ATS Messaging Management Centre

**Eighth Meeting of the MID ATS Messaging Management Centre
Steering Group (MIDAMC STG/8)
(Amman, Jordan, 1-2 May 2023)**

Regional IP Networks

By MIDAMC

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Objective

to learn more about all the available regional IP networks and let all MID States experts review the MID IP Network regional requirements, cost effectiveness considerations, and global/regional integration of the IP networks.
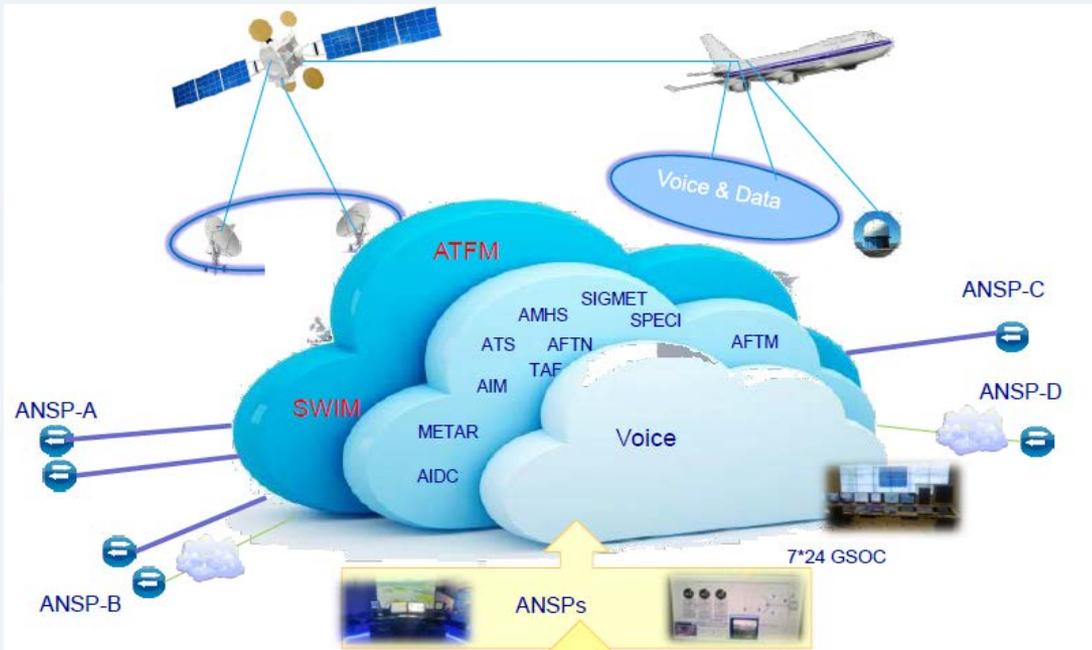
Background

❑ A Regional IP network aims to help States achieve a safe, secure, and reliable backbone network to handle current and anticipated network traffic demand as well as enabling the new features enhancement in the ICAO Regions.

❑ support voice and data communications between Air Traffic Service (ATS) units, increase availability, reduce costs

❑ MIDANPIRG/16 through Conclusion16/15 invited States to engage with the recommended supplier to establish individual service contracts.

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❑ MIDAMC meetings will offer a unique opportunity whereby all MID States work together towards a harmonized IP Network implementation across States and Regions, highlighting the need for interregional coordination and systems' interoperability.

❑ Regional IP Network is an enabler of several ASBU modules.

❑ MID states will use the procurement framework of the available regional network such APAC Common Regional Virtual Private Network Programme (CRV) or New PENS .

❑ **MPLS services are used to implement regional IP networks such as**

1) Common aeRonautical VPN (CRV) for Asia and Pacific (APAC).

2) New Pan-European Network Service (New PENS) for EUR/NAT.

3) South American (SAM) Region Digital Network (REDDIG II).

