



ISA100 Wireless Training: Galveston, Texas

Current State of Market

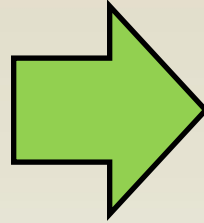
Session 2: 09:45 – 10:45 am

Problem Statement

- Developing an ISA100 Wireless compliant and certified field instrument used to be a complex undertaking that requires
 - In-depth knowledge of ISA100 application layer concepts and constructs – steep learning curve
 - Significant effort for developing the instrument specific code that resides on the application processor
- This results in slow market adoption and hinders the growth of ISA100 Wireless compliant/certified ecosystem of field instruments

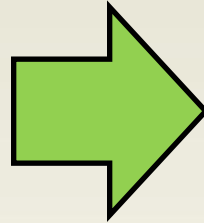
WCI ISA100 Wireless RDK - Benefits

Includes all Components Needed to Develop an ISA100 Wireless Instrument



Simplified, user friendly field instrument development – minimal ISA100 knowledge needed

Includes WCI Compliant Application Processor Code



Significantly reduce time-to-market, just add sensor/actuator specific functionality. Application processor source code is license free.

ISA100 Wireless Certified Wireless Module and Application Processor Code



Minimize WCI ISA100 Wireless Certification Effort

Development and Certification Process



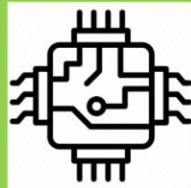
Product Definition, Architecture and Project Planning

- Formulate product requirements and create field device architecture
- Estimate product battery life
- Identify project requirements and costs



Develop Functional Prototype

- Purchase WCI ISA100 Wireless RDK (Rapid Development) KSet up development environment
- Tailor application processor source code provided to burst dynamic variables of interest
- See field instrument specific data being reported in the Gateway

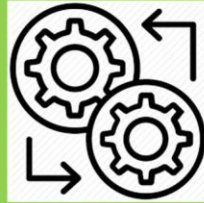


Hardware and Firmware Development

- Select hardware components and design hardware
- Firmware integration of Centero's WISA module with the application processor



Development and Certification Process



Software System Integration

- Develop and generate Device Descriptor and Configuration files (DD/CFF)
- End-to-end system integration tests with ISA100 Wireless Gateways and DCS/PCS of your choice



WCI Field Device Certification

- Join the Wireless Compliance Institute (WCI) as member and purchase Device Test Kit (DTK)
- Run internal certification tests using the Device Test Kit (DTK)
- Go through WCI certification process and obtain certificate

