Presentation Will Begin Shortly

4:00

LPWAN

FEB 8TH	LPWAN 101 - A Look at the Emerging LPWAN Solutions and the Applications They Serve
MAR 14TH	Wi-SUN FAN 1.1 Rollout
APR 18TH	Amazon Sidewalk – New Features and Market Applications
MAY 23TH	Why Sub-GHz?

Welcome

Why Sub-GHz?

Exploring the uses for Sub-GHz networks in the expanding IoT

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tech talks

Sub-GHz RF Overview

- **Different frequency bands are supported in different parts of the world and for different applications**
  - **EU:** 433/868 MHz
  - **US/LTAM:** 315/915 MHz
  - **Japan:** 426/920 MHz
  - **India:** 868 MHz
- **Devices use unlicensed RF spectrum avoiding fees or high maintenance costs**
  - Licensed bands include things like cellular where carriers purchase a portion of the spectrum for their devices
- **Typically associated with long range, low power applications**
  - Adoption has been driven by things like garage door openers, infrastructure, and security

Wi SUN

LoRaWAN

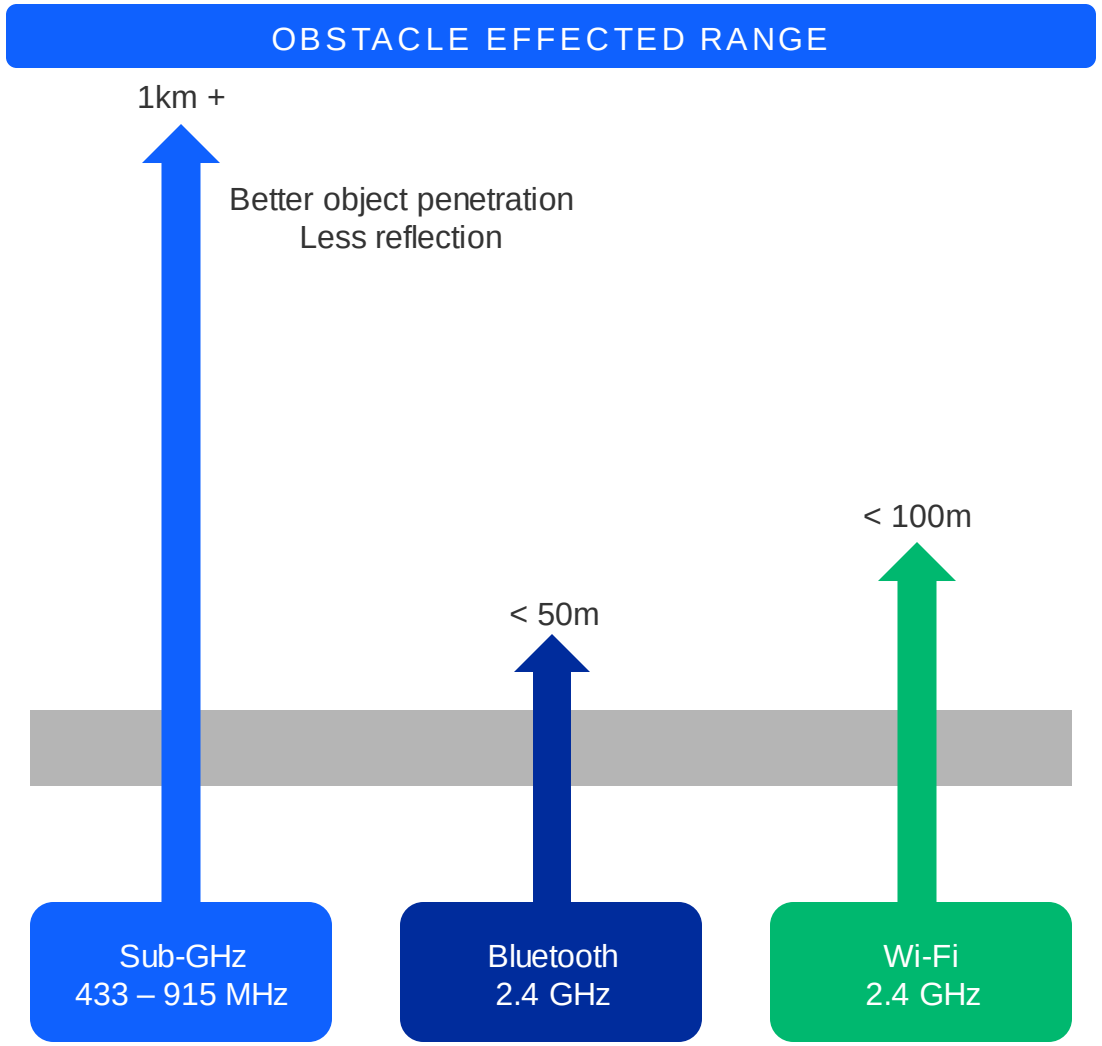
Wirepas

amazon sidewalk

Z-WAVE PLUS LR

mioty

Sub-GHz Advantages



- **Longer point to point transmission range than 2.4 or 5 GHz**
  - Longer wavelengths easily bypass obstacles and penetrate buildings
  - Less prone to reflection lowering free space path loss
- **Less network congestion than 2.4GHz spectrum**
  - Adoption of Wi-Fi, Bluetooth, Matter, etc. have resulted in crowding of 2.4 GHz space
  - Devices typically have lower transmission duty cycles
- **Power Efficiency**
  - Lower data rates and better range performance lower overall system burden
  - Less congestion results in fewer retries resulting in better battery life
- **Cost-Effectiveness**