Currently, the communication services providers for these networks are PCCW Global (CRV), British Telecom (New PENS) and Lumen/Cirion Technologies (REDDIG II).
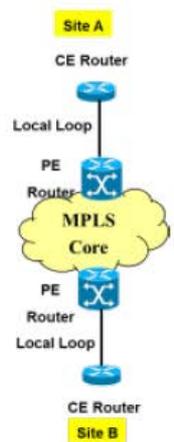
What is MPLS VPN?

- Provides customers private connections among different locations over IP backbone
- Support multiple services over a single network interface

MPLS Service Components

- MPLS PE router port
- CE router (installed in customer site)
- Local loop between PE port and CE router

MPLS Management

Overview of SAM Region Digital Network (REDDIG)

❑ Since 1994, in the SAM Region, States began to examine various digital communications systems in order to implement a regional network to support voice and data communications between Air Traffic Service (ATS) units, increase availability, reduce costs and facilitate the implementation of new services.

❑ Through a Regional Technical Cooperation Project (RLA/98/019), the International Civil Aviation Organization implemented for the participating States the digital network infrastructure that was called the Digital Network of the SAM Region (REDDIG). REDDIG became operational in September 2003 (REDDIG I).

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❑ In 2015, ICAO has coordinated the interconnection with the CAR/NAM network (MEVA); modernized the REDDIG (REDDIG II) to have a terrestrial network (MPLS) as a backup of the main (satellite) IP network; supported the implementation of new applications such as **AMHS** (ATS Message Handling System), **AIDC** (ATS Interfacility Data Communication) and **ADS-B** (Automatic Dependable Surveillance – Broadcasting). (Project RLA/03/901)

❑ The Regional Project (Project RLA/03/901) has also implemented cybersecurity equipment (firewalls and related equipment) to improve the security resilience of the network.

Current situation of the Regional Project RLA/03/901

❑ Currently, the Digital Network of the SAM Region is in its REDDIG II version, having two segments:

- Satellite (VSAT) segment
- Terrestrial (MPLS) segment.

- All States of the SAM Region Participate in REDDIG II Network (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, France (French Guiana), Guyana, Panama, Paraguay, Peru, Suriname, Uruguay and Venezuela), a Caribbean State (Trinidad &Tobago) and a CAR Organization (COCESNA – Central American Corporation of Air Navigation Services).

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Timeline

Implementation

VSAT Stations + ISDN circuits (Redundancy)

Administration

States should have formed a Multilateral Regional Organization (MRO)

Modernization

A Full IP network according to DOC 9896 ATN/IPS

Discussion

IP-V6 applications, new entrants, TFP guidance, etc.