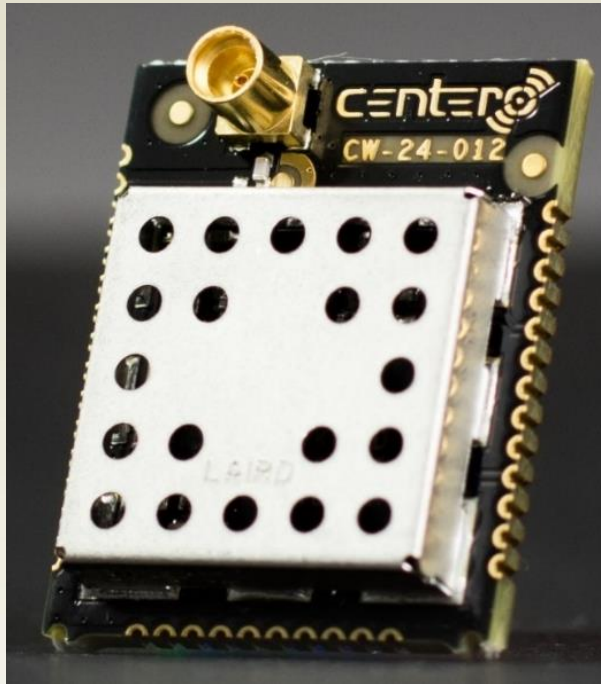


Regulatory Compliance and Certification

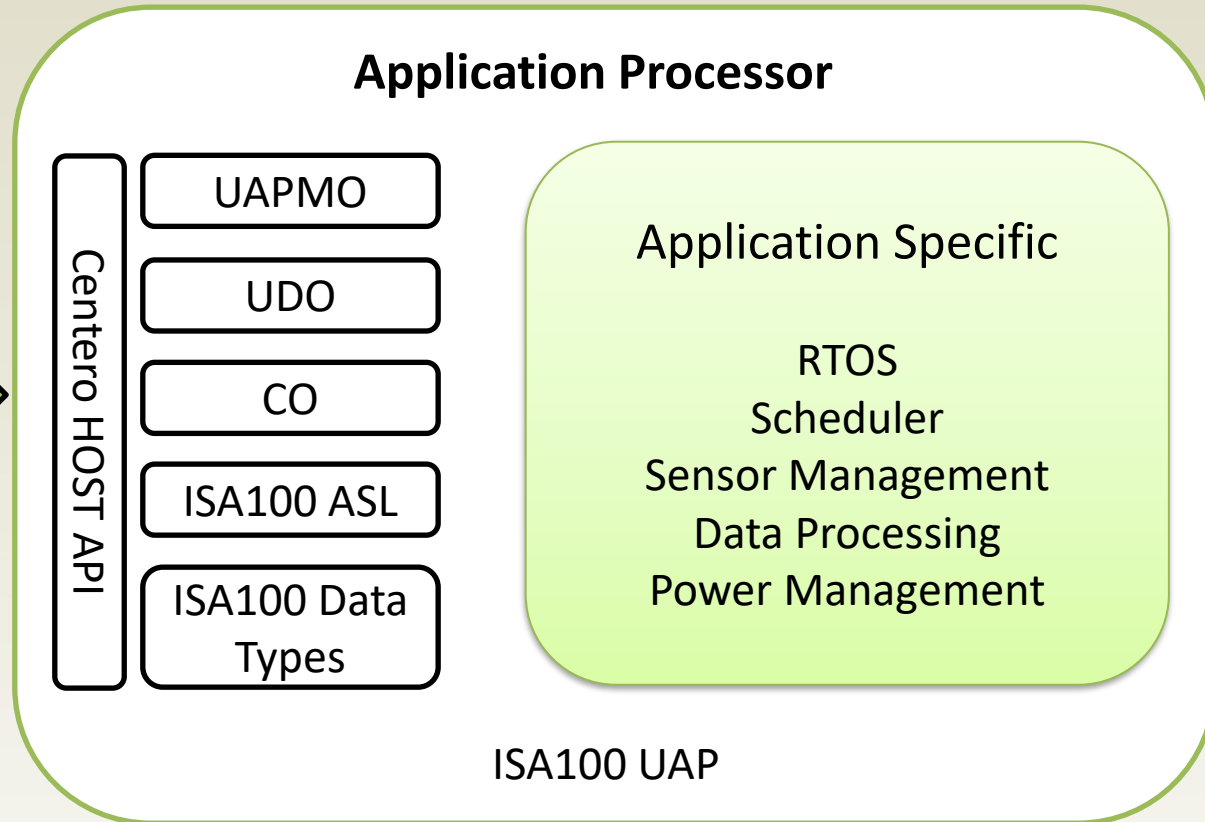
- Compliance and certifications for operation in hazardous areas
- Wireless compliance and certification tests and other EMC, Emissions/RFI, ESD and safety testing



ISA100 Wireless Field Device Architecture



UART



Goals for Rapid Development Kit

- Streamline development process and reduce time-to-market
- User friendly – intuitive interfaces and great out-of-box experience
- Reduce learning curve associated with novel ISA100 technology
- KEY: Minimize application processor development effort
- Offer certifiable field instrument implementation that requires minimal tailoring to the customer's specific needs
- Competitively priced with other kits for industrial IoT technologies (WirelessHART, LoRa, Bluetooth Mesh etc)



