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The First Responder Network (FirstNet) and Next-Generation Communications for Public Safety: Issues for Congress

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Summary

Congress included provisions in the Middle Class Tax Relief and Job Creation Act of 2012 (P.L. 112-96) for planning, building, and managing a new, nationwide, broadband network for public safety communications, by creating the First Responder Network Authority (FirstNet). The act allocated 10 MHz of additional radio frequency spectrum to accommodate the new network and required that the Federal Communications Commission (FCC) assign a license to FirstNet, comprising the newly designated frequencies plus 10 MHz previously assigned to states by the FCC for public safety use. In addition, the act designated federal appropriations of over $7 billion for the network and other public safety needs. These funds are provided through new revenue from the auction of licenses to the commercial sector in other spectrum bands.

The establishment of FirstNet is an important step toward reaching what has been a national goal since September 11, 2001: the provision of interoperable communications for first responders. The immediate goal for FirstNet is to provide a broadband network nationwide to carry data, although it will provide an option for voice communications as well. The cost of constructing and maintaining a nationwide network is estimated by many experts to be in the tens of billions of dollars over the long term. The law anticipates that most of these costs will be covered by partnerships between FirstNet and the private sector in return for commercial access to FirstNet's spectrum.

In order to maintain control over the quality and nature of communications, many states are likely to continue to invest in and maintain their own Land Mobile Radio (LMR) networks that operate on narrowband frequencies under the jurisdiction of state and local public safety agencies. Information available to the public indicates that FirstNet intends to discourage states from building and operating their own networks within FirstNet, in part by limiting the amount of spectrum available for this purpose. FirstNet has taken the position that state autonomy in network design decisions and management will jeopardize FirstNet's ability to provide a network that meets its coverage and service goals.

P.L. 112-96 was signed into law on February 22, 2012, setting in motion the process of setting up FirstNet as an "independent authority within the National Telecommunications and Information Administration," as required by the act; laying out the parameters for partnerships, and state, tribal and federal participation; and meeting requirements either statutory or practical. After extensive consultation with stakeholders and potential partners in preparing proposals for partnering with FirstNet, the initial phases of organization are scheduled to culminate on May 31, 2016: the deadline for submitting proposals to build and operate the nationwide network.

The governance model chosen by FirstNet is a federalized, centrally planned and directed network, bolstered by federal procurement practices that limit states to a consultative role. A risk in choosing this model is that states may consider the federal presence excessive and cease to cooperate with FirstNet, jeopardizing the purpose of the network. FirstNet has announced that it will announce the winning bidder or bidders before the end of 2016. Once the contracts are awarded, as the network becomes operational, the potential level of public safety agency participation should be better understood, providing opportunities to evaluate the success of FirstNet in meeting the goals Congress set for it in 2012. Among the provisions of the act is a requirement that the General Accountability Office, before the end of FY2022, recommend to Congress what actions should be taken in regard to the ending of FirstNet's authority, mandated to occur in 2027.

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Introduction

The First Responder Network Authority (FirstNet) is a federal agency that includes private sector and other non-federal representation on its board of directors. FirstNet was created by Congress with provisions in Title VI (Spectrum Act) of the Middle Class Tax Relief and Job Creation Act of 2012 (P.L. 112-96) to ensure the deployment and operation of a nationwide, broadband network for public safety communications. It is established as an "independent authority"[1] within the National Telecommunications and Information Administration (NTIA), part of the Department of Commerce.

In addition to establishing the structure and goals for FirstNet, Congress provided $7 billion for costs related to planning and deploying the broadband network, and a $135 million grant program to assist states with plans to connect to FirstNet's broadband network.[2] These funds are provided from revenue realized through auctioning licenses for radio frequency spectrum, as designated in the act. The anticipated cost of building and operating a nationwide core broadband network—and the interoperable radio networks that connect to it—is significantly in excess of the amount appropriated. The act therefore provides for public-private partnerships with FirstNet or with states, and for fees (charged to states and other users) to ensure that FirstNet becomes self-sustaining. To attract private sector partners, FirstNet can offer access to its assets, including radio frequency spectrum capacity, in return for financial payment or other support. FirstNet holds a license for 20 MHz of broadband spectrum,[3] assigned by the Federal Communications Commission (FCC), as required by the act. The act allows states that meet specified requirements to lease spectrum from FirstNet and thereby negotiate their own partnerships that share spectrum in Radio Area Networks for their state or region. The viability of state-managed partnerships depends in large part on the amount of spectrum that will be made available to the state.

There are many challenges for public safety leaders and policymakers in establishing the framework for a nationwide network that meets state, local, tribal and territorial needs for robust, interoperable emergency communications. Currently, for example, state emergency communications needs are typically met by separate networks using different technologies. Furthermore, each state has its own laws and procedures for building, managing, and funding communications infrastructure. Among the challenges facing FirstNet is establishing a governance model that accommodates current investments and future needs of its clients without compromising the coherence of a national network.

Issues for Congress

FirstNet officials face enormous pressure to produce a functional network in a timely manner, reflecting widespread concerns that public safety communications will not be adequate for response and recovery if a catastrophic national emergency occurs. Building momentum after a slow start in setting up the organization, it is possible that FirstNet, working closely with the

[1] P.L. 112-96, Section 6204 (a).

[2] P.L. 112-96, Section 6202 (b) (2) (B).

[3] The spectrum license issued to FirstNet is for two 10 MHz channels of paired spectrum at 758-768 MHz and 788-798 MHz, plus guard bands at 768-769 MHz and 798-799 MHz to mitigate interference from adjacent channels. For purposes of allocation and assignment, spectrum is segmented into bands of radio frequencies measured in cycles per second, or hertz. Standard abbreviations for measuring frequencies include kHz—kilohertz or thousands of hertz; MHz—megahertz, or millions of hertz; and GHz—gigahertz, or billions of hertz. The designation can refer to an entire band, such as the 700 MHz band, or to specific frequencies within a band.

NTIA, is now opting for expediency at the expense of states' own public safety goals. For example, much of the available information about the role of states in managing networks in their jurisdiction is—at this point in time—vague, with a heavy emphasis on proposals, drafts, and works-in-progress.

FirstNet may not have fully evaluated the consequences of a centralized, closely controlled network over the long term. In particular, states that may be considering building their own networks, within FirstNet, may find that the final plans proposed to them, after the contracts are awarded in late 2016 are too federal-centric. State governors may at this point turn to their Members of Congress for assistance in gaining more control over the operations within their own jurisdictions. At this point, however, revising the contracts negotiated by the FirstNet Board of Directors may be difficult and costly.

Both the Government Accountability Office and the Inspector General of the Department of Commerce have found fault with the decision-making process at FirstNet and the level of oversight by the NTIA.[4] If these faults appear to be a trend, Congress may consider the value of greater vigilance over the planning process for the deployment of the Nationwide Public Safety Broadband Network that it created. For example, a number of economic decisions that claim to justify federal control are not supported by public circulation of the economic modeling.

FirstNet Network Strategy

Achievements since the FirstNet board first met officially in September 2012 include a number of Requests for Information (RFI), notably the September 2014 *Request for Information for Comprehensive Network Solution(s)*.[5] This document proposes a comprehensive broadband network solution for FirstNet that would reach from core network management requirements to include local area networks in many communities, as well as some devices used to access the network.[6] A *Second Notice,* issued by the Department of Commerce for comment on March 9, 2015,[7] provides FirstNet's perspective on the intent of Congress in enacting language that allows states to build their own network. The discussion in the *Second Notice* also supplements the *Public Notice on Statutory Interpretations*,[8] issued in September 2014. A number of important issues are raised in these formal statements of proposed interpretation, including possible definitions of "public safety" and "rural" to be used in negotiations with potential commercial partners.

A third public notice[9] concerning the definition of "public safety" was released after a FirstNet board meeting on April 24, 2015.[10] Also on April 24, the proposed acquisition approach[11] and the

[4] Summaries of these agency reports appear in later sections of this report.

[5] FirstNet, *Request for Information for Comprehensive Network Solution(s)*, September 17, 2014, http://www.firstnet.gov/sites/default/files/ Request%20for%20Information%20for%20Comprehensive%20Network%20Solutions.pdf.

[6] Congressional Research Service was informed of the outline for FirstNet's comprehensive network strategy in discussion with NTIA officials between July and September 2012.

[7] FirstNet, *Second Notice*, March 9, 2015, at http://www.firstnet.gov/sites/default/files/ FirstNet_Second_Public_Notice_0.pdfplus; also published in *Federal Register*, Vol. 80, No. 49, Friday, March 13, 2015, 1336-13351 (Docket Number 150306226-5226-01); comments due by April 28, 2015.

[8] FirstNet, *Public Notice on Statutory Interpretations*, September 17, 2014, at http://www.firstnet.gov/sites/default/ files/firstnet-public-notice-middle-class-tax-relief-job-creation-act-of-2012.pdf.

[9] FirstNet, "Further Proposed Interpretations of Parts of the Middle Class Tax Relief and Job Creation Act of 2012," at http://www.firstnet.gov/sites/default/files/firstnet-third-notice-final-prepublication-version.pdf.

draft Request for Proposal(s) (RFP)[12] were considered in a closed meeting. The draft RFP builds on proposals from previous notices and RFIs. The planning process for 2015-2016 is centered on circulating the draft Request for Proposal(s) and a final RFP. FirstNet has announced that the contract or contracts will be awarded through the Federal Acquisition Regulation (FAR) process[13] sometime in late 2016.

As currently envisioned, after the initial contracts are awarded, the winning bidders will provide individual proposals for each state for the deployment and operation of FirstNet's broadband service within that state. Negotiations between each state and FirstNet may lead to contract modifications. Some observers have estimated that the process, to be properly executed with all states and territories, may take as much as three years. The finalized contract terms for each state are then likely to be submitted for final review by the state. Submission of the final proposals to state governments is expected to trigger the required 90-day decision period for each governor to accept FirstNet's proposal or to opt out in expectation of separately building a Radio Area Network. The act's opt-out requirements as described in the Spectrum Act are discussed in a later section, "State Participation: The Opt-Out Provision."

