

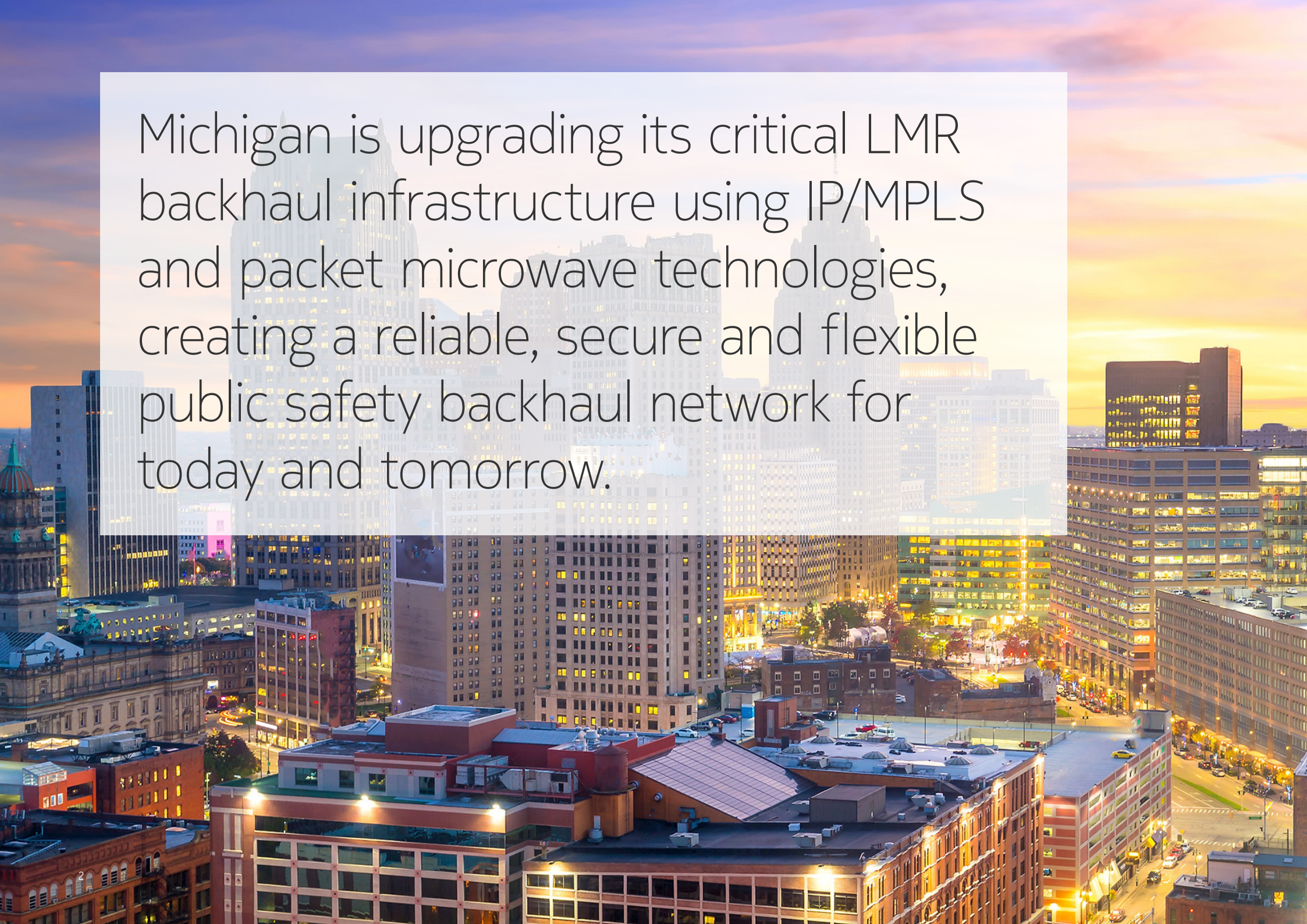


Michigan's IP/MPLS backhaul network
transforms public safety services

NOKIA



MPSCS
Michigan's Public Safety
Communications System

An aerial photograph of a city skyline at sunset. The sky is a mix of orange, pink, and blue. The city is filled with numerous buildings, many of which have their lights on, indicating it is evening. The buildings vary in height and style, with some having distinctive architectural features like domes or multiple stories. The overall scene is a vibrant and detailed representation of a modern urban environment.

