



Codepoint Cora™ Connecting the Business Enterprise: Low-Power, Long-Range, Scalable Wireless IoT

Wirelessly connected devices are fundamentally changing the way we communicate and manage information in the Business enterprise. Once limited to devices like the smartphone, wireless connectivity is fast becoming a popular means to connect all sorts of Internet of Things (IoT) devices. Whether they are sensors, smart devices (e.g., vehicles, buildings, switches, actuators, or mobile equipment), or wearables, by 2025 there will be more than 30.9 billion IoT devices. A significant portion (perhaps most) of these devices will connect wirelessly due to the physical impracticality of running wires to each device. Currently, there are three primary choices for wireless data connectivity:

- ◆ Regional Wireless (Cellular)
- ◆ Low Power Wide Area Network (LPWAN)
- ◆ Short Range Radio (Wi-Fi / Bluetooth / BLE)

While each method has its advantages/disadvantages depending on the application, this paper focuses on the LPWAN in the business enterprise and describes the superior solution that Codepoint has developed.

Codepoint Cora is an LPWAN based set of building-blocks comprising scalable wireless IoT infrastructure, smart devices, and components. Cora was developed specifically to meet the requirements for secure, responsive, and reliable business enterprise solutions. This paper introduces Cora and selected applications by first looking at the existing alternatives: their successes and limitations. Second, Cora's innovative enabling protocol, Coralink™ is explored. It overcomes many of the limitations of alternative LPWAN protocols. Finally, this paper discusses the elements of Cora: how they work together to enable device manufacturers and application developers to create rapidly deployable, reliable, low-cost enterprise solutions.

For more information contact:

info@codepoint.xyz

+1.425.765.1237

Codepoint Technologies, Inc.

www.codepoint.xyz



210823

Wireless IoT and Its Challenges for the Enterprise

Short range wireless infrastructure dominates today's business enterprise given the need to support the wide variety of Wi-Fi and Bluetooth devices currently in use by the workforce. At first thought, it might seem an ideal option to use that existing infrastructure to connect Wireless IoT for the enterprise. Certainly, given the explosive growth in home consumer IoT solutions like those offered by Ring® and Nest®, a short-range wireless approach can leverage existing cost-effective infrastructure that is available in the home.

Short-range wireless is also ideal for high bandwidth communications needed by some devices including phones and video cameras. However, it is not needed for many devices that have minimal data communication requirements like temperature sensors, lighting control, location trackers, etc. Also, unlike home consumer applications which may cover a few thousand sq. ft., a larger enterprise may have needs to cover much larger areas both indoors and outdoors potentially in the millions of sq. ft.

In practice, short-range wireless has an effective range typically less than 150 ft indoors, whereas LPWAN can range up to 1,500 ft. To cover the same area using short-range wireless versus LPWAN could require 100 times the number of gateways or employ complicated mesh techniques, which can introduce delay and impact network performance. Because of this, scaling short-range wireless IoT solutions to support the large-scale enterprise is often impractical considering the multiple floors and buildings comprising a campus where IoT devices may be deployed well out of short-range coverage.

For IoT sensors, wearables, and connected devices, LPWAN is very attractive as a connectivity solution. LoRaWAN® (Long Range Wide Area Network) is one communication standard that demonstrates some of the capabilities needed. Currently there are LoRaWAN IoT devices that are targeting both consumer and enterprise applications. The standard protocol provides secure,

