COMSOFT
is making the link

COMSOFT Presentation
Surveillance Data Networking (RADNET, RMCDE)

ATM Automation Seminar (ICAO region CAR/SAM)

11-13 June 2008, Rio de Janeiro, Brazil

by Simone Doerr, Project Manager

Presentation Overview

- **Part I:**
  COMSOFT Company Profile and Product Portfolio
- **Part II a):**
  Surveillance Data Networking: RMCDE
- **Part II b):**
  Surveillance Data Networking: RADNET

Location

COMSOFT GmbH

Wachhausstr. 5a
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Germany

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www.comsoft.aero

History in a Nutshell

1979

Foundation of COMSOFT

1989

EUROCONTROL contract for European Surveillance Network

1997

COMSOFT AMHS system chosen as candidate for ECG

2001

Contract for 5-year term of ARTAS support (CAMOS)

2007

Renewal of CAMOS contract until 2012

1980 | 1990 | 2000 | 2010

Entering the Industrial Communication market

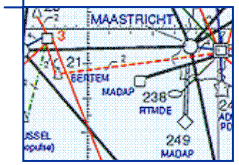
1979

Entering the ATC market

1989

22 operational RADNET Nodes

1994

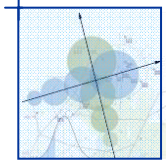


RAPS is certified as ASTERIX Reference & Test Tool

1998

First safety net solution (STCA) launched

2003



COMSOFT enters market for ADSB MLAT

2006

COMSOFT adds FDPS to product portfolio

2007

Scope of Performance

Quality, Safety & Standards

Quality Management

- 1993: COMSOFT was awarded the ISO 9001 certificate
- 2003: upgrade to 9001:2000 standard
- Constant quality control

Safety Management

- We work according to the widespread standards IEC 61508 and EURO CAE ED-109
- Proven ESARR 4/ESARR 6 compliant project execution
- EC 552/2004 conformant deliverables

Standards

- Active contribution to harmonization in ATM is one of our permanent objectives
- Our participation in defining evolving standards in international working groups is a reward for past achievements as well as a motivation for the future

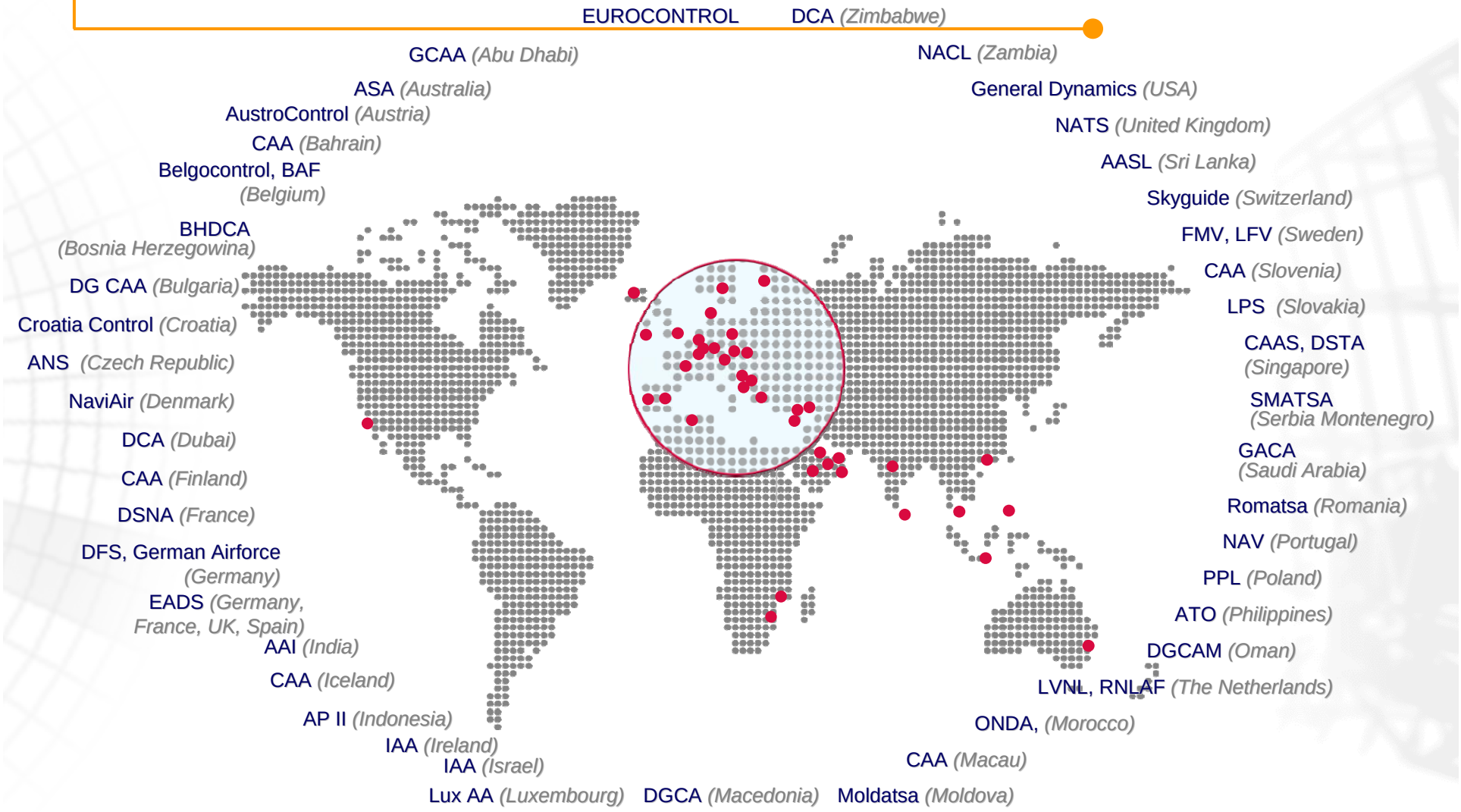
Membership in International Organisations & Working Groups

- **ATCA**
  Air Traffic Control Association
- **CANSO**
  Civil Air Navigation Service Organisation
- **SDDR-TF**
  Surveillance Data Division Requirements Task Force
  Eurocontrol EATMP working group
- **RDEFG**
  Radar Data Exchange Focus Group
- **SUGCT**
  Surveillance User Group on Center Tools
  Eurocontrol EATMP working group
- **AUG**
  ARTAS User Group
- **CCB**
  CAMOS Configuration Board

Membership in International Organisations & Working Groups

- **EUROCAE**
  Working Group 50, Sub-Group 4,
  Ground Recording Requirements
- **EUR AFS**
  ICAO working group on CIDIN/AFTN
- **AFSG**
  ICAO working group on ATN panels
- **CUG**
  CIDIN User Group
  Former EUR AFS WG 3

Map of Customers



COMSOFT in the CAR/SAM region

- **CORPAC – Peru**

  2008: Installation and commissioning of a state-of-the-art Aeronautical Message Handling System.

EUROCONTROL Project Sample - ETFMS/DDS

Enhanced Tactical Flow Management System – Data Distribution System

Customer:

- EUROCONTROL

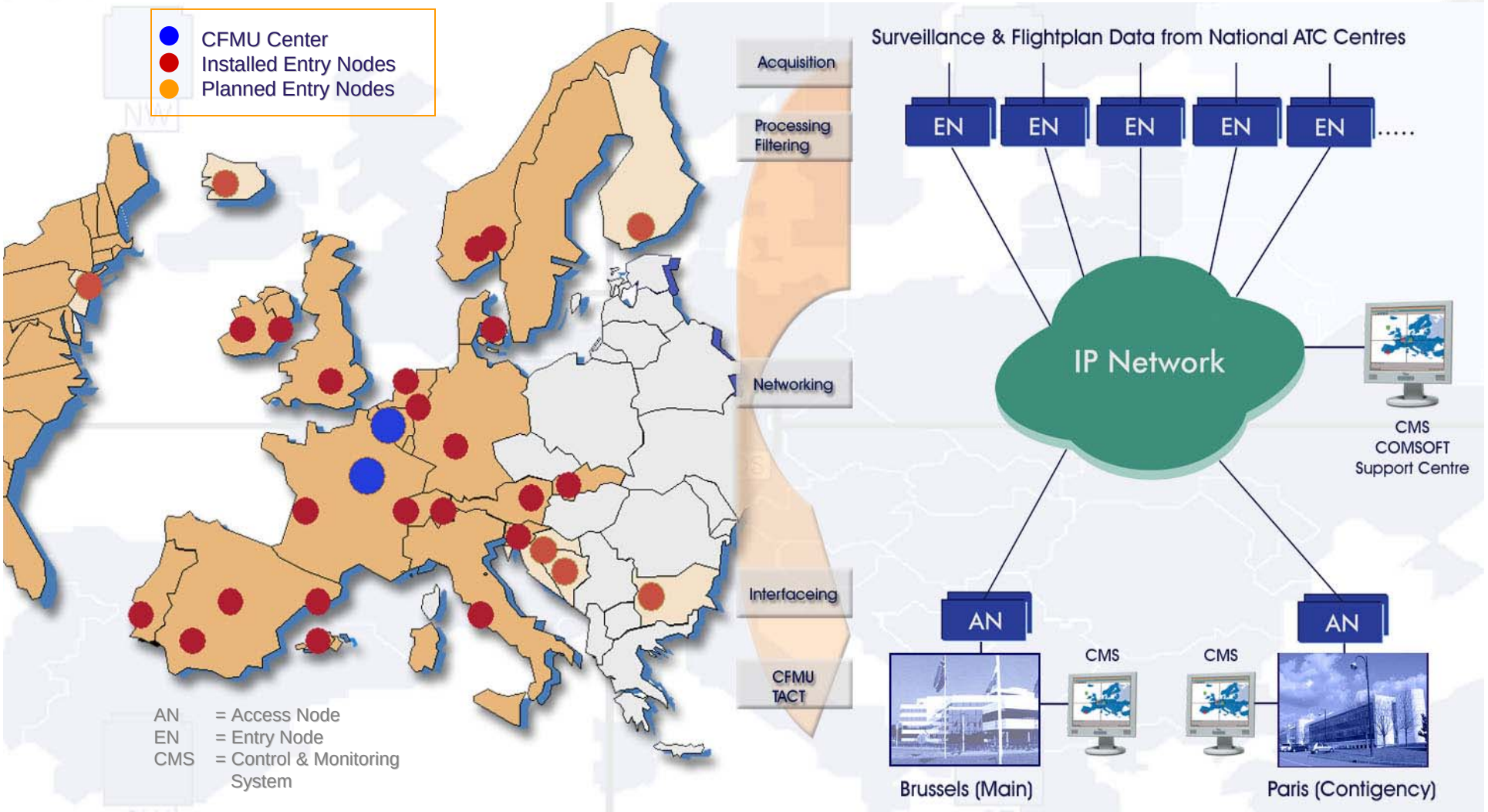
Objectives:

- Feedback of information about overall European air situation to EUROCONTROL member states
- Provision of enlarged air situation picture beyond own FIR borders

Project:

- Contracted in 08/2002
- Main phase acceptance in spring 2004

ETFMS Network



ATM/ATC Divisions & Product Spectrum

Surveillance Communication □ □ □ □ Aeronautical Message Handling □ □ □ □ Air Situation Displays

Surveillance Data Processing □ Recording & Replay □ Control & Monitoring □ Surveillance Support Tools

Aeronautical Message Handling

Surveillance Communication □ □ □ □ Aeronautical Message Handling □ □ □ □ Air Situation Displays

Aeronautical Message Handling

- Message Handling systems & gateways for all sizes of applications
- Aeronautical e-services, aeronautical data access systems
- Aeronautical information systems

Surveillance Data Processing □ Recording & Replay □ Control & Monitoring □ Surveillance Support Tools

AMHS – Product Spectrum

Products

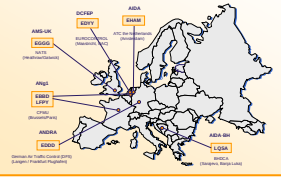
Message Handling Systems

- ECG (EATMP Communications Gateway)
- AIDA-NG (Aeronautical Integrated Data Exchange Agent – New Generation)

Client Terminals

- CADAS (COMSOFT Aeronautical Data Access System)
- CADAS AMHS UA (AMHS and ATS User Agent)

Reference Projects



International Message Handling Systems

- ECG (European EATMP Communications Gateway ETFMS)
- List of References (COMSOFT MHS in Europe)

MHS References in Europe

NATS, UK
Locations: Heathrow and Gatwick
2 redundant
AFTN/CIDIN/**AMHS** systems
1 redundant
AFTN/CIDN/**AMHS** test system

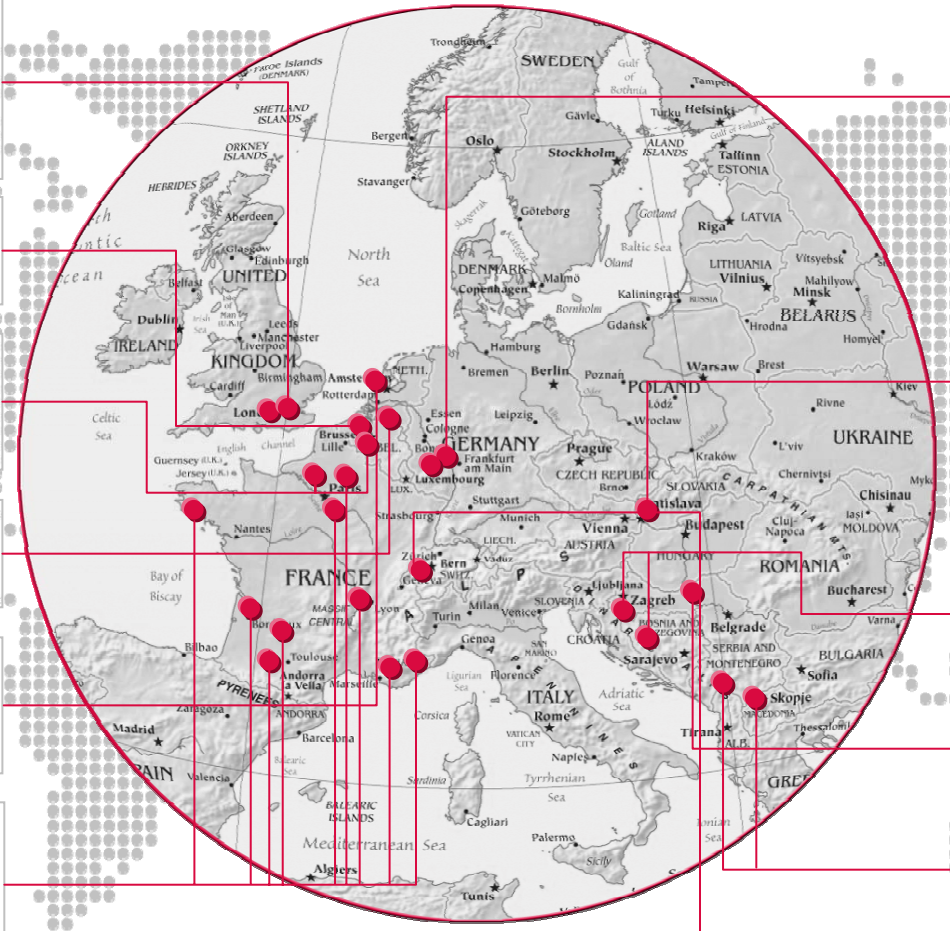
EUROCONTROL
Location: Brussels
AMHS ECG Reference System

