

Go Allwhere.

ANSP NETWORK SOLUTIONS

High Performance Networks for ANSPs


George Verdes,
Head of Transportation - Middle East & Africa



150 years of reinvention and disciplined execution for successful integration and transformation



Expanding presence in enterprise and vertical markets

<p>Transportation</p> <p>References</p> <p>150+</p>	<ul style="list-style-type: none"> • Railways • Highways & roads • Maritime • Aviation 	
<p>Public sector</p> <p>References</p> <p>270+</p>	<ul style="list-style-type: none"> • Government broadband • Smart/connected cities • Defence • Public safety 	
<p>Energy</p> <p>References</p> <p>220+</p>	<ul style="list-style-type: none"> • Utilities • Oil & Gas • Mining 	

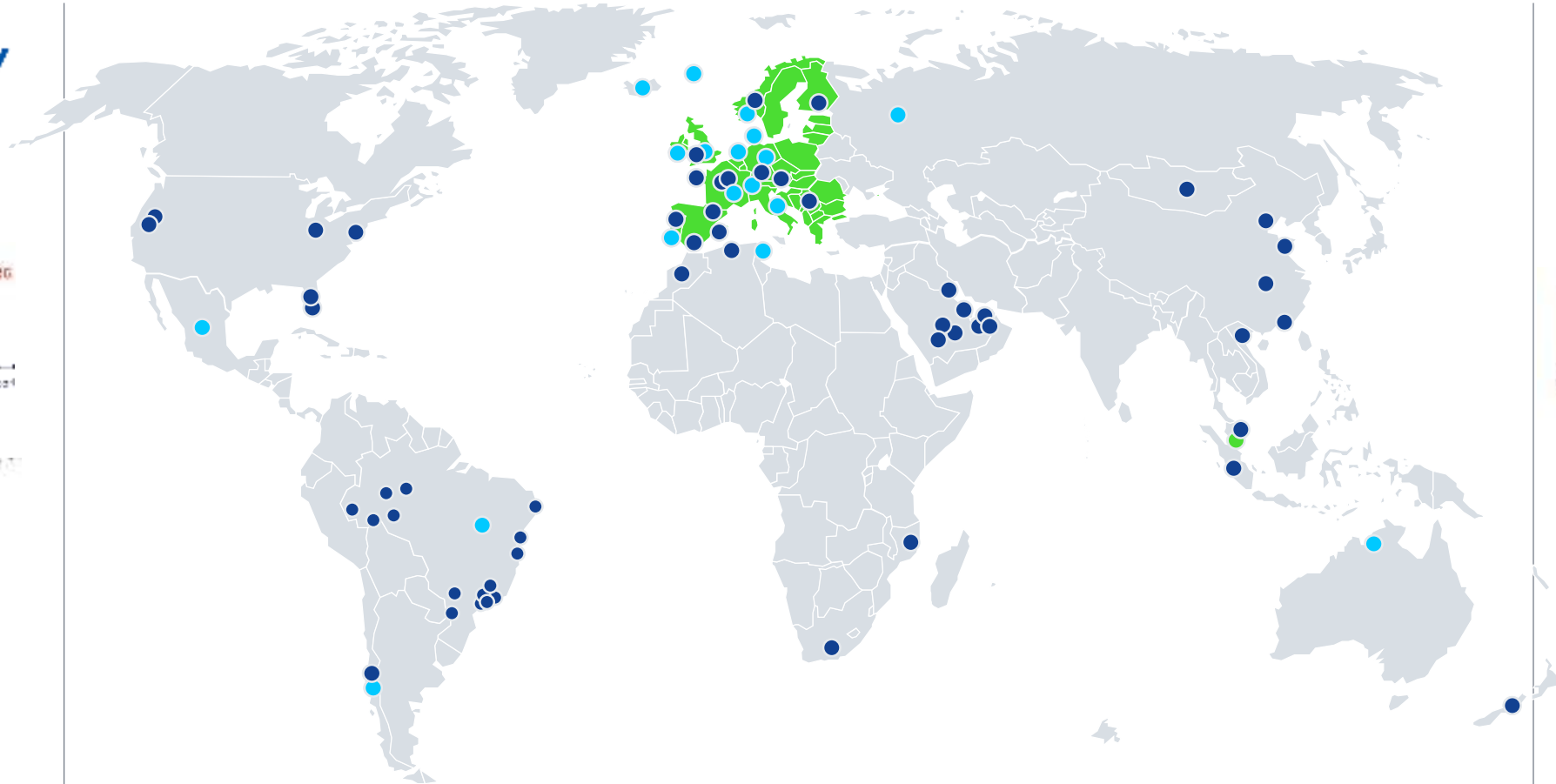
NOKIA IN AVIATION



HELSENKI AIRPORT
Helsinki - For seamless travelling



BERLIN
BRANDENBURG
AIRPORT



MEMBERSHIPS



ANSP

AIRPORT

AIRLINE

Role of Nokia in ANSP certifications

High Performance Networks for ANSPs

REGULATORY

SAFETY CASE

ED STANDARDS

WHAT

- Working with ANSPs and key regulatory organisations globally

- Support ANSPs in developing ATC safety cases and supporting Safety Case – Part 2/3

- Meeting ED Standard



HOW

- Developing Standards
- Implementation alignment between ANSPs

- Design the network to meet safety standards
- Provide continuous reports for safety requirements

- Nokia supports the WAN requirements to meet W67 ED136, ED 137 (VoIP), ED 138 (latency, jitter, packet loss) and ED 139 standards.
- Nokia ANSP solution is to support data, voice and radar communications services

WHERE

- Member ICAO CNS
- Member Eurocontrol working group (vote)

- Avinor
- Skyguide
- Isavia

- Avinor
- Skyguide
- Isavia



skyguide

ISAVIA

AVINOR

skyguide

ISAVIA

AVINOR

INTRODUCING NOKIA ANSP Solutions

IP/MPLS and MICROWAVE at the heart
of critical communication networks

TRUST

- Proven for more than 10 years
- Fully Standardized
- Referenceable ANSP Projects: Domestic and Airport
- Nokia successfully delivered these solutions to other critical com domains

