FREQUENTIS

FOR A SAFER WORLD

ICAO 11th North American, Central American and Caribbean Working Group (NACC/WG/11)

ATM-grade Networks

Agenda

1 About Frequentis

2 Drivers for ATM Network Modernisation

3 Regional ATM-grade Network Implementations

4 Enabling Technologies

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Solution Consultant

FREQUENTIS

We set standards in control centres worldwide

FREQUENTIS
FOR A SAFER WORLD

Enabling our global customers to make the world a safer place

…for more than 75 years!

Our vision

#1 in safety-critical control centre solutions

2,400 employees

Vienna headquarters

95% of all air traffic safely managed by Frequentis technology

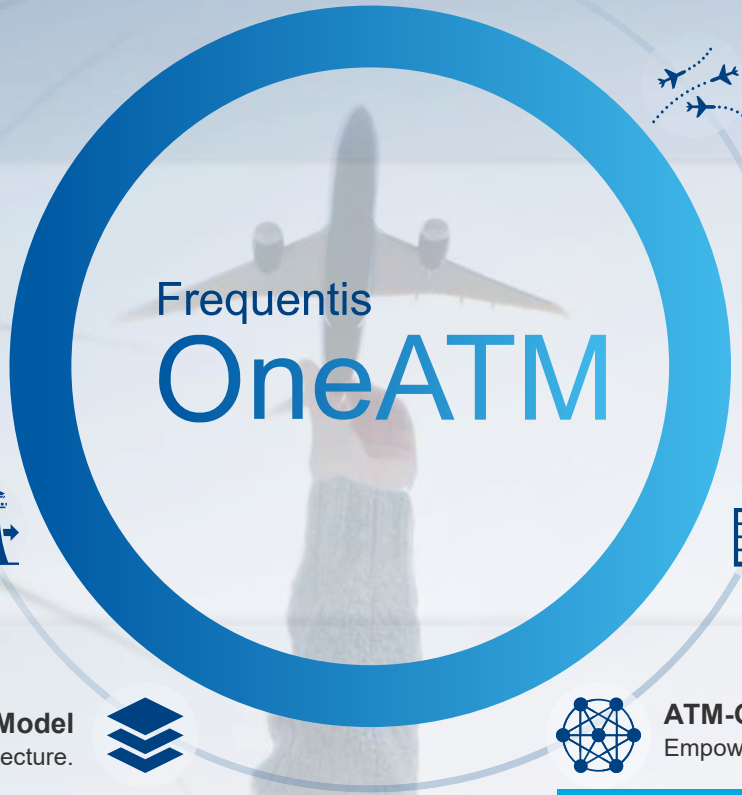
7 of the 10 largest rail networks in Europe use Frequentis technology

240,000 km largest maritime coastline protected

Embedding ATM market trends across OneATM portfolio
“One stop shop... all under one roof” concept

2026

Tendencias del mercado



Trajectory-Based Operations
Uniting the sky.

Accelerated Drone Management
Orchestration of new airspace users.

Harmonised Control Centres
Versatility meets integration.

ATM-Grade Networks
Empowering the digital sky.

Service Delivery Model
Interoperability in a cloud-native architecture.

Integrated Tower Solutions
Power at your fingertips.

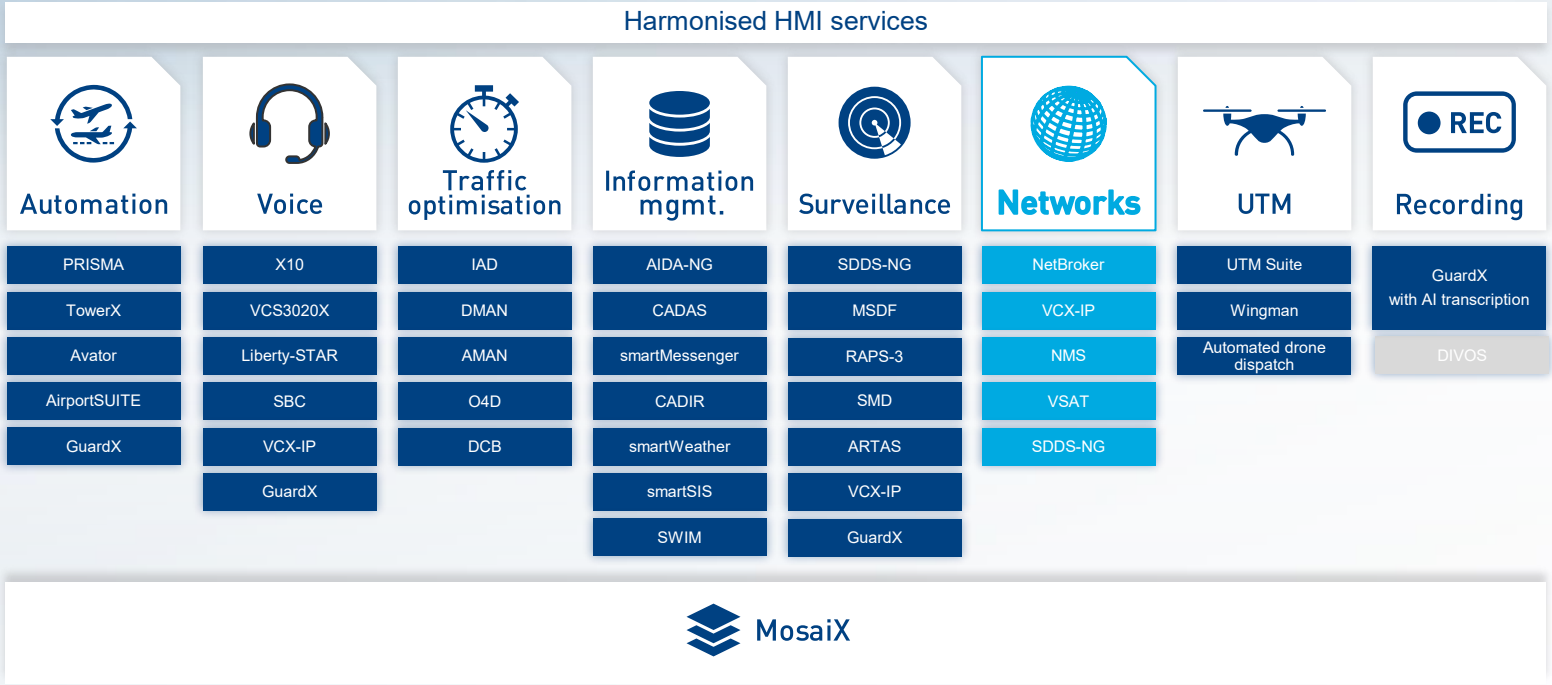
Unified Aeronautical Communications
Beyond voice.