EUROCONTROL, CFMU
Locations: Brussels and Paris
4 redundant
AFTN/CIDIN/**AMHS** systems

EUROCONTROL
Location: Maastricht UAC
1 redundant AFTN/CIDIN Switch

LVNL, the Netherlands
Location: Amsterdam
1 redundant AFTN/CIDIN switch
1 redundant test/development system

DSNA (Project: MESANGE), France
Location: Toulouse, Bordeaux, Reims, Athis-Mons, Brest, Aix-en-Provence, Aéroport de Nice, Aéroport de Lyon, Aéroport de Blagnac



DFS, Germany
Locations: Frankfurt and Langen
3 redundant
AFTN/CIDIN/**AMHS** systems
first operational AMHS connection in Europe (to Spain)

LPS, Slovakia
Location: Bratislava
1 redundant operational
AMHS/CIDIN/AFTN systems
+ 1 single contingency
AFTN/CIDIN/**AMHS** system
1 redundant disaster recovery
AMHS/CIDIN/AFTN system +
1 single contingency
AFTN/'CIDIN/**AMHS** system

BHDCA, Bosnia and Herzegovina
Location: Sarajevo and Banja Luka
2 redundant AFTN switches

SMATSA, Serbia and Montenegro
Location: Belgrade
1 redundant AFTN switch

MCAA, Macedonia
Location: Skopje and Ohrid
1 redundant AFTN/**AMHS** system

Skyguide (Project: MESANGE), Switzerland
Location: Geneva

MHS References in Middle East & Africa

CAA, Zambia
Location: Lusaka
1 redundant AFTN switch

CAA, Zimbabwe
Location: Harare
1 redundant AFTN switch

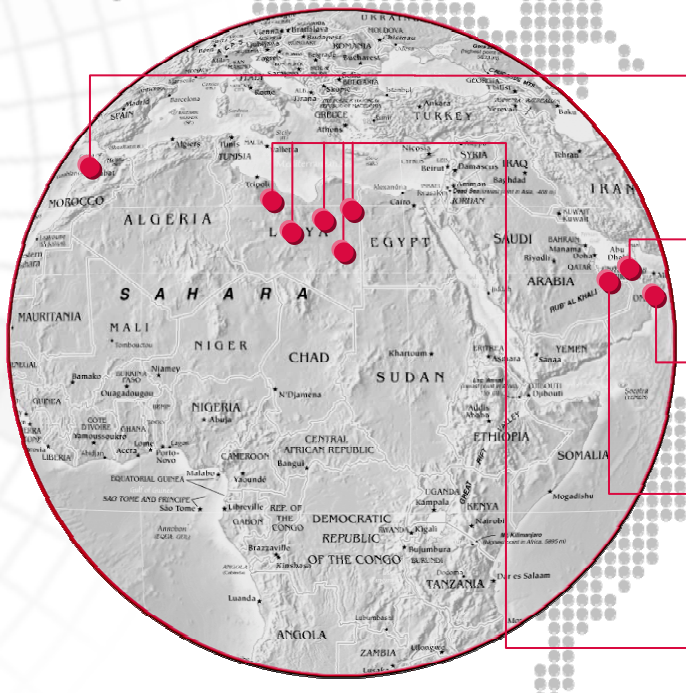
ONDA, Morocco
Location: Casablanca
1 redundant operational
AMHS/CIDIN/AFTN system
1 AMHS/CIDIN/AFTN
Test/Development System

GCAA, Abu Dhabi
Location: Abu Dhabi, UAE
2 redundant AFTN/**AMHS** systems

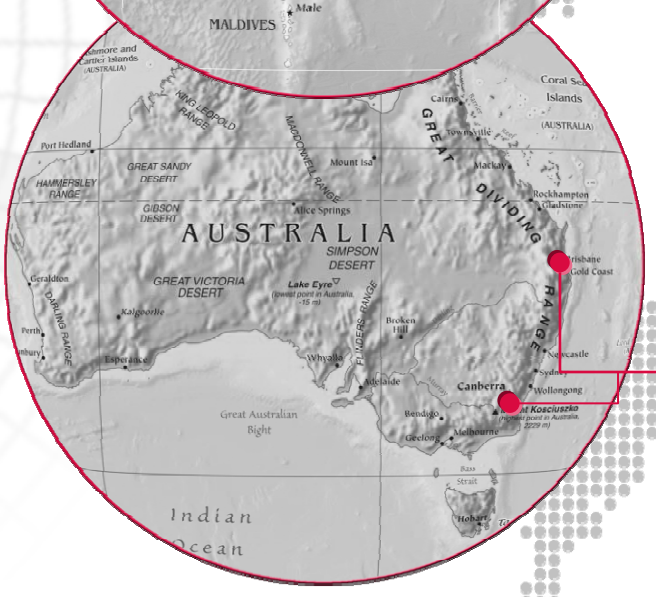
DGCAM, Oman
Location: Muskat
1 redundant AFTN/**AMHS**/AIS system

DCA, Dubai
Location: Dubai, UAE
1 redundant AFTN switch

CAA, Libya
Location: Tripolis, Bengasi, Sirt, Sheba, Metiga
1 redundant AFTN/**AMHS** system & five Gateways



MHS References in Asia Pacific



AAI, India
Location: New Delhi
1 redundant operational
AMHS/AFTN system

CAA, Macau
Location: Macau
1 redundant AFTN/**AMHS** system

ATO, Philippines
Location: Manila
1 redundant AFTN/**AMHS** system

CAAS, Singapore
Location: Singapore
2 redundant AFTN/**AMHS** systems

APII, Indonesia
Location: Palembang
1 redundant AFTN switch

ASA, Australia
Location: Brisbane, Melbourne
2 redundant AFTN/**AMHS** systems
1 redundant test/development system

New Message Handling Contracts 2008

- **CORPAC - Peru**
- LVNL - The Netherlands
- DGCAM - Oman
- NANSC - Egypt
- AACM - Macau
- PCAA - Pakistan
- GACA - Saudi Arabia
- DSNA - France
- Skyguide - Switzerland

Air Situation Displays

Surveillance Communication □ □ □ □ Aeronautical Message Handling □ □ □ □ Air Situation Displays

Air Situation Displays

- Controller Working Positions for tower, en-route & approach
- Displays for technical monitoring

Surveillance Data Processing □ Recording & Replay □ Control & Monitoring □ Surveillance Support Tools

Air Situation Displays & Safety Nets

Products

Surveillance Data & Air Situation Displays

- RDD (Surveillance Data Display;
  Controller Working Positions for Tower & Approach)
- RMD (Radar Monitoring Display;
  Real-time Surveillance Display for Technical Monitoring)

Safety Nets

COMSOFT Safety Net Modules:

- STCA (Short Term Conflict Alert)
- MSAW (Minimum Safe Altitude Warning)
- APW (Area Proximity Warning)

World-wide References

Air Situation Displays - References

- NATS, UK
- ANS, Czech Republic
- LVNL, the Netherlands
- AustroControl, Austria
- CAA Slovenia
- Belgocontrol,Belgium
- LuxAA, Luxemburg
- RNLAF, the Netherlands
- EADS, Germany
- German Airforce
- FMV, Sweden
- Moldatsa, Moldova

Surveillance Data Processing

Surveillance Communication □ □ □ □ Aeronautical Message Handling □ □ □ □ Air Situation Displays

Surveillance Data Processing

- Maintenance & operational support of ARTAS
- SAMSON

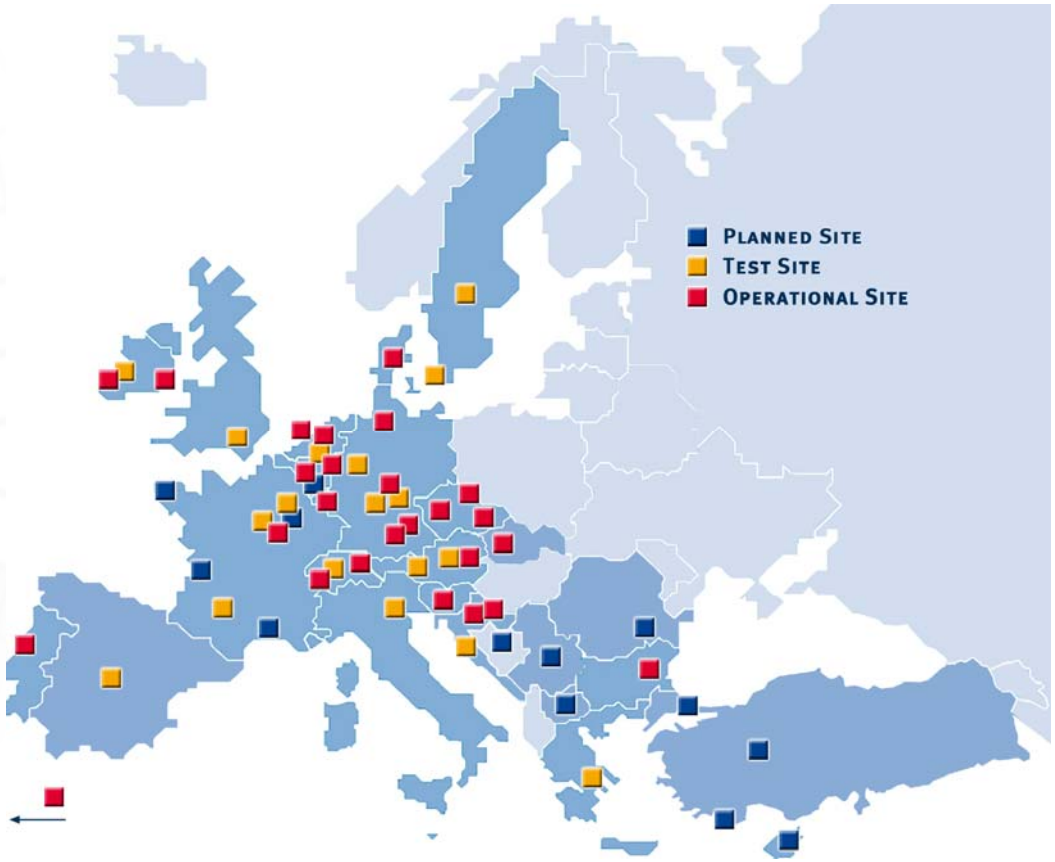
Surveillance Data Processing | Recording & Replay □ Control & Monitoring □ Surveillance Support Tools

SDPS – Product Spectrum

Products	SDPS System
	• SAMSON (**S**urveillance **A**rchitecture for **M**ulti **S**ensor Fusi**on**); - PSR, SSR, Mode S, ADS B/C, Multilateration

Reference Projects	EUROCONTROL ARTAS Tracker
CAMOS	• CAMOS (Centralised ARTAS Maintenance & Operational Support)

COMSOFT References for ARTAS



ARTAS Turnkey Installations, Integration,
Fine Tuning, Training, Support Services

ANS, Czech Republic
ATSA, Bulgaria
Austrian Air Force
Austrocontrol, Austria
BHDCA, Bosnia Herzegovina
CCL, Croatia
DCA Cyprus, Cyprus
DFS, Germany
EUROCONTROL, Brussels
GCAA, Abu Dhabi
German Air Force, Cologne
German Air Force, Neuburg
IANS, Luxembourg
Irish Aviation Authority, Ireland
LFV, Sweden
LVNL, Netherlands
EUROCONTROL, Maastricht UAC
NAV, Portugal
NAVIAIR, Denmark
NATO, Warsaw
NATS, UK
Royal Netherlands Air Force
Skyguide, Switzerland
Slovenia Control, Slovenia

Recording & Replay

Surveillance Communication □ □ □ □ Aeronautical Message Handling □ □ □ □ Air Situation Displays

Surveillance Recording & Replay

- Recording of large amounts of surveillance data
- Fully synchronized, integrated radar & voice logging

Surveillance Data Processing | Recording & Replay | Control & Monitoring □ Surveillance Support Tools

Recording and Replay
Product Spectrum

Products	Surveillance Data Recording & Replay Systems
 	• RRR (Surveillance Recording & Replay System; Parallel recording & replay of surveillance related data on mass storage devices for legal recording, search & rescue, instant analysis) • XRR (X-workstation Recording & Replay; Solution for recording & replay of any X-windows based controller screen)
	Combined, Synchronized Recording & Replay of Surveillance & Audio Data
	• R_2D_2® (Recording and Replay of Digital Data)

COMSOFT
Recording and Monitoring Architecture

Audio Data

Recording System

Surveillance Data

Audio &
Data Replay

Audio & Data
Replay

Data Export

ARTAS

Technical
Replay

RMD

Situation Replay
Briefings, Quick Assessments,
Investigation & Documentation

SASS-C

Radar Performance
Assessment

World-wide References

RRR & R_2D_2® - References

Archiving, retrieval & replay of large amounts of data

- AASL, Sri Lanka
- LVNL, the Netherlands
- RNLAF, the Netherlands
- Belogocontrol, Belgium
- LuxAA, Luxemburg
- FLIZ, German Airforce
- CAA Slovenia
- CAA Czech Republic
- Moldatsa, Moldova
- Skyguide, Switzerland
- Armasuisse, Switzerland
- NATS, United Kingdom

New Products - Quadrant ADS-B / MLAT

ISAVIA, Iceland
ADS-B sensors in the North of Iceland, Greenland and Faroer Islands.

QinetiQ, UK
Test and Reference Station in Malvern

GCAA, Abu Dhabi
United Arab Emirates
ADS-B sensors including SDPS (ARTAS) and CWP displays, installed in 2007.

Batam Industrial Development Authority, Indonesia
ADS-B system
Reception and visualisation of ADS-B reports, includes ADS-B server and data display. Installed in 2006.