According to FirstNet, "key goals are to meet the needs of public safety and to provide extensive coverage so Federal subscribers and other public safety users can count on the network when they are on the job."[14] Network coverage includes deployable units, such as vehicles equipped to connect with the network, and local area networks operated by FirstNet. "Incident commanders and officials will have local control over the network so, for example, they can assign users and talk groups and determine who can access applications."[15] The underlying premise of the strategy is that the chosen network solutions will allow FirstNet to "control and operate" national and regional core network infrastructure, Radio Area Networks (RANs) in states that opt-in, as well as devices, applications, and other functions.[16] To achieve this level of coverage, FirstNet's "acquisition strategy centers on maximizing the network's value to public safety while meeting its financial sustainability obligations under the Act."[17] The intent of this network design is to maximize the value of spectrum for the benefit of the greater good by capturing the full value of the spectrum, nationwide, in order to provide sufficient funding for rural coverage.[18]

(...continued)

[10] FirstNet, Special Board Meeting Agenda, http://www.firstnet.gov/sites/default/files/FirstNet-April-24-2015-Meeting-Agenda.pdf

[11] "FirstNet's Proposed Acquisition Approach," April 24, 2015, at http://www.firstnet.gov/sites/default/files/firstnet-special-notice-and-draft-rfp-documents_0.pdf.

[12] FirstNet, *Special Notice* and supporting documents for draft RFP, Federal Business Opportunities, Solicitation Number D15PS00295, at https://www.fbo.gov/index?s=opportunity&mode=form&tab=core&id=55fa4d3227d5ac0173e4613e04368c86.

[13] As a federal agency, FirstNet is required to follow federal procurement processes but the act does not mandate the use of FAR. Some legal experts might argue that the contracts to be negotiated through the RFP process are not subject to FAR. For more information on FAR, see CRS Report R42826, *The Federal Acquisition Regulation (FAR): Answers to Frequently Asked Questions*, by Kate M. Manuel, L. Elaine Halchin, and Michelle D. Christensen.

[14] Fact Sheet, "FirstNet and Federal Departments and Agencies," October 2014 at http://www.firstnet.gov/sites/default/files/federal-information-fact-sheet-1.pdf.

[15] Ibid.

[16] Ibid.

[17] FirstNet, *Request for Information for Comprehensive Network Solution(s)*, September 17, 2014, http://www.firstnet.gov/sites/default/files/Request%20for%20Information%20for%20Comprehensive%20Network%20Solutions.pdf.

[18] "We believe as a general matter that Congress did not intend for a few, high density states to be able to withhold (continued...)

State Radio Area Networks

Since September 11, 2001, state and local agencies—aided by federal grant programs—have invested in improving the reliability and interoperability of mission critical voice communications over Land Mobile Radio (LMR) networks. The 2014 National Emergency Communications Plan prepared by the Department of Homeland Security emphasizes the need to continue investment in these networks to provide communication for first responders until such time as FirstNet is deployed and capable of handling mission-critical voice communications over broadband.[19] These networks may also be essential for local and state backup service when access to FirstNet has been preempted by a large-scale emergency, or they may be an alternative to using FirstNet.[20]

Although many details have not been made public, the general architecture of FirstNet's broadband network has been presented at numerous public events and is available on the FirstNet website.[21] The network design shows what is referred to as a heterogeneous network, or HetNet. It depicts the Radio Access Network to include both macro and micro networks. In simple terms, high towers with base stations, known as eNodeB in LTE network design, are referred to by the wireless industry as a macro network; a variety of small cell[22] network designs are referred to as micro networks. The macro network is often described as providing coverage over distance and the micro network as providing capacity as well as extra coverage at the local level.[23]

Micro Networks

The trend in the evolution of micro networks is depicted in **Figure 1**. In this configuration, the micro network has become the predominate provider of mobile communications coverage and capacity through contiguous small cell networks. The tower of the macro network (eNodeB) assures connectivity and provides additional coverage. Small cell networks are by and large autonomous, providing coverage for their area and connecting to other small cell networks or cellular towers when needed. These micro networks are local in nature but fully interoperable across wide geographic areas. For FirstNet, a network strategy that shifts the majority of routine, public safety mobile communications onto shared spectrum in small cell networks will free much of the 20 MHz spectrum license for secondary use. Only in times of a major emergency would public safety users make heavy demands on the macro network and spectrum licensed to FirstNet.

(...continued)

material funding for all the other States under the Act." *Second Notice*, op.cit.

[19] Department of Homeland Security, *National Emergency Communications Plan*, November 12, 2014, p .7: "… the primary means to achieve mission critical voice communications." At http://www.dhs.gov/sites/default/files/publications/2014%20National%20Emergency%20Communications%20Plan_October%2029%202014.pdf.

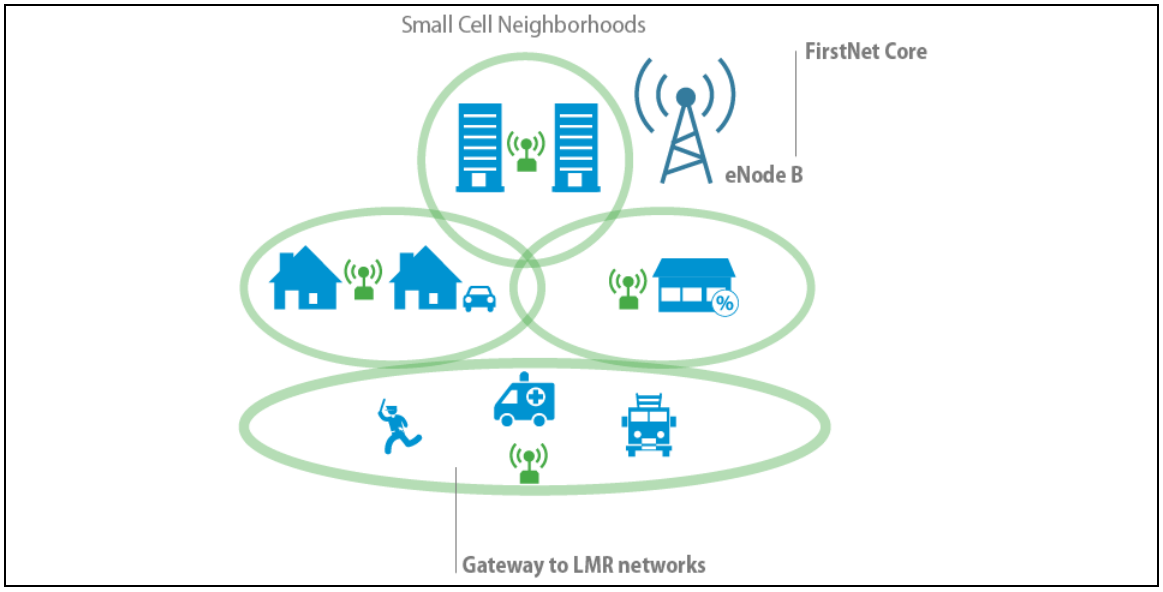
[20] The California Bay Area Regional Interoperable Communications Systems Authority is testing a wireless broadband network for public safety developed by xG Technology that can be deployed on existing LMR infrastructure.

[21] "FirstNet LTE Overview," at http://www.firstnet.gov/sites/default/files/LTE%20Overview-.pdf. The version referenced in this report is dated March 2, 2015.

[22] Small cells are low-powered radio access nodes that are used to boost capacity and manage network interference and connectivity. The types of small cells include Femtocells, typically used in a home; Picocells, that may serve a business; Metrocells, for urban areas; and Microcells, the largest in terms of geographic coverage, used primarily in rural areas. The term small cells is used by the Small Cell Forum as an umbrella term for operator-controlled, low-power radio access nodes using licensed or unlicensed spectrum.

[23] A more detailed discussion of the evolution of wireless network concepts appears in CRS Report R43595, *Mobile Technology and Spectrum Policy: Innovation and Competition*, by Linda K. Moore.

Figure 1. Small Cell Neighborhood Micro Network



Source: 4G Americas, *Meeting the 1000X Challenge: The Need for Spectrum, Technology and Policy Innovation,* October 2013, Figure AI-1, p. 130, http://www.4gamericas.org/documents/2013_4G%20Americas%20Meeting%20the%201000x%20Challenge%2010%204%2013_FINAL.pdf.

Revised by CRS to include a small cell deployment for public safety operations.

In an LTE network, it is the eNodeB macro coverage infrastructure—not the micro network—that requires a significant spectrum assignment to operate efficiently. During the period 2011-2012, when the Spectrum Act was drafted and enacted, the Radio Area Network would have consisted primarily of high-site towers with base stations (eNodeB).[24] Since the Spectrum Act was passed, communications technologies have evolved in ways not fully anticipated at the time.[25] Congress, therefore, may have assumed that a state with a successful plan to opt out and create its own public-private partnership would be granted a statewide license for 20 MHz to operate a Radio Area Network using eNodeB towers and base stations. Micro networks, however, can operate within the 20 MHz assignment, essentially sharing the spectrum, but may require no more than 1.5 x 1.5 MHz for a basic LTE network. Therefore, if FirstNet decides that only micro network capacity will be made available for a state-operated Radio Area Network, then the state will have a sub-license for a relatively small amount of spectrum that may be difficult—perhaps impossible—to leverage in a public-private partnership.

[24] P.L. 112-96, Sec. 6202 (b) states that the network consists of "(1) a core network that—(A) consists of national and regional data centers, and other elements that may be distributed geographically, all of which shall be based on commercial standards; and (B) provides the connectivity between—(i) the radio access network; and (ii) the public Internet and the public switched network, or both; and (2) a radio access network that—(A) consists of all cell site equipment, antennas, and backhaul equipment, based on commercial standards, that are required to enable wireless communications, with devices using the public safety broadband spectrum; and (B) shall be developed, constructed, managed, maintained, and operated taking into account the State, local, and tribal planning and implementation grant program, under section 6302 (a)."

[25] In 2012, small cell deployments now commonly used by the industry to expand their LTE networks were considered experimental, for example comments in President's Council of Advisors on Science and Technology (PCAST), *Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth*, July 20, 2012, at https://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_spectrum_report_final_july_20_2012.pdf.

[25] FirstNet, *Second Notice*, at http://www.firstnet.gov/sites/default/files/FirstNet_Second_Public_Notice_0.pdfplus.

