

FREQUENTIS
FOR A SAFER WORLD

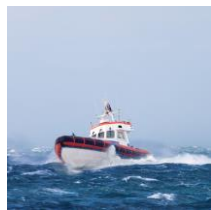


Welcome to our workshop:
Next-Generation ATM Technology
Digitalise Local, Deliver regional, Develop Global

FREQUENTIS
75

We set standards
in control centres
worldwide

FREQUENTIS
75



FREQUENTIS


Frequentis group at a glance

30+ years of profitable growth

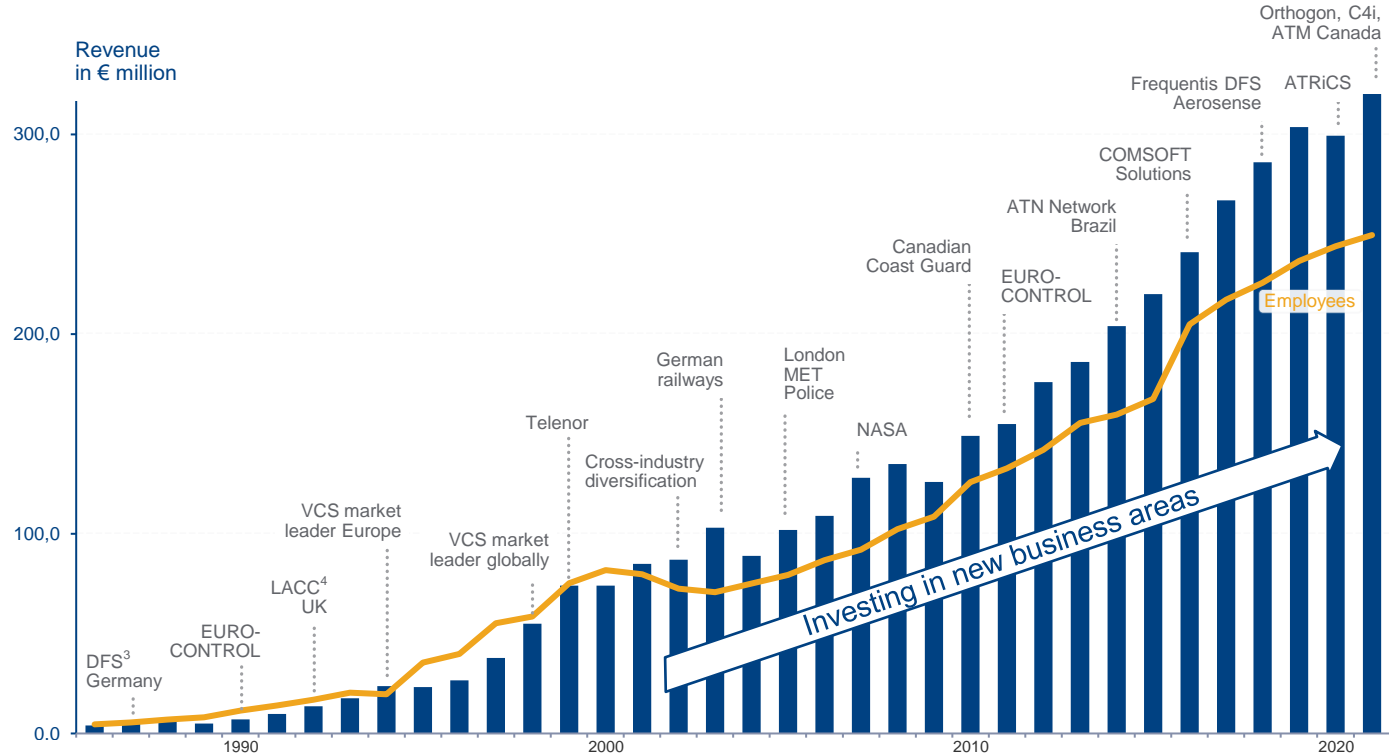
Established **1947**
Headquarters Vienna, Austria

75 years experience with
safety critical applications

2,000+
Employees¹


75% STEM² & specialists
50+ nations

€334m
Revenue in 2021



¹) Average 2021, in full-time equivalents (FTE); ²) Science, Technology, Engineering, Math ³) Deutsche Flugsicherung ⁴) London Area Control Centre, operated by NATS

(as of: 04/2022)

