COMSOFT AFTN/AMHS Products

by Peter Cornelius, Head of Department Centre Solutions for Air Traffc Control

Transition to AMHS – COMSOFT's Experience from multiple Installations

COMSOFT's Advanced Message Handling Product Line

ERNAM, Dakar, May 28/29, 2013

COMSOFT
is making the link

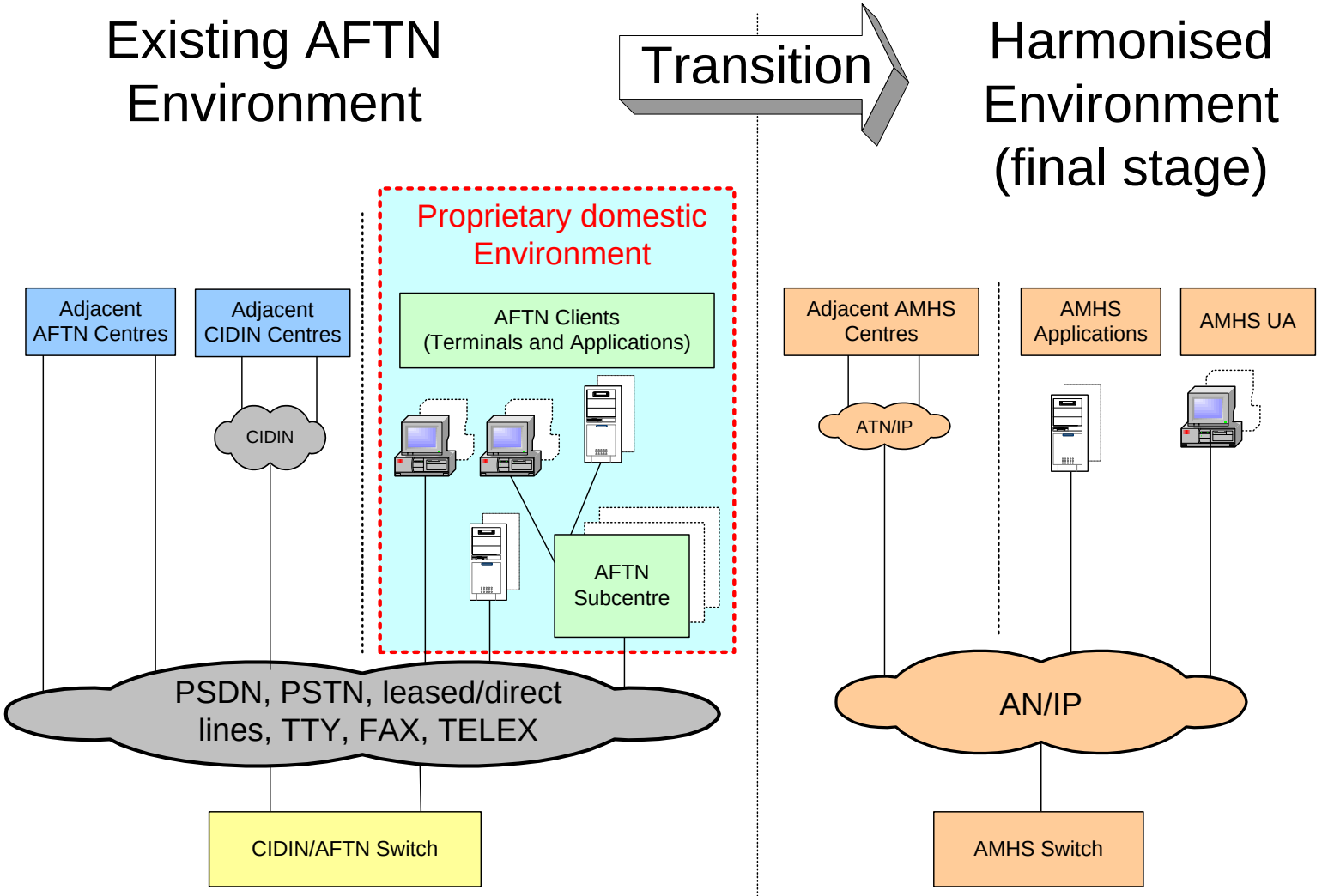
The Transition to AMHS – A Global Issue

- The transition to AMHS is a fundamental change in the world-wide provision of the Aeronautical Fixed Services (AFS)

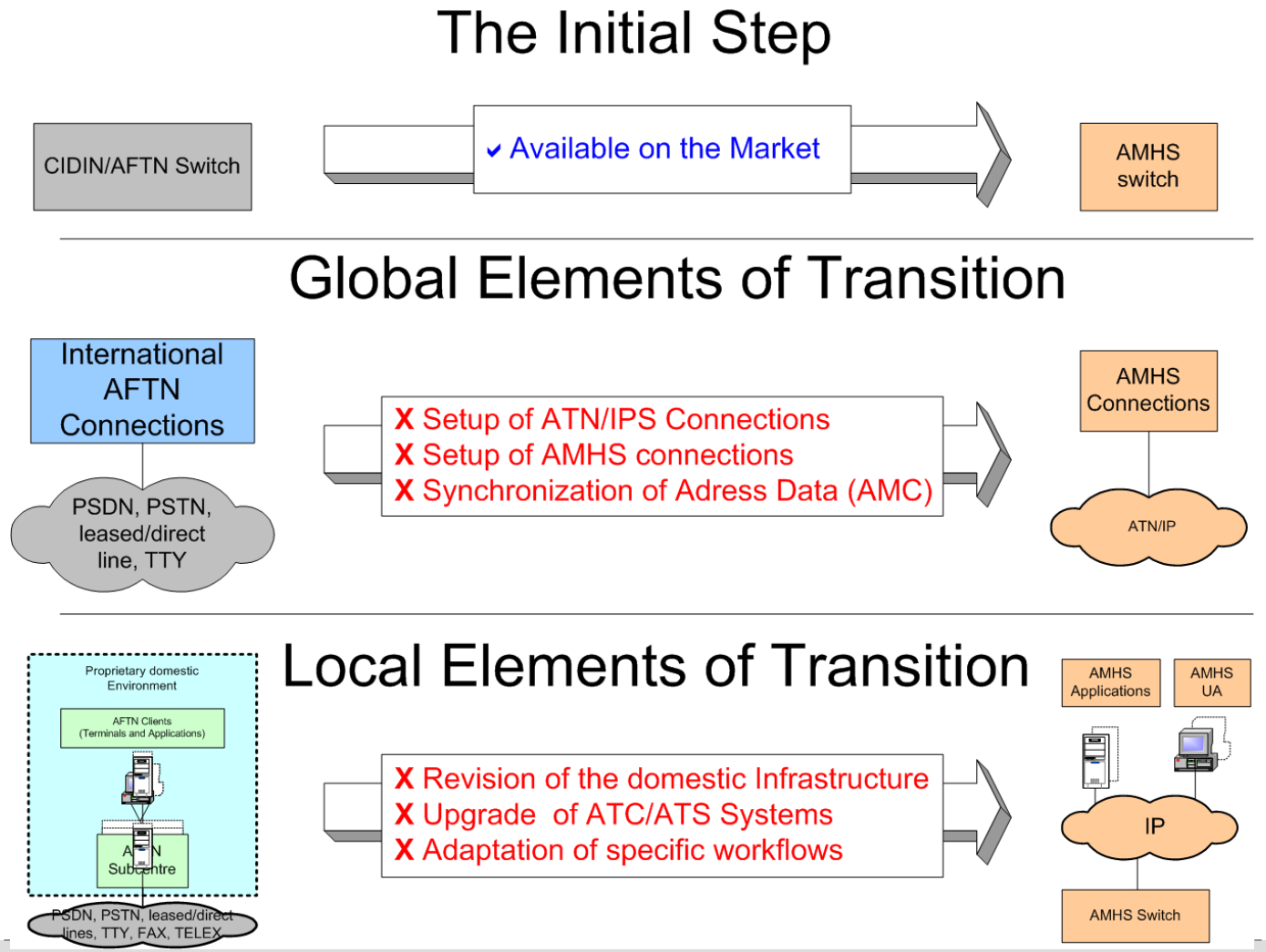
- The existing AFTN COM-Centre structure and message work flows will be completely revised

This presentation summarizes the facts gained from multiple AMHS Installations

Starting Point – Heterogeneous AFTN Environment

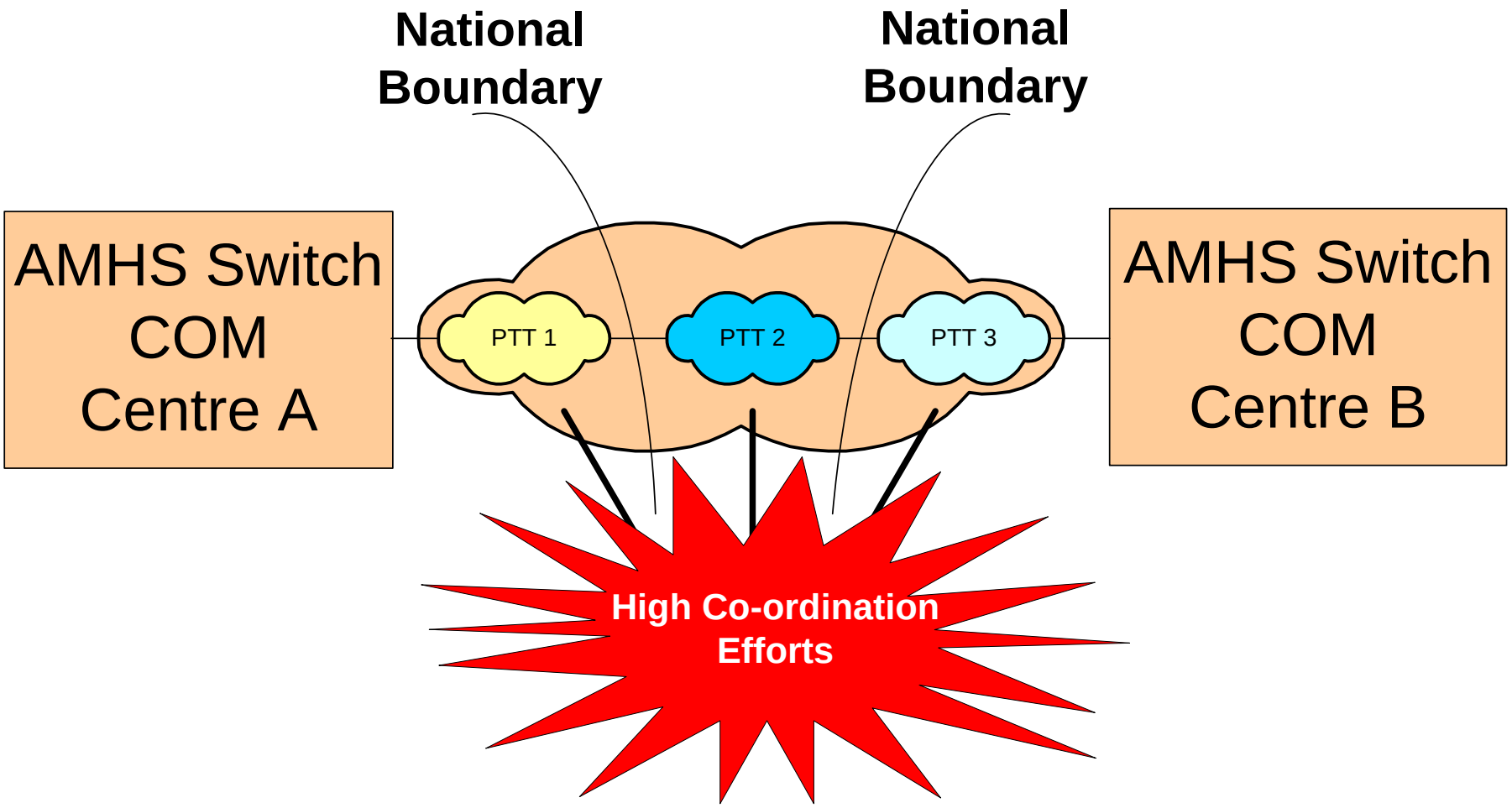


Transition – Identification of "Crucial" Elements (X)



Global Issues

Global Issue – Setup of the ATN/IPS Connection



Global Issue – Setup of the AMHS Connection

- The setup of an AMHS connection with an adjacent country requires a strict sequence of test activities as described in the

ICAO EUR AMHS Manual

1. Appendix D – AMHS Conformance Tests
2. Appendix E – AMHS Interoperability Tests
3. Appendix F – AMHS Pre-operational Tests

Global Issue – Setup of the AMHS Connection

- AMHS systems who do not provide the AMHS conformity certificate in accordance with **Appendix D** caused during AMHS Interoperability Tests (**Appendix E**) the following problems:

  - Incompatibilities with basic AMHS Protocol Elements
  - Incompatibilities of AFTN ←→AMHS conversion procedures
  - Non-conformant behaviour in error situations

Global Issue – Synchronization with AMC

- ICAO requested 2009 all ANSPs per state letter to register at the AMC and to regularly update their own AMHS address database from the global AMC AMHS address database (AIRAC Procedure)

- AMHS systems working with outdated AMHS address databases caused

  - ❑ AFTN and AMHS routing problems/errors

  - ❑ AFTN/AMHS conversion errors

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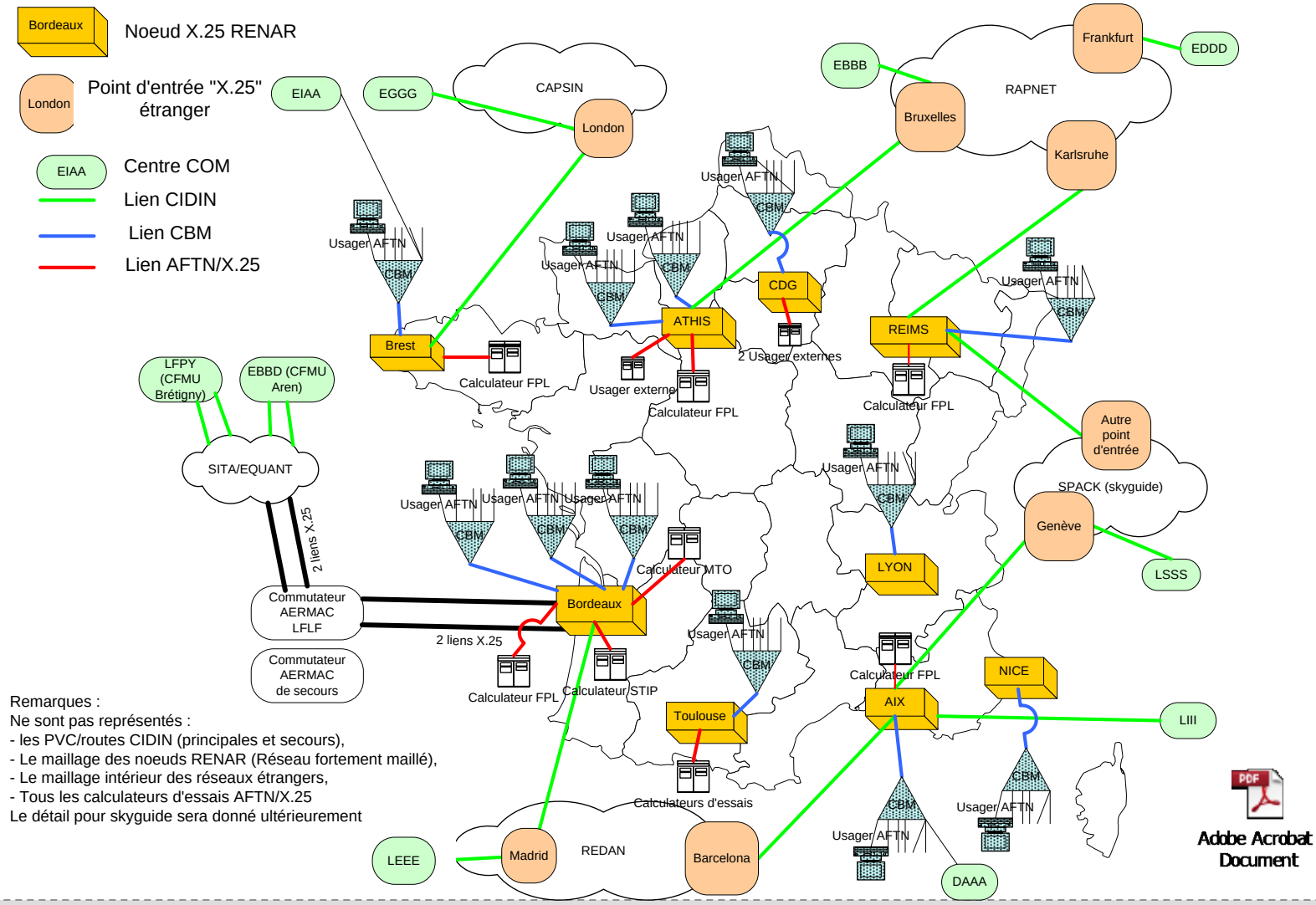
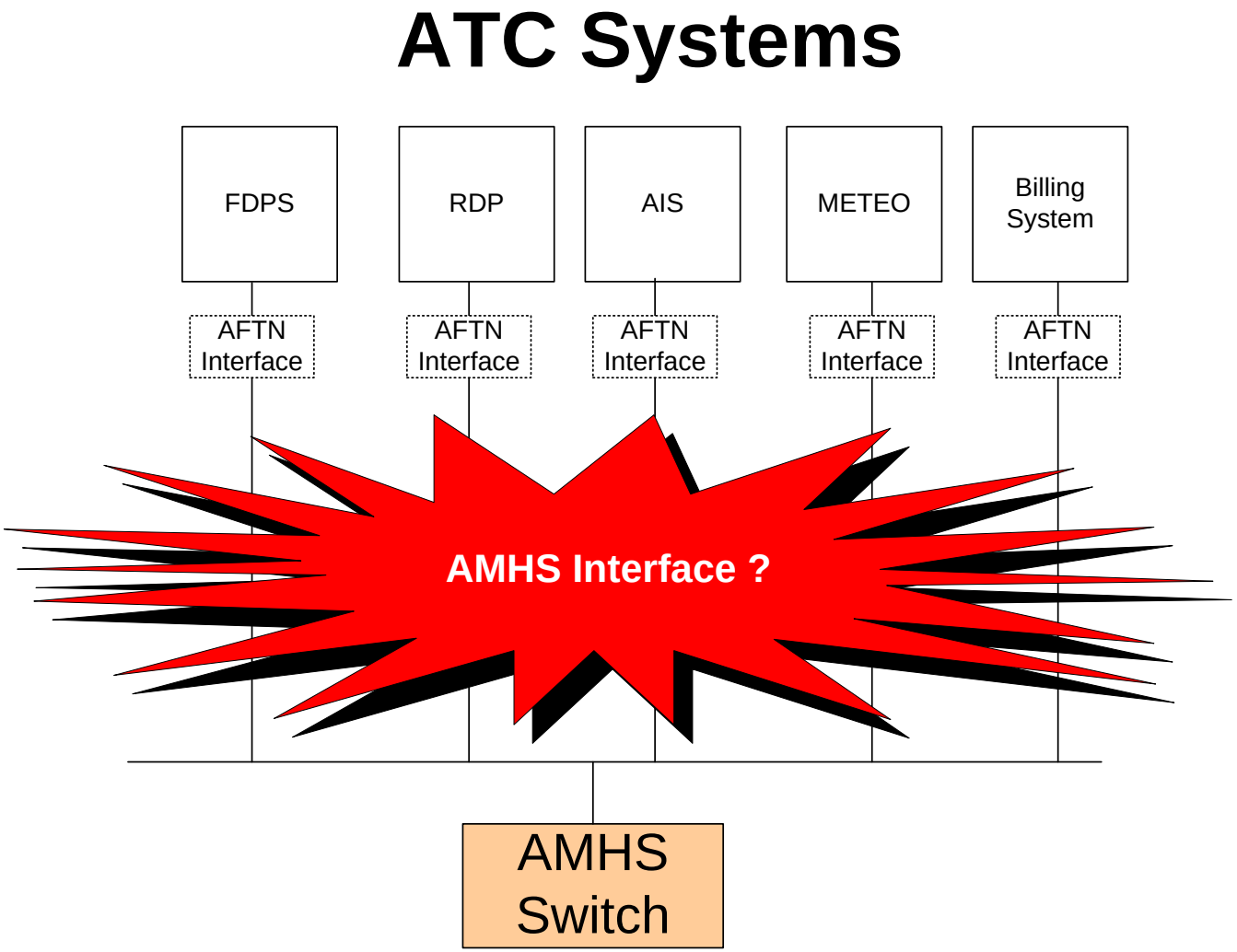
Local Issues