CAPABILITIES

- Mission Critical Resiliency Grade: 99.999%
- Integrated Legacy Application support
- Integrated Microwave for e.g. remote radar
- CCTV: Multicast Aware
- Allows transport over Ethernet, a Telecom carrier infrastructure or SDH

COSTS

- Cost reduced compared to legacy infrastructure



TRANSPORTATION



ENERGY



GOVERNMENT & DEFENSE



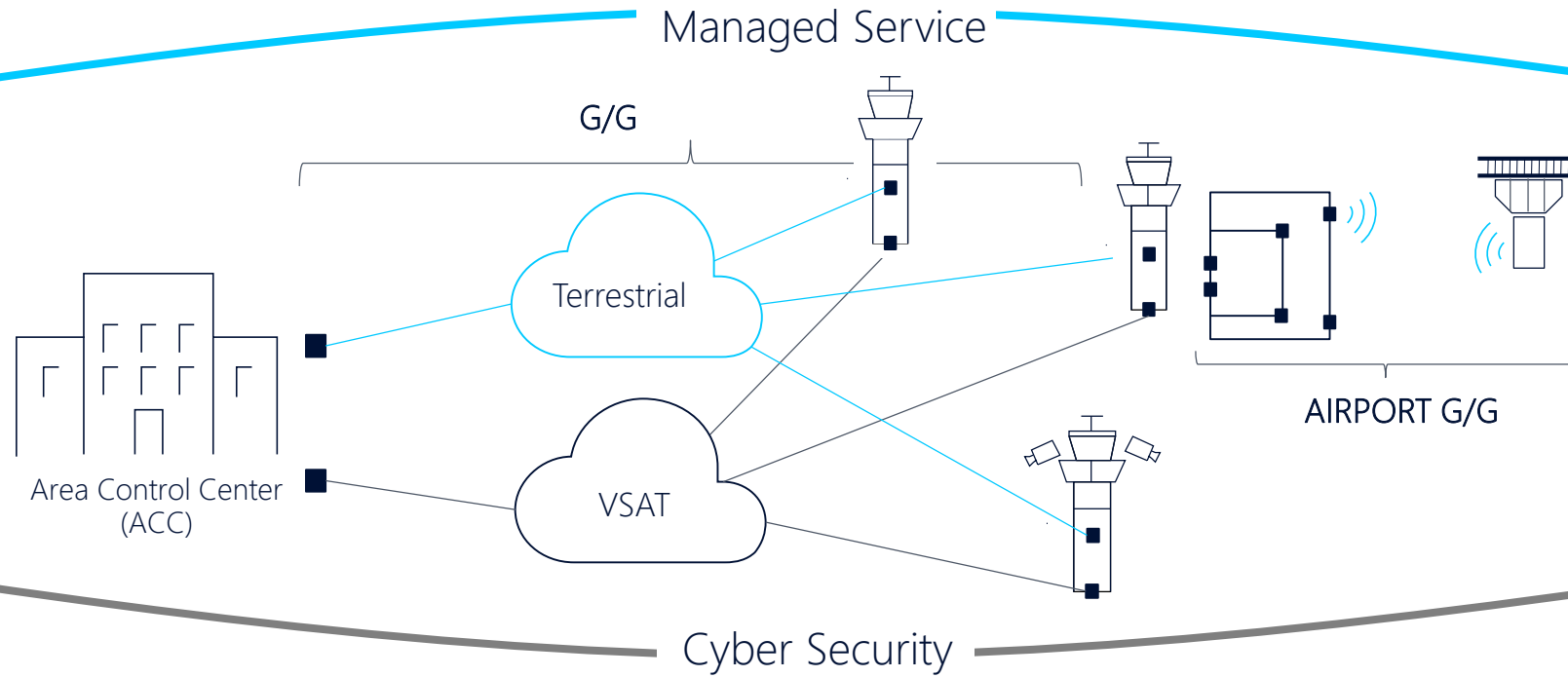
OIL, GAS & MINING

NOKIA IP/MPLS trusted by 500+ critical infrastructure operators

NOKIA MICROWAVE trusted by 160+ critical infrastructure operators

ANSP High Performance Networking

G/G Network Upgrade without changing the applications



RELIABILITY
Resiliency
Predictability

FINANCIALS
Reduced Costs

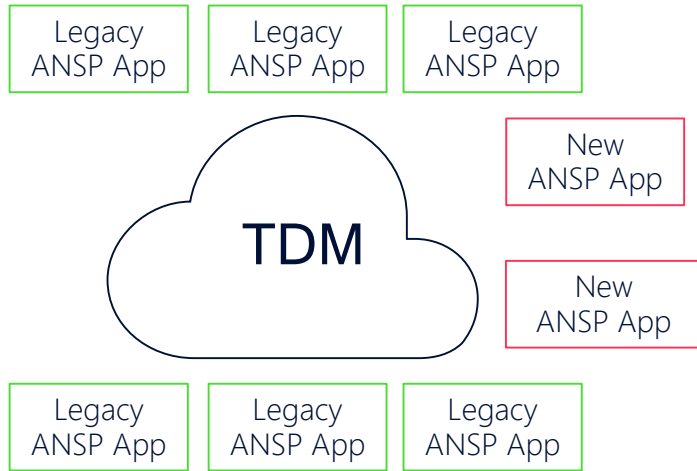
LEGACY ANSP
service
support

DESIGN
Meets ATC
Safety
Requirements

SECURITY

ANSP networks

Meeting ICAO ASBU requirements



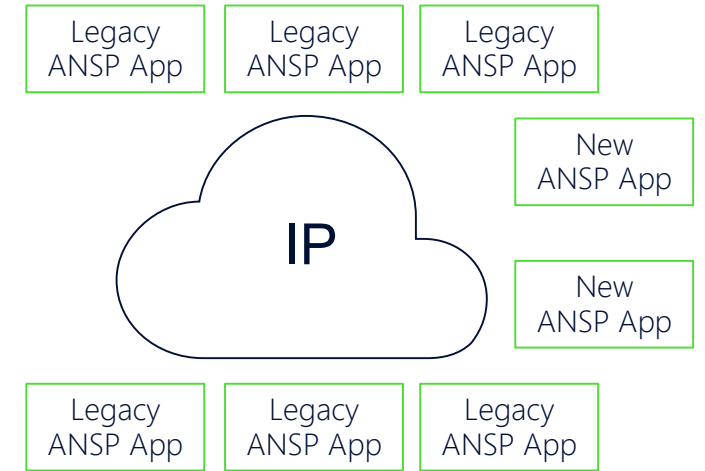
CHALLENGES

- Legacy services / product become expensive or no longer available from Service Provider or vendor
- Single applications may require dedicated network
- Redundancy
- Bandwidth & Technology to support new IP or ethernet based ANSP apps
- Reduced Costs



REQUIREMENTS

- Maintain Safety
- Secure Operational Continuity
- New IP Application Support
- Cost Optimized




GAINS

- Continued support for legacy ANSP services
- Ability to interface b/w applications and services
- More Redundancy
- More Bandwidth & right Technology to support new IP-based ANSP apps
- Reduced Costs

Migrate Ground Ground network whilst securing ANSP legacy services

