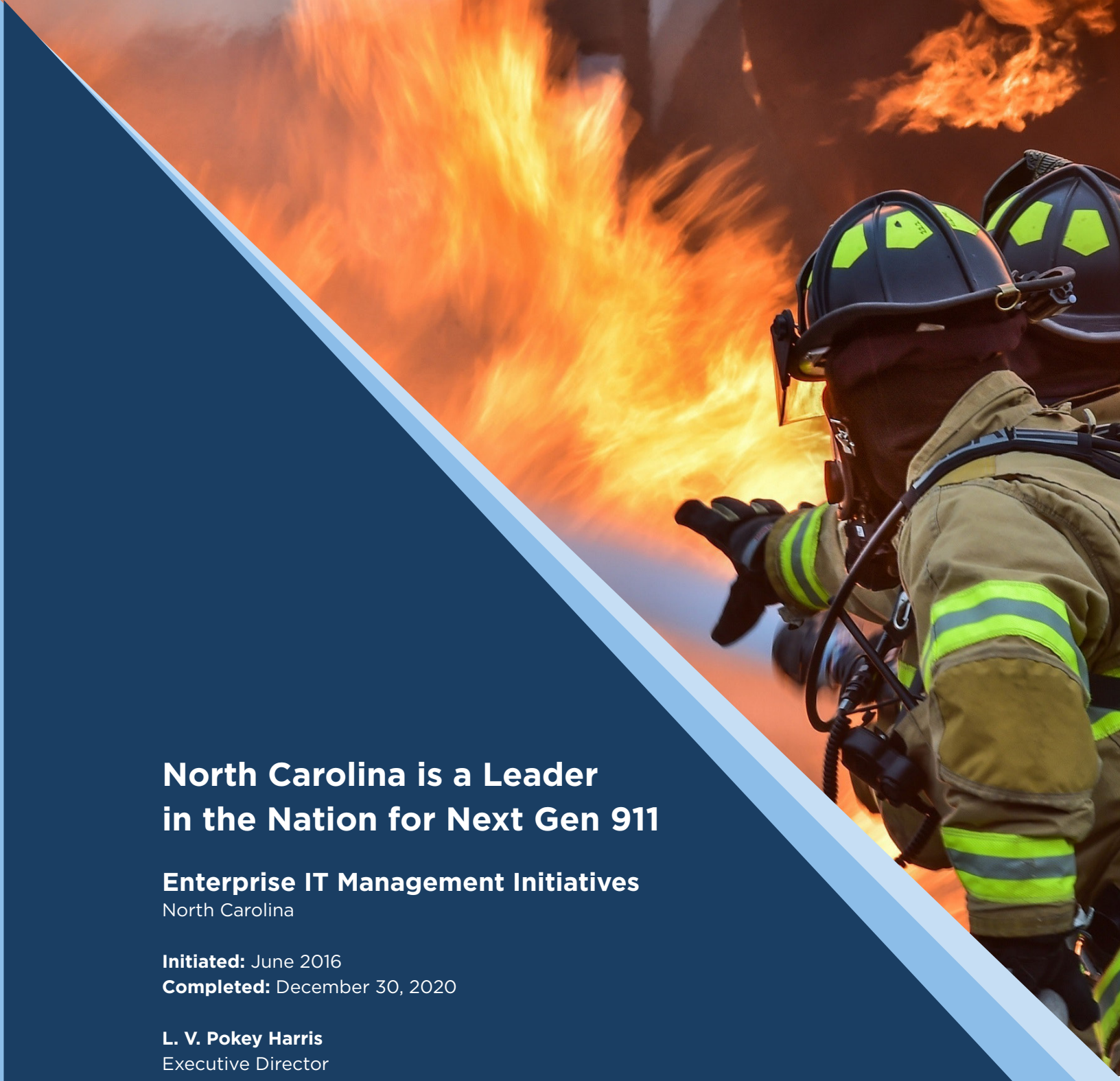

North Carolina is a Leader in the Nation for Next Gen 911

Enterprise IT Management Initiatives

North Carolina

Initiated: June 2016
Completed: December 30, 2020

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Broadband Infrastructure Office

