ATM-grade VSAT Networks

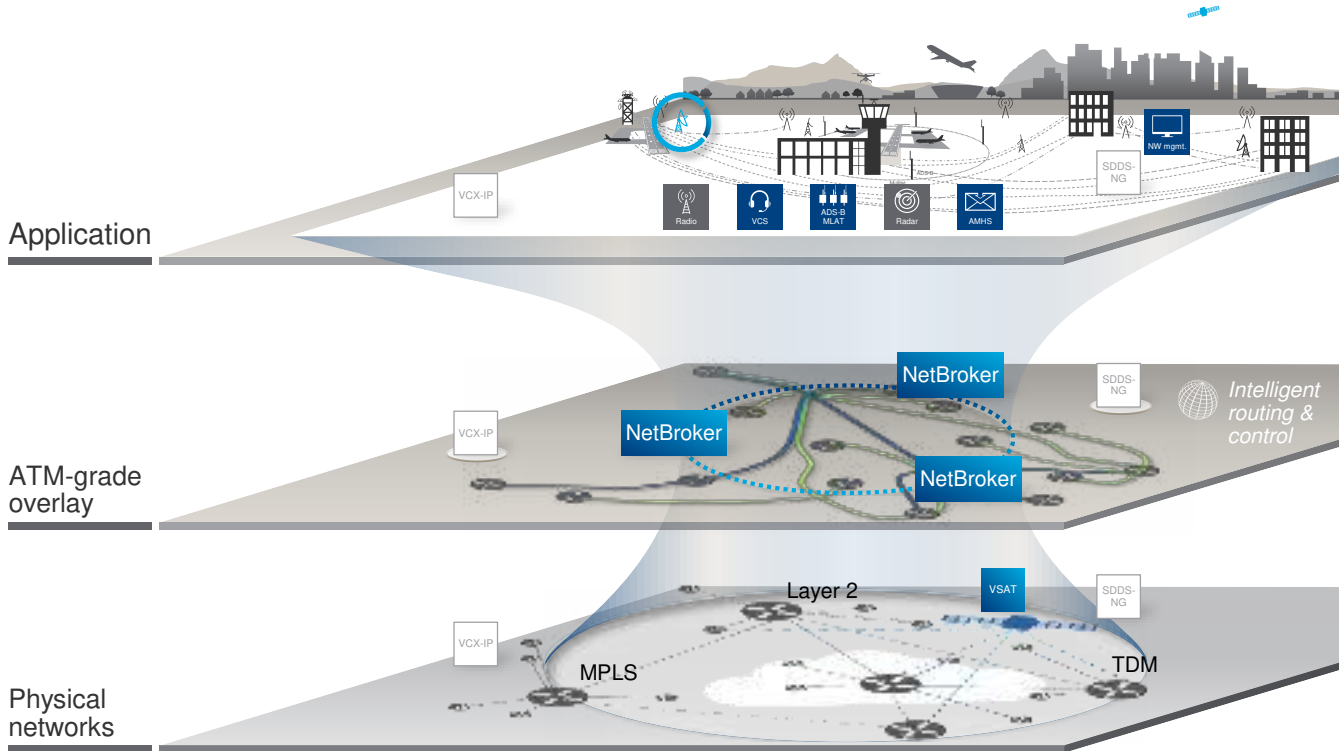Matthias Gerlich

Air Traffic Management

FREQUENTIS
FOR A SAFER WORLD

Frequentis VSAT services for safe & secure communications

Frequentis implementation and services

Network Management

Deliver end-to-end application view with active measurement of performance

→ ATM application view

NetBroker: ATM-grade router

Ensuring ATM-grade performance and enhancing network capabilities

→ Application based routing and brown-out detection

VSAT network integration

Delivery of ATM-grade VSAT networks with VCX-IP

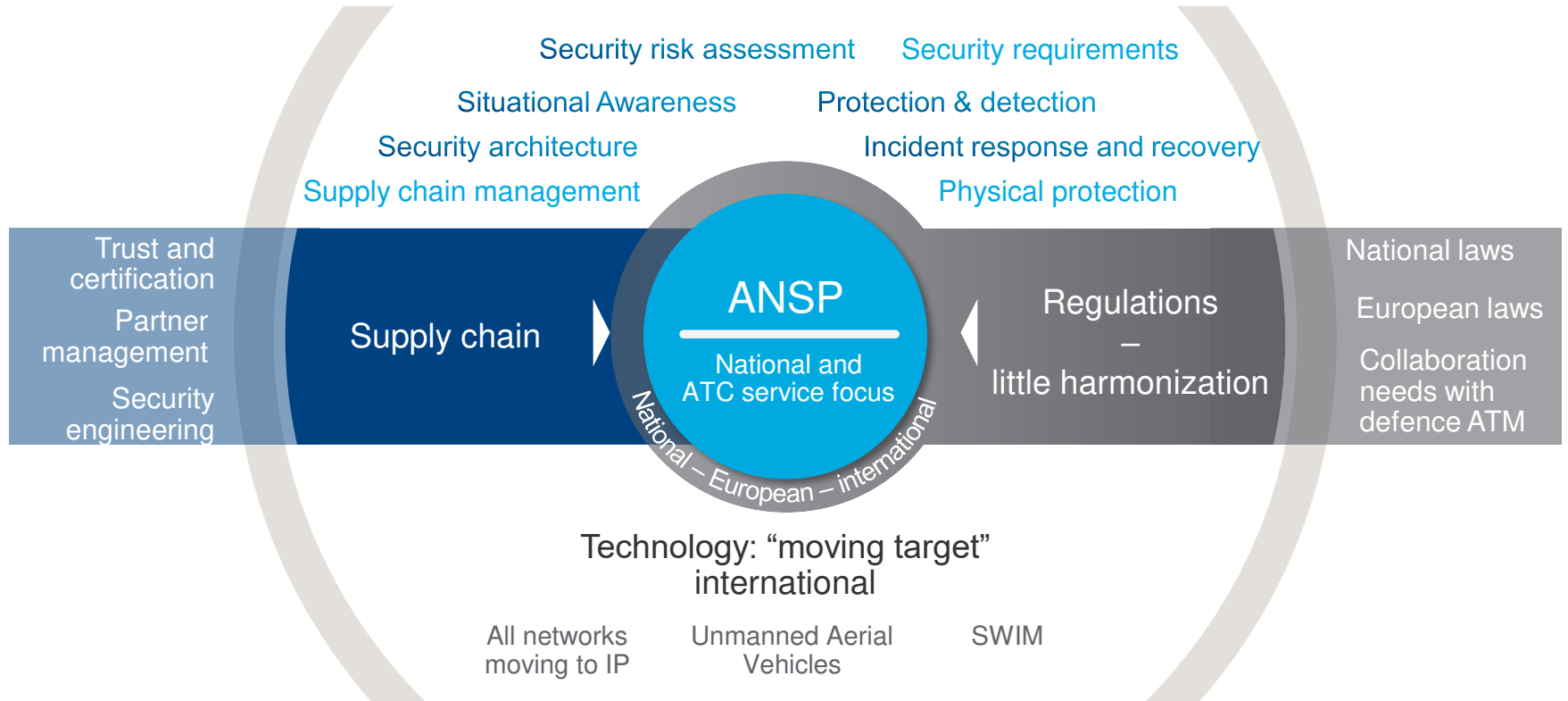→ supporting all types of applications: G/G, A/G, AMHS, AFTN, Remote Tower,…

