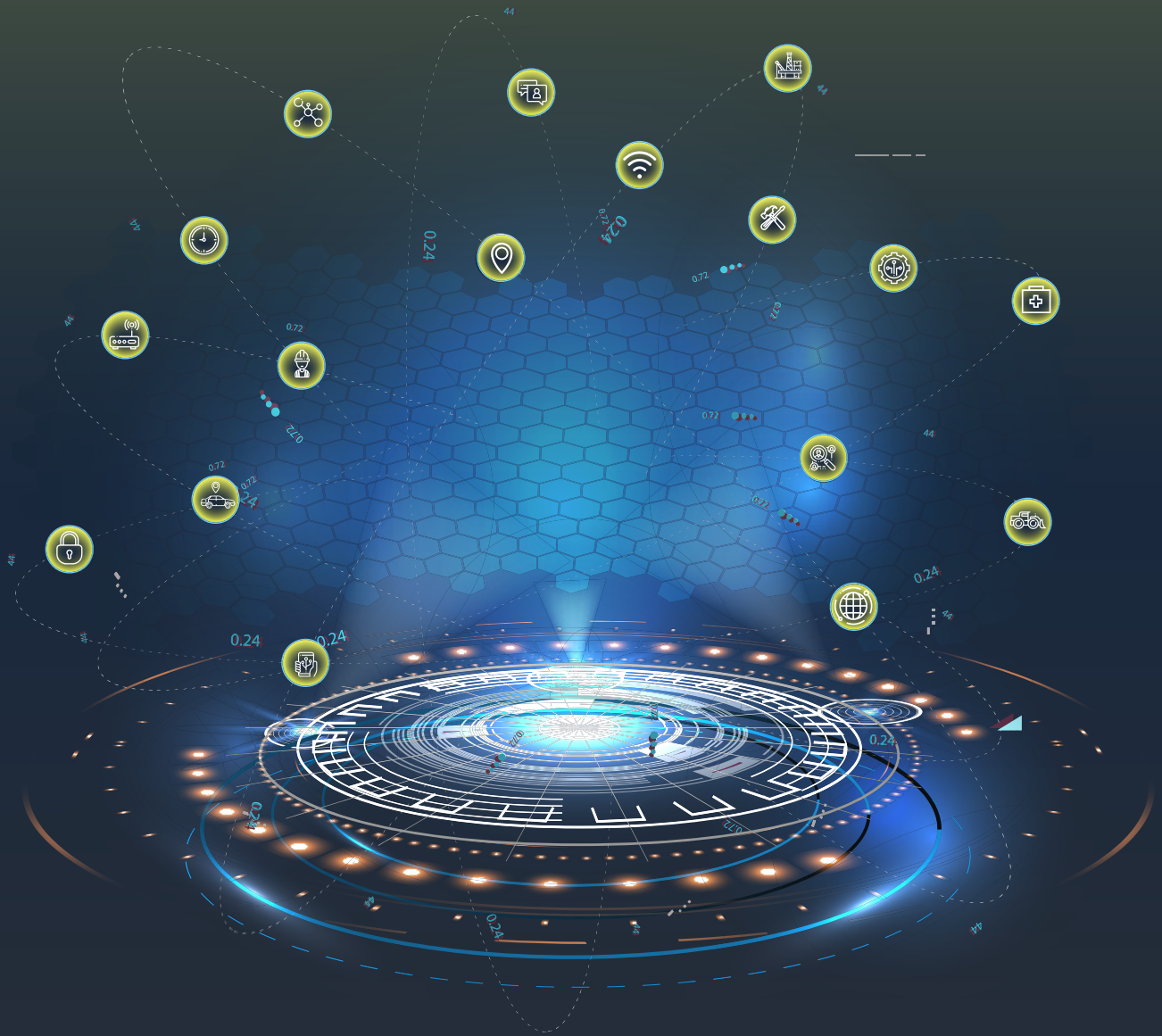


# Super-B for IoT: Improving QoS in LoRa Networks

WHITEPAPER



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**LONGVIEW**

A CARNEGIE TECHNOLOGIES COMPANY

# Super-B for IoT: Improving QoS in LoRa Networks

To say the Internet of Things (IoT) has finally come into its own would be a vast understatement. Companies from a wide variety of industries—from construction, mining and oil & gas, to auto dealers, healthcare and agriculture—are seeing real business value from their IoT investments. According to the IoT Barometer 2019 from Vodafone Business, 34 percent of companies worldwide are using IoT, and of those, 76 percent say it's mission-critical to their business, while 8 percent say their “entire business depends on IoT.”