500+
customers

150
countries

>90% of our customers are
government agencies



40,000+
working positions using
Frequentis solutions



33%
of the world safer with
Frequentis networks



90% of all air
passengers globally served
by Frequentis customers

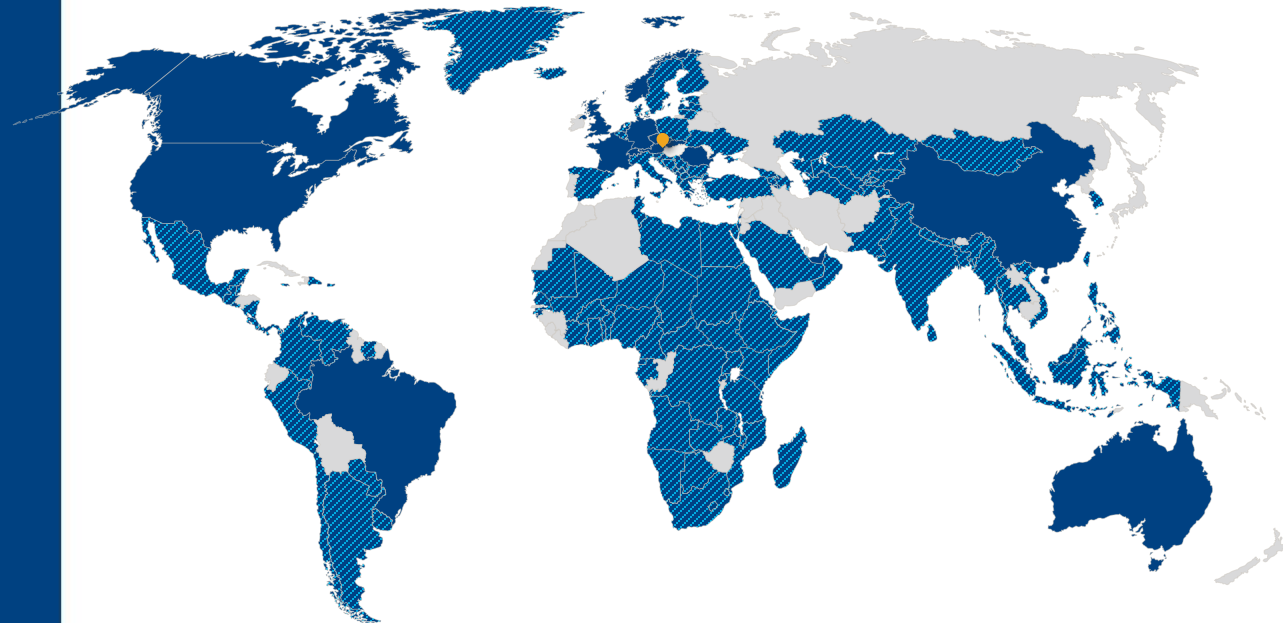


#1 in GSM-R
dispatcher terminals



240,000 km
longest maritime coastline
protected

A strong network around the world



■ Regional offices

■ Sales representatives

● Frequentis HQs



Markus Klopff
Director ATM
Strategic Marketing
and International
Relations,
Frequentis AG

ATM strategy: Creating the open ATM ecosystem

ADRESSING THE FUTURE – GROWING TOGETHER

The aviation market globally and in Asia shows signs of recovery

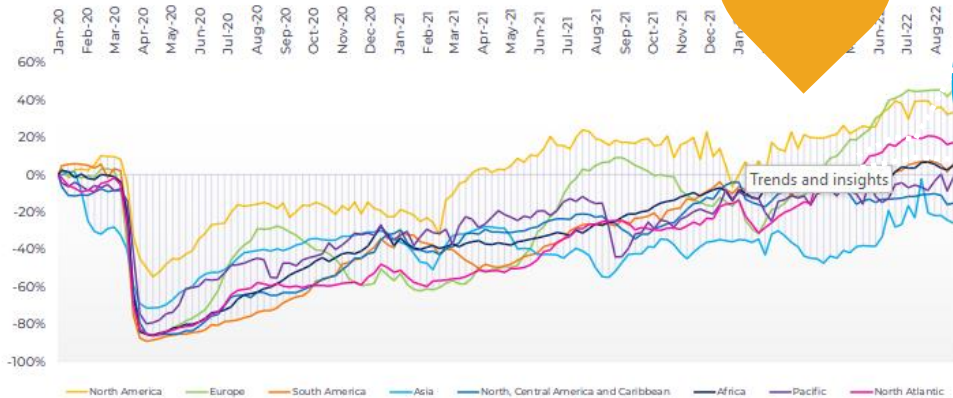
The ATM playbook has changed

Automation and AI are in the core of our investments

Sustainable growth requires collaboration

Trends and insights

Percent change in movements by region



Airport capacity ?

Quo vadis?

UTM/ATM integration

Slower progress during pandemic, now picking up.

Strongly driven in APAC, Europe, and US

Automation in towers

Expected to be a major topic again from 2023, when traffic picks up

Driven in several regions (EU, NA, ME, APAC)

Cyber security

Importance has increased even more due to geopolitical situation.

Worldwide trend.