State and Community Network Participation

The following discussion focuses on key statements from FirstNet that seem to indicate the agency's current plans for state, tribal, territorial, and local participation in the network. FirstNet may later choose to alter its plans.[26]

FirstNet's deployment strategy reportedly will:

- Include state-based eNodeB's in FirstNet's core services, thereby bringing the entire 20 MHz spectrum license under the full control of FirstNet and its federal contractors.[27] This decision, if implemented, represents a change in an earlier statement that proposes including the eNode B as part of the Radio Area Network.[28]
- Provide local area network capacity and connections as an extension of FirstNet, limiting state authority to providing fill-in capacity for some under-served areas.[29]
- Assign to FirstNet contractors the responsibility of identifying additional partners or subcontractors to act under the authority of the contractor; this might include, for example, negotiating an agreement with a local power company for access to its infrastructure.[30]
- Assign negotiations for access to existing state, local, or tribal infrastructure to contractors, to be pursued after the contract has been issued.[31]
- Extend coverage to rural areas where there is currently little or no commercial service through new, federally funded build-out to the commercial networks of partners chosen through the RFP process.[32]

A major goal of this network design is to maximize the value of spectrum by capturing its full value, nationwide, in order to provide sufficient funding for rural coverage. FirstNet therefore believes that allowing states to build their own RANs "potentially takes with it subscriber fees and/or excess network capacity fees that would have helped fund the FirstNet network in all other states."[33]

Apparently not included in FirstNet's planning process is an analysis of the costs to be assumed by states as a consequence of its business plan. These costs include the continued operation and possible expansion of state and local LMR voice networks; the cost of integration of LMR and

[26] The discussion is based on currently available information as of the publication date of this report.

[27] CRS meeting with FirstNet officials, February 13, 2015.

[28] FirstNet, *Public Notice on Statutory Interpretations*, at http://www.firstnet.gov/sites/default/files/firstnet-public-notice-middle-class-tax-relief-job-creation-act-of-2012.pdf. The *Special Notice*, "Terms of Reference," reiterates the proposed definition but does not provide a conclusive description of RAN.

[29] CRS meeting with FirstNet officials, February 13, 2015.

[30] Ibid.

[31] Hearing, Senate Committee on Commerce, Science, and Transportation, "Three Years Later: Are We Any Closer to a Nationwide Public Safety Network," March 11, 2015: oral testimony of Ms. Susan Swenson, Chairwoman, FirstNet. Ms. Swenson further explained that FirstNet had found it difficult to negotiate for access to state and local infrastructure as part of its pilot with the Los Angeles Regional Interoperable Communications System (LA-RICS). See also FirstNet, "Early Builder's Blog, February12, 2015, at http://www.firstnet.gov/newsroom/blog/early-builders-blog-la-rics.

[32] Ibid.

[33] FirstNet, *Second Notice*, at http://www.firstnet.gov/sites/default/files/FirstNet_Second_Public_Notice_0.pdfplus.

broadband infrastructure; the costs of forfeiting to FirstNet the potential economies of scale in network construction and operation; and the cost of lost opportunities for competitions and innovation in wireless services at the state and local level.

Risks and Rewards

FirstNet appears to be making decisions about the network design that are evolving as new information is gathered and analyzed. It claims that a federalized network is the "only solution"[34] that meets its goals of providing nationwide coverage, interoperability, and assured access. In the *Second Notice* it concludes that allowing populous states to opt out of FirstNet and build their own public safety broadband networks, monetizing the value of the 20 MHz of spectrum assigned for that purpose, will beggar their more rural neighbors who cannot so readily capture the value of excess capacity. This is a presumption of market failure that is not supported by information made public by FirstNet and is inconsistent with the many positive analyses of the economic value of small cell networks, community broadband, and the Internet of Things.[35]

The value of economies of scale in building and operating wireless networks has long been recognized by telecommunications experts and policymakers. The FCC, for example, has modified its policies to make it easier for wireless companies to expand through mergers and acquisitions in order to benefit from scale economies.[36] These and related FCC decisions are based on, among other considerations, improving coverage through macro networks to customers for wireless services. When FirstNet refers to the importance of economies of scale, it is apparently referring to geographic coverage through macro networks.[37]

The economics for small cell networks, however, enable profitability by providing economies of scope, with many different types of services to multiple customer segments in a small area. Economies are provided not through macro network coverage but by micro network capacity to accommodate many customers with different technology needs. Many wireless network experts believe that dense deployments of small cells in an area served by a single eNodeB tower will increase efficiency and reduce costs while increasing capacity to handle many different markets.[38]

Although urbanized areas are seen by many as the primary market for expanding small cell services, the benefits may also be important in rural or remote areas. Experts suggest that, in

[34] This phrase has reportedly been used in many discussions between FirstNet staff and Members of Congress or their staff. It was also used in the February 13, 2015 CRS meeting with FirstNet officials.

[35] Examples of sources that discuss potential value or wireless broadband for rural, suburban, and urban areas include Small Cell Forum case studies, including rural and remote areas (http://scf.io/en/documents/047_Extending_rural_and_remote_coverage_using_small_cells.php); NTIA, *Broadband USA*: *An Introduction to Effective Public-Private Partnerships for Broadband Investments* (http://scf.io/en/documents/047_Extending_rural_and_remote_coverage_using_small_cells.php);and testimony at Senate and House hearings on the Internet of Things (Senate, Committee on Commerce, Science, and Transportation, February 11, 2015; House, Committee on Energy and Commerce, March 24, 2015).

[36] FCC News, "FCC Announces Wireless Spectrum Cap to Sunset Effective January 1, 2003," November 8, 2001. Report and Order FCC-01-328. See Docket No. 01-14, *Notice of Proposed Rulemaking*, released January 23, 2001, at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-01-28A1.pdf.

[37] FirstNet, "Stakeholder Quarterly Webinar," April 2, 2015, presentation on FirstNet *Second Notice* by Eli Veenendaal, Attorney-Advisor, at http://www.firstnet.gov/sites/default/files/Stakeholder_Qtrly_Webinar_20150402.pdf.

[38] See, for example, Qualcomm, "1000x: More Small Cells; Hyper-Dense Small Cell Deployments," June 2014. For presentation slides, see http://www.slideshare.net/qualcommwirelessevolution/web-bringing-1000x-closer-to-reality-hyper-dense-small-cells-wirelessnetworks-052014.

addition to serving public safety, a rural small cell configuration could support, for example, transportation improvements, education, job search, agricultural and forestry management, new efficiencies in municipal government and services, and economic growth.[39] Economies of scale at the macro level may also be available in states with a low population density. A cost-effective network solution may be achieved by adjacent states combining their resources to provide coverage with eNodeBs and maximizing the utility of small cell networks at the local level. For state and local public safety agencies, maximizing the value of spectrum may be less important than achieving sufficient levels of scale and scope to meet their requirements.

FirstNet refers to the need to monetize the value of its spectrum holdings to expand coverage, based on the existing commercial footprint for LTE, not the footprint of statewide or local public safety networks. It does not estimate the value to states and communities of small cell networks and the wireless component of community broadband that may be transferred to FirstNet's commercial partners. FirstNet's plans appear to capture for its own use most of the value of spectrum used to provide both coverage and capacity. This value is unknown but potentially far greater than what FirstNet can lawfully[40] spend on improving its network or by reducing user fees. The excess value of the spectrum and access to local markets that FirstNet is using to barter for goods and services, therefore, will in most cases go to FirstNet's contractual partners, not to the states and communities intended by the act to be the primary beneficiaries of FirstNet's actions.

FirstNet appears to have documented the benefits but not the risks associated with their decisions. Some of the more salient pros and cons of FirstNet's strategy are summarized below.

Advantages of FirstNet's Comprehensive Network Strategy

Advantages of a federalized network, cited by FirstNet,[41] include:

- Swift execution. Adding public safety access to existing commercial LTE infrastructure provides a turn-key solution for immediate access to a potentially large number of public safety agencies, federal agencies, and others;
- Extension of LTE service to rural areas that currently have no commercial broadband service and might not have public safety communications coverage;
- Streamlined access for federal partners. Instead of negotiating with each state or regional network, federal agencies need only negotiate with FirstNet to gain immediate access to the entire network;
- National reach in times of emergency and assured access to federal incident commanders and officials;

[39] See, for example, Computerworld, "Verizon Boosts Role in Farm Services and Smart Cities," by Matt Hamblen, May 1, 2015, at http://www.computerworld.com/article/2917932/internet-of-things/verizon-boosts-role-in-smart-cities-and-farms-services.html.

[40] The act requires FirstNet to reinvest in the network any excess receipts from the fees it is authorized to collect, P.L. 112-96, Section 6207 (b).

[41] These advantages were, for example, highlighted in presentations at FirstNet's "Stakeholder Quarterly Webinar," April 2, 2015 (http://www.firstnet.gov/sites/default/files/Stakeholder_Qtrly_Webinar_20150402.pdf) as well as in other documents.

- Economies of Scale. FirstNet requires full control of many assets in order to maximize their value throughout the network; and
- Sustainability. Development of small cell networks under FirstNet's control allows for most traffic to be off-loaded on to local networks that require minimal spectrum, freeing spectrum for customers with a higher dollar-value for FirstNet.

Other Advantages

A number of advantages offered by FirstNet could be available in many other governance or business models. These include:

- Operation of core network (Evolved Packet Core) services such as enforcement of rules for interoperability and other policies and rules, operations, performance and security management, and subscriber databases;
- Purchasing power. Negotiated discounts for equipment through buying cooperatives;
- Research and development, standardization, and negotiations with standards bodies;
- Widespread adoption of broadband technologies to improve, enhance, and extend the effectiveness of emergency responders; and
- Development of best practices for cybersecurity and enforcement of network security procedures.

Disadvantages of FirstNet's Comprehensive Network Strategy

Some disadvantages of a federalized network might be:

- Loss of state autonomy. States have a consultative role but many decisions rest with FirstNet. States also lose control of spectrum assets, potentially limiting their ability to develop capabilities and services that are of value to them but not to FirstNet's customers for nationwide service;
- Devaluation of state and federally funded investments in existing public safety communications networks. Although contractors may, after receiving a contract, negotiate with states and localities for access to their assets, the value and availability of those assets have not been openly stated in the FirstNet planning process;
- Displacement of local competitors by the FirstNet contractor in local and state broadband development. Smaller communities may not be able to generate sufficient business for two or more broadband service providers. To achieve financially viable programs, they might be restricted to using the incumbent (FirstNet) provider;
- Displacement of partners for broadband development. Desirable partners (such as a rural utility) may not be available for local projects because of contractual obligations to FirstNet;
- Loss of market power for state public safety customers. If fees from state and local public safety agencies are a small part of FirstNet's revenue stream,

states lose some of their bargaining power in negotiating for improved services or other requests; and

- Increased risk through lack of diversified assets. Risks include operational risks such as a system wide failure or cyberattack; financial risks such as monopoly pricing; competitive risks in some markets controlled by FirstNet contractors that may lead to reduced innovation; and the risk of poor management decisions with systemwide impact.

