



ITRON NETWORK PLATFORM

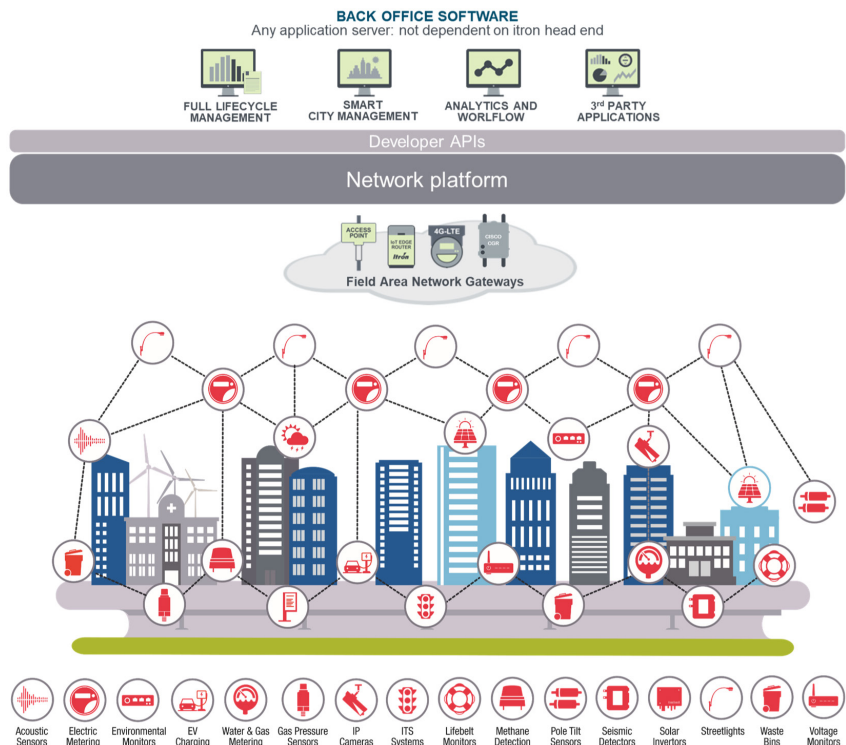
DELIVERING END-TO-END SOLUTIONS FOR THE INTERNET OF IMPORTANT THINGS™

Itron Networks

In January 2018 Itron completed our acquisition of Silver Spring Networks; enhancing Itron's capabilities and advancing our strategy of delivering highly secure, value-generating solutions for utilities, smart cities and the broader industrial IoT sector. This merger of the two companies has given Itron two network technologies that will enable customers to reap the benefit of both platforms in a converged solution. As we work towards this converged network, we support development on both the GenX and the OpenWay Riva networks.

We are committed to providing a path to the converged network that incorporates the strengths of both platforms to ensure that our customers networks can continue to provide value over time and evolve without disruption. If you have a prototype in development using either network technology, you can rest assured that Itron will continue to support your solution with a path towards commercialization on the converged platform. With a focus on open-standards platform development for connectivity and automation, we want to enable our technology partners to leverage Itron technology create innovative solutions that enable our customers to increase operational efficiencies, accelerate progress towards sustainability goals, and enhance quality.

ITRON INDUSTRIAL IOT PLATFORM



GENX NETWORK

DATA PLATFORM: The Itron Data Platform supports open ecosystem of applications to leverage the robust capabilities of both Itron mesh and other third-party IoT networks. With the Data Platform, system users and third-party providers can derive insights and create value from a real-time data cloud delivering unparalleled flexibility and scale.

The platform automatically ingests device data from a variety of sources, normalizes and enriches that data, and then makes it secure and accessible to users and third parties through standard APIs. Many applications, including Itron applications and thirdparty developed applications, are available pre-integrated with the Data Platform.

CONTROL PLATFORM: This suite of software products enables the full lifecycle management of an IoT device, including the provisioning, operation, and troubleshooting of the connected devices.

Itron's Control Platform's sophisticated network capabilities include state management, security, firmware, remote programming, quality of service and prioritization, providing full visibility into the performance of IoT endpoints.

NETWORK PLATFORM: An open, standards-based all IPv6-enabled wireless network that provides unsurpassed, ubiquitous coverage. Our Access Points support thousands of devices at data rates of up to 2.4Mbps, and come in a variety of form factors to fit the varying use cases presented by utilities, cities and other critical infrastructure providers. Range is extended through meshing capabilities provided by all continuously powered devices and some battery enabled devices. Multiple layers of security are built into the infrastructure to safely connect devices and transport data.

