

Modernizing Communications for Airports

with Ribbon's Optimized Packet and Optical Transport Solution



Digitizing Airports to Efficiently Support Rapid Growth

An airport's main function is to provide air transport for cargo and passengers. To do so, it must support many airlines and associated agencies, like air traffic control (ATC), customs, and border control. However, airports are becoming more and more like small cities, with numerous shops, restaurants, security functions, service companies, and information systems that provide services to the millions of passengers that pass through them each year. To support such diverse needs, airport operators have deployed a plethora of different networks, introduced at different times, using different technologies. Now, these disparate systems are hampering the airport operators' ability to support the projected growth in passengers and cargo. In the next generation of airports, we will see high-resolution video everywhere, Big Data analysis for passenger and cargo trends, and interactive information systems. A converged secure IP communication network is necessary to provide the real-time data required for these systems to function. The network must also continue to provide support for mission-critical applications like ATC, SCADA, radars, emergency communications, and CCTV. switching has the ability to combine and re-combine OTN signals in a network flexibly, for improved overall network efficiency.

Risk-Free Transition
tailor-made evolution for
all services and networks

Secure Packet
guarantees mission
critical services

Multiservice
to support seamless
evolution to IP

High Availability
provided by advanced
network architecture

Digitizing Airports to Efficiently Support Rapid Growth

Digitizing Airports

Digitization allows airport operators to support rapid growth and provide services that greatly improve user experiences, user safety, and punctuality of services. Legacy TDM cannot support this evolution, so transformation to packet transport is required.

Increased Regulation

We see ever-increasing regulation to reduce carbon footprint and to improve safety and service availability.



Better User Experience

Digitization greatly enhances user experience by providing real-time information about the flow of people and assets. This allows the right resources to be allocated and provides accurate real-time information to multiple sources (i.e., mobile apps, information boards, etc.)

Security and Safety

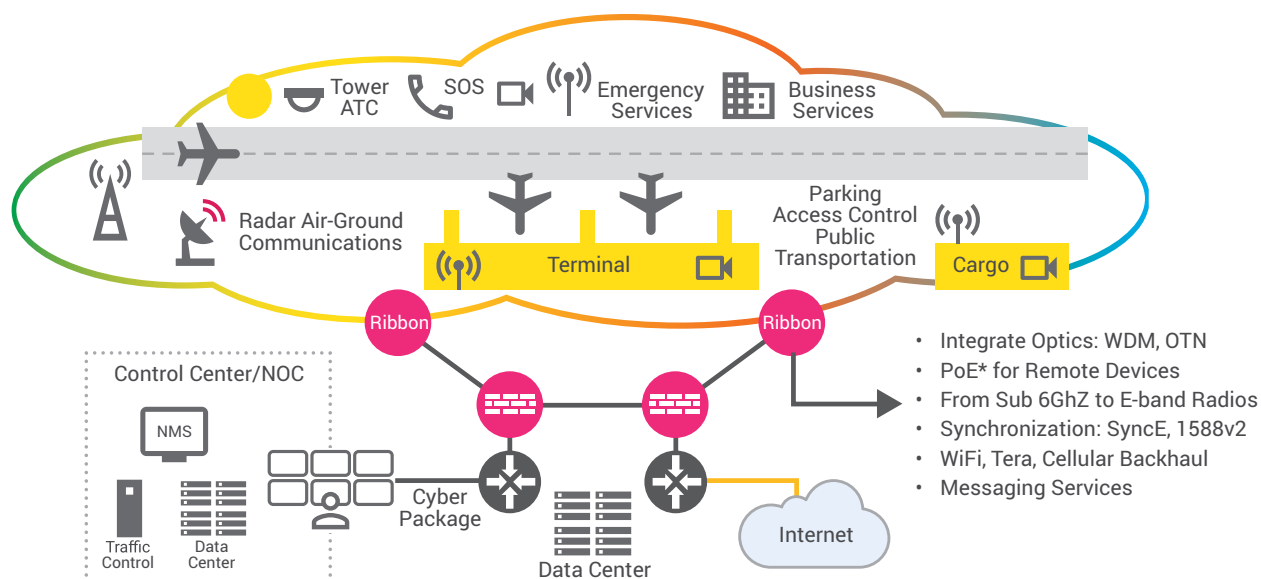
Security is paramount and networks must be hardened against physical and cyber attacks. SCADA, ATC, and emergency voice continue to be key for supporting staff, assets, and customer safety.

Cost-Effective and Risk-Free Transition to Packet

Ribbons packet solutions are optimized for the communications network used in Airports. We have used them to provide Airports around the world with a risk-free evolution to packet based communications infrastructure.