... things are changing

→ A new playbook •

~~Constant growth~~

→ Strong dynamics



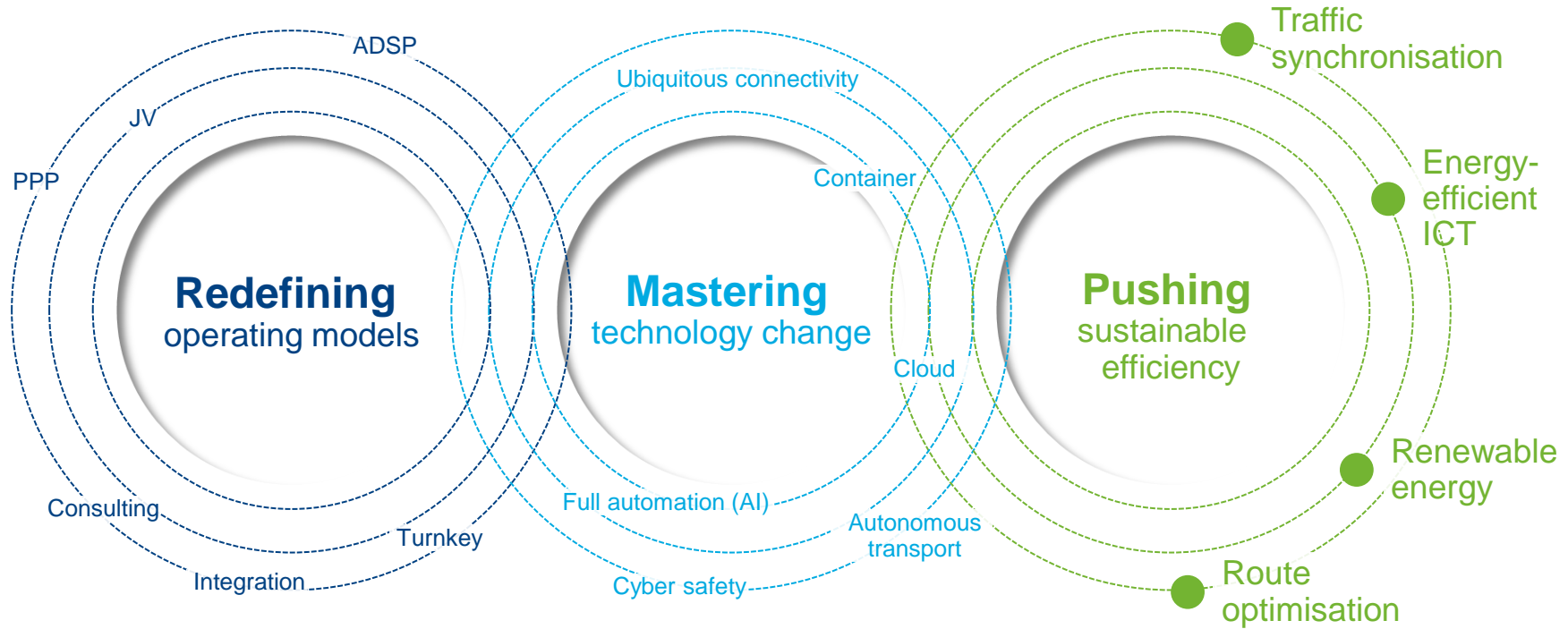
~~Long-term planning~~

→ Immediate reactions

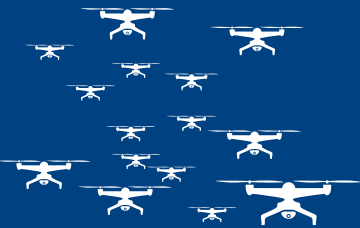
~~Predictability~~

→ Agility

Adapting to the new market dynamics: Frequentis ATM core strategic elements



Unmanned Traffic Management

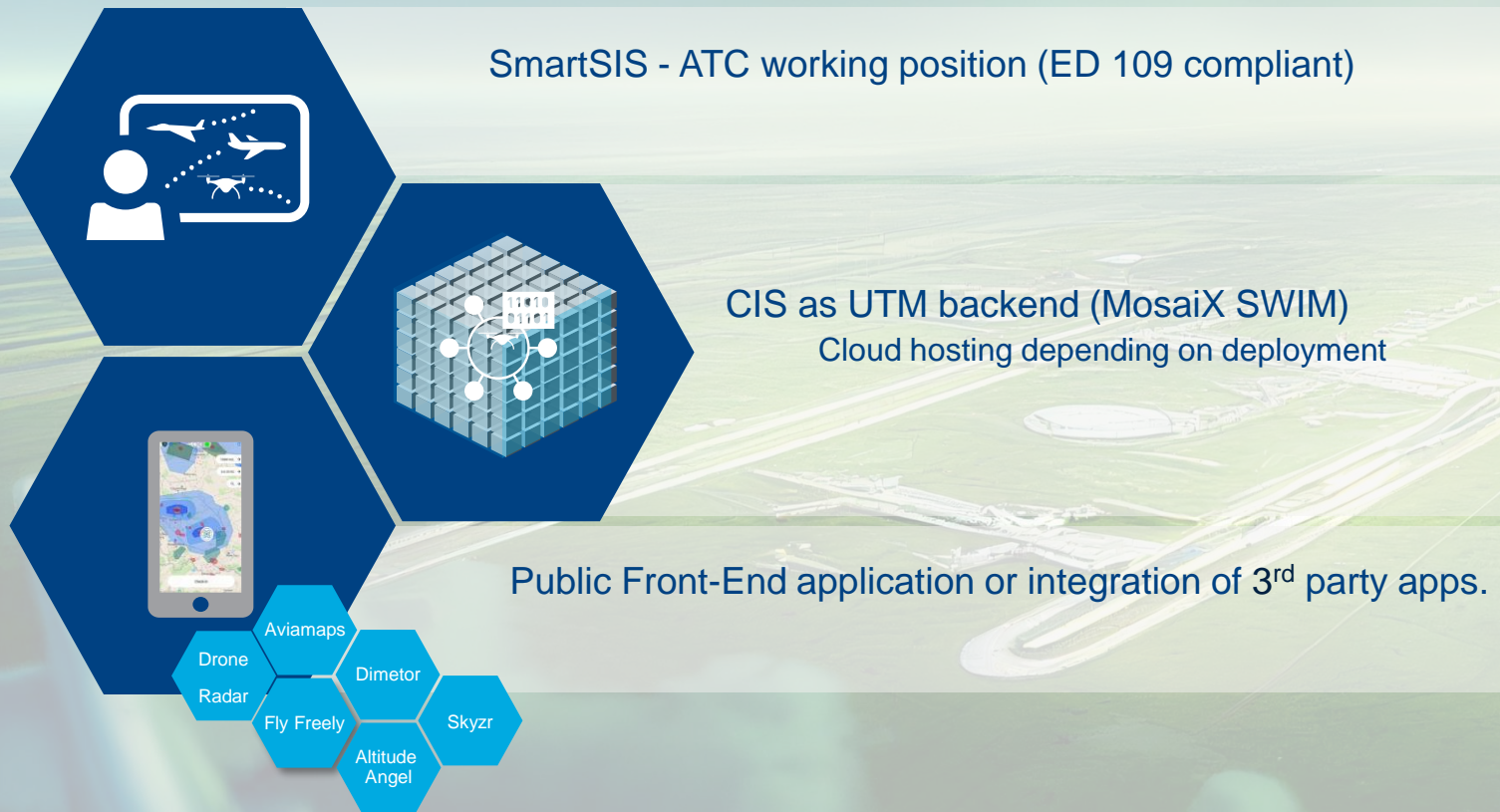


UTM Offering for ANSPs

Frequentis
Common Information
Service (CIS)
Function
(MosaiX SWIM)

as central
component for safe,
secure and efficient
data distribution
across the UTM
ecosystem

UTM system to comply with the local and global regulatory framework for the U-space / UTM, existing of:



Avinor UTM system

Software as a Service, Cloud Deployment



Systems

Containerised
Applications in
Multicloud

Deployment

Tower backend
Business frontend
Consumer
frontend (Mobile)

Scope

24/7 technical
operation
Cloud security
Cloud
orchestration...