Many of the IoT implementations to date have utilized LoRaWAN, a low-power wide-area network (LPWAN) protocol that connects IoT devices using LoRa® wireless technology. LoRa runs on unlicensed frequencies worldwide and can be used for both public and private deployments. LoRa and LoRaWAN, like other LPWAN technologies, cover vast ranges and enable long battery life for devices in the field. These types of LPWAN technologies sit between local wireless such as Bluetooth and Wi-Fi and cellular-based wireless.

**“LoRa can't promise quality of service (QoS), especially as IoT networks scale or require more frequent communications between sensors and the gateway.”**

Longview IoT has introduced a new protocol called Super-B that rides atop the LoRa protocol, utilizing standard LoRa but extending its structure to allow for the scheduling of messages from gateway to devices (and vice versa) while maintaining extremely low power. With Super-B, Longview is able to provide a wealth of new benefits to companies that select the Longview comprehensive IoT solution, including the ability to:

- Densify IoT networks to meet their organization's growing requirements
- Vastly improve data delivery and deliver QoS
- Better secure IoT networks through firmware over the air (FOTA) updates
- Deliver strong return on investment (ROI) by reducing the need to add hardware to scale networks





# Understanding the Inherent Benefits of LoRa

**LoRa has several key features that have made it a strong choice for organizations that are looking to achieve efficiency and cost savings through IoT deployments:**

- Long Range – LoRa and LoRaWAN can reach up to 30 kilometers in flat areas with uninterrupted lines of sight, and 3 kilometers in urban environments, depending on gateway performance.
- Long Battery Life – LoRa transmissions are compact, and the protocol is built to use minimal amounts of energy, which leads to longer battery life.
- Security – LoRa implements 128-bit encryption on all transmissions, similar to cellular and virtual private networks (VPNs).
- Cost-effectiveness – LoRa runs on unlicensed radio networks throughout the world, with no need to pay an operator to use the network.

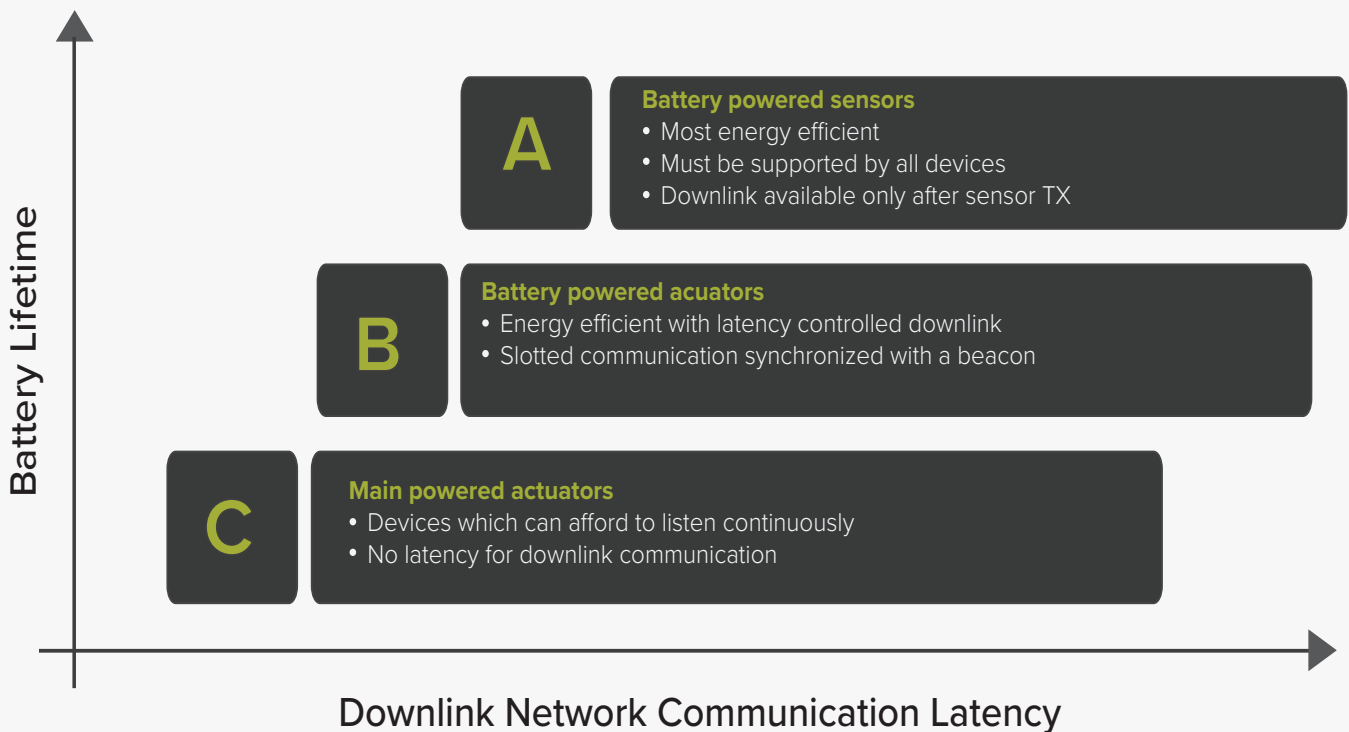
**LoRaWAN has three “classes” of communications between sensors and gateways:**