When it makes sense for the network operator, legacy services and low-rate mission-critical services like SCADA, monitoring and control are migrated to the packet layer. Our Elastic MPLS, dual stack, packet technology has been designed with mission critical networks in mind, it provides IP/MPLS to support IT networks and MPLS-TP (deterministic MPLS) which is industry accepted as the technology to support mission critical OT services which require low deterministic latency, high latency and extensive OAM. With extensive Circuit emulation (CES) capabilities the correct packet transport technology can be selected to meet the service needs on a service by service basis. Ribbon's field proven processes ensure this migration process is risk free.

- **Capacity is added when needed** with unique in-service expansion units and in-service upgradeable packet fabrics (e.g. 10G to 60G, 100G to 200/320G, 1T to 2T).
- **Technology is introduced when required** with unique in-service expansion units to scale connectivity and elasticity (Eth, Optical, PCM, CES); and with integrated WDM, OTN, and bidirectional SFPs to simplify optical connectivity.



Ribbon has extensive experience in transitioning networks and developed field hardened, proven processes for this migration.

Holistic Security Suite

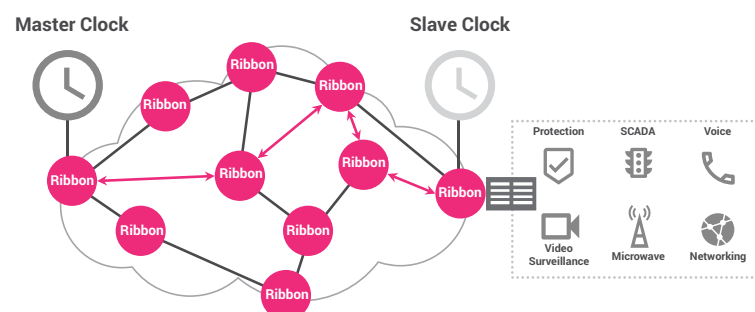
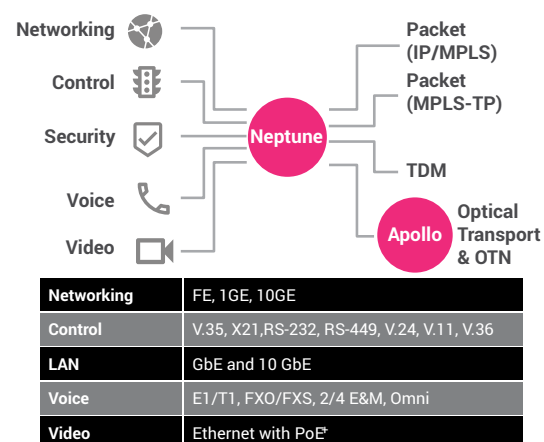
Critical industries are a prime target for cyber-attacks. Data security is a particularly complex matter. It must protect both IT and OT assets and be able to identify tangible threats from amongst the multitude of reported events.

Our solution provides physical layer security, encryption, firewalls, and intrusion detection. It provides the capabilities to identify and tackle potential attacks in several ways:

- **Preventing attacks where they occur** with distributed attack mitigation.
- **Guarding the integrity of the SCADA and OT network.** The system maintains a complete OT network map and continuously monitors all transactions for abnormal behavior, providing early warnings of any tampering.
- **Identifying real threats** with advanced correlation and analysis for a clear view of tangible threats.

Multiservice Platform

With Ribbons packet and optical portfolio you have a complete multiservice platform for supporting the OT and IT services over the most appropriate transport technology. Mission-critical OT like SCADA, requires the static and deterministic behavior, provided by TDM and MPLS-TP. For IT services like voice, video, and non-mission-critical networking, IP/MPLS provides optimized support. The dual-stack IP/MPLS and MPLS-TP approach allows the transport of IT and OT traffic on the same platform. Configuring and maintaining the SLAs and QoS on a service-by-service basis supports this, without compromising security. It seamlessly integrates the packet and optical layers to enable cost-efficient transport of the high-capacity data generated by video and other IT applications. Video is essential for the daily operations of an airport and adds specific challenges. The cameras used to provide video surveillance generate vast quantities of HD video content, which needs to be backhauled to control locations to allow real-time analysis. The solution provides a multicast architecture with end-to-end QoS monitoring to ensure the quality of the video network. Cost-effective bulk transport of video traffic is provided by optical transport and Power over Ethernet (PoE) interfaces. These are available to power the cameras, sensors, and control devices. The solution provides an open and future-proof way to add new services and applications.



