



Modernizing mission-critical private networks with packet microwave backhaul

Application Note

Contents

Market trends	3
Much more than point-to-point connectivity	3
A mature microwave market	4
Microwave infrastructure that meets stringent industry requirements	4
Evolve your operational network with the Nokia 9500 Microwave Packet Radio (MPR)	5
Build in integrated access/microwave transport network with full IP/MPLS capability	6
Learn more	6

Market trends

Continued automation across a number of vertical industries, such as oil and gas, transportation, electric power generation and distribution, national security, and government has created a growing need for tailored operational networks. These networks require a level of quality and reliability above and beyond what is available in commercial networks.

Traditionally, such operational networks were limited to the headquarters (or one location) of these organizations and were based on tried-and-true, field-proven technology. Recently, however, these operational networks have started going through a transformation, which includes:

- No longer being confined to individual locations. A growing number of organizations are setting up operational networks that cover all their key locations and, in most cases, allow supervision and control from duplicated network operation and control centers.
- Acceptance of carrier-class Internet Protocol/Multi-protocol Label Switching (IP/MPLS) as a basis for operational infrastructure. The associated solutions make use of “carrier-class routers” rather than commodity IP products. As the majority of information exchanged over the networks is data, using IP/MPLS makes sense.
- Ethernet interfaces as the basis for the majority of applications controlling the facilities (replacing traditional low-speed voice and data interfaces such as RS232 and E&M), with the supporting network providing a secure and resilient network architecture. Examples include E-SCADA, voice-over IP (VoIP), closed-circuit television (CCTV) and IP cameras.

Much more than point-to-point connectivity

Industrial communications networks place the most stringent requirements on networking infrastructure in terms of factors such as reliability, stability and response times. This is because these networks—in addition to carrying communications and other services—are mainly used to facilitate the operations critical infrastructure, such as power grids, pipelines, railways, air traffic control, national security, emergency services and other facilities. Outages and unpredictable data flows are unacceptable in these networks, even for the shortest period of time.

This is evident when analyzing the architecture of today’s operational networks. While many telecommunications networks use ring or mesh networks with an active and standby path, many vertical industries will go a step further, building their networks around double rings in which each ring follows a physically distinct path, or mesh networks in which critical connections are not just doubled, but tripled. Additionally, the requirements for a significant number of industrial networks stipulate that a redundant/alternative path should be created using another physical medium.

Most traditional optical transport products can support these highly secure dual-ring or advanced mesh infrastructures. The weak link in the infrastructure has often been microwave solutions. Recent developments in the industry, however, have produced a state-of-the-art packet microwave designed to provide the performance required by private commercial networks.

A mature microwave market

As discussed, industrial operational networks are key to organizational survival. Regulations are often so strict that organizations prefer not to outsource the transport portion of their operational networks to other companies.

While some industries—such as transportation and electric distribution—can use their distribution or transportation infrastructure as a right of way, numerous industries do not have such a resource. For these companies, microwave is the solution of choice to interconnect sites.

Even organizations that do own a right of way often struggle to define the multiple physical paths between all locations needed to achieve the reliability required for their operational networks. In many cases, these companies will use microwave solutions to complement their right of way infrastructure to achieve the necessary infrastructure reliability.

In other cases, the geography prohibits the use of fiber in the network end-to-end, either for cost or geo-technical reasons. Microwave is again a viable alternative in these scenarios.

Furthermore, other considerations such as speed of deployment and overall capital expenditure (CAPEX) often make microwave the prime solution.

Finally, for any case in which local regulations force the organization to use another medium for the alternative path, microwave is the logical, cost-effective choice.

In short, microwave transport is commonplace in industry infrastructure, either as the sole basis of the regional operational infrastructure or to complement a right-of-way fiber-based network.

Microwave infrastructure that meets stringent industry requirements

Most traditional microwave solutions were designed as point-to-point transport systems. They also can be used as individual links in a reliable transport network, but their role is really limited to point-to-point transport. In such scenarios, reliability is assured by the optical products used as the backbone of regional infrastructures.

Now that IP/MPLS is increasingly accepted as the most suitable operational network solution for industrial communications networks, a new set of transport solutions is required to replace aging microwave and optical transport technologies.