- Class A – The gateway is passive and in listen-only mode. Sensors utilize listen before talk and send messages whenever there is a message to send. Because of its random nature, Class A is prone to significant noise and interference, and thus packet loss, which can be exacerbated by the all-too-common practice of sending a message a few times to increase the likelihood of delivery.
- Class B – The network establishes a session to communicate but it’s set up and torn down, forcing the sensor to search for the gateway each time it connects, creating inefficiencies. Has limited scheduled receive slots, however, lacks the efficiency needed to scale. Has rudimentary FOTA capabilities. Class B sensors frequently cause interference with Class A sensors.
- Class C – Has a bidirectional link that is never torn down, so is “always on” to send and receive messages.

The vast majority of sensors today—up to 99 percent—utilize Class A, as it allows for simple one-way IoT communications, for example, a basic sensor that monitors if a gate is open or closed, or that lights are on or off, and sends one message to the gateway. As use cases become more advanced, however, and require bidirectional communications, like actuation (actually opening or closing the gate) and OTA updates, the demand for Class B sensors will also grow (and add more stress and interference to the network). Class C, which is not yet widely used, is

utilized for low-latency actuators that are powered continuously without a battery. However, simply moving from Class A to Class B sensors does not solve some of the inherent issues with LoRa as an organization’s IoT requirements scale. Neither part of the protocol is structured to handle a large network with thousands of sensors, never mind a large network of sensors that are in motion. The issues with noise and interference still exist, and scalability is still a challenge. A new way of approaching the problem is required.

“Super-B capitalizes on the best parts of LoRa A and LoRa B to deliver scalable, secure IoT with strong ROI.”



# What is Super-B, and How Does it Work?

Super-B is an advanced, patent-pending technology from Longview that is built on top of the LoRaWAN protocol and utilizes the same network infrastructure as LoRa. A mixed-mode operation protocol, Super-B capitalizes on the best parts of LoRa A and LoRa B to deliver scalable, secure IoT with strong ROI.

Typical LoRa networks face a scalability problem—as the number of sensors increase, they begin to transmit over one another because their send patterns aren't coordinated. As density increases, the capacity able to be achieved by a single gateway is limited.

Super-B alleviates this problem by scheduling a time slot in which each sensor in a network can transmit to the gateway using a framing and beacon and signaling solution to allow gateways to send precisely timed beacon messages. These beacon messages are used by sensor devices to time their data transmissions into assigned time slots to avoid interference with messages sent from other sensors. By scheduling the messages, which are timed to GPS, sensors turn on, send their message in their scheduled slot, and turn off, requiring very little power – much less than standard LoRa. The gateway is listening at an exact time for exact sensors based on the schedule. By eliminating the random nature of sensors transmitting as found in Class A,

interference is reduced because each message is sent at a scheduled time (and only once), ensuring it is not talking over a message being sent by another sensor. Thus, QoS is vastly increased because more packets are successfully received with only one attempt.

