White paper: Virtual Centre

Breaking down barriers in air traffic management to increase cost-efficiency and facilitate growth

Challenged by growing demands and increasing cost pressure, air navigation service providers (ANSPs) need to find more efficient and flexible ways of working. Airspace users also want to see closer collaboration between ANSPs, as this will cut fragmentation in airspace management.

The Virtual Centre concept is making headlines in the industry as the best solution to these challenges. By geographically decoupling air traffic management (ATM) services from location, Virtual Centres increase agility, capacity and cost-efficiency, while enabling better contingency planning. To help make Virtual Centres a reality, Frequentis has developed a service-oriented architecture to facilitate seamless collaboration based on interchangeable standard services.

Air Traffic Management

FREQUENTIS

Navigating the winds of change

The ATM industry is at a turning point, with ANSPs facing the twin pressures of growing demand for their services combined with limited air traffic control (ATC) resources. Costs are always rising, not least because many providers must also tackle the challenges associated with infrastructure that is nearing its end-of-life. ANSPs must also adapt to meet new operational requirements: managing increased demand with limited ATC resources, improving resilience for critical infrastructure, and coping with the changing profile of air traffic as unmanned aerial vehicles (UAVs) begin to proliferate.

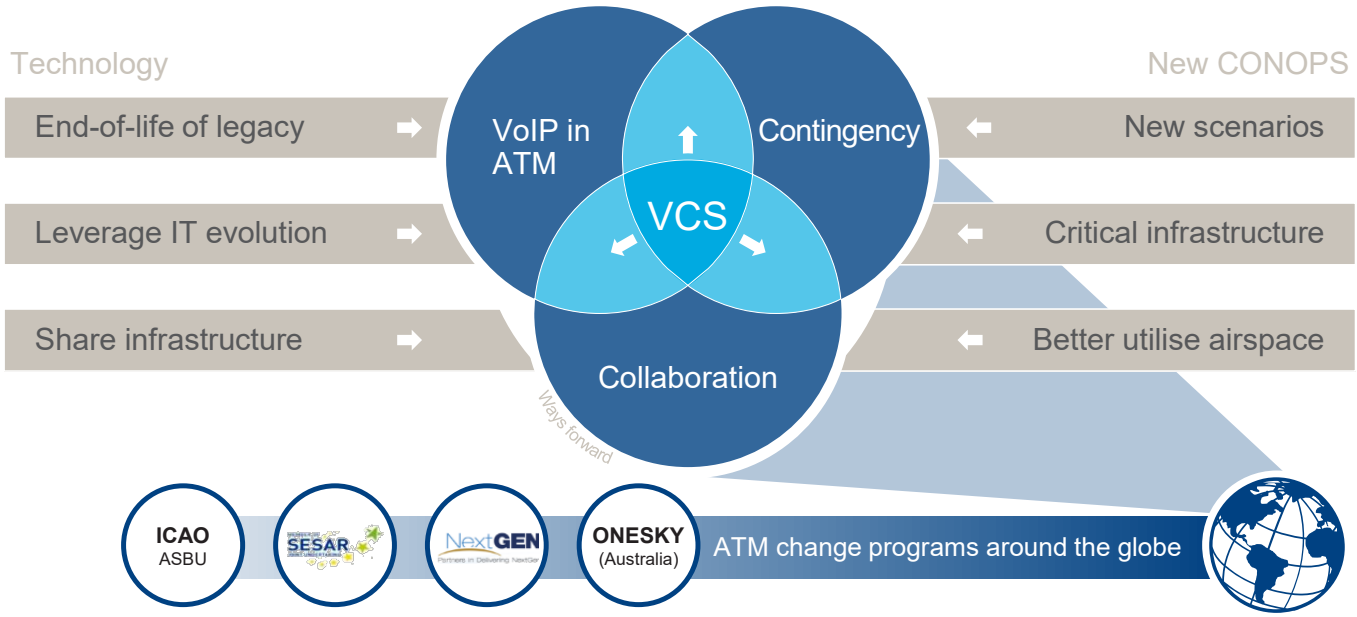
In many cases, ANSPs are struggling to deliver all of these use cases safely and efficiently because of the inflexibility of their legacy systems and processes. These internal challenges are also felt externally, where they make it difficult for ANSPs to work seamlessly with their peers. The resulting fragmentation of ATM is becoming more obvious; airspace users and regulators want providers to collaborate further, but incompatible ways of working and obstacles to sharing information tend to prevent this.

In addition to reducing operational efficiency and creating inconvenience for airspace users, ATM fragmentation stands in the way of achieving better contingency planning, which is an increasingly important objective for many ANSPs. The primary goal is to facilitate the smooth and safe handover of air traffic from one centre to another (or from one ANSP to another) in the event of an unexpected interruption in service.