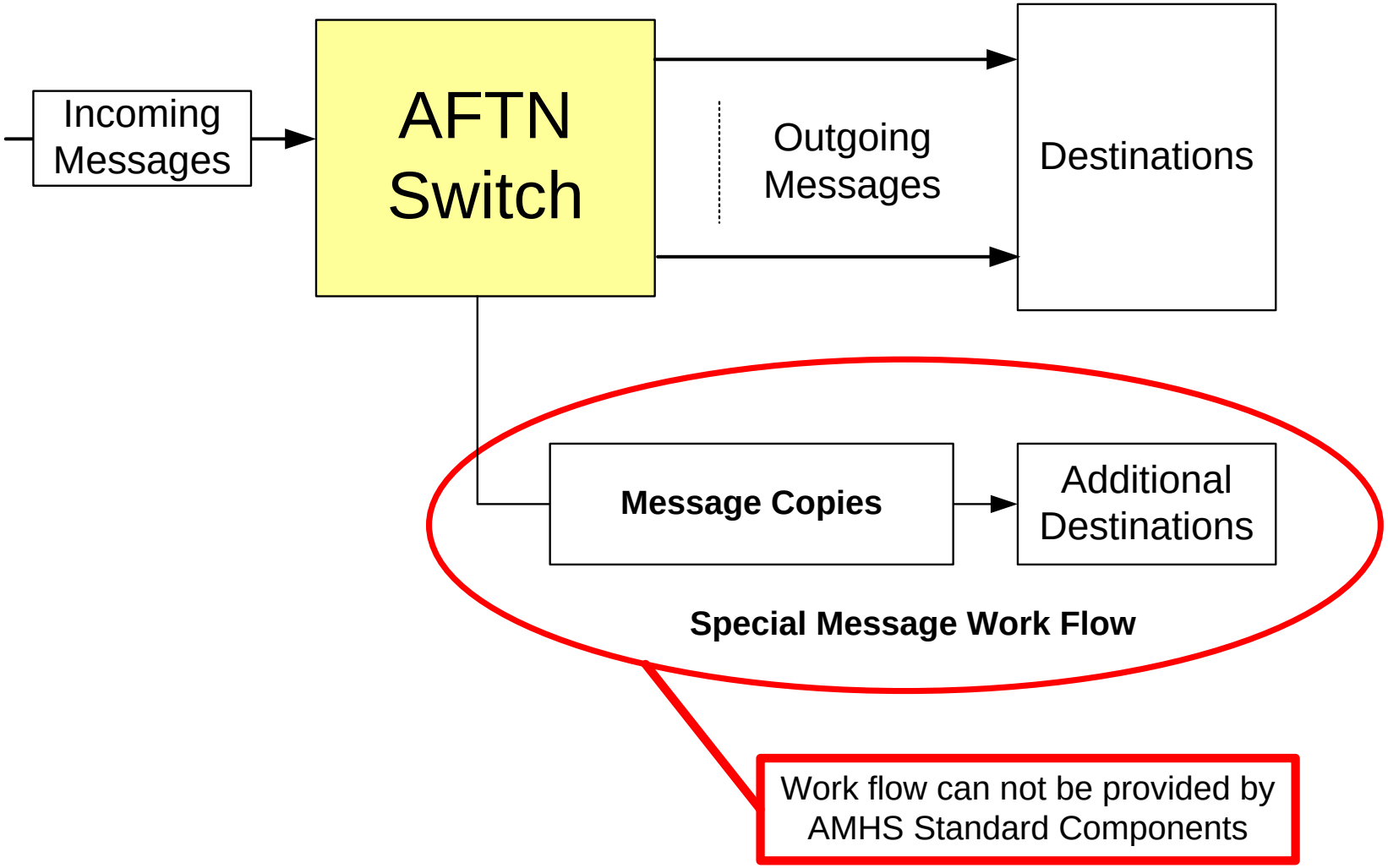
Local Issue – Example of a complex domestic Infrastructure



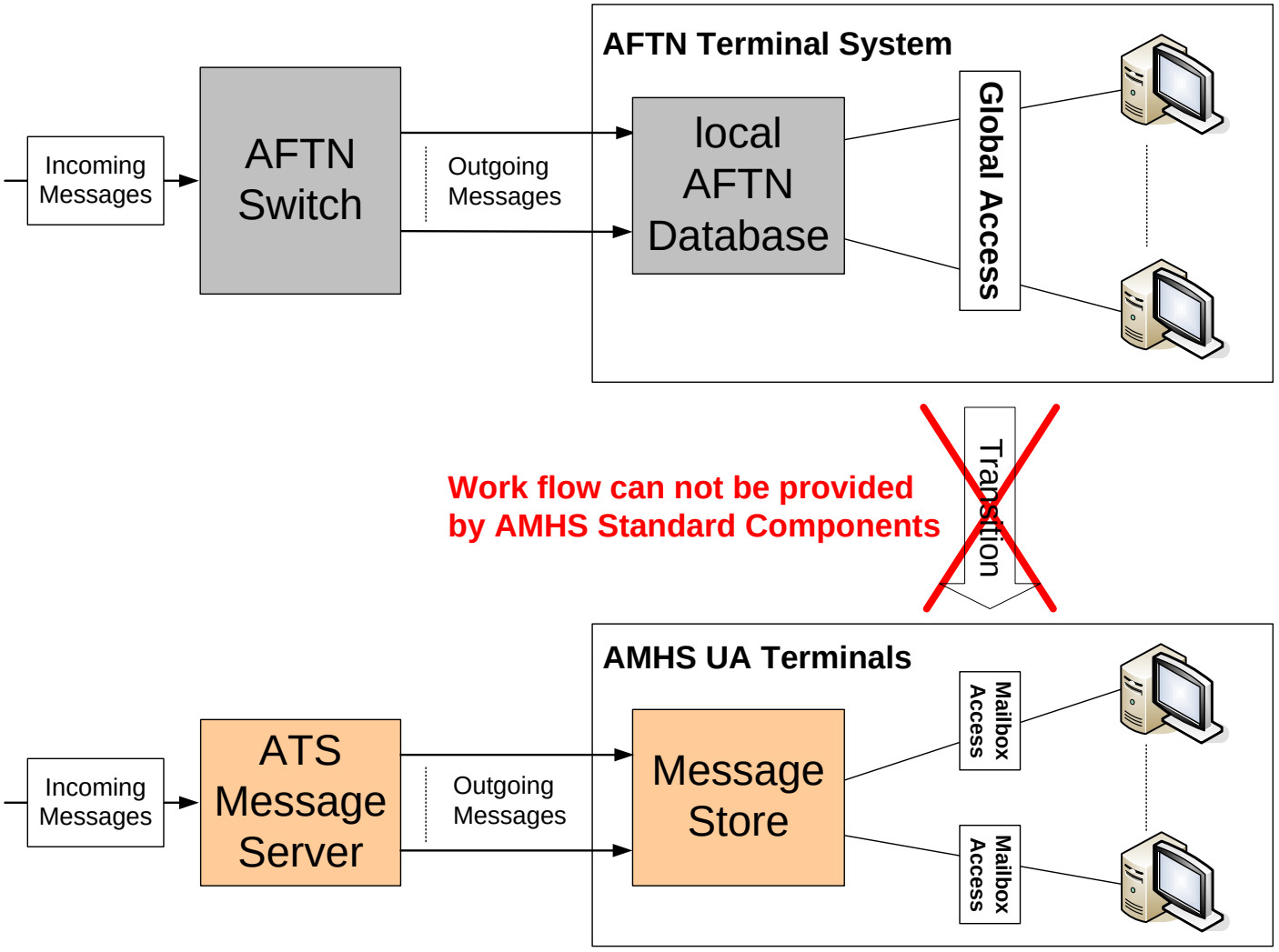
Local Issue – Upgrade of existing ATC Systems



Local Issue – Special Domestic Message Workflow



Example 2 – Special Domestic Message Workflow



Result

Existing AFTN environments cannot be replaced by AMHS

"in one shot"

AMHS Transition Strategy – Mixed Operation of AFTN and AMHS

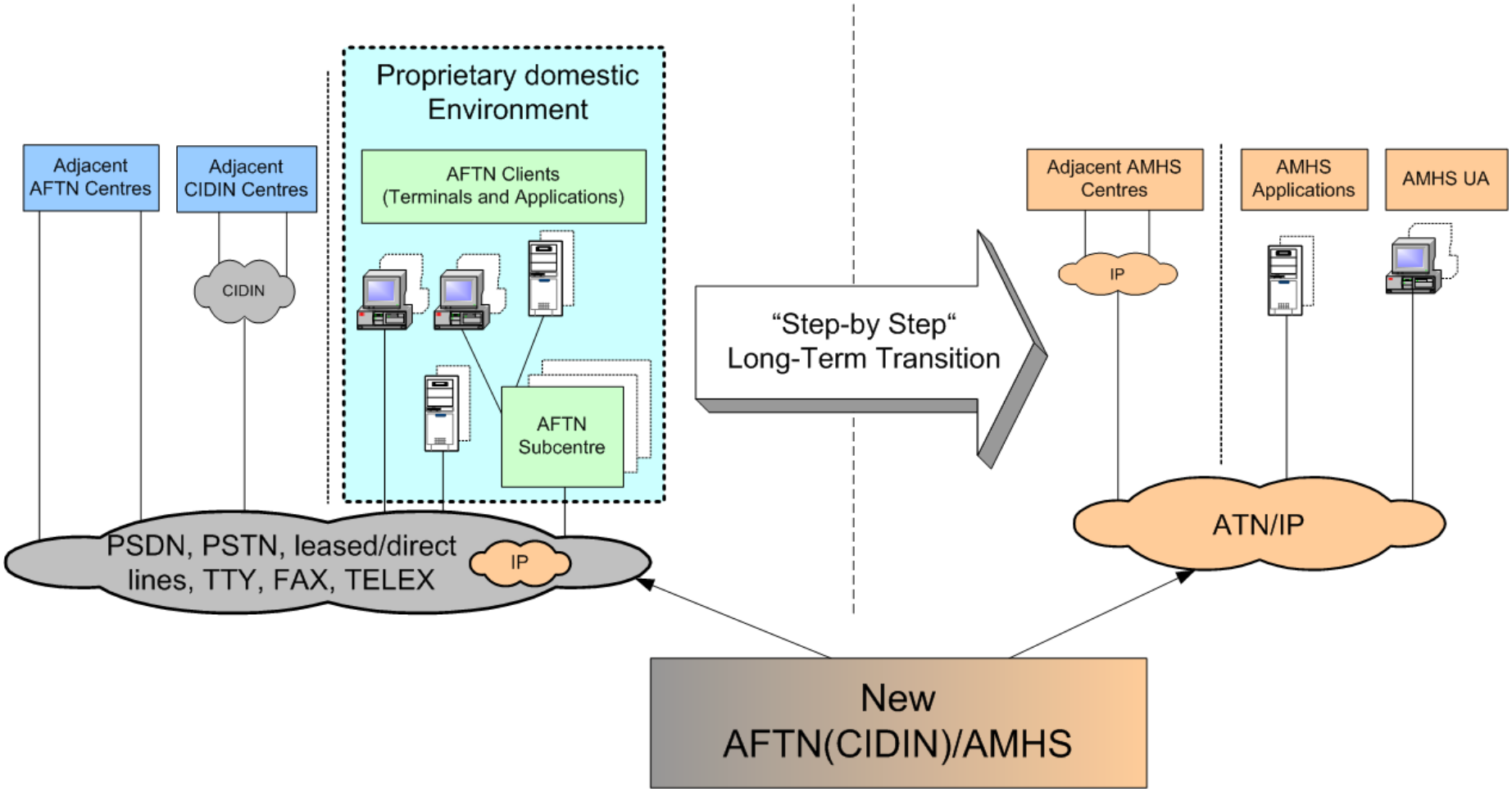
AMHS Transition Strategy – How ANSPs proceed

1. Installation of an AFTN/AMHS switch and operation in the current AFTN environment

2. Upgrade of the international/domestic communication infrastructure

3. Start of the “step-by-step” AMHS transition process

AMHS Transition Strategy – “Step by Step”



COMSOFT AMHS Transition Support

AMHS Transition - COMSOFT's Support

- ✓ COMSOFT provides **as the only supplier on the market** an integrated AFTN/AMHS product suited at best for the mixed operation of AFTN and AMHS
- ✓ COMSOFT provides highest expertise in deploying AMHS systems; COMSOFT AFTN/AMHS customers operate 90% of all worldwide operational international AMHS connections
- ✓ COMSOFT provides the AMHS/SOAP interface in order to facilitate the upgrade of existing customer end systems to AMHS
- ✓ COMSOFT owns a source code license of the X.400 Software (ISODE) and, if required, is able to implement specific workflows

COMSOFT's Advanced Message Handling Product Line

COMSOFT's AMHS Solution

AIDA-NG – AFTN/CIDIN/AMHS Product

COMOSFT provides two products for AFTN/AMHS

- **AIDA-NG**
  Integrated AFTN/CIDIN/AMHS Switch

- **CADAS**
  Client-Server-based terminal system for the ATS end user

Both Products are native COMSOFT key-products, which have proven their high flexibility by being deployed in most different ATC environments

AIDA-NG – AFTN/CIDIN/AMHS Product

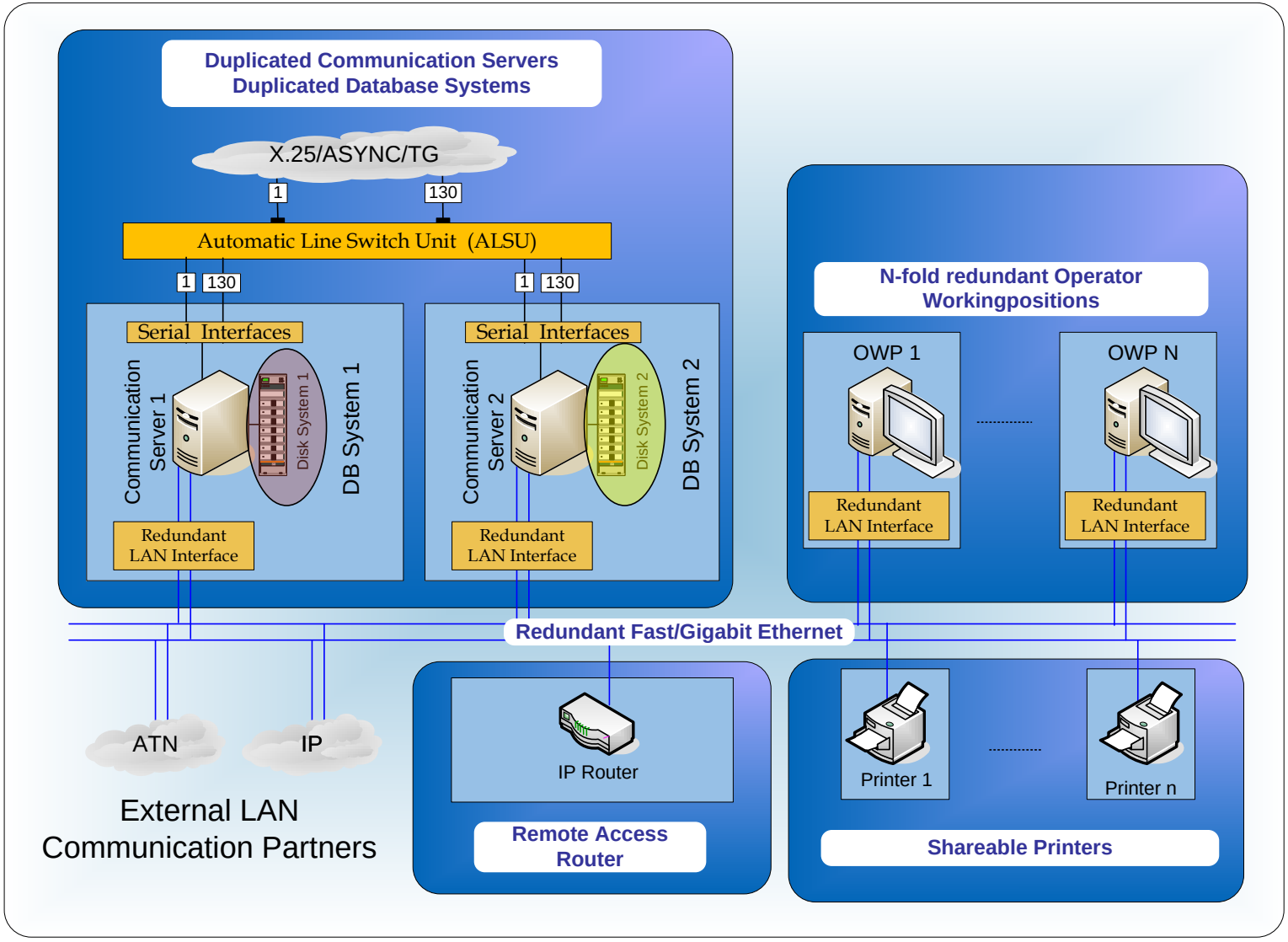
AIDA-NG

Aeronautical **I**ntegrated **D**ata Exchange **A**gent - **N**ext **G**eneration

COMSOFT key product since more than 20 years

Only MHS on the market providing a common messaging framework for all types of aeronautical data
(AFTN, CIDIN, AMHS, SITA, WMO, AIDC, OLDI….)

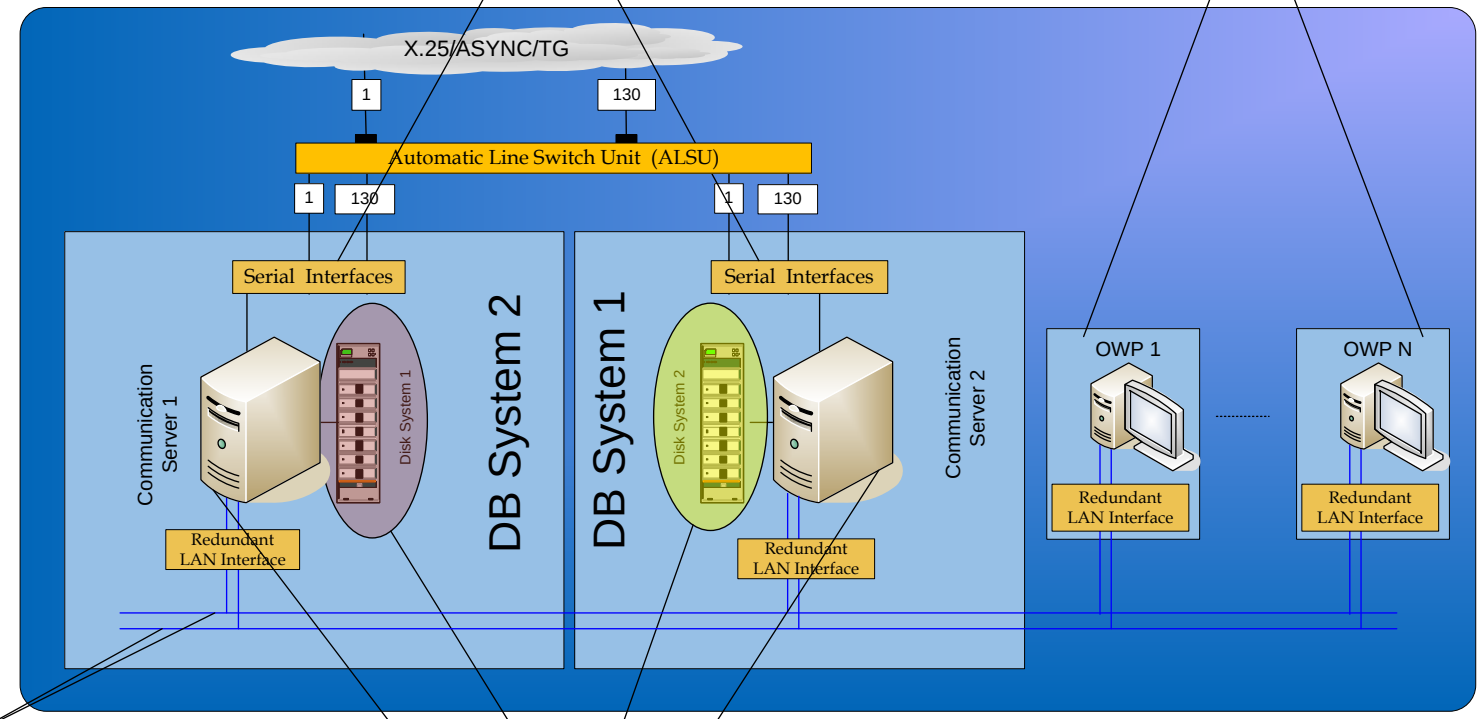
AIDA-NG – Fully Redundant System Architecture



AIDA-NG – Redundant in all Components

✓ Duplicated serial interfaces with Automatic Line switch Unit

✓ N-fold Redundancy by indentical OWPs

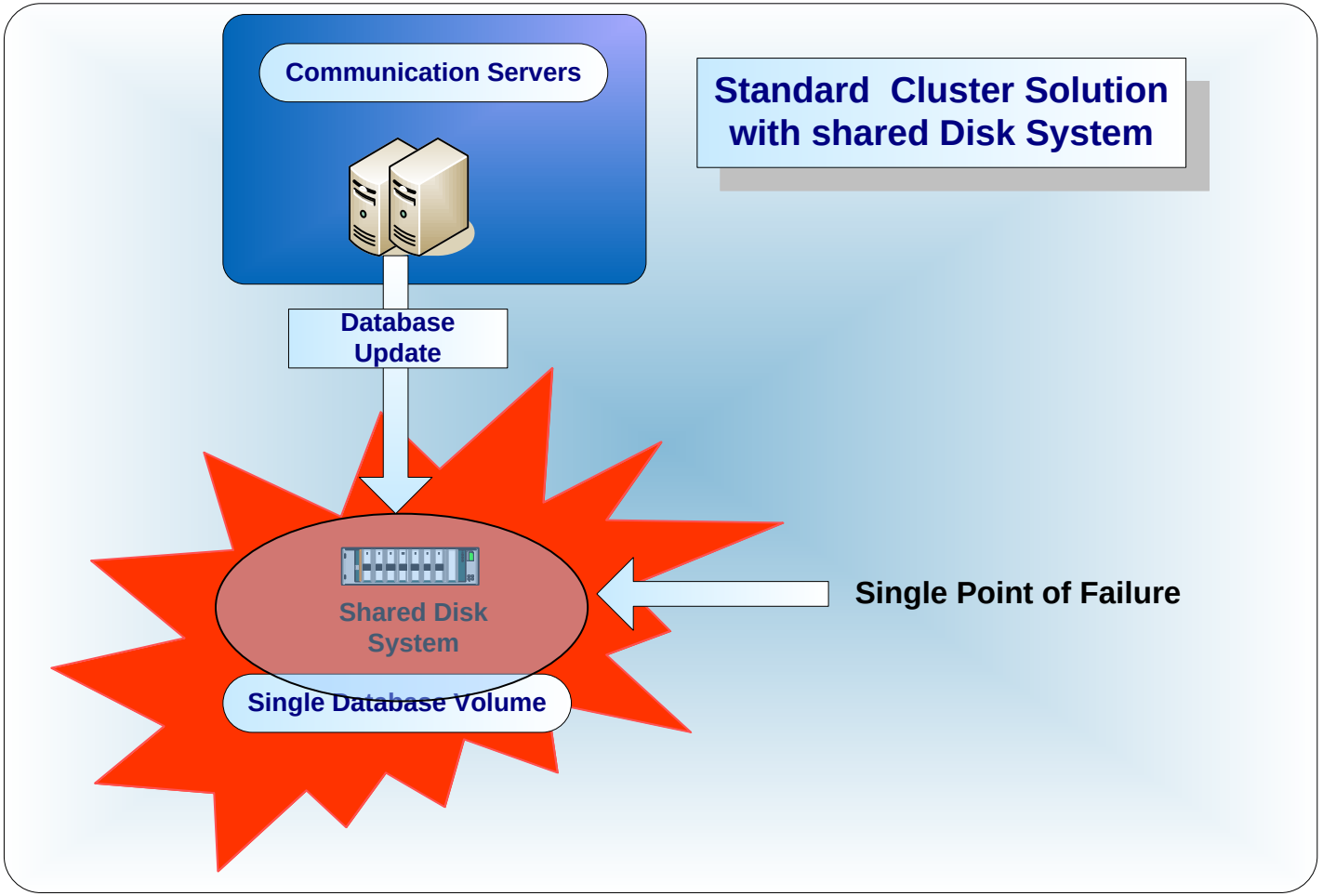


✓ Fully redundant LAN Architecture

✓ Duplicated Databases provide true data redundancy (major improvement of the non-reliable RAID-based Storage Technology)

✓ Servers working in symmetric Operational/hot standby Combination
✓ Switchover time 5 secs without loss of data

AIDA-NG - What we avoid – Shared Storage Devices



- Conventional Cluster Solutions typically use "shared" components, e.g. Application Software, Data Volumes, and Storage Devices.