  - Provide a cost-effective solution for low-data-rate systems, from simple point-to-point connections to larger mesh networks
- **Security and Reliability**
  - Historically been based on proprietary technologies optimized for specific applications, ensuring reliability and security requirements

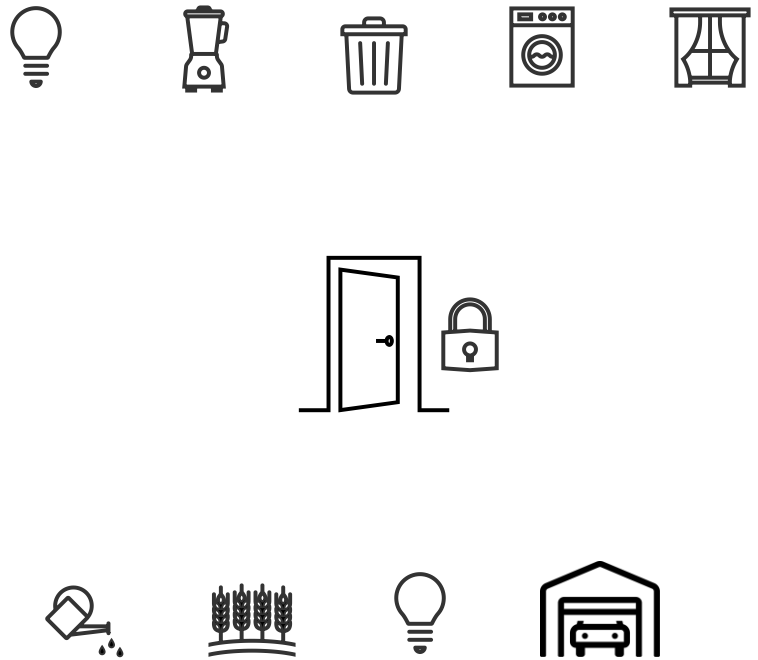
Sub-GHz Disadvantages

- **Historically limited to lower data rates**
  - Narrower bandwidth restricts the amount of data that can be sent within transmit windows
- **Spectrum may be limited in different regions**
  - Some bands may be licensed or limited to certain devices resulting in spectral crowding
  - Certain geographies may also limit output power or duty cycle
- **Longer wavelengths require larger antennas**
  - May be difficult to design antennas to work in small form factor, space constrained devices
- **Multipath fading may affect overall performance**
  - Simple modulations may have degraded performance in urban environments
  - Introduction of more complex modulations like OFDM have had a major impact on this
- **Historically based on proprietary technologies**
  - Optimized for specific applications, which can limit flexibility and interoperability

	Band	Range	Transmit rate
Wi-SUN	433 / 868 / 915 MHz	Up to 2 KM	2.4 Mbps
Wirepas	868 MHz	Up to 2 KM	1 Mbps
LoRaWAN	433 / 868 / 915 MHz	Up to 10 KM	Up to 50 Kbps
WMBus	169 / 868 / 433 MHz	Up to 1 KM	Up to 100 Kbps
MIOTY	868 / 915 MHz	Up to 2 KM	512 bps
Sigfox	862 to 928 MHz	Up to 10 KM	Up to 600 bps
NB-IOT	800 / 900 MHz	Up to 10 KM	128 Kbps
Z-Wave LR	900 MHz	Up to 1 Mile	100 Kbps
Thread	2.4 GHz	Up to 100 Meters	250 Kbps
Wi-Fi	2.4 / 5 / 6 GHz	Up to 100 Meters	9.6 Gbps
Bluetooth LE	2.4 GHz	Up to 100 Meters	2 Mbps
ZigBee	2.4 GHz	Up to 100 Meters	250 Kbps