Michigan is upgrading its critical LMR backhaul infrastructure using IP/MPLS and packet microwave technologies, creating a reliable, secure and flexible public safety backhaul network for today and tomorrow.



The State of Michigan has 9.9 million residents in 83 counties. Nokia has been working to replace Michigan's time division multiplexing (TDM)-based public safety Land Mobile Radio (LMR) backhaul infrastructure with IP/MPLS and packet microwave technology. The new network provides highly reliable and secure backhaul to support P25-based public safety digital radio communications, with integrated voice and data capability. The new network not only is strengthening the responsiveness and coordination of Michigan's public safety services, but also has significantly increased overall network capacity. It offers unified provisioning, operation and performance management for higher reliability and cost efficiencies, with a highly scalable and robust foundation for more advanced public safety communications capabilities in the future.

Challenges

- Maintain a mission-critical LMR microwave backhaul network spanning 59,415 square miles, an area larger than the nation of Greece, with 245 radio towers and more than 80,000 radios, serving 1,562 local, state, federal, tribal and private partners.
- Upgrade the existing LMR system deployed in the 1990s, comprised of older analog equipment for which Michigan could no longer get support or replacement parts, making it increasingly more difficult and costly to maintain.
- Provide high-speed voice and data capability to a variety of locations (urban, suburban, remote, industrial) with a modular, scalable architecture that can be built upon as user needs increase.
- Migrate public safety applications seamlessly to the new backhaul network while leveraging as much existing equipment as possible to conserve government budget.

The solution

- Reliable, scalable and secure IP/MPLS backhaul solution with 7705 Service Aggregation Router (SAR), Wavence Microwave Transport and the Network Services Platform (NSP)
- Flexible multi-service support (Ethernet, TDM, IP), including deterministic, hierarchical QoS with 7705 SAR, ensuring critical traffic is always delivered with the highest priority
- Unified end-to-end service management with 5620 SAM, for simplified and optimal management of network resources, service creation and performance, and faults
- Extensive microwave link monitoring and control via automatic event collection and alarm, status and performance data from the Wavence Microwave Transport with the TSM-8000 fault management system.

Benefits

- Advanced IP/MPLS services enable public safety agencies from across the state to share the network with no performance degradation
- Deterministic, hierarchical QoS ensures real-time, critical traffic is never compromised.
- A multi-ring topology and advanced MPLS mechanisms such as fast re-route ensure a high level of redundancy and ultra-high reliability, with rapid recovery even after multiple disruptive events.
- High service flexibility supports closer agency collaborations
- Graceful legacy applications migrated to the new network with no impact on current operation mode and performance, extending field life of current applications.

Challenges

Michigan's Public Safety Communications System (MPSCS) provides interoperable communications for the second-largest trunked system in the world, including administration of a statewide 700/800 MHz mutual aid land mobile radio (LMR) network, simulcast systems and inter-zone statewide communications for local, tribal, state, federal, and private first responders. The system spans 59,415 square miles, has 245 radio towers and includes more than 80,000 radios.

In 2014, MPSCS began design work on replacing the system's existing TDM-based microwave backhaul infrastructure, commissioned in 1998, with a cutting edge Internet Protocol/Multiprotocol Label Switching (IP/MPLS) backhaul network to carry Project 25 (P25) digital radio traffic.

Michigan recognized the advantages provided by digital radio communications, and that the new network would provide an easy path for scaling and incorporating new-generation technologies going forward.