State reactions in weighing risks and rewards of network participation may lead to another risk: limited participation, negating much of the intended value of FirstNet.

State Participation: The Opt-Out Provision

Every state has one or more agencies that plan for public safety, homeland security, and emergency communications. To be eligible for grants from the Department of Homeland Security, states have established a Statewide Interoperability Coordinator (SWIC) to administer its Statewide Communication Interoperability Plan (SCIP).[42] SCIPs are written to conform with federal guidelines and requirements, such as the National Emergency Communications Plan. FirstNet is required to consult with regional, state, tribal, and local authorities regarding decisions such as those concerning the costs of the policies it formulates, as required in the law, including expenditures for the core network, placement of towers, coverage areas, security, and priority access for local users. Consultation will be through a state-selected coordinator as specified in the act.[43] Appointment of an individual or governmental body as the Single Point of Contact (SPOC) is required as a condition of state participation and eligibility to receive grants established by the act.[44]

States may decide to use the existing SWIC as the required single point-of-contact or may choose to appoint a separate coordinator. Each state and other participants have appointed a coordinator to work directly with FirstNet.[45] The coordinator (SPOC) is responsible for managing FirstNet activities in his or her state. Often this includes revising the existing SCIP to include broadband communications.

The governor of each state is to be notified by FirstNet when it has completed its requests for proposals regarding construction, operation, maintenance, and improvement of a nationwide network. The governor or his designee will receive the details of the proposed plans and notification of the amount of funding available to the state if it participates in the FirstNet program.[46]

The act only identifies two options for a state: join FirstNet or build a statewide Radio Access Network subject to the provisions of the act. The act does not include specific provisions for a state that chooses to build its own Radio Access Network without opting out of FirstNet, although providing such an option may be within FirstNet's charter. A state might, for example, choose to

[42] See "Statewide Interoperability Coordinators," at http://www.dhs.gov/files/programs/gc_1286986920144.shtm.

[43] P.L. 112-96, Section 6206 (c) (2) (B).

[44] P.L. 112-96, Section 6302 (d).

[45] Hearing, House Committee on Energy and Commerce, Subcommittee on Communications and Technology, "Oversight of FirstNet and the Advancement of Public Safety Wireless Communications," testimony of Samuel Ginn, Chairman, FirstNet, November 21, 2013. List of state contacts at http://www.firstnet.gov/sites/default/files/spoc-list-directory-20150113.pdf.

[46] P.L. 112-96, Section 6302 (e) (1).

build its own data management center or mobile access routers while also sharing FirstNet's infrastructure for regional and national coverage. The act also is silent on whether states may choose to opt out of the broadband network entirely, choosing neither to join FirstNet nor to build a broadband network on the frequencies assigned to FirstNet.[47] Some states may prefer to concentrate their resources on improving mission-critical voice networks and acquire broadband access from a commercial provider or through other means. FirstNet, through its partners, intends to provide service in all states, even if a state chooses not to be a customer or otherwise participate in the network.[48]

The Spectrum Act specifies that a state that chooses to build its own Radio Access Network must submit an alternative plan for construction, operation, maintenance, and improvement of the Radio Access Network within the state. The state must demonstrate to the FCC, which the law requires to review the plan, that its planned Radio Access Network would comply with minimum technical requirements and be interoperable with FirstNet. The state has 90 days to agree to participate or to notify FirstNet, the NTIA, and the FCC of its intent to deploy its own part of the Radio Access Network, and an additional 180 days to provide its plan to the FCC.[49]

If a state's plan is approved it will be eligible to apply for a grant, administered by the NTIA, that will be funded from the Network Construction Fund created by the act. The amount available may be less than what would have been provided if the state had opted in to the FirstNet program, because the grant will be applied only toward building the Radio Access Network and may be subject to matching grant requirements. Approval of the grant is contingent on meeting additional requirements established by the NTIA, including sustainability, timeliness, cost-effectiveness, security, coverage, and services that are comparable to FirstNet.[50] The state would be required to pay a user fee for access to FirstNet's core network.[51] It would not be permitted to enter commercial markets or lease access to its network except through a public-private partnership. Any revenue to the state from a partnership must be used only for costs associated with its broadband network.[52] If a state's plan meets FCC and NTIA requirements, then the NTIA may grant a license to a state to operate on some portion of the FirstNet spectrum.

NTIA Grant Programs

The NTIA, in consultation with FirstNet, has responsibility for carrying out two grant programs: the State and Local Implementation Grant Program (SLIGP); and grants from the Network Construction Fund to states that are permitted to build their own Radio Area Networks.

State and Local Implementation Grant Program

The State and Local Implementation Fund was allocated $135 million[53] from the Public Safety Trust Fund for grants to be made available to all 56 states and territories to develop a plan on how

[47] A discussion of courses a state might choose appears in a blog post on medium com: Bill Schrier, "FirstNet: More Choices than Just Opt-In/out," February 7, 2015, https://medium.com/@BillSchrier/firstnet-more-choices-than-just-opt-in-out-cb47b306b62c.

[48] FirstNet, *Second Notice*, at http://www.firstnet.gov/sites/default/files/FirstNet_Second_Public_Notice_0.pdfplus.

[49] P.L. 112-96, Section 6302 (e) (2) and (3).

[50] P.L. 112-96, Section 6302 (e) (3) (D).

[51] P.L. 112-96, Section 6302 (f).

[52] P.L. 112-96, Section 6302 (g).

[53] P.L. 112-96, Section 6413.

to use a nationwide public safety broadband network to meet their emergency communications needs. The distribution of available funds among the states is established by the NTIA, which administers the State and Local Implementation Grant Program in consultation with FirstNet. The program is as a matching grant program. Federal grants from the fund are not to exceed 80% of the projected cost to the state; however, the NTIA may make the decision to waive the matching funds requirement.

The NTIA decided to plan for funding in two phases. Grants for both phases totaled over $116 million. Grants for the initial phase were awarded to 54 of the 56 eligible states and territories in FY2013. The state of Mississippi and the territory of the Northern Mariana Islands did not receive grants. The first phase of funding, totaling about $58 million, has helped states conduct outreach with public safety and state and local officials to determine their needs, gaps, and priorities for public safety wireless broadband and to prepare for formal consultations with FirstNet. Grants in the second phase may be used by states to collect data identifying and prioritizing where public safety broadband coverage is needed; identifying potential users and their capacity needs; detailing current providers and procurement mechanisms; and similar needs.[54] Reportedly,

> NTIA has recently decided no federal grant monies (SLIGP) can be used to explore any option other than "opt in". FirstNet itself recently asked for review of its interpretations of the Law ("second notice"), and those interpretations also tend to restrict the ability of states to explore options to build their own. It is clear NTIA does not want states doing coverage and financial modeling, even though such work would result in improved FirstNet plans for each state.[55]

Network Construction Fund

The Spectrum Act requires that $7 billion, reduced by the amount needed to establish FirstNet, be available for a Network Construction Fund established in the Treasury to be used by FirstNet for costs associated with building the nationwide network and for grants to states that qualify to build their own networks.[56]

The act effectively creates three types of expenditures from the Network Construction Fund but does not specify how funds would be allocated for (1) expenditures by FirstNet on construction, maintenance, and related expenses to build the nationwide network required in the act; (2) by the NTIA to make payments to states that are participating in FirstNet; and (3) by the NTIA for grants to those states that qualify to build their own Radio Access Networks.[57]

In FirstNet's *Special Notice*, the "Proposed Pricing Methodology" suggests that little or no provision is being made for grants to opt-out states. The notice proposes,

> Potential offerors may be required to propose how much of the $6.5 billion in Government funding that FirstNet will make available is needed to deploy, operate and maintain the NPSBN, based on their proposed solution given the level of value available as described in (2) below. Potential offerors would be required to propose the timing of

[54] NTIA Press Releases, "NTIA Announces Second Phase of Funding for State and Local Implementation Grant Program," March 23, 2015, http://www.ntia.doc.gov/press-release/2015/ntia-announces-second-phase-funding-state-and-local-implementation-grant-program.

[55] Bill Schrier, the Chief Seattle Geek Blog, "Live Long and Prosper: Impressions from the SPOCs Meeting," April 19, 2015, at https://schrier.wordpress.com/2015/04/19/live-long-and-prosper-impressions-from-the-spocs-meeting/.

[56] P.L. 112-96, Section 6413.

[57] P.L. 112-96, Section 6206 (e).

when the funding is required to achieve the initial operating capability milestones that are detailed in the draft RFP documents.[58]

FirstNet Administrative Expenditures

The FY2014 *Annual Report to Congress*[59] from FirstNet shows operating expenses for the year of $24.4 million, of which $6.2 million was attributed to administrative expenses. The report notes that the Spectrum Act caps administrative expenditures at $100 million for the first 10 years of operation and states the "cap has been identified as a future barrier for FirstNet progress because it is projected to limit administrative costs to impractical levels. Management estimates that to operate within this limitation, FirstNet and the public will have to accept risks to FirstNet operations.... " The funding guidance for FY2015 allows for a budget of as much as $120 million, of which up to $21.4 million is anticipated for expenditures on organizational infrastructure, project support, and administrative functions. An additional $22.3 million is projected for planning, consultation, and outreach activities.[60]

The FY2016 budget proposal limit for all expenses is $160 million, which includes funding for approximately 150 Full Time Equivalent employees as well as additional contracting and administrative support.[61]

FirstNet has not made public its projections for annual salaries and expenditures that might be attributed to operating costs or to administrative expenses. A possible yardstick might be the annual expenditures of the NTIA to manage what are referred to as "reimbursable obligations." These funds are provided through fees that the NTIA is authorized to collect for services, such as payments from other federal agencies for spectrum management. These fees support a workforce roughly equivalent in size and purpose (managing technical programs and meeting client needs) to FirstNet. With a work force of 155 Full Time Equivalent employees, annual expenditures attributed to reimbursable operations at the NTIA are estimated at $40.6 million in FY2015 and $42.6 million in FY2016.[62]

An alternative to increasing the amount available for FirstNet administrative expenses would be to give more responsibility to states, tribal authorities, and territories in administering the networks in their states.

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[58] FirstNet, *Special Notice*, "4.5 Proposed Pricing Methodology" proposes two main elements: "Level of Government Funding," quoted above; and "level of Fixed Payments to FirstNet," regarding fixed payments to FirstNet.