Extending IoT beyond the Front Door

- **Growing desire to add IoT devices outside the home**
  - Add intelligence to improve resource utilization, heighten security, or elevate homeowner experience
- **Sub-GHz already has major foothold within homes**
  - Devices like garage door and gate openers have been utilizing sub-GHz RF for decades
- **Huge base of installers for managed systems**
  - Most managed security systems leverage Z-Wave today and are continuing to grow their footprint
- **Sub-GHz still dominates low power space**
  - Standards like Matter and Wi-Fi are not as optimized for battery powered applications
- **Multi-family residential usage is driving significant growth**
  - Property managers want to offer automation and monitoring without burdening residents



Smart Cities Expanding Sub-GHz Footprint

- **Major uptick in deployments of connected devices for infrastructure, energy management, and environmental monitoring**
  - Solutions like cellular have scalability challenges due to cost and complexity
- **Move from proprietary to standards based solutions has improved network access and reliability**
  - Networks no longer limited to one device type or vendor without compromising performance
- **Need for more real-time control and monitoring**
  - Device connectivity improves ability to make decision making at a node or neighborhood level
- **2.4 GHz Considerations:**
  - Distance between nodes and presence of buildings limits feasibility for backhaul connections
  - Can be used in conjunction for diagnostics, local sensor networks, or configuration

Global Deployment of Smart Meters

SILICON LABS

Growing needs for interoperability

- **Higher cost equipment is building out backbone of municipal LPWAN networks**
  - Streetlights, electric meters, and other line powered devices make up majority of existing LPWAN use cases
- **Allows for faster ROI for entities responsible for deployment of networks**
  - Looking to expand use cases and allow other devices on formerly private networks
  - Allows for service fee model to help recoup costs by allowing third party devices on networks
- **Enabling expansion of LPWAN connectivity into lower cost and low power nodes**
  - Gas meters, water meters, and environmental sensors are most frequently brought up first
- **Multi-vendor interoperability is critical to this growth**
  - Network accessibility and reliability are now being added at SLA level to guarantee performance

Eliminating Wires in Industrial Applications

- **Wires increase cost and complexity in factories and warehouses**
  - Wireless solutions improve layout flexibility and decrease clutter with connected equipment
- **Increased data rates with emergence of OFDM have brought performance in-line with wired solutions**
  - Allows users to replace CAN, RS-232 or RS-485 with higher throughput wireless
- **Provide more installation flexibility for individual applications**
  - Not tied to existing wire runs or building limitations for equipment placement
- **2.4 GHz Considerations:**
  - Existing IT infrastructure could potentially be leveraged and lower network overhead cost
  - Congestion of 2.4 and 5 GHz spectrum limits reliability and reach

Q&A

Applications

Asset Tracking / Supply Chain Managment

APPLICATION DETAILS

- Tracking of individual assets through supply chain is becoming more important
- Challenges today due to cost of hardware and services to track throughout entire journey
- High node count implementation where many hundreds or many thousands of connected nodes may be present

WHY SUB-GHZ?

- **Better penetration:** Need to be able to perform reliably in challenging RF environment created by containers, shelves, and other metal objects
- **Optimized for low power:** Sensors do not need to transmit frequently or at high data rates
- **Less Interference**: Limited transmit windows and separation from IT networks lowers overall network congestion
- **Recommended Protocols :** Proprietary, Wi-SUN, Wirepas, Mioty

2.4GHZ CONSIDERATIONS

- **Higher Data Rates:** Need to transmit data more frequently at different points of the journey may require higher data rates
- **Standardization:** Need for interoperability between systems and vendors
- **Worldwide Support:** Assets may travel across global regions increasing need for single solution
- **Recommended Protocols:** 2.4GHz Mesh (Zigbee, Thread), Wirepas

Parking Availability Tracking

APPLICATION DETAILS

- Monitor and notify drivers of open parking spaces limiting the amount of searching needed and lowering environmental impact
- Typically, battery powered sensors located either in a garage or street side to determine if a parking space is occupied
- Can leverage subscription model or fee collection model to simplify usage and notification for patrons
- Garage applications may have different needs / requirements than open city parking

WHY SUB-GHZ?