Control & Monitoring

Surveillance Communication □ □ □ □ Aeronautical Message Handling □ □ □ □ Air Situation Displays

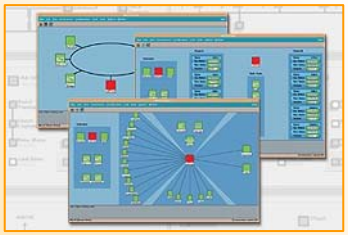
Control & Monitoring

- Country-wide control & monitoring
- Center-based management systems for ATM infrastructure

Surveillance Data Processing □ Recording & Replay Control & Monitoring □ Surveillance Support Tools

Control & Monitoring – Product Spectrum

Products



Control & Monitoring Systems

- CMS/XA (Control and Monitoring System – Extended Architecture)

System Management

- ESMS (Enhanced System Management Station for Air Traffic Control Environments)

Reference Projects

Control & Monitoring Systems

- ERCAMS (En-Route Radar Control & Monitoring System for UK NATS)

Surveillance Support Tools

Surveillance Communication □ □ □ □ Aeronautical Message Handling □ □ □ □ Air Situation Displays

Surveillance Support Tools

- World-wide first officially qualified EUROCONTROL ASTERIX Reference Product & Test Tool

Surveillance Data Processing □ Recording & Replay □ Control & Monitoring Surveillance Support Tools

SST - Product Spectrum

Products	Analysis & Test Tools for quality assessment of surveillance data or ATC systems
	• RAPS-II (Recording, Analysis, Playback & Simulation System for Surveillance Data; Reference system for checking of ASTERIX Conformity) • IQM (Integrated Quality Monitoring for Radar Sensors)

RAPS-II Qualification

RAPS-II – Officially EUROCONTROL qualified Reference Product & Test Tool

- Initial Qualification in 1998 under tentative procedures
- Re-Qualification in 2003 under new EUROCONTROL regulatory procedures
- Formal Acceptance of RAPS-II as ASTERIX Reference Product and Test Tool on Sept. 26th 2003 by international jury

RAPS-II - Areas of Application

Used by ANSPs and manufacturers for:

- Optimisation, maintenance and fault-finding
- Day-to-day trouble-shooting and error fixing
- Testing of equipment within the surveillance chain from sensors down to the displays
- Acceptance testing, qualification and certification of interfaces
- Quality checking and robustness tests
- Pre-operational monitoring
- Training

European References

RAPS-II - References

- Eurocontrol
  Maastricht, Brussels, Bretigny (11)
- DFS, EADS, Germany (13)
- NATS, GB (9)
- LFV, Sweden (1)
- FMV, Sweden (1)
- IAA, Ireland (3)
- RNLAF, the Netherlands (1)
- Austrocontrol, Austria (1)
- Skyguide, Switzerland (1)
- ANS, Czech Republic (1)
- LPS, Slovak Republic (1)
- ATSA, Bulgaria (1)
- PPL, Poland (1)

Surveillance Communication Systems

Surveillance Communication □ □ □ □ Aeronautical Message Handling □ □ □ □ Air Situation Displays

Surveillance Communication Systems

- Collection, distribution, filtering & conversion of surveillance data
- Build-up of surveillance networks
- Fallback & gateway systems

Surveillance Data Processing □ Recording & Replay □ Control & Monitoring □ Surveillance Support Tools

SCS - Overview

Products

Network Nodes for International Surveillance Networks

- RMCDE (Radar Message Conversion & Distribution Equipment)
- RMCDS (Radar Message Conversion & Distribution System)
- CRMCS (COMSOFT Radar Network Monitoring & Control System)

Back-up & Gateway Systems

- ADR (All-Purpose Data Stream Replicator)
- RFC (Radar Fallback Communication System)

Reference Projects

International Surveillance & Data Distribution Networks

- RADNET (Radar Message Conversion & Distribution Equipment)
- UK RADNET (Radar Message Conversion & Distribution System)
- ETFMS (COMSOFT Radar Network Monitoring & Control System)

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  Surveillance Data Networking: RMCDE
- **Part II b):**
  Surveillance Data Networking: RADNET

RMCDE

Radar Message Conversion & Distribution Equipment

RMCDE – General Characteristics

- Highly versatile system for the exchange of any kind of surveillance data
- De facto standard for real-time radar data communication
- Cornerstone of European RADNET and
- Key promoter of European ATC/ATM harmonization
- First generic ASTERIX implementation world-wide
- Over 100 installations in more than 50 ATCCs

Reference Project - RADNET

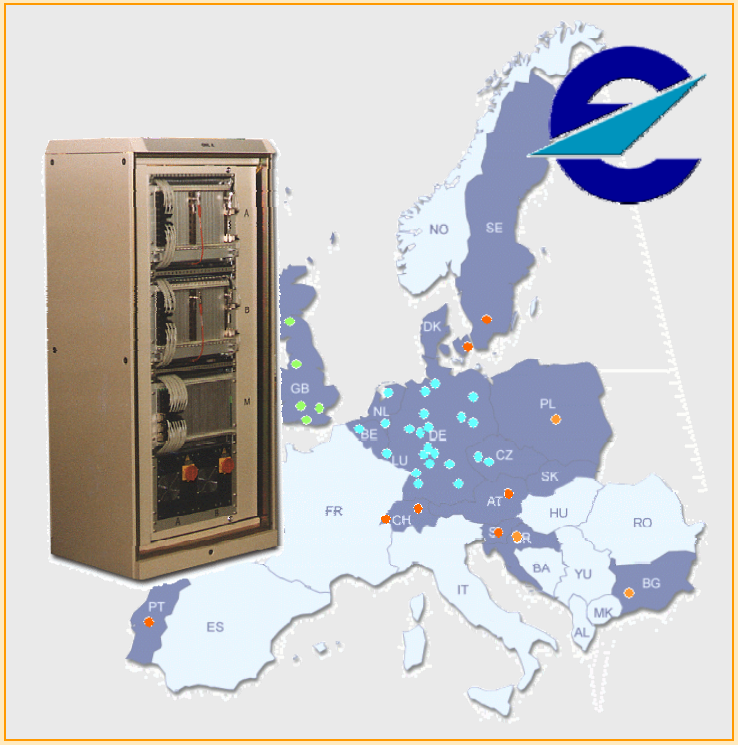
RMCDE – Radar Message Conversion and Distribution Equipment

Customer:

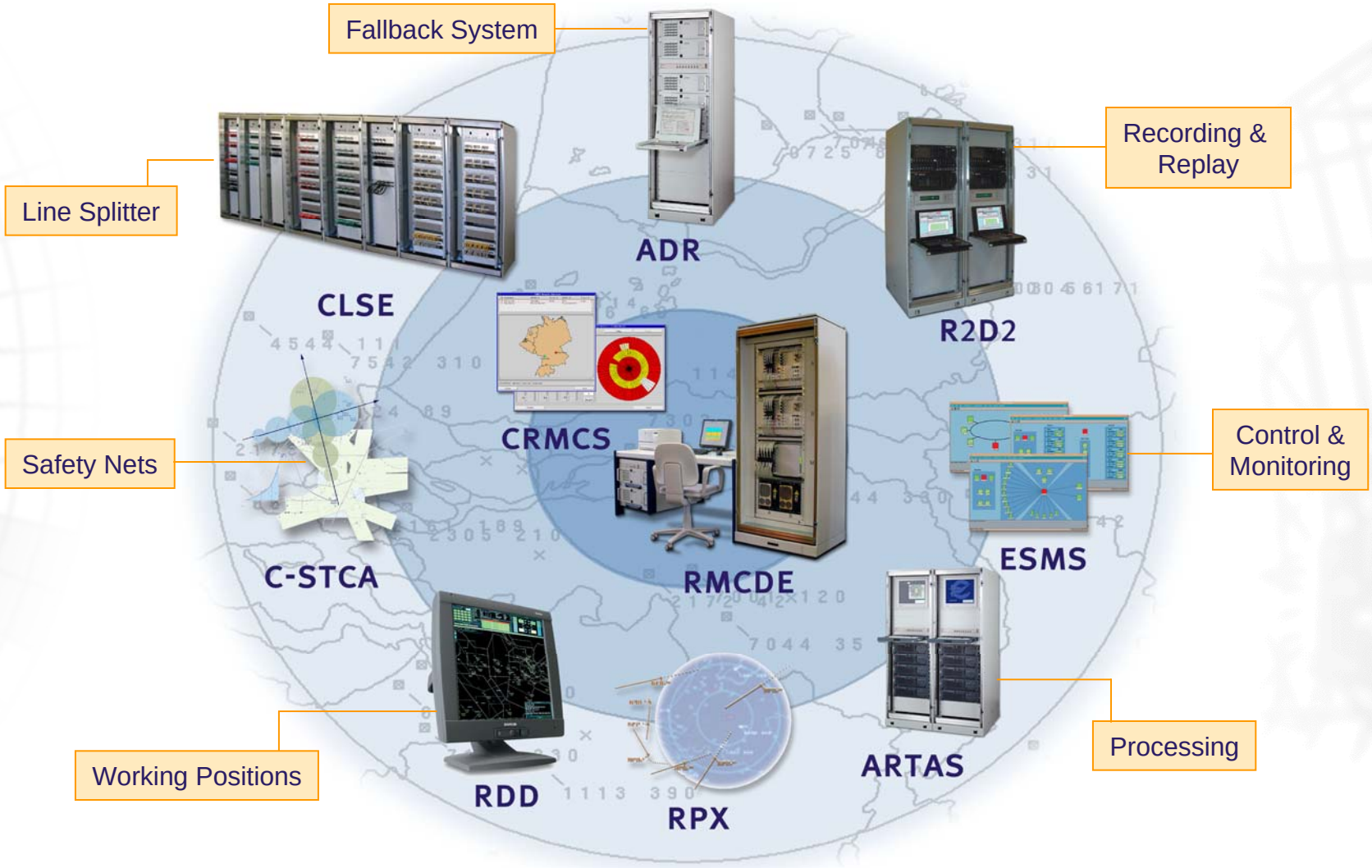
- EUROCONTROL

Objectives:

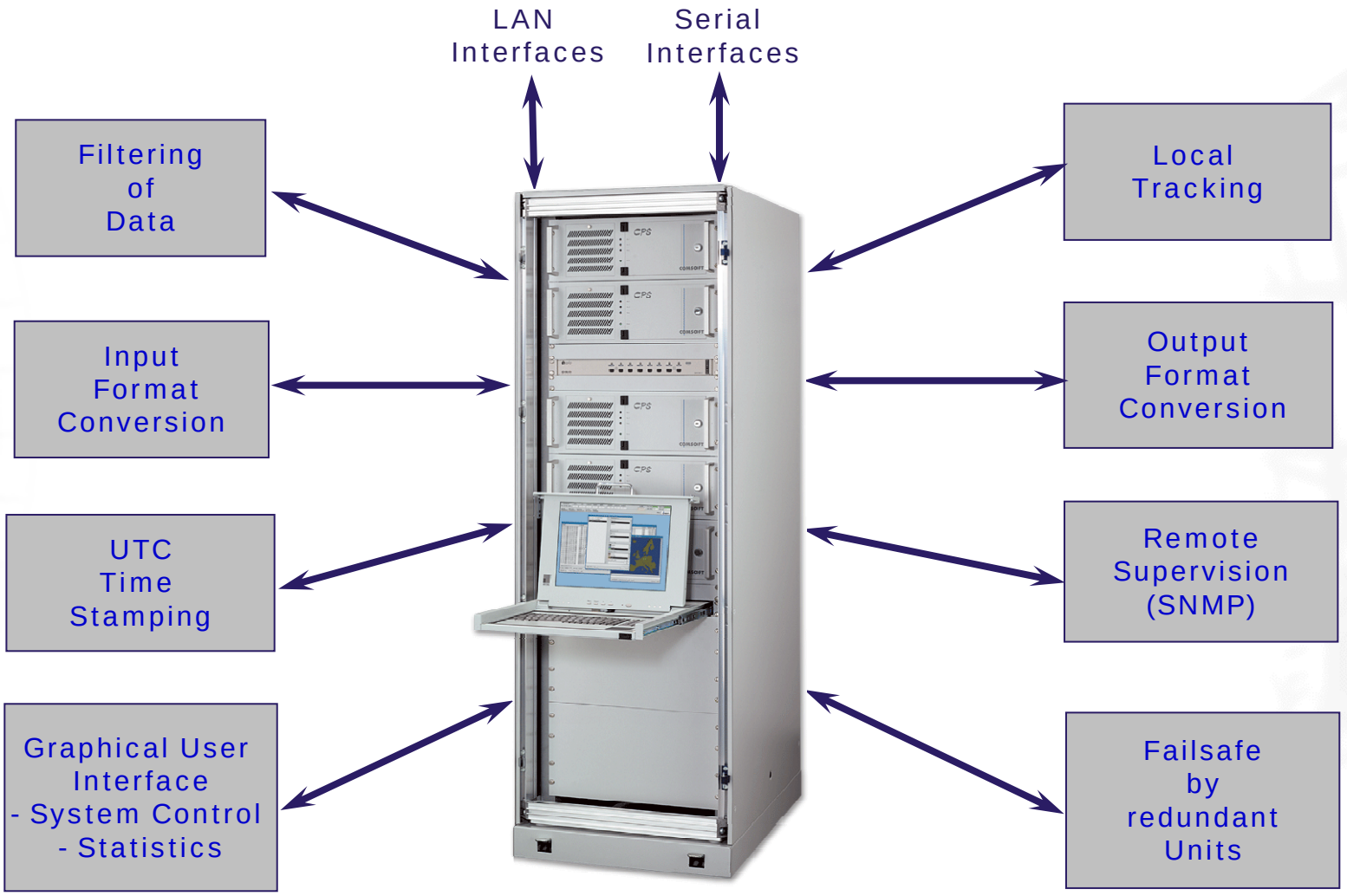
- Multi-national data network for the exchange of all kind of surveillance data
- Common use of radars
- ASTERIX as standardized radar data format



Related Products



ADR - Functional Scope



ADR - References

Fallback Solutions & Front-end Systems

- DFS, Germany
- LVNL, the Netherlands
- BAF, Belgium
- Skyguide, Switzerland
- CAA Finland
- CAA Bahrain
- FMV, Sweden
- MUAC, EUROCONTROL

