A low-angle shot of a person wearing a light-colored cowboy hat, looking up at a tall skyscraper in a city. The image is split diagonally by a white line. The top right portion is dark with white text, while the bottom left portion shows the person's hat and the building.

# Modernized IP backhaul network transforms city & public safety services in Dallas

The ninth-largest city in the United States modernizes its LMR backhaul network with an IP/MPLS microwave network solution, creating a new-generation platform for shared and advanced municipal voice and data communications.

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Dallas, Texas, is the ninth-largest city in the United States, with 13,000 city employees and a typically broad range of departments and public safety agencies that serve approximately 1.2 million residents. Its Radio Network Group is responsible for ensuring that all public safety personnel and first responders are always connected through a fully secure and reliable radio system 24 hours a day, 7 days a week, 365 days a year. Used by the city's police, fire and municipal public works employees, the land mobile radio (LMR) communications system relies on a packet microwave network, based on IP/Multiprotocol Label Switching (MPLS), supplied by Alcatel-Lucent. This new network provides higher bandwidth and expanded capacity for deployment of advanced Project 25 (P25) radios, and is ready for next-generation Long Term Evolution (LTE). Already it is saving Dallas thousands of dollars for each of the high-speed data connections at five water treatment plants, the Dallas Fire Training Center and the city's police stations; and it is poised to support other projects in the works, including a major body camera initiative for its police force and video surveillance at sensitive sites.

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## Challenges

- Update an analog microwave network supporting an LMR system of 11,000 radios (including 6000 public safety radios), 700 receivers, 400 antennas, 250 transmitters and 23 towers
- Provide high-speed data capability to a variety of locations (urban, suburban, remote, industrial) with modular, scalable capability that can be built upon as customer needs increase
- Prepare the city for migration to P25 with a proven, secure and highly reliable microwave system

## Solutions

- Secure and reliable IP mobile backhaul solution with Nokia **9500 Microwave Packet Radio (MPR)**, featuring scalability and resiliency
- Flexible multiservice support (Ethernet, TDM, IP video), including appropriate quality of service with Nokia **7705 Service Aggregation Router (SAR)**
- Easy monitoring and control via automatic collection and alarm, status and performance data from the transmission equipment with **TSM-8000 Fault Management System**
- Unified end-to-end network management with Nokia **5620 Service Aware Manager (SAM)** Design to implementation, connecting all radio sites, within 12 months

## Benefits

- Shared IP-based radio network supporting the city's public safety systems, as well as multiple public services
- Monthly cost savings for recurring expenses on commercial leased circuits
- Higher bandwidth and capacity, using less radio spectrum through patented capability, while guaranteeing that mission-critical traffic gets delivered on time
- Scalable and ready for next-generation LTE systems, this network will support unlimited innovation in city services, starting with a police body-camera program.

“ Alcatel-Lucent has opened our eyes to a lot of things that we didn't think were possible — those kind of things that we traditionally don't really think about.”

C. J. Holt, IT Manager, Communications and Information Services, City of Dallas, Texas





## The challenges

In 2010, the City of Dallas, Texas, began studying ways to upgrade its aging LMR network — a 40-year-old analog wideband system consisting of 11,000 radios (including 6000 public safety radios), 700 receivers, 400 antennas, 250 transmitters and 23 towers. Seventy percent of its equipment was no longer supported by the manufacturer, with the remaining support ending after 2012. Further complicating issues, the city maintained four separate radios systems in multiple frequency bands (VHF, UHF, 700 MHz and 800 MHz). The systems suffered from numerous issues; signal strength was weak inside buildings throughout Dallas, and public safety users had limited interoperability with neighboring jurisdictions such as Denton County, Collin County and the cities of Irving, Arlington, Fort Worth

plus a number of smaller municipalities. The city recognized the advantages in efficiency and resiliency provided by digital radio communications, and wanted to begin migrating to the P25 digital radio standard. Developed in North America with state, local and federal representatives and Telecommunications Industry Association (TIA) governance, P25 has gained worldwide acceptance for public safety, public service and other communication applications. Dallas was also faced with FCC's requirement for narrowbanding.

