White paper: ATM-grade networks

Achieving safe, efficient, future-ready air traffic control communications

Frequentis was instrumental in introducing ATM-grade networks to the air traffic control industry, and continues to invest in taking them to the next level.

If you are yet to embrace ATM-grade networks, this paper aims to demonstrate why you should.

For those that have deployed such solutions already, our aim is to show how Frequentis can help you evolve them, by introducing intelligent routing and control, scalable networks and situational awareness, all through a seamless migration path.

Balance performance and efficiency, overcoming the challenges of a modern air traffic network to keep aviation passengers safe without letting costs soar.

Air Traffic Management

FREQUENTIS

Understanding the challenges faced by Air Navigation Service Providers

Global air traffic levels are rising, with the latest data from the International Air Transport Association (IATA) showing that total passenger numbers are expected to reach up to 4 billion this year. Worldwide, 58 million jobs and $2.4 trillion in economic activity are related to aviation. As air travel continues to generate economic and social benefits, growth in traffic is likely to continue, with SESAR assuming 50 percent traffic growth in Europe alone by 2035.[1]

As flight traffic grows, so do the challenges. In air travel, there can be no compromising on safety. Faced by an increase in demand Air Navigation Service Providers (ANSPs) need to balance their top priority of maintaining the highest levels of passenger safety with a variety of other challenges.

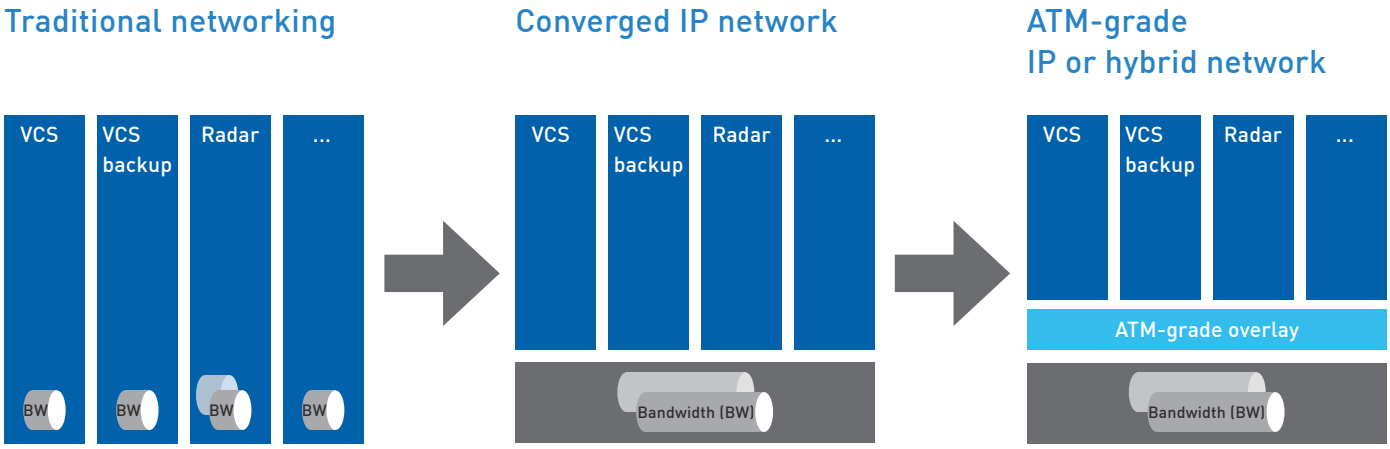
To respond to these challenges, ANSPs need to be able to exchange large and growing amounts of data in more time- and cost-effective ways—making reliable communications the central element for ANSPs' infrastructures. Daily operations, collaboration with other providers and integration of systems all depend on ANSPs' ability to communicate, which is where application-aware networking technology can help. However, many ANSPs have legacy technology in place that they need to phase out in a non-disruptive way.

Previously, networking was usually handled as a sub-element of each application in an ATM infrastructure, resulting in a patchwork of different networks, each managed and procured separately. Operating in this way makes allocating the correct level of security and priority to each type of communication increasingly challenging, especially when different networks offer varying levels of performance.

Building on more than 70 years of experience in ATM, Frequentis is using its experience with ANSP requirements to propose a more effective approach based on its vitalsphere™ network portfolio: replacing ANSP networks with ATM-grade networks. An ATM-grade network can react to changing network performance to ensure that communications reach their end destination with the appropriate priority and protection.