[59] FirstNet, U.S. Department of Commerce, *FY2014: Annual Report to Congress*, at http://www.firstnet.gov/sites/default/files/Annual%20Report_FY2014_FINAL_3_3_15.pdf.

[60] FirstNet News, "FirstNet Finance Committee Gives Go-Ahead to Fund Key RFP, Consultation Activities in FY15," November 17, 2015, at http://www.firstnet.gov/news/firstnet-finance-committee-gives-go-ahead-fund-key-rfp-consultation-activities-fy15.

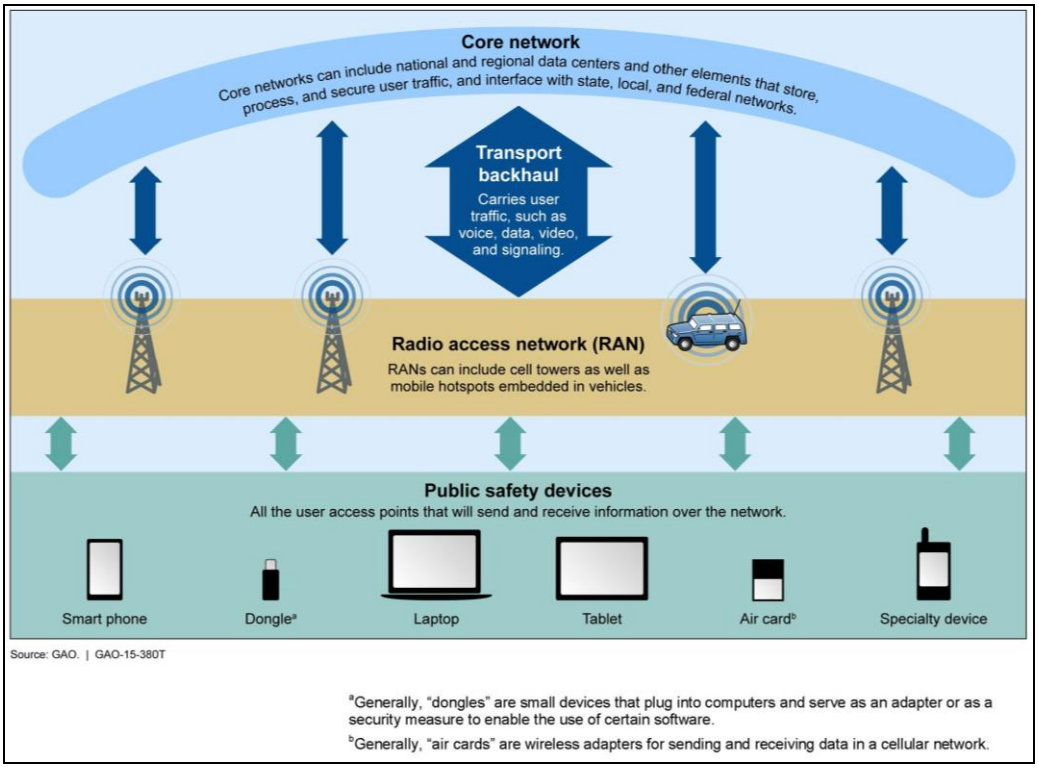
[61] Hearing, Senate Committee on Commerce, Science, and Transportation, "Three Years Later: Are We Any Closer to a Nationwide Public Safety Network," March 11, 2015: testimony of The Honorable Todd J. Zinser, Inspector General, U.S. Department of Commerce at http://www.commerce.senate.gov/public/index.cfm?p=Hearings&ContentRecord_id=25dedd7c-815b-4b3d-a420-4f4324d01041&Statement_id=ec8d2396-ecd6-4787-bcc6-6c0152203066&ContentType_id=14f995b9-dfa5-407a-9d35-56cc7152a7ed&Group_id=b06c39af-e033-4cba-9221-de668ca1978a&MonthDisplay=3&YearDisplay=2015.

[62] U.S. Department of Commerce, National Telecommunications and Information Administration, *FY 2016 Budget as Presented to Congress*, February 2015, at http://www.ntia.doc.gov/files/ntia/publications/ntia_2016_cj_final_2-5-15-508_checked.pdf.

GAO Study

The Spectrum Act requires that, before the end of FY2022, the Government Accountability Office (GAO) is to recommend to Congress what actions should be taken in regard to the ending of FirstNet's authority, mandated to occur in 2027. Additionally, at the request of the Senate Committee on Commerce, Science, and Transportation, GAO has prepared an evaluation of FirstNet's organization, including business decisions contained in the request for proposal; use of commercial, federal, state, local, and tribal infrastructure in deploying the network nationwide; and financial sustainability. GAO presented preliminary findings as testimony at a Commerce Committee hearing on March 11, 2015,[63] and issued a final report on some of these issues on April 28, 2015.[64]

Figure 2. Key Elements of First Responder Network Authority's Public Safety Network, GAO



Source: GAO, *Public Safety Communications: Preliminary Information on FirstNet's Efforts to Establish a Nationwide Broadband Network*, GAO-15-380T

The preliminary report included estimates of the cost of building a public safety broadband network from various sources, but no information from FirstNet. The costs were not broken down by key elements, as identified in the report as core network; transport backhaul; Radio Access

[63] Hearing, Senate Committee on Commerce, Science, and Transportation, "Three Years Later: Are We Any Closer to a Nationwide Public Safety Network," March 11, 2015: Testimony of Mark L. Goldstein, Director, Physical Infrastructure Issues, GAO at http://www.commerce.senate.gov/public/?a=Files.Serve&File_id=782a6761-b54b-4e6b-918d-6bd28b287f34.

[64] GAO, *Public-Safety Broadband Network: FirstNet Should Strengthen Internal Controls and Evaluate Lessons Learned*, GAO-15-407, April 2015, at http://www.gao.gov/assets/670/669861.pdf.

Network (RAN); and public safety devices. A depiction of the elements, provided in the report, appears in **Figure 2**. This depiction reflects the language in the Spectrum Act, not FirstNet LTE network design proposals. Therefore, **Figure 2** does not include small cell networks, unlike the schematics provided by FirstNet in its recent presentations.

In testimony, GAO summarized the progress FirstNet has made in meeting its responsibilities but noted that it had not put in place a number of measures that GAO considers important. Notably, GAO found that FirstNet has not fully assessed the risks associated with its planning efforts (such as conflict of interest); has not established Standards of Conduct; and is not fully evaluating the information from five "early builder" projects.[65]

GAO noted that, as of February 15, 2015, there are over 120 people employed by FirstNet, with a number of positions unfilled. The annual cost of salaries and expenditures that will be required to maintain FirstNet and its outreach programs to states and other customers was not discussed in the preliminary report.

The full report expands on the information provided in testimony. The full report includes, for example, a timeline and other information regarding the development of FirstNet; more details about the "early builder" program; and some insight into FirstNet's planning process. Regarding the interaction of planning and the cost of building the network, GAO's comments include these observations:

- "As part of its planning and market research, FirstNet has developed a cost estimate for its public safety network that met most of the best practices against which we evaluated it."
- "FirstNet's cost estimate, including the assumptions it is based on, are not public because of the highly sensitive nature of the information it contains."
- "We did not assess FirstNet's cost estimate against all the characteristics established in our Cost Estimating and Assessment Guide. Specifically, we did not assess whether FirstNet's estimate was 'credible' or 'accurate' because the estimate and its associated documentation were deemed business sensitive."
- "We did not analyze the quantitative input and output of the cost model because the data included procurement sensitive information, and we would therefore be unable to report our findings in a public report."
- "Therefore we cannot say if the estimate is in line with the credible and accurate characteristics of our Cost Estimating and Assessment Guide."[66]

[65] The early builder projects refer to four recipients of BTOP (Broadband Technology Opportunities Program) grants from the NTIA that also qualified for temporary sub-leases of the spectrum license held by FirstNet as well as Harris County, TX, which qualified for a license but did not receive a BTOP grant. These programs are intended to provide valuable lessons for FirstNet as it prepares to deploy nationwide. The four early builders with BTOP grants are Los Angeles County, CA (LA-RICS); Adams County, CO; New Jersey; and New Mexico. Three recipients with BTOP grants that did not qualify as early builders are Charlotte, NC; San Francisco, CA; and Mississippi. More information regarding the early builders is on the FirstNet website and in its FY2014 *Annual Report to Congress*. Information on BTOP grant programs appears in CRS Report R41775, *Background and Issues for Congressional Oversight of ARRA Broadband Awards*, by Lennard G. Kruger.

[66] GAO, *Public-Safety Broadband Network: FirstNet Should Strengthen Internal Controls and Evaluate Lessons Learned*, GAO-15-407, April 2015, p. 32, at http://www.gao.gov/assets/670/669861.pdf.

OIG Report on FirstNet

Criticism by a member of the board of FirstNet, in April 2013—regarding a lack of transparency in information provided to the board, and other issues—led to a review of practices by the Office of Inspector General (OIG.).[67] The primary focus of the review had two main objectives, to determine whether the Department of Commerce (DOC)

- had adequate processes in place to ensure that FirstNet Board members properly filed financial disclosures and identified potential conflicts of interest; and
- used appropriate contracting processes and requirements.

The overall finding is that some monitoring procedures were inadequate, including, for example, a finding that "FirstNet contracting practices lacked transparent award competition, sufficient oversight of hiring, adequate monitoring, and procedures to prevent erroneous costs.... "[68]

In its review, the OIG looked at the roles of the NTIA, the DOC Office of General Counsel, and two agencies within DOC that were assigned direct responsibilities to assist FirstNet; the Bureau of Census and NIST were asked to award and manage contracts with outside entities to provide assistance to FirstNet. The OIG did not specifically review activities of the NTIA Office of Public Safety Communications, created to assist FirstNet with administrative tasks, including staffing.

The OIG review determined that nearly $11 million had been inappropriately spent, much of it going for consulting work that did not meet contractual definitions of deliverables. The OIG referred to this consulting work as "work products" and questioned the expenditures. The DOC responded that it conducted relevant contracting activities in accordance with federal procurement laws and regulations and monitored performance, and that the contracts produced "first-rate feasibility research, technical analysis, strategic planning, and outreach services from highly specialized consultants, whose work product has laid the groundwork for executing FirstNet's mission."[69]

The OIG made recommendations to the Secretary, the General Counsel, the Chair of FirstNet, and the DOC's Senior Procurement Official regarding various procedures and responsibilities. A joint response from FirstNet, the NTIA, and the General Counsel concurred with the specific recommendations from the OIG, although not all the findings. In general, they defended their actions in the context of unique requirements and time constraints in setting up FirstNet.

