



ATM network solutions

Mission-critical communications solutions
for air traffic management

NOKIA

Safer today, smarter tomorrow

Aviation plays an important role in facilitating the efficient movement of people and goods globally. Air traffic management is essential to ensuring air space safety and helping airlines operate safely and cost efficiently, while reducing emissions and providing the best possible experience to passengers. Air Navigation Service Providers (ANSPs) are constantly striving to improve communications, navigation and surveillance systems needed to meet these goals.

Today's ANSPs face complex challenges with new technologies, new safety and security requirements and new environmental concerns; all of this against the backdrop of an increasingly congested airspace as new carriers and new routes proliferate to meet growing demand.

Competitive pressures, regional harmonization initiatives and market liberalization are also driving ANSPs to seek ways of improving efficiency and productivity, meet stricter emissions targets and new security and flight safety provisions — all of which is presenting new operational challenges.

In order to meet these new operational challenges, ANSPs are in the process of digitally transforming their operations for increased efficiency and cost reductions. As they move away from legacy point-to-point communications systems, they need to enhance interoperability with other industry stakeholders to allow collaborative decision-making (CDM), dynamic airspace management, strategic conflict management and flexible use of airspace.

Addressing these challenges requires specialized expertise, cutting-edge modelling and simulation tools, and a comprehensive understanding of the new and emerging technologies that are redefining air traffic management. **That's where Nokia can help.**

Nokia has a long history providing communications solutions for air traffic management. We work closely with Airport Authorities and ANSPs installing and maintaining the

networking infrastructure and applications that ensure efficient, secure and safe operations. We provide a variety of solutions and services to help in the digital transformation of air traffic management (ATM) systems while ensuring safety, security and service continuity are maintained.



Ground-ground communications solution

The Nokia ground-ground ANSP communications network solution provides the required protection and resilience to support ATC safety, security and service continuity requirements. Composed of an IP/MPLS network, it provides a single communications network that converges data, video and voice for operational efficiency while retaining complete reliability, deterministic performance and strong security.

It supports multiple mission-critical services and applications providing the quality of service (QoS) and capabilities required by the service or application, such as voice, surveillance and navigation systems, CCTV and IT systems.

The Nokia converged aviation communications network incorporates optical transport layer for a complete range of integrated capabilities. It is highly scalable and resilient with rapid fault detection and recovery. The IP/MPLS network supports multiple virtual private networks (VPNs) each secured and shielded from the other to ensure the security and deterministic performance of each application, as if each application were on its own separate physical

network. It also supports all legacy applications and protocols for seamless migration from TDM to IP/MPLS and concurrent support of both legacy, if required, and new connectivity requirements.

For our ground-ground solution, we will build, design and migrate communications of your existing systems onto a custom-designed converged IP/MPLS wide area network (WAN).



Mission-critical WAN essentials

The WAN is a multilayer network that features IP/MPLS over carrier ethernet services, microwave transmission, or optical transport. It is built with the following essential mission-critical networking capabilities:

- **Multiservice capability:** The WAN needs to support a mix of new IP-based applications as well as older applications that may still operate with legacy serial and four-wire analog interfaces respectively. It also needs to support flexible layer 2 and layer 3 network services with highly scalable connections for a plethora of equipment and sensor endpoints. Additionally, IP multicast capabilities are essential for efficient point-to-multipoint distribution of data for applications.
- **Strong resiliency:** A WAN outage would cause the loss of visibility and disruption and could have grave safety consequences. The WAN can leverage the full capabilities of IP/MPLS multilayer/multifault redundancy protection to ensure high network availability and withstand extreme weather events and deliberate fiber cuts.
- **Deterministic quality of service (QoS):** The WAN needs robust and flexible QoS capabilities to constantly meet the network performance requirements of a diverse set of applications, including voice and real-time applications

that have strict latency and lossless networking requirements even when the network is congested

- **Diverse access media:** Ubiquitous connectivity throughout the expansive infrastructure is vital. The WAN connects with various access domains from copper cable wire to optical fiber to commercial and private links.

Zero-trust WAN security

The International Civil Aviation Organization (ICAO) has set ambitious security targets for the global ATM system. We build cyber-defenses aligned with an ANSP's and ICAO operational objectives to achieve layered security across network, application, data, identity and access management, establishing a series of defenses that close off any attempts to exploit security gaps.

Mission-critical IP/MPLS wide area networks (WANs) can keep pace with the connectivity demands of physical and digital ATM infrastructure and counter more complex cyber threats. ATM systems are high-value targets for malicious actors in cyberspace. As ATM operations become increasingly digitalized, the attack surface of ATM infrastructure expands significantly. Protecting the confidentiality, integrity and availability of application data as it traverses the transport network is paramount for ensuring safe and efficient digital ATM operations. An impregnable cyber defense requires a zero-trust approach combined with a

multilayer defense-in-depth framework that extends across the infrastructure, networks and applications.