End-to-end safety & security view

Application

ATM-grade overlay

Physical networks

FREQUENTIS

Safety and security need to go hand in hand

Can impact

Safety
"Never change a running system"

Priority over security

How to deal with conflicting requirements

Security
"Always apply the latest security patch"

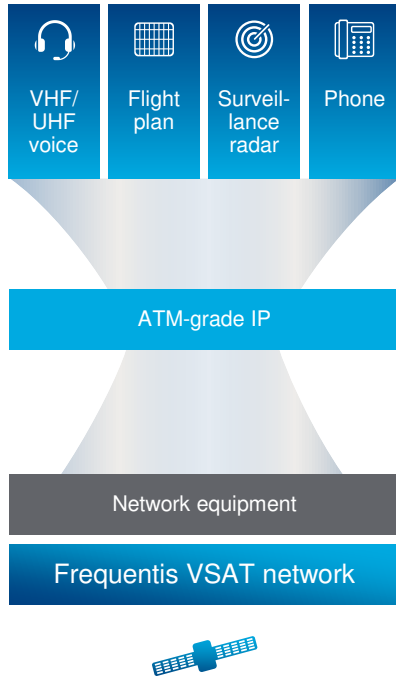An integrated safety and security methodology delivers the required trust and reliability for ATM

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A challenge requiring expertise and collaboration of the industry

Cyber crime is more and more a high-tech business

Security risk assessment   Security requirements

Situational Awareness   Protection & detection

Security architecture   Incident response and recovery

Supply chain management   Physical protection

Trust and certification			
Partner management	Supply chain	**ANSP** National and ATC service focus *National – European – international*	Regulations – little harmonization
Security engineering			

National laws

European laws

Collaboration needs with defence ATM

Technology: "moving target" international

All networks moving to IP   Unmanned Aerial Vehicles   SWIM

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Create user networks at the Edge
Characteristics of an ATM-grade VSAT network

VHF/UHF voice	Flight plan	Surveil-lance radar	Phone

ATM-grade IP

Network equipment

Frequentis VSAT network

VSAT network as IP based transport layer

- Main path or complement as redundancy to other technologies
- General purpose L2/L3 access ports (switch/router) for data

VSAT ATM-grade enhancements

- VCX-IP application gateway
  - Ensuring bandwidth savings through domain specific functionalities (on top of voice compression)
  - Legacy interfaces where still needed (E&M, FXS/FXO, serial, …)
- NetBroker
  - Flow-based and SLA-based re-routing
  - Deterministic methods that allow a safety case
  - Saftey based bandwidth calculation models reducing OPEX

VSAT ATM grade networks support intra-airport multiservice connectivity and high capacity operational networks
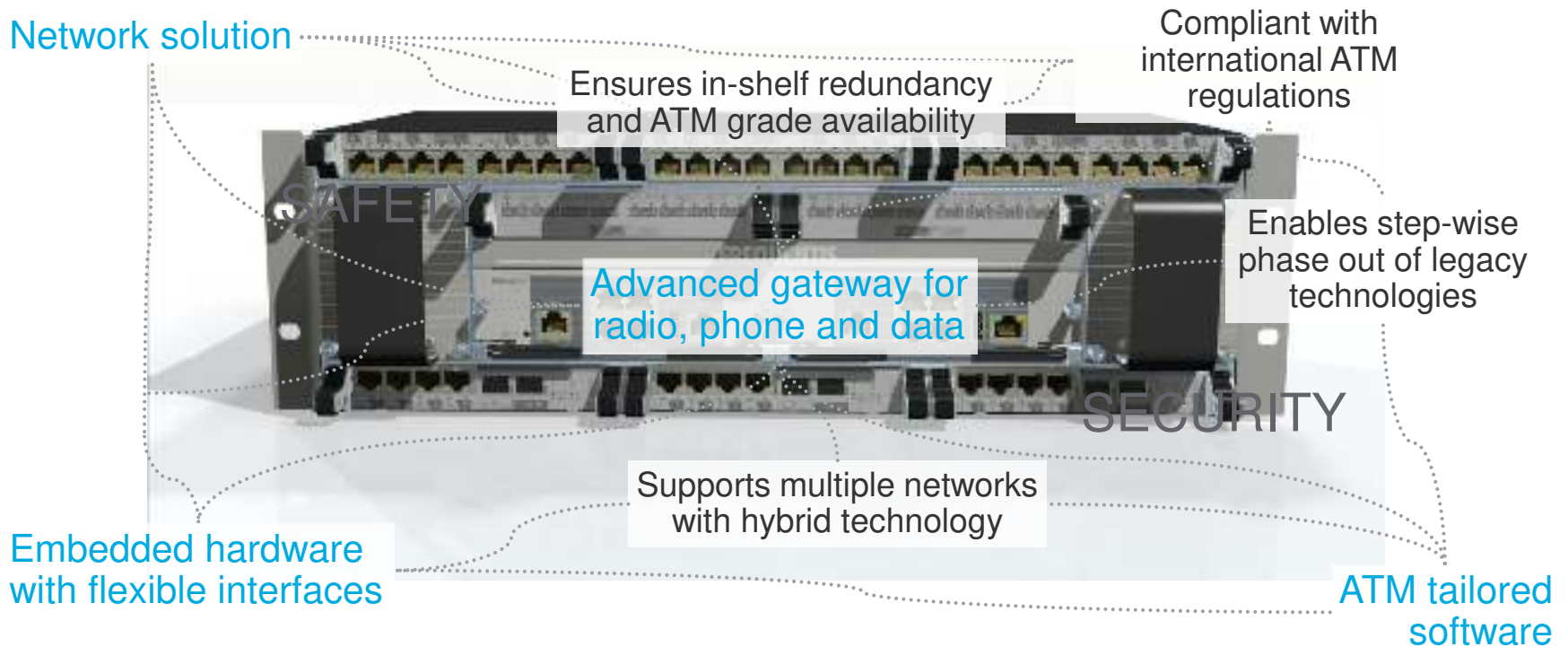
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Enabling transition of safety-critical voice and data applications to IP networks

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VCX-IP network solution

… what is it?