The OIG review covered a limited range of issues linked to oversight procedures. Although it did not go into detail, the OIG noted "inconsistent administration"[70] and several instances of significant time lags in the performance of DOC officials. For example, "6 months after the Board began regular meetings, senior NTIA and Office of General Consel officials were still debating [the monitoring] of potential conflicts of interest."[71] OIG found that most of the lapses occurred in the year after the FirstNet board held its first official meeting in September 2012. The

[67] OIG, First Responder Network Authority: FirstNet Must Strengthen Management of Financial Disclosures and Monitoring of Contracts, Final Report No. OIG-15-013-A, December 5, 2014, at http://www.oig.doc.gov/OIGPublications/OIG-15-013-A.pdf.

[68] Ibid., cover memorandum.

[69] Ibid., p. 36.

[70] Ibid., p. 5.

[71] Ibid., p. 6.

review observed that "neither a business plan nor a network plan were completed or delivered to FirstNet during the 1-year performance period of the contracts.... "[72]

The OIG has established a team to audit and evaluate FirstNet activities. Additionally, it operates a fraud, waste, and abuse hotline for the Department of Commerce, which has received complaints regarding FirstNet. The OIG conducts follow-up on these complaints.[73]

Discussion of Other Provisions in the Spectrum Act to Improve Public Safety Communications

Following is a discussion of major provisions in the act that pertain to public safety communications, including provisions to improve the nation's 911 emergency call system.[74]

Among federal agencies designated by the act to provide consultation and support are the Federal Communications Commission (FCC), the National Telecommunications and Information Administration (NTIA), the National Institute of Standards and Technology (NIST), and the Office of Emergency Communications (OEC). The FCC manages commercial and non-federal spectrum use, including spectrum allocated to public safety. The NTIA manages federal spectrum resources and, along with NIST, is an agency within the Department of Commerce. OEC is part of the Office of Cybersecurity and Communications, Department of Homeland Security.

Spectrum Assignment

Radio frequency spectrum is an essential resource for wireless communications. The energy in electronic telecommunications transmissions converts airwaves into signals to deliver voice, text, and images. These signal frequencies are allocated for specific purposes, such as television broadcasting or WiFi,[75] and assigned to specific users through licenses. Allocating sufficient spectrum for wireless emergency communications has long been a concern for Congress. The Balanced Budget Act of 1997 (P.L. 105-33), for example, directed the FCC to allocate 24 MHz[76] of spectrum in the 700 MHz band for public safety use.[77]

With the passage of the Spectrum Act, some existing public safety licenses in the 700 MHz band[78] and an additional license for commercial use (known as the D Block)[79]—together totaling

[72] Ibid., p. 12.

[73] Hearing, Senate Committee on Commerce, Science, and Transportation, "Three Years Later: Are We Any Closer to a Nationwide Public Safety Network," March 11, 2015: testimony of The Honorable Todd J. Zinser, Inspector General, U.S. Department of Commerce at http://www.commerce.senate.gov/public/index.cfm?p=Hearings&ContentRecord_id=25dedd7c-815b-4b3d-a420-4f4324d01041&Statement_id=ec8d2396-ecd6-4787-bcc6-6c0152203066&ContentType_id=14f995b9-dfa5-407a-9d35-56cc7152a7ed&Group_id=b06c39af-e033-4cba-9221-de668ca1978a&MonthDisplay=3&YearDisplay=2015.

[74] The information in this and following sections has appeared in earlier versions of this report.

[75] WiFi, for wireless fidelity, operates on unlicensed frequencies that are not assigned to a specific owner but instead are available to support any device approved by the FCC.

[76] Spectrum is segmented into bands of radio frequencies and typically measured in cycles per second, or hertz. Standard abbreviations for measuring frequencies include kHz—kilohertz or thousands of hertz; MHz—megahertz, or millions of hertz; and GHz—gigahertz, or billions of hertz. The 700 MHz band includes radio frequencies from 698 MHz to 806 MHz.

[77] 47 U.S.C. §309 (j) (14).

[78] 763-768 MHz, 793-798 MHz, 768-769 MHz and 798-799 MHz.

[79] 758-763 MHz and 788-793 MHz; P.L. 112-96, Section 6001, (2).

22 MHz—have been re-designated by Congress for a federal license for paired spectrum at 758-768 MHz and 788-798 MHz, plus guard bands at 768-769 MHz and 798-799 MHz to mitigate interference from adjacent channels. As required by the act, the initial, 10-year license to use these frequencies was assigned by the FCC to FirstNet. It is renewable for an additional 10 years, on condition that FirstNet has met its duties and obligations under the act.[80]

A total of 34 MHz of spectrum capacity will therefore be available for public safety networks within the 700 MHz band: the 22 MHz designated for broadband, and 12 MHz allocated for narrowband communications, primarily voice.[81] Additionally, there are public safety networks on adjacent frequencies within the 800 MHz band. Time and technological advances may someday bring these spectrum assets together, but at present there are three distinct public safety network technologies in use or planned within the 700 MHz and 800 MHz bands. These are broadband communications at 700 MHz; interoperable narrowband communications at 700 MHz; and narrowband communications at 800 MHz. Some of the narrowband networks at 700 MHz and 800 MHz can share infrastructure and radios but older narrowband networks at 800 MHz are often not easily integrated with narrowband networks being built on 700 MHz frequencies.

All of the 700 MHz band spectrum allocated for public safety use can support broadband networks. At present, however, there is no tested technology to deliver voice communications over LTE broadband that meets first responder requirements. New technology that provides push-to-talk voice connections over LTE is likely to be available by the end of 2016.[82] The act also gives the FCC the authority to "... allow the narrowband spectrum to be used in a flexible manner, including usage for public safety broadband communications.... " subject to technical and interference protection measures.[83] States, therefore, might be able to convert some existing narrowband networks to broadband use in addition to service from FirstNet.

The act requires that public safety users return frequencies known as the T-Band.[84] These are frequencies between 470 and 512 MHz allocated for television that have been made available for public safety use in 11 urban areas.[85] Since the transition to digital television, radio transmissions on some of these frequency assignments have experienced interference and the public safety agencies that use them are considering moving to new networks at 700 MHz. Other areas have recently invested to upgrade networks built on the T-Band frequencies and are concerned about the loss of this communications capacity. The act requires that the FCC act by February 2021 to establish a relocation plan that would free up the T-Band for reassignment through competitive bidding. Proceeds from the auctions of T-Band frequencies are to be available for grants to cover relocation costs.[86] There are no requirements in the law as to how the NTIA, the designated grants

[80] P.L. 112-96, Section 6201.

[81] 769-775 MHz and 799-805 MHz.

[82] Push-to-talk—walkie-talkie—provides the capability for group communications. 3GPP, the international standards group for LTE, has announced that mission-critical voice communications will be available over LTE networks in 2016. See Donny Jackson, "LTE Standards Group Targeting Mission-Critical Push-to-Talk Voice Spcifications for Early 2016," *Urgent Communications*, February 12, 2015, http://urgentcomm.com/3gpp/lte-standards-group-targeting-mission-critical-push-talk-specifications-early-2016?NL=UC-03&Issue=UC-03_20150212_UC-03_140&sfvc4enews=42&cl=article_2_b&YM_RID=CPEQW000001101112&YM_MID=2611.

[83] P.L. 112-96, Section 6102.

[84] P.L. 112-96, Section 6103.

[85] Metropolitan areas: Boston, MA; Chicago, IL; Dallas/Fort Worth, TX; Houston, TX; Los Angeles, CA; Miami, FL; New York, NY/Newark NJ; Philadelphia, PA; Pittsburgh, PA; San Francisco/Oakland, CA; and Washington, DC.

[86] The National Public Safety Telecommunications Council (NPSTC) prepared a report that provided an overview of T-Band assignments, some of the problems created by the act's requirements, and possible alternative solutions. NPSTC, *T-Band Report*, March 15, 2013; link to PDF at http://www.npstc.org/, "NPSTC Releases T Band Report."

administrator, is to structure the grant program or determine eligible costs, although the agency might decide to follow procedures for reallocating federal spectrum.

Some of the earliest spectrum assignments for public safety are in channels below 512 MHz. Public safety and other license-holders in designated channels below 512 MHz are required to reband their holdings to conform to an FCC mandate to improve spectrum efficiency.[87] This narrowbanding requirement, as it is called, requires that assigned channels be reduced from a width of 25 khz to 12.5 khz, thereby freeing up new spectrum capacity for public safety and other uses. The deadline to meet the narrowbanding requirement was January 1, 2013. To accommodate public safety license holders in the T-Band that now fall under requirements established in the act, the FCC has ruled to exempt them from the narrowbanding requirements.[88]

Expenditures and Revenue Sources

The cost of building a new wireless communications network with nationwide coverage is likely to be in the tens of billions of dollars.[89] Most of these costs are for building, maintaining, and operating the Radio Access Network (RAN). To meet these costs, the expectation is that FirstNet will have access to existing infrastructure for some of the network's components and that it will be able to invest through partnerships—with commercial wireless carriers or other secondary users of its spectrum and infrastructure—that generate revenue. However, building and operating essential elements of the core services of the network (Evolved Packet Core) are estimated by industry experts to be in the low millions of dollars.[90]

The Spectrum Act provides over $7 billion in funding directed to FirstNet and to states, either as direct transfers or as grants. There was an initial loan of $2 billion (repayable from spectrum-license auction proceeds) to set up FirstNet and begin its operation.[91] The remaining $5 billion became available as auctions for spectrum licenses were concluded and the revenues deposited in the Public Safety Trust Fund. The full amount of the federal funding commitment has been covered by auction revenue.

Public Safety Trust Fund

The law provides for transfers from a Public Safety Trust Fund, which is established in the Treasury by the act, to receive revenues from designated auctions of spectrum licenses.[92] The designated amounts are to remain available through FY2022, after which any remaining funds are to revert to the Treasury, to be used for deficit reduction. Auction proceeds are to be distributed in the following order of priority:

[87] Details at http://transition.fcc.gov/pshs/public-safety-spectrum/narrowbanding.html.

[88] FCC, "Waiver of Narrowbanding Deadlines for T-Band (470-512 MHz) Licenses," Docket No. WT 99-87, released April 26, 2012.