This has created a market for a packet microwave solution that does much more than replace traditional point-to-point microwave links, including:

- The ability to support stringent quality of service (QoS) requirements for operational traffic. In fact, packet microwave will be able to transport both operational traffic and also a vast amount of other service traffic between sites. If rain, sand or fog degrade the air interface, the solution will automatically switch to less complex coding. The lower channel speed maintains support for mission-critical traffic with the required QoS, performance and reliability levels, and temporarily limits capacity allocated for transporting less critical information. This approach is called adaptive modulation.

Packet microwave combines mechanisms and techniques both at the packet and radio layer that help industries scale capacity according to their requirements, without compromising performance.

- Support for ring networks. The most common networks to be built are either ring or double-ring; best-in-class packet microwave solutions have been designed from the beginning to support rings without requiring additional external equipment. This means packet microwave will transmit information in one direction but switch to the other direction in less than 50ms if failure occurs.
- All the security mechanisms seen in traditional best-in-class carrier microwave solutions. 1+1 redundancy per radio link is the minimum requirement and features such as 2 X (1 + 1), fast rerouting and Ethernet ring protection are valued by network architects.
- Lower power consumption and a small physical footprint, providing better efficiency and a lower total cost of ownership (TCO).

New building blocks are required to support each function in an updated IP/MPLS packet-microwave regional operational architecture, including:

- Carrier-class routers form the core of the campus-wide infrastructure.
- A best-in-class carrier-grade packet microwave solution with QoS designed to operate in a ring architecture to complete the regional operational networks.

As mentioned, while these networks are primarily designed to support operations, they can also be used to carry the ever-growing volume of communications and data traffic generated by the organization. Best-in-class traffic management is a must in this case.

Evolve your operational network with the Nokia 9500 Microwave Packet Radio (MPR)

The Nokia 9500 MPR meets all vertical industry requirements for operational networks. This packet microwave solution is designed to support carrier class infrastructures, and has the following attributes:

- Achieves the highest possible bit rate in normal transport conditions using dynamic encoding techniques, automatically falling back to simpler coding algorithms to assure successful delivery of operational information even in the worst atmospheric conditions.
- Designed for use in ring networks with fast swap-over in case of failure.
- Lowers costs through the use of highly compact antenna units.
- Uses the same radio across traditional microwave applications (split-mount, full-outdoor).
- Supports IP/MPLS over microwave through a seamless and highly cost-effective connection to the Nokia 7705 Service Aggregation Router (SAR).
- Solution design allows room for evolving technology and business requirements.
- Combines aggregation and secured transport in one product supported by an end-to-end service-aware manager.

- Seamlessly integrates into a mixed fiber/air network

The solution is available in a wide range of frequency bands supporting both short- and medium-haul.

Build in integrated access/microwave transport network with full IP/MPLS capability

Combining the Nokia 9500 MPR with the Nokia 7705 SAR—a carrier-class, multiprotocol IP router that supports the wide range of interfaces found in industrial operational networks—produces further benefits:

- Significant operational savings through the implementation of a single management solution across carrier-class IP and microwave environments.
- Further savings are available by adopting the Nokia 9500 MPR-e, a cost-optimized version of the Nokia 9500 MPR. The Nokia 7705 SAR can be connected directly to the antenna unit of the Nokia 9500 MPR-e and supports all relevant multiprotocol access. This removes the need for (and investment in) the standard Nokia 7705 MPR multiservice access box.
- Access to a truly differentiating multiprotocol router, recognized by analysts and award committees as “best router product for vertical industries operational networks”.

Furthermore, the Nokia 9500 MPR was not developed exclusively for industrial operational networks; it also addresses telecommunications and enterprise markets. This enables economies of scale unattainable by products aimed at industrial operational networks markets alone.

The solution is field proven in a number of industrial network deployments, including:

- Interconnecting oil platforms in the Gulf of Mexico. The solution was introduced to replace an aging satellite-based interconnection solution and achieved far superior bit rates at a fraction of the cost.
- Regional operational infrastructure of a number of power distribution companies.
- Backbone transport for TETRA and LTE national security networks.
- Border control and security projects.
- Air traffic control systems, radar backhaul.

Learn more

Contact Nokia for more information about the Nokia 9500 MPR, the showcase product within the Nokia mission-critical industrial operations infrastructure solutions.

Nokia has established partnerships with regional companies to facilitate access to the packet microwave solution. An appropriate partner or Nokia representative will follow up your request.



Nokia is a registered trademark of Nokia Corporation. Other product and company names mentioned herein may be trademarks or trade names of their respective owners.

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

Product code: GSM2013041021EN