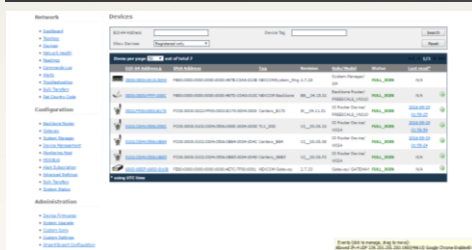
ISA100 Wireless RDK Highlights

Includes 10 Hours of Engineering Support

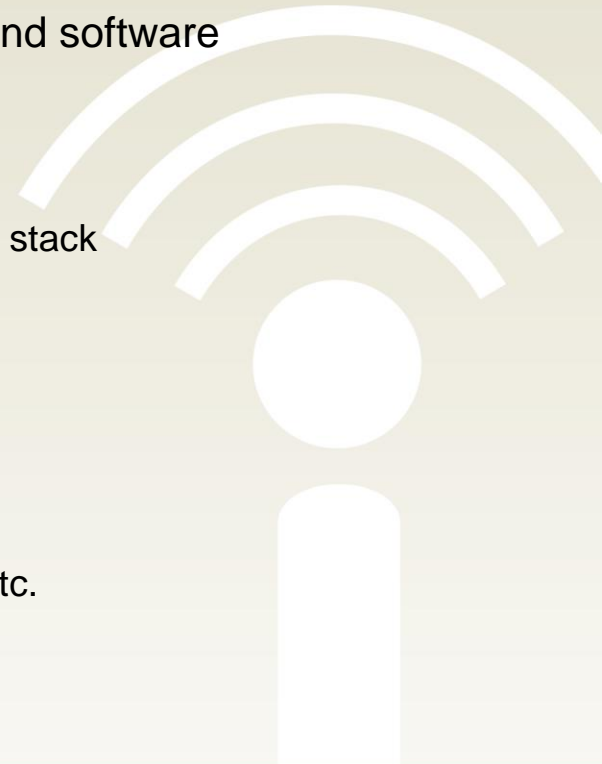
- Develop ISA100 Wireless (IEC 62734) compliant and certifiable field instruments with minimal effort using application layer code provided
- WISA wireless modules included run ISA100 Wireless communication stack
- Gateway boasts feature rich web-based Network Operation and Management System
- User friendly SPiN development board includes OLED display and a large variety of sensors
- Connect external processors, sensors or actuators via Arduino and Freedom form factor connector
- All firmware and software components are remotely upgradeable



ISA100 Wireless Rapid Development Kit



- Comprehensive end-to-end development platform
- Includes everything needed to
 - Swiftly develop ISA100 Wireless compliant field instruments and devices
 - Evaluate performance of ISA100 Wireless technology
- Includes integrated and pre-configured ISA100 hardware, firmware and software
 - Low-cost NIO200IAG Gateway
 - Two (2) SPiN development boards that include a wide gamut of sensors
 - Two WISA wireless module that run the ISA100 Wireless communication stack
 - Field provisioning and configuration software
- Feature-rich Monitoring and Controls System software
 - Configure and visualize process values received from field instruments
 - Network topology and health diagnostics
 - Device management including RF statistics, remote firmware upgrades etc.
 - MODBUS server configuration
 - All components are remotely upgradable



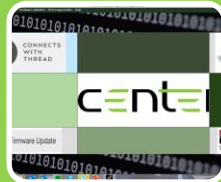
Rapid Development Kit (RDK) Components



ISA100 Wireless Gateway (Quantity: 1)



SPiN Field Development Board (Quantity: 2)