AIDA-NG – Integrated ATSMHS

AIDA-NG is powered by ECG Core Software

(ECG = European Communications Gateway)

EUROCONTROL

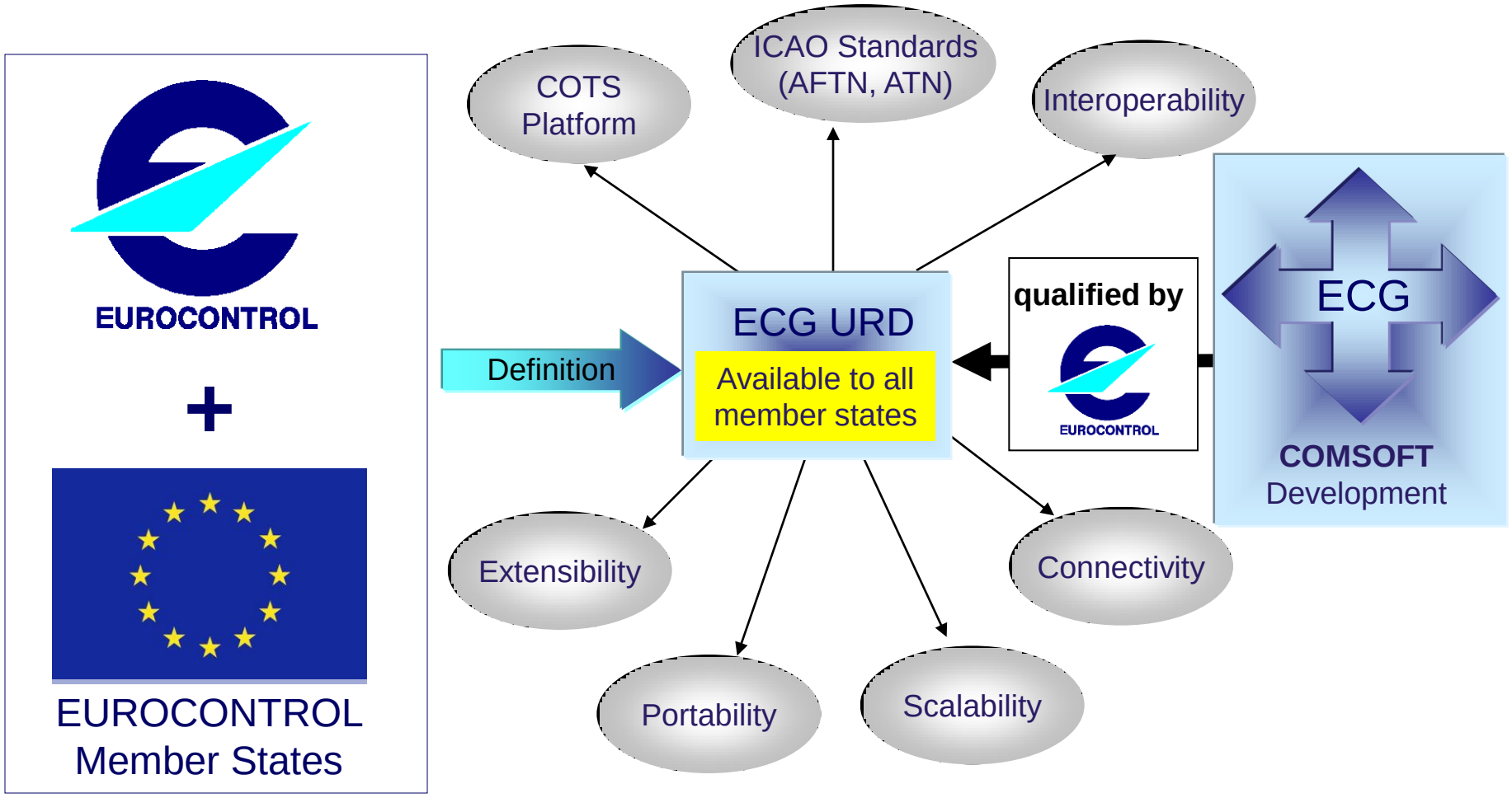
Provision of
ECG Core Software

EUROCONTROL
Member States

The ECG Core SW is the basis for the universal ground-ground communication service of the European ANSPs

COMSOFT is official ECG supplier to EUROCONTROL

ECG Core Software – Realisation

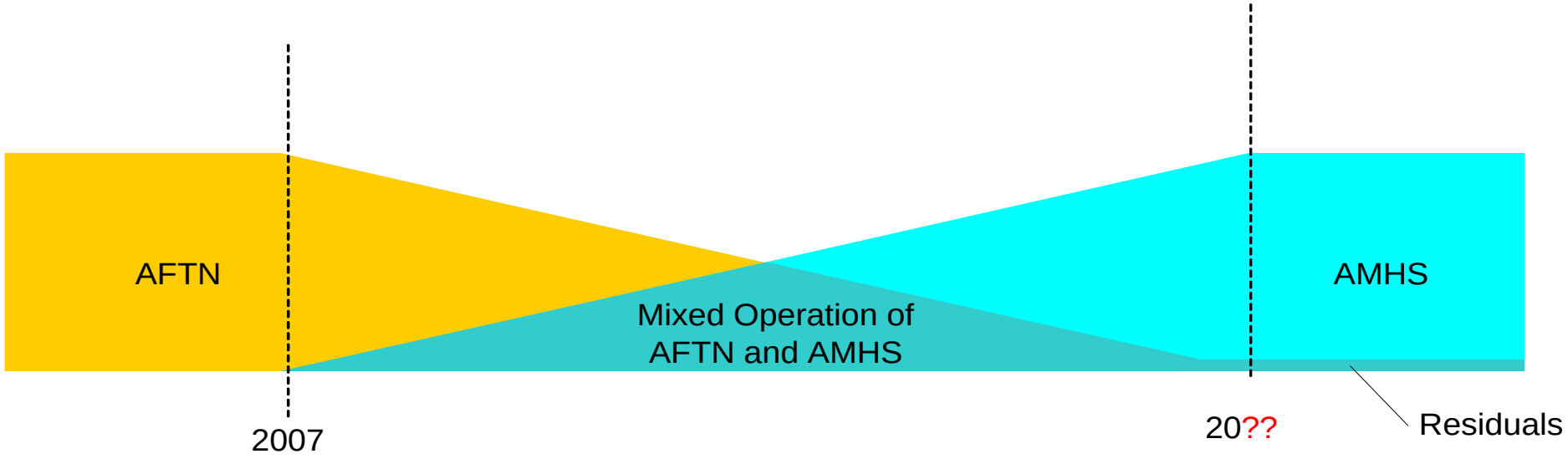


URD = User Requirements Document

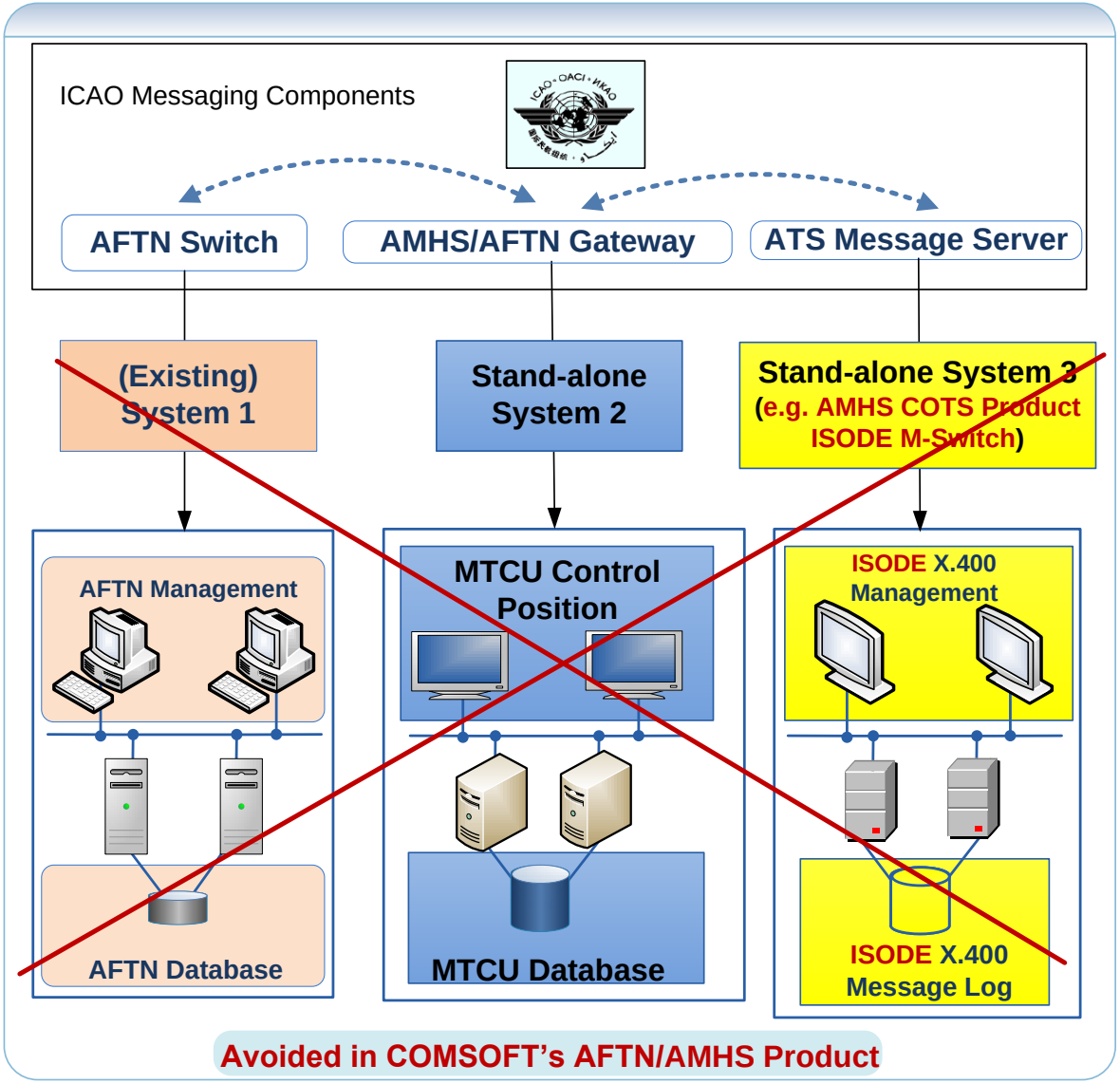
ECG Core Software - Key Requirements

- Integrated on COTS Platform
  (standard server-based architecture)
- Universal Connectivity
  (AFTN, AMHS, SITA, WMO, OLDI, AIDC, etc.)
- Deployable in every ATS Environment
  (small(est), medium, big, obsolete, or advanced infrastructure…)
- Maximum Support of the AMHS Migration
  ("online", without stopping the service)

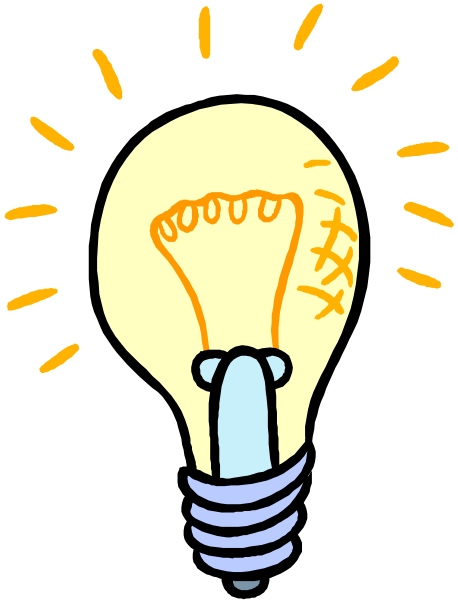
Long-Term Mixed Operation of AFTN and AMHS



Standard (Fragmented) Solution – Suitable ?

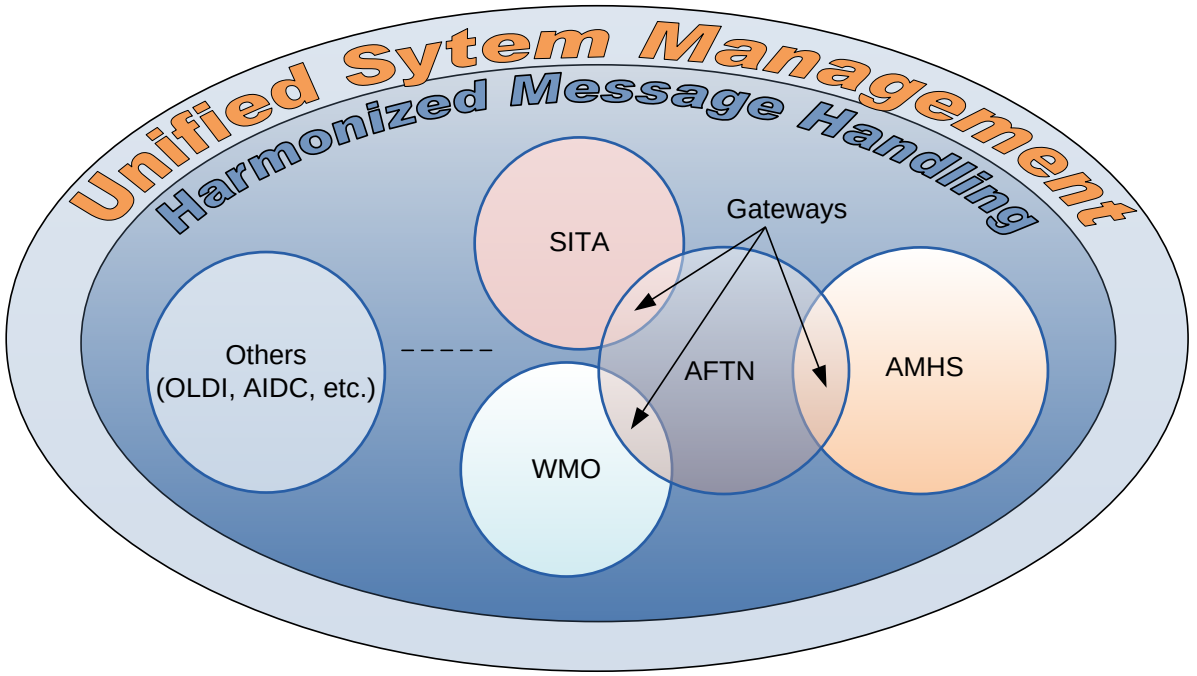


The Solution



Integrated System

AIDA-NG – Integrated Messaging Services



100% Compliance to Standards

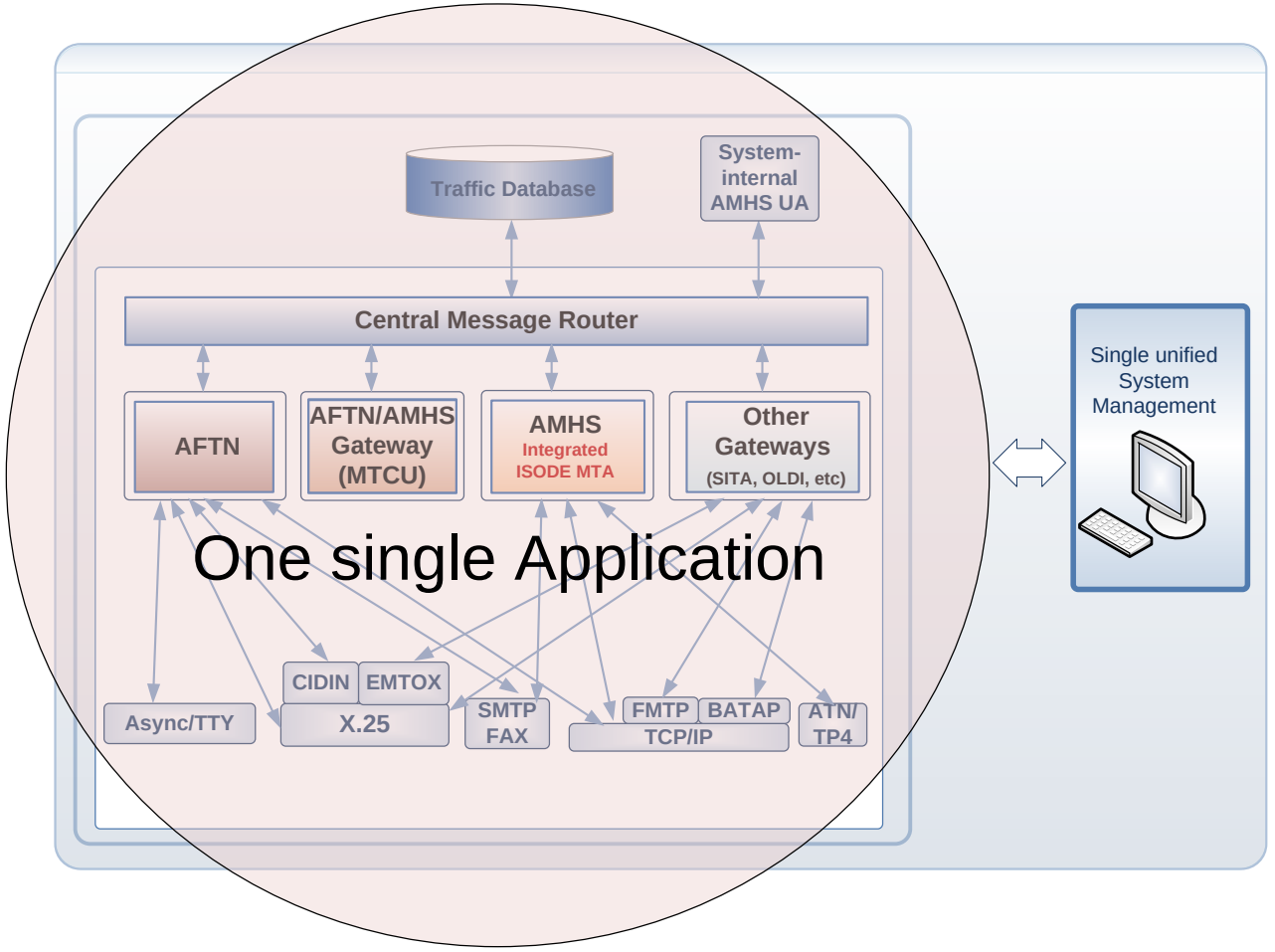
EUROCONTROL

World Meteorological Organization
Working together in weather, climate and water

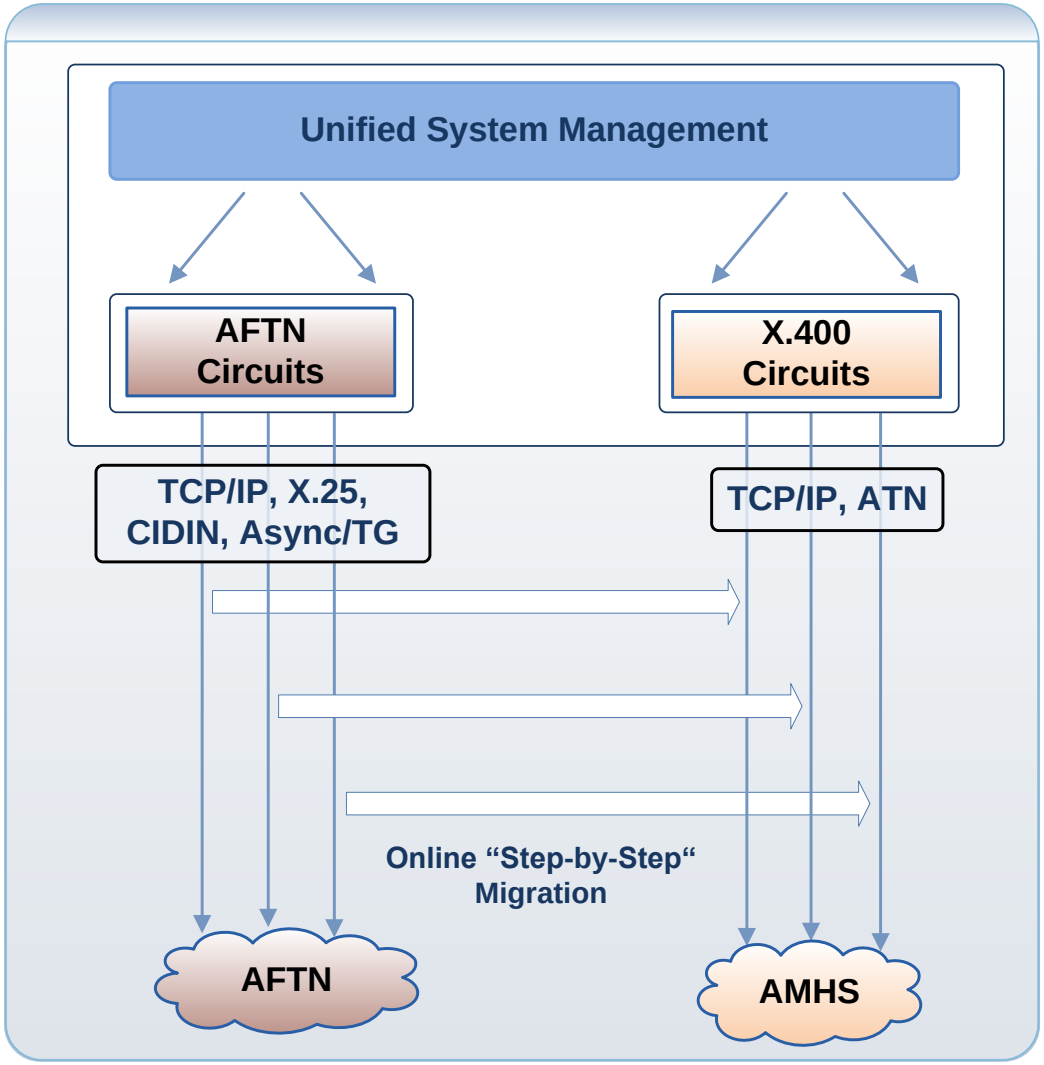
+

- ✓ **100% Integration of all messaging entities (AFTN, AMHS, SITA, WMO, OLDI, others)**
- ✓ **Harmonised Message Handling (AFTN,AHMS,SITA,WMO, OLDI, others)**
- ✓ **Unified System Management**