EXECUTIVE SUMMARY

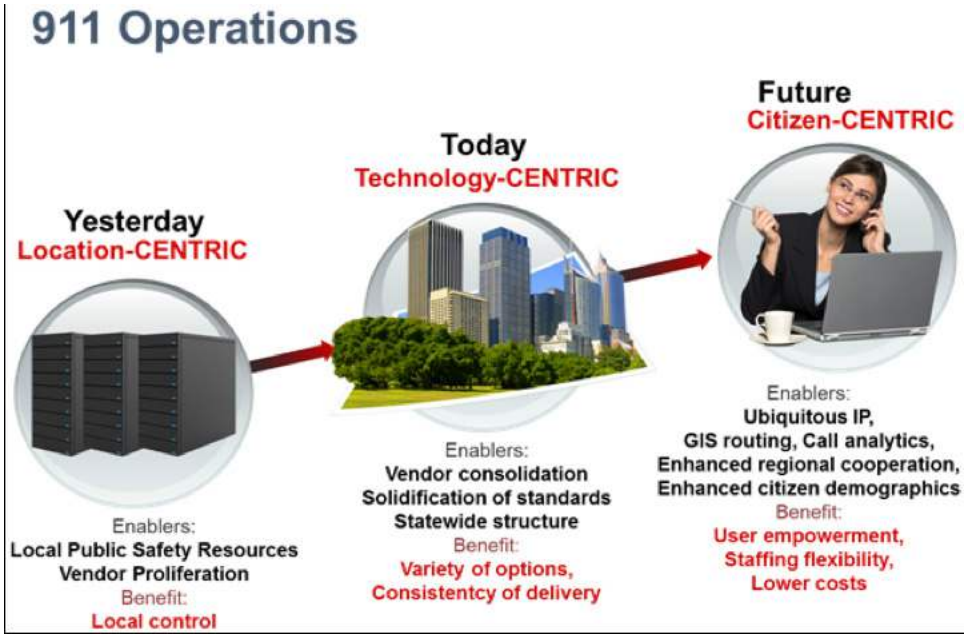
In an emergency, people need immediate access to 911 for assistance. Communications technologies have changed, and we now rely heavily on texts, instant messages and Voice over Internet Protocol (VoIP) services. Legacy 911 service is not natively capable of managing these types of communications. As the public shifts to these technologies, emergency services across the country have no choice but to update their technologies to the next generation of 911 services (NG911). In North Carolina, approximately 80% of 911 callers are on mobile devices. North Carolina's NG911 network is based on the National Emergency Number Association's (NENA) i3 standard, which defines location accuracy, allowing emergency services to pinpoint a caller's location. This ability, called geospatial call routing, allows emergency services to be dispatched with greater accuracy and improved response times. All public safety answering points (PSAPs) are migrating to the NG911 Emergency Services Internet Protocol Network (ESInet) and are utilizing this standard.

North Carolina's 911 Board chose to take a hosted, managed service approach to the migration to NG911 and is a leader in the nation in the deployment of i3-based NG911 services. The board contracted with AT&T and GeoComm, Inc. to implement the service.

The ESInet and hosted call handling solution has substantially improved the geo-location accuracy of all 911 cellular and landline calls and adds the ability to handle text messages and eventually video messages. The ESInet also provides high-speed data network connections that enable every 911 center to serve as a backup for any other center in the state in the event of a natural disaster or an overload of emergency calls.

On November 13, 2018, Durham 911 became the first PSAP in the nation to transition to a cloud-hosted ESInet and hosted call handling solution.

As of December 31, 2020, 66 of the 127 PSAPs had implemented NG911 call handling solutions and were fully functional on the new ESInet, compared to a total of 33 at the end of 2019. All remaining PSAPs are in the process of migrating to the NG911 suite of services, and the Board anticipates all PSAPs will be live by December 2021.



IDEA

The North Carolina 911 Board was established in law in 1988 to integrate the state's 911 system and oversee 911 funding and expenditures. Since then, the board has worked to ensure that the best possible emergency services responses are provided across the state, including new features, functionalities and applications that address a changing technical landscape and meet the needs of North Carolinians. The board is responsible for ensuring that these services are provided and managed efficiently and cost-effectively with the goal of lowering ongoing operating costs while also improving service delivery. This requires making public safety answering points (PSAPs) more accessible to the public to resolve emergencies faster, and as a result, resolve more of them. If calls are received, managed and dispatched faster, PSAPs can serve more people and ultimately save more lives.

Citizens and businesses are increasingly dependent on communications technologies and devices such as cellular, VoIP, instant messaging, text messaging, SMS and email. In the deaf and hard-of-hearing community, many have given up use of TTY/TDD machines in favor of text messaging. People today expect to communicate with 911 using smart phones and smart devices, including texting and sending photos and videos. To support these trends, the board and the state's PSAPs are migrating to a platform that enables these and emerging communications services and devices to access 911.