The plan of action called for three phases:

- Replacement of the subscriber/ end-user radio equipment to achieve narrowbanding
- Replacement of the microwave system to prepare an infrastructure the city could use for a new radio system

- Replacement of the voice radio communications systems

Additionally in many of the situations, Dallas used leased T1 and fiber optic lines to provide network connectivity to facilities that needed increased bandwidth for existing, new and planned technologies. As technology and departmental needs increased, the requirements for new higher-capacity solutions, such as body cameras and video surveillance, became very evident. The city knew that it would not have the time or the budget to deploy its own fiber-based network throughout the hundreds of square miles encompassed by the city itself and surrounding jurisdictions, so it focused on an IP mobile backhaul solution incorporating an IP/MPLS network over packet microwave.



## Why Alcatel-Lucent?

In 2013, the City of Dallas had completed Phase I of the radio system project and had replaced about 75 percent of its end-user radio equipment. Focusing on the next phase, Dallas drew up and published a project RFP with the assistance of a consulting firm, attracting four bidders. “One of the most important things about the project was speed,” says C. J. Holt, Radio Network Manager at the City, noting that pending grants made it critical that the new network be delivered in a fast time frame.

“Alcatel-Lucent supplied two different bids,” Holt remembers. “One for how we had envisioned the new network, which was our traditional design with one city-wide ring. They told us, ‘You can do that, but three rings would serve you better.’ It was an alternative design and technology that we hadn’t thought about.” Holt and his team were skeptical at first, but Alcatel-Lucent assured them that it had local contractors and the experience to accomplish what was needed. They also pointed out their extensive experience in the P25 arena, providing references about the numerous P25 systems they supported. In the end, the solution provided five to six times as much bandwidth as the basic solution that originally had been requested. “They made us believe in what they were

offering — a modular microwave system,” says Holt. “It’s like Legos: you can take a piece out and put another in, changing capacities and frequencies so easily. Alcatel-Lucent’s design and their ability to deliver what we want to do now, as well as in the future, is what won us over.”

## The solutions

In February 2014, Alcatel-Lucent began deploying the 34-site network. Components included the 9500 Microwave Packet Radio, the 7705 Service Aggregation Router to support Ethernet, TDM and IP video services at each microwave site, the TSM 8000 to fully monitor and control transmission equipment, and the 5620 Service Aware Manager network manager to centrally manage the network from end to end. While Dallas’s legacy microwave system was one big ring, the new IP/MPLS backhaul network ultimately employed four separate rings, two of which are currently fully meshed, with a third to be meshed this year. “Thanks to the multiple rings and the dynamic routing capabilities of IP/MPLS, this architecture allows better availability and resiliency, with much less chance of one incident — a storm or other disaster — taking out a good piece of our radio system,” Holt notes. “We bought 160 Mb/s microwave equipment, and as we migrate to bigger sites, we’ll

get bigger cables and bigger pipes. We work very closely with Alcatel-Lucent to make sure that our system will remain at 99.999 percent reliability, which amounts to something like 5 minutes per year.”

Deployment progressed quickly, with a fully functional system connecting all of Dallas’s radio sites together within 12 months, by December 2014. “It really amazed us at how fast Alcatel-Lucent was able to deliver on our needs,” says Holt. The new network now supports the existing LMR communications system for the city and county, plus high-speed data connections at five water treatment plants, the Dallas Fire Training Center and the city’s police stations. Ongoing plans include body cam services for the police department, and additional connectivity (including video surveillance) at locations where it is difficult to place traditional wired networks, such as at water department facilities, the Dallas area landfill and other sensitive sites.

## The benefits

The IP mobile backhaul network gives the city of Dallas highly resilient and extensive capabilities, along with a level of control and flexibility that never before was possible. “We can do Ethernet, we can plug in fiber and all different kinds of connections,” says Holt. “If a radio site isn’t working,

the network tells us why. My techs can do the repairs from downstairs in our Network Operation Center, rather than having to go out to the site and try to figure out what is wrong. Now the unified management system tells us ‘this card needs to be replaced.’ Those are things that make my life easier, allowing me to get my customers back on the air faster and restore services quickly.” The network has more redundancy and capacity. It already supports enterprise IT functions for the city, and is poised to make possible advanced broadband services such as real-time video and analytical data for multiple departments. “Now we have 640 Mb/s of capacity with the four rings — it’s more flexible.” Holt points out. “And because it’s more modular, it’s easier to add new equipment and more capacity.”