AIDA-NG Strong Point – Horizontal/Vertical Integration

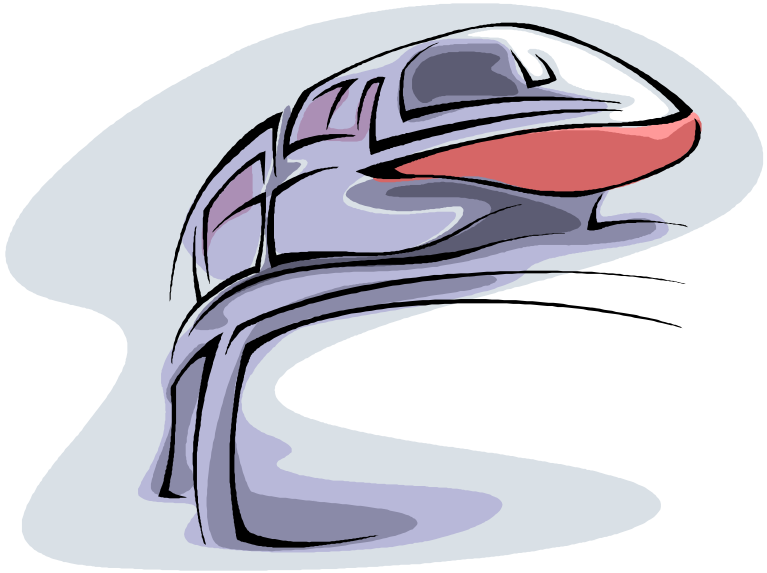


AIDA-NG Strong Point - AFTN to AMHS Transition Support



AIDA-NG Performance Values

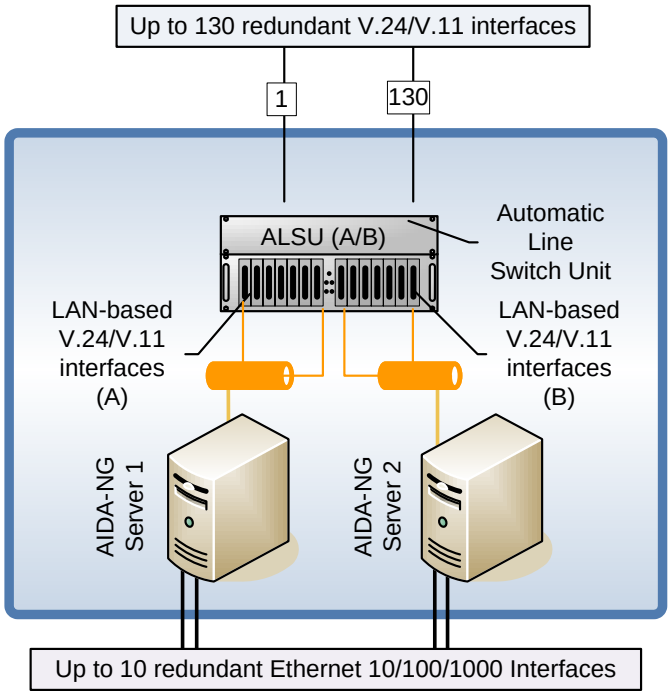
- Platform
- Protocols/Messaging
- Throughput
- Reliability
- Maintainability
- Robustness
- Extended Supervision



Server-Based Platform

- Integrated on Intel® processor-based servers and workstations of various vendors (IBM, HP, DELL, etc.)
- RED HAT Linux Enterprise Distribution (Scientific Linux)
- Fast real-time database of any capacity
- X-Windows and Java-based GUIs

AIDA-NG Strong Point - Interfaces and Protocol Stacks



Messaging Interfaces supported in "one system":

- Up to 130 serial redundant V.24/V.11 interfaces:
  - AFTN/ASYNC (direct, leased lines)
  - AFTN/Telegraphic Interface
  - AFTN/X.25 (PVC/SVC)
  - CIDIN/X.25 (PVC/SVC)
  - WMO/X.25 (PVC/SVC)
  - OLDI FDE ICD (X.25 SVC)
  - SITA/BATAP/EMTOX (X.25 PVC/SVC)
- Up to ten Ethernet LAN 10/100/1000 Interfaces
  - AFTN/TCP/IPv4,6 (bilateral agreement)
  - AFTN/SOAP
  - AMHS P1/ATN (via ATN Router)
  - AMHS P1,P3/TCP/IPv4,6
  - AMHS SOAP **(Service for SWIM)**
  - FMTP (TCP/IP)
  - SITA/BATAP/MATIP (TCP/IP)

AIDA-NG Strong Point – Additional Gateways

- **AFTN/SITA Gateway**

Conversion of AFTN messages ←→ SITA messages

- **AFTN/E-mail Gateway**

Connection to E-mail Server via SMTP/POP3

Conversion of AFTN messages ←→ E-mail

- **AMHS/E-mail Gateway**

Conversion of AMHS Messages ←→ e-mail

Full support of extended services (attachments)

Generic/individual conversion configuration

- **E-mail/FAX Gateway**

Conversion of E-mail ←→ FAX (G3)

Fully applicable for the AFTN/AMHS ←→ E-mail GW

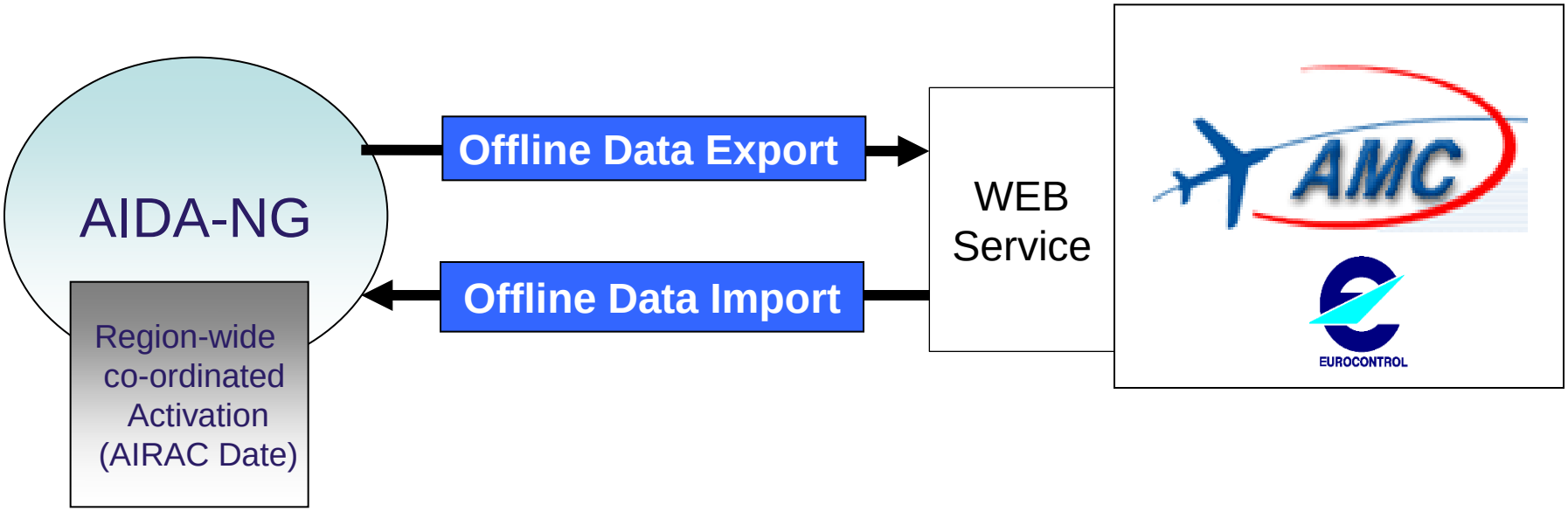
- **OLDI/FMTP Gateway**

Conversion of FDE ICD ←→ FMTP

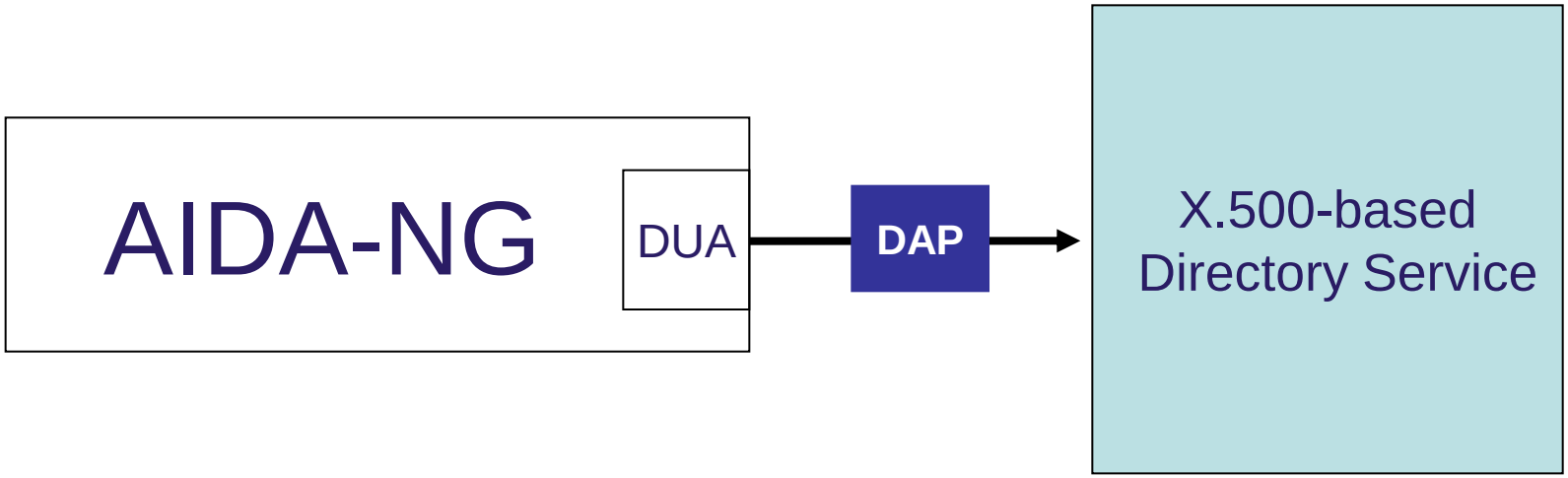
AIDA-NG Strong Point – Access to the EURCONTROL AMC

EUROCONTROL ATS Messaging Management Centre ***AMC***

Centralized Information Database for all ATN users with "offline" access via WEB interface

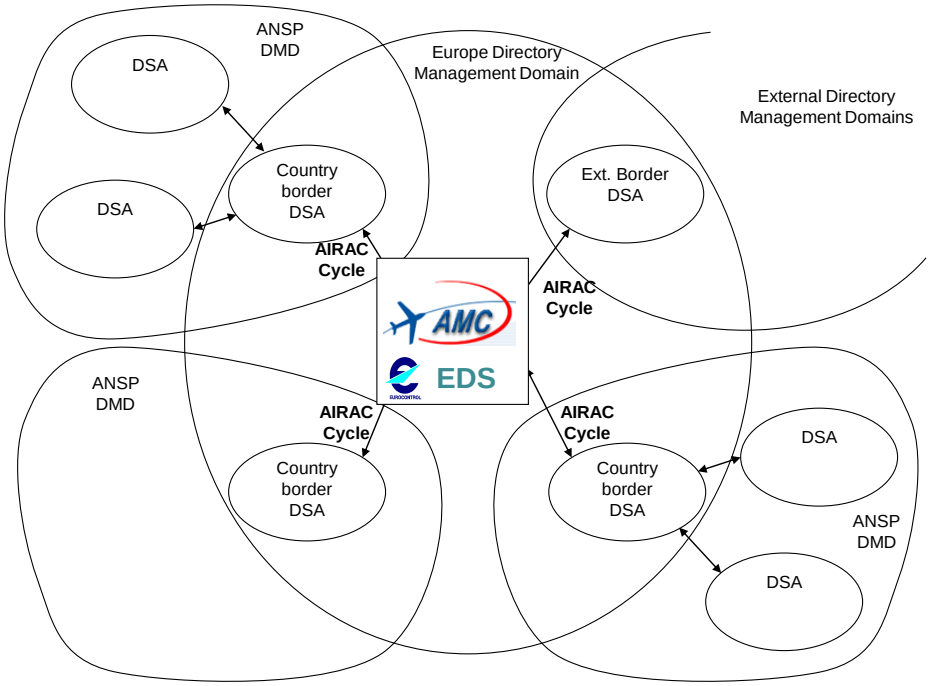


Strong Point – Access to the Directory Service



AIDA-NG Strong Point – EDS Extension

EDS – X.500-based European Directory Service



COMSOFT is the EDS key supplier to EUROCONTROL

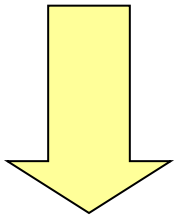
Throughput Figures Example

Scenario	Source: European Customer, Peak Load Measurement

Traffic in/out **Required Throughput:** **15 Million Messages / Day**	AMHS: 100 msg/sec in, 200 msg/sec out AFTN: 70 msg/sec in, 140 msg/sec out Total: 170 msg/sec in, 340 msg/sec out
AFTN/AMHS G/W Traffic	AMHS/AFTN: 50 msg/sec AFTN/AMHS: 50 msg/sec
Average msg length	1000 bytes
Queuing	No
Average Transit Time	AFTN → AFTN: 15 ms AFTN → AMHS: 200 ms AMHS → AFTN: 200 ms AMHS → AMHS: 500 ms average: 300 ms
Command Response Time	< 2 sec

Strong Point - Message Congestion Handling

- ✓ System can hold more than 250,000 pending messages (AFTN/AMHS) in transmission queues
- ✓ Switching Performance and System Access is not degraded under this load
- ✓ System is fully protected against overload by flow control mechanisms



Manual Contingency Procedures on message level (e.g. a message drain function) are not required

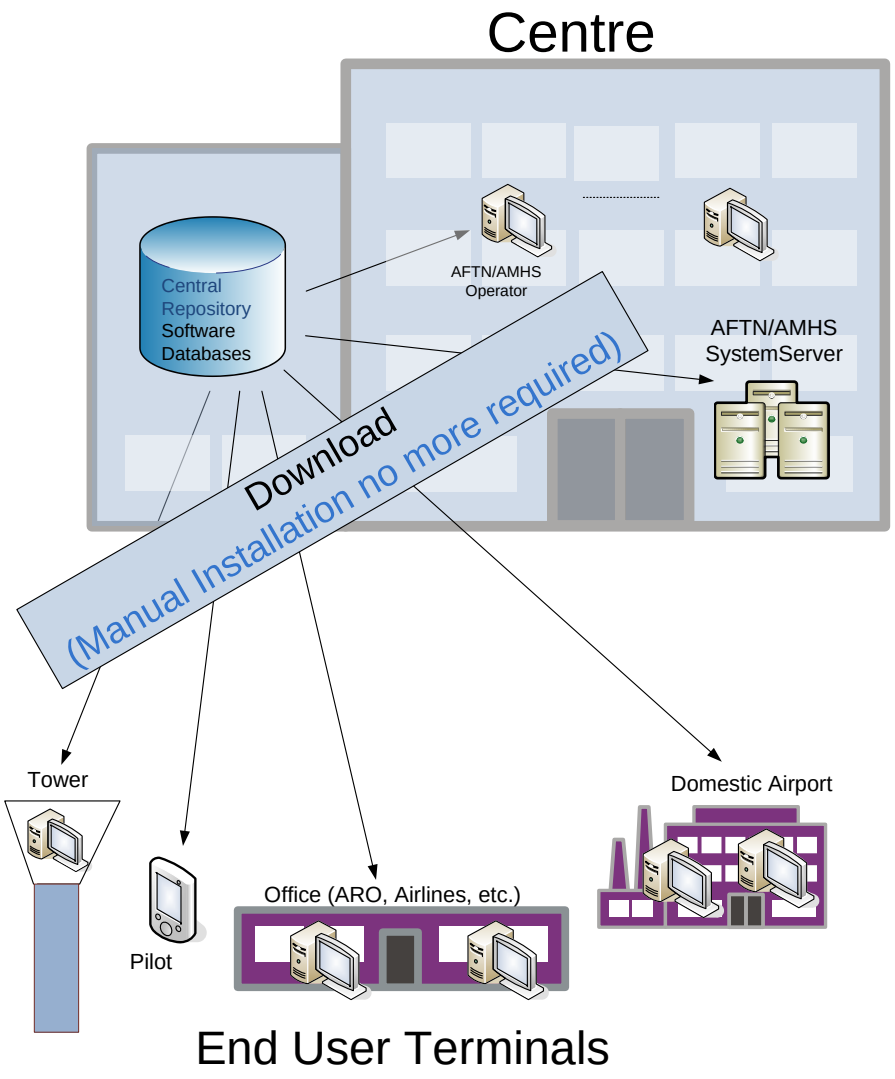
AIDA-NG/CADAS – System Availability (April, 2013)

Excerpt of Customer Installations	Number of Operational Systems	Operational since ...	Number of operational hours/total
Germany	1	Mar-02	98400
Bosnia and Herzegowina	2	Dec-02	183600
Libya	1	May-04	79392
Eurocontrol CFMU	2	Nov-04	149952
Philippines	1	Dec-05	65496
United Kingdom	1	Jun-06	61128
Macedonia	1	Jul-06	60408
Serbia and Montenegro	1	Nov-06	57456
United Arabian Emirates	1	May-07	53112
Singapore	1	Jun-07	52368
Australia	1	Jul-07	51648
Oman	1	Nov-07	48696
Morocco	1	Dec-07	47976
Slovak Republic	1	Apr-08	45048
Egypt	1	Nov-08	39912
Total for all sites	17		912960

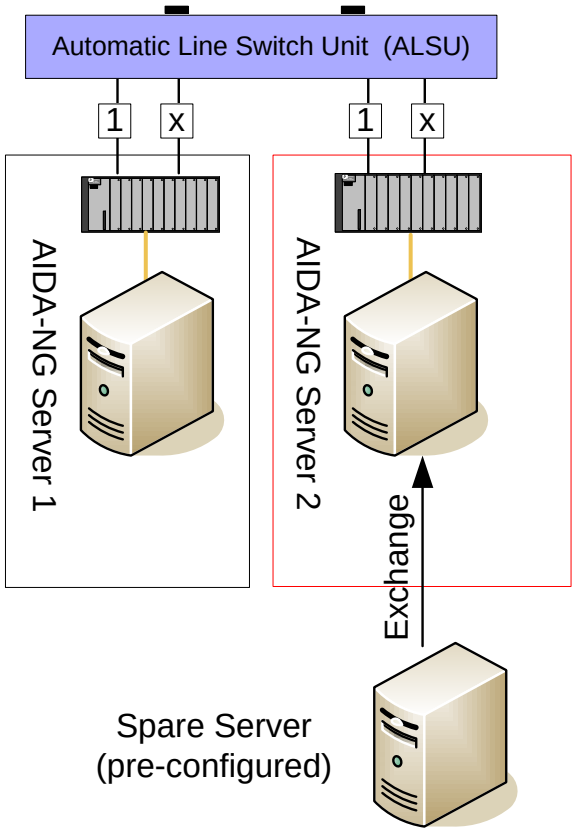
Field-proven system availability: > 99,999945%

AIDA-NG – System Maintainability

Central Boot/Configuration/Software Server



AIDA-NG Strong Point – Example Server Exchange



Exchange of a spare server can be done in two steps:

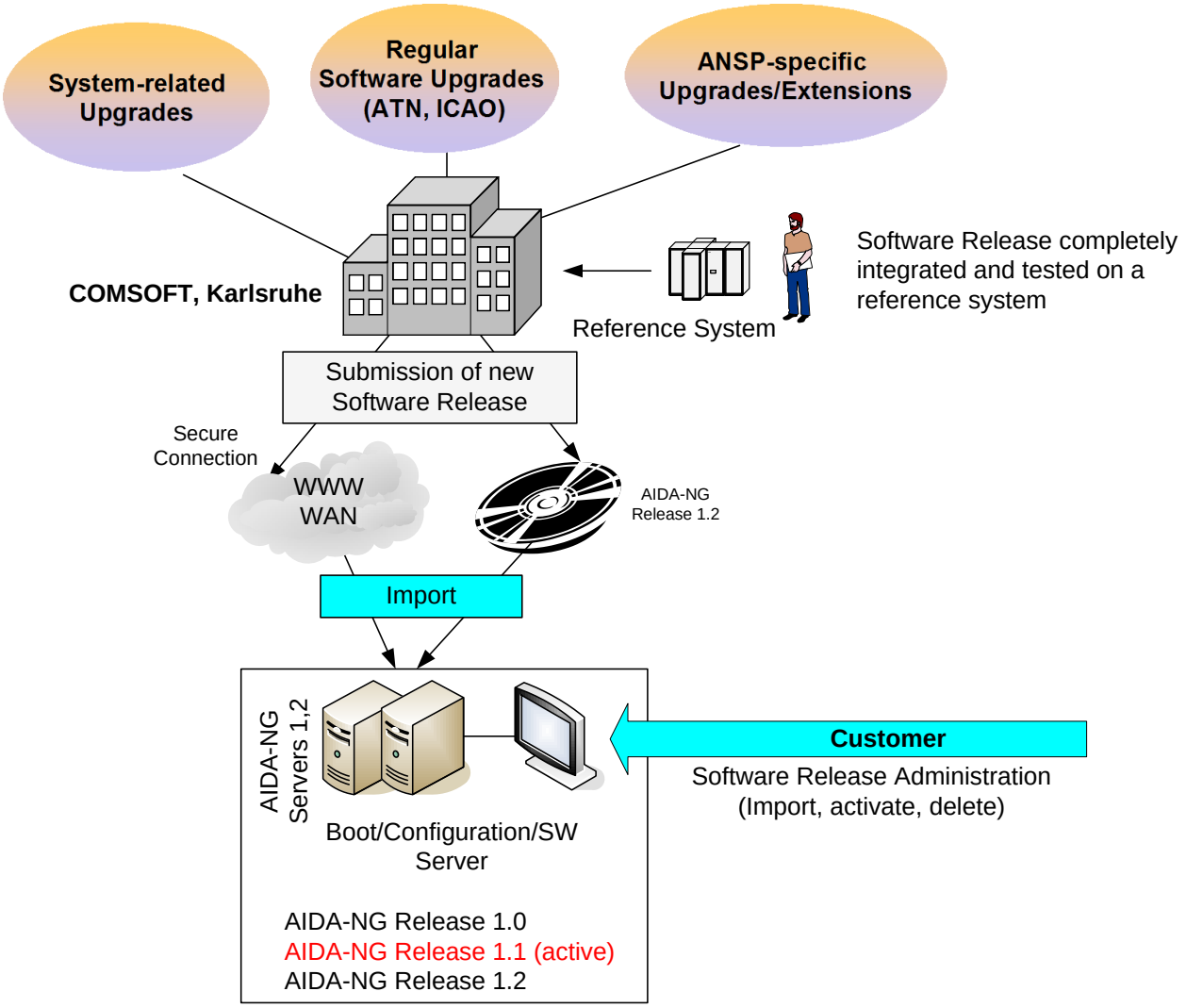
1. Configure spare server via basic installation CD (5 minutes)
2. Reboot spare server