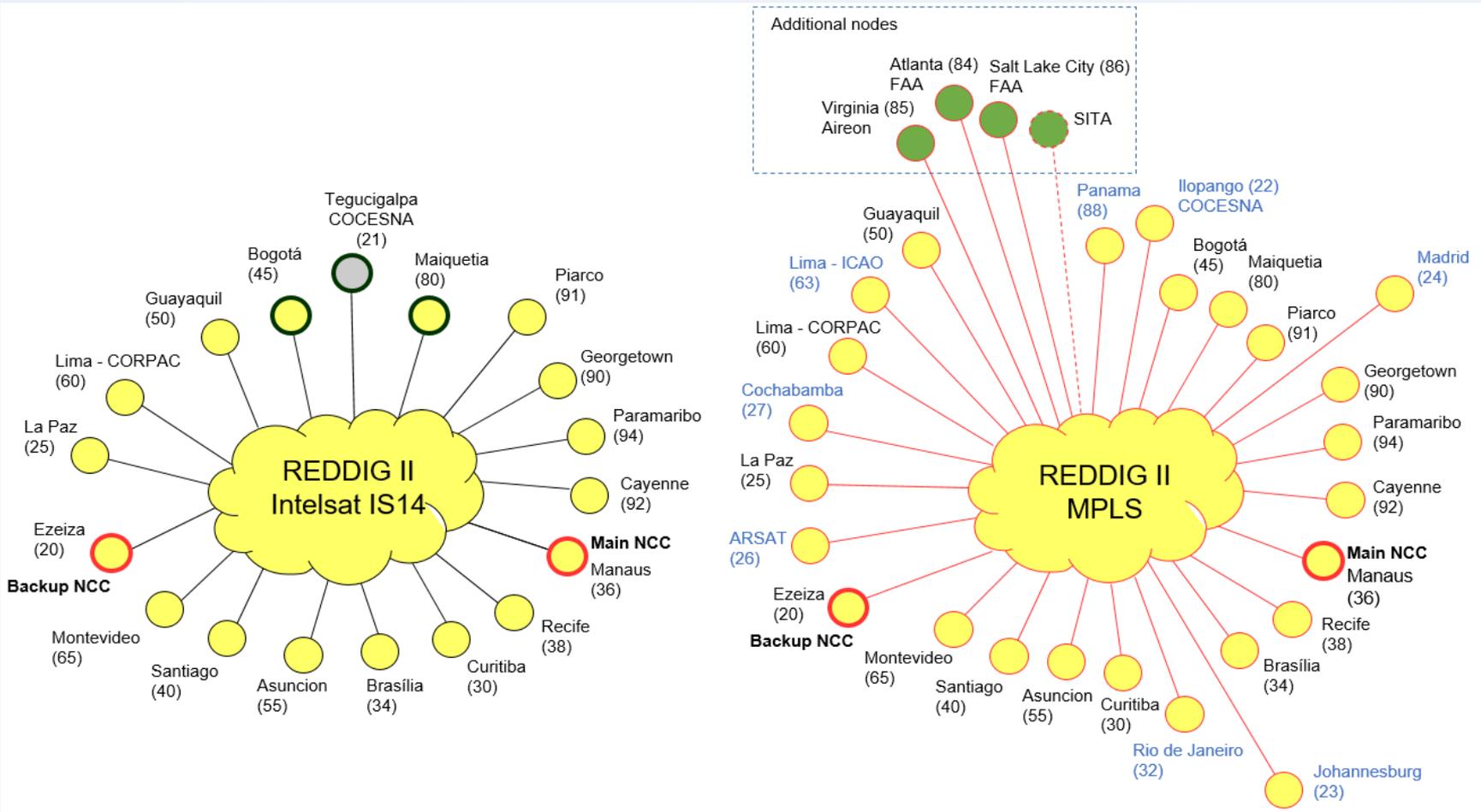| 1998	2003	2015	2023
Project RLA/98/019	**Project RLA/03/901**	**VSAT + MPLS**	**New concept**
REDDIG I	Initial 5 years	REDDIG II	Future REDDIG III

10

Figure 1 – REDDIG II Topology (Satellite + MPLS links)

- Besides the nodes implemented at the Regional Project participants, there are REDDIG II nodes (MPLS) implemented in countries/organizations of other regions: Spain (Madrid), South Africa (Johannesburg), United States (Atlanta and Salt Lake City) and Aireon (Virginia).

- The nodes in green represents the additional nodes contracted directly with the MPLS telecom provider by organizations interested to connect to the network, after the corresponding approval of the REDDIG Coordination Committee. SITA is in the process of a REDDIG II node (MPLS) implementation.

REDDIG Governance

❑ The main body of governance is the Coordination Committee, conformed by representatives of the States participating in the Regional Technical Cooperation Project RLA/03/901 and the SAM Regional Office as Secretariat.

❑ At least one meeting a year is convened .

❑ ICAO, having the Technical Cooperation Bureau (TCB) to execute the procurement processes, contract formalization and finance control, carries out the project management.