Enhancements in contingency planning will also help ANSPs to schedule planned-maintenance activities more easily for centres that currently need to remain in operation 24/7.

In response to these challenges, industry bodies around the globe have initiated ATM change programmes that aim to find new ways to deliver safer and more secure capacity for airspace users, and at a lower cost. The International Civil Aviation Organization (ICAO), the Single European Sky ATM Research (SESAR), the Next Generation Air Transportation System (NextGen) and OneSKY Australia programmes all have stated aims to transform and harmonise ATM in their respective regions.

Figure 1: Drivers for ATC voice communication evolution



Vision of a more connected future

Building on the specifications in SESAR and other industry initiatives, Frequentis proposes a Virtual Centre concept that is already in active implementation worldwide. The concept fulfils all five key technical objectives for Virtual Centres set out in SESAR: service-orientation; multi-vendor; service-provider independence; controller working position (CWP) independence; remote usage. By decoupling aeronautical data service providers (ADSPs) from air traffic services units (ATSUs) through the use of open and standardised interfaces, this concept represents a leap forward in agility and flexibility. Thanks to the ability to run shared services from any location, ANSPs will be able to create – and dynamically recreate as requirements change – Virtual Centres that can seamlessly share workload and reliably hand-over traffic to other providers in the event of a contingency.

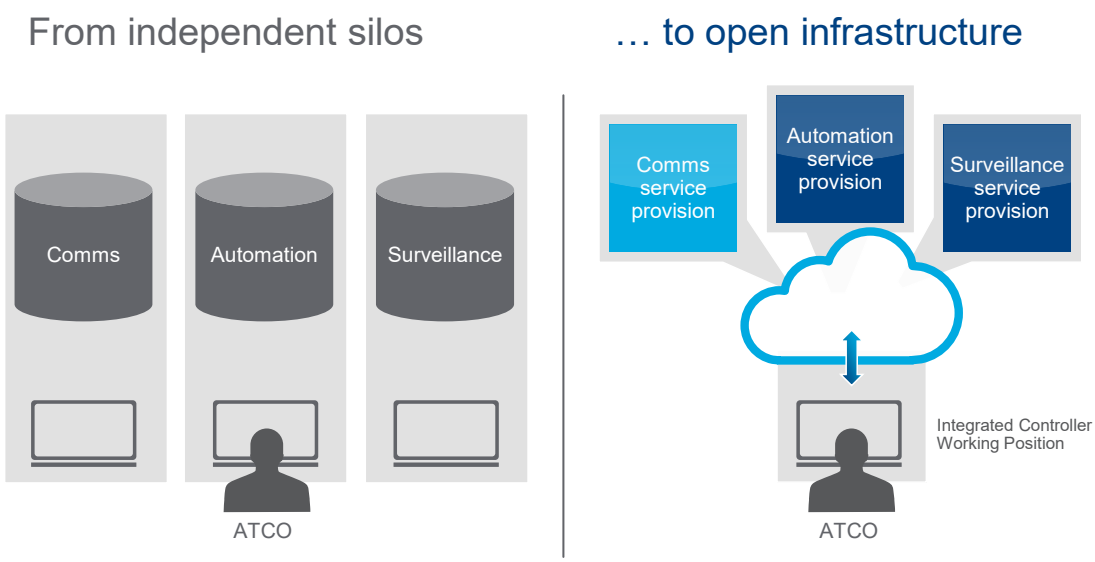
The Frequentis Virtual Centre concept enables the available capacities in a given portion of airspace to be organised using interchangeable standard services. This interchangeability makes it easier and more efficient for ANSPs to share workload. What's more, the functional harmonisation ultimately increases the capacity of the whole system.

By reducing ATM fragmentation through standardisation and easier sharing of workload, the Virtual Centre concept naturally helps ANSPs deliver more enhanced and safer services at lower costs.

The benefits of enabling better collaboration between ANSPs are clear, but of course there are technical obstacles to overcome before this can become a reality. The Frequentis approach starts with breaking down the existing silos in communications, navigation and surveillance, typically built up over years of deploying standalone solutions. These solutions will be replaced by an open, standards-based, service-oriented architecture that provides interchangeable shared services.

Through this approach, the ATC officer (ATCO) who is communicating with a pilot no longer needs to be physically located in the area the aircraft is flying over. In other words, rather than ATC functions being physically tied to a particular infrastructure in a specific centre (and duplicated in different ways in other centres), the Virtual Centre concept proposes standardised ATC services that can be used by any ANSP in any flight information region (FIR), regardless of the infrastructure on which they are running or the centre in which that infrastructure is hosted.