Redes de grado ATM

Integrating market leading technologies on a single platform

Tecnologías líderes

Users



Drivers for ATM Network Modernisation

Factores para la modernización de redes ATM

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Drivers for Network Modernisation

Enabling safe and secure communications

Regional Challenges

- Distributed ANSPs
- Islands and disperse geography
- Disaster recovery

Digital Transformation

- Modernisation
- Reliance on IP-based services
- Migration of legacy ATM systems

Operational Requirements

- Service continuity
- Regional interoperability
- Operational situational awareness
- Resilient infrastructure

The network has evolved from a transport medium into a safety-critical operational system

Conventional vs. ATM-grade Networks

Why ATM needs more than a traditional network

COTS Network	ATM-grade Network
Infrastructure focused	Service focused
Limited operational awareness	ATM service awareness
Generic monitoring	Operational monitoring
Enterprise IT standards	ATM standards (ED-137, ED-138)
Reactive	Proactive

ATM-grade networks are designed for ATM-specific operational requirements

End-to-End Network Portfolio

Components of an ATM-grade network

Diversified technology

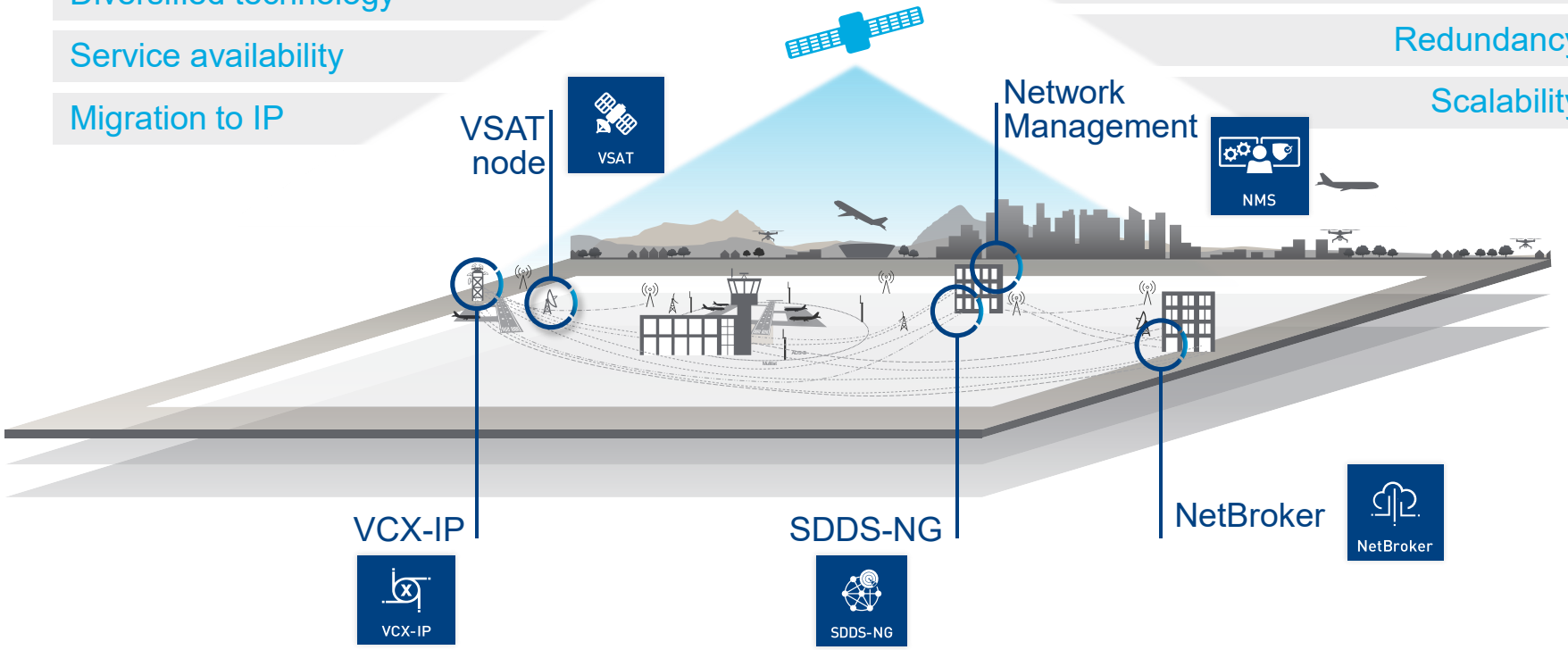
Service availability

Migration to IP

Situational awareness

Redundancy

Scalability



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Regional ATM-grade Network Implementations

Implementación de redes ATM en la región

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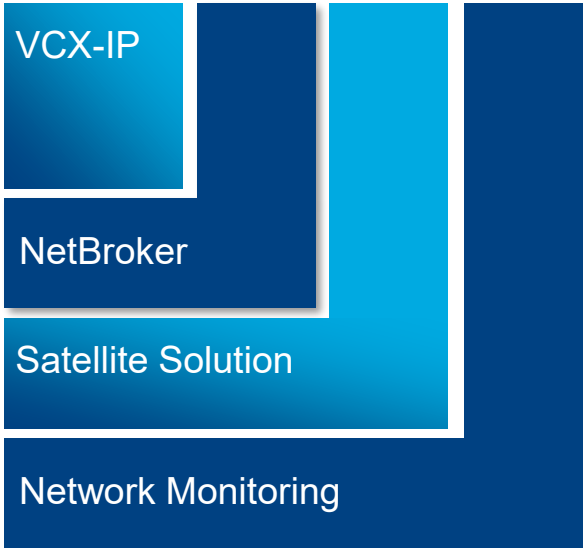
CANSNET Aeronautical Communications Network for Caribbean States

Inter-ACC communication during handover-procedures



- MEVA III successor
- Network design, implementation and operation
- Managed service
- Transition to full-IP
- Scalable and future-proof design