18

Towers

Multiple

Availability
Zones

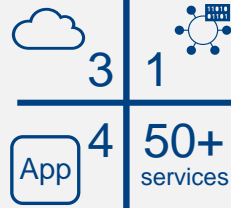


3

Clouds



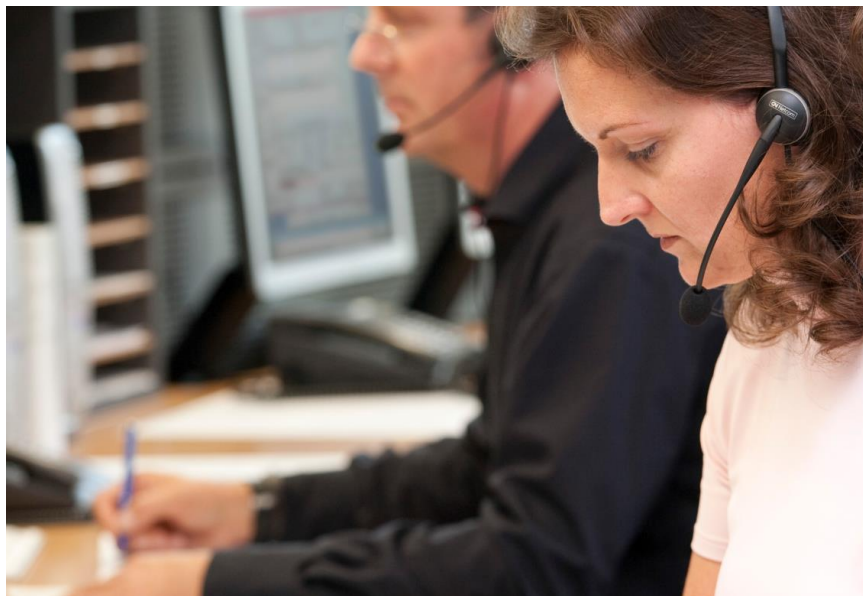
B2A
and
C2A



» The UTM project in Norway supports the Norwegian governments drone strategy for the increased safe use of drones, and to tackle the rising number of reported incidents and airspace violations. The UTM system provides an operational overview of the airspace and allows two-way communication between air traffic control (ATC) and drone operators, enabling safe drone use.

European AIS Database (EAD)

10+ Years Manage Service



Systems

3 x DCs

Deployment

Centralised
Geo-Redundant
design and
independent DR

Scope

Provision and
operation of
Application &
Infrastructure

46

States and ANSPs



99,975%

Availability



€ 60m

Saving to users



World's
largest

Aeronautical
Information
System (AIS)

» It offers instant access, no matter where you are in the world, to the most up-to-date digital aeronautical information from the ECAC area, NOTAM (Notices to Airmen) and Pre-flight Information Bulletins (PIBs) from around the world. EAD is a single source for aeronautical data needs.

MEVA III – Aeronautical Communications Network for Caribbean States

Managed Service

ATM voice and
data VSAT network

Interconnection
with ICAO
REDDIG-II

Prepared for ICAO
E/CAR

Network Design,
Implementation,
Operation

Collaborative
supervision,
coordinated by
ICAO



24/7

network
operation from
single service
provider

Pan-
American

network
establishing

17

stations in 15
states

99,90%

availability

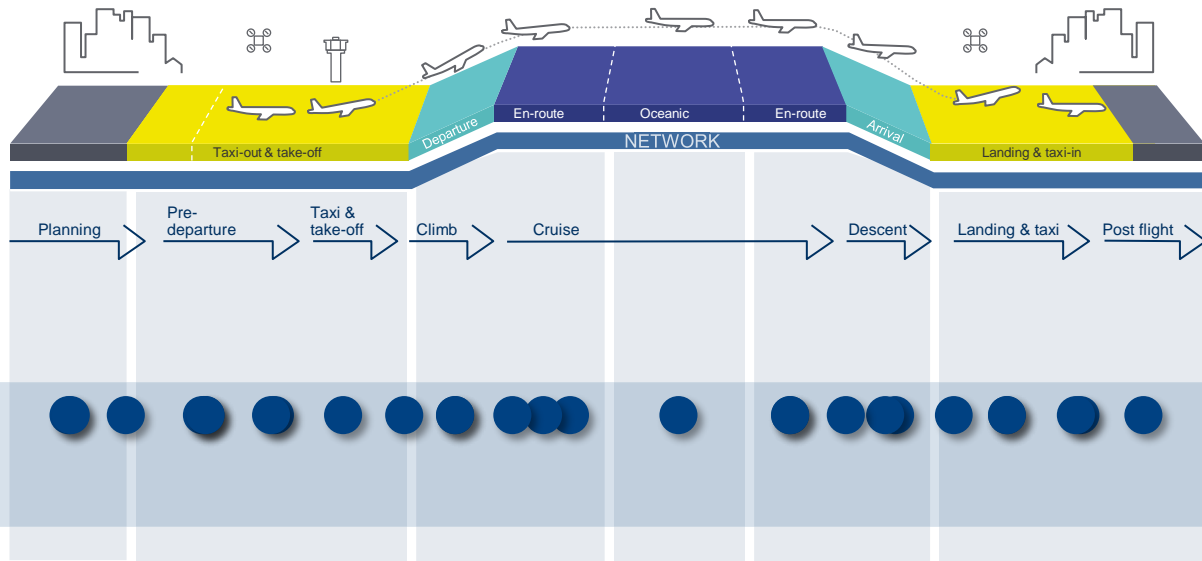
» The project is an important part of ICAO's efforts to create a phased transition from legacy communication to state-of-the-art technologies through a collective, regional solution.



