NOKIA

Prepare your backhaul for the broadband era

Give your backhaul network the key attributes to fully exploit mobile broadband for public safety

White paper

Radios are a lifeline and safety net for first responders. Mobile broadband communications will change the way first responders operate, bringing them new tools and resources to accomplish their missions much more efficiently, while giving them the best chance of going home safely to their families. Your backhaul network makes these life-critical connections, but will have to undergo significant evolution to keep delivering first responders a growing number of more diversified services in a secure way.

NOKIA

Contents

NOKIA

Introduction

The wide adoption of IP-based applications in public safety communications will engender three key trends that create a need to re-imagine public safety backhaul networks.

The first trend is the evolution of existing land mobile radio (LMR)/private mobile radio (PMR) systems. Many public safety network operators are upgrading their current LMR/PMR systems with IP-based technologies that can support a new revision of radio standards, and that take advantage of increased channel capacity and improved spectrum efficiency, as well as more efficient voice encoding.

The second trend is the immense interest in adoption of LTE. Major public safety associations have already endorsed LTE or are looking at LTE as the successor to existing LMR/PMR systems.[1] These agencies recognize that LTE enables the real-time sharing of multimedia information and instant access to databases that can greatly enhance the ability of public safety agencies to respond to any situation more quickly. As a result, many public safety agencies are now considering ways to augment their existing LMR/PMR systems with LTE.

Finally, while public safety agencies are revamping their communications networks, governments are under increasing cost pressure to improve economic efficiency. The idea of network infrastructure sharing, which allows multiple government agencies to share the new networks, is considered an effective way to attain the goal.

Defining the backhaul network for the future

These three trends make it necessary for public safety agencies to re-architect the backhaul networks that support their daily communications. The new backhaul networks need to exhibit the following key attributes:

1. Scale, flexibility and versatility, to efficiently support current and future services
2. Security, reliability and resiliency, to continue delivering life-critical connections
3. Simplicity and cost-effectiveness, to meet stringent budget constraints.

1 Both the Association of Public-Safety Communications Officials (APCO) and the TETRA and Critical Communications Association (TCCA) have endorsed LTE as the standard for emergency communications broadband network

NOKIA

1. A backhaul network ready for current and future services

Graceful legacy TDM migration

Many legacy radio base station and emergency communications are still TDM-based. This current technology must continue working as new technology is introduced. Therefore it is still imperative for the new networks to support TDM traffic migration with no performance compromise.

Scalable network capacity and size

The network needs to be able to scale in capacity and size. As applications become more bandwidth-intensive and more locations are commissioned, "the deployed network equipment has to scale up in capacity gracefully, without forklift upgrades. Concurrently the network architecture needs to scale out to accommodate a bigger footprint.

Network capability extensibility

It is essential that the network can continue to evolve to support future applications not necessarily known today. We are on the cusp of the Internet of Things (IoT) revolution. From drones to robots to body-worn cameras, new applications emerge, stressing a network's extensibility. It is important the network services can expand to use advanced networking technologies including IP multicast and IPv6, and can evolve to support new paradigms like software-defined networking (SDN) and network functions virtualization (NFV).

Versatile and efficient use of transport media and topologies

Because backhaul network coverage must span dense urban landscapes and remote terrain, operators must rely on a variety of transmission options. The network needs to allow flexible use of transmission assets including microwave, fiber, copper, and even third-party leased lines to build the required topology (linear, ring, multi-ring and mesh).

2. A backhaul network that delivers life-critical connections

Strong backhaul QoS

The new networks carry a wide range of applications, including mission-critical LMR/PMR communications, live streaming video and other IT applications. These life-critical applications have to be maintained, including cases of crisis that stress the network. The backhaul network must automatically ensure traffic can be prioritized by setting and executing the requirements for quality of service (QoS). A robust QoS scheme is necessary to ensure each application's QoS requirement is met constantly.

High network resiliency

The new network needs to be highly resilient and be able to recover quickly. To better endure impacts from natural disasters, multi-fault network tolerance is a must to ensure field emergency communications are not disrupted.

Precise synchronization distribution

Precise frequency and time-of-day/phase synchronization is critical for maintaining operations and applications integrity in communications networks. While most radio sites typically have a GPS, it is also essential to use the network as a back synchronization source in case GPS signal reception fails, to keep the highest level of network availability.