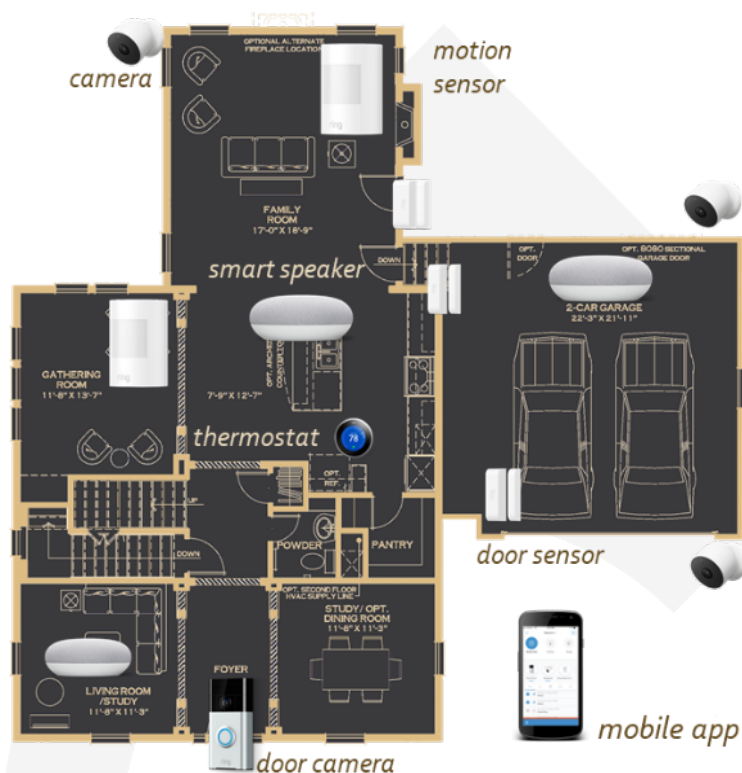


Figure 1 – Short-range Wi-Fi/Bluetooth/BLE Wireless works well for home consumer applications and when communication ranges are less than 150 ft.

long-range, low-power communications with a maximum range of more than one mile under the right conditions. However, LoRaWAN has been shown to have some significant limitations that have hindered its adoption.

These limitations relate to communication delays and the number of devices that low-cost gateways can support. Testing has shown the low-cost gateways can only support about 80 LoRaWAN devices at a time before they become congested. As for delay: low-power devices can take anywhere from several seconds to hours to respond to commands from the network. This delay can be intolerable in mission critical applications, where seconds count. High end gateways that can support more devices can cost thousands of dollars, which makes them impractical for a typical private enterprise application.

A better LPWAN protocol is needed that addresses the scalability and delay limitations of standard LoRaWAN.

Coralink™ Scalable and Reliable Communications

Coralink is an alternative communications LPWAN protocol based on the same underlying technology used by LoRaWAN. Both use the same LoRa® radio engine but employ different signaling methods. Coralink benefits from patented techniques that greatly improves channel capacity and performance with respect to LoRaWAN:

- ◆ Increased scalability to hundreds of devices;
- ◆ Reduced delays for low-power devices to less than one second typically;
- ◆ Peer to peer messaging between devices.

With these improvements, a low-cost Coralink gateway can cover a large area and many devices, significantly reducing overall deployment costs. A reliable/redundant solution would incorporate several gateways to ensure coverage and resiliency in case of a gateway failure.

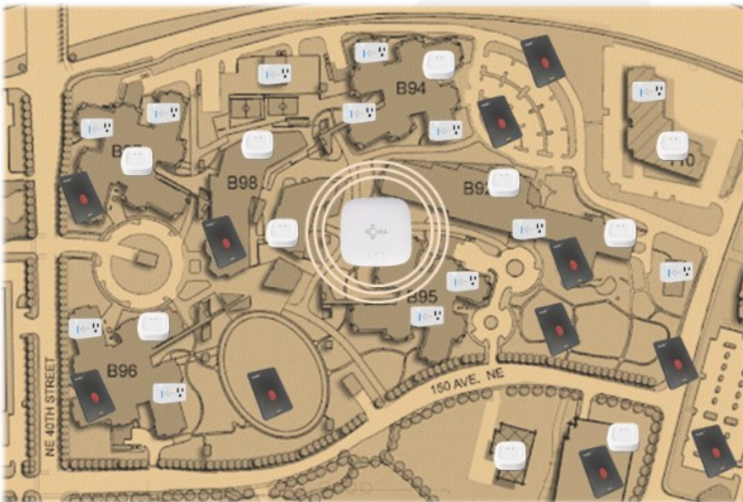


Figure 2 – Low-cost gateways supporting the Coralink protocol can cover wide areas including multiple floors and buildings. A few gateways can provide reliable coverage for many hundreds of devices across an entire campus.

Support for peer-to-peer messages further improves communication reliability in that Coralink connected devices can directly coordinate events and activities without needing to communicate with the network cloud application.