Network solution

Ensures in-shelf redundancy and ATM grade availability

Compliant with international ATM regulations

SAFETY

Advanced gateway for radio, phone and data

Enables step-wise phase out of legacy technologies

SECURITY

Supports multiple networks with hybrid technology

Embedded hardware with flexible interfaces

ATM tailored software

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Enabling safety-critical voice and data applications in a non-deterministic network

The market leading network solution for safe migration to VoIP in air traffic management

Optimizing ATM applications

- ATM grade bandwidth optimization
- Dynamic delay compensation
- Echo-free side tone

Advanced voice & data gateway

- Supporting legacy and IP standards
- Following ICAO/EUROCAE ED-137 regulations
- Providing physical and logical protocol conversion

VCX-IP

Safety by design

- Inter-shelf redundancy for hardware, software, and configuration
- Redundant LAN access of each processing unit
- ED-153 compliance
- Zero down-time for configuration changes
- Admission control
- Pre-emption rules for shared access to resources

+

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VCX-IP network solution – more than a gateway

ATM-grade solution for safety-critical voice and data applications – from legacy to all-IP
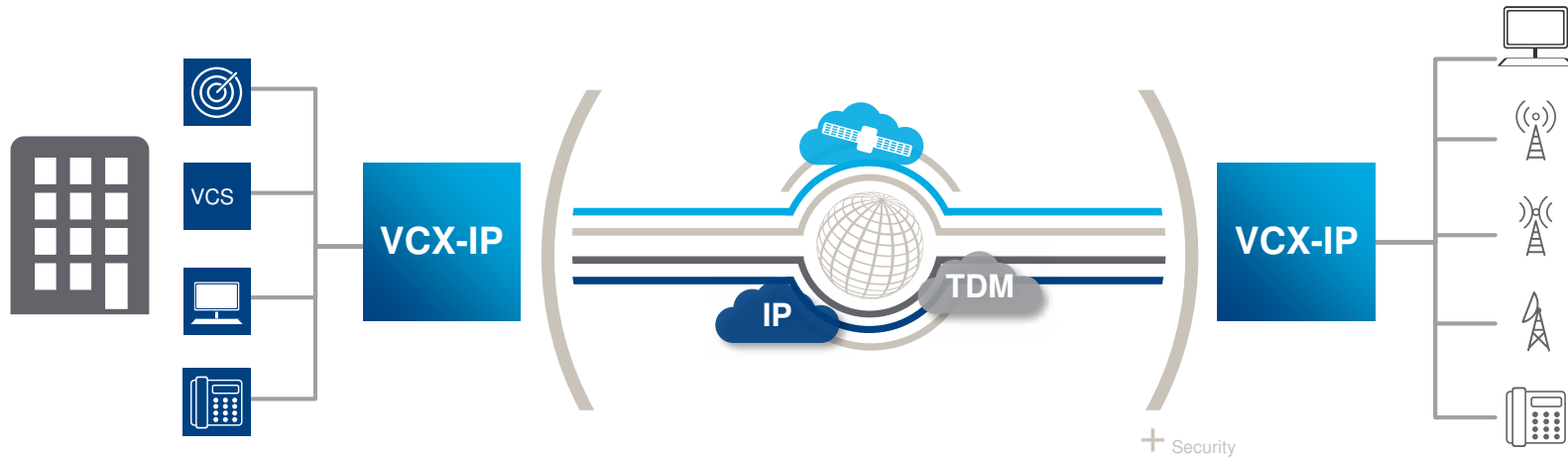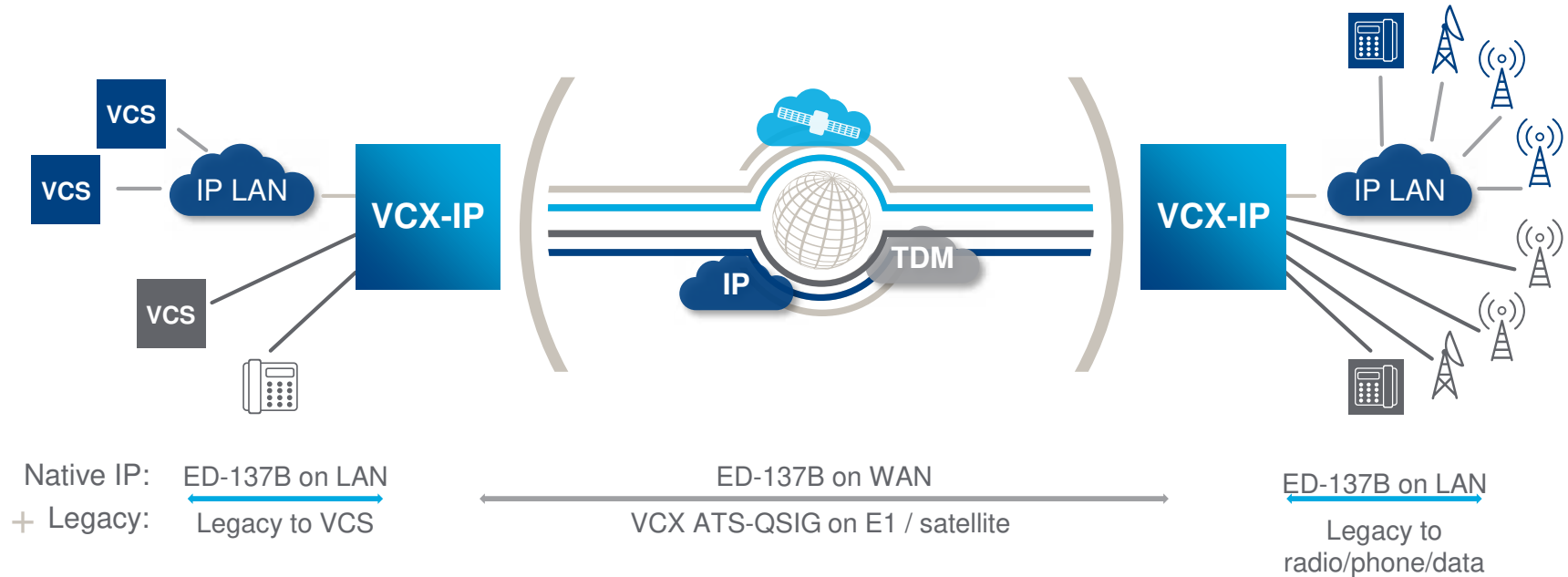

Echo-free radio communication	Highest availability Uninterrupted operations	Redundancy Hot-pluggable interfaces
+ Protecting legacy investment	Optimized bandwidth usage	Admission control

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Enabling legacy equipment for the cloud era