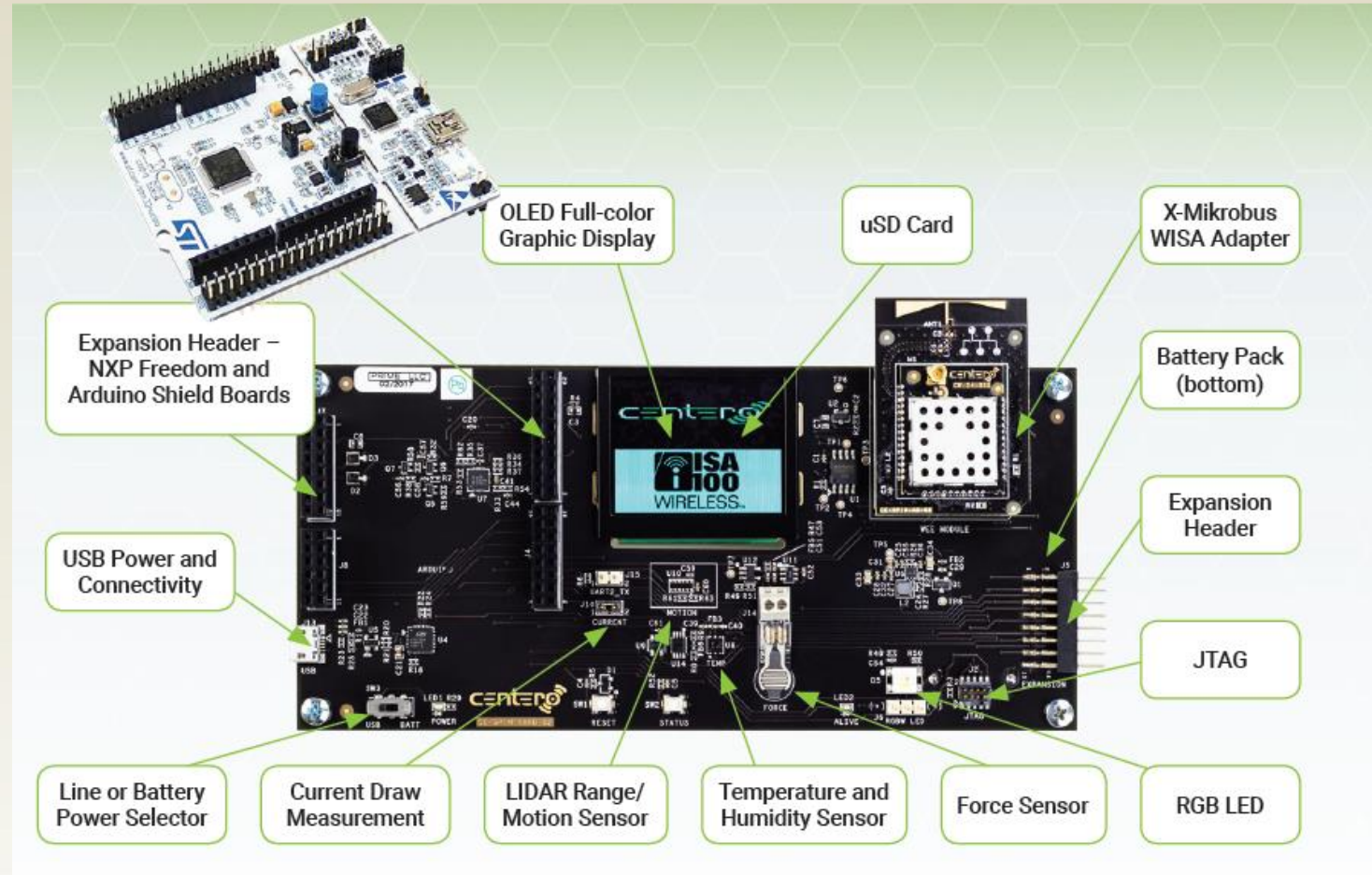
Engineering Utility Software (Quantity: 1)



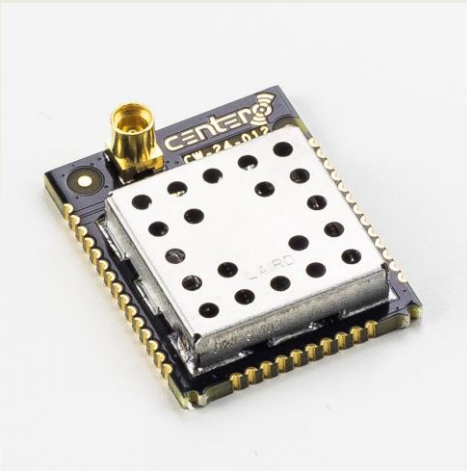
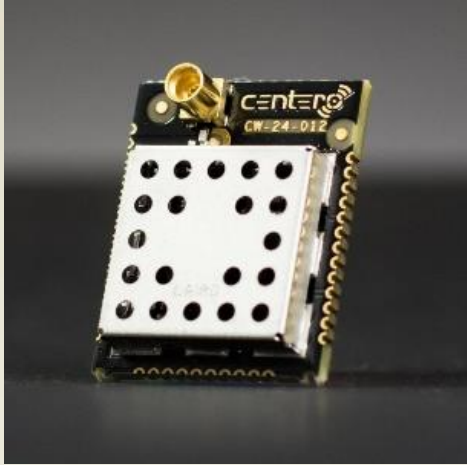
Documentation Package (Quantity: 1)