19
Stations

13
Member states

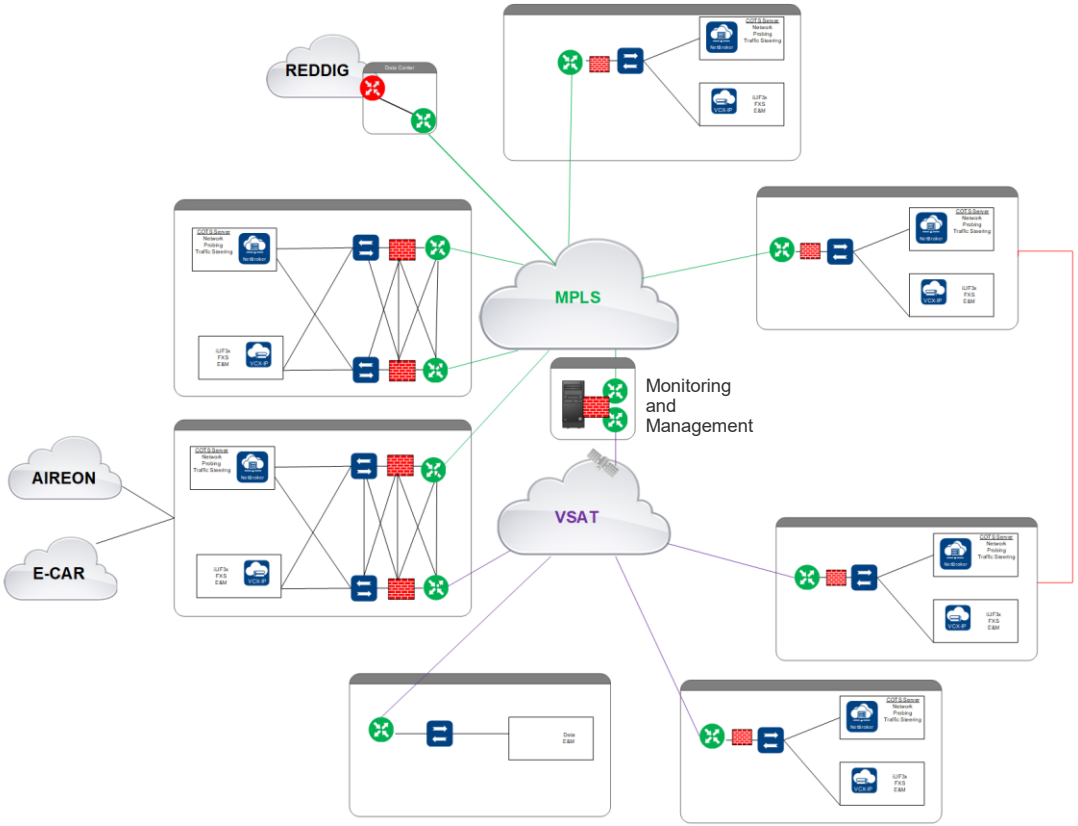
99,99%
Availability
(for redundant setup)

24/7
Proactive network operation

Caribbean Air Navigation Services Network
CANSNET
Caribbean Air Navigation Services Network

ATM-grade Network for CANSNET

Overview

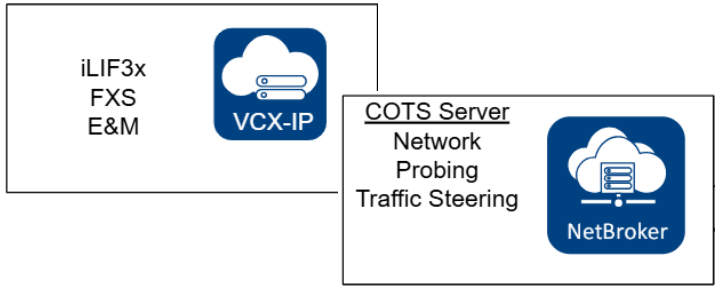


Caribbean Air Navigation Services Network

CANSNET

Caribbean Air Navigation Services Network

- Hybrid networks
- Flexible for the needs of each location
- Any-to-Any communication
- High availability
- Brown-out detection



ATN-Br Nationwide ATM-grade Network in Brazil

Managing air traffic for one of the world's largest controlled airspaces

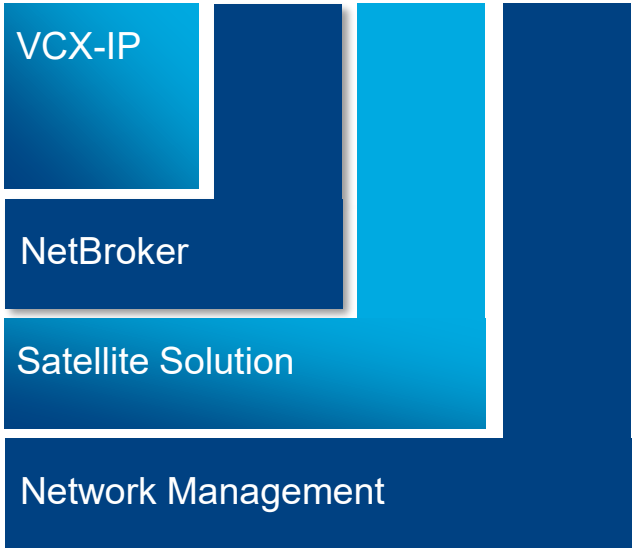
- **Nationwide design – 2014**
- Step-wise regional deployment:
  - CINDACTA II and III
  - CINDACTA I + expansion satellite solution
  - Current extension: CINDACTA IV
- Enhancements upon proven successful operations