Protect your investment by step-wise migrating to an all-IP environment

Native IP: ED-137B on LAN   ED-137B on WAN   ED-137B on LAN

\+ Legacy: Legacy to VCS   VCX ATS-QSIG on E1 / satellite   Legacy to radio/phone/data
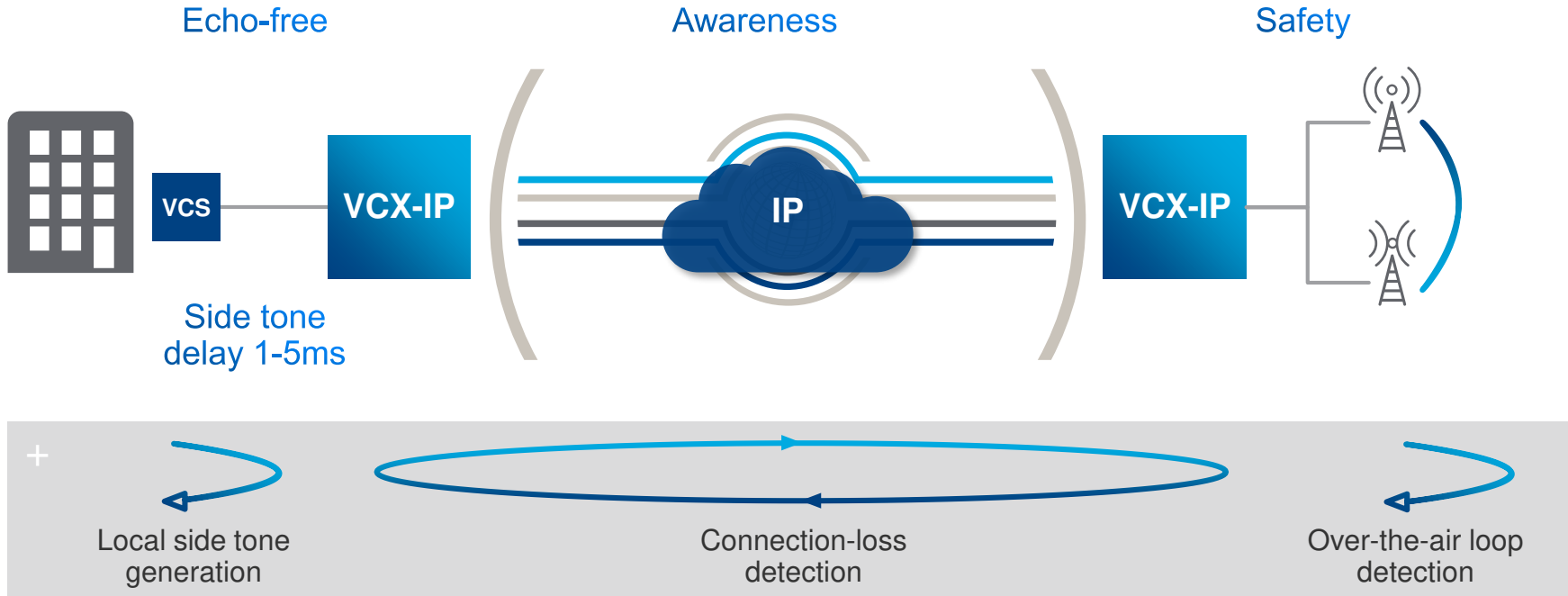
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Bi-directional dynamic delay compensation over any WAN and in any combination

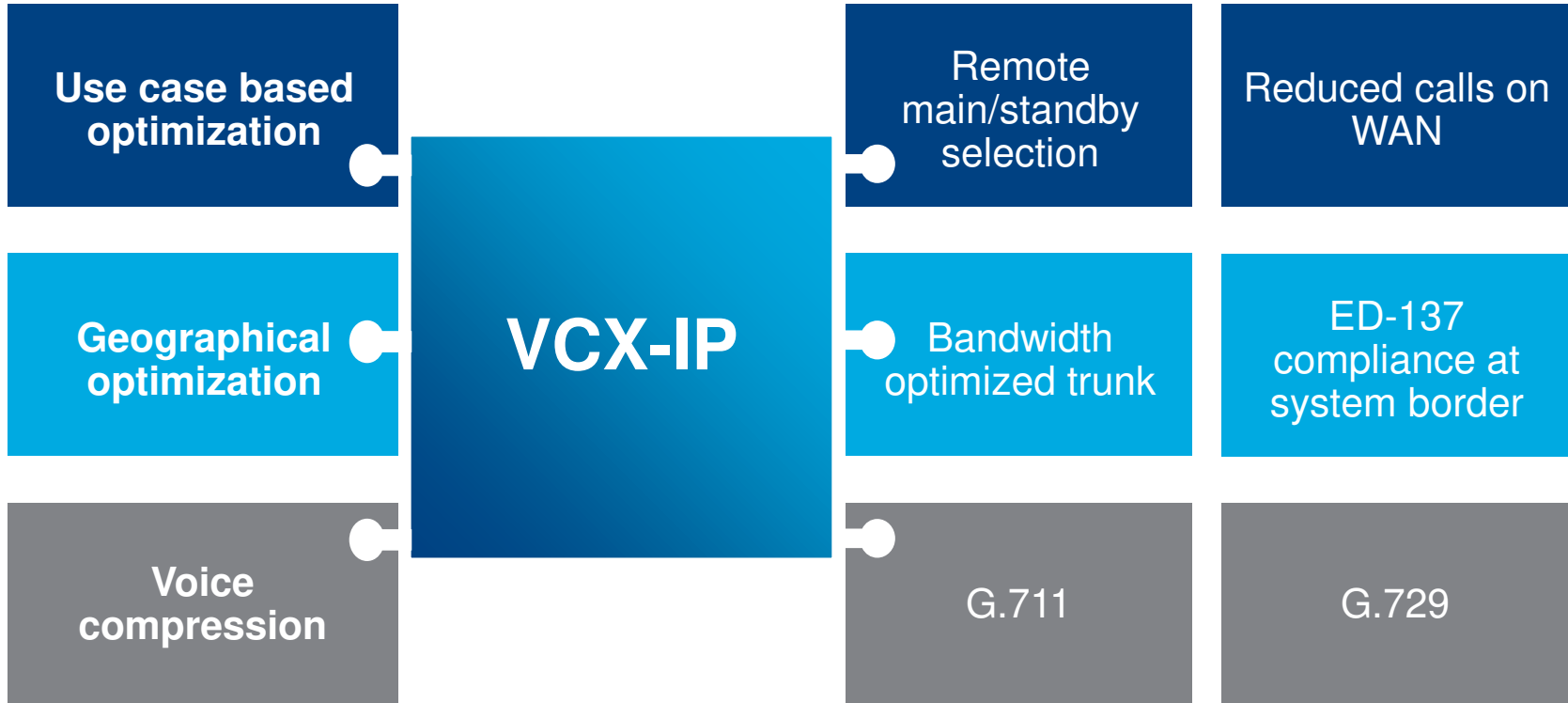Best signal selection based on synchronized audio receptions

