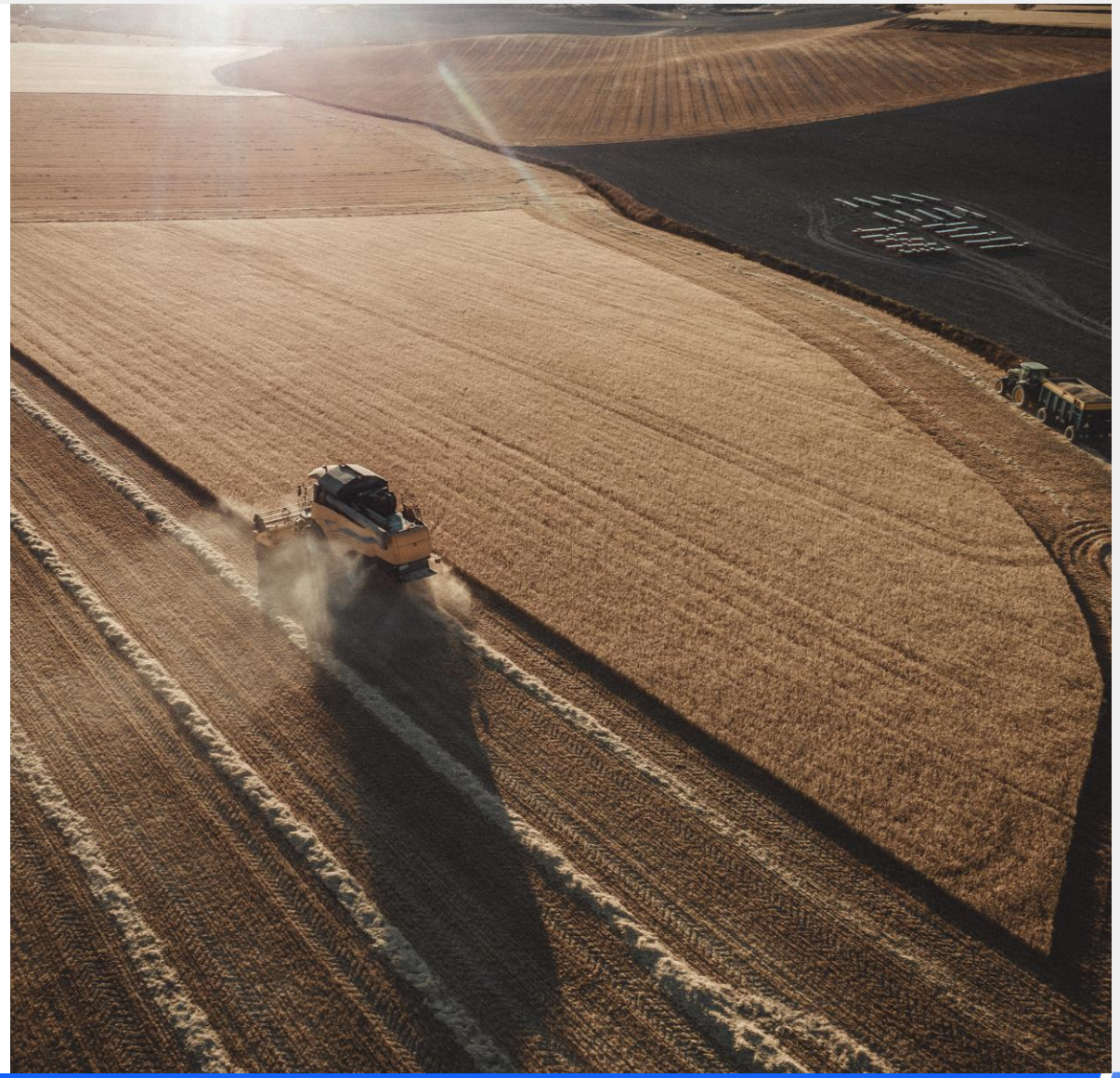
Proprietary

Wi SUN

mioty alliance

Long Range PHY (Proprietary)

sigfox



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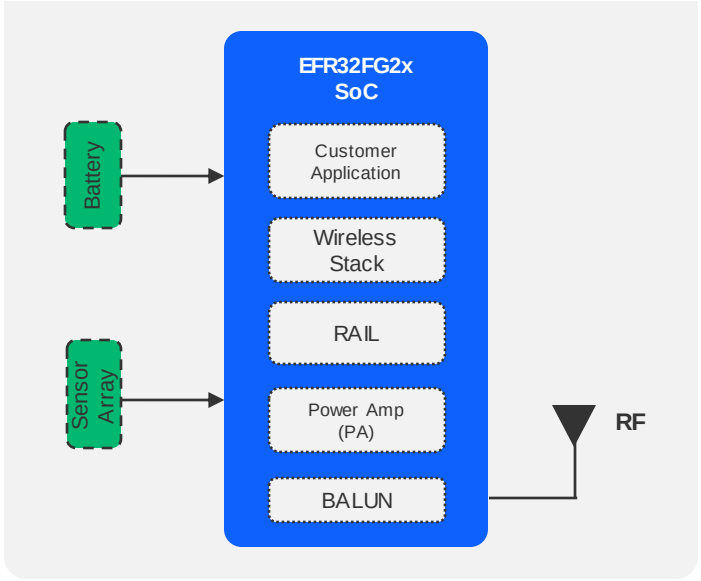
Livestock Monitoring