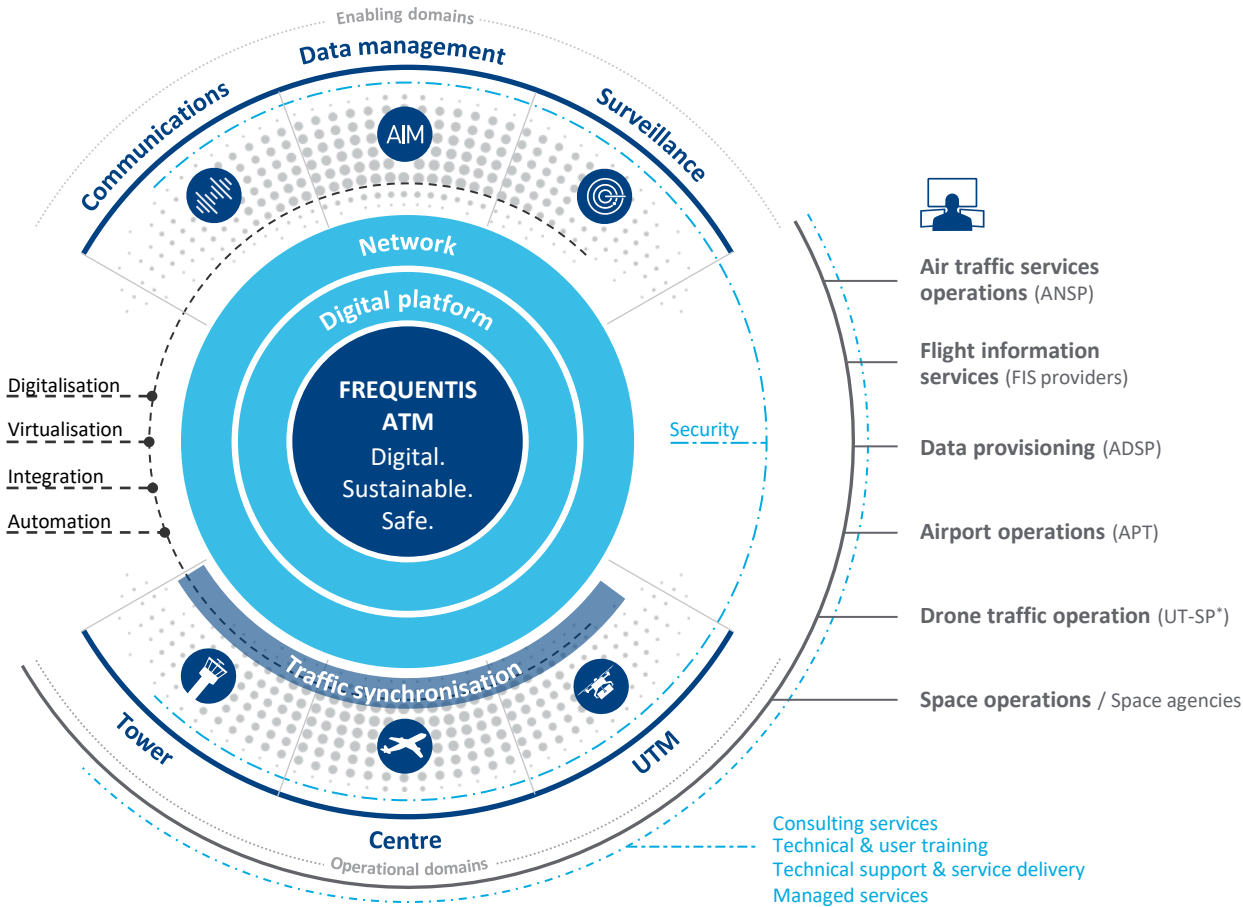
Your reliable
partner for ATM
solutions of all
kinds and sizes

ATM

All operational and technology
know how under one roof



Air traffic management solutions for a safer world



^{*)} Unmanned traffic service providers



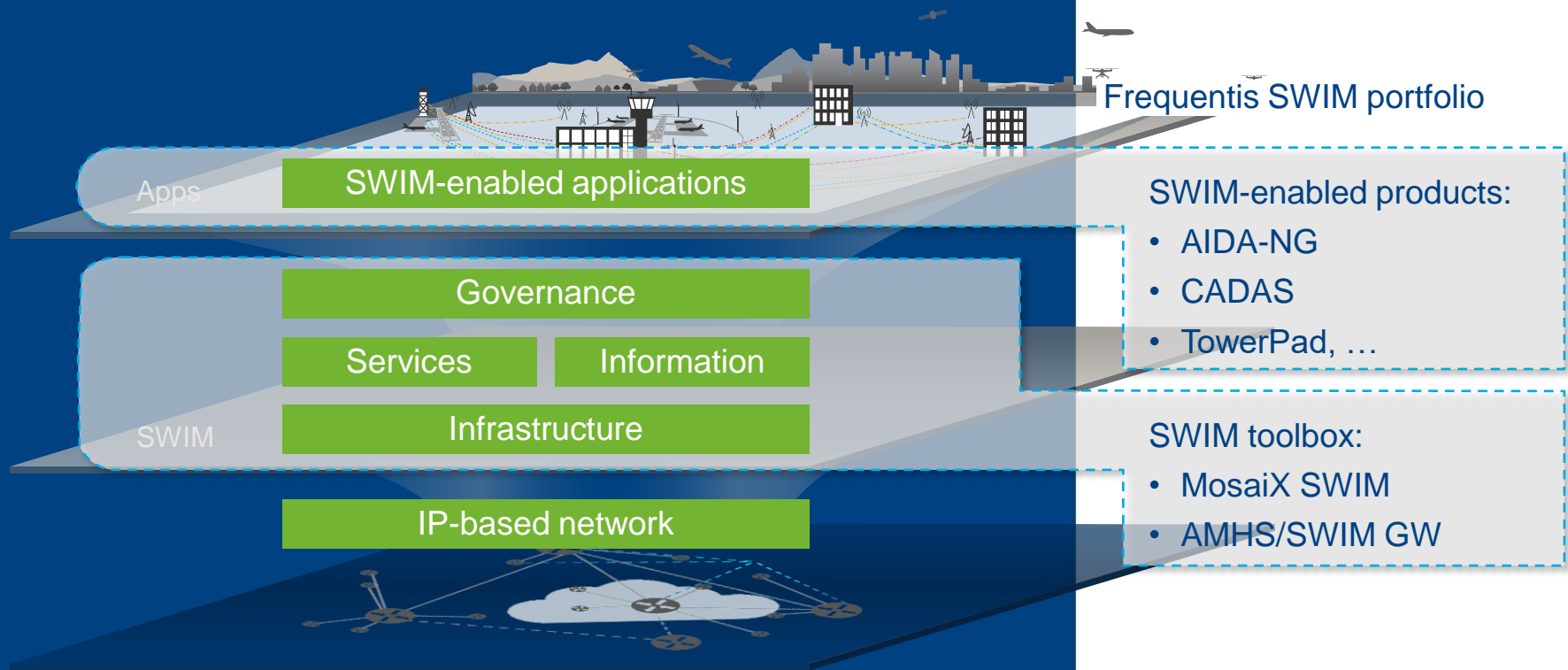
Markus Klopff
Director ATM
Strategic Marketing
and International
Relations,
Frequentis AG



