The essential fabric of the digital airport
A digital platform for airports

Air transport plays a major role in contributing to sustainable economic and social development. A strong and affordable global air transport network transcends continents and greatly expands local access to foreign supplies and markets. Air travel supports the management of global enterprises and organizations, tourism, cultural and social exchanges, and enhances emergency and humanitarian response capabilities during crises and public health emergencies. It is difficult to imagine our modern world functioning without it.

The air transport industry directly and indirectly supports the employment of 58.1 million people and contributes over $2.7 trillion to global GDP. Airplanes carry over 8.3 billion passengers and 118.6 million tons of cargo annually, and the growth in commercial flight volumes shows no signs of slowing. Unfortunately, many airports weren’t designed to deal with the current volumes and the growing diversity of customer needs. Because much of this growth is related to the rise of low-cost carriers, airports are challenged to grow aeronautical revenue and are looking for opportunities to increase their non-aeronautical business.

In addition, airports face new competitors and changing business models, as well as more demanding compliance regulations around security, safety and the environment. As a result, they are embracing scalable new digital technologies to deliver a secure and seamless journey, drive operational efficiencies and allow them to adapt to different business models.

Nokia and air transport

At Nokia we are a global leader innovating the technologies at the heart of our connected world. We understand that smart, dynamic networks will be the foundation for a smarter world, including our airports. The Nokia Future X Network vision is of a connected, digital platform that supports and fosters new air transport applications and services for greater efficiency, richer experiences and cleaner environment.

This dynamic, connected platform is essential to achieving the digitally transformed airport. It provides the reliable broadband connectivity — wired and wireless — to connect all people, processes and systems. Multi-cloud technologies ensure scalability and flexibility, and enable applications to be run locally or centrally. Device and connectivity management, cognitive analytics and machine-learning systems support smart applications and services that will enable cross-agency collaboration and bring about the digital transformation of the airport.

We call this the Future X Architecture for airports. In order to digitally transform their operations, they need systematic approaches that meet specific near-term challenges and provide a platform for future growth. With our commitment to the Aviation Transport Industry (ATI), we believe that building this dynamic, connected platform for airports is the best starting point for achieving their cost competitiveness, ability to monetize investments, improve efficiencies and deliver an excellent passenger experience.
The digital airport opportunity

The primary concern of all airports is the efficient and secure processing of passengers and goods. However, they support a whole ecosystem of partner entities, ranging from passenger, flight, and aircraft operations, to baggage operations, transportation security and border management, cargo operations, and third-party in-terminal services for passengers.

With this kind of diversity, each airport has to design its own individual digital transformation strategy. Although each airport has different needs and willingness to embrace digital technologies, they are generally receptive to the role that technology plays in improving operational efficiency, incremental non-aeronautical revenue growth, reduction in OPEX and regulatory compliance.

Airports need to ensure their wireline and wireless network infrastructure is highly reliable, secure, and provides sufficient coverage, including for mobile vehicles and machinery. It is the foundation for broad digital transformation and can help to improve operational efficiency, such as turnaround times for aircraft services, asset management and luggage handling.

It is essential to link cameras and sensors for enhanced situational awareness for security and first responders, as well as supporting critical voice and data communications.

With the establishment of this connectivity platform, it becomes possible to feed more data and video into big data and analytics applications. There are variety of possible business cases that can bring value across a wide range of airport processes, optimizing passenger flow, passenger processing and baggage reconciliation. In addition, due to safety and regulatory policies, there is an increasing amount of data that needs to be more efficiently processed and acted upon. Sensor information from machinery can be used for predictive maintenance. Machine-learning and AI will make the automation of key processes, as well as the remote operation of a wide variety of airport assets, possible.

Cloud technology has already been implemented by airports in their effort.

### Key Statistics

- **58.1 million** employed in the air transport industry
- **8.3 billion** passengers transported
- **$2.7 trillion** contributed to Global GDP
- **118.6 million** tons of cargo transported

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1 Source: ICAO  
to reduce costs by removing, or at least reducing, the need for costly hardware at airport premises with resulting capital and operating benefits for IT. New advancements in cloud technology, such as local edge computing, will further support IoT and automation applications that require local processing and low latencies.