> 43.000
monitored interfaces

> 5.700
services

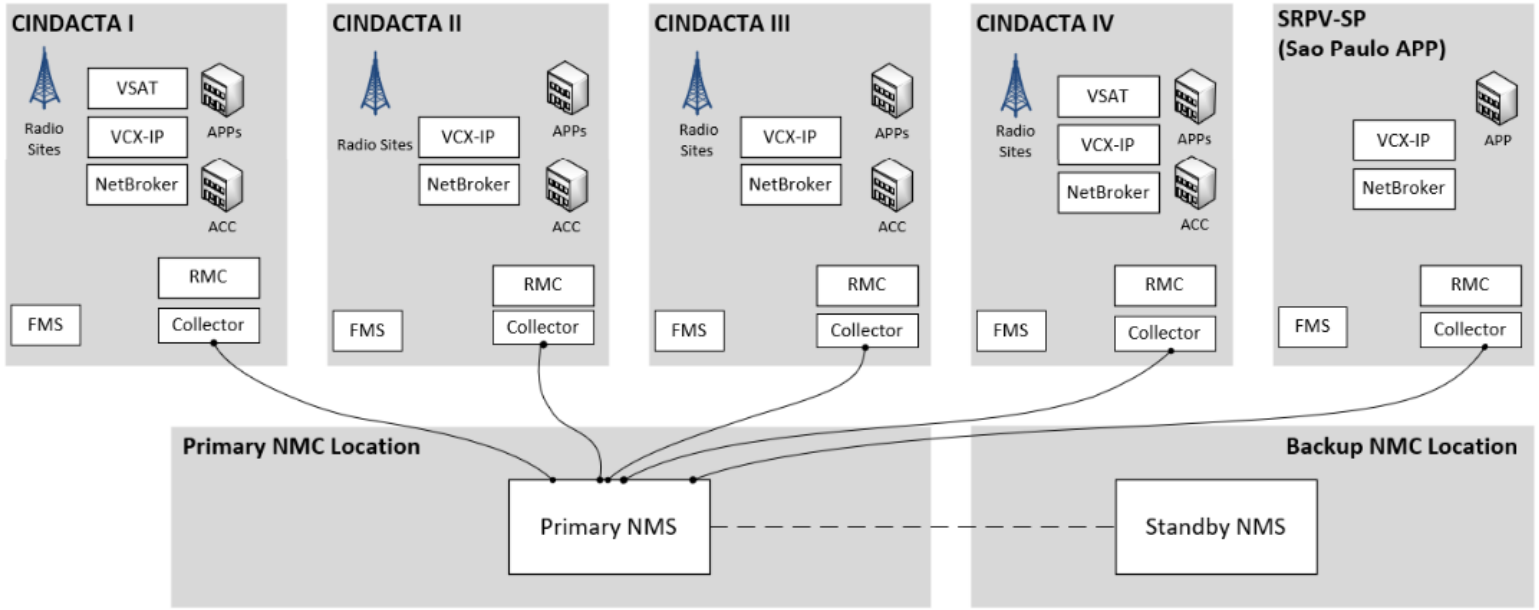
> 3.700
devices in the network

> 500.000
measurement streams



ATN-Br Nationwide ATM-grade Network

Overview



Flight Information Regions / Area control centres	5
National Management Centres	2

Network Modernisation in Mexico

VSAT communication and technology migration towards IP

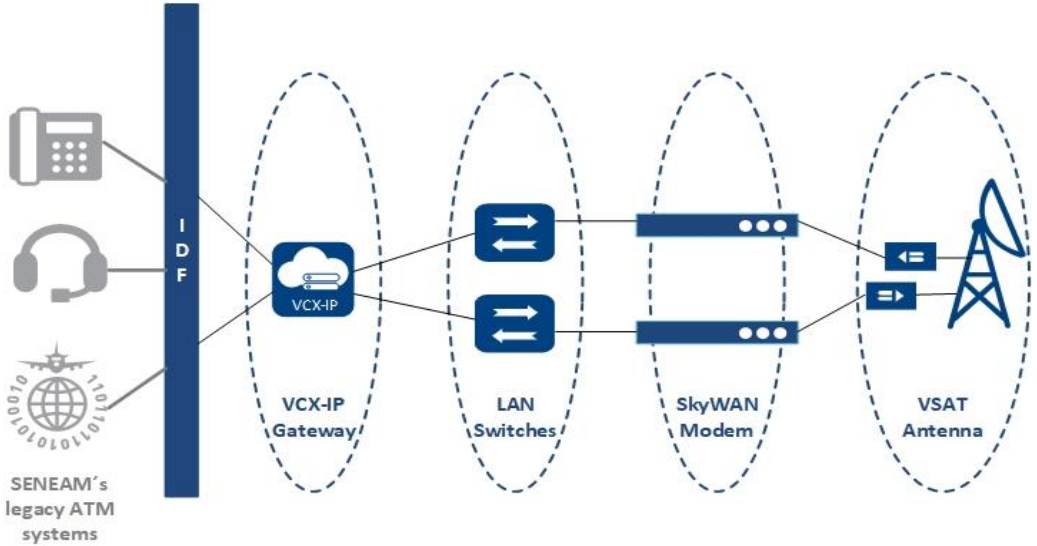
- **Modernisation started in 2012**
- Digitalisation towards IP + bandwidth optimisation
- Backup connectivity and future-proof Satellite Solution – since 2021
- Service continuity across 4 FIRs
- Fully-meshed connectivity

ED-137
compliant A/G
and G/G communication

70
network nodes

40
VSAT stations

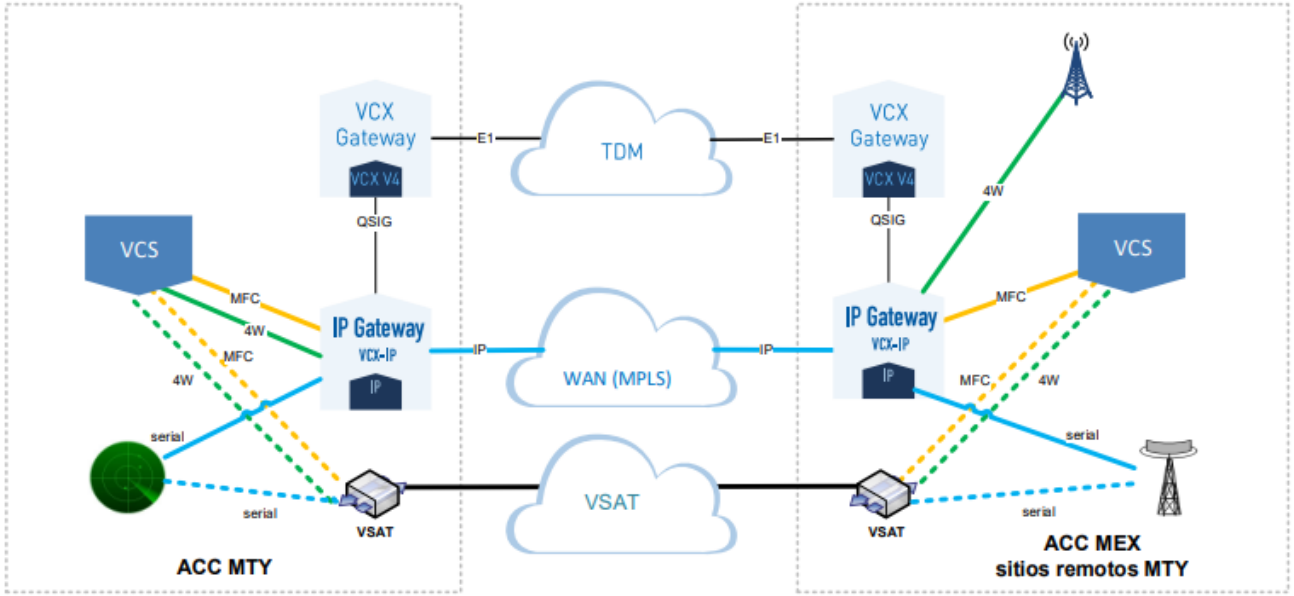
> 500
legacy interfaces



ATM-grade Network for Mexico

Overview

- Access to different backbone network technologies
- Satellite solution for reliable communication
- Dynamic delay compensation: up to 500ms & ED-137 compliant