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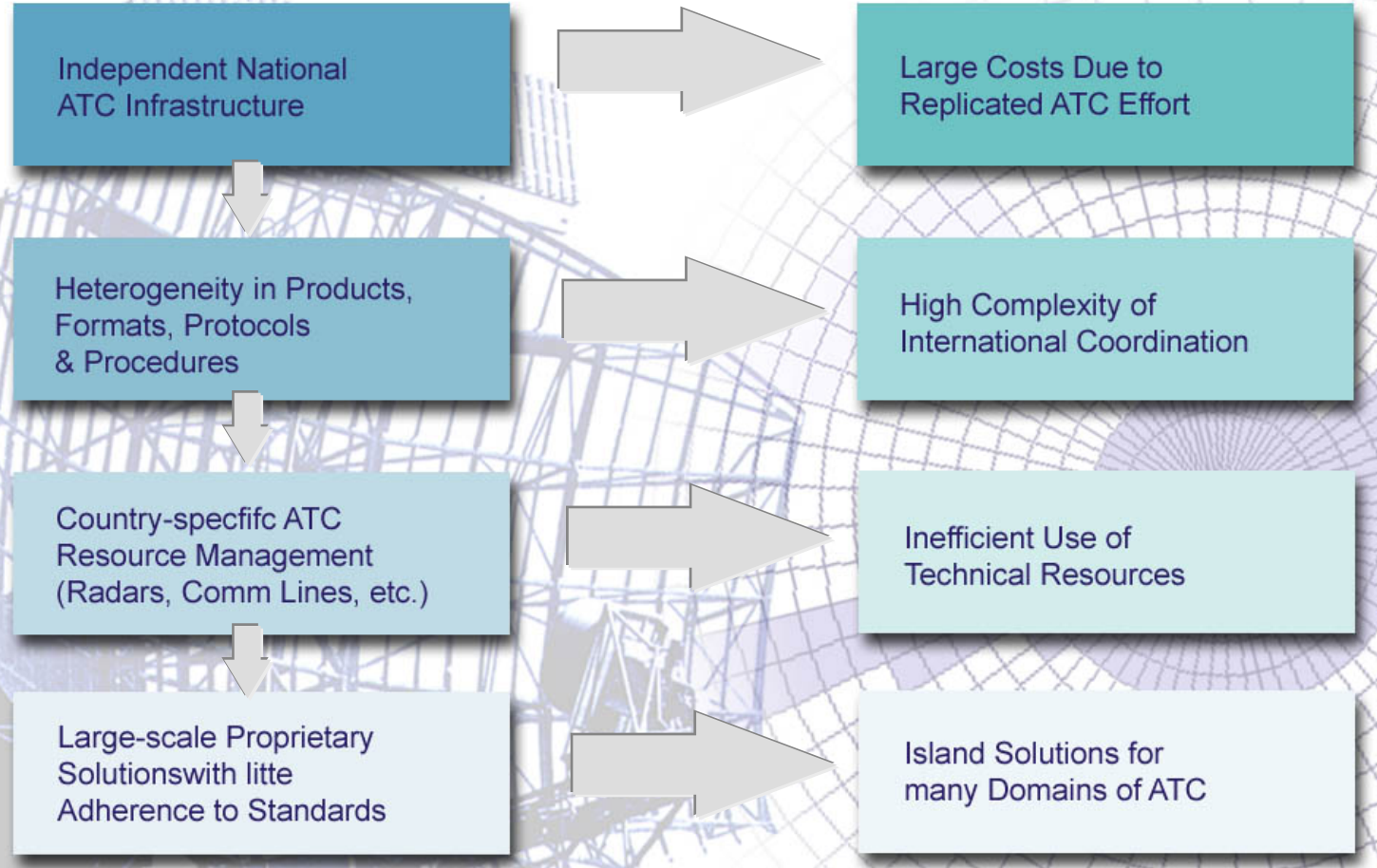
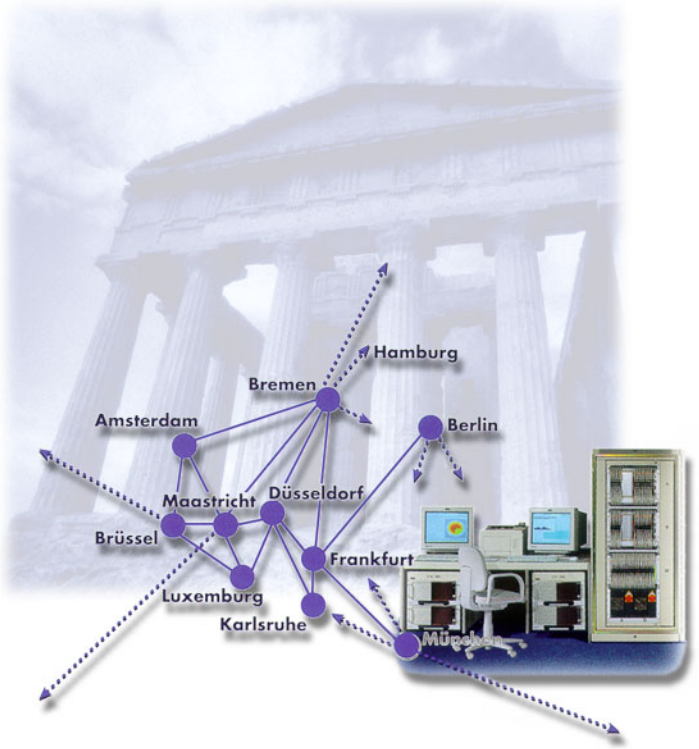
Initial Situation in Europe



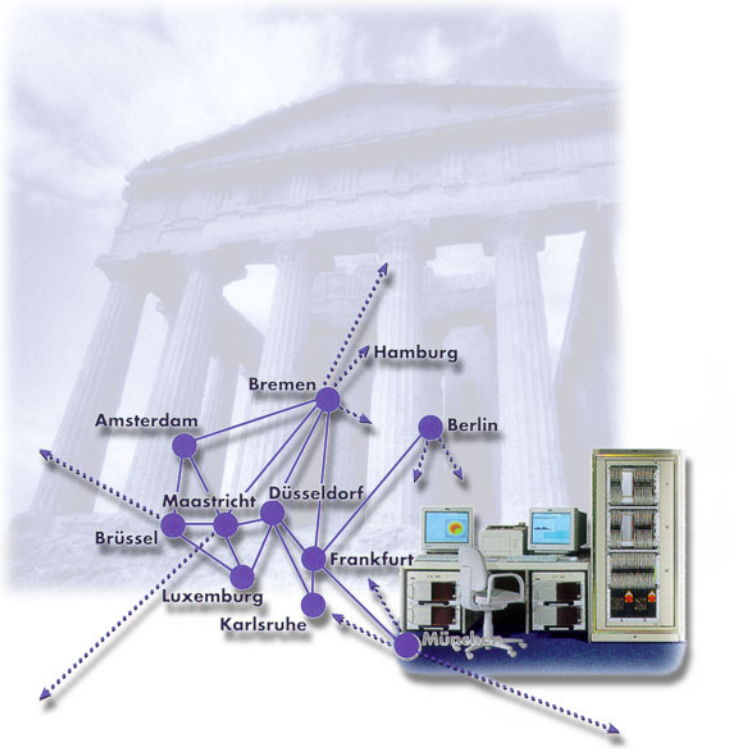
History of RADNET
Targets



Targets since 1989:

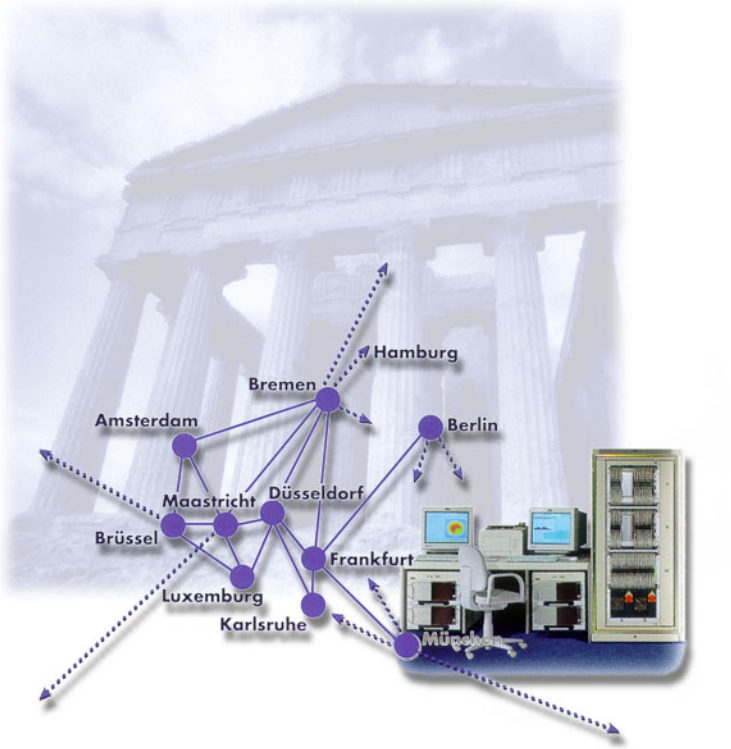
- Reduction of costs
- Access to larger geographical area
- Higher coverage of geographical areas
- Increased precision of information available to each air traffic controller
- Increase of reliability and backup possibilities for sensor and centers
- Increase of safety

History of RADNET
The Solution



- Multi-national data network for the exchange of surveillance data
- Shared use of radars and processing systems
- Redundancy with respect to connection of data sources
- Surveillance data related flow control
- Mutual contingency backup of ACCs
- Reduction of costs for leased data lines
- Standardized radar data format throughout the network: ASTERIX
- Interoperability of systems, using various data formats and protocols

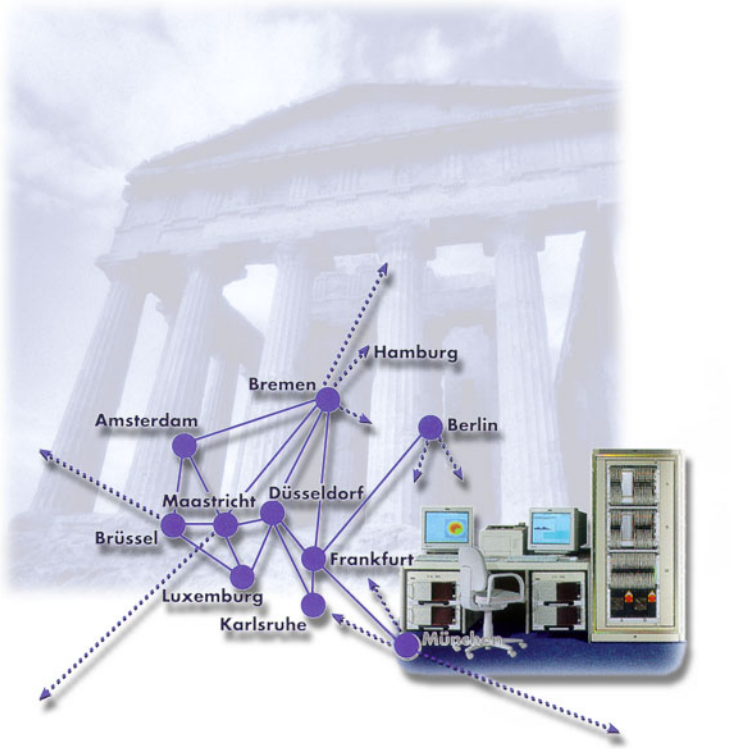
History of RADNET
The Starting Point



Situation in 1989:

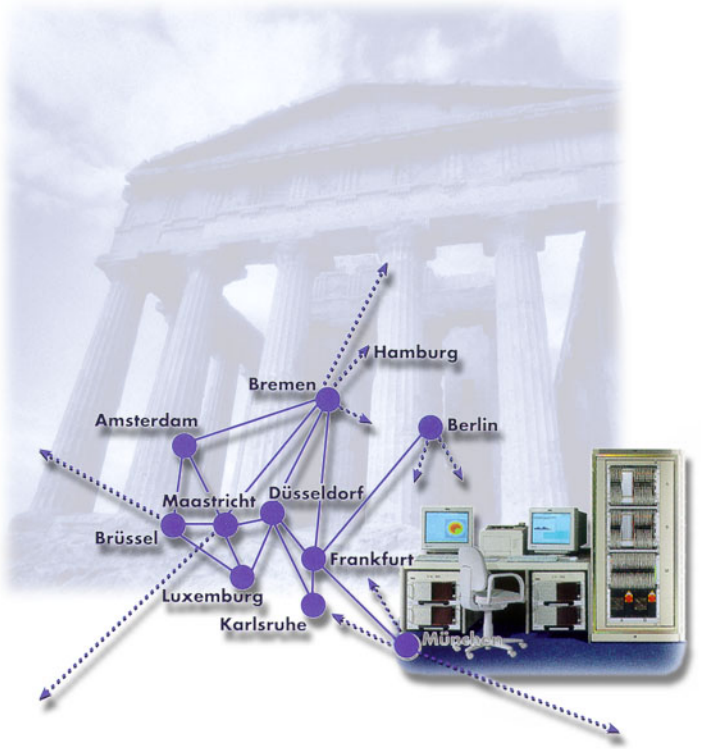
- Each Air Traffic Control Center had access only to its „own radars“
- Each of those radars was connected via one or more telephone lines directly to the Control Center
- Even in the same country radars delivered radar data in various incompatible data formats. Consequently the use of the same radar by different organizations was difficult or even impossible

History of RADNET
The Implementation



- In 1989 EUROCONTROL awarded a contract to COMSOFT to implement a prototype of the Radar Data Network „RADNET“.
- In 1990 Comsoft launched a prototype of RADNET consisting of 6 nodes.
- From the very beginning RADNET supported ASTERIX - the Surveillance Data Format Standard specified by EUROCONTROL.
- After an extensive evaluation phase initial nodes of RADNET went operational in 1992.