Craig Partridge
Director Sales and
Bus. Development,
Frequentis Orthogon

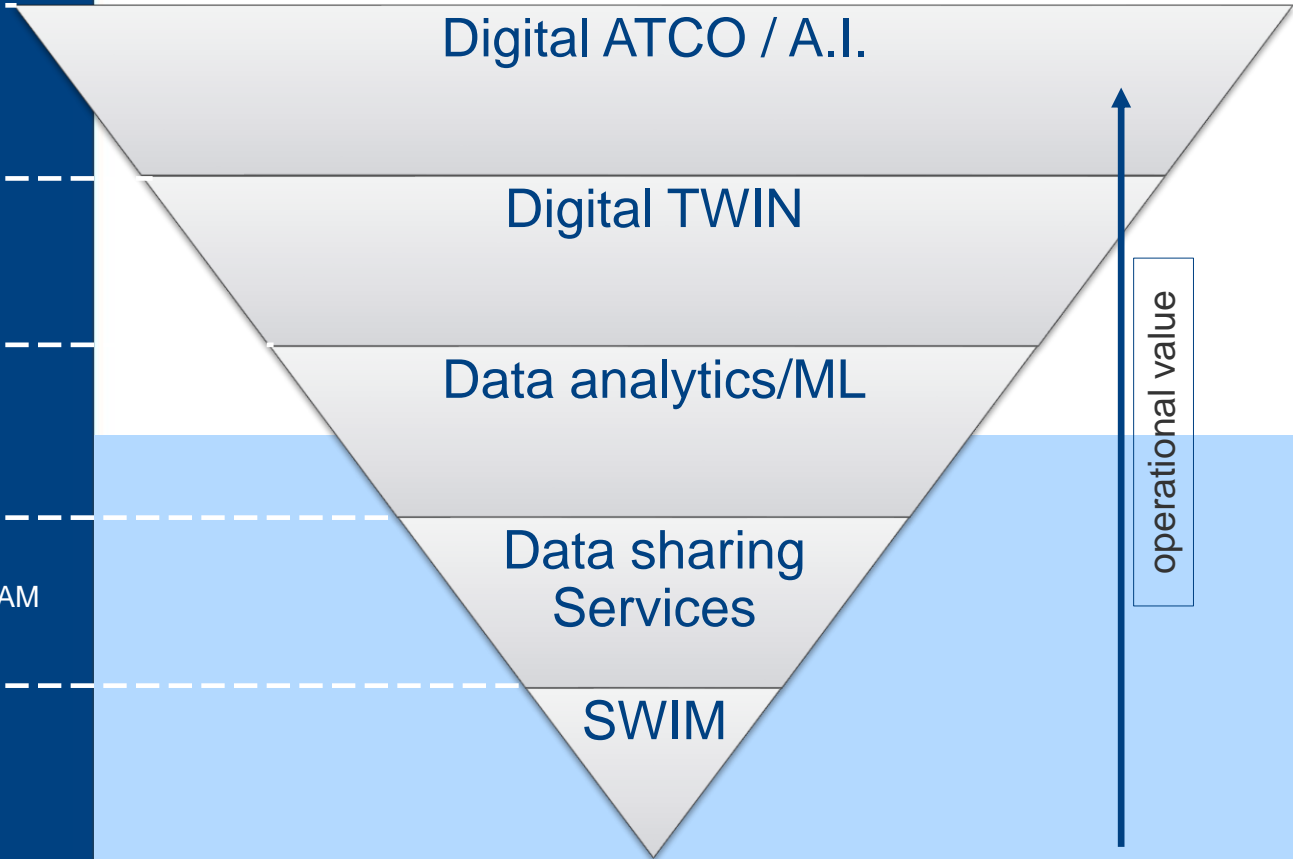
Regional SWIM services for sustainable ATM

SWIM (ICAO Doc 10039)



SWIM and Beyond

- Automation at network level supports ATCO tactical decision making
- Decision making (network level)
- Network planning
- Operational (cost) efficiency
- KPIs
- Trend/pattern analysis
- Predictions (trajectory)
- FF-ICE
- UTM CIS
- LRATFM
- Digital NOTAM
- XMAN
- Data formats (AIXM, FIXM,...)
- Interfaces (Yellow profile, ...)
- Service registry
- Communication infrastructure