SPiN Field Development Board

- Great out-of-box experience
- Hosts a wide gamut of sensors allowing out-of-box monitoring and control
- OLED sensor displays locally ISA100 parameters (role, join status, EUI-64, sensor data etc)
- Connects to Utility Software via USB – on-board USB bridge
- Expandable – hosts Arduino shield connector – user can stack own sensors or controls



WISA ISA100 Wireless Module



- Runs an ISA100 Wireless certified communication stack
- Swift integration within products with minimal learning curve for complex IoT technologies
- Tested for interoperability with Honeywell's WDM, Yokogawa's YFGW710 and Centero's NIO200x Gateways
- Designed for integration in intrinsically safe instruments
- Onboard RF Front-end Module with adjustable output power of up to +14 dBm and selectable RX gain modes
- Market leading sensitivity of -108 dBm and link budget of 122 dB
- Suitable for real estate constrained products
- Wireless compliance certification for US/Canada, Japan, EU etc.

Application Processor Implementation



- ST Micro NUCLEO-L073RZ Arduino development board
- Centered on the STM32L0 ARM Cortex-M0+ MCU 32-Bit
- Low-power application processor suitable for battery powered field instruments with extended battery life
- Firmware includes a full ISA100 Wireless application layer implementation
 - Mandatory structures and objects needed to obtain WCI's Field Instrument certification
 - Data models and mechanisms needed to periodically publish data, establish contracts as well as manage various aspects of the communication stack residing on the wireless module
 - ISA100 Wireless data types and application payload encoding



Application Processor Implementation



- Develop your own field instrument firmware using free Eclipse IDE
- Source code implemented in C++
- Source code offered under permissive, free licensing model
 - No license fees
 - User can create derivatives of work and commercialize field instruments
 - User does not have to make modified code available to the community
- WCI ISA100 Wireless certifiable implementation
 - Was tested with the WCI's Device Test Kit (used for field instrument certification)
 - Full instrument is certifiable assuming you use a WCI certified ISA100 Wireless communication stack

UNISON ISA100 Wireless Field Gateway



- Cost-effective ISA100 Wireless Field Gateway
- ISA100 Roles: System/Security Manager, Gateway and Access Point
- Allows user to swiftly evaluate the performance of ISA100 Wireless field network via rich sensor data set received from SPiN field development boards
- Hosts intuitive web-based interface for
 - Process data monitoring/control
 - Device management and configuration
 - Network topology and health status
 - Over-the-air upgrades of all components
- MODBUS server and intuitive process value mapping
- OPC-UA server and interface – compliant to WCI OPC-UA ISA100 Wireless data model