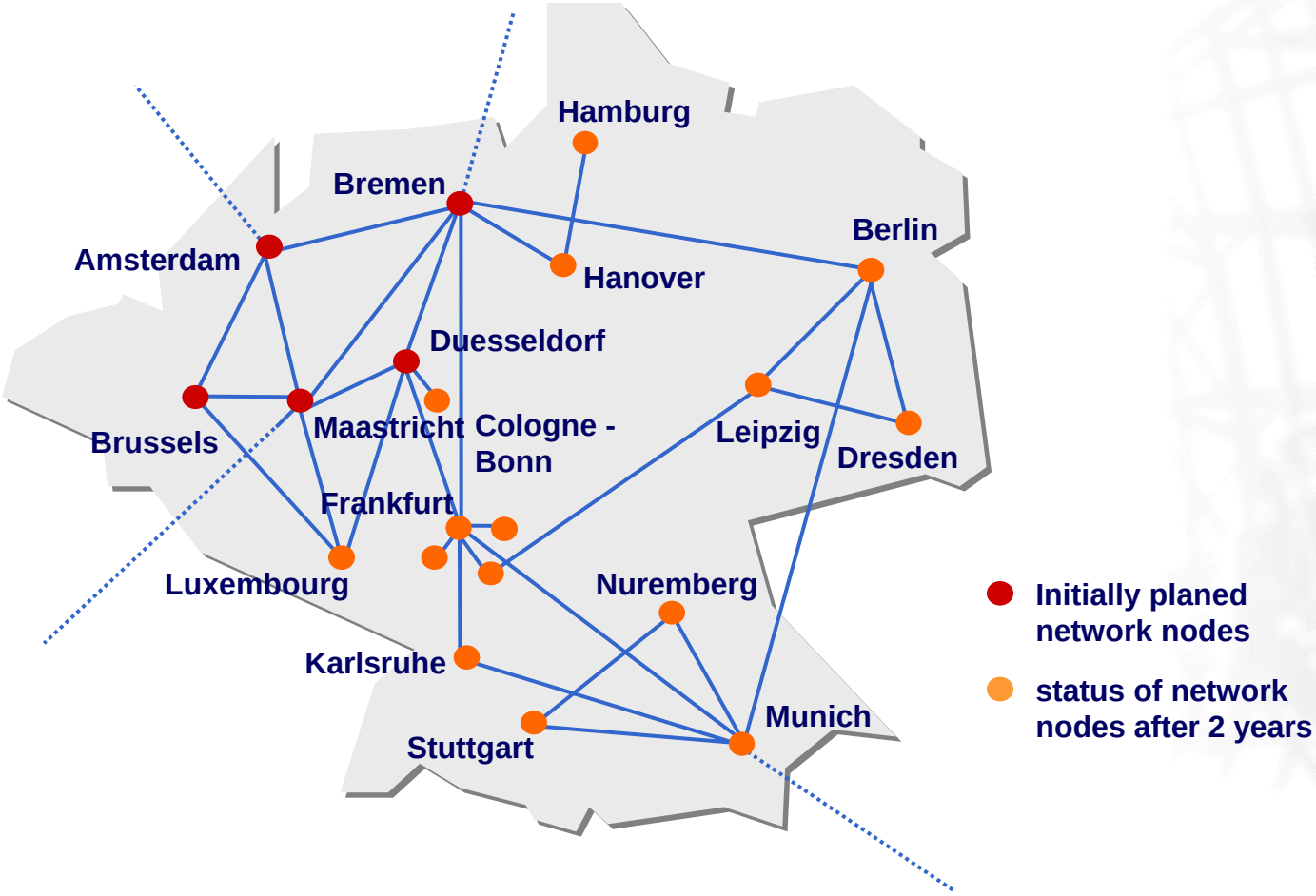
History of RADNET
The Implementation (2)



- RADNET is physically realized by a number of network nodes
- The network nodes of RADNET are called RMCDEs
- RMCDE is a uniquely flexible network processor and communication front-end for surveillance data
- The community of interconnected RMCDEs are forming RADNET
- First ASTERIX implementation world-wide
- Continuous evolution (including Mode-S, ADS-B and Multilateration)

RMCDE in Continental RADNET

4 Country Implementation Program



The RMCDE Family

- RMCDE
  - EUROCONTROL
  - Multiple Users (DFS, Belgocontrol, ATSA, etc.)
- RMCDS
  - Custom Application for NATS UK
  - Since 1995
- RMCDS Sweden
  - Custom Application for Swedish Military
  - Since 1996

Reference Project - UK RADNET

RMCDS – Radar Message Conversion and Distribution System

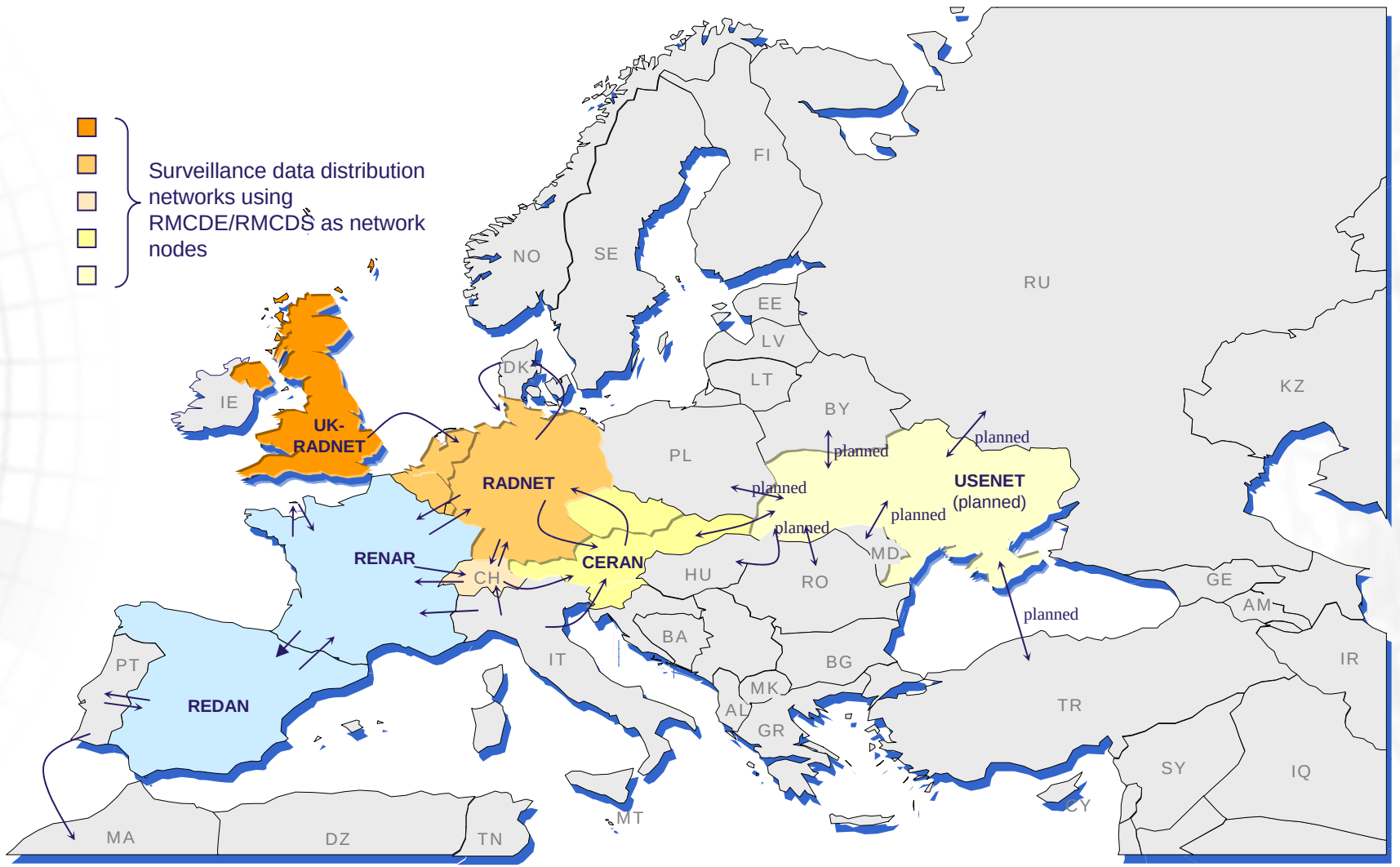
Customer:

- NATS, National Air Traffic Services

Project:

- 16 RMCDS installations in UK
- Link to Continental RADNET via Amsterdam

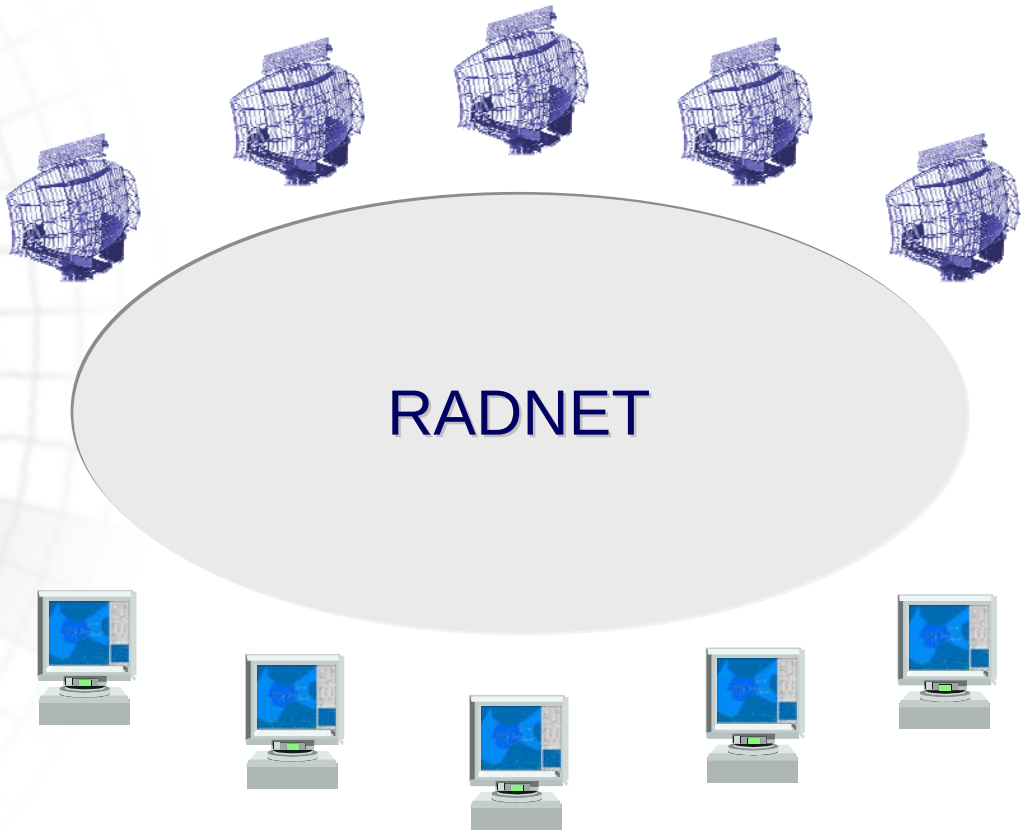
Situation in Europe



Military Surveillance Network Applications

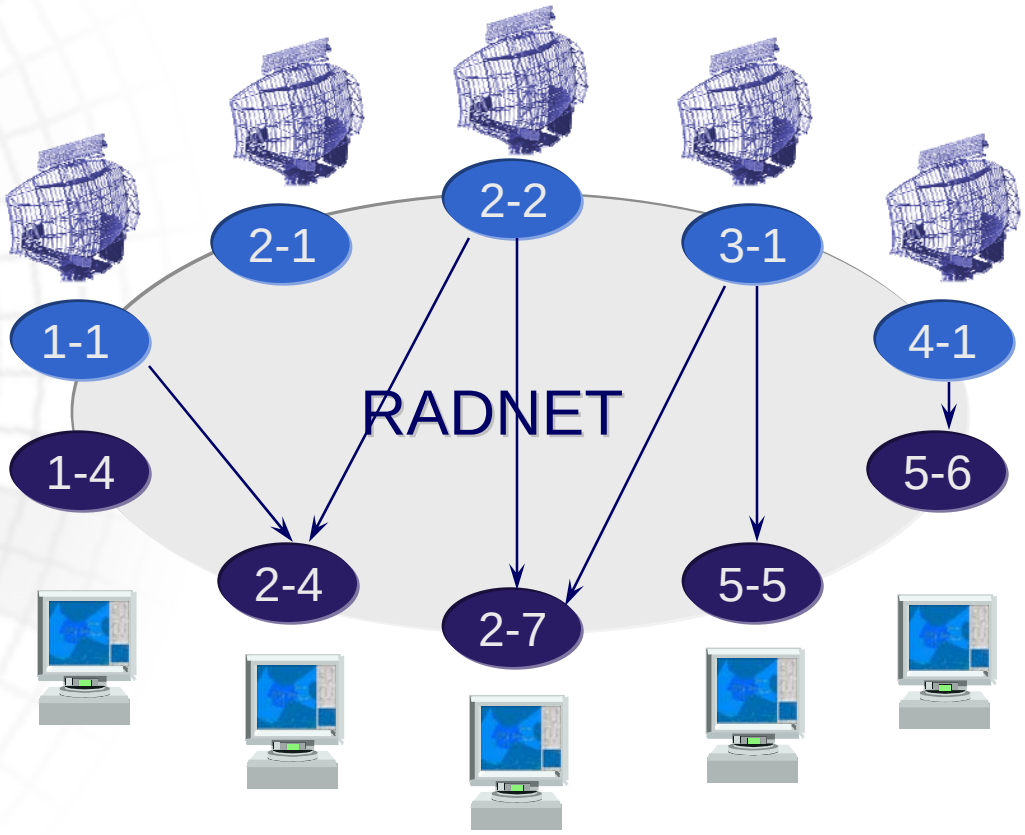
- RMCDE for BAF (Belgian Air Force)
  - Connected to European RADNET
- 2 RMCDEs at RNLAF (Royal Netherlands Air Force)
  - Now integrated in European RADNET
- MilRADNET for GAF (German Air Force)
  - Independent network of currently 5 nodes
  - Future extension with red network
  - Interconnected with civil RADNET via two gateways
- 2 RMCDEs and several mobile RMCDEs for Austrian Air Force
  - Central main system complex
  - Independent network not connected to civil networks (but using same sensors)
  - Dynamic configuration due to mobile use