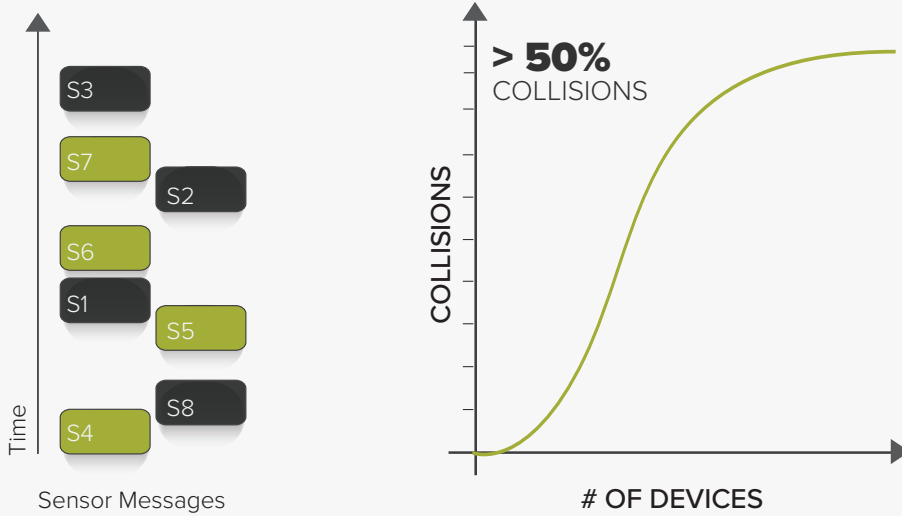
At the same time, Super-B extends the bi-directional capabilities found in Class B, creating robust FOTA capabilities for security and maintenance purposes. Updates can be broadcast to all sensors (for example, creating a channel plan under which all sensors move to a new channel at a precise time to avoid interference) or in a discrete way to just one sensor with a specific message (e.g., asking sensor 87 to give an extra two pings so the system can better determine its location). Both are inefficient or impossible with current LoRa networks.

Super-B adheres to LoRa's joining and packet formats exactly but includes a media access extension at Layer 2 to add complexity and control to provide mobility and density to the network along with significant power savings—without vendor lock-out, as Longview supports any LoRa 1.0.3-compliant Class A sensors. Super-B allows organizations to achieve 95 percent capacity on the network vs. the 20 percent to 30 percent capacity that LoRa alone offers.

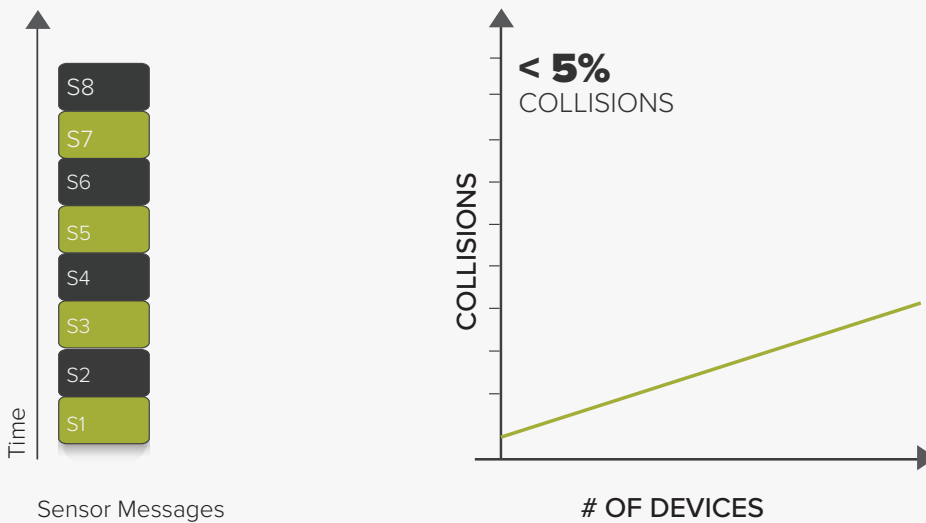
**“Super-B allows organizations to achieve 95 percent capacity on the network vs. the 20 percent to 30 percent capacity that LoRa alone offers.”**

# Super-B vs. Standard LoRa A Example

## Example LoRa A channel



## Example Super-B channel



# What Super-B Means for the Enterprise

Utilities, oil & gas, construction, transportation, logistics, warehousing, and healthcare environments all have a large number of “things” to track, and all can achieve measurable benefits from the ability to receive messages from the sensors on a scheduled

basis—oftentimes many times a day, depending on the application. LoRa alone is not well-suited to deliver on this task, so Super-B provides the structure it needs, without locking out existing Class A sensors.