VCS

VCX-IP

1. Signal alignment

2. Best signal selection

Delay 1

Delay 2

ED-137B

IP

TDM

Delay 3

VCX-IP

VCX-IP

VCX-IP

CLIMAX radio operations

Coverage groups

Continuous delay measurements
Rx and Tx direction

FREQUENTIS
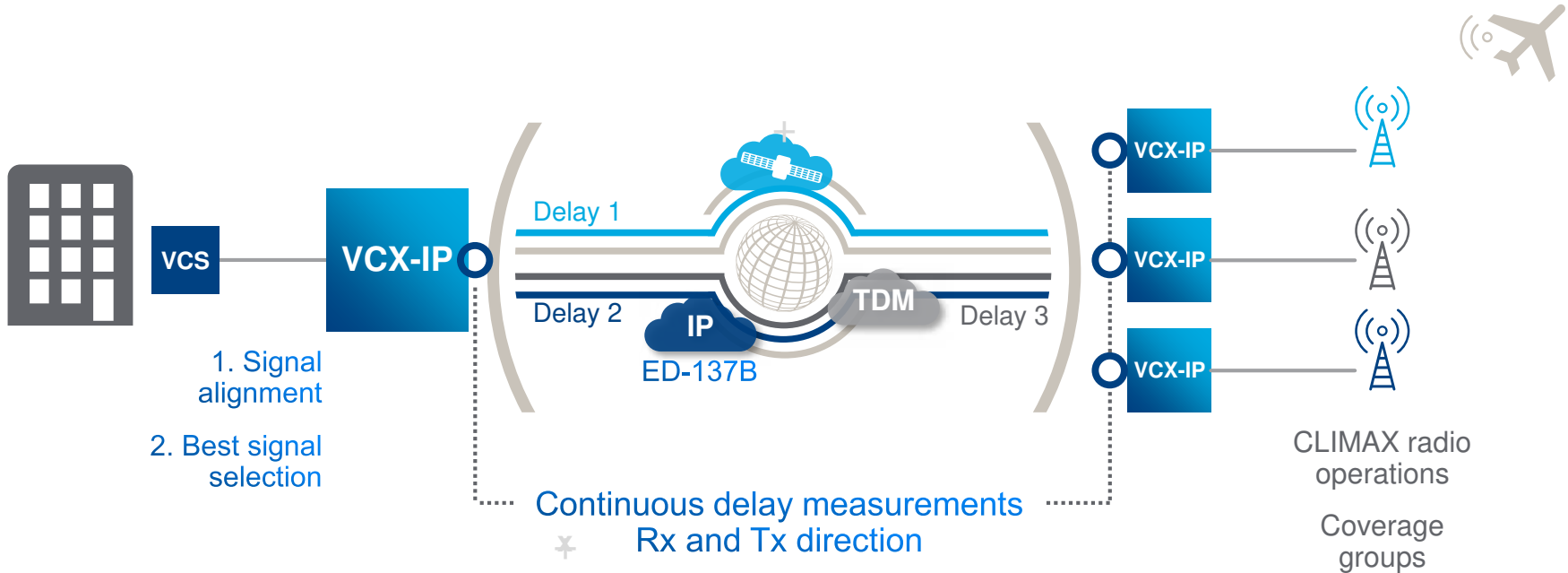
Elimination of echo in higher delay networks

Local side-tone generation with remote loop check

Echo-free

Awareness

Safety

VCS

VCX-IP

IP

VCX-IP

Side tone
delay 1-5ms

+

Local side tone
generation

Connection-loss
detection

Over-the-air loop
detection

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ATM grade bandwidth optimization

Flexible and safe cost saving potentials

Use case based optimization	Remote main/standby selection
	Reduced calls on WAN
Geographical optimization	Bandwidth optimized trunk
	ED-137 compliance at system border
Voice compression	G.711
	G.729

VCX-IP

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ATM grade bandwidth optimization

Use case based optimization: Main/standby switching at the remote site

Availability

Cost savings

Safety

VCS — VCX-IP — VCX-IP — Main / Standby

| Highest availability – transparent m/s switching | Only one call over the WAN – up to 50% less bandwidth consumption | Main / standby switching within milliseconds |

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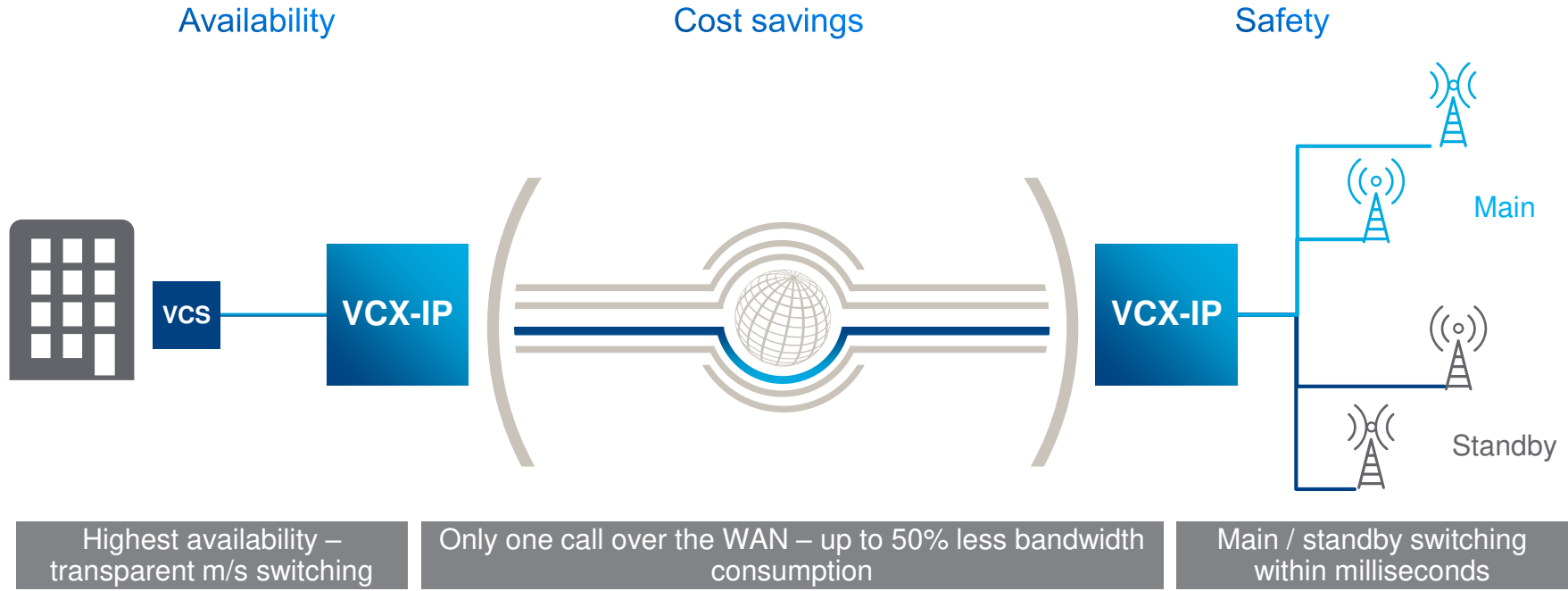
ATM grade bandwidth optimization