RADNET – Basics



- RADNET is interconnecting a variety of data sources and data sinks

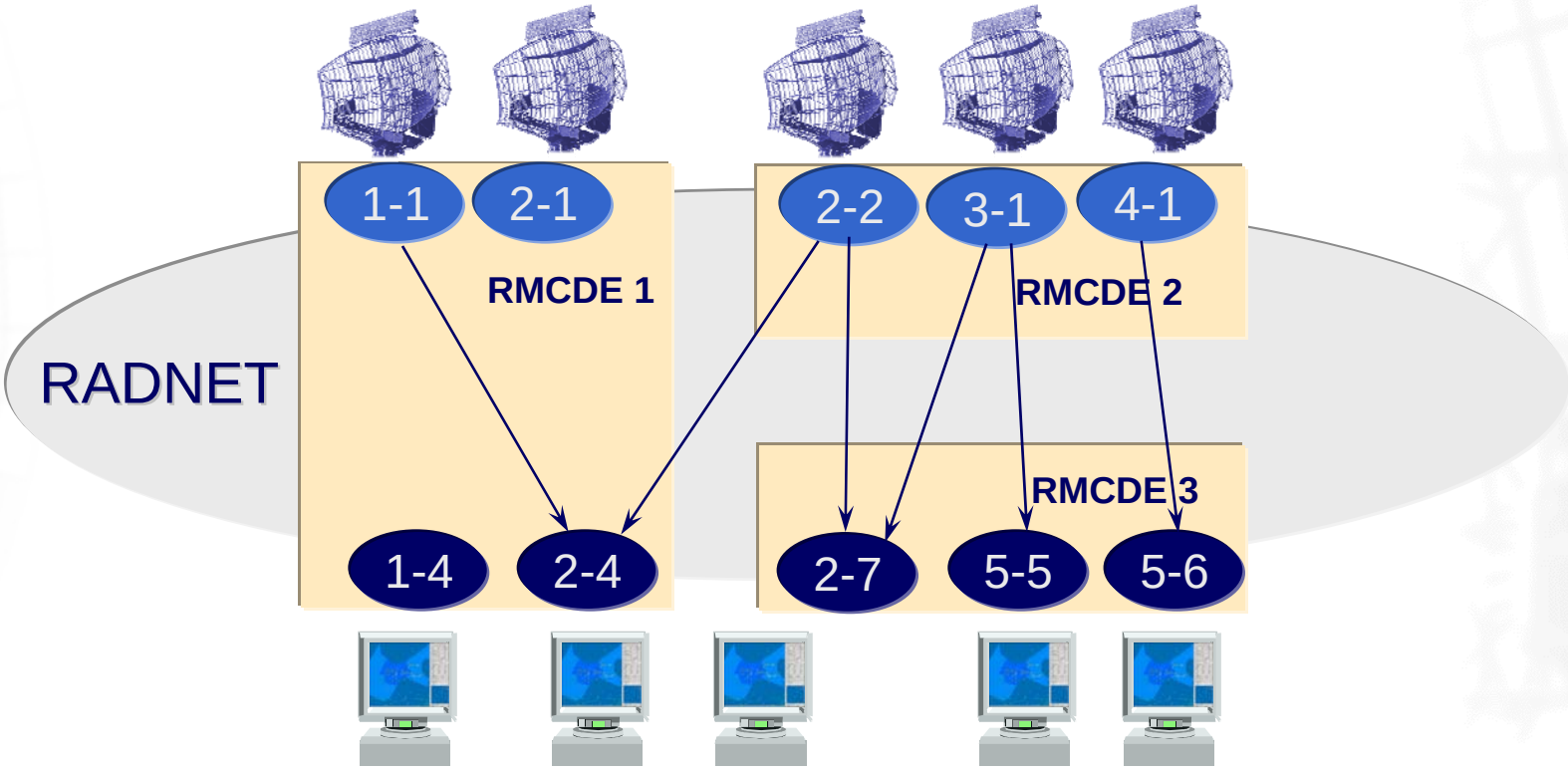
RSAP Connections



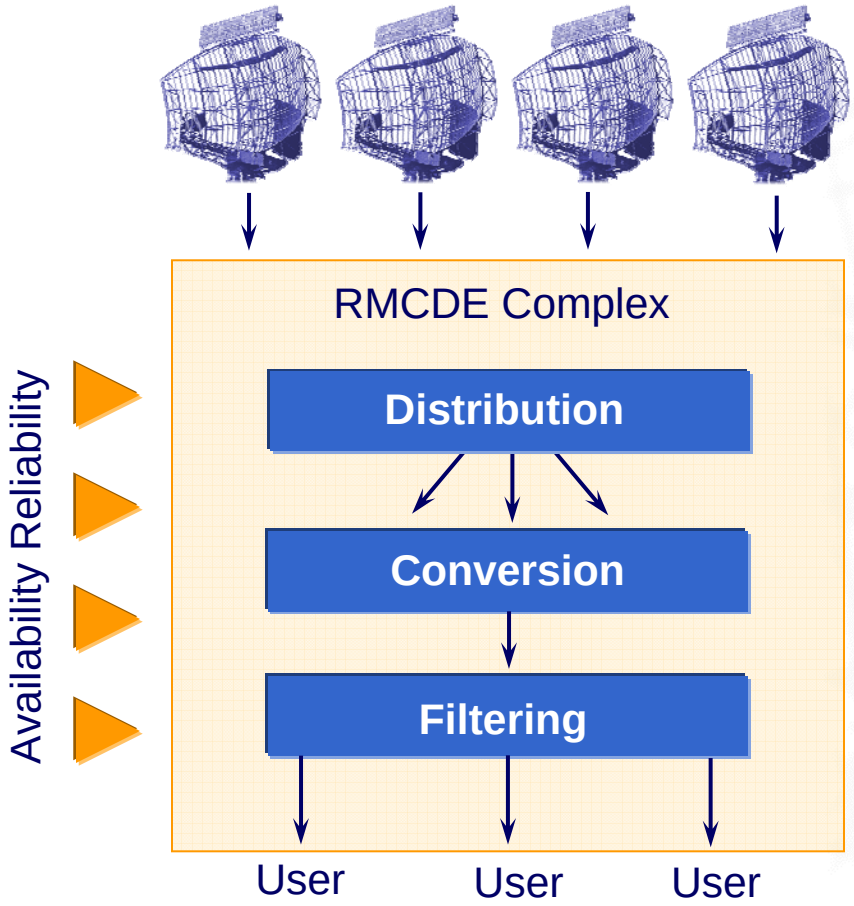
- RSAP Connections
  - Data sources (radars and track servers) provide all data to the network
  - RADNET ensures the delivery of exactly the requested data to individual data sinks

RADNET – Network

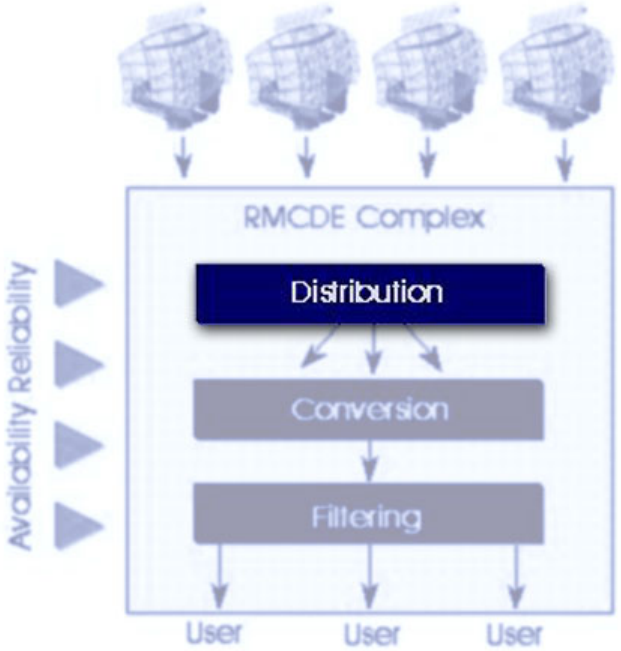
- Example of a small surveillance data network



RMCDE - Main Features

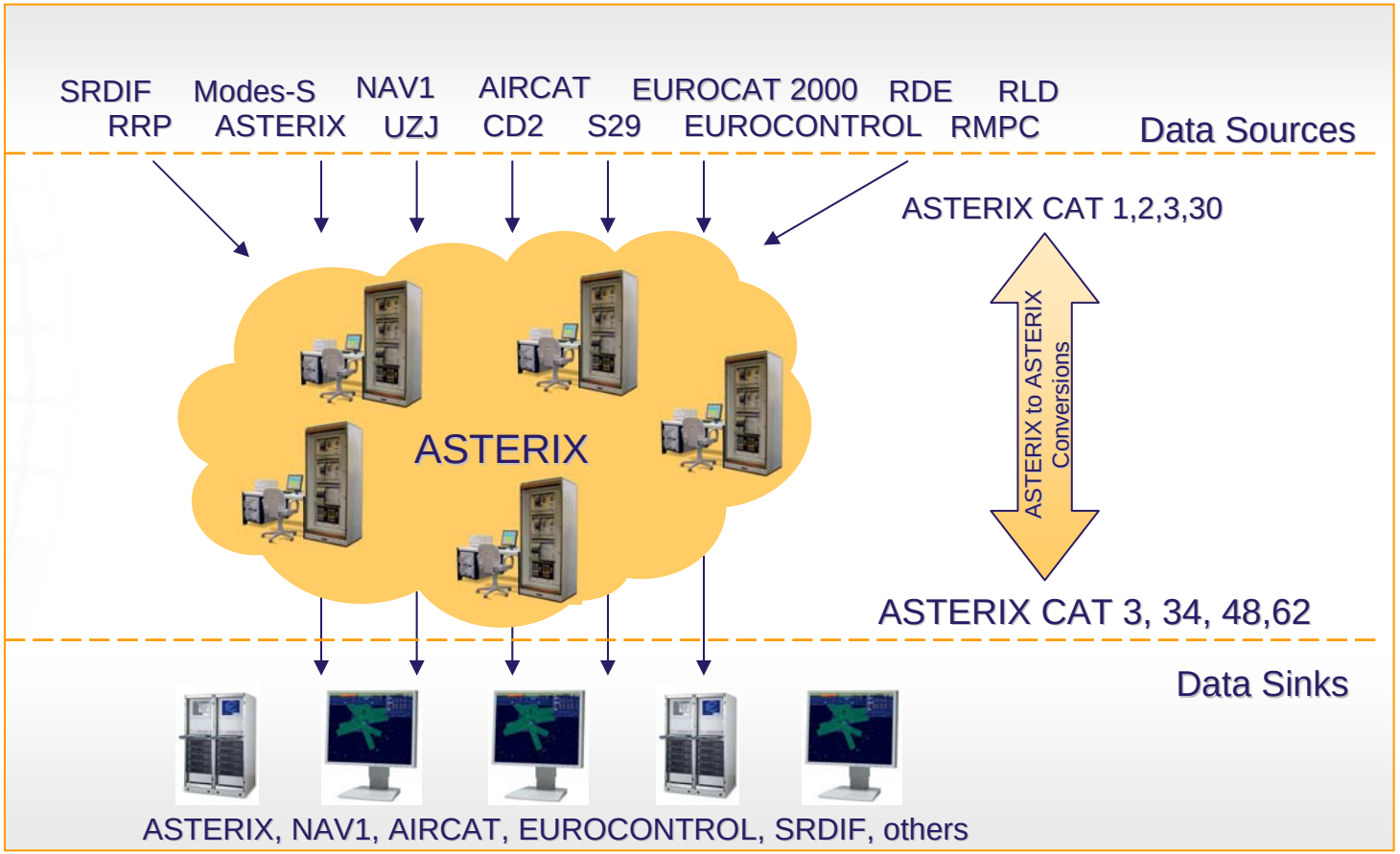


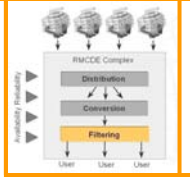
RMCDE - Distribution



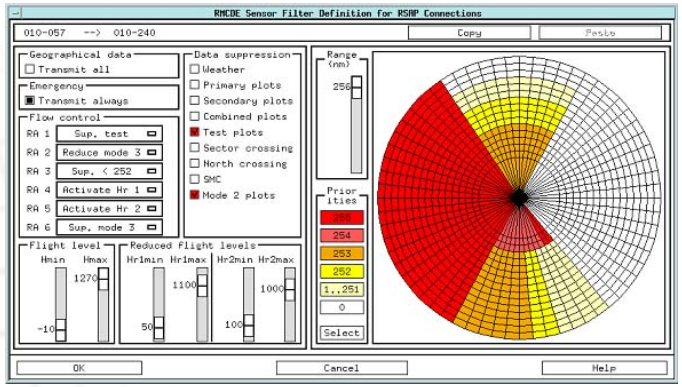
- 1: N distribution from arbitrary source to any number of sinks regardless of location
- Real-time transport with minimum end-to-end delays
- Enhanced reliability on various architectural levels
- Wide range of supported LAN/WAN interface types and protocols
- Radar-specific flow control with priority-based load reduction
- Network functionality including intelligent routing and WAN multicast techniques
- Automatic adaptation to network node and link failures

