Securing reliability of first responders' communications with packet backhauling for a safer German state

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Police, fire departments, rescue squads, and Emergency Medical Services (EMS) operations: the demand is high on the access network to provide the expected reliability for secure and always on communications for all first responders organizations. In Germany, the central public safety agency of the second largest state has decided to move towards a packet based backhauling solution with the 9500 Microwave Packet Radio from Alcatel-Lucent, to meet their stringent requirements while opening the door to new significant data and broadband applications.

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Challenge

- Assuring first responders reliable and secure communications in the second largest state in Germany.

- Migrating to a high-performing IP network while remaining in operation.

- Supporting new services such as video applications with high transmission quality, even in remote areas.

- Enabling highest protection in extreme weather conditions such as heavy rain and disaster scenarios.

- Increasing network security by unified monitoring and redundancy systems.

"We integrate new services, the availability and security have also been significantely improved further."

Frank Wernicke (right) and Stefan Wächter, Public Safety Department of Lower Saxony

Solution

- Upgrading the private mobile radio (PMR) network with the Nokia 9500 Microwave Packet Radio (MPR) solution.

- Cost-effective migrating by optimizing existing assets.

- Smoothly transitioning from legacyTDM to IP technology.

- Switching over the network within 24 months without any downtime and service loss.

- Increasing protection from failure, even in extreme weather conditions, using adaptive modulation.

- Enhancing the resiliency and performance of the network by using ERP technology.

Benefits

- Reliable and secure PMR network for current and future safety services in a large state.

- High availability and stability due to new features such as adaptive modulation and ERP.

- High bandwidths for additional applications such as video surveillance and mobile deployment stations.

- Cost reductions due to new applications such as forest fire and harbor monitoring using modern video systems.

- Optimization thanks to multiple-standard capability (IP, TDM) and retention of important external assets (antennae, cables).

- Simplicity and flexibility with open interfaces and unified network management.

With 17,614 square kilometers, Lower Saxony is the second largest state in the Federal Republic of Germany. The public safety organizations – from the police, fire department, rescue, disaster services to civil protection services - are responsible for just under eight million people' safety. Since 2008 the various organisations have built and shared a microwave public safety network. With almost 50,000 Tetra terminal devices, more than 500 base stations and six control centers, the network running 24/7 reliably and securely. Right from the start, the safety authorities in Lower Saxony have trusted on their own microwave backhaul network.Its network advantages - high availability service, flexibility and network manageability - attracted many users even back in 2008, when it was first implemented. The network, which is operated and monitored from Hannover, the state capital, by the Lower Saxony Authorized Digital Radio Authority (ASDN), decide to completely upgrade its backhauling to packet technology for further reliability and readiness to enhanced data services.

The challenges

"Our network still has to work, even when all the others have failed," Frank Wernicke, Director of ASDN network management, summarizes the maxim of the state-wide public safety network. For this, the requirements in Germany's second largest state are high. Long distances have to be covered. The network has to operate even in remote areas. In addition, the weather in this northern state with its 750 kilometers long coastline is often extreme. Wernicke says: "Only recently our emergency personnel responded during a storm and heavy rain. Basements were flooded, electricity cables ripped out. But even then the emergency personnel have to be able to rely on the radio network". Looking for ways to reduce possible down times in extreme weather conditions even further and increase reserves in the network, was therefore a top priority of any network expansion.

In addition, in the past years there has also been an increasing demand for image-oriented services. Frank Wernicke says: "Many decisions nowadays are made on the basis of video applications". Clearly the existing TDM based backhaul network was not optimal to scale and efficiently support these new services. The need for a system which could significantly increase the bandwidth of the network, was becoming stronger and stronger. In particular, a network able to support data services such as video transmission or office and internet connections for the quick deployment of mobile police or rescue stations.

But there was also strong operational and financial constraints to respect:

- The switchover to this new generation of network would have to take place during ongoing operations. As the entire network is "critical to services", switching it off was out of question - even parts of it.

- Last but not least, migration should be carried out as economically as possible, in light of the scarce public funds; existing indoor and outdoor components should continue to be used as much as possible.

Watch the video ▶

Why Alcatel-Lucent?

"As well as many other performance features, the proposed architecture with three things in particular convinced us about 9500 MPR: new technical capabilities such as service-aware adaptive modulation and Ethernet ring protection (ERP), helps to assure critical data delivery against failure; the openness of the interfaces; and, of course, the cost-efficiency," Wernicke said, explaining why they chose the system.