Figure 2: Dissolving data silos – cornerstone for the Virtual Centre



From systems to information

A key element in the Virtual Centre concept is the provision of voice as a shared service. Today's standard has radio infrastructure directly connected to voice communication systems in control centres, which creates a rigid organisational requirement to deliver those functions from those physical locations. As part of the move away from this systems-centric approach to an information-centric approach, Frequentis proposes the migration to shared-frequency services across the network.

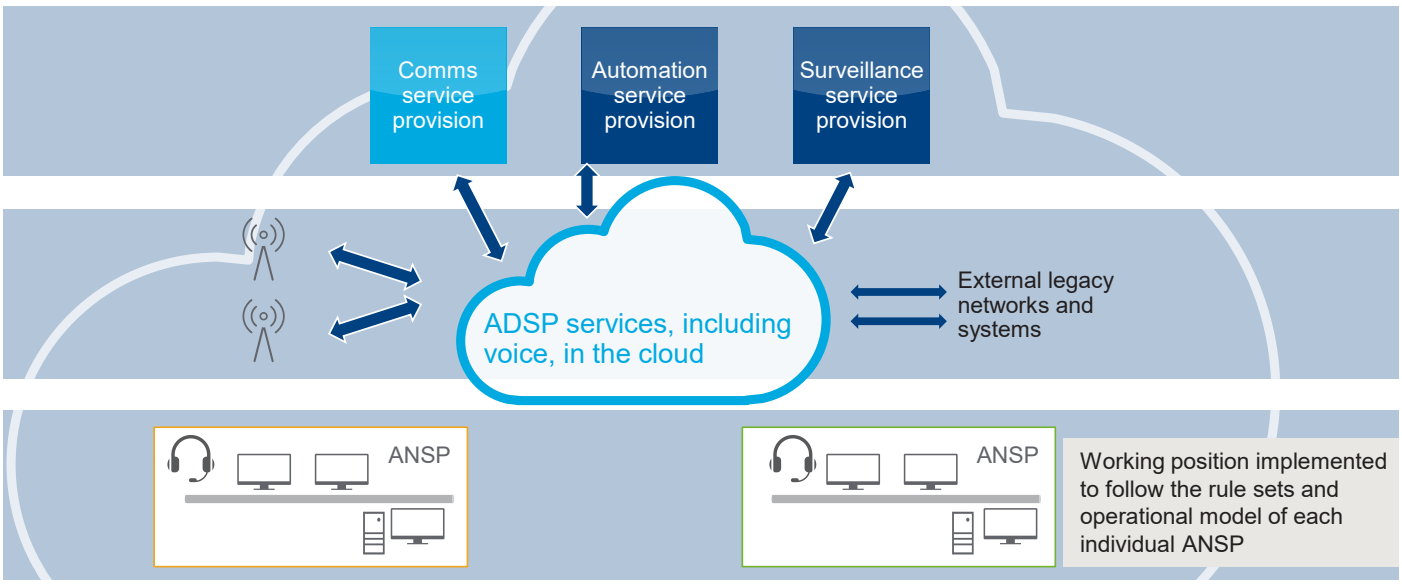
Within the network of the future, each different frequency will represent an individual voice service and will be treated as a shared asset by all participating ANSPs. The organisation and infrastructure underpinning each service can then be consolidated and delivered from wherever the network bandwidth cost is optimal. Similarly, technical centres will concentrate technical equipment: rather than every centre needing to duplicate technology deployed in every other centre, they will be able to specialise in a subset of components from which they will provide services to the whole network. This implies significant cost-efficiency gains by reducing unnecessary redundancy in equipment and personnel.

Breaking the enforced link between ATC services and the locations that deliver them will facilitate new ways of working. For example, it will be easier for aeronautical data service providers (ADSPs) to provide data to ANSPs, enabling them to increase their focus on core ATC functions. As an ADSP will be able to use the same personnel and technical resources to serve multiple ANSPs, this opens up the possibility of significant economies of scale – resulting in cost optimisation for the ANSPs.

Open interfaces for seamless collaboration

The Frequentis Virtual Centre concept defines the top-level service-oriented architecture but also recognises the central role of the controller working position. Effective collaboration between virtual teams spread across multiple locations (and even multiple ANSPs) will depend on having an open platform for using services based on system-wide information management (SWIM) applications. Frequentis has already demonstrated a single open interface for service consumption, covering functionality such as: surveillance; correlation; flight data distribution, coordination and transfer.

Figure 3: Aeronautical data service provision – applied to voice services



By deploying an open interface for consuming shared services, ANSPs will enable their virtual teams to collaborate seamlessly across multiple sites and multiple flight sectors. From the perspective of airspace users, the use of common standards and interchangeable services by ATC operators will make traversing multiple ATSUs as easy and seamless as flying through a single ATSU.