✓Exchange can be done in approximately 10 minutes

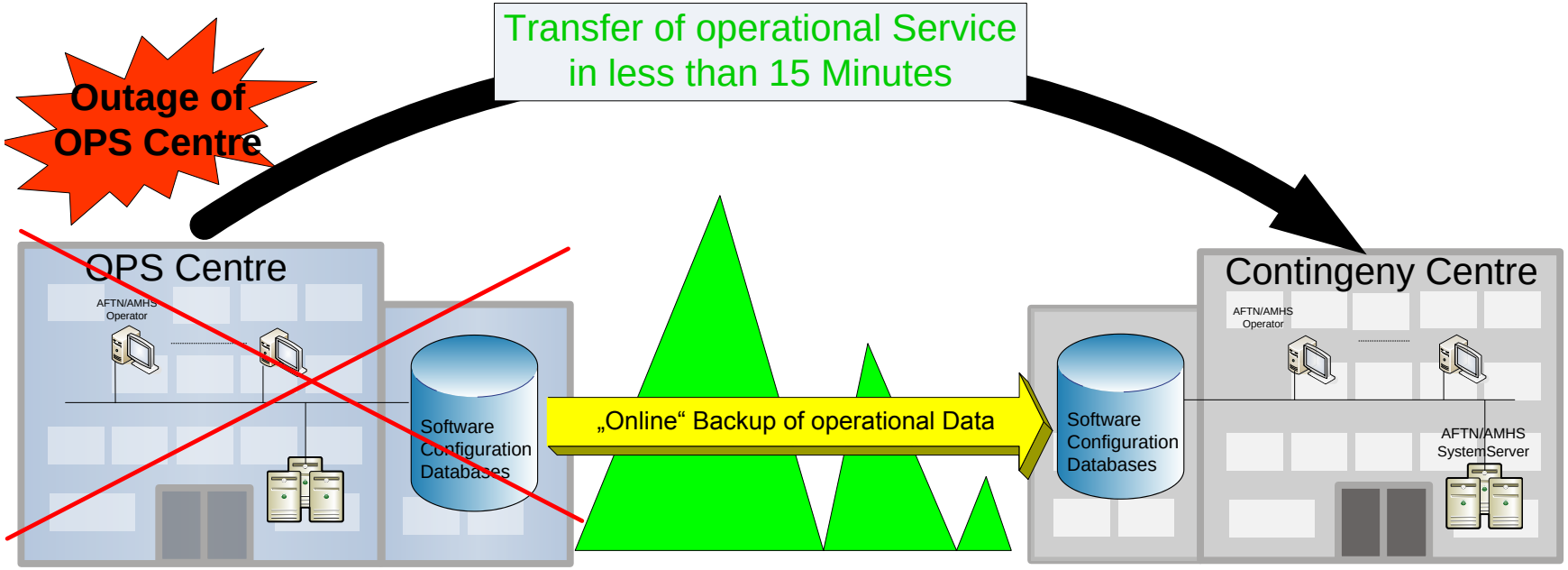
✓Installation of software, configuration, databases, etc. is not required

✓No interruption of service during exchange of the server

AIDA-NG – Strong Point - Software Maintenance



AIDA-NG Strong Point - Dual Site Handling



In Operation – AIDA-NG Dual Site Configuration Australia

Operational System: **Brisbane**

Contingency System: **Melbourne**

Transfer of service from Brisbane to Melbourne was executed within 30 minutes

Strong Point - Unrivalled Benefits for Users

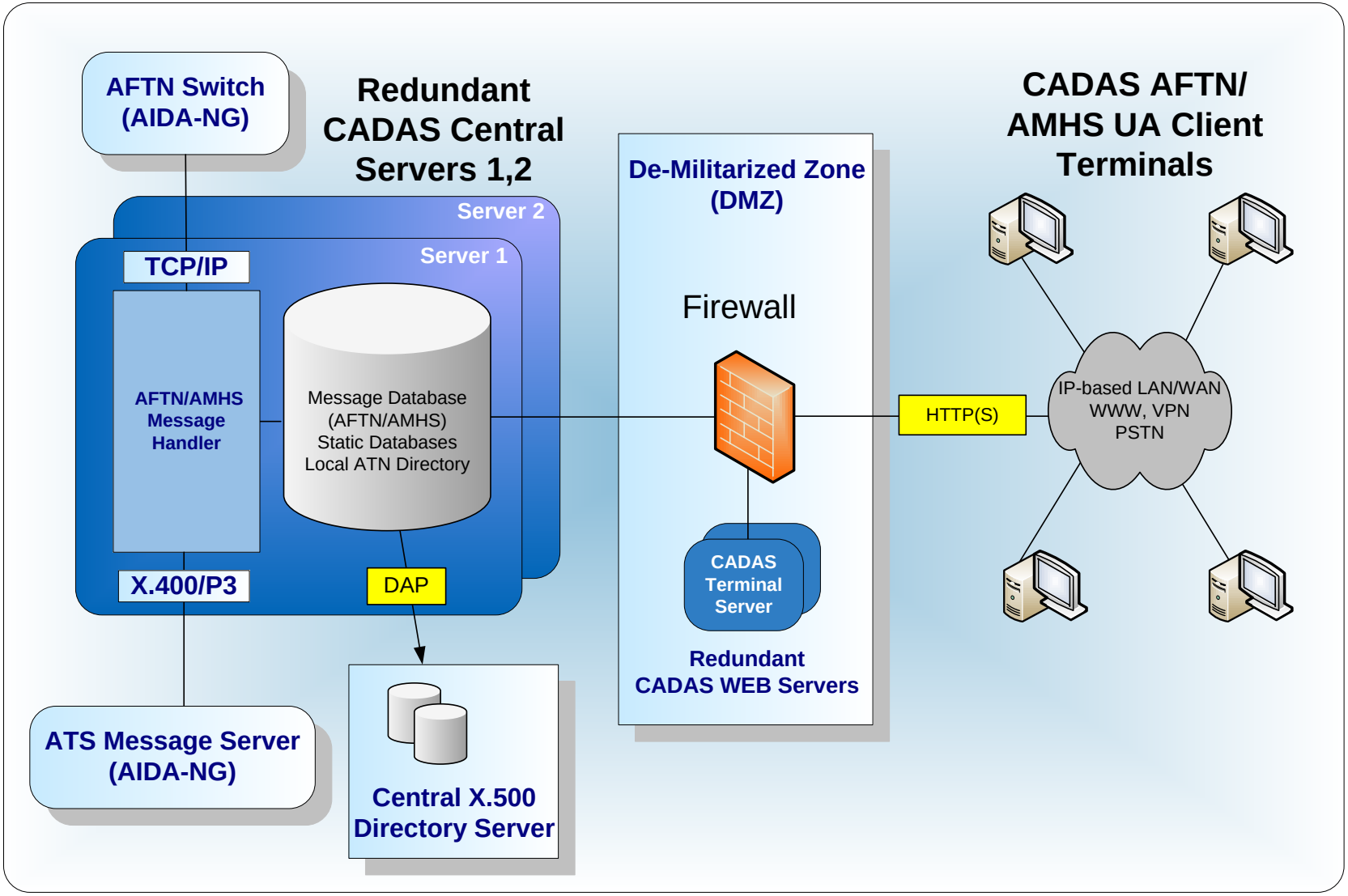
- ✓ Redundancy without any single point of failure
- ✓ Complete System Switchover in < 5 sec
- ✓ Fully integrated and tuned X.400 COTS product (redundancy, stability, throughput, extended queue handling, diagnostics, etc.)
- ✓ Unified System Management (AMHS, AFTN, legacy part, X.400, etc.)
- ✓ 100% protection against overflow situations
- ✓ Unmatched high message throughput
- ✓ Dual Site Operation/Contingency Management

CADAS

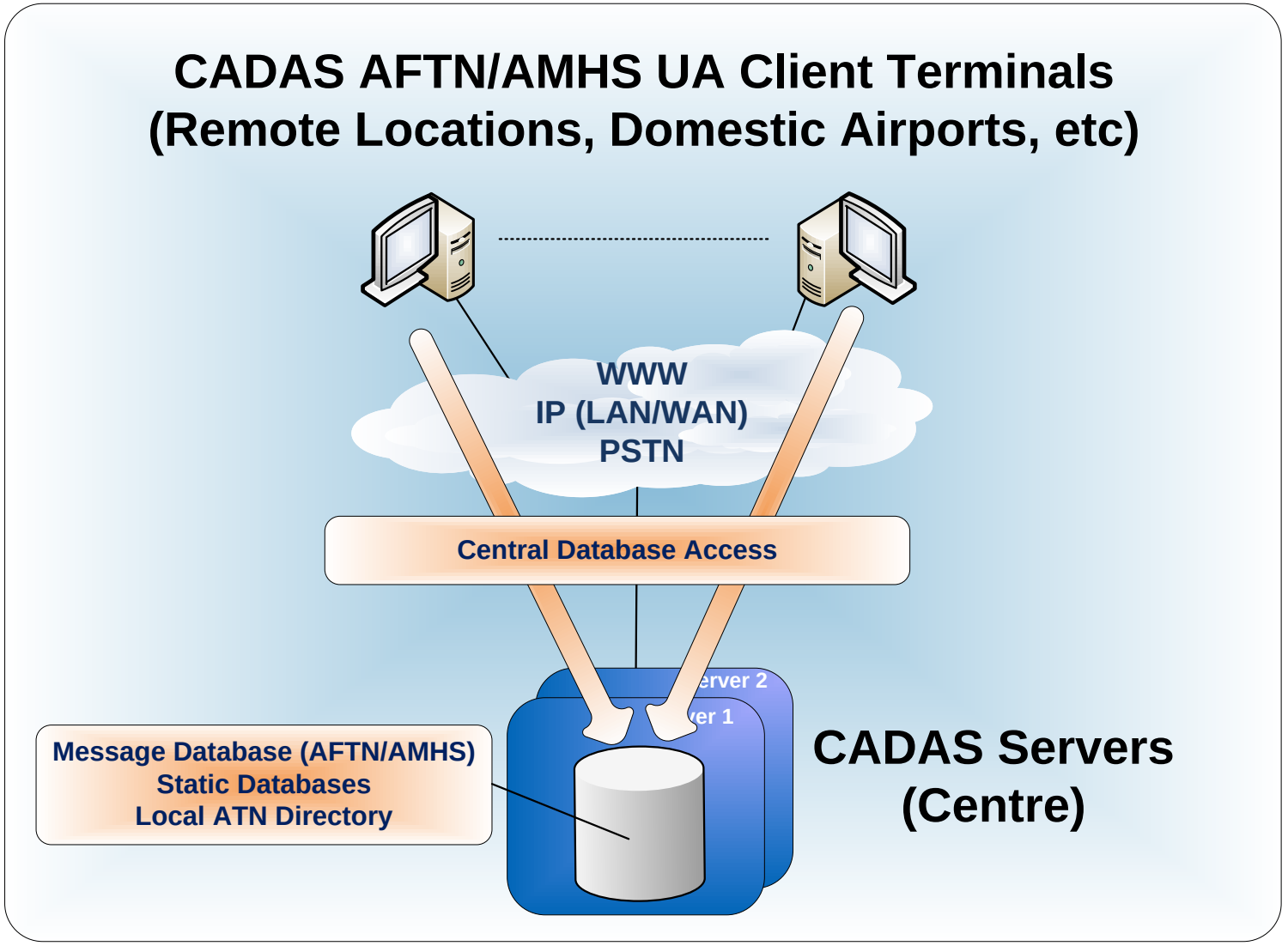
COMSOFT Aeronautical Data Access System

COMSOFT's advanced client/server-based ATS Terminal System

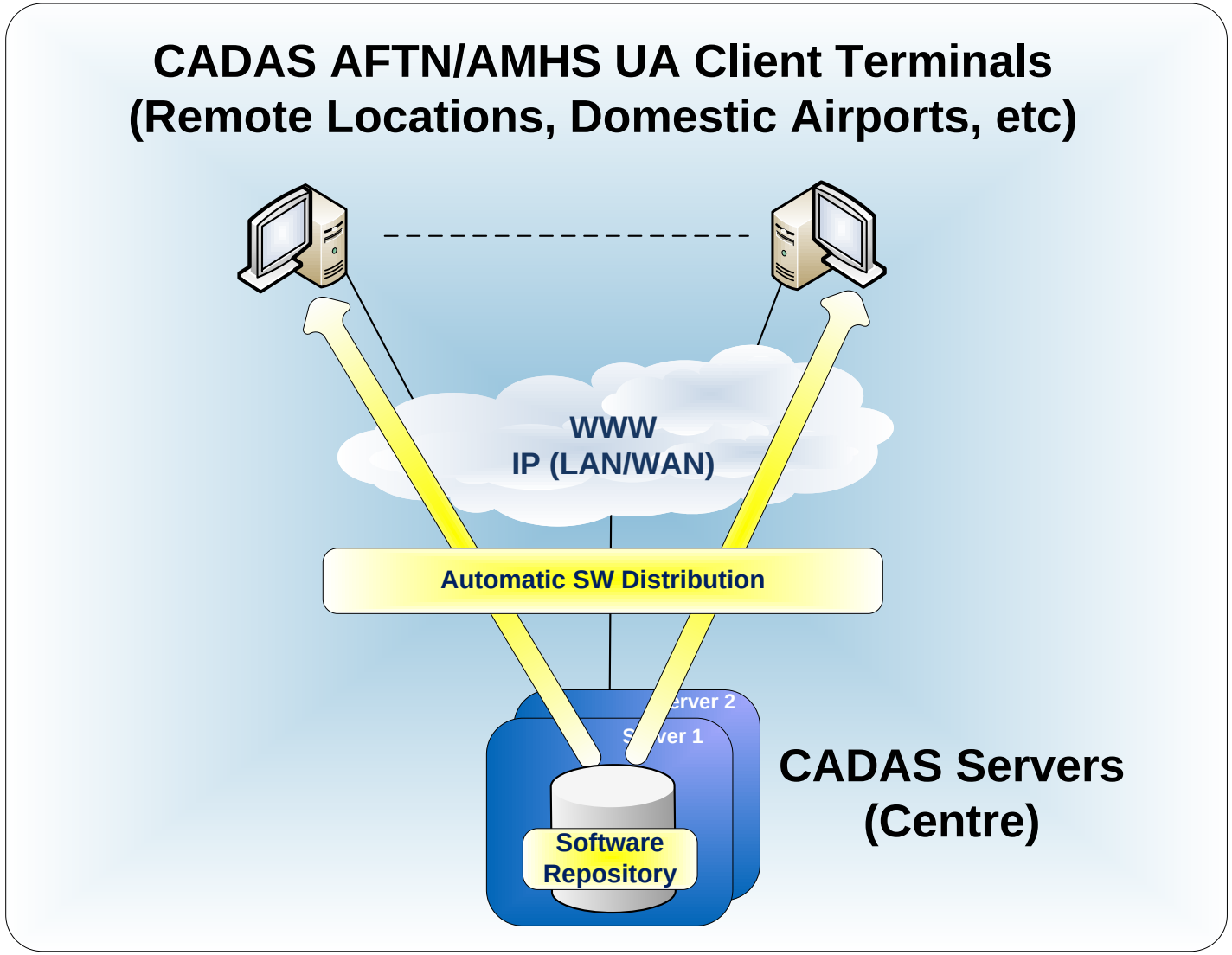
CADAS – Client/Server Terminal System with ATS/AFTN or ATS/AMHS UA Client Terminals



Strong Point - Client/Server System Database Access



Strong Point - Client/Server System Software Maintenance



CADAS-ATS Security I

- CADAS security has been made bullet-proof in order to provide secure access to ATS over the Internet
- Messaging solutions based on SMTP cannot compete with CADAS' security, ease of use and richness of functionality

Strong password checking
Pass phrase
Idle timer
Local cache clearance
Account locking on break-in attempts
Disclaimer

CADAS-ATS Security II

CADAS' Internet security has been validated by independent IT Security Consultants

Procedures:

- Analysis of system design and communication protocols
- Hacking attempts over Internet and local network

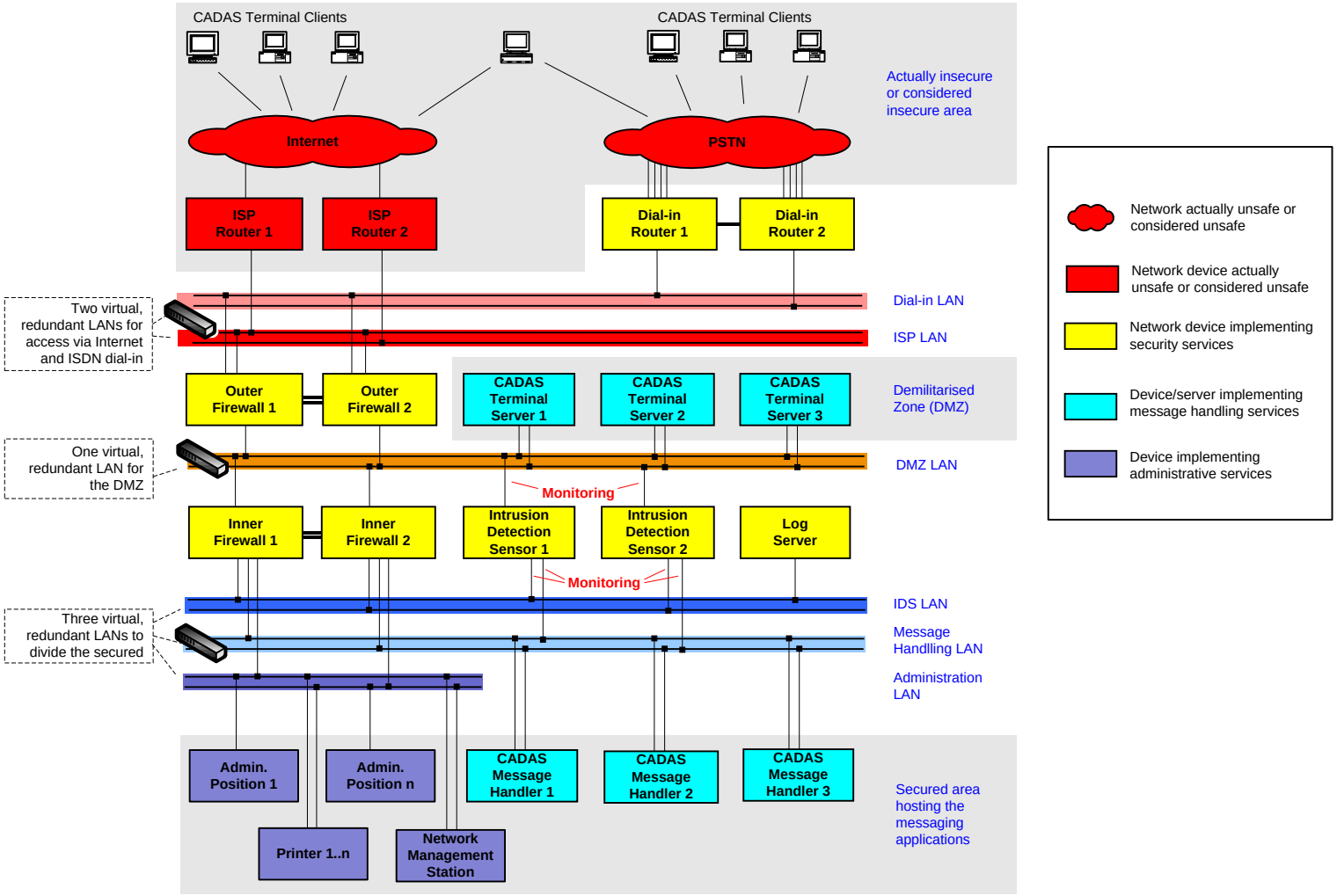
Outcome:

- CADAS does not exhibit any known security breaches and is immune to security threats

Conclusion:

- CADAS can be safely used over the Internet for nation-wide services

Security Framework



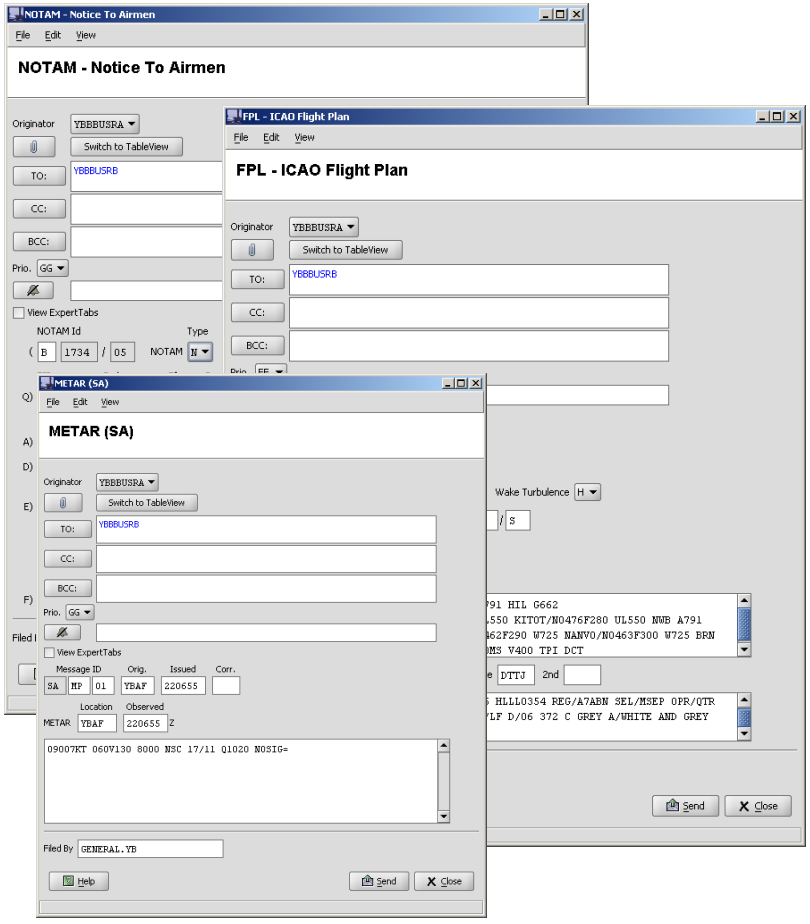
CADAS – Terminal Applications

- Centre Terminal
  Full Scope of ATS Functions for ATC Controllers, Tower, ARO, Airlines
- ATS Terminal
  Management of ATS Messages (FLP+ associated, NOTAM, METEO, free text)
- Pilot Terminal
  Proposal filing (FPL, DLA, CHG, CNL), Active flight monitoring
- Flight Strip Printing Terminal
  Automatic generation, update and printing of flight strips
- Administration Terminal
  Supervision, control and configuration of the entire system