Michigan faced significant technical challenges with migrating TDM-based LMR traffic onto IP/MPLS on a large scale. The system would not tolerate communications outages during the migration, and would need to provide continued support for legacy TDM services in the short term.

There were cost considerations as well. "Our engineering teams needed to ensure that we could migrate to the new microwave solution, and manage that without replacing a lot of equipment on the towers themselves," says Brad Stoddard, Director of MPSCS. "We wanted to leverage as much of our existing investments as possible, and just replace those pieces that we needed to avoid costing the government a considerable amount of money."

QoS policy on the new network would need to classify critical traffic into a high-priority class to ensure that it gets through in the case of network congestion. Additionally, the network would need to provide high resiliency that would re-route traffic from failure caused by a major catastrophe in 50ms or less, demonstrating consistent, reliable performance, and the capability to support internet protocol version 6 (IPv6) and IP multicast when necessary.





Why Nokia?

MPSCS selected Nokia for this project because of our ability to offer a proven backhaul network solution grounded in IP/MPLS and packet microwave, with graceful TDM migration capability – all managed under a unified services platform. The solution would simplify overall network operations and reliably transport mission-critical traffic for all users. It would offer solid, advanced QoS capability including per-service-per-class queuing and hierarchical scheduling. Michigan recognized that Nokia was uniquely positioned to provide the entire solution with an unparalleled suite of products, solutions and professional services that would be able to meet all public safety networking requirements.

““We already had a contract in place, and part of that was to support, maintain and replace the microwave equipment as needed,” says Stoddard. “We had some conversations with other states, and everything seemed to be a success with projects in those places. Also, we had worked together since our original deployment in the 1990s.”

The plan of action called for a deliberate, step-by-step deployment that focused on continued reliable operation of the MPSCS network, with system and applications cutovers conducted in a manner that would minimize operational impact. The migration approach would be consistent throughout the entire project, consisting of comprehensive factory acceptance tests for initial zones, incremental deployment of

new systems to power-up and test, connecting legacy network and new network systems, decommissioning legacy network components, and final installations.

The initial deployment plan encompassed four phases covering distinct geographic regions of the state. The final phase would be in the heavily populated southeastern portion of the state, including metropolitan Detroit, which required the most complexity.

In addition to supplying and deploying the infrastructure itself, including installation and commissioning, Nokia was to provide key professional services such as network design, engineering and field maintenance.

The solution

In 2015, Nokia began deploying the new IP/MPLS backhaul network utilizing a suite of products designed for mission-critical traffic. The new network supports mutual aid communications, computer-aided dispatch (CAD) responding to 911 calls, backup of critical 911 call data, VESTA 911 call (key to multi-agency support), SCADA traffic and other applications. With MPLS, traffic from different agencies and departments sharing the network are completely segregated to ensure that they do not cause unintended interactions and disruptions.

Primary network equipment includes Nokia's 7705 Service Aggregation Router (SAR), Wavence Microwave Transport, which facilitates legacy-to-packet migration in both fixed and mobile environments, the Network Services Platform (NSP) to support cross-layer management, and the TSM-8000 fault management system for microwave links, which automatically collects, displays and stores alarm, status, and performance data from the monitored Wavence Microwave Transport.

IP/MPLS allows the new network to fully employ a multi-ring topology with rich path diversity. This ensures superior redundancy in the event of multiple link or node failures from weather, fires, vandals, cyberattacks and other incidents. This resilient architecture preserves essential communications for response, recovery and operational continuity. In case of network failure,

MPLS's recovery features, such as fast re-route, can be invoked to restore the traffic. The solution's VPN services capability also allows the network to be shared among different agencies, departments and user groups while keeping their traffic segregated.

Migration of legacy TDM applications to IP/MPLS has gone smoothly. Migration steps have included deploying 7705 SAR and Wavence Microwave Transport in parallel all the way to master sites, migrating LMR to Ethernet, migrating mutual aid to the 7705 system, simulcasting TDM to the 7705 CES, migrating alarms to the 7705, then decommissioning the TDM equipment.