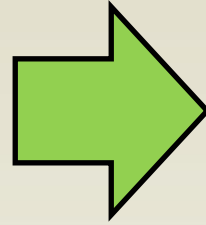
UNISON ISA100 Wireless Field Gateway



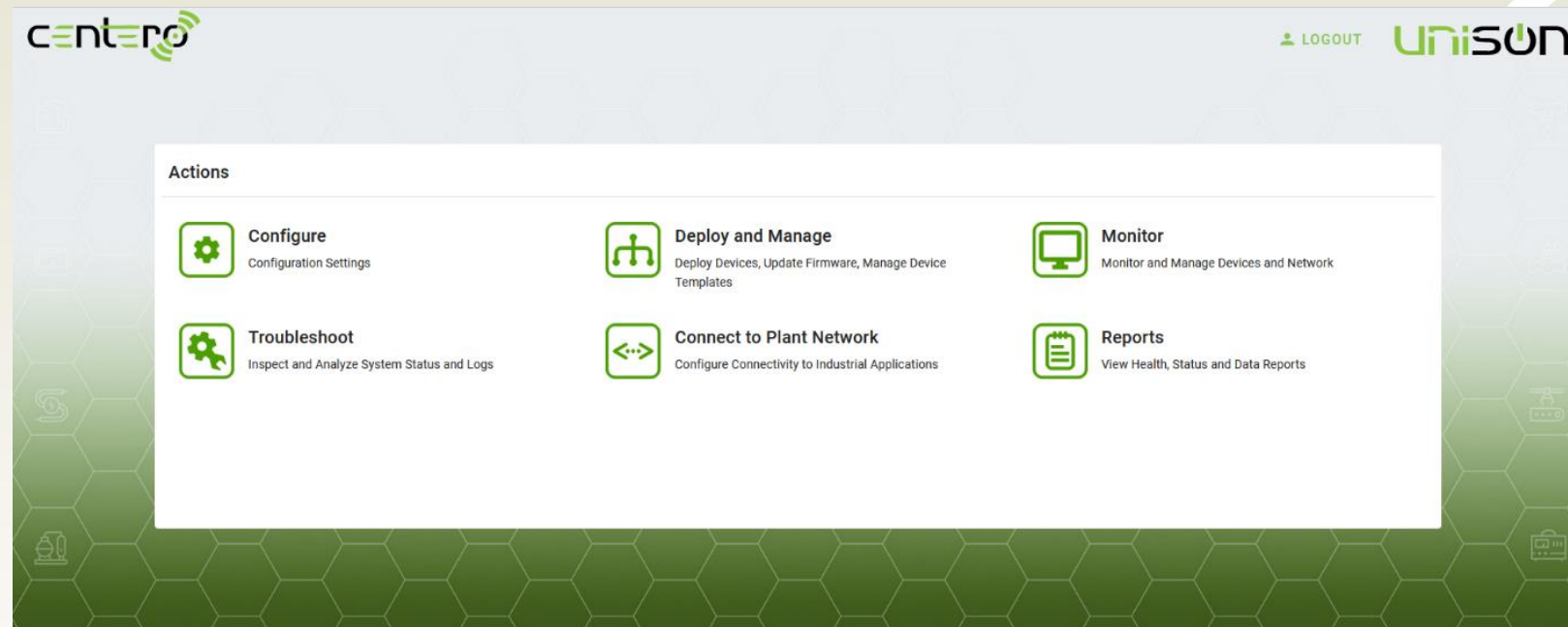
- ISA100 Wireless and WiFi Mesh+ high throughput backbone connectivity
- Supports highly scalable deployments in multiple topologies
- Monitoring and advanced control features
- Over-the-air provisioning with advanced security features
- Advanced diagnostics – NAMUR, wireless health and battery life
- Native support for DD/CF files
- Long-range ISA100 Wireless connectivity - 1.2 miles (2 km) LoS
- Multiple plant connectivity interfaces
- Multiple models for deployments in hazardous as well as non-hazardous areas

UNISON ISA100 Wireless Field Gateway

Suite of “Apps” modeled after field device life-cycle



Clear functional segregation
User friendly and intuitive
Minimum training for plant personnel



UNISON ISA100 Wireless Field Gateway

The dashboard provides a high-level overview of the system's health. It features four main navigation icons: CONNECT, CONFIGURE, INTERACT, and MANAGE. The Network Status section shows 10 active devices, no rejoining devices, and no new alarms. System Status shows OTA provisioning is disabled, no firmware updates are in progress, the system version is 2.8.5, there are no errors, and the battery level is low.

Network Status	System Status
10 Active Device(s)	Version: 2.8.5
No device rejoins	No Errors
No New Alarms	Low
OTA Provisioning Disabled	
No Firmware Updates in Progress	

This page provides detailed information for a specific device. It includes device identification details such as MAC ID, IPv6 address, and Subnet ID. The device status is 'Joined & Configured & All info available'. The application section lists various diagnostic and management tools like INFORMATION, DIAGNOSTICS, and PROCESS VALUES. A restart device section offers options for Warm Restart, Restart as provisioned, and Reset to factory defaults.