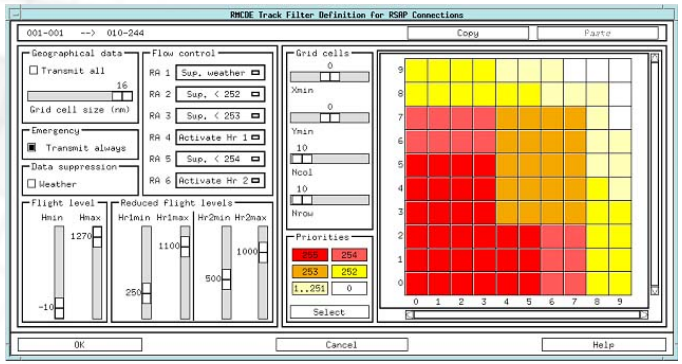
RMCDE - Conversion





RMCDE - Filtering





Geographical Filtering

Height Filtering

Data Type Filtering

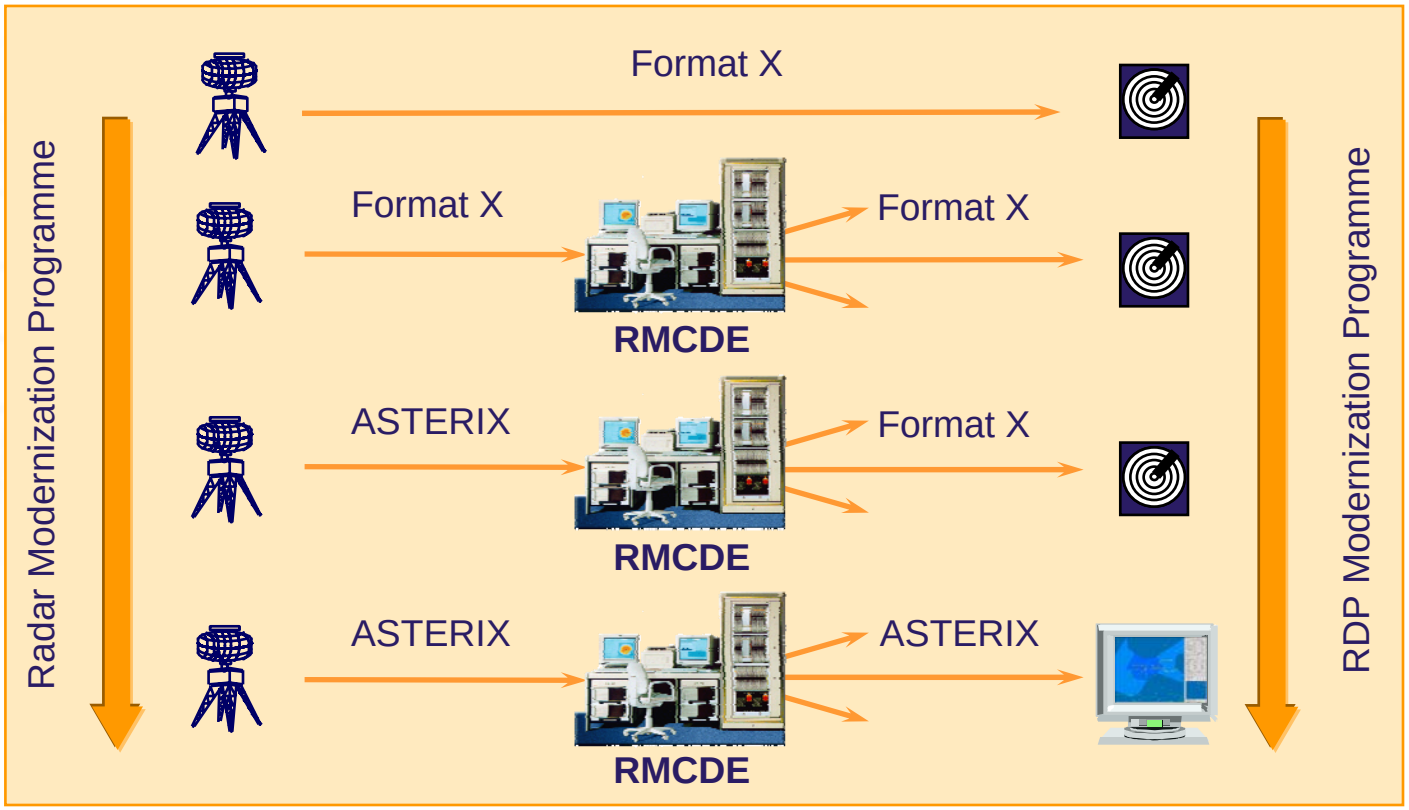
RMCDE - Connectivity

Interfaces	Serial (V.24 or V.11), Ethernet, FDDI
Formats	ASTERIX, RDIF, EUROCONTROL, CD2, CAA, Aircat, RDE, RLD, RRP, MPR F200, RDIF, various military formats
Protocols	HDLC LAP-B, HDLC Frame Level, X.25, OSI/TP4, TPD, CLNP, LLC 1, ES-IS, UDP/IP, TCP/IP, SNMP V.1, various proprietary Formats

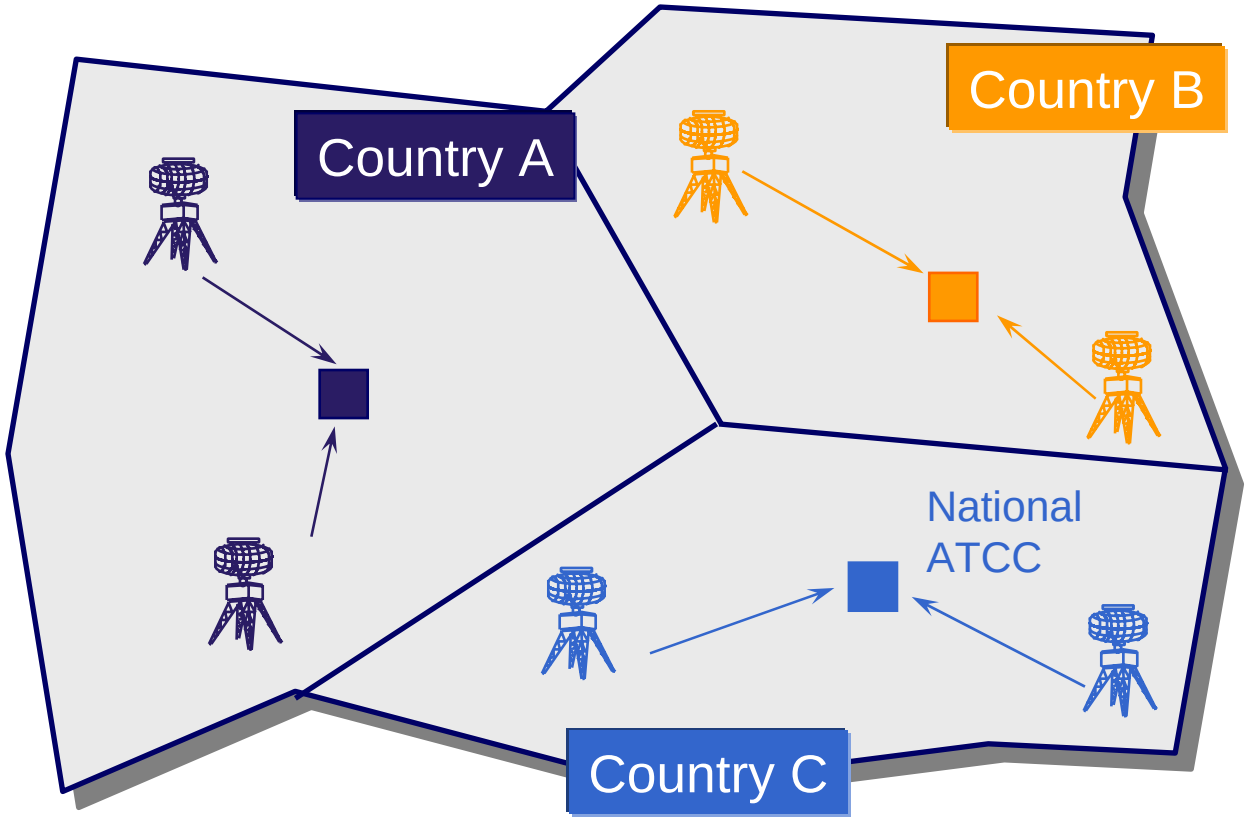
RMCDE - Technical Data

Time Services	GPS, NTP, crystal backup
Availability	Computed Availability: 99,9999986%
Maintainability	MTTR (Mean Time To Repair): 15 min
Delay (internal)	< 50 msec per plot at high data load
Throughput	> 10.000 plots/sec.
Hardware	Rack-mounted multiprocessor board system, PC-based operator subsystem (desk-mounted)
Software	Realtime operating system for core communication unit HMI based on LINUX and OSF/Motif