Use case based optimization: Reduced calls on the WAN

Safety

Bandwidth optimization

Shared access

VCS VCS VCS VCX-IP

IP TDM

VCX-IP

Pre-emption rules, lockout mechanisms and priorities

Reduced bandwidth usage – less calls over the WAN

Shared access to resources based on ED-137

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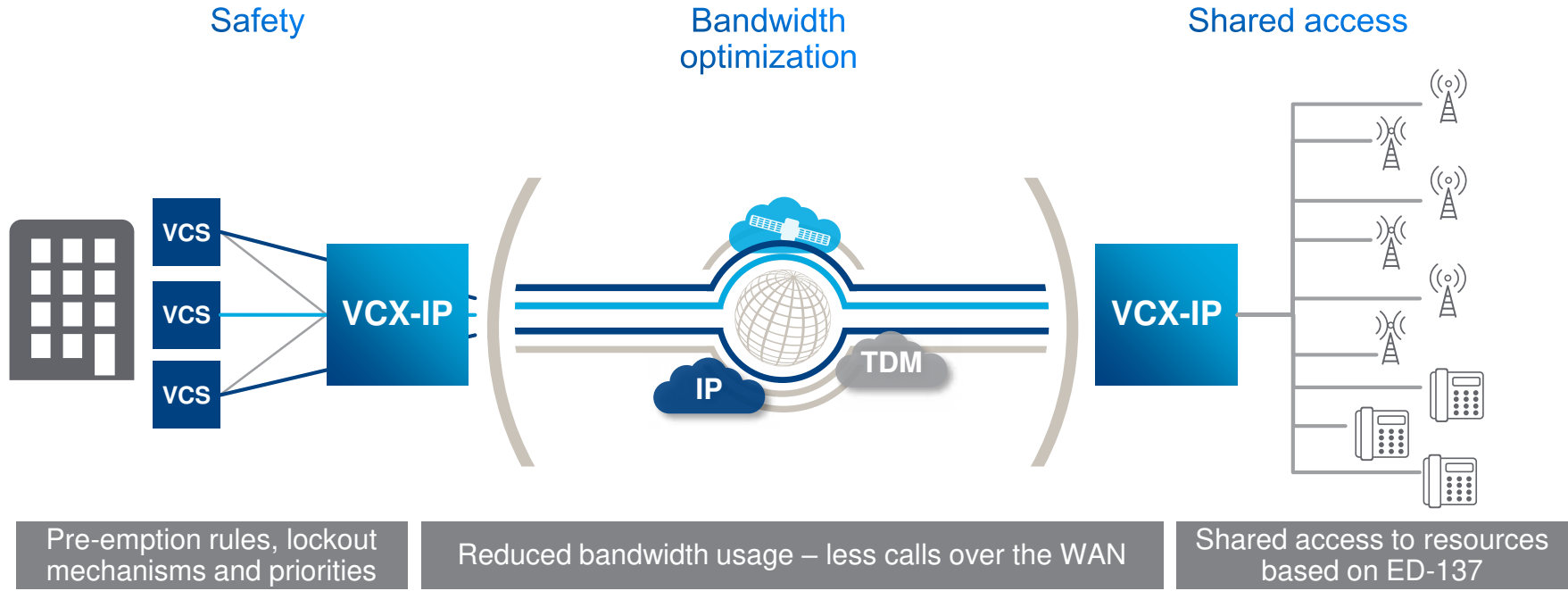
VCX-IP network solution

Overview of phone capabilities

Native IP:	ED-137B on LAN	ED-137B on WAN	ED-137B on LAN
+ Legacy:	Legacy to VCS		Legacy phone

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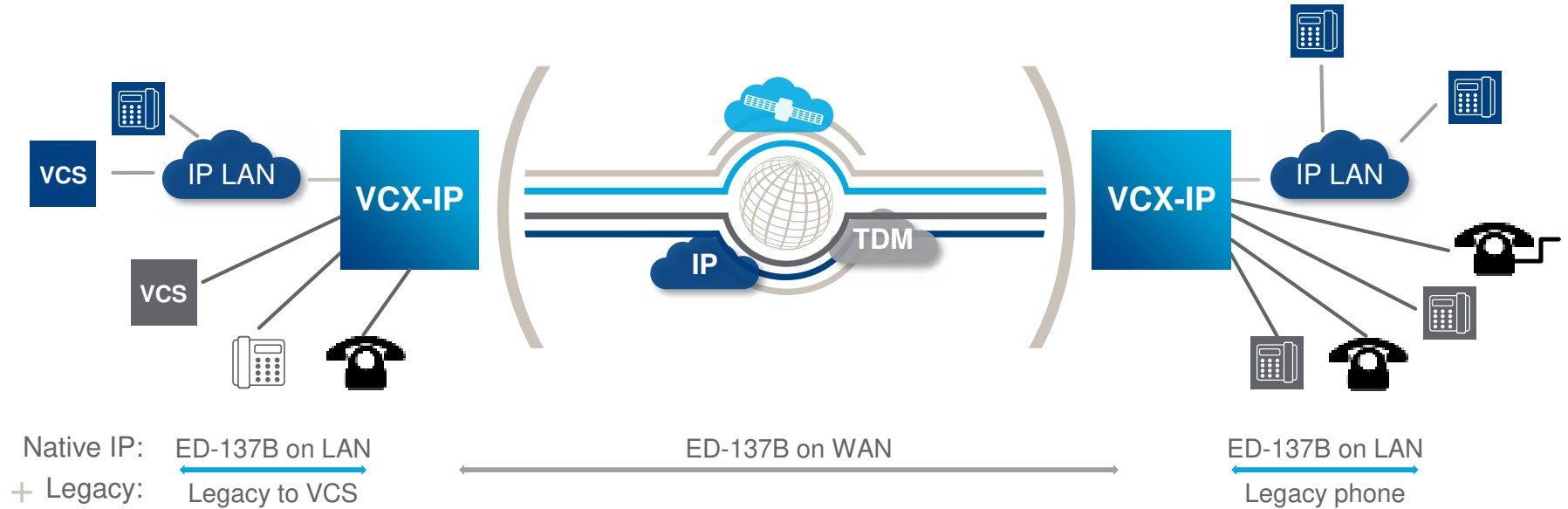
VCX-IP phone protocol and interface gateways
Services independency from physical end-point interfaces