What do we want out of 911?

Moving from Legacy 911 to NextGen 911

The legacy 911 framework was a wireline network comprised of fixed locations and fixed addresses, based on circuit-switched network technology that dates to the 1970s. Within that framework, each 911 call center or PSAP was responsible for planning and designing its own 911 system. PSAPs typically entered into individual agreements or contracts with their 911 System Service Provider (SSP), which provided the 911 network, database, and network monitoring and maintenance. The PSAPs also entered into a separate lease/purchase agreement with the SSP for the call-taking equipment. This structure was more advantageous to larger metropolitan areas than rural communities.

The mobility of today's callers and the variety of devices quickly overwhelmed the complex arrangements cobbled together to manage legacy technologies. In addition, small communities might not have the resources to support complex service arrangements. North Carolina migrated to NextGen 911 (NG911) technology to resolve these issues and provide a consistent level of service across all communities. NG911 refers to the complete ability to transmit, receive, process, transfer, dispatch, use and store both voice and data (in the form of pictures, videos, text messages and incident information) associated with a 911 call or request for emergency assistance. NG911 enables a more efficient use of 911 resources by enabling the transfer of 911 calls between geographically dispersed PSAPs, increased sharing of data and resources to improve emergency response, and improved coordination and partnerships within the 911 community.

E911-NG911 Comparison		
	E911	**NG911**
Networks	Complex Analog Trunking and Data Network to meet IP	Managed Private Emergency Services IP Network (ESInet)
Routing	Class 5 Switch for Selective Routing, limited forwarding of calls	IP Routers, call forwarding more dynamic and flexible
Accepted Media	Voice Calls Only	Integrated Voice, Text, and Video
Integration	Complex Interfaces	Standard IP Interfaces
Data	20 Character Data Limit	Broad Data Bandwidth
Location/Call Routing	Complex translations based on tabular data (MSAG); Location fix occurs at back end of call	Geo-Location/Routing, Location fix more precise and happens at front end of call

IMPLEMENTATION

Our approach: managed services

The transition to NG911 is an enormous undertaking and can be achieved in a variety of ways. In 2016, the board issued an RFP for building and transitioning to a NG911 system. Many of the bidders required large amounts of money up front to build a new network, which would be connected and managed at the individual PSAP level, as in the legacy model. Based on the bid responses and the board's knowledge of the FirstNet implementation, the board chose to contract with AT&T for a hosted, managed service approach to NG911 delivery. The seven-year, approximately $100 million contract was signed in August 2017, for the implementation of a statewide Emergency Services IP Network (ESInet) and a hosted call processing system.

Under this structure, the managed service provider retains responsibility for the functionality of the IT service and equipment. The PSAPs benefit from predictable pricing and the ability to focus on core business concerns rather than IT management. North Carolina's PSAPs thus obtain a more robust 911 network with fewer direct IT responsibilities.

The board has also contracted with GeoComm to assist with the NG911 geographic information systems (GIS) project. GeoComm provides managed services to aggregate geographic data from local agencies and assist in identifying and reporting any gaps, errors and discrepancies in GIS data. Local agencies continue to maintain their own GIS data and submit it to the state through GeoComm's GIS Data Hub. Submitted data is automatically loaded into the state's standardized NG911 GIS database schema and aligned to match i3 GIS requirements.

Operating with managed services

A major component of North Carolina's managed service solution is the Network Monitoring and Assistance Center (NMAC), which is hosted at DIT's Raleigh-based network operations center. This allows the NMAC to take advantage of the extensive IT management resources of DIT's Eastern Data Center. The arrangement fosters the ability to share network and cybersecurity intelligence with local PSAPs to ensure the integrity of the ESInet and its related services.

The NMAC provides centralized monitoring of all AT&T-provided network services and call delivery applications. The NMAC operates 24/7 and is staffed by 911 Board personnel and is accessible by email or toll-free phone lines. In addition, the NMAC utilizes monitoring and capacity management tools provided by AT&T and other selected vendors to monitor all call traffic volume, call quality and the system's overall health. Network outages or service disruptions of any kind are reported to the NMAC as well as outages/disruptions reported by the local exchange carrier and all cellular carriers. The NMAC also maintains a configuration management database (CMDB) for all PSAP sites to aid in the rapid diagnosis and recovery for any incident, as well as the quick analysis of the impact of any system and/or service outage.