Full support of both ATS Formats

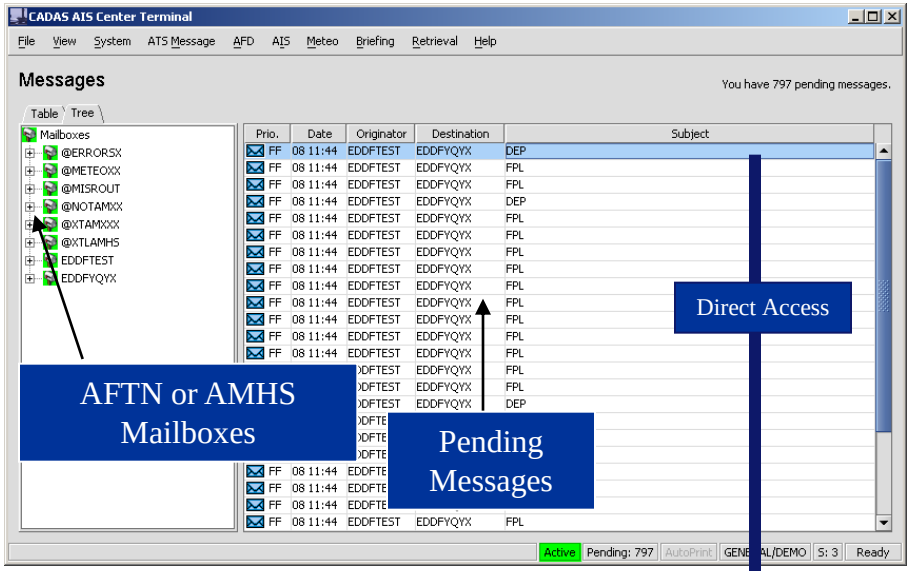
- ICAO DOC 4444 edition 15
- Amendment 1 to DOC 4444 edition 15

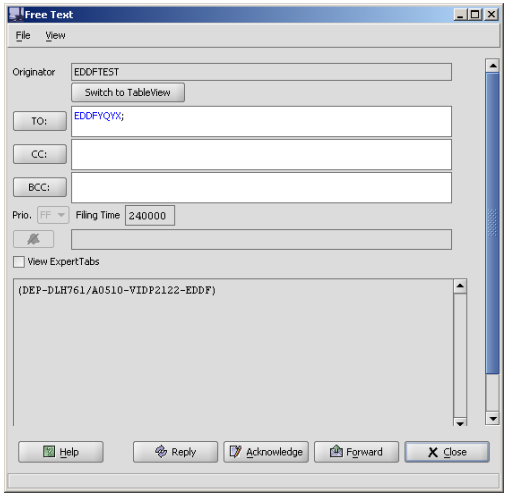
CADAS – ATS Client Terminals (AFTN or AMHS)



- Platform-independent Java Application
- "Online" monitoring of incoming messages (AMHS or AFTN)
- Syntactic/semantic checking of received messages with type detection (FPL, NOTAM...)
- Template-specific view of received messages
- Automatic printout of incoming/transmitted messages
- Templates for all kinds of ATS messages (FPL+ associated, etc.) with online checking mechanisms
- Highly sophisticated message retrieval function with a multitude of filter criteria
- Support by central static databases (aircraft types, flight routes, FIRs, aerodromes, etc.)

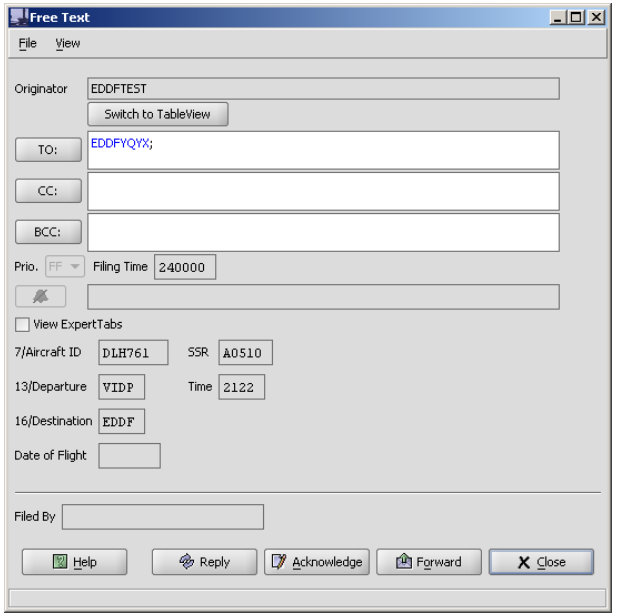
CADAS ATS Client Terminal – Mailbox Monitoring





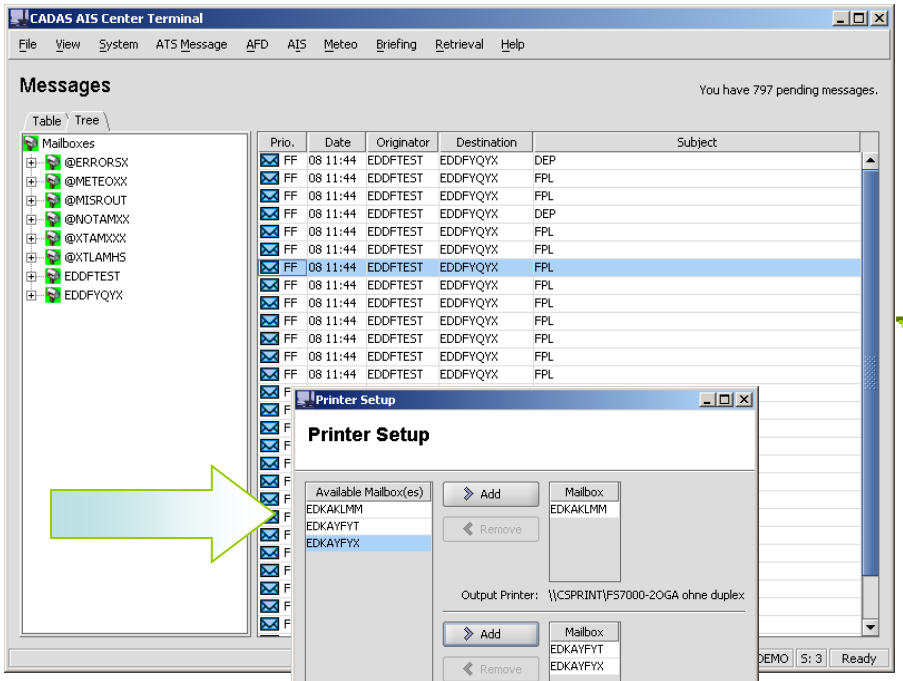
Free Text Processing

Template Processing



- Pending messages (AFTN or AMHS) can be directly accessed and processed
- Several mailboxes can be monitored simultaneously

CADAS ATS Client Terminal – Message Printing



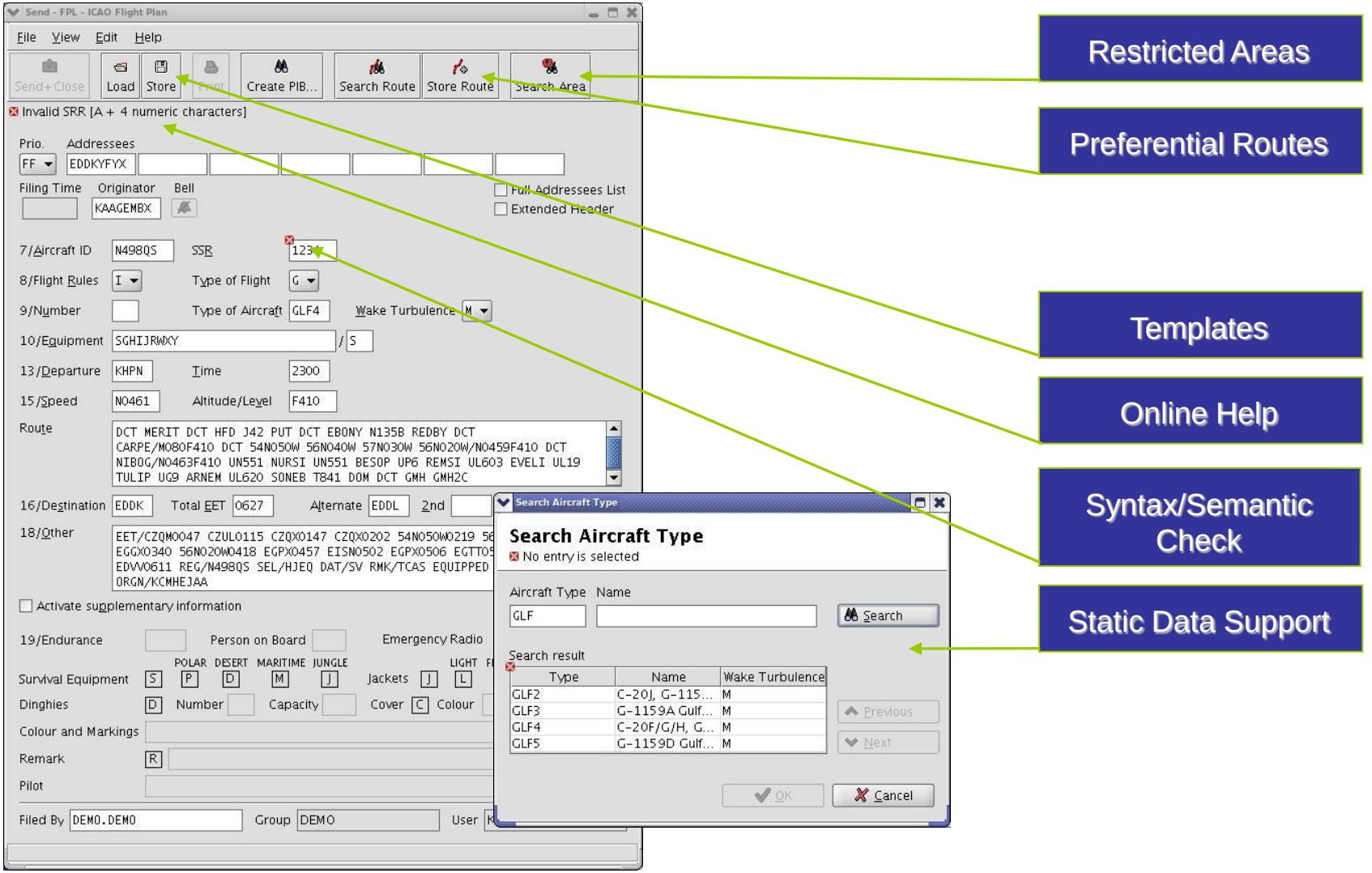
EDKAYFYT ⇒ System Printer 1:

EDKAYFYX ⇒ System Printer 2:

EDKAKLMM ⇒ System Printer 3:

- Automatic printing of messages according to Printer Setup
- Up to three printers can be assigned for auto printing on each Terminal

CADAS ATS Client Terminal - FPL Management



Restricted Areas

Preferential Routes

Templates

Online Help

Syntax/Semantic Check

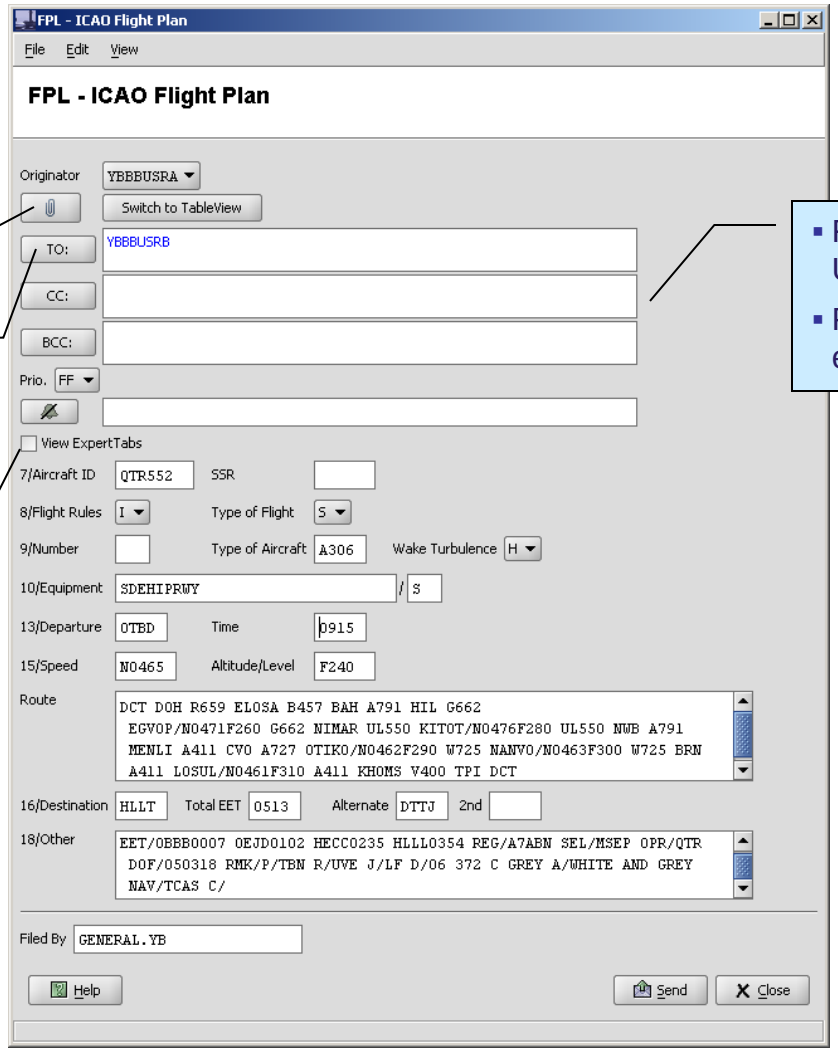
Static Data Support

Strong Point CADAS ATS Client Terminal – Integrated AMHS Functionality

Attachment

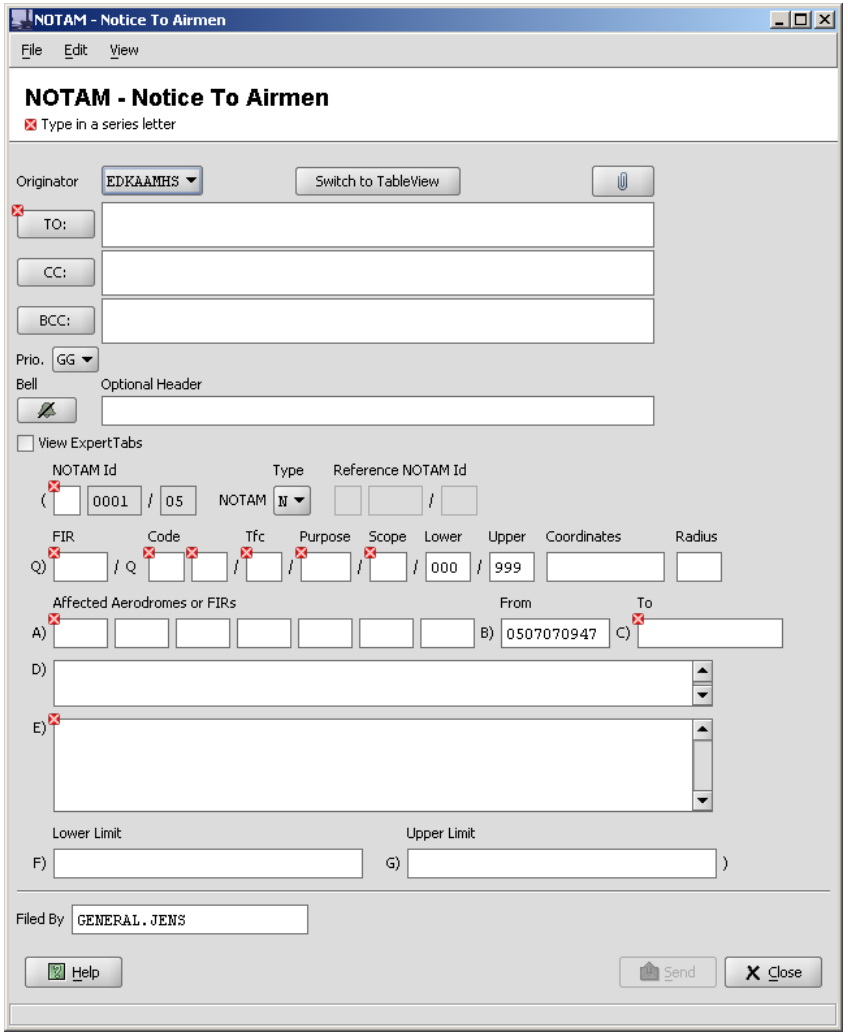
Access to central address book

Display/hide AMHS Attributes



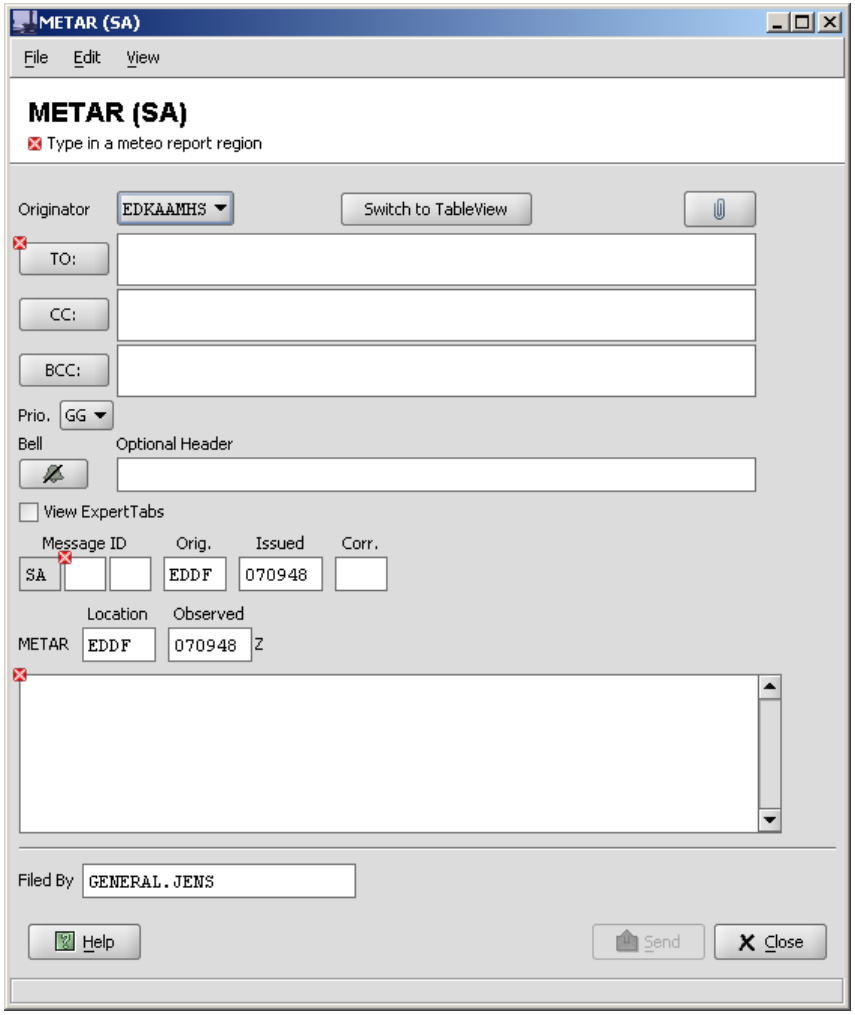
- Fully integrated AMHS User Agent
- Practically invisible to the end user

ATS Terminal – Creation of NOTAMs



- Auto NOTAM Series number allocation,
- Message Templates:
  - NOTAM N/R/C
  - SNOWTAM
  - ASHTAM

ATS Terminal – OPMET Templates



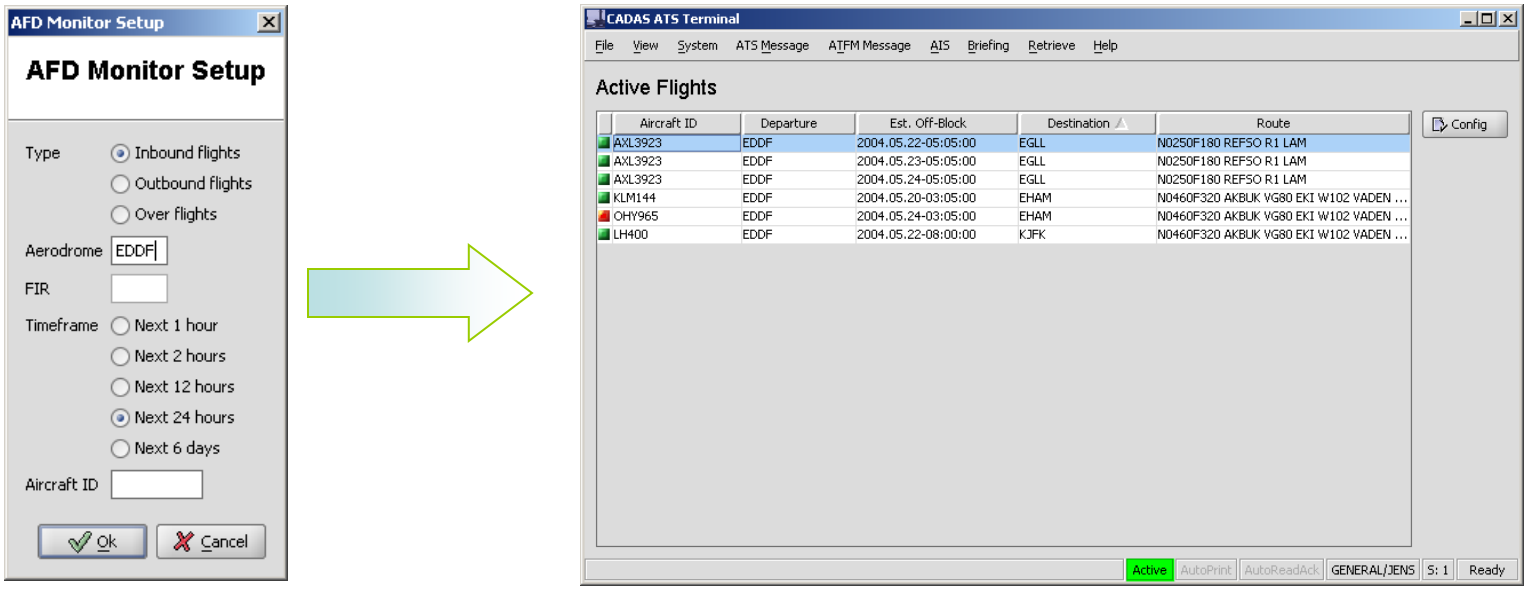
- Sophisticated retrieval mechanism with a multitude of selection attributes available
- METEO Message Templates with formatted Inputs and online field checking mechanisms
- Various message templates including:
  - METAR
  - SPECI
  - SIGMET
  - AIRMET
  - TAF