Device Identification	Device Status
Device Tag: T022FF000002CF89	Join Status: Joined & Configured & All info available
MAC ID: 0022:FF00:0002:CF89	Device Role: IO Router Device
IPv6 Address: FC00:0000:0022:FF00:0002:CF89:0005:0021	Last comm: 2022/02/09 08:09:24
Subnet ID: 5	

The Actions menu provides a central hub for system management tasks. It includes options for Configure (Configuration Settings), Deploy and Manage (Deploy Devices, Update Firmware, Manage Device Templates), Monitor (Monitor and Manage Devices and Network), Troubleshoot (Inspect and Analyze System Status and Logs), Connect to Plant Network (Configure Connectivity to Industrial Applications), and Reports (View Health, Status and Data Reports).

Actions		
Configure Configuration Settings	Deploy and Manage Deploy Devices, Update Firmware, Manage Device Templates	Monitor Monitor and Manage Devices and Network
Troubleshoot Inspect and Analyze System Status and Logs	Connect to Plant Network Configure Connectivity to Industrial Applications	Reports View Health, Status and Data Reports

The Topology map displays an aerial view of an industrial facility with various equipment and structures. A sidebar on the right allows users to interact with the map, including viewing settings and identifying unmapped devices. The map shows a complex network of pipes, tanks, and buildings, with several green callouts indicating device locations.

Comparison of Industrial IoT Wireless Technologies

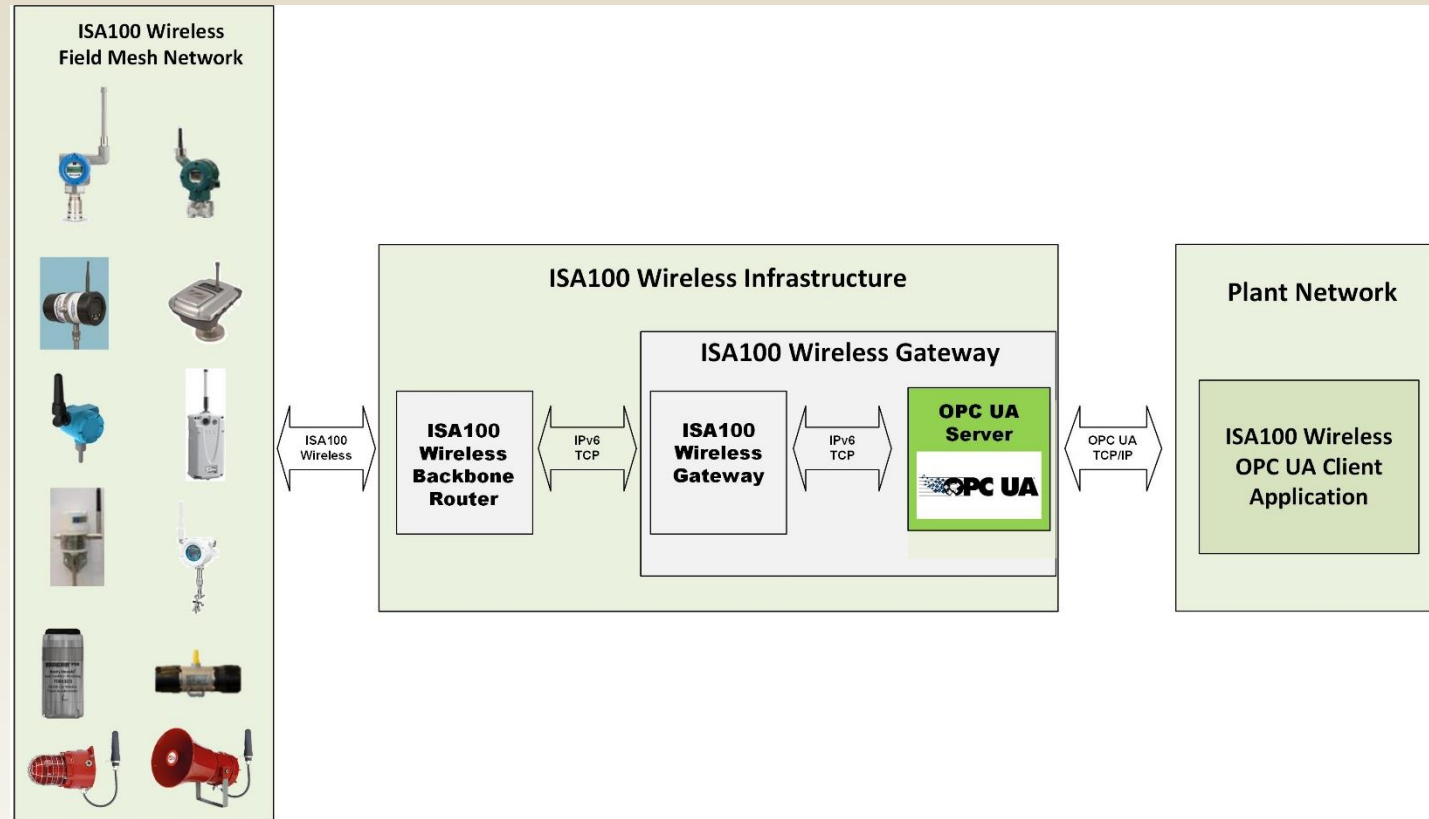
Technology	Frequency Band	Data Rate	Range (max)	Battery Life	Mesh
ISA100 Wireless	2.4 GHz	250 Kbps	250 m – 2 Km	Up to 10 years	
Zigbee	2.4 GHz + Sub-GHz	250 Kbps (2.4 GHz)	250 m – 2 Km	Up to 10 years	
Bluetooth Low Energy	2.4 GHz	1 – 3 Mbps	100 m	Up to 10 years	
Wi-Fi	2.4 GHz + 5 GHz	Mbps	100 – 200 m	Very short	
LoRa	Sub-GHz	0.3 – 50 Kbps	Over 10 Km	Up to 10 years	
NB-IoT (LTE CAT NB2)	Cellular	25 – 64 Kbps	Up to 10 Km	Up to 10 years	
LTE-M (LTE CAT M2)	Cellular	4 – 7 Mbps	Over 10 Km	Years	
5G (native)	Cellular	Mbps – Gbps	Depends	Very short	