DESIGN CONSIDERATIONS

- Battery Life
- Long Range for real-time monitoring
- Minimal Infrastructure
- Low maintenance
- Low datarate
- High node count – easy commissioning

HARDWARE SOLUTIONS

- **FG23**
  - Good for battery powered applications
  - Great FSK performance (up to +20dBm)
- **FG25 (Gateways)**
  - OFDM support for high bandwidth
  - FSK, OFDM switch
  - Large memory footprint (1920kB Flash, 512kB RAM)
- **FG28**
  - High GPIO count (49)
  - Superior RF performance (Link budget)
  - AI/ML Accelerator
  - Dual band support (Sub-GHz, 2.4GHz BLE)

RECOMMENDED KITS

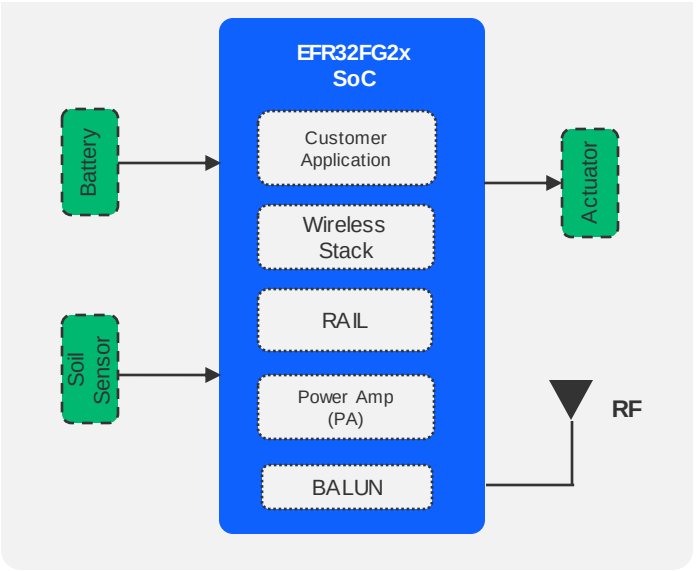
- **FG23**
  - xG23-PK6068A - EFR32xG23 Pro Kit (+20 dBm)
- **FG25**
  - FG25-PK6011A – EFR32FG25 Pro Kit
  - Wi-SUN-PK6016A– Wi-SUN Pro Kit
- **FG28**
  - FG28-PK6025A Pro kit (+20 dBm)
  - xG28-EK2705A Explorer Kit

SOFTWARE SOLUTIONS

- **Wi-SUN (FG25, FG28)**
  - Certified stack
  - Certified PHYs (FG12, FG25)[1]
  - Integration into GSDK
  - Reference designs for all node types
- **Proprietary**
  - Complete software development suite for proprietary wireless applications (Flex SDK)
  - Simplified Developer Experience - (Simplicity Studio 5)
- **Mioty (FG23/FGM230S)**
  - Support for Class Z (unidirectional) and Class A (bidirectional) modes
  - EU0, EU1, EU2, and US0 communication profile support
  - Class B (battery powered low latency) and FGM230S support in development

1 – FG28 PHY certification scheduled to be completed in 23Q4

Smart Irrigation and Soil Monitoring



DESIGN CONSIDERATIONS

- Range
- Real time monitoring
- Battery Life
- AI / ML at the edge
- Environmental conditions
- Security

HARDWARE SOLUTIONS

- **FG23**
  - Superior RF Performance (Link budget of ~146 dB)
  - Lower cost BOM with integrated DC/DC power supply, PA and BALUN
  - Output power options to +20 dBm
- **FGM230S**
  - SiP module based on FG23
  - Matching components included in module for simplified RF design
  - Optimized for 868 and 915 MHz bands
- **FG28**
  - High GPIO count (49)
  - Superior RF Performance (Link budget of ~146 dB)
  - AI/ML Accelerator for battery power consumption
  - Suitable for Wi-SUN battery-powered LFN nodes
  - Dual band support (Sub-G, 2.4G BLE)