Figure 1: Take advantage of the benefits of converging networks, and avoid the downsides

IP network technology removes the need for traditional standalone networks for ATM applications



- Expensive to maintain
- Many different technologies
- Lots of specialists needed

- Reduce OPEX/CAPEX
- Non-deterministic behaviour
- Competition between applications
- Unclear demarcation between applications and networking

- Increased availability
- Brown-out detection
- Path diversity
- Deterministic routing
- Defined competition

[1] http://www.sesarju.eu/approach/cost

Indeed, Frequentis' innovative approach to communication not only increases security and performance in ATM-grade networks, it can also cut the cost and hassle of managing multiple networks by converging them. Converged networks empower ANSPs to run multiple applications on a single network infrastructure—increasing their operational efficiency and streamlining information integration.

What makes a network ATM-grade?

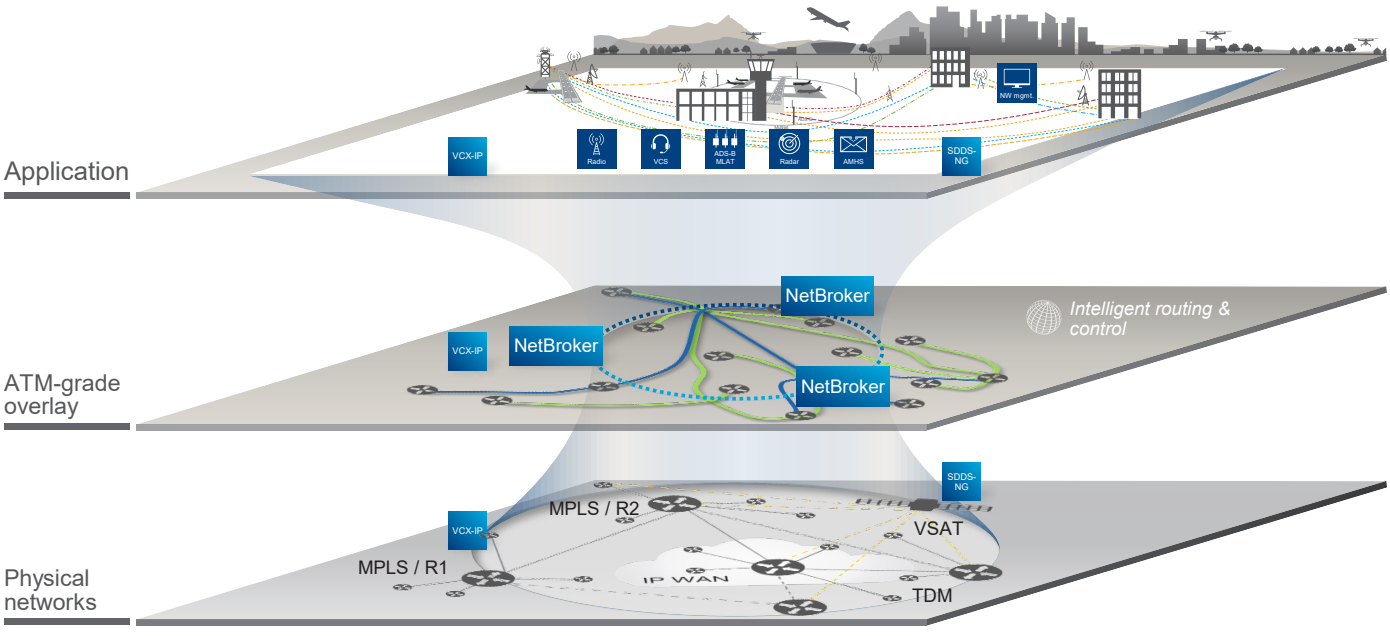
To address the problems that emerge in the transition to IP-based or hybrid converged networks, a new network architecture and design must be developed based on the following expectations:

- The network must be application-aware, with traffic management based on the service quality
- Safety-critical methodology must be applied to network design
- Resilience to multiple simultaneous failures and unpredictable anomalies must be built in.

Working from this premise, there are several distinguishing characteristics of an ATM-grade network that arise. Unlike a typical enterprise network, an ATM-grade network is:

- Deterministic in its performance
- Resilient to unusual errors and security incidents
- Built with the safety requirements of ATM applications in mind
- Pre-integrated with network management components
- Compliant with international rules and regulations for the ATM domain
- Operated according to well-defined and executed procedures, especially concerning changes and their effects.

Figure 2: Building ATM-grade networks by introducing an SDN overlay – the vitalsphere™ concept



How is Frequentis delivering ATM-grade networks ?