VCX-IP

Satellite Solution

Enabling Technologies

Tecnologías habilitadoras

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Satellite Solution for Borderless Communication

Very Small Aperture Terminal (VSAT)

Antenna, Outdoor Unit (BUC, LNB), Indoor Unit

Adaptable frequency band – C, X, Ku, Ka-Band

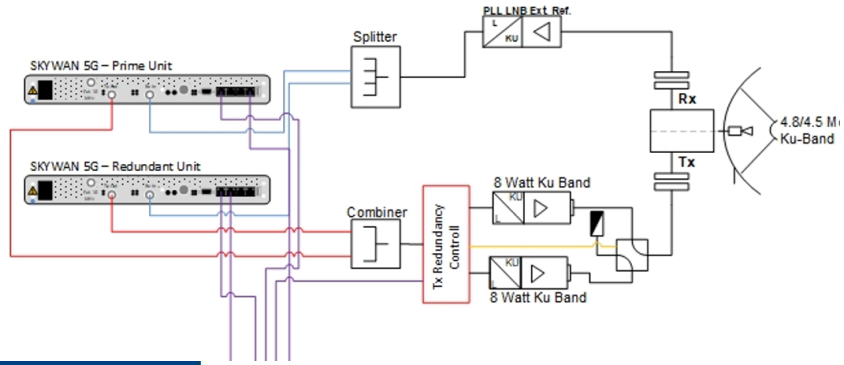
Different coverage, bandwidth, reliability, and cost

Efficient bandwidth utilisation

Bandwidth-on-Demand & TDMA Technology

Redundancy and high availability

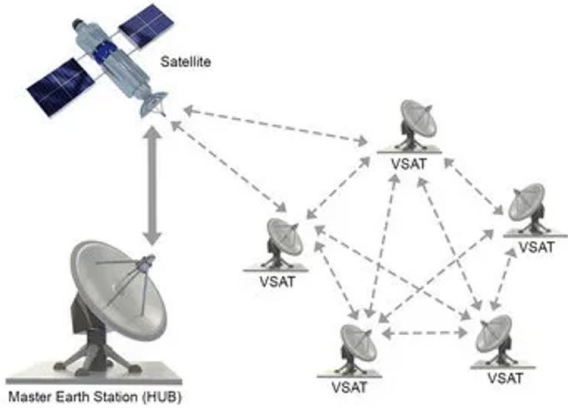
- Assign to any node – Master/Backup
- Automatic failover
- No terrestrial connections needed



Satellite Solution for Borderless Communication

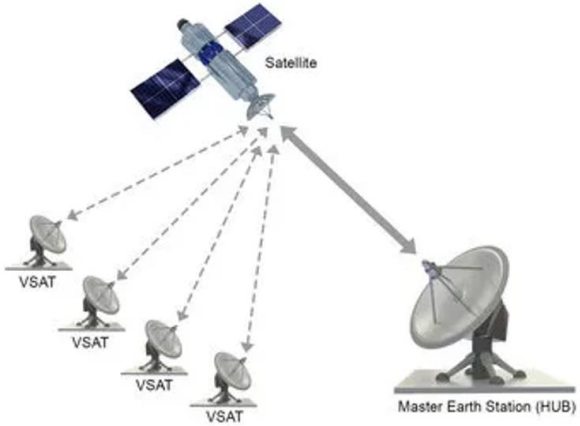
Advantages

- GEO satellites – wide region coverage
- Backup system for disaster recovery
- Rapid deployment
- Design flexibility
  - Diverse topologies
  - Modem licensing
- Enhancements via configuration



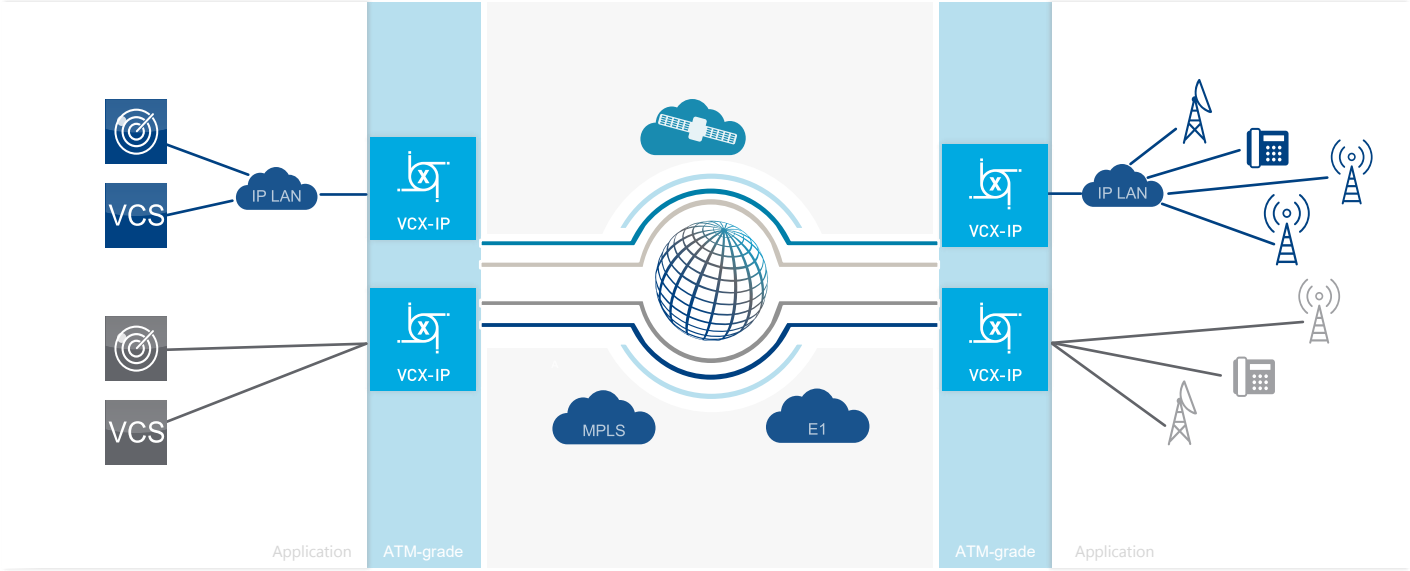
Considerations

- Higher latency due to satellite distance
- Limited bandwidth
- Weather phenomena can temporarily reduce performance