In summary, as volumes continue to grow in the airport sector, the challenges grow as well. In order to respond to the need for greater capacity and efficiency, airports require a digital architecture that helps them to improve operational efficiency and continuity, passenger experience and grow revenue. Airports are complex ecosystems that, much like smart cities, require a foundational framework that can support tremendous diversity and yet create synergies, collaboration and harness network effects that will help them evolve from terminals to multi-modal service centers.

“In few years from now, we will be handling 3 times more passengers than we used to 10 years ago. That is not possible without integrating the network of the different systems we use here. The capacity surge is going to be the biggest issue, because more people are going to use air travel.”

Airport technology leader, UK

2018 ATI Market Reality¹

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Industry wide challenges on Airspace- and Airport Capacity

Financials
- Reduce Cost
- Increase Revenue

PAX eXPerience
- Digital Expectations
- E2E Journey

Efficiency
- Connect all Stakeholders
- Realtime Adaption

In order to meet the complex needs of tomorrow’s multi-modal airport, the Nokia Bell Labs Future X architecture for airports provides a powerful digital value platform. Pervasive high-performance networks host public and private core and edge clouds, analytics and machine-learning capabilities, all with end-to-end security. These capability layers enable the creation of diverse, advanced business applications that integrate and support everything from single-purpose applications to the entire airport ecosystem.

The Nokia Bell Labs Future X architecture for airports provides an intelligent, dynamic communications and cloud-based platform to support all of the individual systems, processes and activities of the airport. It will enable better interaction between many existing systems and provide a launch pad for innovative new applications and services.

At the deepest level of the Future X architecture lies dedicated universal broadband connectivity, both wireless and wired, making every kind of communication and information exchange possible. Built with a dynamic mesh fabric around a high
performing IP/optical/microwave core, it uses wired or wireless access to connect with people, sensors, video monitors, aircraft and vehicles, all securely and with the highest reliability.

Cloud technology is essential to the Future X architecture, ensuring the flexibility, scalability and universal availability of both data and intelligence. Placed throughout the network fabric, local and distributed edge clouds ensure the ultra-low latencies required for video analytics and other processes.

Cloud-native, software-defined networks dynamically allocate capacity when and wherever it’s needed — whether to support airport passenger surges, rush hour congestion, or popular sporting events being watched by passengers in the airline lounges or restaurants. Built into the Future X architecture are data processing capabilities and analytics, including machine learning and artificial intelligence systems. These ensure that, out of the ocean of data about assets, processes, environment and people, relevant and actionable insights can enable greater operational efficiencies, awareness and new services. Analytics, operational systems and automation provide open, digital value platforms that can be harnessed by any kind of airport application.

The Nokia Bell Labs Future X architecture will help airports to launch their digital transformation. Airports will be able to create new levels of efficiency, continuity, responsiveness and business and operational intelligence. With it, they will be better able to address their many challenges and help the airport to realize its new role in a more sustainable world.

The Nokia Bell Labs Future X architecture for airports provides an intelligent, dynamic communications and cloud-based platform to support all of the individual systems, processes and activities of the airport.
Use cases for the new airport:

**Private wireless broadband for airports**
Airports and their many stakeholders rely heavily on wireless services for their operational processes. To safeguard operational continuity, these services need to be highly reliable and available everywhere at the airport. With continued passenger growth, airports will increasingly rely on broadband data and service availability to enhance operational efficiency. General public cellular services and Wi-Fi, which have served airports for many years, do not provide predictable, reliable performance. With private wireless solutions, based on LTE and 5G, airports have the opportunity to converge all operations wireless services onto a single multiservice technology that can provide the digital wireless foundation for all stakeholders involved.

**Enhanced situational awareness**
Video surveillance enables airport operators to monitor critical assets and ensure the safety of personnel and passengers. Today, most airports use fixed CCTV cameras. Although they cover large areas of the airport, their coverage is not complete. Mobile connected cameras like bodycams, cellphone cameras and cameras on cars and drones (away from controlled airspace) will increase the situational awareness of the airport and contribute to safety. In all cases, it is important to connect these cameras to a high-capacity reliable campus network that safeguards video integrity under all circumstances. This would require the network to support fast network convergence, for instance, in case of a fiber cut or changes to the network.