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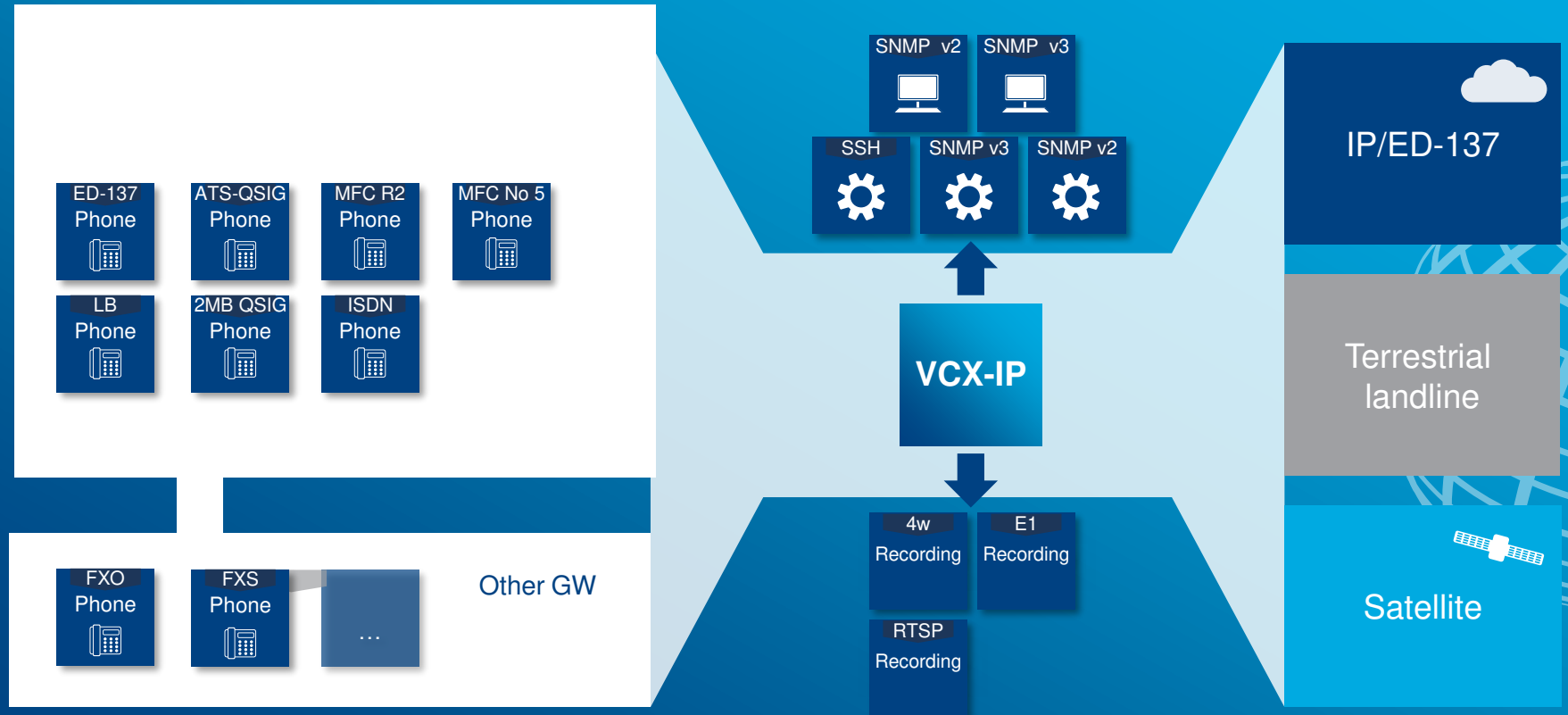
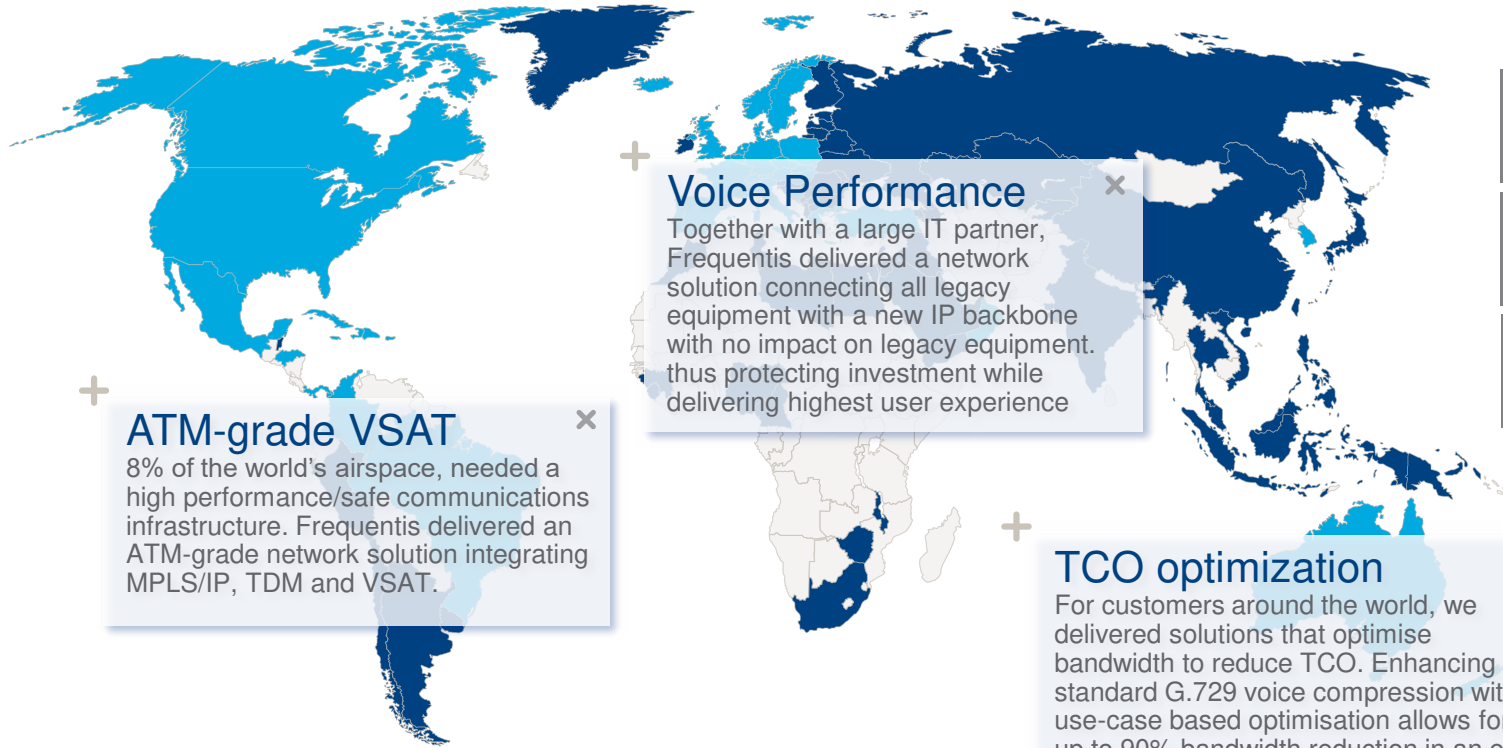# VCX-IP network solution
Overview data capabilities

Efficient sharing

Bandwidth optimization

Flexibility

IP LAN

VCX-IP

TDM

IP

VCX-IP

IP LAN

Native IP: ED-137B on LAN — ED-137B on WAN — ED-137B on LAN

Legacy: Legacy — Legacy to data
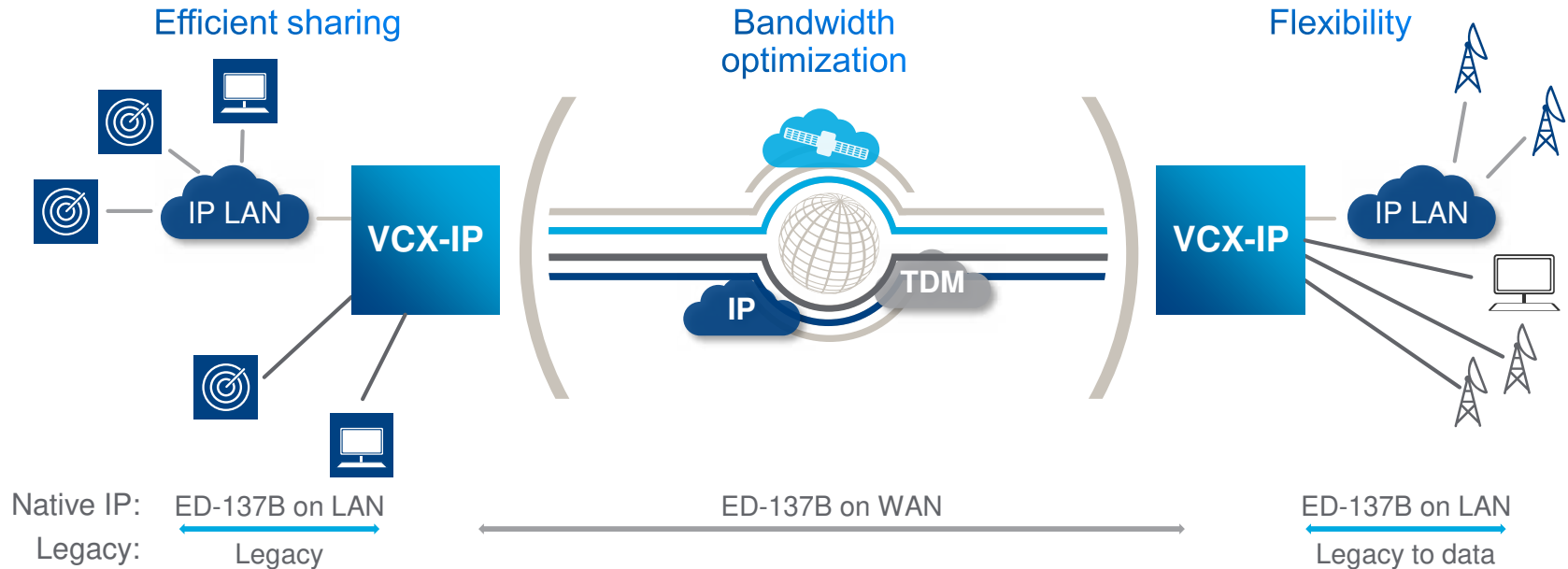
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VCX-IP data protocol and interface gateways
Services independency from physical end-point interfaces