Nokia and MPSCS completed Phase 1, covering southwestern Michigan, in 2015. Phase 2 became operational for the northern portion of the state's lower peninsula in 2016. Phase 3, covering the upper peninsula, will be finished in 2017. To address the more complex aspects of the deployment across the southeastern part of the state, Nokia and MSCPS divided Phase 4 into two segments to be completed in 2018 and 2019 respectively.





We've also added a Phase 5 to pick up additional complex systems throughout the state, including more rural communities where there is a need for public service coverage. Overall, the network will incorporate 270 hops and 265 sites.

The benefits

MPSCS's new backhaul network is providing the state with many advantages. It enables unified management across IP/MPLS and microwave layers, integrated operational efficiency and comprehensive monitoring. Its industry-leading set of network and services management tools provide end-to-end visibility, fault detection/correction and service provisioning. Its multi-ring architecture provides rich path diversity, shortening the distances for connecting remote locations while allowing unprecedented flexibility and resiliency in routing

network services. This assures high QoS for real-time public safety applications, which now can be distributed to any point on the network with unparalleled reliability.

"We had some sites that may have been remote or spurs off the network, so we closed a lot of those loops," Stoddard explains. "That has provided the capability to manage that traffic more efficiently than what we were able to do in the past. We will have greater resiliency not only from these closed loops, but also because we'll be able to manage more of this network centrally. So now we can manage both remotely and centrally to have a better understanding of what's happening – and in a more timely basis in a true 24x7 operation."

The network also can evolve to support 10 Gb/s and beyond when necessary, providing Michigan's public

safety operations with the capacity to embrace new technologies, such as drones and the Internet of Things (IoT), in the future.

Stoddard believes that the most important benefit has been risk mitigation. "When we were asked initially to put together the budget for this, and identify what the savings would be, we looked at it the other way around and asked what would be the overall budget impact if we were to lose a site, or lose a portion of the system with that legacy equipment for which we could not buy replacements," he explains. "That is a greater risk, because then you would have a network that first responders would be unable to use to do their daily jobs, and you would erode trust in the public safety system."



Looking ahead

Stoddard sees a number of potential uses for the new network going forward. “That mission-critical voice we now have is the foundation for leveraging new technologies in the future; for example, incorporating security video or SCADA,” he notes. “It could be used to enhance first responder services in rural areas of the state where MSCSP may have some tower sites. And, we have been in some dialogue with each of the power companies in the state of Michigan about leveraging the system for them.”

He also envisions a backhaul capability for state police aviation in order to get a video back to the command center. “We’re currently working through an initial pilot for that, and a second pilot will look at how we can backhaul that video over the network without creating any issues for voice traffic,” he says. And, Stoddard believes that the new network also could lead to enhanced partnerships with entities such as FirstNet, the FBI or DEA, which may have some uses for getting their video from one location to another. “We’ve been able to do that for years with the Coast Guard and in remote areas, sending data back to a fiber