- **Urban canyons:** Sub-GHz frequencies can cover larger distances and penetrate through concrete walls making them better suited for urban environments
- **Low Power Performance:** Parking sensors typically battery powered and do not need to transmit data very frequently
- **Mesh network:** Expand the overall network footprint without carrying the burden of the network infrastructure
- **Recommended Protocols :** Wi-SUN

2.4GHZ CONSIDERATIONS

- **Low Power Performance:** Networks like Zigbee are optimized for low power, low bandwidth sensor applications
- **Small footprint coverage:** Indoor parking may not need the wide area coverage of outdoor solutions
- **Scalability:** Mesh networks scalability in larger open parking spaces would require repeaters and hubs
- **Recommended Protocols:** 2.4GHz Mesh (Zigbee, Thread, etc)

Irrigation Monitoring and Control

APPLICATION DETAILS

- Wide array of needs depending on use case
- Made up of controller that interfaces with overall sprinkler system and sensors placed throughout coverage area
- Drive to better understand and control resource utilization for home, agriculture, and commercial uses

WHY SUB-GHZ?

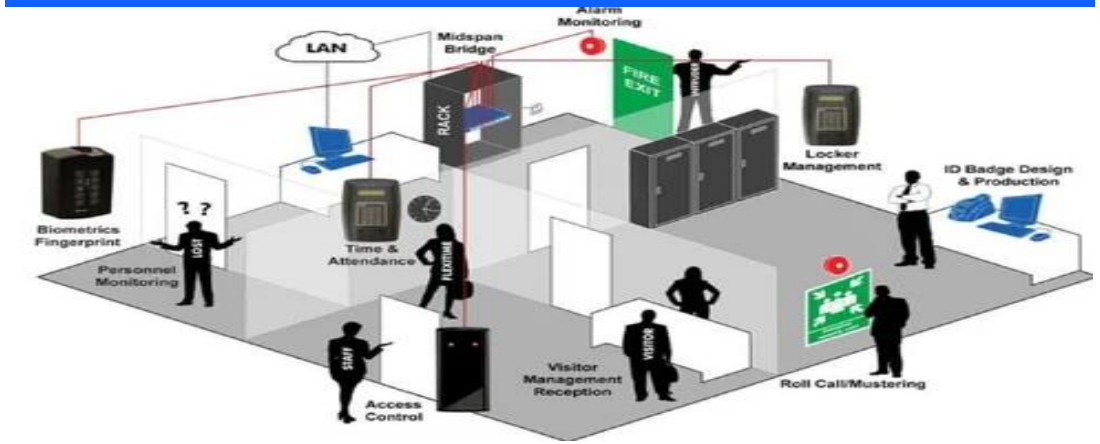
- **Long range:** Reduce number of gateways required to cover large form land
- **Network scalability**: Commercial implementations may need to scale to hundreds or thousands of nodes without network interruption
- **Optimized for low power:** In ground sensors need to operate for months or years without any user interaction
- **Low bandwidth:** Sensors are not required to transmit frequent or large amounts of data
- **Recommended Protocols:** Wi-SUN (Agriculture) / Z-Wave (Home)

2.4GHZ CONSIDERATIONS

- **Indoor applications:** Greenhouses or other indoor installations do not require long range
- **Worldwide support:** Can easily deploy the same system across the globe without any redesign
- **Recommended Protocols:** 2.4GHz Mesh (Zigbee, Matter, Thread)

Building Security and Automation

APPLICATION DETAILS



- Need to expand systems from just security to automation driving need for multi-vendor interoperability
- High node counts driven by door, window, and environmental sensors
- Infrastructure cost and setup can be prohibitive depending on network architectures.

WHY SUB-GHZ?

- **Robust connectivity:** Need to ensure all nodes can maintain reliable connectivity for access control and credentialing
- **Coverage of large number of assets:** Network congestion and scalability important as use cases expand
- **Mix of line and battery powered end nodes:** Need to support multiple types of nodes without compromise in performance or security