7705 best in class legacy support

Radar	CCTV	Weather Systems	Analog Phone	Radio	Remote Control & Monitoring System	LAN	Alarms	Voice	TDM Mux
									
V.24, RS232 X.21, Microwave	Ethernet	Serial RS232	FXO / FXS	E1/E&M	V.24, RS232	Ethernet	Dry Contacts	RS422/530 X.21/V.35	G.703/E1



7705 SAR18



7705 SAR8



SR
OS

MICROWAVE		Gig E/10G		CWDM		LEGACY	
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Nokia Wavence portfolio at a glance

Wavence Family

UBT

Radio's



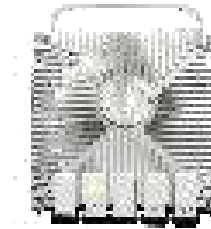
ULTRA BROOADBAND
TRANSCIEVER 80

Compact
E-band (80 GHz)
10 Gbps



ULTRA BROOADBAND
TRANSCIEVER TWIN

Dual carrier
6-42 GHz
2.5 Gbps



ULTRA BROOADBAND
TRANSCIEVER SINGLE
Wideband radio

6-42 GHz
1.3 Gbps

MPT

Radio's



MICROWAVE PACKET
TRANSCIEVER XP-HQAM

Extended power
6-11 GHz
500 Mbps



MICROWAVE PACKET
TRANSCIEVER HQAM

Standard power
6-38 GHz
500 Mbps



MICROWAVE
PACKET
TRANSCIEVER MC

Entry level
6-38GHz
350 Mbps

MSS

Networking units

MULTI-SERVICE SWITCH OUTDOOR



MULTI-SERVICE SWITCH 1



MULTI-SERVICE SWITCH 8



MULTI-SERVICE SWITCH 4



7705 SAR 8 or 18 (*)



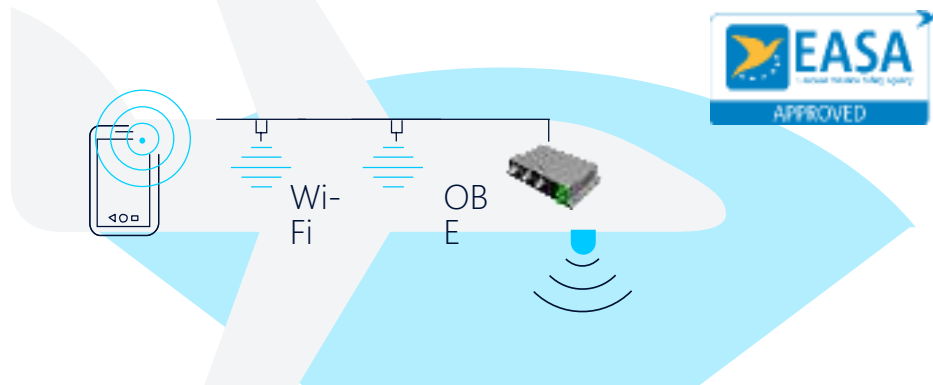
UBT: Ultra Broadband Transceiver
MPT: Microwave Packet Transport
MSS: Microwave Service Switch

European Aviation Network

Scalable answer to high density traffic



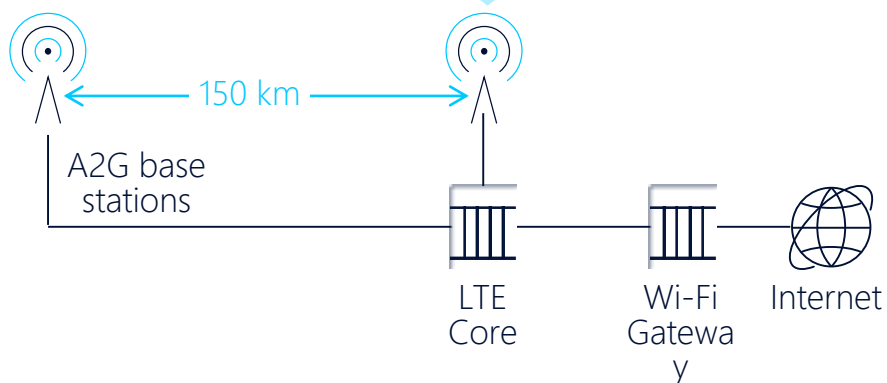
Small & light-weight antennas and onboard equipment



Based on standard 4G/5G technologies – inherits technology evolution and economies of scale