To deliver ATM-grade networks, Frequentis provides solutions based on its vitalsphere™ product and service portfolio that enable:

- Scalable networks that integrate diverse technologies, including multi-vendor solutions
- Situational awareness for end-to-end, real-time monitoring of all applications and networks
- Intelligent routing and control that match real-time network performance and application needs.

NetBroker

NetBroker is an open standards-based software defined networking (SDN) controller tailored for ATM networks. It unites real-time network performance data with application needs and pre-defined mitigation scenarios, filling the technical gap between conventional IP networks and the very specific and heterogeneous requirements of different ATM applications.

Unlike conventional networks, which react only to total link loss (black-outs), NetBroker detects degradation of performance (brown-outs) and selectively and deterministically reroutes impacted application traffic to ensure that applications meet their required service levels. Through precisely defined SLAs and priorities per application class, NetBroker ensures deterministic behaviour, so ANSPs can keep airspace open even when performance of some network links degrades.

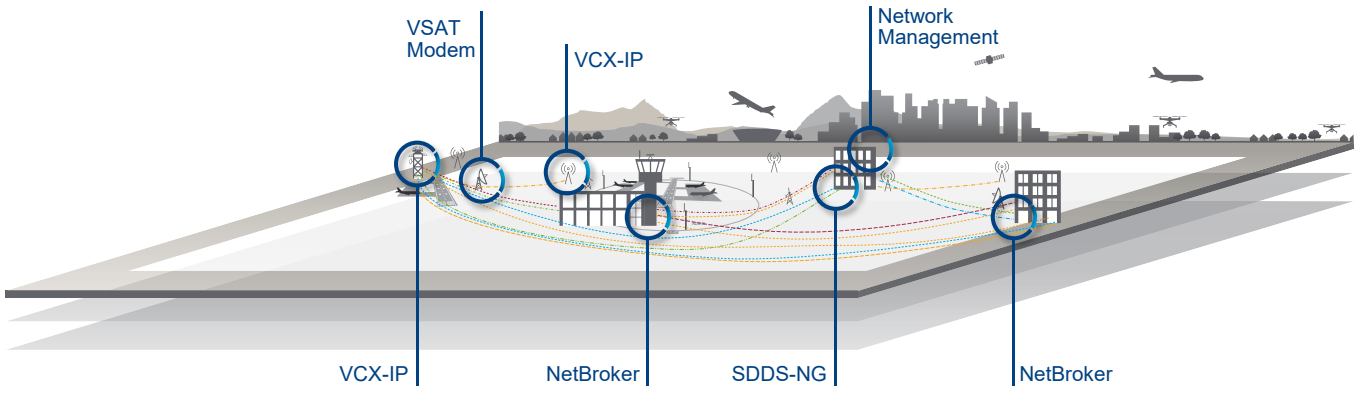
It also monitors transmission modulation changes in satellite- or microwave-based links and estimates expected changes in bandwidth capacities across every layer of the network, enabling further proactive redirection of traffic to help maximize service continuity. Designed to integrate seamlessly into any forwarding plane environment, NetBroker can be used to manage almost any virtual or physical network device, helping ANSPs make use of existing investments.

VCX-IP Network

Offering a sophisticated, application-level gateway for safety-critical voice communications, VCX-IP complies with European and international Voice over IP (VoIP) standards for civil and military ATM and includes security functions. Through a cost-efficient, step-wise migration path, it delivers protocol conversion for radio and phone, enables ATM-specific contingency scenarios using intelligent routing, and optimises ATM applications.

VCX-IP provides echo-free voice communications and deterministic network behaviour for all voice and data communication flows to deliver extremely high performance. Its safety-driven, fully redundant hardware and software design maintains connections in almost any scenario for exceptional service continuity. Finally, proven interoperability with other vendors' and legacy equipment, cost-effective support and ATM-specific bandwidth savings that go well beyond simple voice compression combine to ensure a low total cost of ownership.

Figure 3: The Frequentis vitalsphere™ product portfolio



Surveillance Data Distribution

Surveillance Data Distribution (SDDS-NG) is a highly versatile system for the exchange, conversion and distribution of any kind of surveillance data in heterogeneous ATM or air traffic control (ATC) environments, providing a single access point to this vital information. It supports standard ASTERIX data formats, IP-based communication protocols, serial protocols and legacy data formats, helping operators make use of existing infrastructure and prepare for the advent of new technology.