RS232 sync
Data

RS232 async
Data

RS422 sync
Data

RS422 async
Data

X.21
Data

V.35
Data

IP
Radar

IP
Flight Plan

SNMP v2

SNMP v3

SSH

SNMP v3

SNMP v2

VCX-IP

IP/ED-137

Terrestrial landline

Satellite
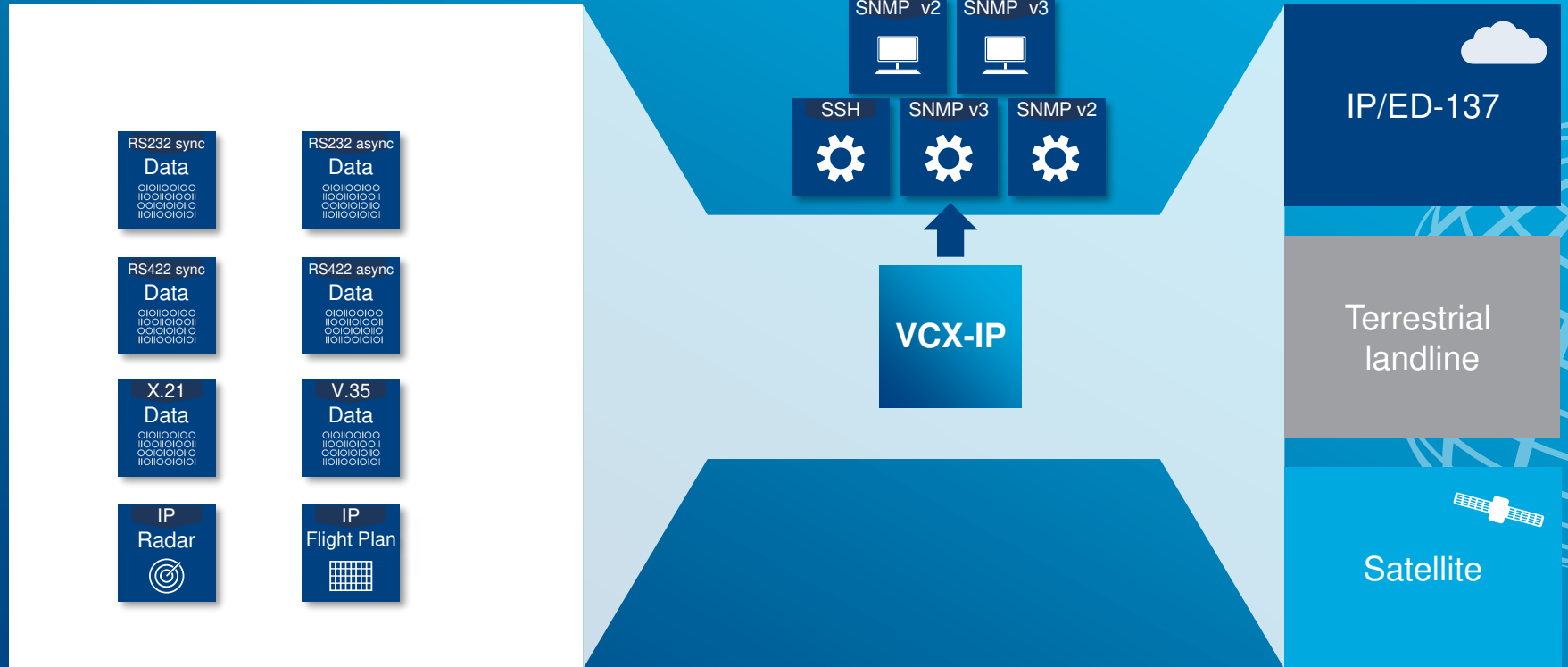
FREQUENTIS

High performance, safety and security
Networks

250,000
connected users

50+
countries of the world

33%
of land mass connected by Frequentis network solutions

ATM Civil

Networks

Voice Performance
Together with a large IT partner, Frequentis delivered a network solution connecting all legacy equipment with a new IP backbone with no impact on legacy equipment. thus protecting investment while delivering highest user experience

ATM-grade VSAT
8% of the world's airspace, needed a high performance/safe communications infrastructure. Frequentis delivered an ATM-grade network solution integrating MPLS/IP, TDM and VSAT.

TCO optimization
For customers around the world, we delivered solutions that optimise bandwidth to reduce TCO. Enhancing standard G.729 voice compression with use-case based optimisation allows for up to 90% bandwidth reduction in an end-to-end ED-137B voice call.

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Enabling safety-critical voice and data applications in a non-deterministic network

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Point of Contact

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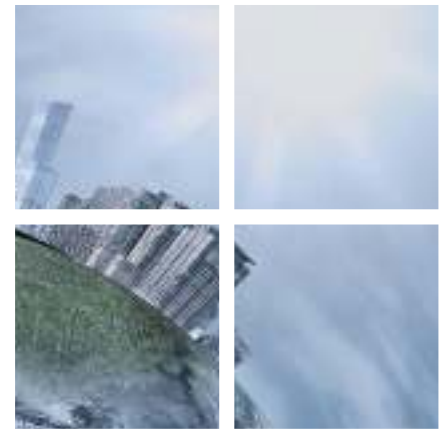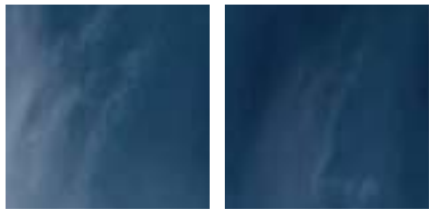
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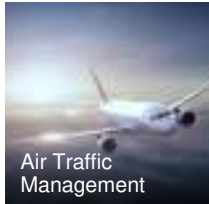**Matthias Gerlich**

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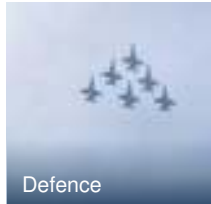E-Mail: Matthias.gerlich@frequentis.com
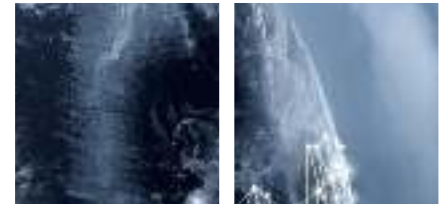
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FOR A SAFER WORLD

Air Traffic Management

Defence

Maritime

Public Transport

Public Safety