Traditionally, TDM provides the tools to derive and distribute accurate timing, which is fundamental to maintaining the operation of the monitoring and control devices. As networks evolve to packet, the timing architecture must remain robust. The solution allows an approach similar to that used in TDM. A built-in GPS receiver or an external timing source provides the master clock. 1588v2 Precision Timing Protocol (PTP) distributes timing across the network

and MPLS-TP reduces packet delay variation by using deterministic, bidirectional traffic paths. Muse provides an intuitive GUI, this provides an intuitive GUI that simplifies operations with rapid get-it-right-the-first-time network provisioning and rapid fault isolation. Advanced operations software provided by Muse™ is able to analyze the network data to ensure the network is operating at maximum availability, utilization, and efficiency. This functionality can be further extended to non-Ribbon transport devices by using Ribbon's 3rd party integration solution. Ribbon's packet and optical solutions provide a comprehensive solution for airport operators with an integrated IP platform providing - deterministic transport for mission-critical applications; optimized L2 and L3 VPNs for the business services required by the enterprises operating in the airport; and L0-L1 bulk transport for high-capacity bulk data transfer.

Optimized for High Availability

Operators of airport communications networks require 'five-9s availability' or better, Ribbons solution for Airports provides this with:

- **Fully-redundant hardened design of the Network Elements** with 1+1 and 1:1 protection of key units and an extended temperature range for use in energy applications (-25°C to +70°C)
- **Fast protection against single and multiple network failures:** MPLS-TP supports sub-50ms protection switching for single failures. Used in conjunction with pseudowire redundancy, protection is provided for multiple failures.
- **Remote disaster recovery** allows network and management restoration from geographically dispersed sites in the event of catastrophic failure.
- **Potential network failure protection:** LightAPPS™ provides advanced operation software to monitor network performance in real time and help identify trends over time.

Risk-Free Transition to Packet

Your Challenges	Our Solutions
Need risk-free evolution to packet	Ribbons communications solutions for airports provides a risk-free evolution path to allow airport operators to move their legacy networks onto an integrated packet platform: <ul style="list-style-type: none">• Legacy services are supported on this platform, with circuit emulation.• MPLS-TP is used to provide deterministic packet transport and advanced OAM, required for mission-critical services.• Service assurance is guaranteed with advanced operations software, provided by Muse
Need enhanced security	Tailored, holistic security suite provides comprehensive protection for the communications infrastructure: <ul style="list-style-type: none">• Integrated SCADA protection, secured connectivity, and secured services• L1 to L3 encryption with L1 optical intrusion detection from LightPULSE™.

Intelligent High Availability Multiservice

Your Challenges	Our Solutions
An integrated, multiservice, IP network	Extensive multiservice capabilities provide support of OT services, IT services, and advanced consumer services from a single platform: <ul style="list-style-type: none">• Mission critical services like teleprotection and SCADA are supported by MPLS-TP.• IP/MPLS is used to support L2 and L3 services.• Pay-as-you-grow design, with unique in-service expansion units, scalable cross-connects, and in-service upgradable packet fabrics.• Easy extension of the services with intuitive, right-first-time introduction of new resources, enabled by Muse.• Proven SDN capabilities can be introduced as required by the energy operators.• Supports business services, residential services, mobile backhaul and future IoT applications, allowing energy operators to evolve as a Utelco.
Need highly available telecoms network for mission-critical services	Provides the intelligent, highly-available network required for mission-critical services, via: <ul style="list-style-type: none">• EHardened network elements and optimized architectures, provided by Neptune and Apollo.• Intuitive operations and rapid fault isolation, provided by Muse.• Mission-critical service assurance is guaranteed with advanced operations software provided by Muse.• Third-party device management integrated into Ribbon's end-to-end management, with Generic EMS.

About Ribbon

Ribbon Communications (Nasdaq: RBBN) delivers communications software, IP and optical networking solutions to service providers, enterprises and critical infrastructure sectors globally. We engage deeply with our customers, helping them modernize their networks for improved competitive positioning and business outcomes in today's smart, always-on and data-hungry world. Our innovative, end-to-end solutions portfolio delivers unparalleled scale, performance, and agility, including core to edge software-centric solutions, cloud-native offers, leading-edge security and analytics tools, along with IP and optical networking solutions for 5G. We maintain a keen focus on our commitments to Environmental, Social and Governance (ESG) matters, offering an annual Sustainability Report to our stakeholders. To learn more about Ribbon visit rbbn.com.

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Contact us to learn more about Ribbon solutions.