VCX-IP - The Integrated Voice and Data Gateway

Seamless migration of legacy towards IP



- Multi-level redundancy
- Assurance: ED-153 SWAL3 / ED-109A AL4 (DO-278)
- Zero down-time for configuration changes
- Long lifecycle support

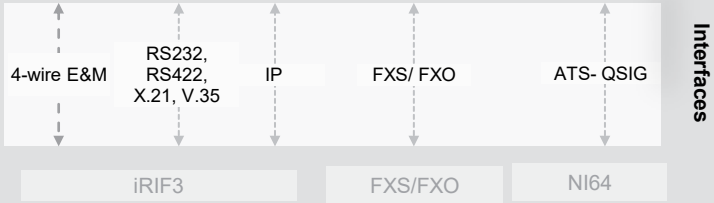
VCX-IP – The Integrated Voice and Data Gateway

ATM–grade Network Functionalities

Session Controller	Dynamic Delay Compensation
Bandwidth Optimization	Call and Data Forking
Echo-Free Communication	Multi-Network Availability

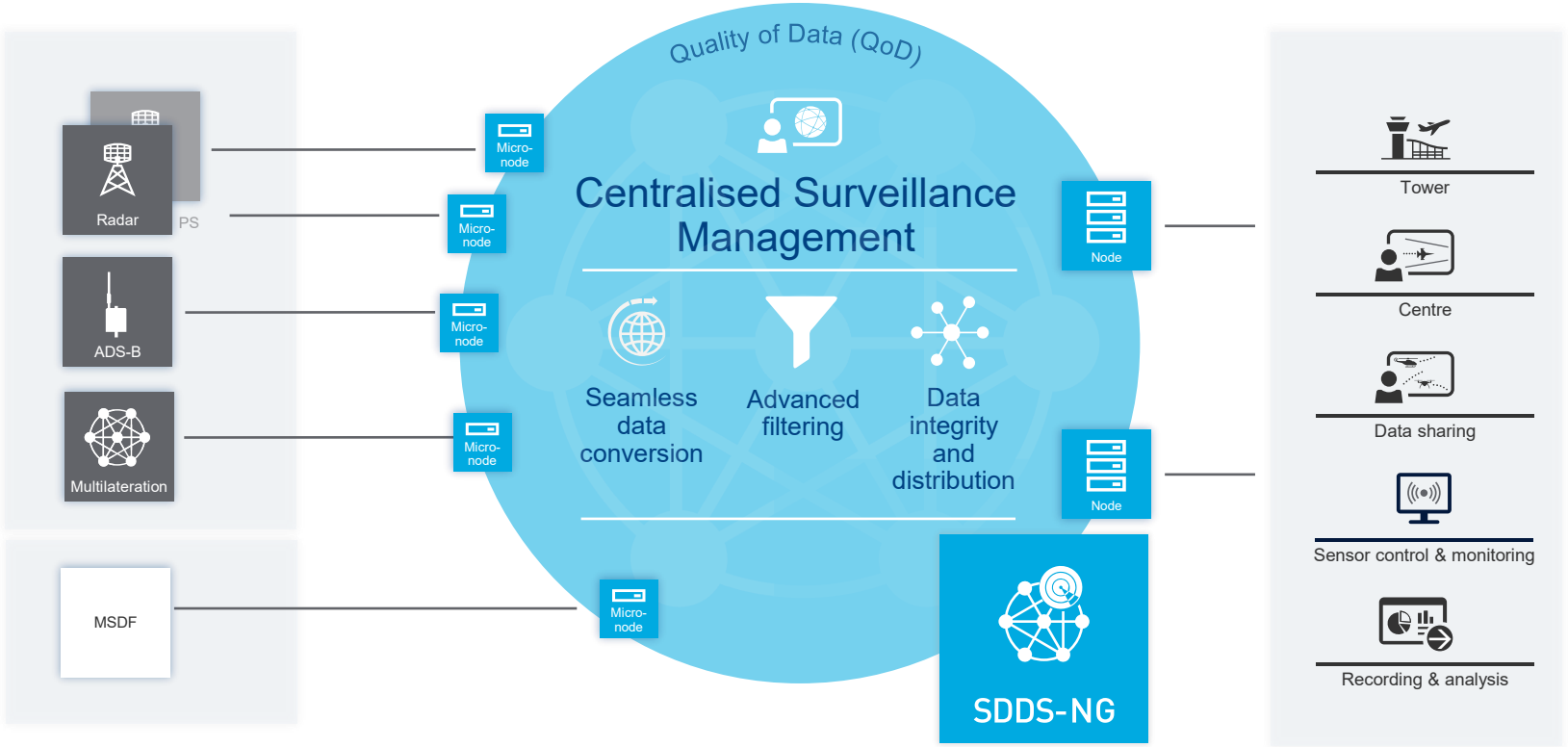
VCX-IP

Factory - Vienna



Surveillance Data Distribution System – Next Gen (SDDS-NG)