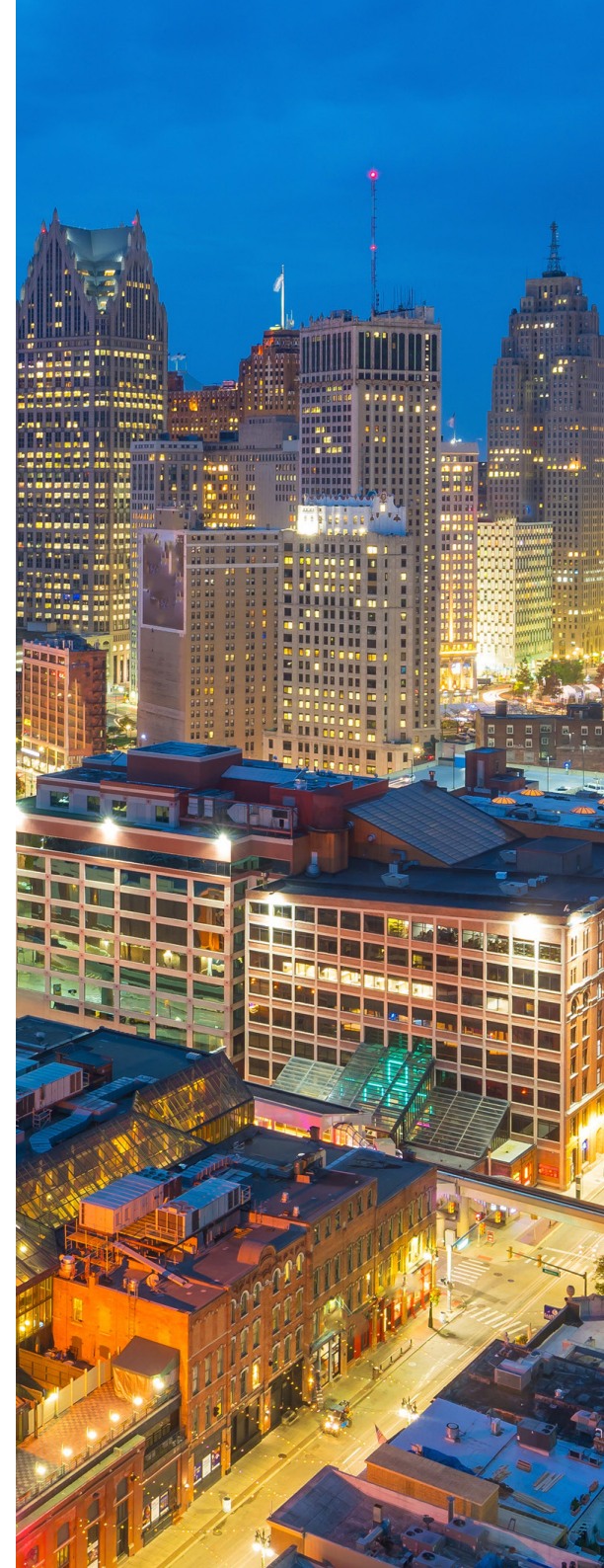
hotspot, then connecting to the network. So that’s a potential. However, we don’t necessarily know how much bandwidth we will be able to utilize until we create more loops in the system for resiliency. At that point, we’ll have a much greater understanding for where we have additional bandwidth to utilize for other solutions. By having this foundation, it’s allowing us to be nimble and address the needs of citizens and our partners within the state.”

Summary

Michigan's new IP/MPLS backhaul network now is providing broadband, high-capacity data connections between hundreds of local first-responder agencies, enabling enhanced voice and data communications to augment situational awareness with stronger resiliency and higher reliability. It also provides a scalable communications platform ready for future technologies such as the IoT.

Public safety will always be a high priority for Michigan, as well as for other national and regional governments seeking to modernize their aging communications infrastructures for first responders. "What may have happened decades ago - build it and forget it - is not an option for us. We need to build our network and maintain it to ensure that public safety is responding to citizens' needs when and how they are required," Stoddard says.

This project and Nokia's long partnership with Michigan public safety highlights our continuing unique position as the leading supplier of reliable mission-critical networks for markets beyond traditional communications service providers. "Our network's original equipment had been in place for two decades, which really shows its reliability, and that's critical for us," Stoddard explains. "Public Safety doesn't have a lot of money, and what it does have is invested in ensuring that we can respond to our citizens' needs. That in turn is quantifiable in terms of lives saved by first responders. Our new network ensures that the reliability on which those lives have depended for the last 21 years will be there for the next 21."



Nokia OYJ
Karakaari 7
02610 Espoo
Finland
Tel. +358 (0) 10 44 88 000

CID 201286

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