[89] Some cost estimates for building and operating a public safety broadband network are provided by GAO in *Preliminary Information on FirstNet's Efforts to Establish a Nationwide Broadband Network*, March 11, 2015, at http://www.commerce.senate.gov/public/?a=Files.Serve&File_id=782a6761-b54b-4e6b-918d-6bd28b287f34.

[90] Elements needed for a nationwide, redundant, load-sharing network core would include the key control node (Mobility Management Entity, MME); Serving Gateway; and Packet Data Network Gateway. Source: "LTE and Beyond," January 7, 2012, at http://www.lteandbeyond.com/2012/01/functions-of-main-lte-packet-core.html.

[91] P.L. 112-96, Section 6207.

[92] P.L. 112-96, Section 6413.

- To the NTIA, to reimburse the Treasury for funds advanced to cover the initial costs of establishing FirstNet: not to exceed $2 billion.
- To the State and Local Implementation Fund for a grant program: $135 million.
- To the Network Construction Fund for costs associated with building the nationwide network and for grants to states that qualify to build their own networks: $7 billion, reduced by the amount advanced to establish FirstNet.
- To NIST for public safety research: $100 million.
- To the Treasury for deficit reduction: $20.4 billion.
- To the NTIA and the National Highway Traffic Safety Administration for a grant program to improve 911 services: $115 million.
- To NIST for public safety research, phase two: $200 million.
- To the Treasury for deficit reduction: any remaining amounts from designated auction revenues.

In compliance with the act, the FCC conducted two auctions in 2014-2015 (Auctions 96 and 97) that generated sufficient revenue to meet the funding requirements of the act summarized above.[93]

FirstNet: Limit on Expenditures

The act caps FirstNet's administrative expenses at $100 million in total over the first 10 years of operation. Costs attributed to oversight and audits are not included in the expense cap.[94]

FirstNet: Fee Income and Other Revenue

Congress gave FirstNet the authority to obtain grants, and to receive payment for the use of network capacity licensed to FirstNet and of network infrastructure "constructed, owned, or operated" by FirstNet.[95] Specifically, FirstNet is authorized to collect network user fees from public safety and secondary users[96] and to receive payments under leasing agreements in public-private partnerships.[97] These partnerships may be formed between FirstNet and a secondary user for the purpose of constructing, managing, and operating the network. The agreements may allow access to the network on a secondary basis for services other than public safety.[98] The act requires that these fees be sufficient each year to cover annual expenses of FirstNet to carry out required activities,[99] with any remaining revenue going to network construction, operation, maintenance, and improvement.[100] There is a prohibition on providing service directly to consumers; this does not impact the right to collect fees from a secondary user or enter into leasing agreements.[101]

[93] For additional information on the auctions, see CRS Report R44433, *Framing Spectrum Policy: Legislative Initiatives*, by Linda K. Moore.

[94] P.L. 112-96, Section 6207 (b).

[95] P.L. 112-96, Section 6206 (b) (4).

[96] P.L. 112-96, Section 6208 (a) (1).

[97] P.L. 112-96, Section 6208 (a) (2).

[98] P.L. 112-96, Section 6208 (a) (2) (B).

[99] P.L. 112-96, Section 6208 (b).

[100] P.L. 112-96, Section 6208 (d).

[101] P.L. 112-96, Section 6212.

Planning Authority

The Spectrum Act created FirstNet as an independent entity within the NTIA. FirstNet is required to plan for and establish an interoperable broadband network for public safety. The act requires that state and local agencies and tribal authorities have a consulting role in the development, deployment, and operation of the nationwide network. The act further provides an opportunity for states to plan and build their own Radio Access Networks within the framework of the nationwide broadband network.[102] Unless renewed, this authority expires in 2027.[103]

When Congress creates an independent entity within the federal government, it may have the obligation to achieve a specific goal, usually within a specific time frame.[104] As an independent entity, FirstNet—the First Responder Network Authority—has been given both goals and timeframes. It has been instructed by Congress to exercise all powers specifically granted by the act and "such incidental powers as shall be necessary"[105] to create a nationwide broadband network for public safety. The law requires FirstNet to become a self-funding entity, independent of government subsidies.[106] FirstNet is to take "all actions necessary to ensure the building, deployment, and operation" of the network in consultation with federal, state, tribal, and local public safety entities, the Director of NIST, the FCC, and the public safety advisory committee.[107] FirstNet appears therefore to be an autonomous organization, with broad powers to carry out its mandate, within the requirements established by the law. It has, for example, sole power to select the program's manager and its agents, consultants, and other experts subject to the requirement that they be chosen "in a fair, transparent, and objective manner."[108] However, FirstNet, except for certain exemptions provided in the act, must follow federal agency requirements, notably in hiring and procurement, slowing down the process for establishing FirstNet as a going concern.[109]

FirstNet is headed by a board of 15 members of which 12 are appointed by the Secretary of Commerce according to criteria established by the act, which are intended to provide both representation from key stakeholders and expertise. The other three members of the board are designees of the Secretary of the Department of Homeland Security, the Attorney General of the United States, and the Director of the Office of Management and Budget. The Secretary of Commerce is required to appoint a chairman of the board for an initial term of two years.[110]

As part of its management of the network, FirstNet is required, at a minimum:

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[102] Current information on FirstNet's activities, including network design and state planning, is available at http://www.firstnet.gov.

[103] P.L. 112-96, Section 6206 (f).

[104] For examples, see CRS Report RS22230, *Congressional or Federal Charters: Overview and Enduring Issues*, by Henry B. Hogue.

[105] P.L. 112-96, Section 6206 (a) (1).

[106] P.L. 112-96, Section 6208.

[107] P.L. 112-96, Section 6206 (b) (1).

[108] P.L. 112-96, Section 6205 (b) (1).

[109] Hearing, House Committee on Energy and Commerce, Subcommittee on Communications and Technology, "Oversight of FirstNet and the Advancement of Public Safety Wireless Communications," testimony of Samuel Ginn, Chairman, FirstNet, November 21, 2013.

[110] P.L. 112-96, Section 6204.

- To establish network policies, including development of detailed requests for proposals to build the network, and operational matters such as terms of service and billing practices.[111]
- To consult with states on network-related expenditures, as part of the preparation of policies and requests for proposals.[112]
- To enter into agreements to use existing communications infrastructure, including commercial and federal infrastructure, "to the maximum extent economically desirable."[113]
- To ensure the construction, maintenance, operation, and improvement of the broadband network, taking into account new and evolving technologies.[114]
- To enter into agreements with commercial networks to allow public safety roaming on their networks.[115]
- To represent the interests of the network's users before standards-setting boards, in consultation with NIST, the FCC, and its own Public Safety Advisory Committee.[116]

FirstNet is required to create a public safety advisory committee to assist in carrying out its mandate.[117] There are no requirements in the statute as to the composition of the committee. By-laws adopted at the organizing meeting of the FirstNet Board of Directors on September 25, 2012, created a Public Safety Advisory Committee.[118] It was further agreed that the members of the committee would be chosen from the Advisory Committee to SAFECOM, within the Department of Homeland Security, in consultation with the Secretary of Homeland Security. The organizations chosen to be represented on the committee were announced on February 20, 2013.[119] State and local government interests are represented through a subcommittee of PSAC.

Statutory Obligations

Examples of statutory obligations for Congress and the Administration in the direction of FirstNet include the following.

Membership on FirstNet board. The members of the FirstNet board are to be chosen by the Secretary of Commerce, within the parameters established in the act. The Department of Homeland Security, the Attorney General, and the Office of Management and Budget each have one member on the board in permanence. The Secretary of Commerce is required to appoint a chairman of the board for an initial term of two years.[120]

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[111] P.L. 112-96, Section 6206 (c) (1).

[112] P.L. 112-96, Section 6206 (c) (2).

[113] P.L. 112-96, Section 6206 (c) (3).

[114] P.L. 112-96, Section 6206 (c) (4).

[115] P.L. 112-96, Section 6206 (c) (5).

[116] P.L. 112-96, Section 6206 (c) (7).

[117] P.L. 112-96, Section 6205 (a).

[118] Board Resolution 1, By-Laws, http://www.ntia.doc.gov/files/ntia/publications/firstnet_resolution_no._1_on_bylaws_adopted_9.25.12.pdf.

[119] NTIA, "FirstNet Names members of Public Safety Advisory Committee," February 20, 2013, http://www.ntia.doc.gov/press-release/2013/firstnet-names-members-public-safety-advisory-committee.

[120] P.L. 112-96, Section 6204.

Grant programs for planning. The NTIA is to establish and administer the State and Local Implementation Fund. Grant provisions are to be decided in consultation with FirstNet,[121] but not necessarily in accordance with decisions made by the FirstNet board and executive management.

Grant programs for state networks. The NTIA is to administer grants from the Network Construction Fund to states that qualify to build their own Radio Access Networks and choose to apply for a grant.[122]

Funding for FirstNet and participating states through the Network Construction Fund. The NTIA is to determine the funding level available to each state for the buildout of the nationwide broadband network, if the state chooses to participate in FirstNet.[123]

Spectrum leases for state networks. The NTIA sets the terms and is responsible for enforcing the requirement that states qualifying to build their Radio Access Networks must sublease spectrum through FirstNet, the assigned license-holder.[124]

License review. The FCC is required to review the initial 10-year license assigned to FirstNet and consider its renewal based on performance criteria.[125]

Performance review. The Government Accountability Office (GAO), within 10 years, is to prepare a report providing recommendations on "what action Congress should take" regarding the mandated termination of authority of FirstNet in 2027.[126]

Fee schedule. The NTIA is to review and approve the annual schedule of fees charged to public safety agencies and other users for access to FirstNet's resources.[127]

Annual audit. The Secretary of Commerce is to contract for an annual audit of FirstNet's finances and activities. The reports are to be submitted to Congress, the President, and FirstNet.[128]

Report to Congress. FirstNet is required to submit annual reports to Congress on its "operations, activities, financial conditions, and accomplishments."[129] The designated appropriate congressional committees are, in the Senate, the Committee on Commerce, Science, and Transportation; in the House, the Committee on Energy and Commerce.[130]

Although there are several platforms for oversight and guidance provided in the act, it seems likely that the primary, day-to-day responsibility for monitoring progress will fall to the NTIA. Agency discretion for funding states that participate in FirstNet and for providing grants to states that opt out is authorized by the act. The $7 billion grant to the Network Construction Fund is implicitly divided into three parts: one funding FirstNet to establish the network; one funding states that participate in FirstNet; and one funding states that choose to opt out. Clauses that may have been intended to oversee state expenditures might be construed by the NTIA to include

[121] P.L. 112-96, Section 6302 (a).