As part of the central management of 911 services, the board has built and implemented a statewide GIS database that is used as a core service of the i3 NG911 system.

In addition to enhanced location accuracy, the AT&T i3 policy routing capability provides the state's PSAPs with extensive flexibility to define and update standard and alternate routing polices. PSAPs can request the modification of routing policies, set priorities and modify their operational state through the NCPIP, a web-based management portal maintained and operated by the NC 911 Board.

The following types of routing policies are supported:

- **Abandonment/Night Service Routing.** The abandonment policy is engaged whenever the terminating emergency services routing proxy (ESRP) operational state is defined as 'Disabled'.
- **Overflow Routing.** The overflow routing policy is applied during overflow scenarios when a PSAP is receiving more calls than its occupied workstations can accommodate.
- **Diversion Routing**. The diversion routing policy is applied whenever the PSAP opts to engage alternate diversion routing rules.
- **Special Event Routing.** Special event routing is a special type of diversion routing policy that is applied during a scheduled time window. If a PSAP jurisdiction contains venues that host events that may warrant dedicated call handling (mobile command center or dedicated resources at the PSAP), special event polygons can be pre-provisioned.

Abandonment, Overflow, and Diversion policies can be configured to use any of the following policies:

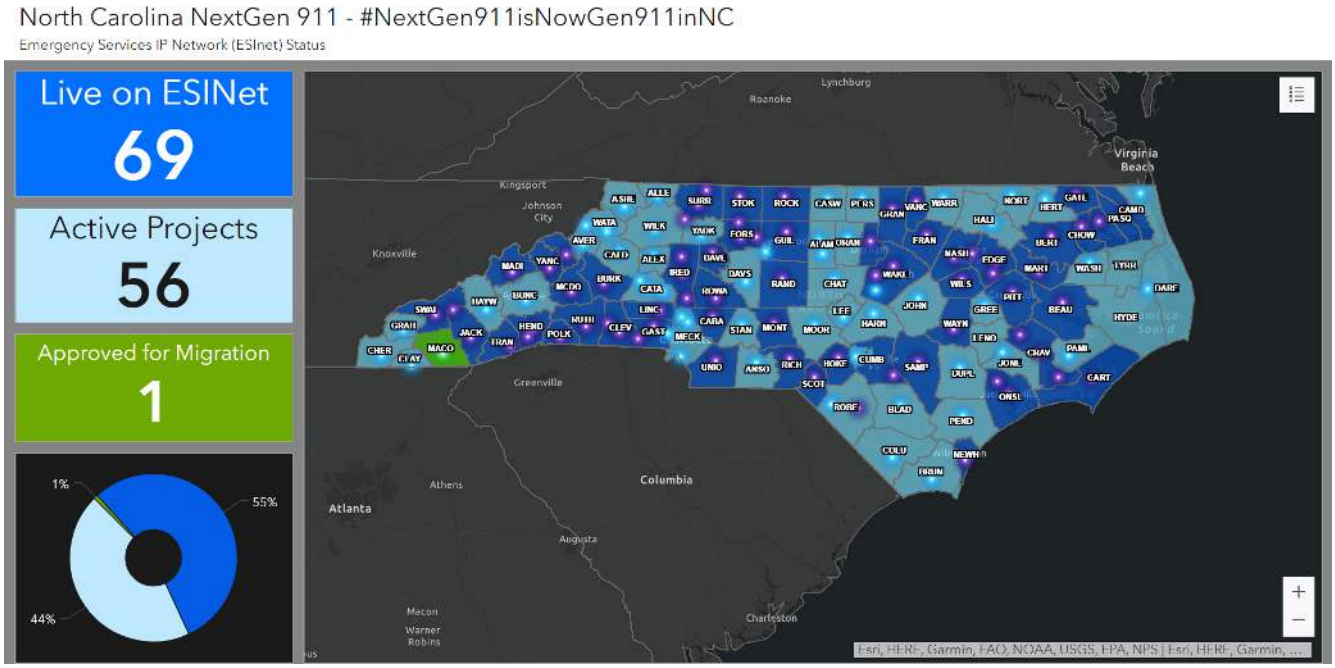
- **Geographically.** The system can be configured to send abandonment calls to different alternate PSAPs based on the geographic location of the calling party within the primary PSAP's jurisdiction. Geographic abandonment or alternate routing polygons can be pre-provisioned via the SI or submitted dynamically.
- **Hierarchically.** The system can be configured to cascade a call to up to nine consecutive, alternate PSAPs.
- **Load-balanced.** The system can be configured to distribute calls between PSAPs.