Dedicated spectrum and optimized antennas
Global A2G band: 2.1GHz, 2x15MHz

Ground network



Patented algorithms to enable high speeds (1,200km/h) and long ranges (150km)

European Aviation Network: world's first A2G network for world's busiest airspace

Already more than 200 planes have been equipped, cabin service will soon be launched

One A2G network for all of Europe



Solution overview

- 300 base stations across all of Europe
- Up to 100Mbps per aircraft
- Live since February 2018
- First customer: International Airlines Group



WHY Nokia

LTE air-to-ground – WIN for ALL

For passengers

- Affordable high-speed connectivity
- Superior user experience with low latency
- Same user experience everywhere

For airlines / Airports

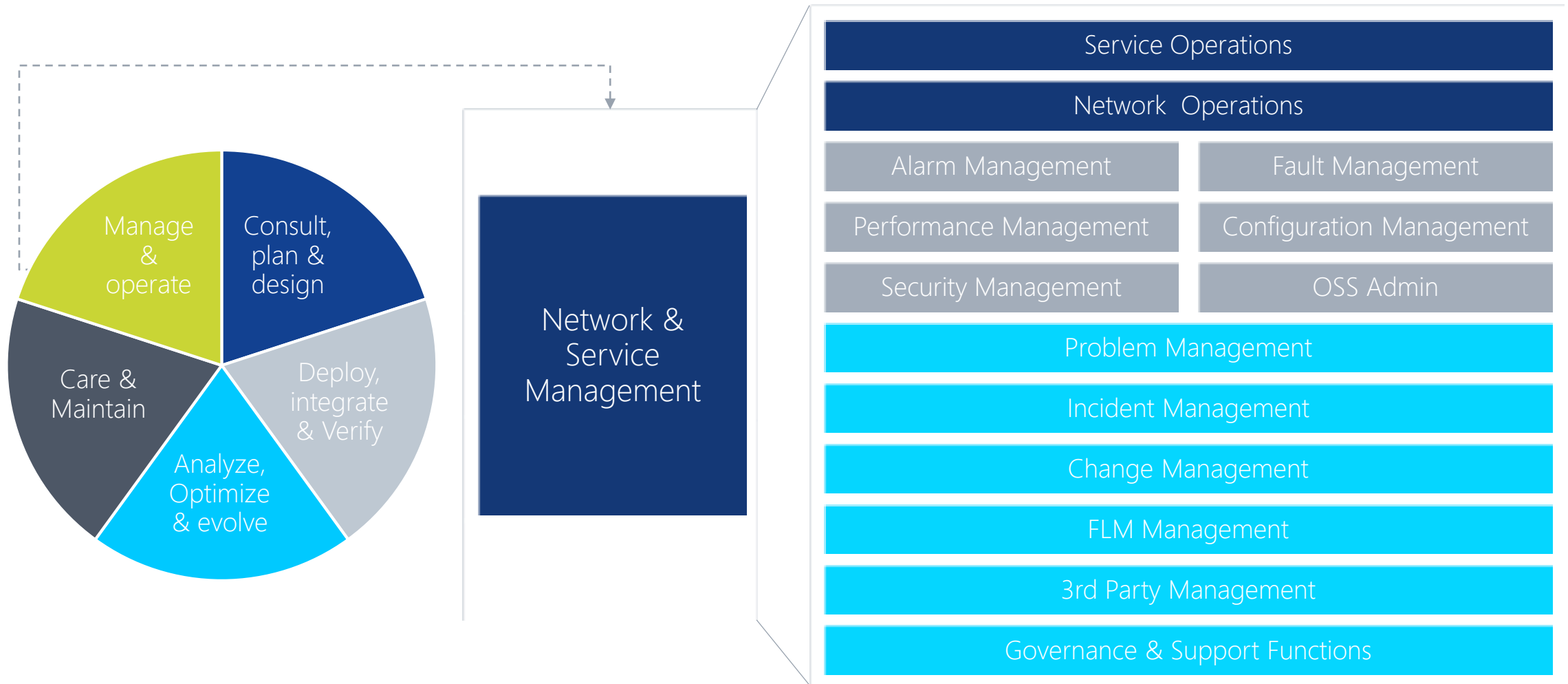
- Service differentiation at superior total cost of ownership
- Affordable high-speed connectivity for crew communication
- Service monetarization plus incremental services revenue (duty free, catering, etc.)
- Future-proof solution

For ANSPs

- Meets demand to replace obsolete Technology
- Will meet safety standards
- Low technical and economic risk (proven solution from Nokia)
- Replace current VHF services

End to End Services portfolio incl. Managed services

Services to effectively operate your network 24 x 7



Why choose Nokia as your strategic partner?

High Performance Networks for ANSPs

Nokia has an existing and proven portfolio to serve ANSPs

Nokia aims to support ANSPs, meeting their goals and ICAO plans – ASBU*

Substantial cost savings in provision of Network infrastructure support services

Better exploitation of technology for business benefit

Access to ANSP specialist, technical and IT development resources

Network Design meets ATC Safety Requirements

Nokia Design and Components assure mission critical resiliency grade: 99.999%

Best integrated solution to support ANSP legacy applications

* ASBU: Aviation System Block Upgrades

Go Allwhere.