Unlike emerging IoT networks, our solutions have demonstrated the highest levels of performance and are backed with an SLA. Itron offers a variety of network integration options to connect third party devices, ranging from battery-powered modules for sensors to best in class modules featuring multi-megabit speeds and robust distributed processing. All are designed for multi-decade operation in the most demanding environments.

RIVA NETWORK

At the highest level, the Itron OpenWay Riva network is a multiple-media, self-organizing mesh network technology utilizing IPv6 for both standard (mains powered) and low powered (battery or similar) devices. It is the backbone of Itron's OpenWay Riva smart meter solution, and is deployed by electric, gas, and water utilities around the world. But what does that mean in detail? Let's break it down.

Multiple-Media

Itron OpenWay Riva Networking operates simultaneously on wireless (RF), wired powerline carrier (PLC), WiFi, and cellular media.

The adaptive communications layer we've developed automatically switches media at every hop to find the most effective route for every packet. This enables rural communication at low densities, and bridges the gap to high density, urban environments where RF may not penetrate, such as commercial basements and neighborhoods with high-rise buildings.

RF Media

The RF layer of Itron OpenWay Riva Networking is based upon IEEE 802.15.4g and the upcoming WiSUN standard. It operates in the 900mhz ISM (unlicensed band) and has region specific adaptations to operate globally using the same hardware.

PLC Media

The power line carrier (PLC) communications layer operates over the AC power lines that exist nearly everywhere electronics are to be used. This secondary media layer enables Itron OpenWay Riva networking to reach places no RF only network can, and it does so seamlessly.

Self-Organizing Mesh

Itron OpenWay Riva networking forms a self-organizing mesh network. No topology or other manual configuration is necessary, and as nodes (devices) are added, the network will expand and grow automatically to include them, reorganizing and re-optimizing routes as necessary. At the heart of this functionality is RPL a standard for "Routing Protocol for Low power and Lossy networks."

IPv6

All of the above are combined "behind the scenes" to provide an IPv6 network capable of supporting UDP transmissions for thousands of devices per router (what we call a "root node.") All devices and endpoints in the mesh are directly and globally addressable by their unique IPv6 address, and endpoints can thus communicate directly with head-end systems, no longer relying on protocol gateways, consolidators, concentrators, or other middle-ware.

Standard vs. Low Power Devices

Itron OpenWay Riva networks are designed to support both normal, mains-powered devices (such as electric meters, streetlights, etc.) and low or battery powered devices (such as gas/water meters, remote monitoring stations, etc.) in the same mesh. Battery powered devices are designed to operate for a decade or more, waking only rarely to transmit/receive data. They can communicate either directly with a root node/router, or behave as a "leaf" on a larger mesh. In leaf mode, the nearest powered device will temporarily store data destined for the leaf device, and transmit it as the device wakes up.

PERFORMANCE

Itron OpenWay Riva networking is designed primarily to support data collection from large networks of IoT (internet of things) style devices. As such, many of its layers are optimized for upstream data flow at low bandwidths, but at long range.

Range

In line of sight, the RF component of Itron OpenWay Riva Networking can reach many miles, though as with all RF systems, performance and bandwidth diminish with greater ranges. For PLC, specific ranges are difficult to estimate, as it varies heavily with building wiring, but the design goal of the system is to reach sub metering locations in even the deepest high-rise basements.

Bandwidth

The RF component has modulations ranging from 600kbps OFDM down to 12.5kbps FSK at maximal ranges. In practice, throughput is limited by the size of the mesh (as every device may potentially be relaying for other devices) and constrained by the lowest throughput of any given hop. Additionally, as it is a packet based system, packet frequency is a large element of bandwidth calculations. We've found that 1kb packets can typically be transmitted once every few seconds.

Latency

The IPv6 mesh supports per hop latencies of 10ms - 500ms with the average expected to be 150ms per hop. Due to the nature of the technology, latency on Itron OpenWay Riva networks with far ranging members can typically be high.

Other Limitations

One other key constraint of Itron OpenWay Riva Networking is that, due to the latencies mentioned above, it only (currently) supports UDP and ICMP traffic. Native TCP applications will not work, and applications



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