Mastering surveillance information



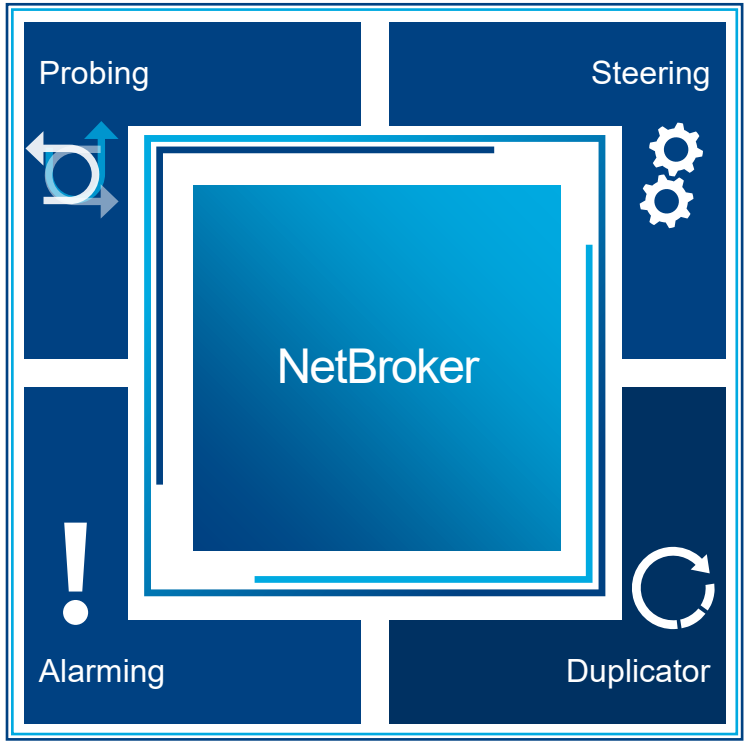
NetBroker for Continuous Monitoring

Modular architecture

Near real-time measurements

Visualise KPIs per service class

KPI-based alarms

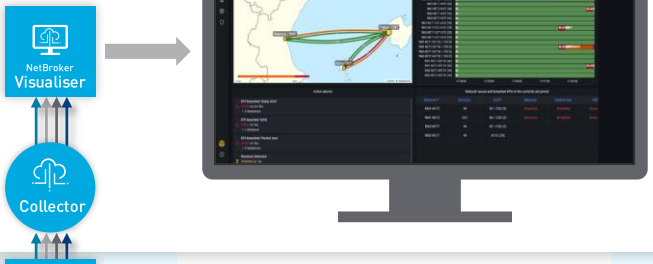


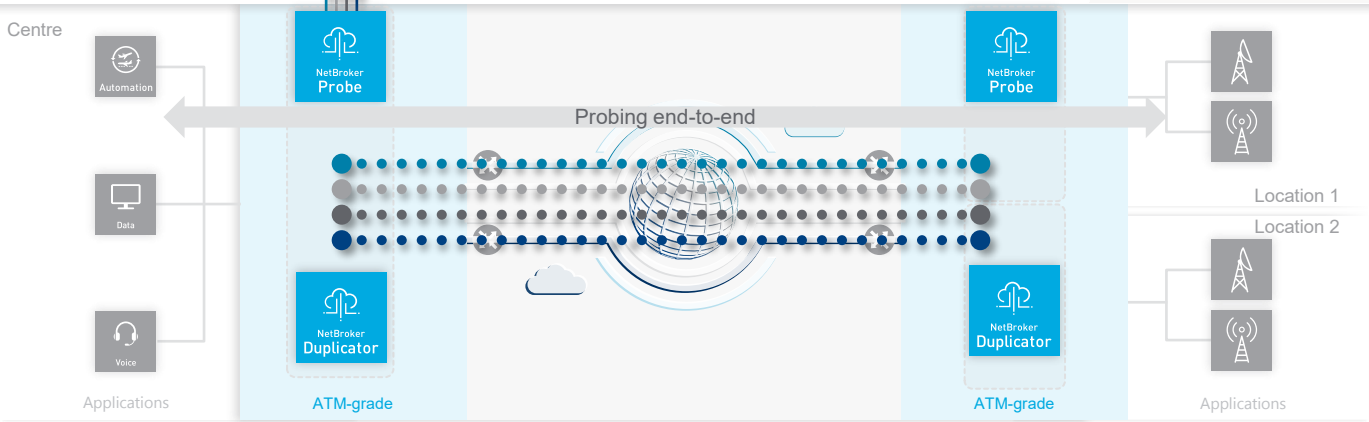
ATM-specific insights

Brown-out detection

Optimized use of all available networks

Enhancing E2E Operational Awareness

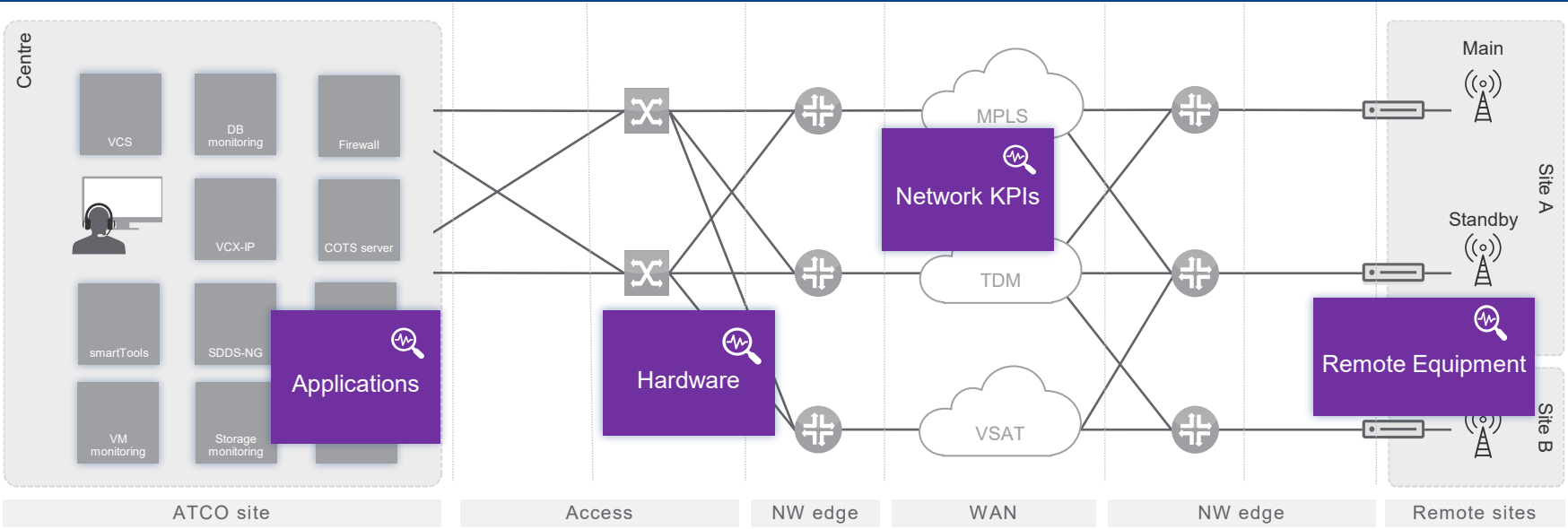




Unified Network Situational Awareness

Advanced NMS

Active KPI probing	Status and fault management	Configurable dashboard	Event Logging	User access control