REFERENCES



ATC Ground – Ground Critical Communication Network

PROJECT DATA

Project: Ground – Ground network
Solution: IP/MPLS

Applications: ATC connectivity for:

- Radar
- Weather systems
- LAN
- Radio

Nokia products involved: 7705 SAR-8, Microwave Wavence, NSP/NFM-P

QUICK FACTS

Country of Operation: Switzerland
Services: Civil ATC, Military, FIS
Number of Airports: 11



Source: www.skyguide.ch

ATC Ground – Ground Critical Communication Network

PROJECT DATA

Project: Ground – Ground network
Solution: Migration from TDM network to IP/MPLS

Applications: ATC connectivity for

- Radar
- Weather systems
- LAN
- Radio
- CCTV
- Analog Phone

Nokia products involved: 7705 SAR-18, 7705 SAR-8,
NSP/NFM-P

QUICK FACTS

Country of Operation: Norway
Services: Civil ATC
Number of Airports: 46



Source: Avinor.no

Oslo Gardermoen Airport

ATC Critical data communication network

PUBLIC



PROJECT DATA

Project:	ATC Critical data communication network
Solution:	IP/MPLS
Service provider:	-
Airport operator:	Avinor
Spectrum:	-
Applications:	<ul style="list-style-type: none">• Flight critical services:<ul style="list-style-type: none">- Radar- ILS (Instrument Landing System)- Security Access

Nokia products involved: 7705SAR-8 with ethernet, SDI (RS232, X25, V.35) E&M, E1 and SCADA MDDDB (ISC card), NSP/NFM-P

QUICK FACTS

Number of passengers:	26M
Number of terminals:	1
Number of gates:	34
Number of runways:	2



Source: Avinor

NOKIA

BACK-UP SLIDES

Go Allwhere.



Harnessing IP/MPLS capabilities for ANSP

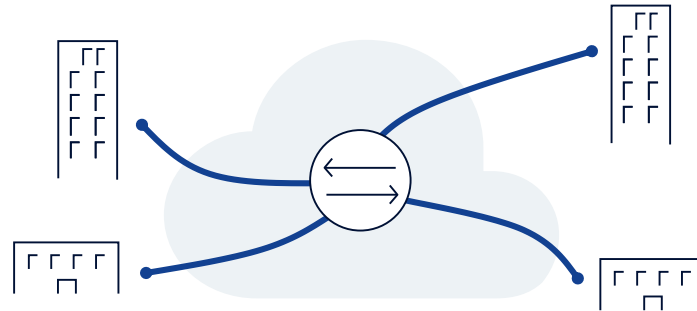
Application-dedicated IP/MPLS VPN

Virtual Leased Line (VLL)



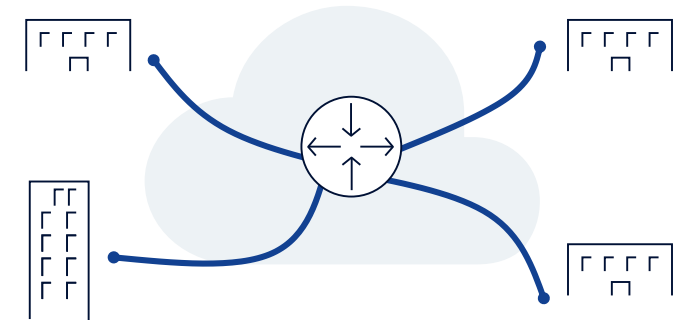
- Point-to-point (C-PIPE and C-PIPE)
- Transparent transport of Ethernet, TDM, serial, ATM traffic over a packet shared infrastructure
- Used for legacy TDM (radar, analog voice, etc)

Layer 2 VPN



- Point-to-multipoint
- Transparent transport of any data application
- VPLS = Virtual Private LAN service
- Network appears as a L2 switch to end customers
- Used for CCTV, ATM, IT Applications

Layer 3 VPN



- Point-to-multipoint
- Transport unicast IP and multicast applications
- VPRN = Virtual Private Routed Network
- Network appears as a L3 router to end customers
- Used for VoIP, etc

Different ANSP applications, different communication solutions

Application	(Legacy) Interface	Connectivity	Recommended IP/MPLS Technology
Radar	Serial RJ45/DB25 or IP	Point-to-point & multipoint	TDM pseudo-wire (C-pipe) or VPRN
Weather systems	RS-232/V.24	Point-to-point	C-pipe
Weather observation system	IP	Multipoint	VPRN
Operational voice	FXS/FXO or T1/E1	Point-to-point	C-pipe
VHF radio communication	E&M or IP	Point-to-point & multipoint	C-pipe or VPRN
CCTV	IP	Multipoint	VPLS, multicast
A-SMGCS	IP	Multipoint	VPRN
PMR / LMR	T1/E1 or IP	Point-to-point	C-pipe or Ethernet pseudowire
CFMU	IP	Multipoint	VPLS or VPRN
SCADA	Serial or IP	Multipoint	C-pipe/multi-drop bridging or VPRN Raw Socket
IT applications (LAN, VoIP and Internet)	IP	Multipoint	VPLS or VPRN

● **C-PIPE**
Circuit Emulation Service

● **E-PIPE**
Ethernet point to point

● **VPLS**
Virtual Private Lan Service

● **VPRN**
Virtual Private Routed Network

Upgrade your network without changing the Apps

MPLS Traffic differentiation and resource reservation

BANDWIDTH

Priority applications are protected from a bandwidth perspective by Hierarchical QoS (H-QoS) mechanisms

- Per VPN Bandwidth protection
- Per Application QoS mapping

LATENCY

Latency Sensitive application are served first

BEST EFFORT

Best-effort traffic are equally well-served when critical applications don't use the full bandwidth