**Predictive maintenance and operational intelligence**
The maintenance and repair of large numbers of airport assets is an ongoing challenge to airport operations. Predictive maintenance applications, as opposed to preventive and conditions-based maintenance, rely on data analytics using historical and live asset data delivered from IoT sensors and cameras. In addition, asset location management provides the airport with improved awareness of where assets are, which helps more reliable and may even reduce turnaround times. Video analytics can also improve intelligence to operations management for better real-time insight into the turnaround process, which usually involves multiple stakeholders. Process irregularities can be detected, analyzed and mitigated wherever possible. These analytic solutions are focused on cost reduction, increased asset utilization, enhanced safety, and optimized operational efficiencies.

**The digital passenger**
The modern passenger expects to be connected all the time. They expect the airport to understand their needs and respond with personal, bespoke communications and services. Making sure that the passenger has full in-terminal and on-board broadband connectivity, either through Wi-Fi or cellular, is only the beginning. Smartphones and wearables, such as watches, can provide directions to the gate, their favorite restaurant or shop, as well as alerts and information updates. Airport personnel should be equipped with handheld devices that can immediately identify the passenger and provide them with key contextual information. Airports need to provide seamless connectivity, cloudified data and analytics engines that enable them to partner with others to develop these innovative applications and services.
Customer case story:

Helsinki, Vantaa Airport – Wireless coverage for operations

Finavia is the operator of Vantaa airport in Helsinki, which handles 20 million passengers per year through two terminals. They needed to upgrade their network to deal with increased traffic and to securely expand coverage for sensors and other wireless devices to the airfield including aprons, hangars and the carpark. The coverage needed to be capable of handling moving vehicles, as well as the diverse needs of tenants and security operations.

They turned to Ukkoverkot, a digital connectivity provider specializing in private networks for accelerated digitalization. Because Wi-Fi and public LTE networks do not provide reliable service for critical operations, Ukkoverkot chose to implement a Nokia private LTE solution to ensure operational continuity and service capacity. With their focus on security, they also preferred private LTE because devices and sensors are secured with customer-specific SIM cards, which ensure secure access through SIM authentication.

Looking to future growth of mobile data and devices, Ukkoverkot was confident that the coverage of the Nokia private LTE solution would meet the needs of Finavia and provided a clear evolutionary path to 5G.
Customer case story:

Berlin Brandenburg and Schönefeld Airport – Campus WAN/LAN Network

The Berlin Schönefeld Airport handled 12.9 million passengers in 2018 and has experienced dramatic growth in the last five years. It will eventually be absorbed into the Berlin Brandenburg airport, which is currently under construction and is scheduled to open in October, 2020. The new expanded airport will handle 34 million passengers annually, and it will be Germany’s third busiest airport. Expansion is already planned for it to handle 58 million passengers by 2035. The Schönefeld airport is today fully supported by a Nokia carrier-grade IP/MPLS network that provides network services for the entire airport. This network will also support the new, expanded Brandenburg airport. Supported services include L2/L3 services to airport tenants, CCTV cameras, flight information displays, land mobile radio system and ticketing, among many other applications. The Nokia supplied network is able to segregate traffic and provides QoS guarantees for business-critical applications.
In response to growth in passenger traffic in the last decade, this international airport, handling over 9 million passengers, needed to upgrade its wireless connectivity throughout the terminal, including parking garages and rental car terminals. The goal was to provide improved coverage and reliability for all agencies including UHF air-ground communications, Tetra P25, public safety communications, as well as multi-operator cellular coverage for 3G and LTE. The Nokia Distributed Antenna Solution (DAS) provided a complete band architecture to support these diverse requirements providing improved operations and continuity for TSA/Security, air operator ground crews, public safety and general passenger connectivity.
As a leader in communications, we believe that the Nokia Bell Labs Future X architecture is the best starting point for achieving a smarter, safer and more passenger-focused airport. From secure wireless, wireline and IoT connectivity to the edge cloud, datacenter and airport analytics, Nokia is well placed to build the essential fabric of the digital airport. Complementing our full portfolio of airport solutions, Nokia also offers professional and managed services to airports. Bell Labs Consulting will help with planning for the future and for understanding the business case benefits of new technologies using a structured methodology that establishes quantifiable outcomes for airports.

“We are delighted to be among the first using a private LTE network in Finland, supporting our current and future connectivity needs and strategy at the Helsinki airport. The Nokia solution currently being rolled out is unique; we expect it to provide unprecedented capacity and resilience for our critical airport services.”

Harri Karjalainen, CIO, Finavia.

Solutions for a smarter, safer, passenger-focused airport.