Offering a highly scalable and flexible solution, SDDS-NG can be used as a configurable protocol and/or a data converter, or as the foundation for a surveillance data network that supports originator-controlled data sharing and data and format conversion. In conjunction with data filtering, this gives users extensive flexibility. By centralising the monitoring, configuration and control of the entire surveillance data distribution environment, it supports efficient data management. Just as VCX-IP Network offers an application-level gateway for voice and data communications, SDDS-NG provides the equivalent for surveillance data. Incorporating dynamic filtering, it resolves overload situations for a deterministic response that preserves safety at the application level.

Network Management Solution

Frequentis network management solutions are built on operational analysis; they are designed to integrate and augment information provided by standardised third-party tools to help ANSPs work effectively. Meeting the fault-management, configuration, accounting, performance and security levels of the FCAPs framework created by the International Organization for Standardization (ISO), they also include network simulation and workflow design elements.

To ensure ANSP stakeholders have the information they need at all times, Frequentis network management solutions provide situational awareness based on data from multiple subsystems, combined to provide a big picture tailored to users' specific requirements. Equipped with comprehensive insights into network status, ANSPs can benefit from greater performance, lower costs and enhanced resource planning.

By transitioning to such a solution, ANSPs can evolve their approach to network management from passive and reactive to proactive and more effective. Mission-critical situations can be detected with greater ease and forewarning, enabling faster mitigation and minimising impact on operations.

Satellite-based backbone

Regardless of an ANSP's location or needs, satellite is the best method for bypassing or extending the existing national and international terrestrial networks because it can remove local loop difficulties, especially in areas with poorly developed infrastructure.

Frequentis Very Small Aperture Terminal (VSAT) solutions incorporate technology and configurations including full-mesh, star or point-to-point, according to what fits the customers' needs the best. Our focus is the seamless integration of various applications into a single shared infrastructure like operational voice (A/G or G/G), video (remote tower) or data services (AMHS, and others).

Our VSAT solutions serve as primary and/or back-up networks in combination with other technologies such as Multiprotocol Label Switching (MPLS), time-division multiplexing (TDM) or microwave links. Incorporating faster switching mechanisms than regular VSAT networks provide today, they deliver the high availability that fulfils ANSPs' requirements of uptime with minimal loss of voice and data packets.

Unique features such as dynamic delay combination for operational voice are incorporated in Frequentis satellite solutions. Through compression capabilities optimised for the operational Air Traffic Management Voice over IP standard ED-137, they ensure efficient and economical use of satellite bandwidth.

Proven benefits of ATM-grade networks from Frequentis

ASNPs that deploy a Frequentis vitalsphere™ network can expect to enjoy a range of benefits, including but not limited to the following.

Exceptional availability

ATM-grade networks from Frequentis can deliver better than 99.999 percent availability, giving ANSPs the tools they need to achieve superb service continuity so that they can keep passengers safe and moving through airspace.

Reduction in bandwidth

By adopting ATM-grade networks from Frequentis, clients have realised reductions in bandwidth of up to 90 percent, enabling dramatic cost savings.

Safety

With application-aware routing, users benefit from deterministic behaviour and graceful degradation capability, helping them to preserve safety consistently. All solutions are developed according to the ED-153 SWAL3 standard required in the ATM industry.

Security

Operational networks incorporate strict levels of security: only authorised and pre-known traffic is granted access to the ATM network.

Ready for now and the future

Supporting ATM-specific interfaces and incorporating a range of industry standards, Frequentis solutions are designed for interoperability with legacy and future technology, and satisfy various regulatory bodies' rules.

Drive performance

Offer controllers an enhanced experience for voice and data communications, helping them work more productively to pave the way for increases in passenger capacity alongside enhanced service quality.

Closing remarks

The Frequentis vitalsphere™ network portfolio holds the answer to many of the most pressing challenges faced by ANSPs today – and some they are likely to encounter in the future. By partnering with Frequentis, organisations can benefit from leading-edge technology and thought leadership, such as voice and surveillance applications. Frequentis offers an end-to-end approach to design, and delivers overlay networks that create transparency for applications to maximise flexibility. Drawing on years of experience from large-scale network modernisation projects, Frequentis can ensure a seamless migration from current to desired state, including the necessary support and knowledge of legacy applications and backbone architectures.

Don't delay, contact Frequentis today (atm-networks@frequentis.com) to ensure your ATM network is ready for what the future might hold.

FREQUENTIS AG
Innovationsstraße 1
1100 Vienna, Austria
Tel: +43-1-811 50-0
www.frequentis.com