RECOMMENDED KITS

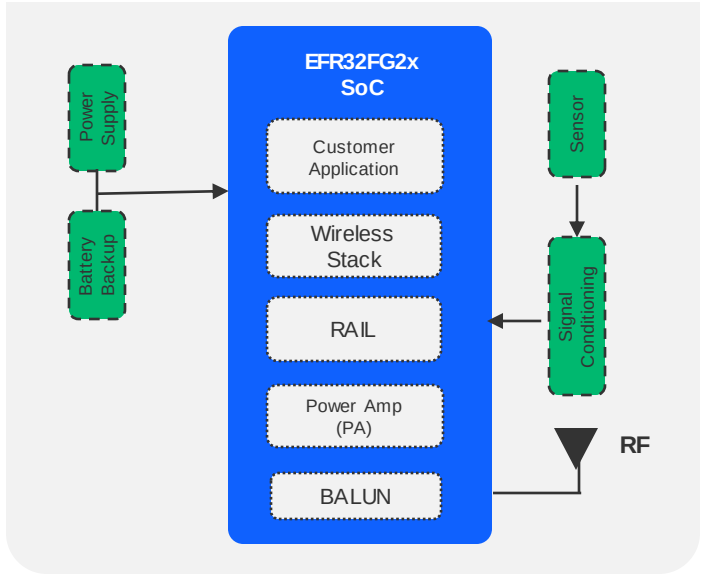
- **FG23**
  - xG23-PK6068A - EFR32xG23 Pro Kit
- **FG25**
  - FG25-PK6011A – EFR32FG25 Pro Kit
  - Wi-SUN-PK6016A – Wi-SUN Pro Kit
- **FG28**
  - FG28-PK6025A Pro kit (+20 dBm)
  - xG28-EK2705A Explorer Kit

SOFTWARE SOLUTIONS

- **Wi-SUN (FG28)**
  - Certified stack
  - Certified PHYs (FG12, FG25)[1]
  - Integration into GSDK
  - Reference designs for all node types
- **Proprietary (FG23, FG28, FGM230S)**
  - Complete software development suite for proprietary wireless applications (Flex SDK)
  - Simplified Developer Experience - (Simplicity Studio 5)
- **AI/ML Acceleration (FG28)**
  - Simplify AI/ML applications with hardware libraries
  - Existing partnerships to simplify development
- **Mioty (FG23/FGM230S)**
  - Support for Class Z (unidirectional) and Class A (bidirectional) modes
  - EU0, EU1, EU2, and US0 communication profile support
  - Class B (battery powered low latency) and FGM230S support in development

1 – FG28 PHY certification scheduled to be completed in 23Q4

Environmental Condition Monitoring



DESIGN CONSIDERATIONS

- Long Range
- Real time monitoring
- Battery Life
- Environmental conditions
- Security
- AI/ML at the Edge

RECOMMENDED KITS

- **FG23**
  - xG23-PK6068A - EFR32xG23 Pro Kit
- **FG28**
  - FG28-PK6025A Pro kit (+20 dBm)
  - xG28-EK2705A Explorer Kit
- **FGM230S**
  - FGM230-RB4328B

HARDWARE SOLUTIONS

- **FG23**
  - Superior RF Performance
    - DSSS-OQPSK link budget up to 151 dBm
  - Low sleep and active currents
  - Extended operating temps
- **FG28**
  - High GPIO count (49)
  - Superior RF Performance
  - DSSS-OQPSK link budget up to 151 dBm
  - AI/ML Accelerator
  - Dual band support for extended use cases
- **FGM230S**
  - SiP module based on FG23
  - Matching components included in module for simplified RF design
  - Optimized for 868 and 915 MHz bands

SOFTWARE SOLUTIONS

- **Wi-SUN (FG28)**
  - Certified stack
  - Certified PHYs (FG12, FG25)[1]
  - Integration into GSDK
  - Reference designs for all node types
- **Amazon Sidewalk (FG23, FG28)**
  - Native pipeline to AWS cloud
  - No additional infrastructure cost
  - 1.5+ mile range with FSK
- **Proprietary (FG23, FG28, FGM230S)**
  - Complete software development suite for proprietary wireless applications (Flex SDK)
  - Simplified Developer Experience - (Simplicity Studio 5)

1 – FG28 PHY certification scheduled to be completed in 23Q4

LPWAN, key part of the growing Smart Cities infrastructure

- Each LPWAN technology provides differentiated and unique advantages that it can bring to a variety of different applications
- Support model for each technology varies, but EFR32 delivers a flexible platform no matter what LPWAN is chosen
- EFR32 Series 2 offers a unique security advantage that is critical to LPWAN with both Secure Vault™ – Mid and Secure Vault™ – High options

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THE LATEST

LPW-201 Advanced Features Coming to Sub-GHz Networks

WI-SUN

LPW-202 Wi-SUN Ecosystem for Large-Scale Outdoor IoT Wireless Networks

AMAZON SIDEWALK

LPW-203 Ecosystem Developer Journeys for Amazon Sidewalk

OUR OFFERING

LPW-205 Explore the New FG28 Dual-Band, Sub-GHz 2.4 GHz Bluetooth LE SoC

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Thank you!