As a result, mission critical functions can continue to operate even when disconnected from the Internet. Peer to Peer further reduces delay by avoiding the latency incurred when communicating with the network.

Codepoint Cora Infrastructure, Devices, and Components

While Coralink provides the fundamental elements for achieving reliable LPWAN communications suitable for enterprise applications, Cora also provides the elements needed by solution developers and device manufacturers to create and deploy fully functional enterprise Wireless IoT applications. Working together with a growing ecosystem of partners, Codepoint is developing Coralink based infrastructure, devices, and components. Selected elements are available for limited sampling.

As shown in Figure 3, Cora solution elements comprise cloud services infrastructure, ecosystem devices, and Components/Development Tools. Solution providers can integrate directly with Cora services or use the integration features, which can route data through popular middleware solutions including Microsoft Azure IoT Central.

Cloud Services Infrastructure

Cora Cloud services provide the network infrastructure to manage communication, integration, and enablement for Cora supported devices. The network stack provides built-in support for Coralink networks as well as legacy support for LoRaWAN devices using external public providers or its own private network management solution.

Solution providers have the choice of using Codepoint cloud subscription services or deploying their own on-premises/private cloud solution when full control of the data is required. On-premises/private cloud deployments also support critical infrastructure that must continue to operate when the Internet is unavailable or unreliable.

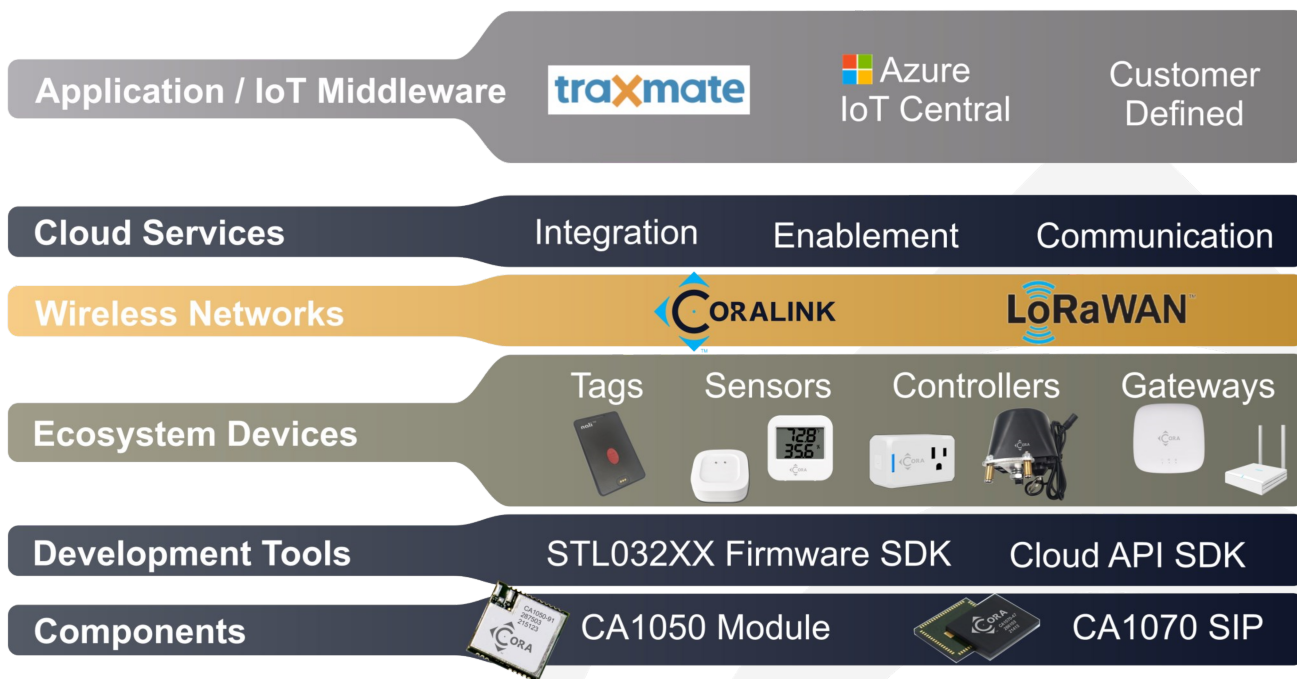


Figure 3 – Codepoint Cora offers solution providers ready to deploy infrastructure and devices, which can be easily configured and integrated with existing applications and well-known IoT middleware providers. Device manufacturers can leverage Cora hardware components and SDKs to connect with any Coralink based network.