Rigorous security protection

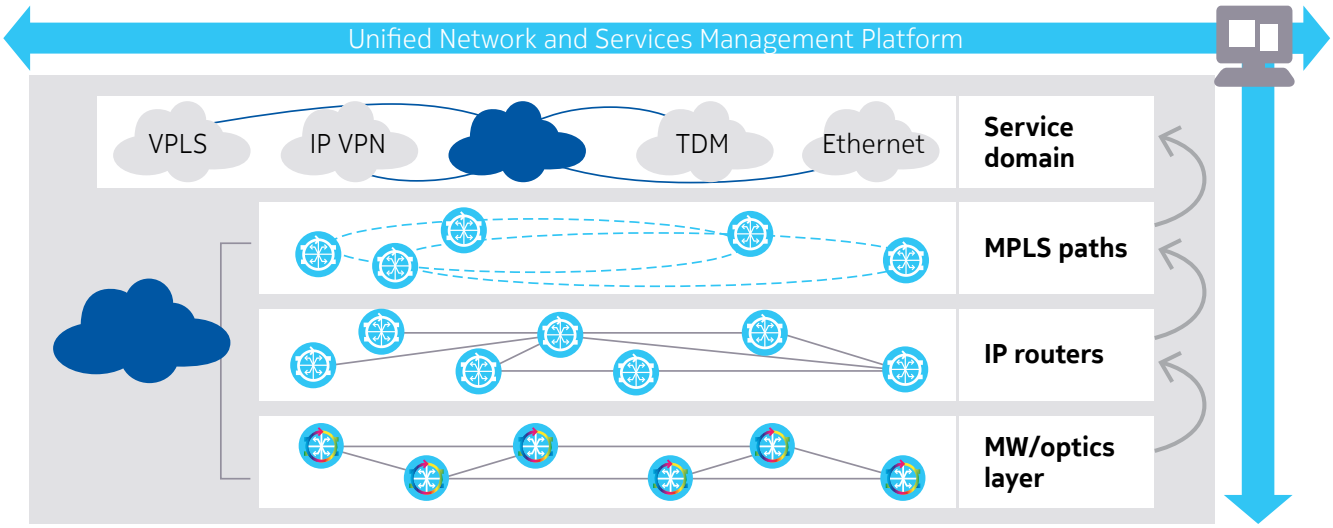
Cybersecurity is a major concern of public safety agencies, particularly as they'll move to IP-based services. Therefore, backhaul networks should have extensive integrated security features that will defend against cybersecurity threats, ensure communications and data privacy, and deliver uninterrupted service. Strong mechanisms should protect the management, control, and data planes against security threats from outside and inside the agency.

3. A backhaul network that meets stringent budget constraints

Unified end-to-end network management

A converged packet backhaul network must also provide unified end-to-end management that allows network operators to manage all MPLS services and the underlying optical and microwave transport domains (see Figure 1).

Figure 1. Unified network services platform

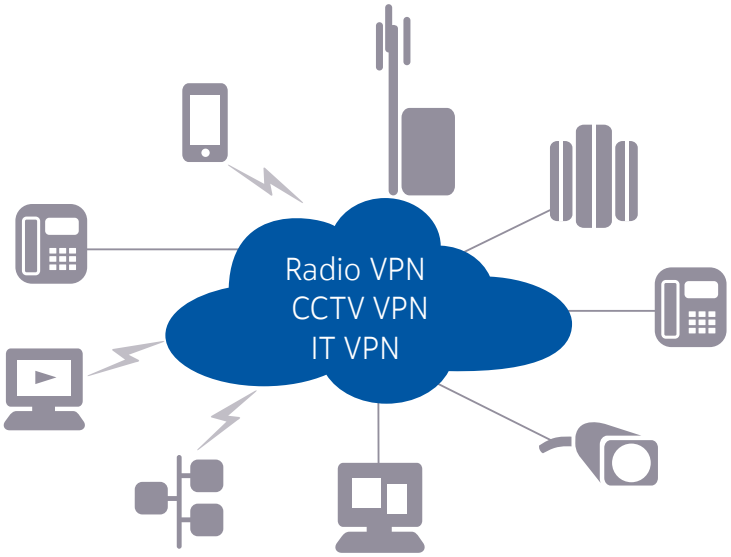


This cross-domain management capability minimizes operations complexity and technical training requirements, and simplifies network configuration and control. It also enables effective problem isolation and resolution, and supports new management applications. It is an important element of simplification for the operations team.

Effective infrastructure sharing

With governments demanding that more be done with less, there is strong incentive to capitalize on the new backhaul network to carry other agencies' traffic. Multiservice capability is necessary to converge many different user groups carrying traffic in segregated IP/MPLS-based VPNs (see Figure 2). Thus, each government agency keeps full control of its "slice" of the network and its QoS management, while its network TCO is lowered as it is shared between the different governmental entities.

Figure 2. Converged multiservice network



Conclusion

As the familiar LMR in every police car, on every fire engine and in every ambulance eventually gives way to devices that look like smartphones and tablets, the network that ties everything together must work even harder and stretch beyond public safety. This is creating the need for a new approach to continue delivering life-critical communications.

The good news is that IP/MPLS provides the performance, scalability, reliability and operating efficiencies that public safety agencies need. A converged IP/MPLS backhaul network provides the foundational connectivity for dispatch, situational awareness, and communications among first responders and between first responders and their command centers. It also has the potential to support network sharing by other government agencies, thereby expanding the potential uses of more advanced public safety networks and creating an opportunity for more efficient use of public funds by all government entities.

But a backhaul network able to fully deliver on these promises also needs strong expertise to optimize network interworking across all its components, from the LTE radio to IP/MPLS, optics and packet microwave. Thus it will enable capabilities your first responders can only imagine.

For a more detailed discussion on the public safety backhaul network, please download the following two papers:

- Mission-critical communications networks for public safety
- Is your network ready for public safety in 2020?

Acronyms

IOT	Internet of Things
LMR	land mobile radio
LTE	Long Term Evolution
MPLS	Multiprotocol Label Switching
NFV	network functions virtualization
PMR	private mobile radio
QoS	quality of service
SDN	software-defined networking
TCO	total cost of ownership
TDM	time division multiplexing
VPLS	virtual private LAN service
VPN	virtual private network

Nokia Oyj
Karaportti 3
FI-02610 Espoo
Finland
Tel. +358 (0) 10 44 88 000

Product code: PR1610001153EN (November)