IMPACT

Just under 7.2 million 911 calls were made in North Carolina in 2020. The ESInet system allows all 117 primary 911 centers statewide to connect through internet protocol-based routing services, allowing the call centers to seamlessly communicate with one another. In addition to improved geo-location of cell calls and the ability to handle text messages, high-speed connections enable every center to serve as a backup for any other center in the state in the event of a natural disaster or an overload of emergency calls (which was first put to use as Hurricane Florence pounded our coast in September 2018).

As of December 31, 2020, 66 of the 127 PSAPs had implemented NG911 call handling solutions and were fully functional on the new ESInet, compared to a total of 33 at the end of 2019. In 2019 North Carolina's General Assembly issued a legislative mandate for the remainder of PSAPs to migrate to the statewide ESInet. All remaining PSAPs are in the process of migrating to the NG911 suite of services, and the board anticipates all PSAPs will be live by December 2021.

Note: The graph below shows real time project status and reflects status as of the time of this writing earlier in 2021.



https://nconemap.maps.arcgis.com/apps/opsdashboard/index.html#/ca70ca087c084a35ab644ea0b693ffcb

Benefits of centralized network and GIS management

The managed service structure enables North Carolina to achieve high levels of service reliability with rapid implementation without large capital expenditures for hardware, software and professional services. Using the managed service approach, North Carolina was able to go from signing the contract to spinning up the first site in 15 months, whereas a state-built network would require two to three years to provision and an up-front investment of millions of dollars just to get the first site up and running.

NG911 allows 911 calls to be mapped by coordinates or address locations, and GIS data is used to validate address data and route 911 calls to the correct PSAP. GIS data is used by the location validation function to validate address locations and by the emergency call routing function to geospatially route calls to the correct PSAP. In the NG911 call flow architecture, GIS data from all 127 PSAPs is aggregated and validated in a statewide NENA-compliant geodatabase within the state's NG911 system. The GIS data will be used to enable the emergency call routing function to determine the 911 call center where a call should be routed and the location validation function to identify the correct location of a civic address (house number and street name).

The parallel effort of creating a centralized NG911 NMAC in conjunction with the NG911 migration provides a valuable safety net to the PSAP community in its role as a PSAP-only support center. The NMAC is co-joined with the extensive resources of the DIT Raleigh-based network operations center which fosters the ability to share network and cyber security intelligence. The NMAC staff have extensive PSAP operational experience in addition to network management skills to provide comprehensive services to the PSAP while ensuring effective oversight of AT&T's service delivery.

North Carolina was the first in the country to implement the NMAC concept for NG911 Service Management and is often referenced as a leading innovator in NG911.

Benefit Category	Benefit Description
Central management and oversight	• Removes single points of failure through geo-redundant call processing with redundant and diverse networking • All GIS data for routing housed on servers in state data centers • Routes calls using geographic information or tabular addresses so that PSAPs can define routing rules for 911 calls/text by drawing geographical boundaries on a map (requires GIS/Call Handling equipment compatible with ESInet) • Call routing can be managed/monitored centrally • Future hosted computer aided dispatch (CAD) allows the 911 Board to standardize a CAD application to PSAPs, or integration infrastructure for multiple CAD packages.
Mobility and reliability	• Provides robust and flexible policy-based call delivery functions so PSAPs can automatically failover and overflow calls based on conditional call processing rules (e.g., call volume) for voice or text calls (legacy PSAP failover requires manual intervention that takes time) – PSAPs can failover/overflow calls to any other PSAP in the state. • Automatically detects and recovers from PSAP CPE call failures – ESInet can represent an active 911 call to a PSAP without losing the originating call leg • Establishes an IP network foundation for future advanced capabilities that support receiving critical incident awareness info e.g., video transmitting to first responders, providing secure access to public safety apps via Netbond
Security	• Closed network: nobody can connect to the internet through this network • Network Operations Center and Security Operations Center housed in central Network Managing and Assistance Center at DIT

The managed service approach has saved our PSAPs considerable time in implementation. Without this approach we would still be provisioning services and many of our smaller counties would be unable to afford the migration to NG911.

As of the time of this submission, 77 PSAPs are live on the ESInet. The improved failover capabilities of the NMAC will allow our emergency services to continue operations in the face of natural disaster, helping to keep North Carolinians safe as hurricane season approaches.