## Super-B extends the LoRaWAN protocol to help enterprises achieve a wealth of benefits:

- **Network Densification** – Super-B allows organizations to vastly increase the number of sensors on their network without risk of interference, and without having to replace or redesign the network when it “reaches capacity.” Interference is caused by a fundamental problem with the random nature in which LoRa networks communicate and can’t be solved by adding more gateways. Super-B solves the problem through scheduling when each sensor sends its message, without requiring additional gateways.
- **Increase in Successful Data Delivery** – The ability to schedule messages from the sensors prevents collisions and data loss. Organizations can expect data delivery rates of approximately 95 percent—more than three times higher than achieved through LoRa alone.
- **Enables FOTA Upgrades** – One of the primary reasons FOTA is used in IoT networks is to update sensors and gateways to patch security flaws. In traditional LoRa networks, Class A sensors send messages but do not receive them, making FOTA impossible. With Super-B, if an organization sees a problem, it can prescriptively or postscriptively fix it with a patch via a FOTA update. Super-B offers a differential patch, so that only the software that needs to be updated is fixed. Ongoing upgrades and maintenance can also be achieved via FOTA with Super-B.
- **ROI** – Super-B delivers attractive ROI because as IoT becomes more integral to the business, more sensors can be added to the network without causing interference and without requiring a new network or an overlay. The investment becomes even more valuable when sensors have the ability to send messages as often as needed by the application without jamming the network. Sensors also experience extended battery life—instead of waking up and sending at will, often multiple times to hedge against interference, they operate on a scheduled basis, and turn off when their message is sent.



LoRa has done a tremendous job of capturing the IoT market's earliest adopters as a simple, easy-to-deploy technology for basic IoT applications. Much like the Internet created data ubiquity and mobile phones created mobile ubiquity, the IoT is poised to create location ubiquity. Asset tracking has emerged as a killer app for the IoT—organizations in every industry want to know where their

valuable assets are. To achieve location ubiquity, network density is required, and networks need to be able to handle thousands or tens of thousands of sensors in motion, tracking people, equipment, tools, vehicles and other things on a very large site, across sites or even regionally. Low-powered networks have been unable to meet this challenge—until the arrival of Super-B.



# Longview at a Glance

## Conclusion

Companies in just about every industry are making substantial investments in IoT to gain insights from data capture, including operational improvements, faster time to market with products and services, and enhanced customer experience. However, the proliferation of IoT products and platforms has created confusion and uncertainty as organizations try to make their implementation decisions.

Currently, there is an overemphasis on “platform” for IoT implementations, but platforms require compiling components from various vendors and developing additional software. This approach is expensive and time-consuming, and may not deliver the desired outcomes. Instead, organizations should invest in comprehensive, IoT solution delivering all the necessary layers, which is what Carnegie Technologies provides with its Longview solution. Longview is an out-of-the-box complete solution that accelerates IoT deployments while saving time and money and allows companies to capitalize on the benefits of IoT faster.

## Single Solution

Longview IoT, a Carnegie Technologies company, provides organizations across multiple industries with the most secure, easy-to-deploy and comprehensive IoT solution.

Our IoT experts designed the Longview IoT solution in-house, developing a combination of purpose-built sensors and configurable software made for simple implementation and the highest levels of security, scalability and reliability.

With Longview IoT, now you can reduce costs and increase efficiency by identifying issues before they become expensive problems. Achieve better business outcomes and save money by more effectively tracking your people and assets, monitoring and using equipment, and shortening response times.

The world is connected. Now you can digitally connect your most important people and things — simply, securely and completely.

## Longview at a Glance

Built and developed by a single vendor, Longview delivers a complete solution for IoT implementations. In a short time, businesses can start tracking, measuring, and managing people, places, and things.

## Longview solutions include:

- Industry-specific web/mobile applications to view sensors and data and manage the IoT system
- Configurable analytics and reporting
- Based on industry standard LoRaWAN but extended with patent-pending Super-B protocol that increases bandwidth and allows over-the-air upgrades
- Triple-layer security integrated with the hardware and software
- Sensors for a variety of uses, including asset and people tracking, level monitors, leak detection, motor monitors, air quality monitoring and push buttons
- Mesh-networked gateways designed to reduce costs

**Stay ahead of the game and master your IoT with a single solution.**

**Schedule Your Demo Today At**  
[www.LVSuperB.com](http://www.LVSuperB.com)

**Super-B is patent-pending and is offered as part of Longview’s comprehensive IoT solution.**