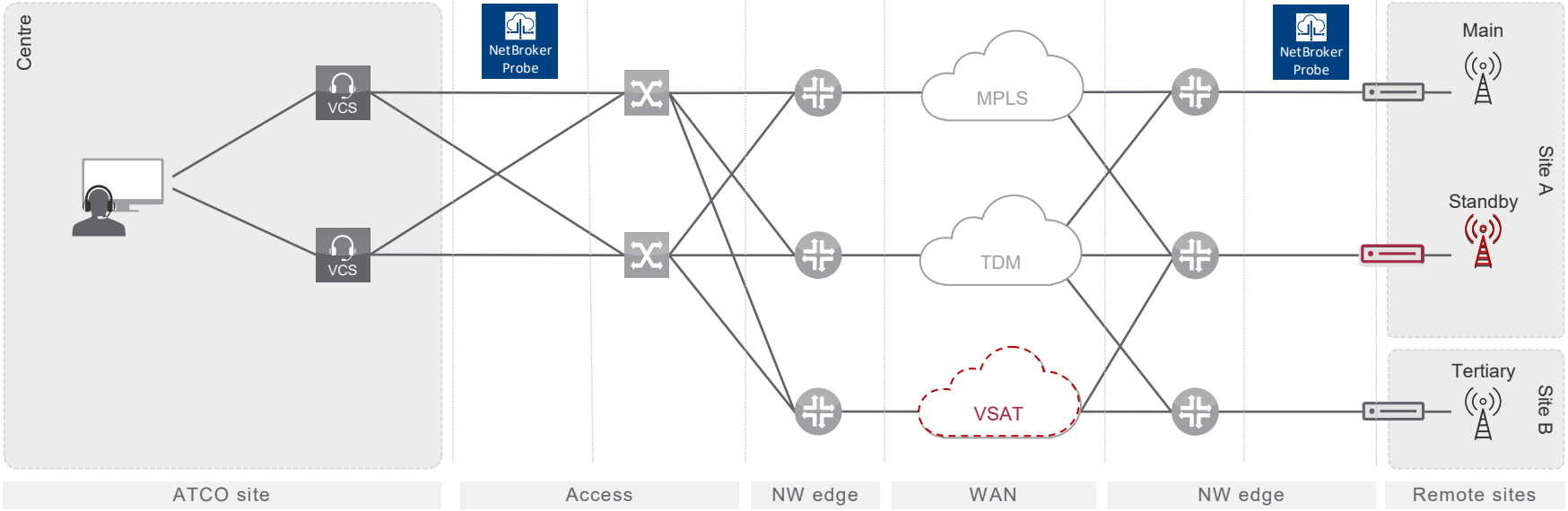


End-to-end ATM Critical service monitoring

Example for radio service

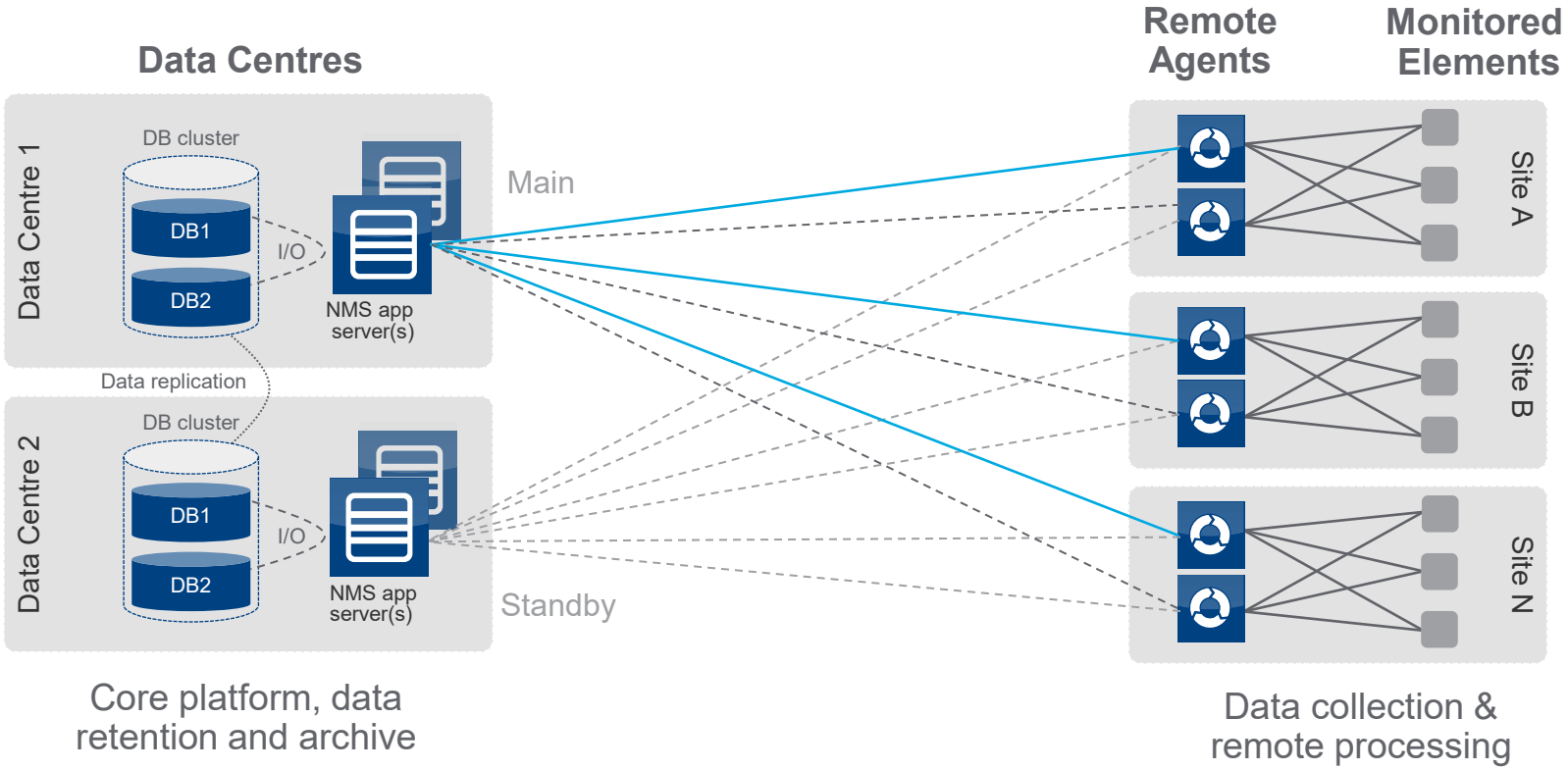
123,5 MHz

VCS	NetBroker	Switch	Router	WAN	Router	NetBroker	Radio
Main	Main	Main	R1	W1	R1	Main	TRX1
Standby	Standby	Standby	R2	W2	R2	Standby	TRX2
			R3	W3	R3		TRX3



Advanced-NMS High Availability Set Up

Database and agent redundancy



ATM-grade Networks

Enabling operational excellence

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Thank you!

¡Gracias!

Danke!