CADAS – Extensions

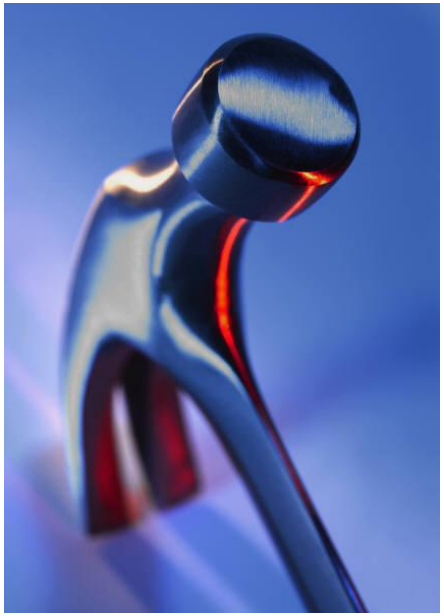
Active Flight Database

Active Flight Database

- Online monitoring of Inbound, Outbound, and Over-Flights
- Configurable time window
- Callsign filter and sorting criteria
- List of ATS message history of each flight



Services - How you get it



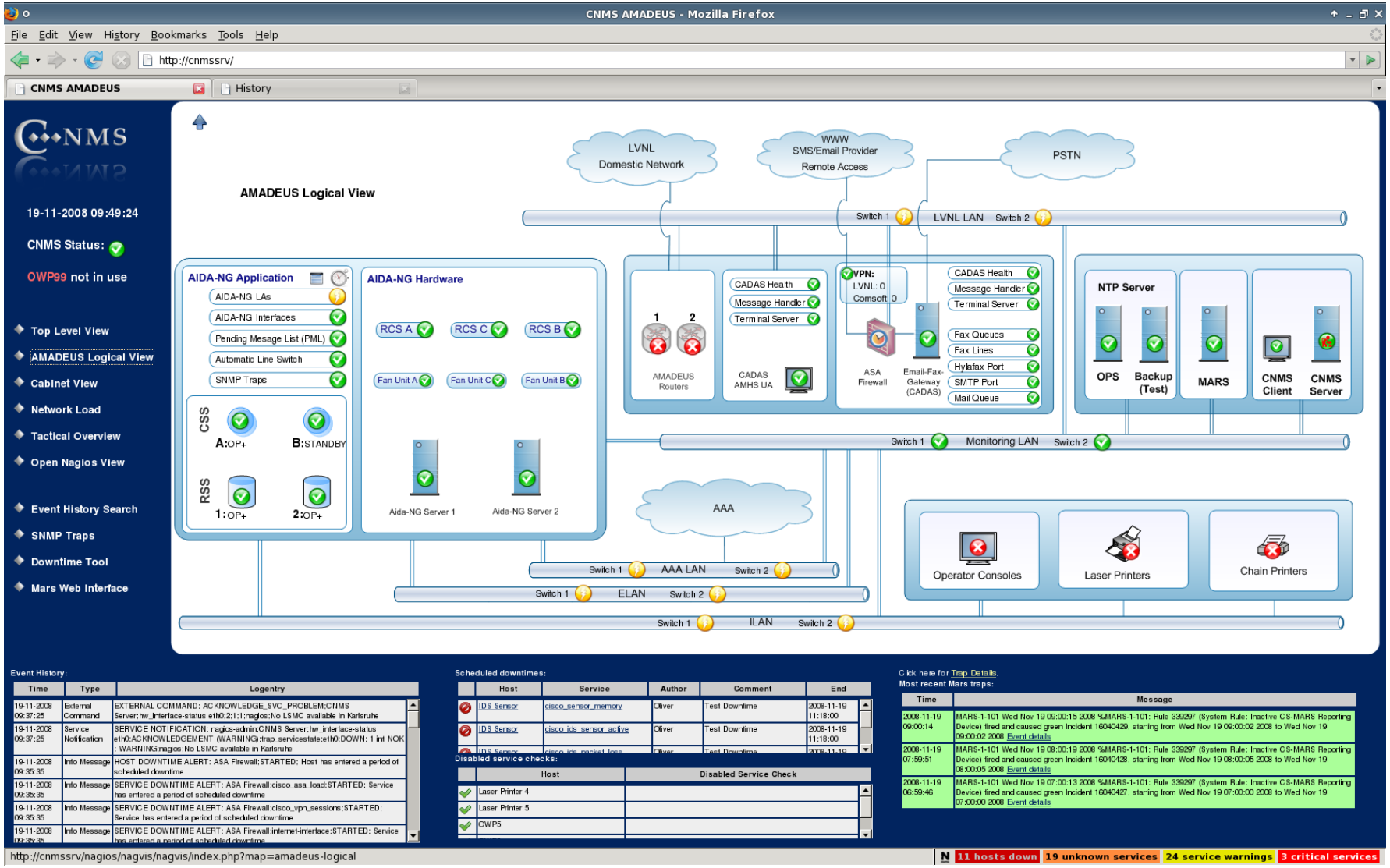
COMSOFT delivers "turnkey" solutions

Services – "Turnkey" Solution – Example

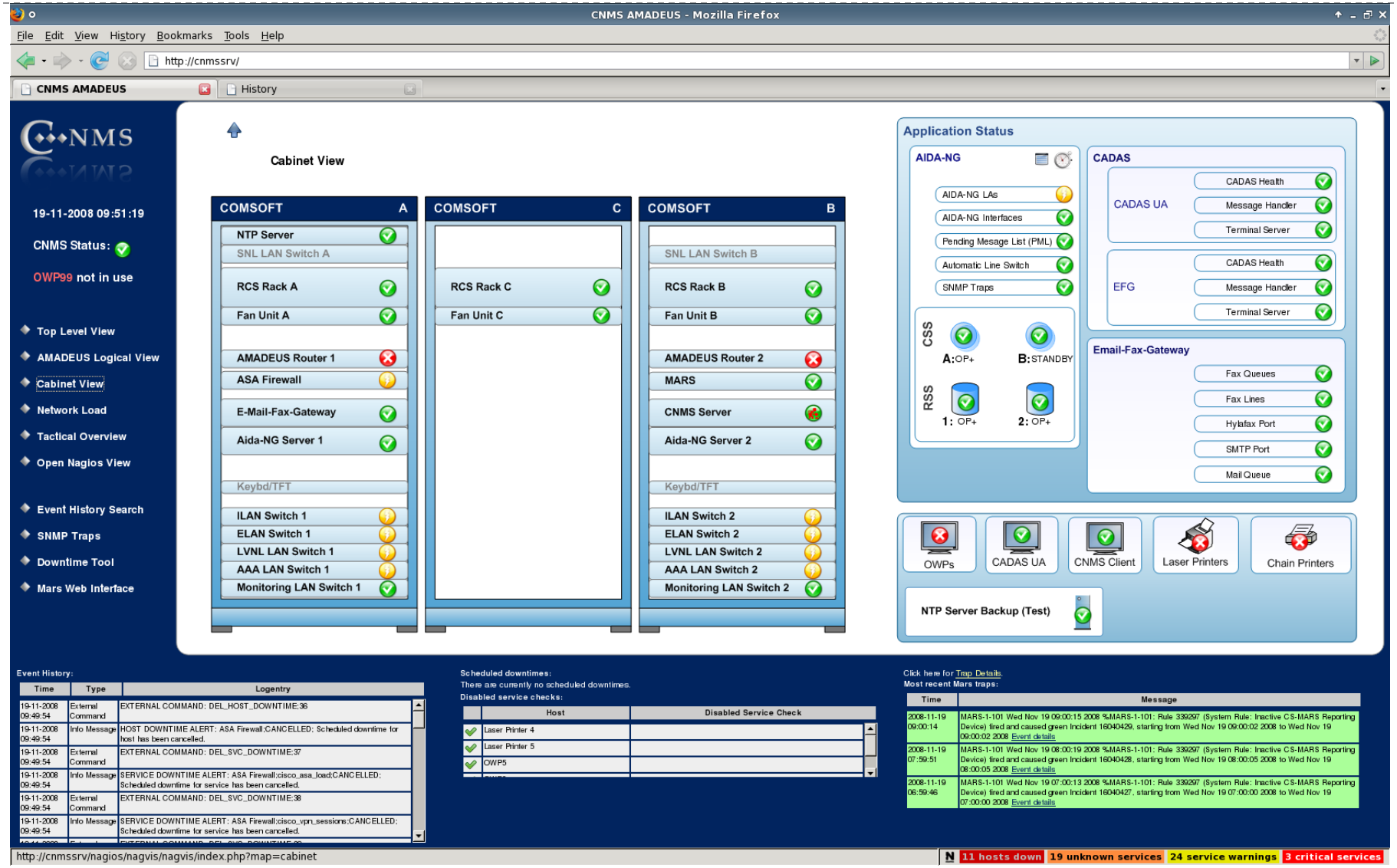
Valuable Add-On: COMSOFT Network Management System

Central Supervision of the entire Location

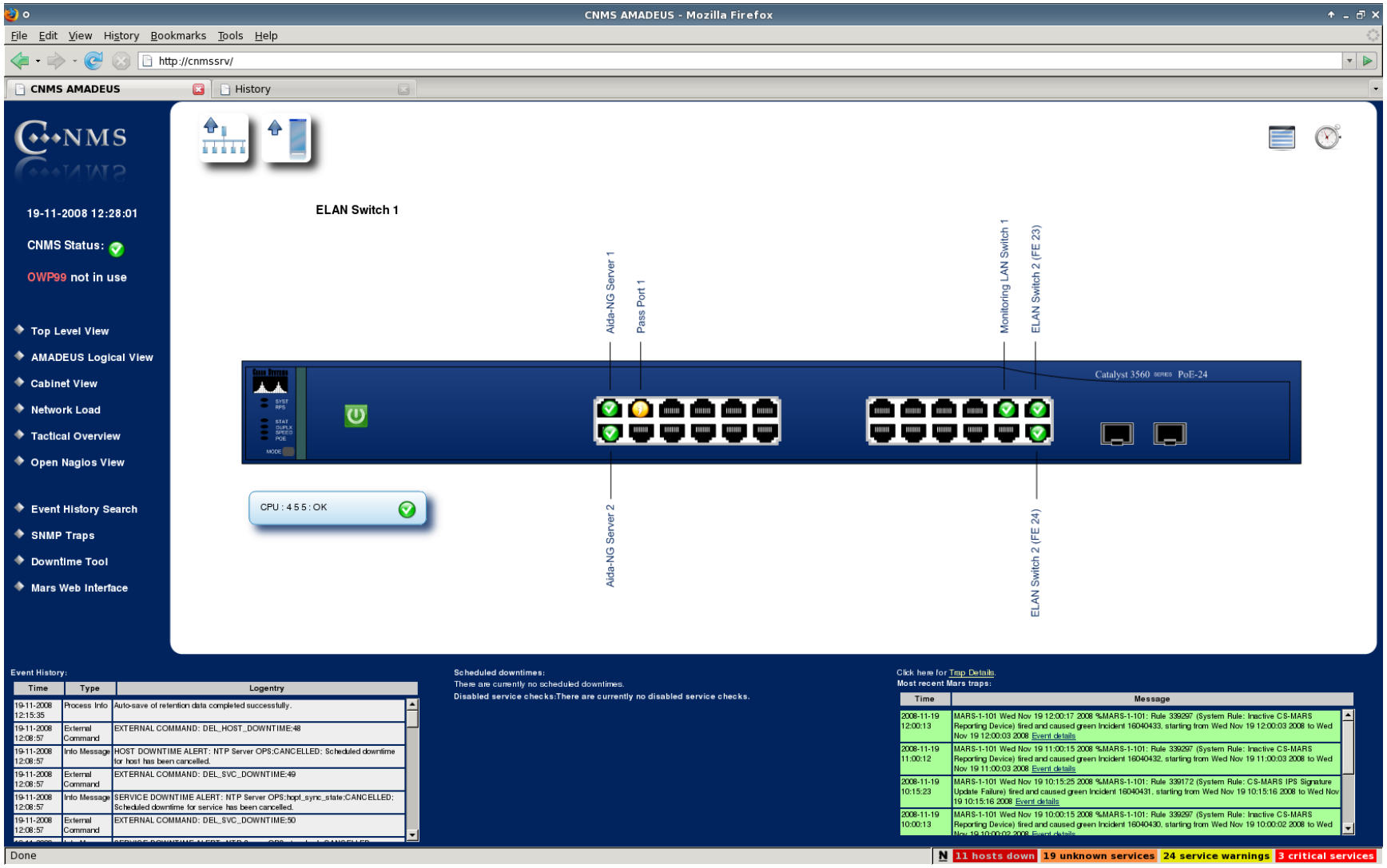
CNMS – Central Supervision of Components – Logical View



Central Supervision – Cabinets



CNMS – Central Supervision of Components - Switches

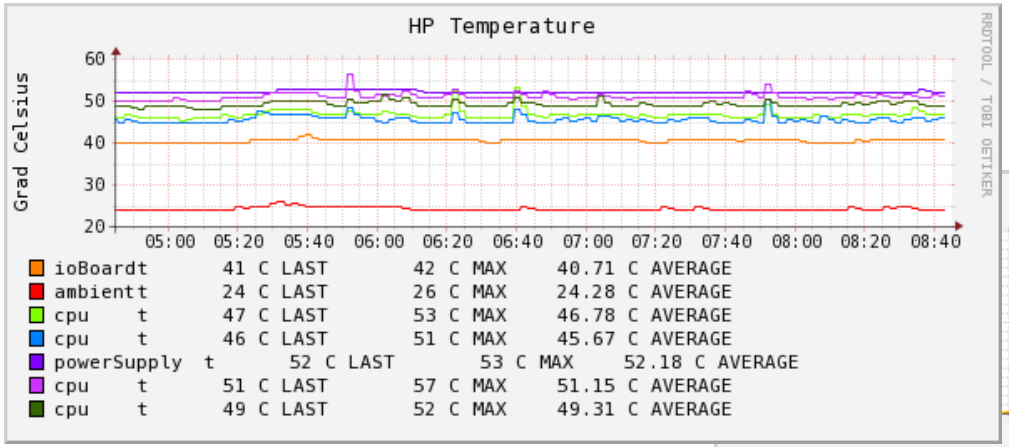


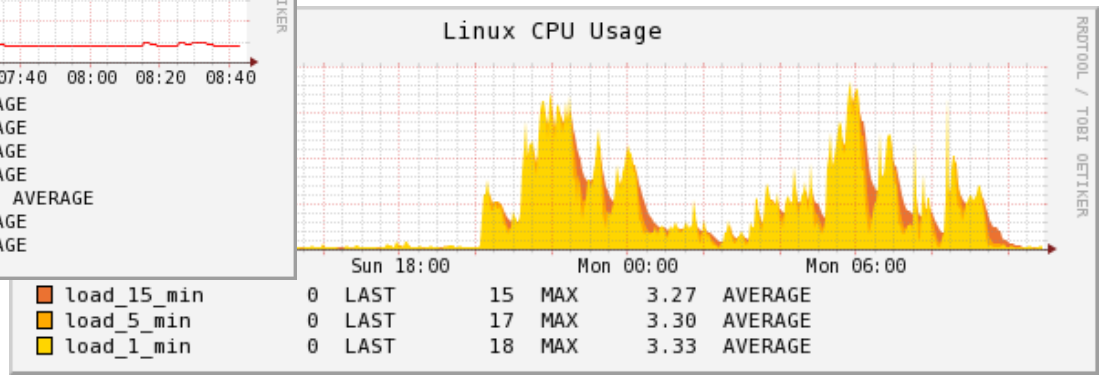
CNMS – Central Supervision of Remote Terminals

Visualisation of Performance Data

- CPU Load
- Memory Usage
- Temperature
- Availability Figures
- Number of pending messages
- ……

Performance graphics are generated automatically





Services – Support During all Project Life Cycle Phases

- Design
- Production
- Commissioning
- Long-Term System Support

The Goal: Satisfied Customers

Peter,

See note from Kevin confirming that the transition onto AMS-UK is now complete. I like to add my thanks to everyone at Comsoft for your support in achieving this important milestone.

The whole transition has gone very smoothly and the delay in transitioning the last Xx connections was due to a problem with the Xx system and NOT AMS-UK.

Could you please forward this on to all interested parties at Comsoft.

Regards,

Malcolm.

Gents,

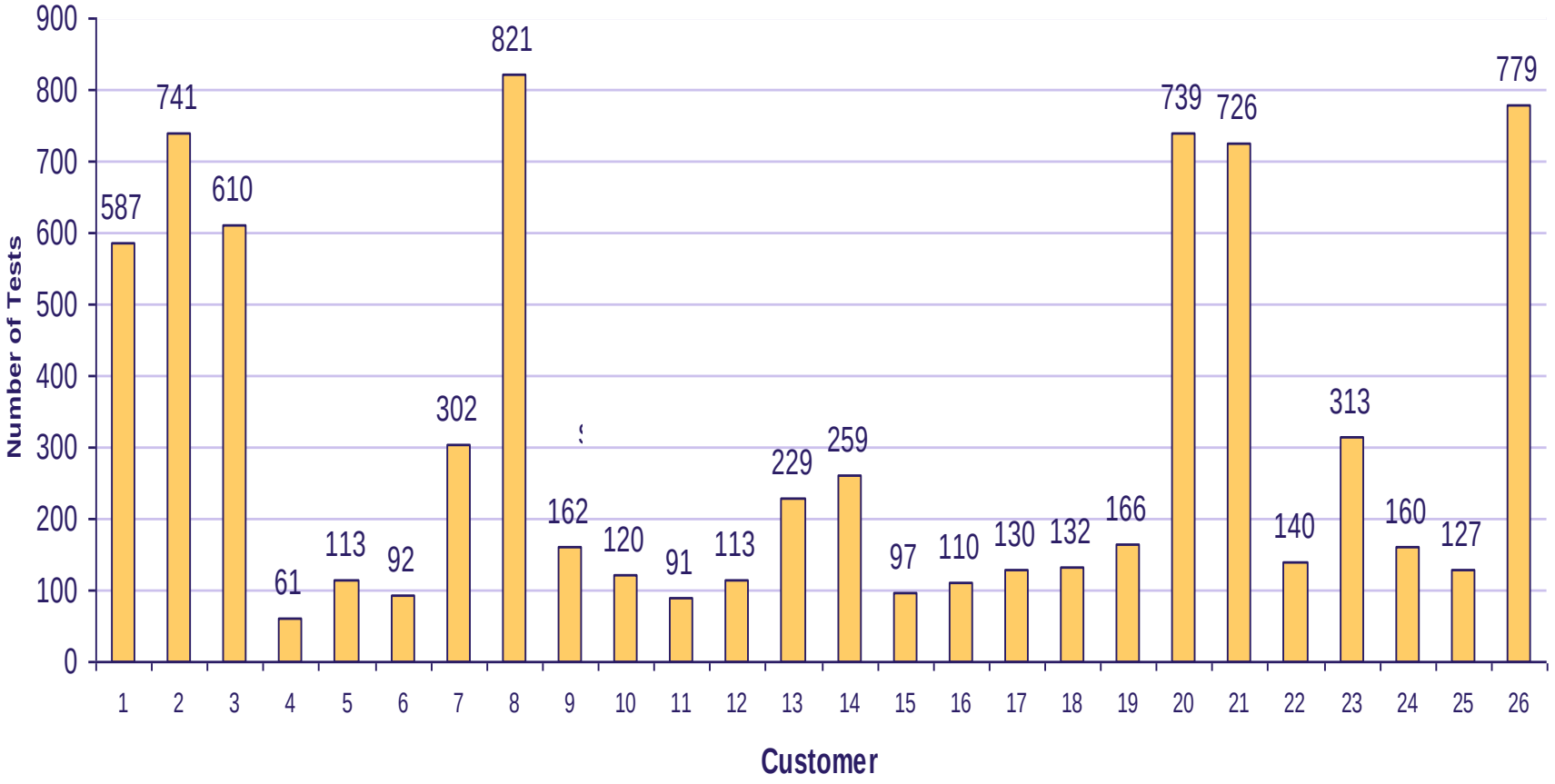
I believe all of you are aware that following an extremely successful transition of almost all of the users by the 1st week in September, we were stuck with problems with Xx connections. Following another set of testing, we have subsequently been able to transition them to AMS-UK today and I can thus declare that the user transition is complete. Although this is a week later than I had planned, in comparison to previous transitions of this magnitude, I cannot emphasise enough how well this has gone and would not have been achieved without a magnificent team effort and I take my hat off to them.

Regards, Kevin

AIDA-NG Product Line – Outstanding Maturity Level

- More than **700,000** (!) automated module and integration tests for each customer baseline.
- The AIDA-NG product line has been excessively tested in a multitude of implementation projects:
- More than **7900** test cases witnessed by numerous FAT inspection teams since 2005

System Testing – Acceptance Tests



Added Value – Compliance with European Safety Regulations

- ✓ Full compliance with **European Safety Regulations** (ESARR1-6).

- ✓ Proven **Software Assurance Level (SWAL) 3** according to EUROCONTROL Safety Assessment Methodology (SAM) (SIL-2/IEC 61508 and AL 4/ED-109).