[122] P.L. 112-96, Section 6302 (e) (3) (C) (iii) (I).

[123] P.L. 112-96, Section 6302 (e) (1) (C).

[124] P.L. 112-96, Section 6302 (e) (3) (C) (iii) (II).

[125] P.L. 112-96, Section 6201 (b).

[126] P.L. 112-96, Section 6206 (g).

[127] P.L. 112-96, Section 6208 (c).

[128] P.L. 112-96, Section 6209.

[129] P.L. 112-96, Section 6210.

[130] P.L. 112-96, Section 6001 (3).

FirstNet. The act, however, does not provide guidance to the NTIA on how to balance fiduciary caution with entrepreneurial initiative in assuring a flow of funds to FirstNet.

Timeframe

The requirements of the Spectrum Act must be substantially met and the viability of the project demonstrated no later than the end of FY2022, if not sooner. The State and Local Implementation Fund and the Network Construction Fund expire in 2022, with any balances reverting to the Treasury. By 2022, GAO must have assessed the performance of FirstNet and provided a report to Congress; and the FCC must decide whether or not to renew the licenses for the public safety broadband network. Within this 10-year timeframe, there are few deadlines beyond requirements for the initial establishment of the planning and implementation framework.

Many of the important steps for building the network have no required deadline. Some milestones, such as rural coverage, are mandated in the act, but the deadlines are not specified. There are, for example, no deadlines in provisions that require FirstNet to:

- Develop requests for proposals that include a requirement for timetables.[131]
- Consult with states on establishing state and local planning processes.[132]
- Complete the request for proposal process that is to be given to each state governor regarding the request for proposal and its details, and the funding level for each state as determined by the NTIA.[133]

Mandated deadlines for states include

- Within 90 days of receipt of notice from FirstNet, the governor shall choose either to participate in deployment of FirstNet or to conduct its own Radio Access Network deployment within the state.[134]
- Within 180 days of giving notice to opt out of FirstNet, the governor shall complete requests for proposals for a state network.[135]

No deadline is established in the statute for the FCC to approve or disapprove state proposals for their own portion of the nationwide broadband network.[136] There are also no specified deadlines for a state to apply to the NTIA for a grant to construct the Radio Access Network and to lease spectrum capacity from FirstNet, if FCC approval is received for a state network.[137] However, one condition of eligibility for a grant to a state to build its own Radio Access Network is that the state's plan must demonstrate "the ability to complete the project within specified comparable deadlines.... "[138]

[131] P.L. 112-96, Section 6206, (c) (1).

[132] P.L. 112-96, Section 6206, (c) (2).

[133] P.L. 112-96, Section 6302 (e) (1).

[134] P.L. 112-96, Section 6302, (e) (2).

[135] P.L. 112-96, Section 6302, (e) (3) (B).

[136] P.L. 112-96, Section 6302 (e) (3) (C) (i).

[137] P.L. 112-96, Section 6302, (e) (3) (C) (iii).

[138] P.L. 112-96, Section 6302, (e) (3) (D) (i) (III).

Next Generation 9-1-1

Today's 911 system is built on an infrastructure of analog technology that does not support many of the features that most Americans expect to be part of an emergency response. Efforts to splice newer, digital technologies onto this aging infrastructure have created points of failure where a call can be dropped or misdirected, sometimes with tragic consequences. Callers to 911, however, generally assume that the newer technologies they are using to place a call are matched by the same level of technology at the 911 call centers, known as Public Safety Answering Points (PSAPs). However, this is not always the case. To modernize the system to provide the quality of service that approaches the expectations of its users will require that the PSAPs and state, local, and possibly federal emergency communications authorities invest in new technologies. As envisioned by most stakeholders, these new technologies—collectively referred to as Next Generation 911 or NG9-1-1—should incorporate Internet Protocol standards. An IP-enabled emergency communications network that supports 911 will facilitate interoperability and system resilience; improve connections between 911 call centers; provide more robust capacity; and offer flexibility in receiving and managing calls. The same network can also serve wireless broadband communications for public safety and other emergency personnel, as well as other purposes.

Recognizing the importance of providing effective 911 services, Congress has previously passed three major bills supporting improvements in the handling of 911 emergency calls. The Wireless Communications and Public Safety Act of 1999 (P.L. 106-81) established 911 as the number to call for emergencies and gave the Federal Communications Commission (FCC) authority to regulate many aspects of the service. The most recent of these laws, the NET 911 Improvement Act of 2008 (P.L. 110-283), required the preparation of a National Plan for migrating to an IP-enabled emergency network. Responsibility for the plan was assigned to the E-911 Implementation Coordination Office (ICO), created to meet requirements of an earlier law, the ENHANCE 911 Act of 2004 (P.L. 108-494). Authorization for the ICO terminated on September 30, 2009. ICO was jointly administered by the National Telecommunications and Information Administration and the National Highway Traffic Safety Administration.

Spectrum Act provisions re-establish the federal 9-1-1 Implementation Coordination Office (ICO) to advance planning for next-generation systems and to administer a grant program.[139] ICO is to provide matching grants to eligible state or local governments or tribal organizations for the implementation, operation, and migration of various types of 911 and IP-enabled emergency services, and for public safety personnel training.[140] States that have diverted fees collected for 911 services are not eligible for grants under the program.[141]

Provisions in the act regarding 911 programs include

- GAO is required to study how states assess fees on 911 services and how those fees are used.[142]
- The General Services Administration is required to prepare a report on 911 capabilities of multi-line telephone systems in federal facilities and the FCC

[139] P.L. 112-96, Section 6503, "Section 158 "(a).

[140] P.L. 112-96, Section 6503, "Section 158 "(b).

[141] P.L. 112-96, Section 6503, "Section 158 "(c).

[142] P.L. 112-96, Section 6505.

is to seek comment on the feasibility of improving 911 identification for calls placed through multi-line telephone systems.[143]

- The FCC is to assess the legal and regulatory environment for development of NG9-1-1 and barriers to that development, including state regulatory roadblocks.[144] The FCC is also to (1) initiate a proceeding to create a specialized Do-Not-Call registry for public safety answering points, and (2) to establish penalties and fines for autodialing (robocalls) and related violations.[145]
- ICO, in consultation with NHTSA and DHS is to report on costs for requirements and specifications of NG9-1-1 services, including an analysis of costs, and assessments and analyses of technical uses.[146]
- Immunity and liability protections are provided—to the extent consistent with specified provisions of the Wireless Communications and Public Safety Act of 1999—for various users and providers of Next Generation 911 and related services, including for the release of subscriber information.[147]

The act also requires FirstNet to promote integration of the nationwide public safety broadband network with PSAPs.[148] Draft proposals consider PSAPs as customers of FirstNet[149] but do not specifically discuss the integration of NG-9-1-1 infrastructure into the FirstNet network.

Roaming and Priority Access Within the 700 MHz Band

In its *National Broadband Plan*, the FCC indicated that it wanted to make commercial networks in the 700 MHz band available for public safety use and requested that Congress confirm the FCC's authority to act.[150] The Spectrum Act provides the FCC with statutory authority to establish rules in the public interest to improve the ability of public safety networks to roam on commercial space and to gain priority access.[151]

FirstNet is empowered by the act to enter into agreements with commercial providers that would allow public safety network users to roam on partnering networks.[152] The act does not state whether roaming agreements may be negotiated by states that opt out and receive spectrum leases from the NTIA to operate their own Radio Access networks. Agreements might also cover rules for priority access in times of high demand for network capacity. Priority access can take several forms, such as "ruthless pre-emption," in which non-public-safety transmissions are immediately terminated to make way for emergency communications, or negotiated priority agreements that might, for example, place public safety users at the head of the line for network access as capacity becomes available. The act stipulates that the FCC's authority may not require roaming or priority access unless (1) the public safety and commercial networks are technically compatible; (2) the

[143] P.L. 112-96, Section 6504.

[144] P.L. 112-96, Section 6509.

[145] P.L. 112-96, Section 6507.

[146] P.L. 112-96, Section 6508.

[147] P.L. 112-96, Section 6506.

[148] P.L. 112-96, Section 6206 (b) (2) (C).

[149] FirstNet, *Special Notice*, "Operational Architecture Functional Descriptions," Figure 1 and Figure 2.

[150] FCC, *Connecting America: The National Broadband Plan*, http://www.broadband.gov/download-plan/.

[151] P.L. 112-96, Section 6211.

[152] P.L. 112-95, Section 6206 (c) (5).

commercial network is reasonably compensated; and (3) access does not preempt or otherwise terminate or degrade existing traffic on the commercial network.[153] Within these limits, the FCC appears to have some leeway to use its regulatory authority to support public safety in negotiations with partners. The FCC cannot, under the act, mandate ruthless pre-emption, although the act does not preclude contractual negotiations that would allow it.

The act's provisions for roaming and priority access do not require a commercial vendor to make additional investments to insure technical compatibility, and the act's language might be interpreted as precluding an FCC mandate to that effect. Interpretation and enforcement of the compatibility provision may pose an obstacle to achieving desired levels of network interoperability and cross-network roaming because existing technical standards for the 700 MHz band might preclude affordable full-spectrum roaming, that is, the ability of any network within the 700 MHz to roam on any other network within the 700 MHz band. Full-spectrum roaming is considered by many to provide advantages for public safety and also for the public at large. For example, it makes more network capacity available for shared emergency communications of all types, not just for first responders. Many believe that full-spectrum access supports competitiveness among wireless carriers—in particular assisting small wireless carriers serving rural areas to offer new broadband services—by providing access to all customers within the band.

Achieving full-spectrum roaming on the 700 MHz band requires modifications of technical requirements for LTE, the preferred technology for mobile broadband within the 700 MHz band. The FCC has taken actions in support of full-spectrum roaming,[154] including steps to implement a voluntary industry agreement to establish interoperability for LTE in the lower 700 MHz band.[155] Establishing additional standards to enable full-spectrum interoperability will permit interoperability among all commercial carriers and public safety agencies.

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[153] P.L. 112-96, Section 6211.

[154] FCC, "Promoting Interoperability in the 700 MHZ Commercial Spectrum," Notice of Proposed Rulemaking, WT Docket No. 12-69, released March 21, 2012.

[155] FCC, "Report and Order and Order of Proposed Modification," WT Docket No. 12-69, released October 29, 2013.