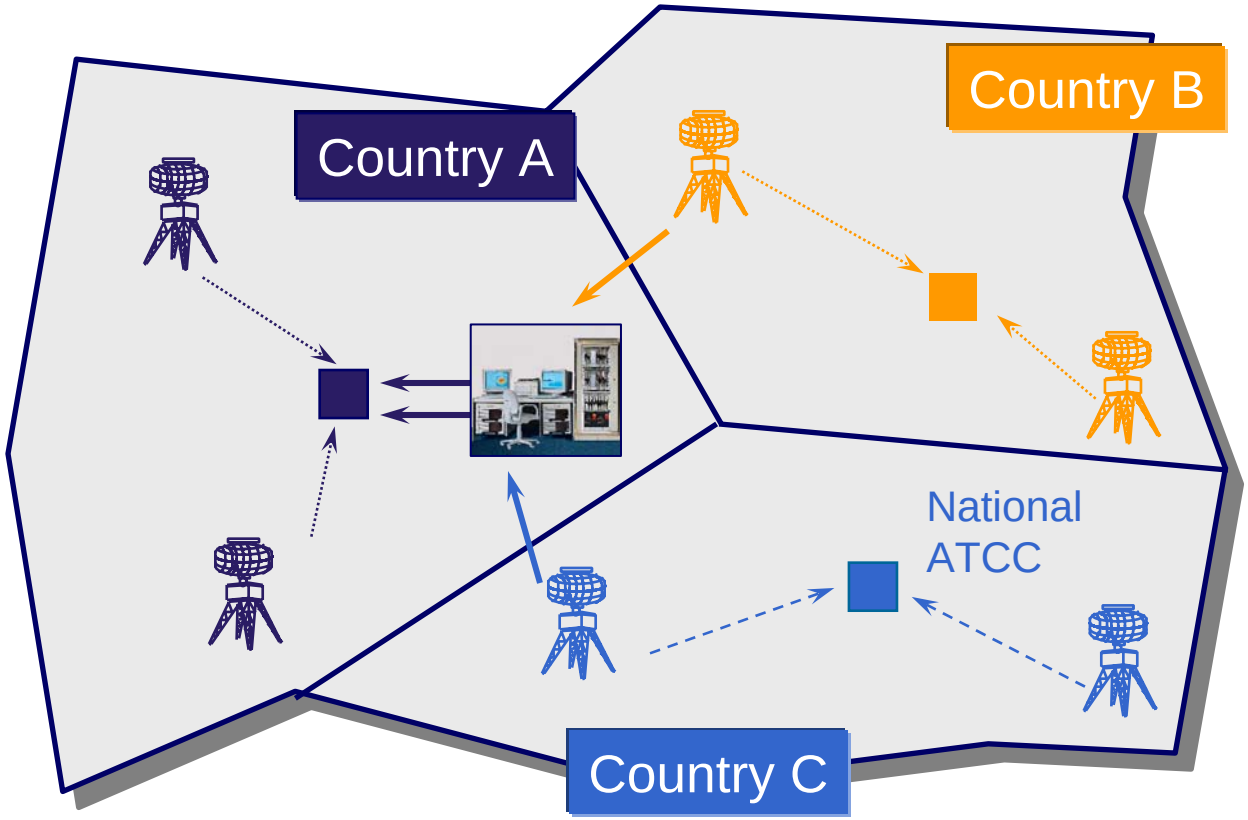
Usage Scenarios - Migration Support



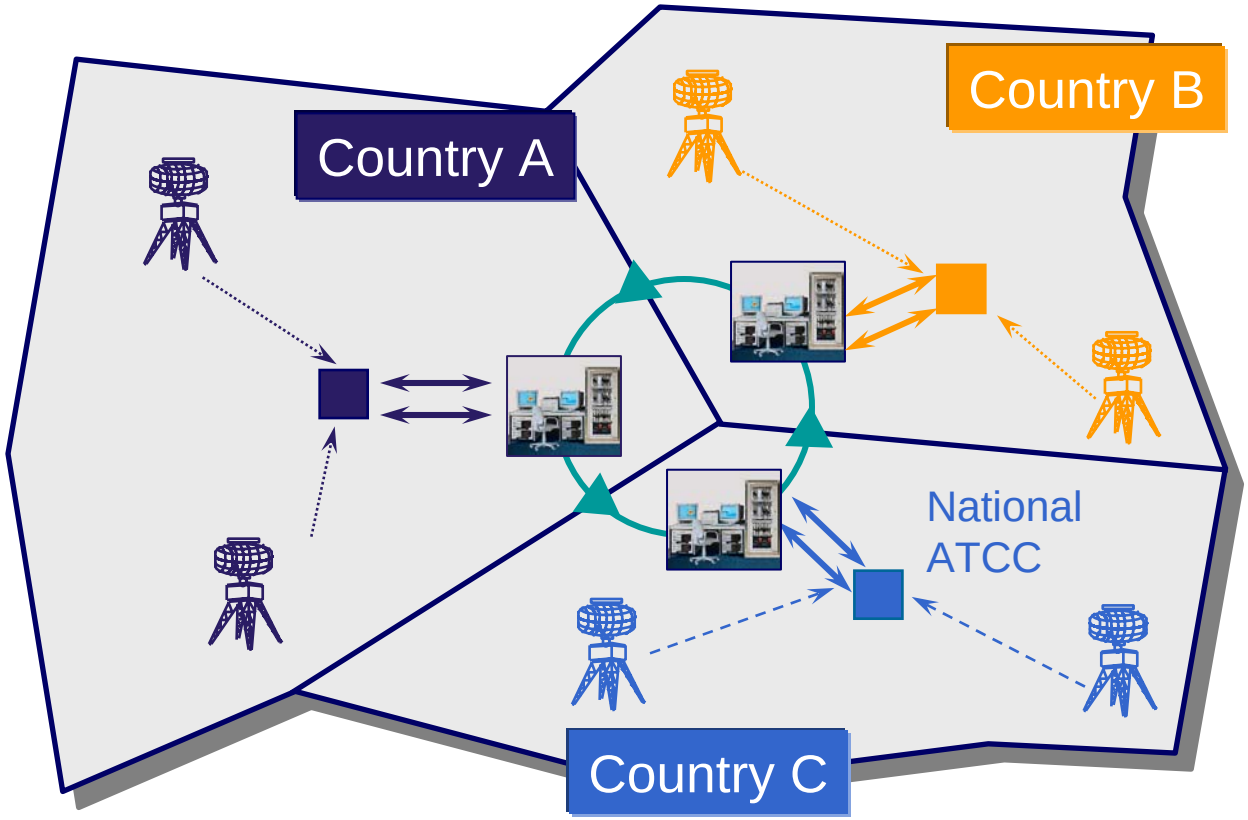
Usage Scenarios
Current Situation



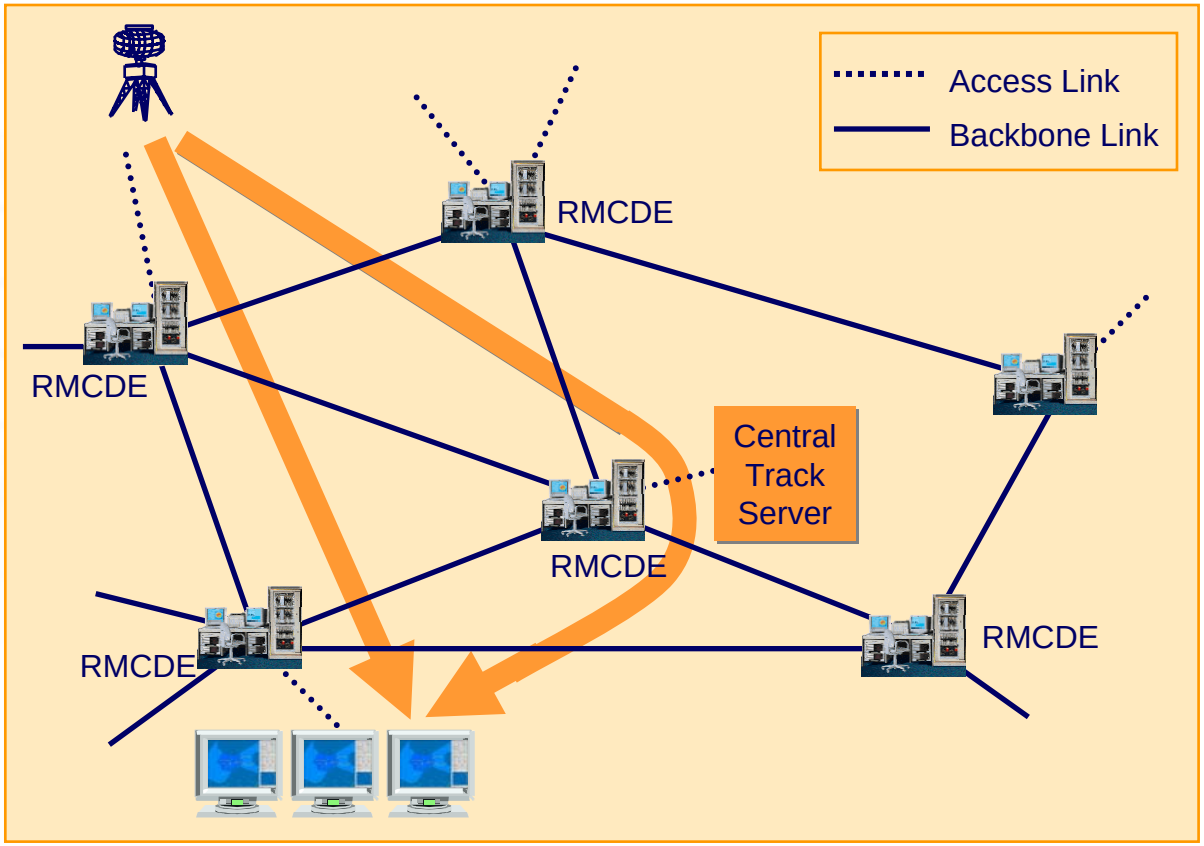
Usage Scenarios - Radar Data Sharing



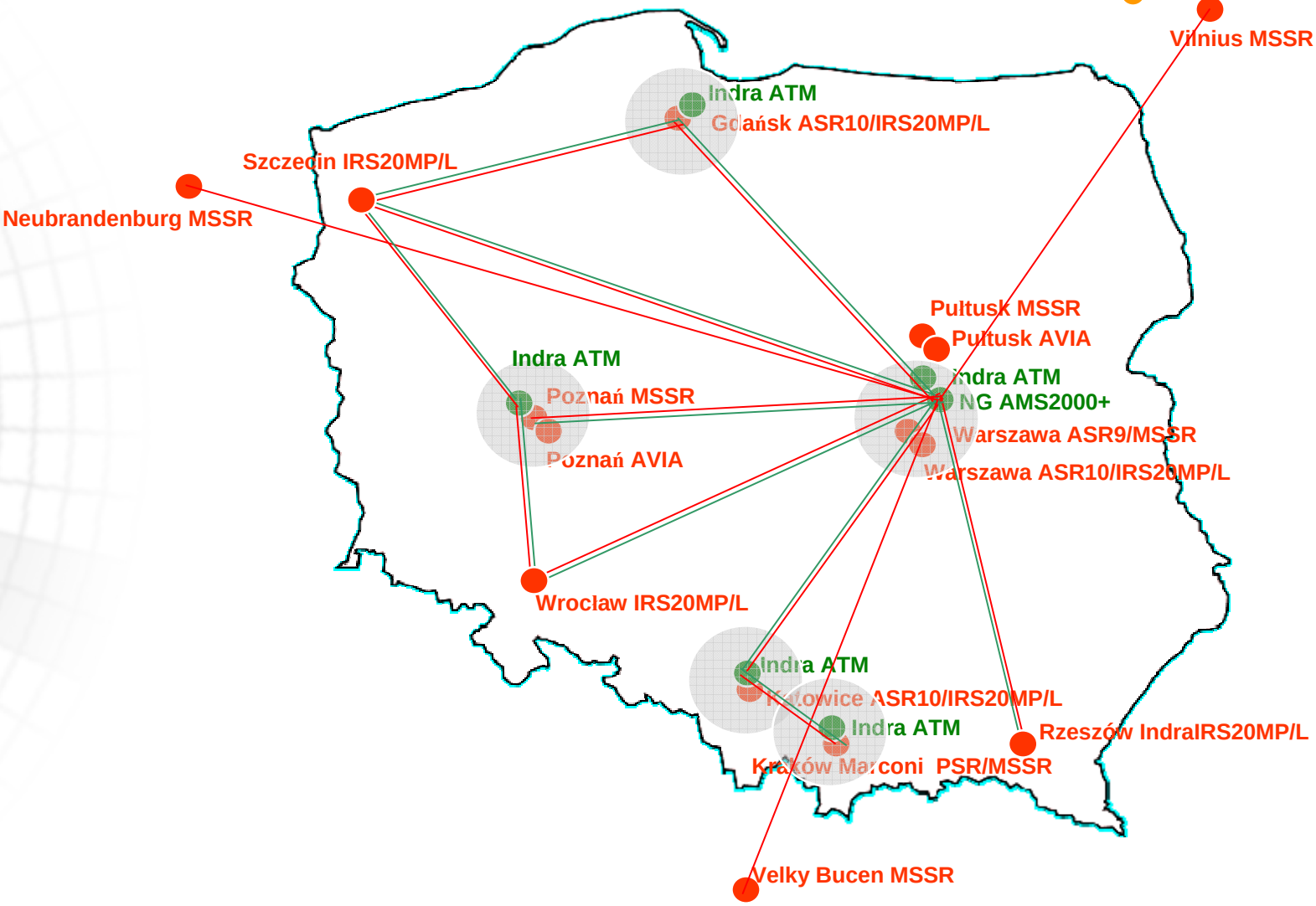
Usage Scenarios - Radar Data Sharing



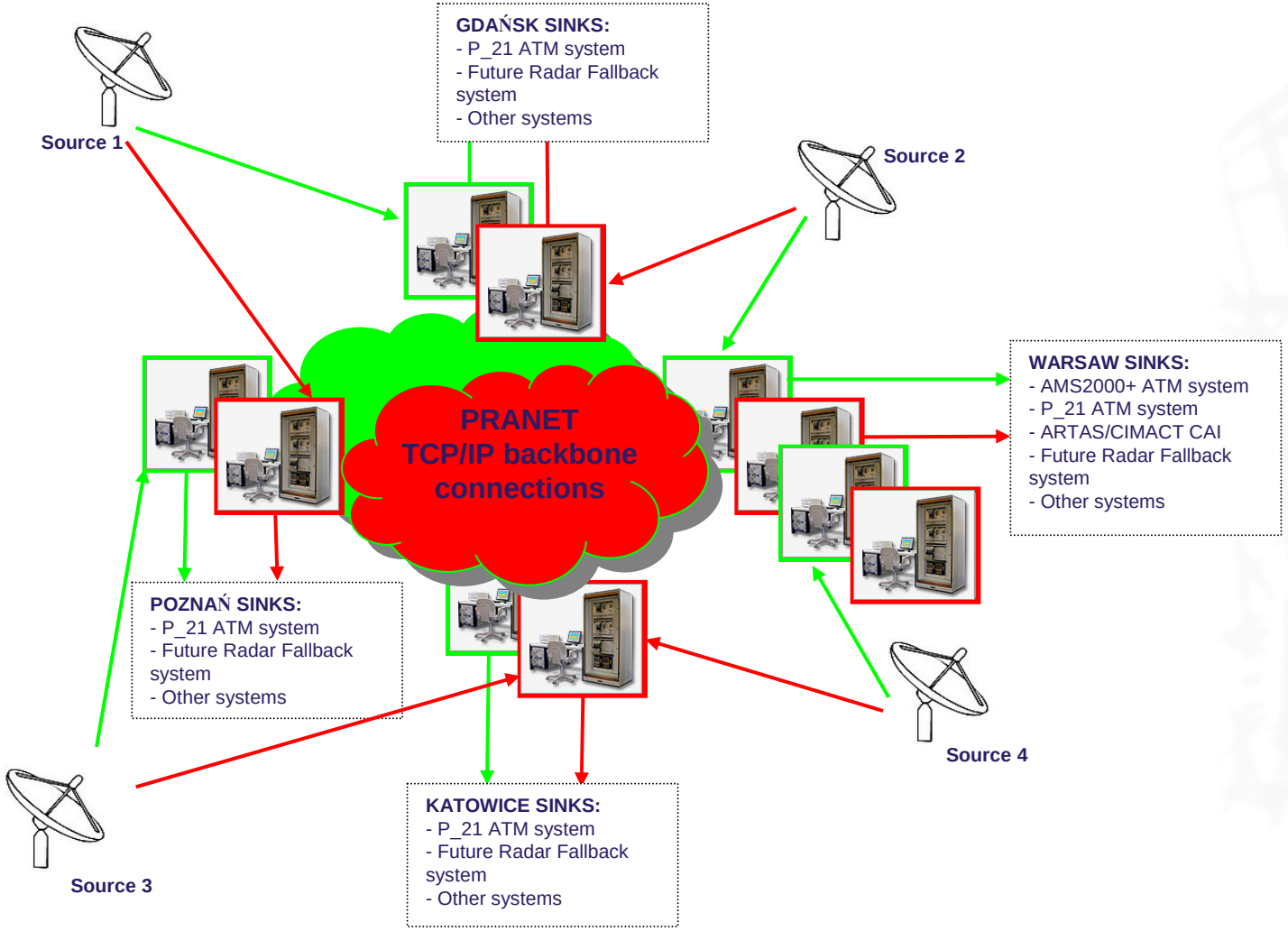
Usage Scenarios - RADNET Service Sharing



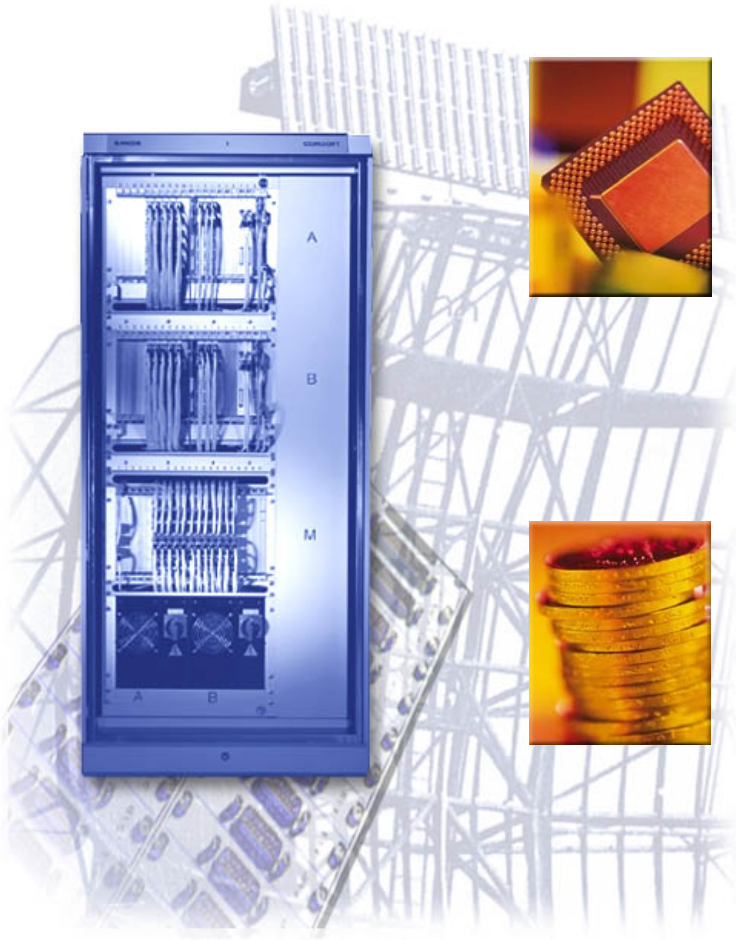
Example PANSA:
Current Surveillance Infrastructure



PRANET Functional Diagram



Benefits of RMCDE I



Superior Technology

- Based on the latest international standards
- Use of modular hardware and mature software

▶ make RMCDE a solid base and strategic element for a country's future in ATC

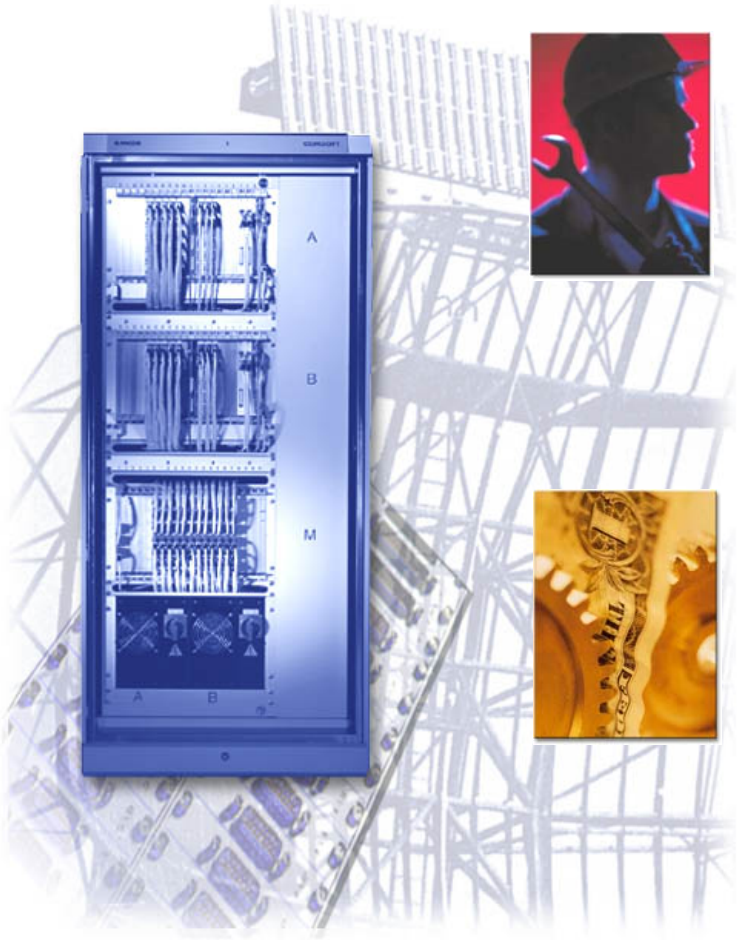
Cost Savings

- Sharing of radar data is a decisive cost saving factor

▶ avoiding investments in new radars

▶ helping to significantly reduce new installations and PTT line costs

Benefits of RMCDE II



Safety

- Sharing of radar data increases coverage
- adds to accuracy and reliability of surveillance

▶ RMCDE networked solution enables the mutual backup of whole centers

Investment Security

- Easy extensibility of the RMCDE with respect to new protocols and formats,
- flexible use within a wide range of application scenarios

▶ guarantee a maximum cost-effectiveness of the equipment for a long period of time

Contact

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is making the link
Thank
You