Cisco industrial routers for FirstNet connectivity

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One of the challenges during the response to the 9/11 terror attacks was the inability of first responders to rapidly access the communications network. Learning from this crisis, public safety organizations and associations came together to pass legislation establishing a reliable, dedicated, and national high-speed network for first responders. The First Responder Network Authority (FirstNet) contract was awarded to AT&T to build a nationwide public safety broadband network. AT&T will provide a turnkey experience (including deploying the dedicated LTE core network and assuming the operational, financial, and technical responsibilities associated with the network for up to 25 years).

The FirstNet network, a national, seamless, IP-based cellular communications network, gives first responders around the United States their dedicated multimedia capabilities using Band 14 on the FirstNet core, along with AT&T’s other spectrum bands. FirstNet’s dedicated broadband LTE network allows public safety to send and receive data, video, images, and text—without concerns about network congestion. FirstNet offers network traffic prioritization and preemption services when needed.
Overview of FirstNet benefits
The FirstNet advantages extend beyond first responders to those who support them. These six benefits help ensure that you are always connected—no matter the situation.

1. Available priority services
2. Elevated network status during an incident
3. Advanced and augmented coverage: Urban to rural
4. Highly secure network
5. Improved communication through interoperability
6. Affordable and accessible rate plans built for you

FirstNet technologies overview
The First Responder Network Authority broadly divides the FirstNet network into the following distinct layers:

- Core network
- Transport backhaul
- Radio Access Network (RAN)
- Public Safety Devices

Figure 1. Overview of FirstNet benefits

Figure 2. Layers of the FirstNet network

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FirstNet

FirstNet ready™
- IR1101-K9
- IR1101-A-K9
- P-LTE-MNA

FirstNet capable
- IR829M-2LTE-EA-BK9
- IR829B-2LTE-EA-BK9
- IR829M-LTE-EA-BK9
- IR829B-LTE-EA-BK9

Core network: The FirstNet network infrastructure consists of a dedicated LTE packet core network, which will effectively separate public safety traffic from commercial traffic and give first responders their own separate, nationwide broadband network. The core network serves as the communications platform for interconnecting with other public sector organizations such as local, state, Federal Emergency Management Agency (FEMA), and other federal networks.

Transport backhaul: In each state, radio-based stations are connected to the core network via the transport backhaul layer. These links carry radio signaling and user traffic, such as voice, data, and video.

Radio access network: The RAN includes wireless infrastructure such as cell towers that backhaul traffic to the FirstNet core network. RAN planning is required to design a core network that delivers the best of class high bandwidth performance and coverage across the nation. FirstNet and AT&T worked with each state and territory to understand unique needs and build a plan for each state. The governor of each state may build the state’s RAN or choose FirstNet to build its RAN. FirstNet is responsible for building and operating the core network and providing RAN connectivity.

Public safety devices: FirstNet Customer Premises Equipment (CPE) undergoes a variety of testing and certification in areas including interference, operation, environmental factors, and security before they are declared ready to connect to the FirstNet core network. They should be equipped with the FirstNet SIM card for connecting to the FirstNet core network. FirstNet-ready™ as well as FirstNet-capable devices can work on the FirstNet infrastructure. FirstNet-ready devices are those that meet FirstNet requirements, pass certifications, and support all FirstNet features. FirstNet-capable products are those that meet FirstNet requirements but do not operate over LTE Band 14.

Table 1. Public safety devices

<table>
<thead>
<tr>
<th>Cisco IoT Gateway</th>
<th>FirstNet Classification</th>
<th>Band 14 Support</th>
<th>FirstNet Features</th>
<th>FirstNet Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR1101</td>
<td>FirstNet Ready</td>
<td>Yes</td>
<td>Yes</td>
<td>Completed</td>
</tr>
<tr>
<td>IR829</td>
<td>FirstNet Capable</td>
<td>No</td>
<td>Yes</td>
<td>Completed</td>
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</tbody>
</table>
FirstNet quality of service, priority, and preemption

FirstNet customers using FirstNet SIM (international mobile subscriber identity (IMSI) range 313-100) are served by AT&T’s dedicated FirstNet network. If they use non-FirstNet SIM (IMSI range 310-410 or 310-030), they are served by the commercial AT&T packet core network. Each FirstNet subscriber is assigned to a specific category, either FirstNet Primary subscriber or FirstNet Extended Primary subscriber. FirstNet subscribers could have different priorities based on the access point name (APN) assigned to the subscriber.

During an emergency event, FirstNet customer can uplift their users to a higher level of quality of service, priority and preemption (QPP) temporarily.