COMSOFT – AMHS Conformance Testing

COMSOFT AMHS Test Suite

AMHS Conformance Verification →

AMHS Implementation under Test

- ✓ Full Support of both, regional EUR + ASIA/Pacific AMHS Manuals (ATN/OSI, ATN/IPS)
- ✓ Highest Automation Grade (>95%) of Test Execution
- ✓ Platform-independent Test-Suites
- ✓ Test Message Repository in XML Format
- ✓ Evaluation of Test Results as integral part of Test Suites
- ✓ Detailed Logs and Test Reports

- ➢ Suitable for any AMHS
- ➢ Use of Standard AFTN/AMHS Interfaces and Configuration
- ➢ No specific IUT Test Harness required

Adobe Acrobat Document

Customer References

Germany, EUROCONTROL, Netherlands, United Kingdom, Belgium, France, Suisse, Lithuania, Poland, Slovakia, Bosnia & Herzegovina, Serbia, Macedonia, Libya, Egypt, Saudi Arabia, Zimbabwe, Morocco, Emirates, Oman, Qatar, Pakistan, India, Macau, Singapore, Australia, Fiji, Hong Kong, Peru, Colombia, Angola, Nigeria, Kuwait, Mongolia

COMSOFT – Experience in AMHS Interoperability Tests

- **ECG**

  The COMSOFT ECG is used as AMHS Reference System by EUROCONTROL to perform interoperability tests for the evaluation of other AMHS products

- **Customer Support**

  COMSOFT is prepared to support its customers for the setup and execution of Interoperability Tests with adjacent centres:

- ✓ Test Harness (System Configuration, Test Messages, etc.) in accordance with AMHS Manual is available
- ✓ Test Documentation (Configuration, Test Suites, etc.) is available
- ✓ COMSOFT can provide
  - remote support during test phase (Option A)
  - on-site support during test phase (Option B)

IOP Tests – Supported COMSOFT Customers

(Blue Colour: COMSOFT Customers)

Option A - Remote Support:

▪ Bratislava	←→	Vienna	AMHS IOP Tests according to EUR AMHS Manual
▪ Frankfurt	←→	Copenhagen	AMHS IOP Tests according to EUR AMHS Manual
▪ Frankfurt	←→	Brussels, CFMU	AMHS Interconnection Tests (Subset of IOP Tests)
▪ Mumbai	←→	Beijing	AMHS IOP Tests according to Asia/Pacific AMHS Manual
▪ Bordeaux	←→	Madrid	AMHS IOP Tests according to EUR AMHS Manual
▪ Singapore	←→	Bangkok	Pending due to X.400 Conformance Problems of Bangkok
▪ Hong Kong	←→	Macau	**Operational AMHS connection**
▪ Frankfurt	←→	Madrid	**Operational AMHS connection**
▪ Sarajevo	←→	Vienna	**Operational AMHS connection**
▪ NATS, UK	←→	FAA, Atlanta	**Operational AMHS connection (inter-regional)**
▪ NATS, UK	←→	Singapore	**Operational AMHS connection (inter-regional)**
▪ Peru	←→	Quito	**Operational AMHS connection**

Option B - On-site Support:

▪ Bogota	←→	Peru	**Operational AMHS connection**
▪ Mumbai	←→	Singapore	**Operational AMHS connection**
▪ Abu Dhabi	←→	Muscat	**Operational AMHS connection**
▪ Abu Dhabi	←→	Doha	**Operational AMHS connection**
▪ Abu Dhabi	←→	Amman	**Operational AMHS connection**
▪ Abu Dhabi	←→	Egypt	**Operational AMHS connection**
▪ S. Arabia	←→	Egypt	**Operational AMHS connection**
▪ Fiji	←→	FAA, Atlanta	**Operational AMHS connection (inter-regional)**
▪ Macau	←→	Beijing	to be continued after Beijing version update

COMSOFT – Customer Base

Our Success

Customer Base - References/Projects in Europe

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

EUROCONTROL
Location: Brussels
ECG Core Software Package
EUROCONTROL AMHS Reference System

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

Belgocontrol, Belgium
Location: Brussels
1 redundant operational **AMHS**/CIDIN/AFTN system
1 redundant contingency **AMHS**/CIDIN/AFTN system
1 redundant test/training **AMHS**/CIDIN/AFTN system
45 CADAS **AMHS UA**/AFTN User Terminals

EUROCONTROL
Location: Maastricht UAC
1 redundant **AMHS**/AFTN/CIDIN system
1 redundant test/development system

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

DSNA (Project: MESANGE), France
Location: Bordeaux and 10 remote sites
1 redundant operational **AMHS**/CIDIN/AFTN system
1 redundant contingency **AMHS**/CIDIN/AFTN system
1 redundant test/training **AMHS**/CIDIN/AFTN system
1 redundant **AMHS**/CIDIN/AFTN development system
16 concentrators installed on 10 remote sites
up to 150 CADAS **AMHS UA**/AFTN User Terminals

skyguide (Project: MESANGE), Switzerland
Location: Geneva
1 redundant operational **AMHS**/CIDIN/AFTN system
1 single contingency **AMHS**/CIDIN/AFTN system
1 redundant test/training **AMHS**/CIDIN/AFTN system
up to 40 CADAS **AMHS UA**/AFTN User Terminals

Sakaeronavigatsia Ltd, Georgia
Location: Belgrade
1 redundant **AMHS**/AFTN switch
15 CADAS **AMHS UA**/AFTN Terminals

Sakaeronavigatsia Ltd, Georgia
Location: Belgrade
1 redundant **AMHS**/AFTN switch
15 CADAS **AMHS UA**/AFTN Terminals

Polish Military, Poland
Location: Warsaw
1 redundant **AMHS**/AFTN switch
63 CADAS **AMHS UA**/AFTN Terminals

PANSA, Poland
Location: Warsaw
1 redundant **AMHS**/CIDIN/AFTN switch

Russian Federation (FGUP RTC AISS)
Locations: Rostov/Don
1 redundant CDIN/AFTN system
1 AFTN concentrator at a remote site

DFS, Germany
Locations: Frankfurt and Langen
2 redundant **AMHS**/CDIN/AFTN systems
1 redundant AMHS/CDIN/AFTN test system

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

FEDCAD, Bosnia and Herzegovina
Location: Sarajevo and Mostar
2 redundant **AFTN/AMHS/AIM** Systems
17 CADAS AFTN Terminals

RSCAD, Republic of Srpska
Location: Banja Luka
1 redundant **AFTN/AMHS** Systems
5 CADAS AFTN Terminals

SMATSA, Serbia and Montenegro
Location: Belgrade
1 redundant **AMHS**/AFTN switch
1 **AMHS**/AFTN test/training system
34 CADAS **AMHS UA**/AFTN User Terminals

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

Aeronavigacia, Lithuania
Location: Belgrade
1 redundant **AMHS**/AFTN switch
15 CADAS **AMHS UA**/AFTN Terminals

Bulatsa, Bulgaria
Location: Sofia
1 redundant **AMHS**/AFTN switch
20 CADAS **AMHS UA**/AFTN Terminals

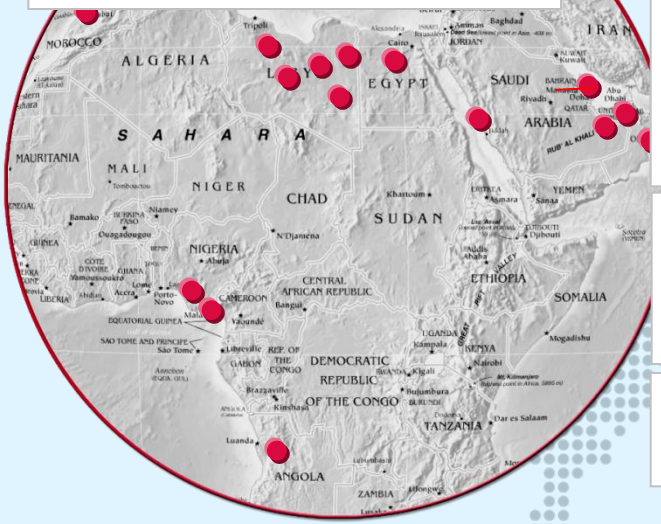
Croatia Control, Croatia
Location: Zagreb
1 redundant **AMHS**/AFTN switch
1 **AMHS**/AFTN test/training system
5 CADAS **AMHS UA**/AFTN User Terminals

Customer Base - References/Projects in Middle East & Africa

ONDA, Morocco
Location: Casablanca
1 redundant operational **AMHS**/CIDIN/AFTN system
1 AMHS/CIDIN/AFTN Test/Training System
5 CADAS **AMHS UA**/AFTN User Terminals

CAA, Libya
Location: Tripoli, Benina, Metiga, Sirt, Sheba
1 redundant **AMHS**/CIDIN/AFTN/**AIM** system and 5 gateway sites with 30 CADAS AFTN/**AIM** User Terminals

NAMA, Nigeria
Location: Lagos, Kano
1 redundant **AMHS**/AFTN/**AIM** System
1 redundant **AMHS**/AFTN/**AIM** Test System
120 CADAS **AMHS UA**/AFTN Terminals



ENANA, Angola
Location: Luanda, Limbago
1 redundant AMHS/**AIM** System
1 test/training AMHS/**AIM** System
50 CADAS AMHS UA/AFTN/**AIM** User Terminals

NANSC, Egypt
Location: Cairo
1 redundant **AMHS**/CIDIN/AFTN system
Up to 200 CADAS **AMHS UA**/AFTN Terminals

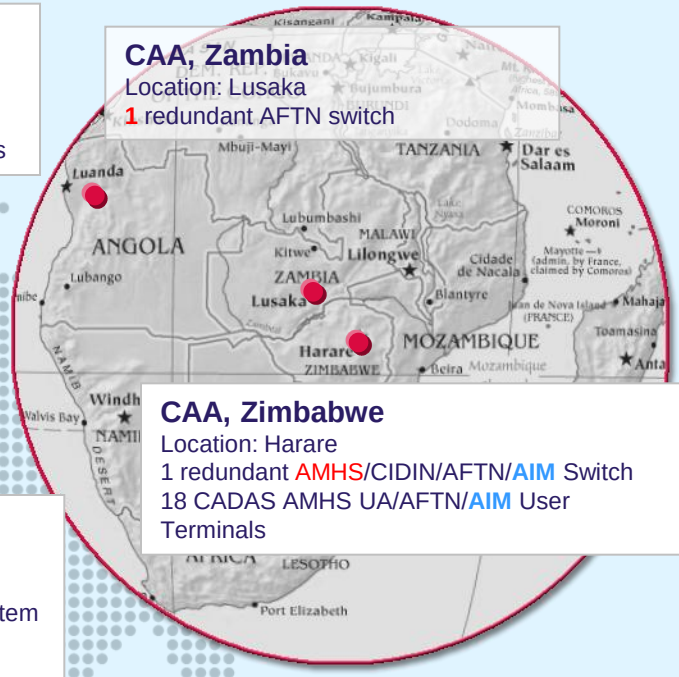
GCAA, Abu Dhabi
Location: Abu Dhabi, UAE
2 redundant **AMHS**/CIDIN/AFTN systems
20 CADAS **AMHS UA**/AFTN User Terminals

DGMAN, Oman
Location: Muskat
2 redundant **AMHS**/AFTN/**AIM** system
1 contingency/test/training **AMHS**/AFTN/**AIM** System
1 test/training **AIM** System
25 CADAS **AMHS UA**/AFTN User Terminals

QCAA, Oatar
Location: Doha
1 redundant **AMHS**/AFTN/**AIM** System
1 redundant **AMHS**/AFTN/**AIM** Test System
up to **60** CADAS **AMHS UA**/AFTN Terminals

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

CAA, Zambia
Location: Lusaka
1 redundant AFTN switch



CAA, Zimbabwe
Location: Harare
1 redundant AMHS/CIDIN/AFTN/**AIM** Switch
18 CADAS AMHS UA/AFTN/**AIM** User Terminals

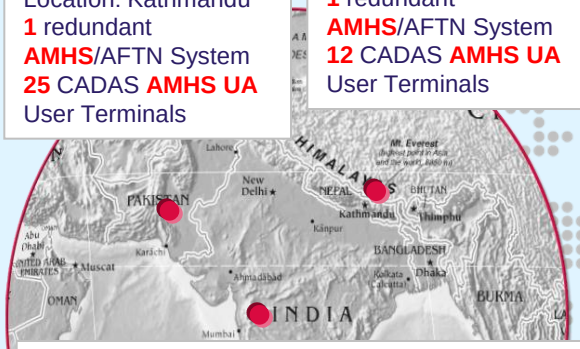
GACA, Saudi Arabia
Location: Jeddah and Riyadh
1 redundant **AMHS**/CIDIN/AFTN System
1 single **AMHS**/CIDIN/AFTN Backup System
Up to 60 local CADAS **AMHS UA**/AFTN Terminals

DGCA, Kuwait
Location: Doha
1 redundant **AMHS**/AFTN/**AIM** System
1 contingency **AMHS**/AFTN/**AIM** System
1 test/training **AMHS**/AFTN/**AIM** System
12 CADAS **AMHS UA**/AFTN/**AIM** Terminals

Customer Base - References/Projects in the Asia Pacific Region

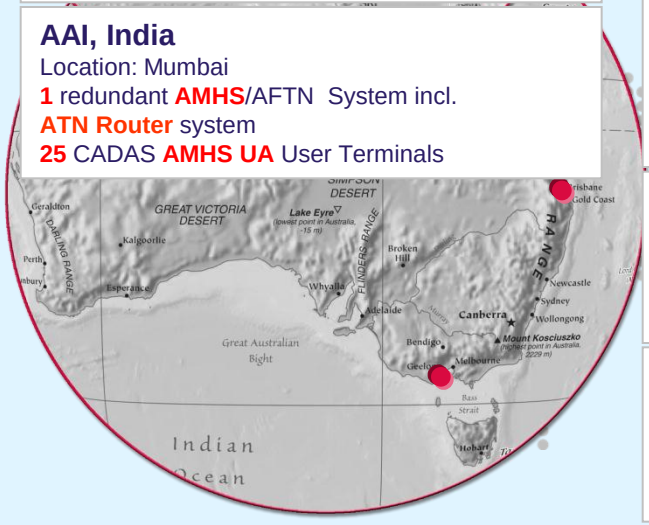
CAAN, Nepal
Location: Kathmandu
1 redundant
AMHS/AFTN System
25 CADAS **AMHS UA**
User Terminals

CAAB, Bangladesh
Location: Dhaka
1 redundant
AMHS/AFTN System
12 CADAS **AMHS UA**
User Terminals



PCAA, Pakistan
Location: Karachi
1 redundant **AMHS**/AFTN/**AIM** System incl.
ATN Router
46 CADAS **AMHS UA** User Terminals

AAI, India
Location: Mumbai
1 redundant **AMHS**/AFTN System incl.
ATN Router system
25 CADAS **AMHS UA** User Terminals



CAAS, Singapore
Location: Singapore
1/1 redundant/single **AMHS**/AFTN+**ATN Router** system
12 CADAS **AMHS UA**/AFTN User Terminals

ATO, Philippines
Location: Manila
1 redundant **AMHS**/AFTN incl. **ATN Router** system
40 CADAS **AMHS UA**/AFTN Terminals

CAAM, Macau
Location: Macau
1 redundant **AMHS**/AFTN incl. **ATN Router** system
14 CADAS **AMHS UA** User Terminals

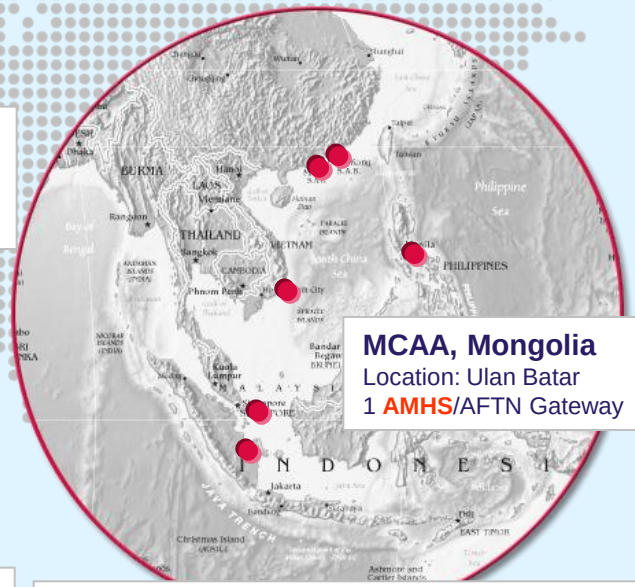
APII, Indonesia
Location: Palembang
1 redundant AFTN switch
10 CADAS AFTN User Terminals

DOTC, Indonesia
Location: Djakarta
1 redundant **AMHS**/AFTN/**AIM** Test and Reference System
10 CADAS **AMHS UA**/AFTN/**AIM** Terminals

ASA, Australia
Location: Brisbane, Melbourne
2 redundant **AMHS**/AFTN incl. **ATN Router** systems
1 redundant test/development system
up to 60 CADAS **AMHS UA**/AFTN User Terminals

Fiji
Location: Nadi
1 redundant **AMHS**/AFTN/**AIM** +**ATN Router** systems
1 single **AMHS**/AFTN/**AIM** test/training system
16 CADAS **AMHS UA**/AFTN/**AIM** User Terminals

HKCAD, China
Location: Hong Kong
2 redundant **AMHS**/AFTN systems
up to 150 CADAS **AMHS UA**/AFTN User Terminals



MCAA, Mongolia
Location: Ulan Batar
1 **AMHS**/AFTN Gateway

Airways New Zealand
Location: Christchurch (OPS, DEV), Auckland (BCK)
3x redundant **AFTN/AMHS** Systems (OPS, BCK, DEV)
Up to 120 CADAS **AFTN/AMHS UA** User Terminals

Papua New Guinea
Location: Port Moresby
1x redundant **AFTN/AMHS** Systems
12 CADAS **AFTN/AMHS UA** User Terminals

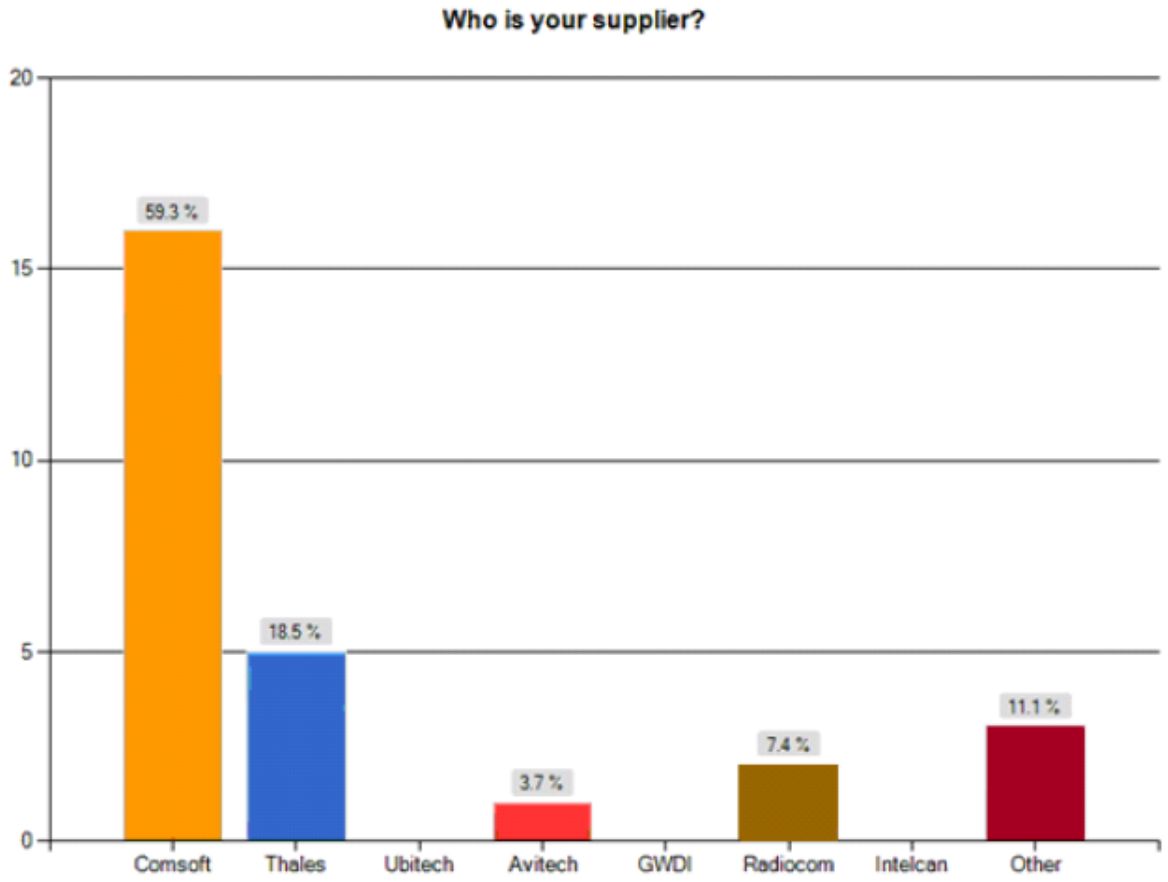
Customer Base – References/Projects in South America/Caribean

U.A.E.A.C, Colombia
Location: Bogota and 6 domestic local and remote sites
1 redundant AFTN/**AMHS** system
63 CADAS **AMHS UA** User Terminals

CORPAC, Peru
Location: Lima and 31 domestic local and remote sites
1 redundant AFTN/**AMHS** system with **AIM** extension
86 CADAS **AMHS UA/AIM** User Terminals

TTCAA, Trinidad-Tobago
Location: Port of Spain and 14 Caribbean
1 redundant AFTN/**AMHS** system
46 CADAS **AMHS UA** User Terminals

SITA AMHS Market Survey (published on the ICAO AMHS workshop in Santo Domingo, November 26th, 2009)



AIR TRAFFIC CONTROL KNOW-HOW

COMSOFT – AMHS Activities 2010 - 2013

In the period from 2010 – today COMSOFT was extremely successful and won multiple AFTN/AMHS customers:

53 ANSPs are equipped with the AIDA-NG/CADAS AFTN/AMHS

AIDA-NG – Result of the Evolution

AIDA-NG has evolved to the most mature AFTN/CIDIN/ AMHS system on the market

COMSOFT is the AMHS Market Leader

CAUG – COMSOFT AIDA User Group

COMSOFT
CAUG
AIDA User Group

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Thank You!