In some cases, the technological advance also provides some financial incentives as well. In many cases, legacy leased lines (T1 and fiber optic channels) will continue to provide the city with ongoing connectivity. However, in situations where high-capacity connections are required, the ability to expand the microwave system provides the city with previously unavailable options that can be evaluated on their technical merits and also on how they can reduce the long-term financial impact to the city. Since the majority of



the cost of microwave systems is in the initial deployment, long-term costs are often lower than those of traditional leased T1 or fiber optic lines.

### Next steps

Holt notes that the new network represents only the first few steps of what he says will become a massive wireless data system throughout the city of Dallas. An enhanced IP backhaul system will bring many more capabilities, opening doors to innovations with the support of high-bandwidth video applications such as the body camera led by the Dallas Police Department. The city also is looking at how it can wirelessly collect data from traffic signals, while backhaul video from the Dallas police department will be distributed throughout Dallas and to city hall to aid law enforcement. Surveillance at the city landfill also could be deployed with the department likely benefiting from realtime video data and enhanced situational awareness. “Those are all things that we’re already working on as we look at the next evolution of the IP backhaul system,” says Holt.

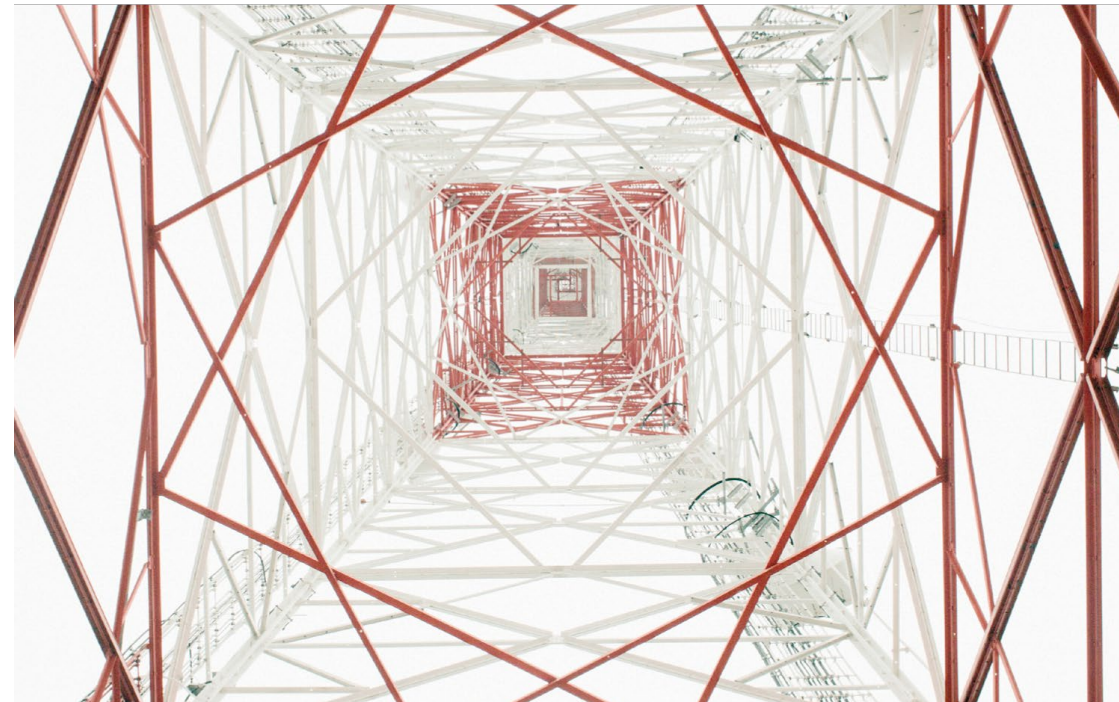
### Summary

Dallas is not only enhancing public safety, increasing city services and saving costs with its new IP network, but also now has an efficient platform

“ The sky’s the limit on what we can do with our technologies and services, and that allows us to attract the people and companies we want to work with in the city of Dallas.”

C. J. Holt, IT Manager, Communications and Information Services, City of Dallas, Texas

for future expansion to address any communications needs that may arise. “Alcatel-Lucent has opened our eyes to a lot of things that we didn’t think were possible, that we traditionally don’t really think about,” Holt points out. “Ultimately the biggest and most important piece of this is this overriding backbone for our radio system, which is giving our first-responders 21st century capabilities. By having that backbone in place, we’ll be able to build radio systems that keep our folks safer and makes our radio systems easier to manage. Before, we were limited. Now, the sky’s the limit on what we can do with our technologies and services, and that allows us to attract



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