The legacy support for LoRaWAN devices enables existing enterprises to leverage their already deployed network and build out new portions supporting the enhanced capabilities of Coralink. With Cora’s unified enablement system, both Coralink and LoRaWAN devices can be managed from a single API set and/or web user console.

Ecosystem Partner Devices

Codepoint together with ecosystem partners will offer a variety of Wireless IoT devices that provide tracking, sensing, and control capabilities. These devices include:

- ◆ Coralink Gateway (< \$50 in small quantities)
- ◆ Nali N110 long-life tracking tag with indoor/outdoor 3-D meter-level positioning
- ◆ Water leak sensor
- ◆ Thermostat control
- ◆ Switches and Power Plugs
- ◆ Water Valve Actuator

More than 12 different devices are planned when Cora is formally launched.

Components and Development Tools

Cora components and development tools make it easy to add Coralink connectivity to virtually any sensor device, providing a variety of integration options. Using the CA1050 module or CA1072 SIP, device manufacturers can simply connect power and control the Coralink telemetry through a serial interface (supporting AT or binary command set). Both components automatically manage network connection as well as message receipt/delivery.

Power management can be externally controlled or internally managed, consuming no more than a few micro-amps when not in use. For device manufacturers needing to integrate Coralink directly into their main processor, Codepoint provides a software development kit (SDK).

Connecting the Business Enterprise

Whether monitoring critical business processes or tracking the flow of equipment and personnel to improve efficiency, Cora extends the reach of wireless connectivity with a more cost-effective approach than can be achieved with short-range radio or cellular wireless solutions. Low-cost, low-power devices can be deployed in large campuses reaching out to the boundaries and across multiple floors including basements. This can be applied to address a wide variety of business use cases two of which are mentioned below.

Indoor/Outdoor Tracking

Many businesses need to know where assets and personnel are located to manage their operation effectively. While there are many options for tracking tags including GPS, BLE, and others, the Nali tracking tags are designed specifically to support indoor/outdoor location within an enterprise campus. Offering room level accuracy, the tag can perform 6000+ locates on a single charge with a battery life of more than 1.5 years if needed.

The size of a credit card, the tag can be mounted to equipment or used as a badge. The N110 uses Codepoint's CP-Flex technology supporting a programmable script environment enabling application developers to change its behavior to match requirements. No firmware programming or recertification of the devices are required.



Figure 4 Traxmate is a Codepoint partner using the Nali N100/N110 tracking tags as part of an Indoor tracking Starter Kit.

Codepoint has partnered with [Traxmate](#) to provide a location Starter Kit providing a simple, easy-to-deploy solution to begin tracking people and things in the business

enterprise. LoRaWAN starter kits are available today, Coralink based kits will be available for sampling later this year.

Leak Detection and Damage Mitigation

Water heaters and boilers are notorious for creating significant damage when they leak or fail. Cora offers a reliable solution to detect and mitigate damage by using a water leak detector and valve controller.



Figure 5 – Cora Water Leak Sensor paired with a valve controller can stop water leaks before they cause serious damage even when there is no power or if temporarily disconnected from the Internet. Using the Coralink peer-to-peer capabilities, the sensor and valve controller can communicate directly.

Codepoint partner YoSmart, Inc is currently using these devices in its [YoLink](#) smart home solutions. Cora versions will be available for sampling later this year.

Summary

LPWAN has a significant role to play in the business enterprise connecting low-power, low data-rate devices. With its long-range capabilities, the infrastructure costs are considerably less than either short-range or regional cellular solutions when applicable.

Cora enables the creation of reliable LPWAN based network solutions that can meet the reliability, security, and privacy requirements for the business enterprise. Implementors have the choice to manage their own data and avoid closed systems, which is important where flexibility and data privacy are a real concern. Further, the responsiveness and peer-to-peer capabilities enhance the robustness of the solution, which can continue to function even when disconnected from the Internet or private cloud.