Table 2. FirstNet QPP static provisioning

<table>
<thead>
<tr>
<th>Type</th>
<th>QoS</th>
<th>Priority</th>
<th>Preempt</th>
<th>PCI/PVI</th>
<th>ACB</th>
<th>B14</th>
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</thead>
<tbody>
<tr>
<td>FN Priority 2</td>
<td>6</td>
<td>3</td>
<td>Y/N</td>
<td>12</td>
<td></td>
<td>Pri</td>
</tr>
<tr>
<td>FN Priority 3</td>
<td>6</td>
<td>4</td>
<td>Y/N</td>
<td>12</td>
<td></td>
<td>Pri</td>
</tr>
<tr>
<td>FN Priority 4</td>
<td>6</td>
<td>5</td>
<td>(Y&amp;N/N)</td>
<td>13</td>
<td></td>
<td>Pri</td>
</tr>
<tr>
<td>FN Priority 5</td>
<td>8</td>
<td>12</td>
<td>N/Y</td>
<td>-</td>
<td></td>
<td>Pri</td>
</tr>
<tr>
<td>Consumer</td>
<td>8</td>
<td>12</td>
<td>N/Y</td>
<td>-</td>
<td></td>
<td>2nd</td>
</tr>
</tbody>
</table>
Cisco’s commitment to FirstNet

Cisco, an industry leader in networking, is committed to supporting first responders in delivering FirstNet support through its Cisco® industrial IoT gateways designed for public safety. Cisco IoT gateways provide seamless connectivity for law enforcement, fire, emergency medical services, transit, and utility agencies. Cisco offers an end-to-end management solution for provisioning, monitoring, and upgrading gateways that provide connectivity to FirstNet devices enabled with FirstNet SIMs.

In this dynamic environment, where it’s crucial to future-proof, secure, and maintain the flexibility of your IoT deployments, the modularity of new generation IoT ruggedized gateways, such as Cisco 1101 Industrial Integrated Services Router (IR1101), a modular and secure FirstNet Ready™ device, offers many benefits.

Table 3. FirstNet QPP temporary uplift provisioning (all uplifts get the same treatment)

<table>
<thead>
<tr>
<th>Type</th>
<th>QoS</th>
<th>Priority</th>
<th>Preempt PCI/PVI</th>
<th>ACB</th>
<th>B14</th>
</tr>
</thead>
<tbody>
<tr>
<td>FN Priority</td>
<td>6</td>
<td>2</td>
<td>N/Y</td>
<td>Not Changed</td>
<td>Not Changed</td>
</tr>
<tr>
<td>1 Uplift</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rugged: The Cisco IR1101 is designed to be rugged to deliver uninterrupted operations in a highly challenging environment—surviving exposure to extreme temperatures, humidity, vibration, and volatile power conditions. All IoT gateways go through rigorous temperature testing in a formal, properly structured environment to simulate extreme temperature ranges.

Secure: Cisco IoT gateways have security built in at all levels, from physical
Put it all together

As a pioneer in connectivity and security, Cisco offers an end-to-end solution for first responders with FirstNet-capable and FirstNet Ready™ devices.

- Law enforcement applications
- Fire and EMS agencies applications
- Transit applications
- Utility applications

security all the way to application-level security. Cisco IR1101 gateways have Cisco Secure Boot and Cisco Trust Anchor technology. Cisco Secure Boot establishes a “chain of trust” from micro loader through bootloader to the operating system, establishing the authenticity of the software. Cisco Trust Anchor technology helps verify that the Cisco hardware is authentic and has not been tampered with. All Cisco gateways have FIPS 140-2 security validation from the U.S. federal National Institute of Standards and Practices (NIST). Cisco offers multiple options VPN options such as Dynamic Multipoint VPN (DMVPN), FlexVPN, etc. that focus on safe data transmissions between the FirstNet network and other destinations, including restricted government databases.

Modular: A device’s form factor is more than just its physical dimensions. It also includes the shape, modular configuration, and mounting requirements. This combination of design elements must be put together in the right way to come up with future-ready and easy-to-scale IoT solutions. A modular form factor allows us to upgrade to new communications protocols such as 5G, FirstNet, etc. when they become available, avoiding costly rip-and-replace. This helps ensure that Cisco IR1101 devices provide the most up-to-date technology as well as the ability to connect using evolving wireless standards.

Edge computing: Cisco IoT gateways offer an application infrastructure framework, called Cisco IOx, that enables applications to run at the edge. Edge computing empowers first responders and disaster workers by providing rapid and actionable analytics in a timely manner. It can effectively process time-critical analytics and generate timely reports without running into bottlenecks further down the network.

SD-WAN: Cisco vManage provides the ability to manage all aspects of the SD-WAN, from provisioning, monitoring, and upgrading gateways to application visibility and troubleshooting. vManage supports both commercial and FirstNet (Band 14) LTE networks. This helps ensure uninterrupted network connectivity between first responders and dispatchers over a network that goes through multiple devices and systems.

Cisco IoT Control Center for FirstNet: Cisco IoT Control Center can manage, monitor, and automate FirstNet services rollout at scale. It reduces deployment and operational costs for FirstNet customers. It supports FirstNet Primary public safety as well as FirstNet Extended Primary public safety users who are eligible to get service on the FirstNet network.
To conclude, Cisco’s IR 1101 series gateway device is best positioned to meet and exceed the stringent requirements which are needed for FirstNet network infrastructure. It provides end-to-end security without compromising on scalability or performance. It protects First Responders from cyber threats by giving them a reliable secure network to run mission-critical FirstNet application. Rugged form factor ensures that it can be deployed in harsh indoor/outdoor environments demanded by First Responders. Cisco Control Center solution ensures reliable SIM management life cycle for FirstNet devices. Cisco IoT gateway provide investment protection, lower TCO and extended product lifetime for FirstNet network.

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