- **Recommended Protocols:** Proprietary, Z-Wave, Wirepas

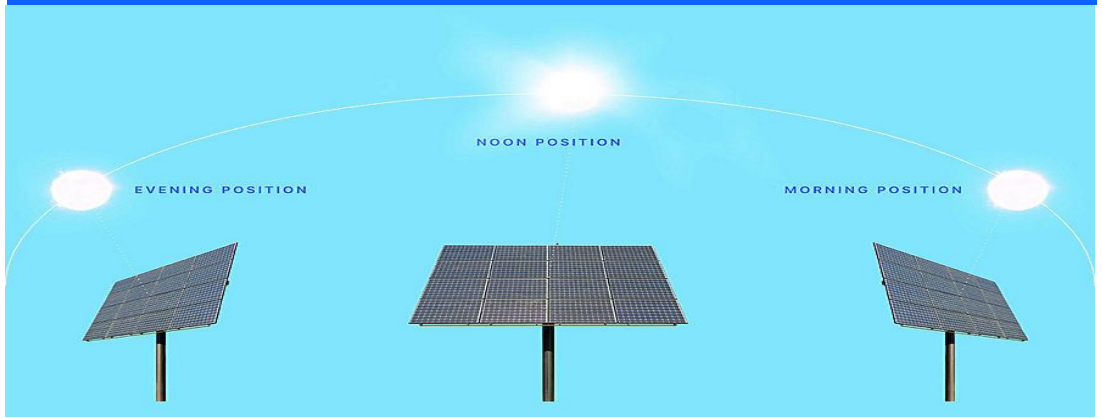
2.4GHZ CONSIDERATIONS

- **Interaction with IT Networks:** Credentials, access control, and support typically done as part of IT process
- **Mix of line and battery powered end nodes:** Need to support multiple types of nodes without compromise in performance or security
- **Scalability:** Need to support large numbers of nodes from multiple vendors

- **Recommended Protocols:** 2.4GHz Mesh (Zigbee, Thread, Matter)

Solar Trackers

APPLICATION DETAILS



- Large scale installations can cover large geographic footprints with diverse landscape presenting unique RF challenges
- Very high node count with multiple types of nodes for different applications within the solar installation
- Emergence of standards like Matter that hope to consolidate use cases for residential use cases

WHY SUB-GHZ?

- **Long range:** Limited control over landscape layout requires long point to point range
- **Obstacle penetration:** Solar panels and support infrastructure create challenging RF environment
- **Network scalability and maintenance:** Need to easily support addition of large number of nodes with minimal support interaction
- **Recommended Protocols:** Wi-SUN, Wirepas

2.4GHZ CONSIDERATIONS

- **Emerging standards:** Standards like Matter and Zigbee adding support specifically for distributed energy resources
- **High node count:** Large number of nodes limits need for long point to point range
- **Interoperability:** Need to interact with multiple systems including IT networks seamlessly
- **Diagnostic support:** Maintenance technicians need to troubleshoot interface-less devices
- **Recommended Protocols:** 2.4GHz Mesh (Zigbee, Matter), Bluetooth LE

Smart HVAC System - Home & Building

APPLICATION DETAILS

- Wiring increase cost and complexity of systems and installation
- Existing interface requirements drive need for higher throughput eliminating some existing technologies
- Challenging installations create complex RF environment and drive needs for better object penetration and longer range
- Need to support multiple technologies to leverage existing sensors or to support multiple types of devices

WHY SUB-GHZ?

- **Range and penetration:** Sub-GHz frequencies offer greater range and penetration, ideal for connecting sensors over large areas and through obstacles.
- **High throughput:** Inclusion of higher data rates with OFDM options allows for replacement of wired interfaces
- **Energy Efficiency:** Energy efficiency of sub-GHz networks, contributing to the sustainability goals of a smart HVAC system.

- **Recommended Protocols**: Proprietary, Wi-SUN

2.4GHZ CONSIDERATIONS

- **Ecosystem support:** Desire for inclusion in existing homeowner systems
- **Off-the-shelf sensor support:** Leverage existing sensors and third-party products to interface with system

- **Recommended Protocols:** 2.4GHz Mesh (Zigbee, Matter), Wi-Fi, Bluetooth LE

Street Lighting &Traffic Control

APPLICATION DETAILS

- Improve energy efficiency and lower costs with more localized control of dimming based on ambient light, traffic patterns or pedestrian activity
- Enhance safety and security with faster response time due to co-deployed sensors and emergency notifications
- Collect data to optimize traffic flow, provide parking guidance, or provide surveillance
- Reduce light pollution and lower carbon footprint by optimizing light output to minimize environmental impact

WHY SUB-GHZ?

- **Flexible network architectures:** Optimize network based on overall need with mesh, star, and point to point options
- **Ease of scalability:** Newly added streetlights and traffic lights could be added to the existing mesh network without much effort
- **Lower infrastructure costs:** Extend network functionality without need for costly infrastructure or service contracts
- **Recommended Protocols:** Wi-SUN

2.4GHZ CONSIDERATIONS

- **Worldwide support:** 2.4GHz limits needs for multiple designs to support different global regions
- **Limited point to point range:** Mesh topologies limit the need for long point to point range
- **Support for configuration and diagnostics:** Allow for use of smartphone or tablet for configuration or troubleshooting
- **Recommended Protocols:** 2.4GHz Mesh (Zigbee), Bluetooth LE

Q&A

Thank You

Watch ON DEMAND