National Air Policing Centre: Collaborative incident management

All the information you need to make the right decisions



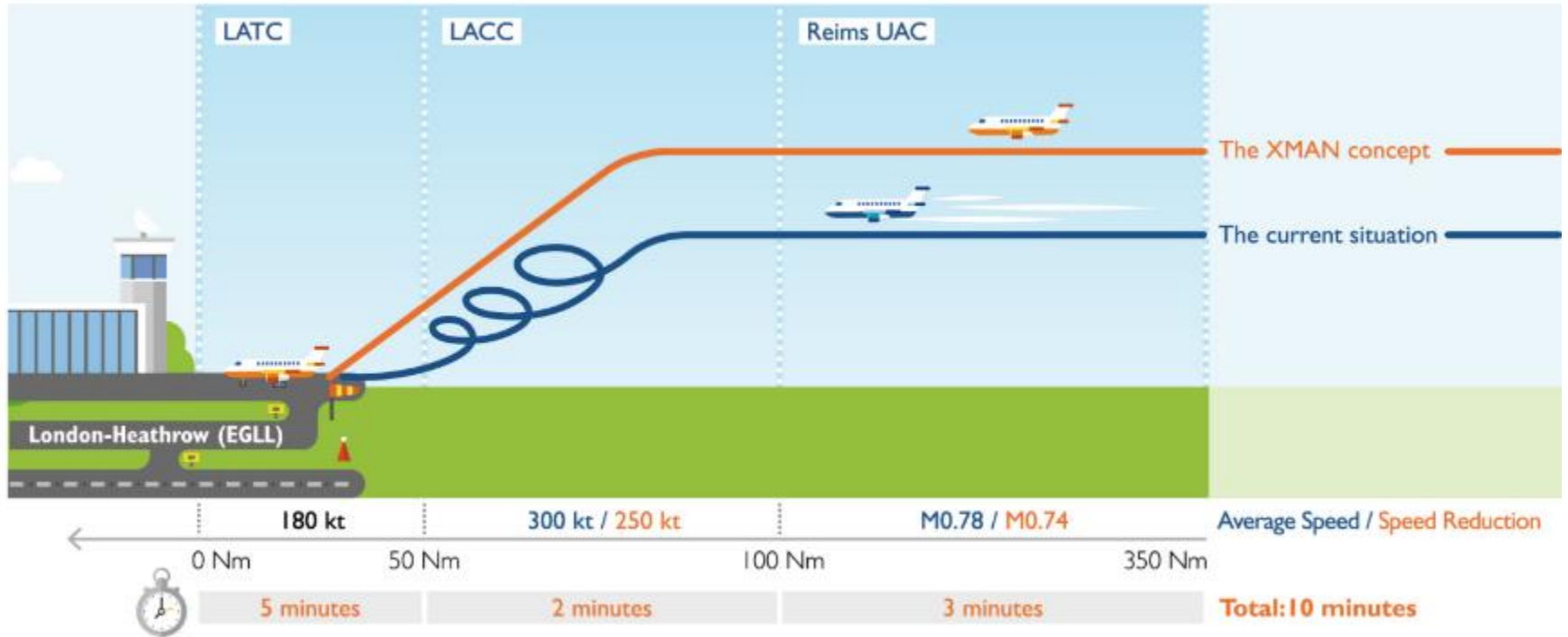
National C2 centre for airspace security

- Founded in 2003
- Located in Uedem, as part of the NATO CAOC
- Civil-military co-operation
 - Air Force, Civil Air Authority, Police
- Major tasks
 - National air policing
 - Defence against terrorism
 - Supportive measures for major events



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XMAN Concept



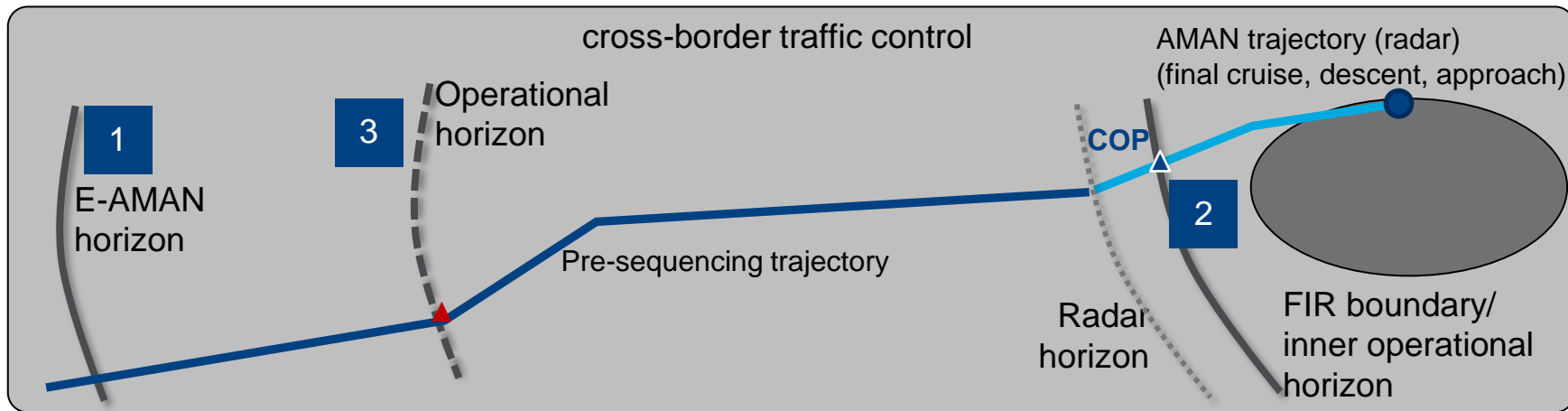
XMAN operational prerequisites

- **Extended arrival management (E-AMAN)**

1. AMAN sequences flights that are still outside the FIR
→ extended planning horizon: pre-sequencing trajectory part

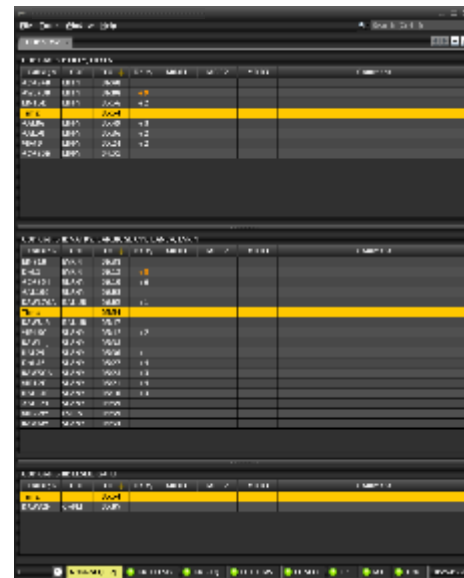
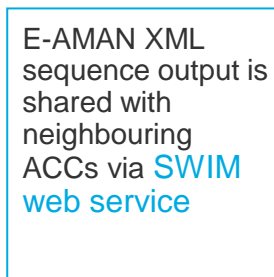
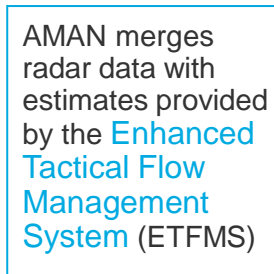
- **Cross-border arrival management (XMAN)**

2. AMAN calculates TTL/TTG at FIR boundary COPs → radar-based trajectory part
3. AMAN shares TTL/TTGs with neighbouring units and they apply speed control (if delay above certain threshold)



Extended arrival management

Promotion of interoperability through automated inter-center coordination by system-to-system communication



Sustainability

Enabling CO₂ Emission Savings

Winner of the Maverick Award 2021 for
One million tonnes CO₂ savings

achieved by our Arrival Management system in 20
years of operation at airports around the globe