Thanks to adaptive modulation, it is possible to guarantee maximum availability, particularly for critical services, even in extreme weather conditions. During operation, transmission will be dynamically adapted to the changing weather conditions. Switching between the various modulation methods will be free of bit errors and happen in a few milliseconds. This means, for example, excellent transmission is assured even under extreme weather conditions like heavy rain.
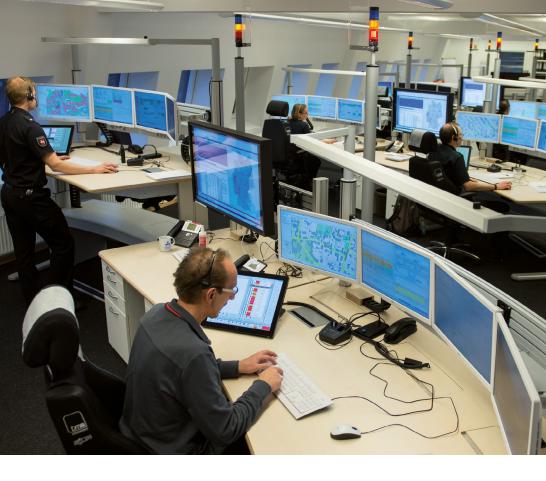
A significant benefit of the packet backhaul technology compared to traditional TDM is the Ethernet ring protection (ERP). It offers the capability of deploying up robust and loop-free packet rings in the network. Major advantage of the Nokia 9500 MPR solution, the ERP ring can comprise both microwave links and optical fiber links, providing ultimate deployment versatility.

Additionally, the 9500 MPR offers a lot of flexibility with regard to migration and network management. As it supports legacy technologies like TDM as well as newer IP, switchover can be carried out step-by-step, reusing existing components as long as necessary. Furthermore, 9500 MPR's open management interface enables operator's to have their own monitoring system to be used in conjunction with Nokia service management service, 5620 SAM. This capability is used to supplement the central ASDN control center with an umbrella management system with GIS integration, making monitoring even easier.

The solution in action

Since mid 2015, Alcatel-Lucent has been gradually replacing the existing TDM infrastructure in-between the 500 base stations with 9500 Microwave Packet Radios which support Ethernet, TDM as well as IP Video Services. Another interesting aspect of this solution is that existing outdoor units can still be used with the new packet technology. Not only does this save on hardware costs, it also means, in particular, a lot of time is saved as we do not have to lay new cables or antennas. Wernicke says: "With this smooth migration we are ahead of schedule, and the operations will not be disrupted in the slightest."

The first video projects are already being carried out. A forest-fire early

detection system with 20 cameras has been installed in the area of Lüneburg Heath, which provides video images in HD quality. Combined with image recognition, the first signs of fire can be recognized early on. This application not only improves safety, it also reduces costs significantly. Until now, such large areas could only be monitored by helicopter, which is today an impossibility considering very high operating costs paired with low funds. An additional positive effect is that "inhabitants are no longer

complaining about the noise disturbances," says Wernicke. The water police too are drawing on the new possibilities of video surveillance. Cameras are being installed in the State industrial harbor. The harbor region can now be monitored remotely by the water police by means of video images.

"We developed a real team spirit. Despite migration, smooth operation was ensured. We're ahead of schedule."

Frank Wernicke, Digital Radio Network Manager, Public Safety Department of Lower Saxony

The advantages

"With the 9500 Microwave Packet Radio solution, we do not only better integrate new services like video, but the availability and security of our network have also been significantly improved further," is Wernicke's first conclusion. In particular, the adaptive modulation is improving the network stability significantly. This is really important as severe weather conditions are projected to intensify further in the future.

Using the important ERP feature, the redundancy and therefore the failure protection in the network can be increased again. The advantage of the Alcatel-Lucent solution of also incorporating fixed-line connections in the ERP technology has been used, and significant locations like the control centers are also safeguarded using fiber.

Thanks to the new IP architecture, it is now easy to install a LAN office network as required. This means for special assignments, mobile police stations can be set up with complete office connection, from voice communication up to internet access. Specific units of Lower Saxony can thus rapidly use the same secured and reliable links to communicate wherever they are and share critical informations.

Wernicke underlines "the good teamwork with Alcatel-Lucent, which was particularly beneficial during the project." There were always new suggestions for how to optimize the network, and the migration has so far gone smoothly. "We developed a real team spirit. Despite migration, smooth operation was ensured and we're ahead of schedule. Therefore it was possible to stick to the budget."

Next Steps

"The major challenge for the coming years will be to increase the bandwidth even further while still guaranteeing the security and reliability of the network, and expand it where needed," says Wernicke about the future. "Most of all, video applications will increase. And we can expect demands for new mobile offices to be installed at short notice even in remote places."

To address these growing needs, the ASDN has set out the vision for a safer Lower Saxony, laying the major solid foundation for a next generation digital radio network. "The future looks good! We're setting the baseline, the building block to provide first responders the necessary multimedia tools and the required reliability."

Summary

"The decision to have our own microwave network from the start with regard to the digital authorities' radio has proven to be completely right," Wernicke recognizes now after seven years of operation. Even states that have favored other technologies until now, are starting to draw on microwave radio. Packet Microwave offers almost unprecedented flexibility and cost-effectiveness. Managing the complete network is simpler thanks to the unified network architecture and enables to be managed autonomously. This ensures easy decision-making channels and a high level of flexibility. Frank Wernicke says: "Packet microwave technology has not just demonstrated its bandwidth elasticity and manageability, it has also proven to be a lynchpin in the integration efforts of bandwidth intensive applications such as video."

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