Safe and cost-efficient air traffic management

Frequentis has designed its Virtual Centre concept to address the key issues facing ANSPs today: rising demands, static (or shrinking) resources, and the obstacles to interoperation created by legacy systems. By decoupling services from physical locations – thereby enabling the creation of dynamic Virtual Centres – this approach facilitates the sharing and balancing of workload between internal teams and other ANSPs. As well as providing the flexibility for ANSPs to address growing demands from airspace users, this approach enables more effective resource utilisation – so that ATC operators are no longer over-worked or under-used.

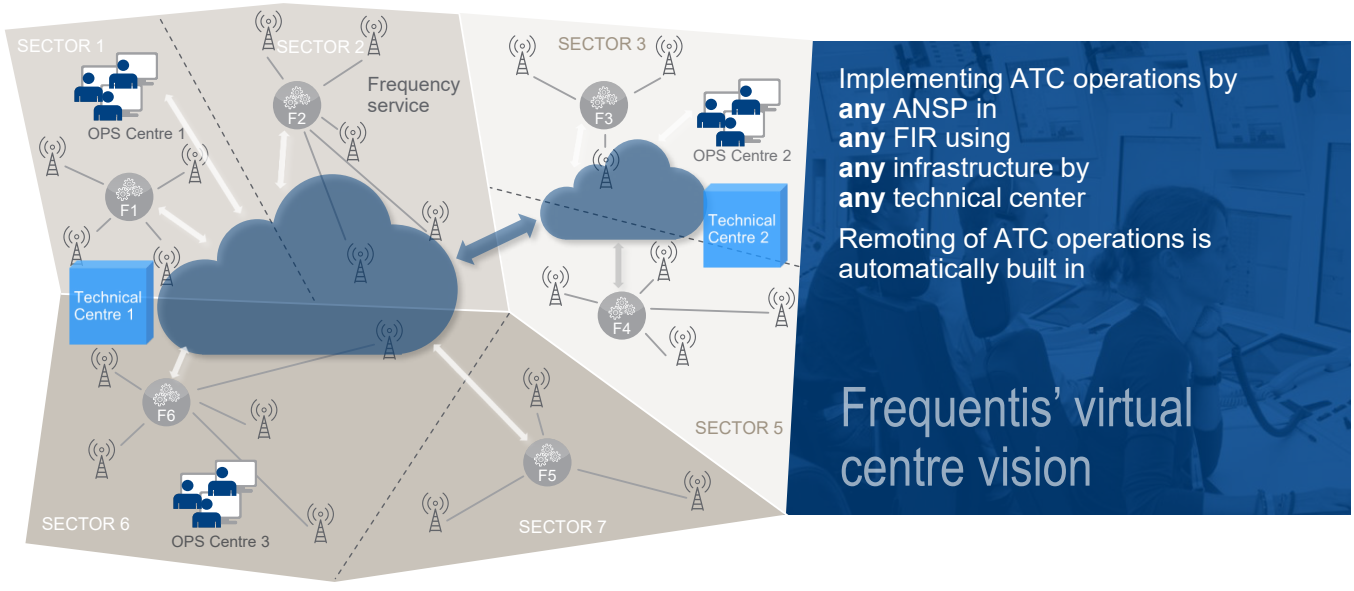
Further reduction of costs is achieved by promoting the harmonisation of processes both within and between ANSPs. In the longer term, decoupling services from specific pieces of technology will increase agility and reduce the cost of implementing new functionalities.

Seamless collaboration using interchangeable standard services increases operator efficiency, and the acceleration of cross-border or cross-ATSU transitions improves airspace users' satisfaction. And with less time and effort expended on managing existing traffic, ANSPs can grow capacity without compromising safety. With air traffic potentially set to grow significantly as UAVs proliferate, this additional capacity will enable ANSPs to scale without necessarily raising their internal costs.

Combined with harmonised interfaces and processes, the decoupling of services from delivery locations will enable truly dynamic airspace allocation, optimising ATM operations. For example, an ANSP could plan to delegate selected airspace sectors to external resources at peak times, or close selected ATSUs at night or to undertake planned maintenance work.

The Frequentis Virtual Centre concept also mitigates risk by helping ANSPs build more effective contingency plans. Interchangeable standard services make it easy for one ATC operator to pick up where another left off in the event of an unexpected outage, ensuring that airspace users remain safe in a contingency scenario. Facilitating the handover of services in this way also makes it possible for ANSPs to carry out planned maintenance on control centres that are currently required to operate around the clock every day of the year.

Figure 4: Network-centric voice services enable flexibility



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