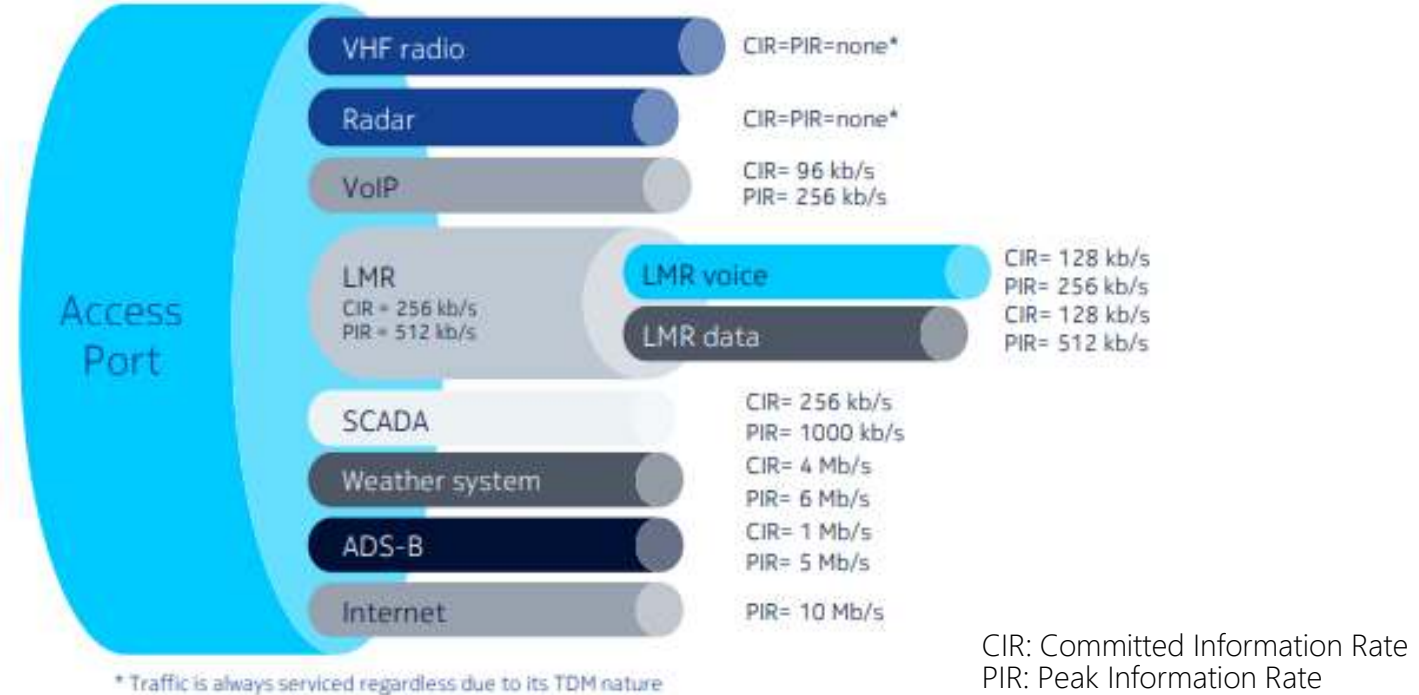
PROTECTION

Applications are protected from each other by Limiting resources per VPN (Mac@, IP Routes, ...)

GRANULARITY

Very high level of granularity for better control

ENSURING DELIVERY OF CRITICAL ANSP APPLICATIONS



QoS for Critical ANSP voice and data traffic requires various mechanisms to **ensure traffic will not be delayed or dropped**