Collaboration

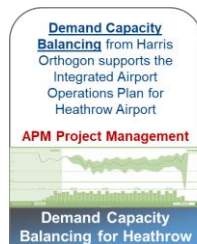
Based on Trusted Partnerships

Orthogon received '**Supplier of the year**' award 2019 by NAV Canada

"We selected Orthogon for responsiveness,
delivery, quality, technology, flexibility and
overall performance"



Excerpt of **Customer awards** using
Orthogon technology



How Frequentis became a leader in Traffic Synchronisation



AMAN London TMA:
Heathrow & Gatwick
Multi-airport AMAN
2009



First operational
DMAN at
Gatwick Airport
2014



Enhanced AMAN for
CAAS
PDS for Singapore Changi
2015



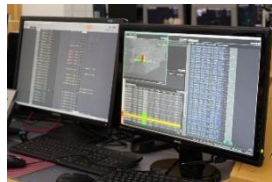
Flow-based Integrated
AMAN/DMAN for
Doha, Qatar; Santiago de Chile
2018



First operational
integrated AMAN/DMAN
at Singapore Changi
2021

2014

SESAR 6.8.4 - Validation exercises
Enhanced operational AMAN/DMAN
baseline for SESAR SOL#54 – CP1 Deployment



2019

SESAR 2020 PJ25 Live Trial
SWIM HMI client
ARR-DEP pattern approximated by flow



2022 ...

Roadmap:
**Green ops through RWY balancing
and pattern generation**

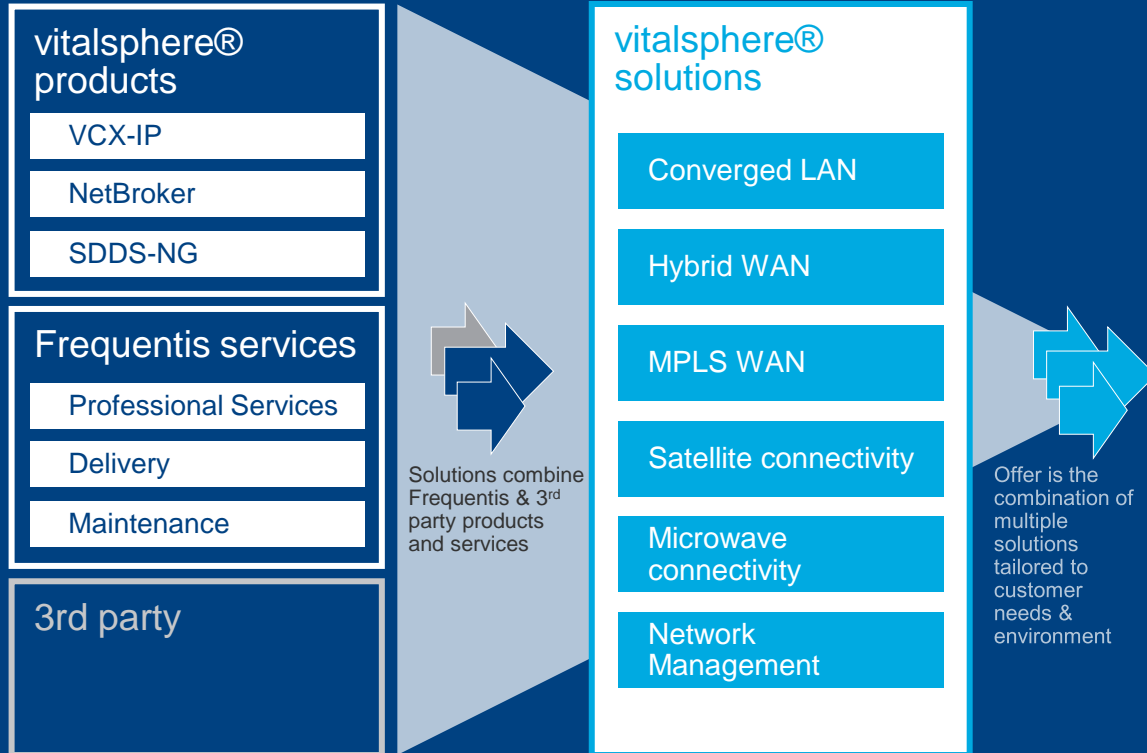


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Introduction of demo stations

Networked remote digital towers


vitalsphere® portfolio building blocks



Fulfilling ATM-grade and mission-criticality needs



1.
Echo-free voice
experience in
hybrid
networks



vitalsphere®
solutions


Converged LAN

Hybrid

2.
End-to-end
monitoring
solutions

Network
Management

is the
ination of
iple
utions
ailored to
customer
needs &
environment



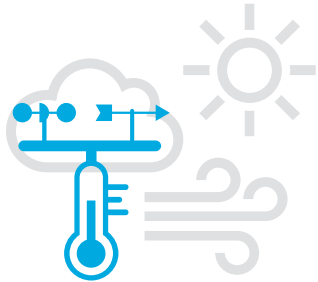
Projects

3.
NetBroker
traffic steering
and profiling
with remote
towers

3. NetBroker traffic steering and profiling with remote towers

A new approach for remote digital towers

Meeting AFIS requirements while dealing with limited infrastructure resources



Weather observation

(especially visibility, clouds and thunderstorms)



Switch on the runway lighting

for night operations only – and checking it!



Assignment of parking positions

and other airport operational tasks, which are safety relevant



Alerting / Alarming

“if you don’t see, you cannot report”
Alarming rescue and firefighting forces

Introduction of demo stations

Rethinking operations with TowerPad

Why TowerPad - Key Performance Areas



...all on a single screen



Closing

From “Technology Dilemma” to “Next-Generation ATM Technology”

Think Global

Open standards and interfaces
Co-development of systems
Transform to Cloud and a-a-S

Develop
Global

Collaborate
Regional

Connectivity and collaboration
SWIM and traffic optimization
Strengthen your eco-system

Deliver
Regional

Accomplish
Local

Automation and virtualization
Scalability of solutions +/-
Alternative sourcing methods

Digitalize
Local



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