Comparison of Industrial IoT Wireless Technologies

Technology	Latency	Full Protocol	Data Costs	Security	Architected for PA
ISA100 Wireless	10 -100 ms	Yes – includes AL	No	Two-layered, link layer and end-to-end	Yes
Zigbee	10 -100 ms	Yes – includes AL	No	Two-layered, next-hop and end-to-end	No
Bluetooth Low Energy	1 - 5 ms	No	No	Link layer	No
Wi-Fi	1 - 3 ms	No	No	Link layer	No
LoRa	High	No	No	Two-layered, link layer and end-to-end	No
NB-IoT (LTE CAT NB2)	1 - 10 s	High	Yes	Link layer	No
LTE-M (LTE CAT M2)	10 – 15 ms	No	Yes	Link layer	No
5G (native)	10 ms	No	Yes	Link layer	No

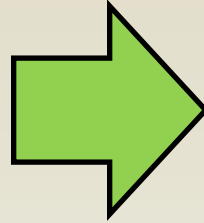
OPC UA ISA100 Wireless Data Model

- WCI standard document that defines an OPC UA Information Model to represent and access ISA100 Wireless devices
- Standardization was a cooperative effort between the WCI and the OPC Foundation
- Includes the following OPC UA models
 - ISA100 Field Devices – extension of PA-DIM model (OPC 30081)
 - ISA100 Access Point
 - ISA100 Network information model
- Interoperable interface for ISA100 Wireless Gateways



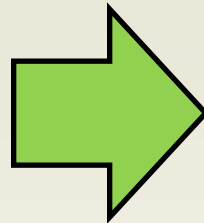
OPC UA ISA100 Wireless Data Model - Benefits

OPC UA connectivity



Connect ISA100 Wireless Gateways to plant network client applications (historians, instrument specific, etc)

Based on open WCI standard



Interoperability – ISA100 Wireless Gateway interoperable OPC UA interface, no need for aggregators or translator

ISA100 Wireless tailored OPC UA data model



Exposes all ISA100 Wireless specific parameters of interest (field instruments, wireless access points, network)