Nokia's solution offers a very high control for **guaranteed service** and optimized bandwidth usage

ANSP LATENCY / DELAY

ANSP REQUIREMENTS

Voice & TDM based applications dictate latency requirements. ANSP minimum voice quality shall equal MOS 4.

VOICE ED-137 (VOIP)

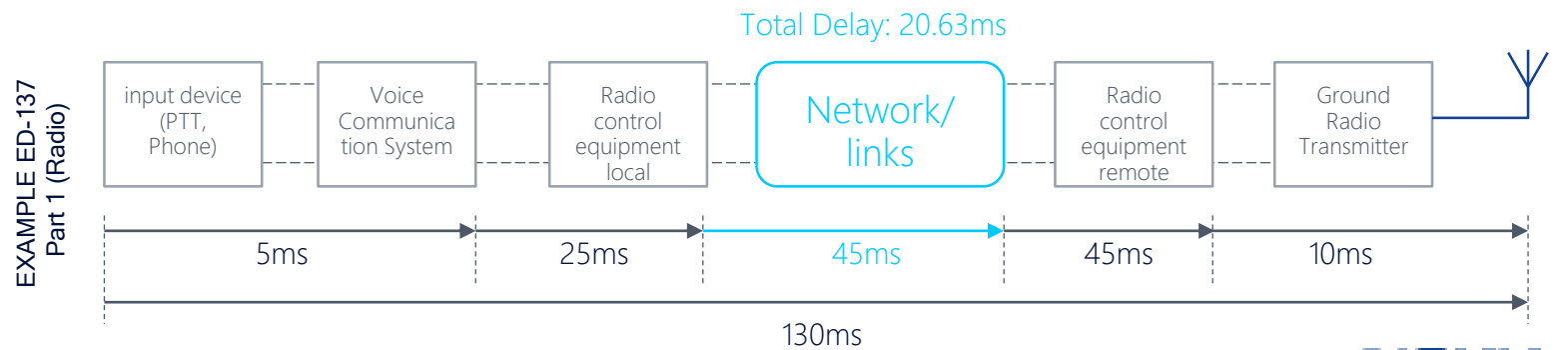
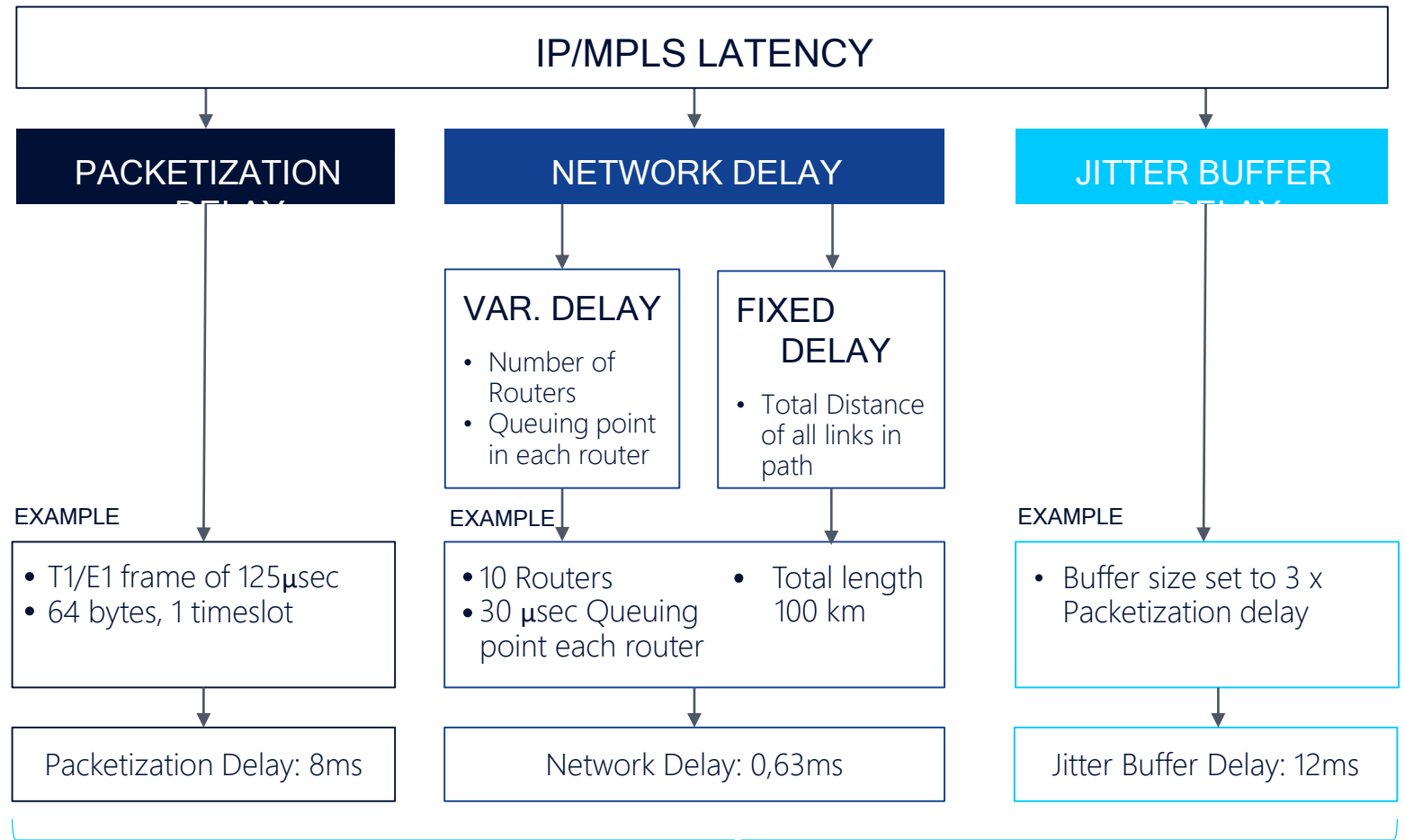
- Eurocae ED-137 (one way):
- E2E Delay: Max 130msec
 - Network Delay: Max 45msec