ANSPs can turn the WAN into the first line of cyber defense by implementing a comprehensive suite of security tools, including network segmentation through IP/MPLS services, IP and Media Access Control (MAC) filtering and role-based network management.

Quantum-safe networking

As bad actors gain access to more sophisticated resources and evolve their attack methods, the security posture needs to adapt to address current and future threats. With the arrival of cryptographically relevant quantum computers (CRQCs) looming, many current network security measures will soon become vulnerable. To ensure an effective defense against current attacks and emerging quantum threat, the transport network security posture needs to be strengthened with quantum-safe encryption. A multilayer defense-in-depth approach that uses Layer 1 OTNsec and Layer 2 MACsec with symmetric AES-256 encryption can provide quantum-safe protection.

OT Cloud networking

Many critical applications and data analytics tools are now deployed in a set of segregated on-premises servers that operate in a cloud environment hosted within the ANSP data center to streamline real-time analytics and to enable seamless collaboration

across multiple stakeholders. This environment is known as operational technology (OT) cloud.

OT cloud is a key component of the infrastructure supporting digital towers, remote monitoring, and AI-driven predictive maintenance, ensuring continuous ATM operations. It serves as a platform for enhancing application performance and agility, which enables operators to adapt to a changing operational environment without compromising the availability and performance of critical applications. It also helps to embrace emerging and innovative technologies such as AI and ML. Technical capabilities such as automation and digital twins significantly improve the availability of the data center fabric. These features simplify and accelerate operations for staff and de-risk network changes or adding new applications.

With the OT cloud, the data center network is now part of the mission-critical connectivity infrastructure. The data center network needs to interwork seamlessly with the IP/MPLS network to provide end-to-end mission-critical connectivity for ATM applications. OT cloud networking is a response to this new requirement. It extends mission-critical connections from the IP/MPLS transport network into the data center network, which is composed of the data center gateway and data center fabric. The tight interworking of the WAN and the data center fabric gives the network the agility required to support dynamic OT cloud networking.

ATM case studies

Irish Aviation Authority (IAA)

Responsible for the majority of the North Atlantic airspace, the Irish Aviation Authority (IAA) turned to Nokia to upgrade its air traffic control communications network at its new West Ireland disaster recovery center. The new network needed to support the migration from legacy services, such as end-to-end radar communications, to new, more demanding IP applications. Nokia supplied its IP/MPLS networking products, specifically designed for this level of mission-critical application, as well as professional services, including integration and testing.

Billy Hann, Director of ATM Operations and Strategy for the IAA, commented on the successful project: “Given our responsibility to ensure the smooth operation of the North Atlantic airspace, it has been crucial that Nokia earn our trust. The quality and reliability of its technology and the thoroughness and collaborative approach of its teams has been first class throughout the entire migration process. We are very pleased and confident in the performance of the new network.”

The successful deployment of the network precedes the expected doubling of global air traffic by 2030. The North Atlantic airspace is one of the most crowded airspaces in the world and the IAA will need more capacity as traffic grows. The network was deployed in early 2019 and is currently in service. It has successfully carried out a number of live trials across multiple airspace sectors in the key North Atlantic region, delivering critical voice and radar services to controllers over the new Nokia IP/MPLS platform.

Airport Authority Hong Kong (AAHK)

In response to anticipated growth in traffic, the AAHK chose Nokia to upgrade its network for increased data capacity to handle aviation control systems and ensure smooth and safe operation of aircraft in its airspace and on the ground.

According to S. F. Chan, Assistant General Manager, Shun Hing Systems Integration Co., Ltd., the “project is an important step in plans to expand the airport’s operations, enabling it to take advantage of IP networking to modernize aviation communications.” The mission-critical IP network will enable the AAHK to seamlessly migrate their legacy applications while adding new applications and services to extend its capabilities.



Why Nokia?

Nokia has extensive experience serving the aviation industry. Its client base includes ANSPs, airports and airlines. More than 10% of the world's ANSPs have relied on Nokia for their IP network transformation.

Nokia's aviation solutions bring substantial cost savings in the provision of network infrastructure support services as well as application of innovative technology to create benefits for passengers and airlines. Nokia's network designs meet ATC safety requirements and assure mission-critical reliability. Our solutions are best in industry for the level of integration they provide to ANSP legacy applications and support for specialists, including technical and IT development resources.



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About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

With truly open architectures that seamlessly integrate into any ecosystem, our high-performance networks create new opportunities for monetization and scale. Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

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