VOICE ED-138 (NETWORK REQ.)

Eurocae ED-138 (one way)

- E2E Delay: Max 150msec

Nokia IP/MPLS low latency characteristics and QoS mechanisms fully meet ED137 and ED138 – even for legacy applications



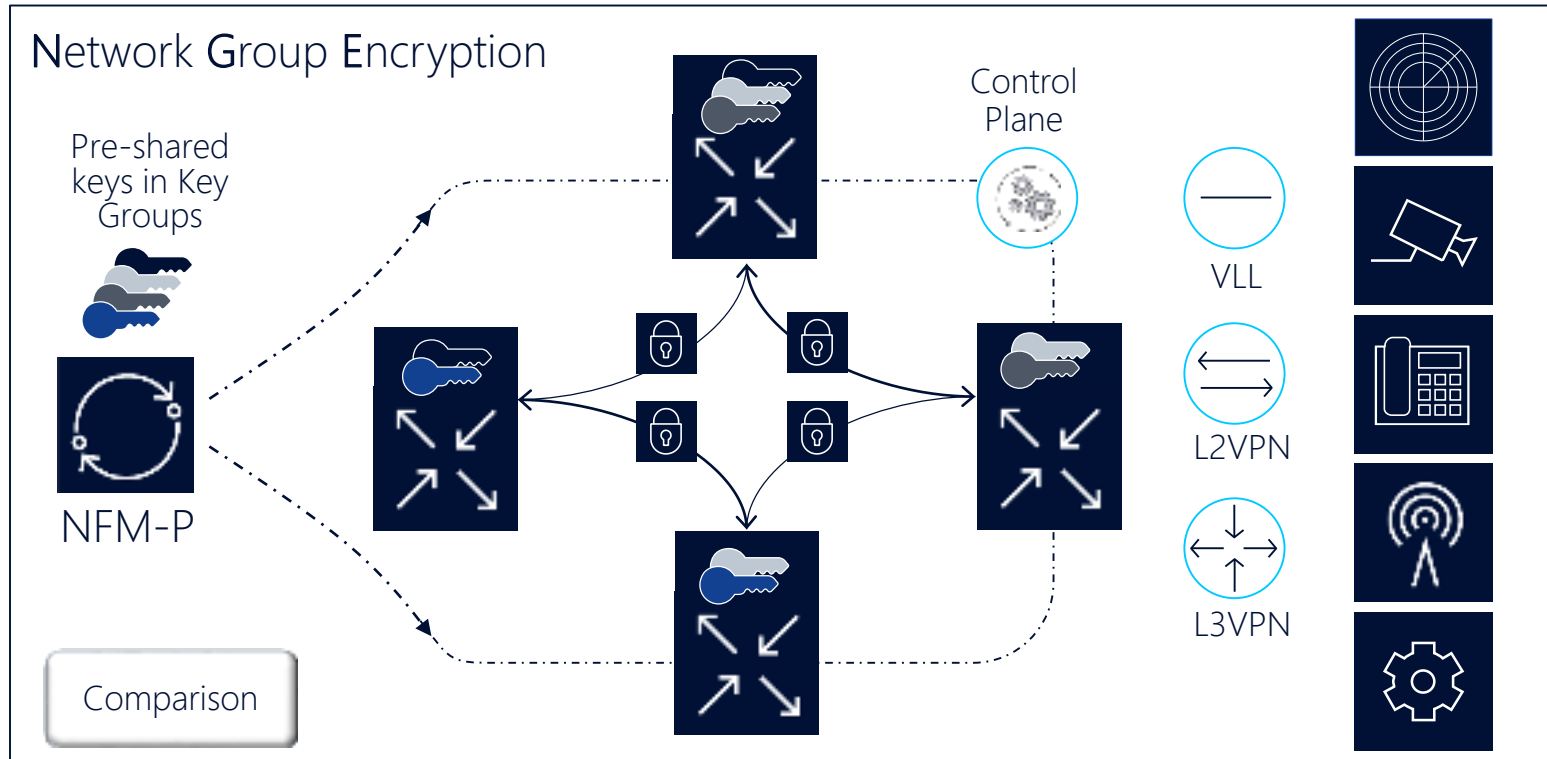
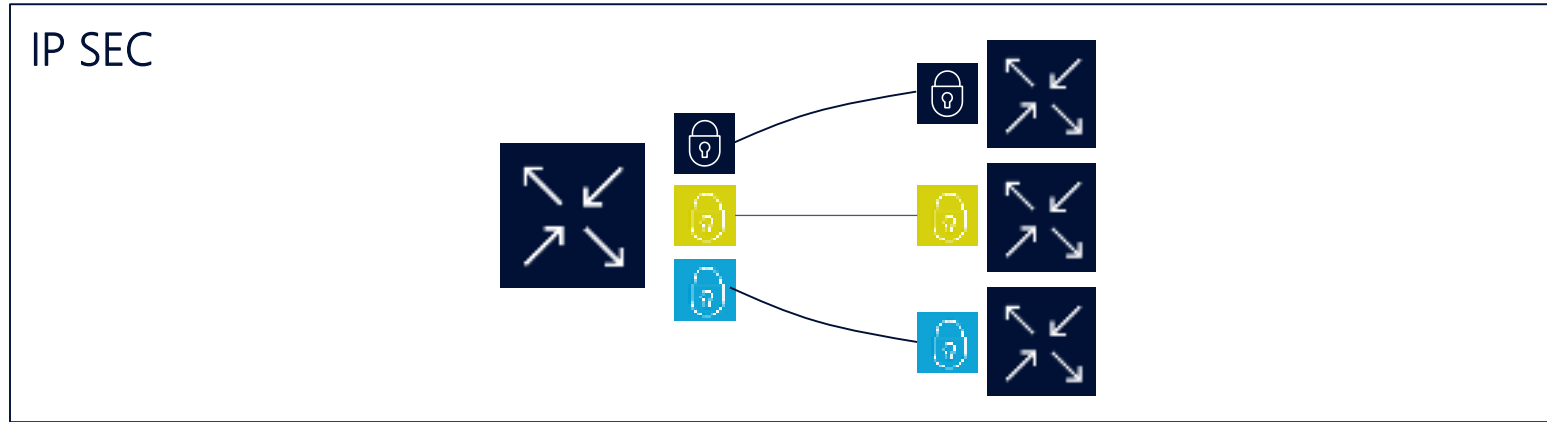
Seamless encryption for critical com networks

IP SEC

- L3 Services only focused design
- Point to Point
- Labor Intensive, Error prone
- Does not scale easy
- Not optimal on overhead (latency, bandwidth)
- Requires maintenance of per-tunnel IKE sessions to maintain traffic flow

NETWORK GROUP ENCRYPTION

- Support for all MPLS services:
 - VLL, L2VPN, L3VPN
 - Any to Any
- Control Plane encryption
- Build for scale
- Minimal configuration & operational complexity
- Low on overhead (latency, bandwidth)
- No control plane requirements; non-stop encryption



7705 SAR supports both IPsec and NGE

Market Trends on ANSP business globally

- ANSP market is reforming globally – more so in Africa
 - and Networks forms a fundamental part of ATC operations
 - Supporting increasing data and higher safety requirements
- Drivers for this change are;
 - State control – strong resistance from state to change
 - Regulatory / governance – there are ANSPs moving towards separation of regulation and services
 - Emergence of new technologies – makes ANSPs work differently
 - ANSPs regional coordination – Although there is regional coordination (ACENA, FABS etc) there is fear of some ANSPs asserting themselves

Evolving Market in African Region

- Creation of regional bodies in the region – e.g. CANSO, ASECNA
 - Increasingly services are provided by these bodies
 - Some ANSP are influenced by these bodies and except services from them
 - Perception and fear of single ANSP domination
- Provision of services by ASECNA is limited due to coverage for support
- Evolution of ATC applications (technologies) in the region demand a service support approach
- Pressure to reduce costs – charges
 - Forces Changes in the way ANSP operates
 - Will need to consider service approach
 - Reduce capex
 - Will consider integrated infrastructure and use of common network management facilities – operational centres
 - Use of common database for services like AMHS, AIS, AIM, ATFMS etc

- DECEA – Brazil (25 years)

- **PPP Model**

- Hand over complete operations of ATC Network – This will include both Voice and Data

- **PENS & New PENS**

- **Managed Service Model** (7 years)
- Currently includes Corporate Backbone (COB) network
- Accommodate for a wide range of service levels and access
- Support both voice and data based applications

- **Regional Networks - Africa**

- AFISNET
 - 26 Western African states
- NAFISAT
 - 16 North Eastern African and Middle Eastern states
- SADC1/2
 - 16 Southern African states
- CAFSAT
 - 8 States from AFI, EUR and SAM

- Airports Authority of India (15 Years)

- **Build Own & Operate (BOO) model**
- ATM voice and data communications across India in a Managed Service Model – BOO.

- **MEVA 111**

- Started operations in 2015

Single service provider – equipment owner

Collaborative supervision

- **CRV**

- **Managed Service model**
- Run by ICAO
- Individual contracts

- **REDDIG**

- **Semi - Managed Service Model**
- 14 countries