❑ The SAM Office is responsible for the administration of the project, maintaining all communication with the participating States, controlling the budgetary resources and contracts in force, as well as providing logistical support for spare parts and maintenance in the factory.
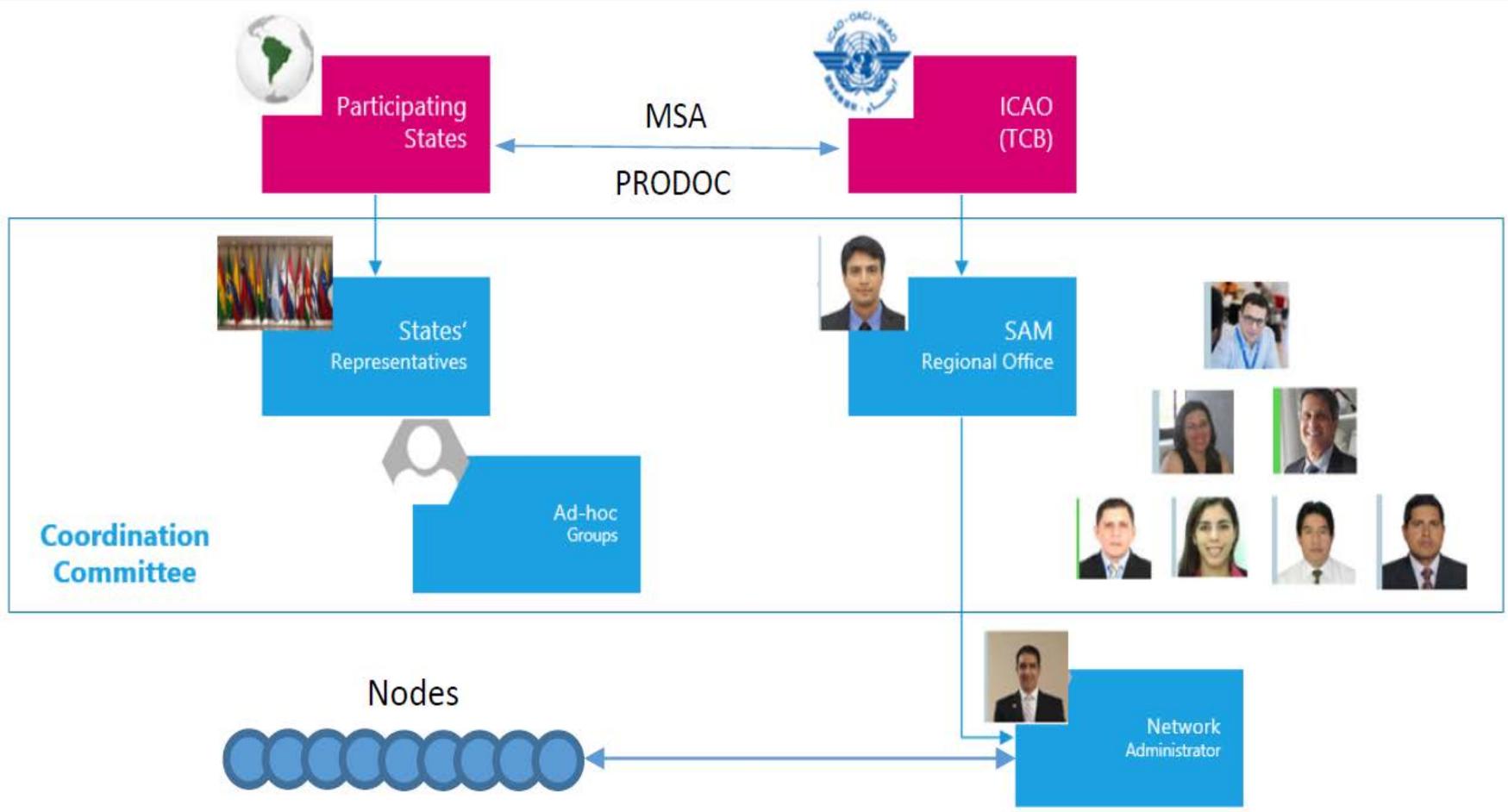
The current managerial organization for the REDDIG Project.

Network Administration

❑ REDDIG II has a main Network Control Center (NCC) located in Manaus (Brazil) and a backup NCC in Ezeiza (Argentina). The Network Administrator works at the Manaus NCC along with five technicians provided by the Brazilian Administration, monitoring the network services, and supporting the participating States' personnel 7 days a week, 24 hours a day.

❑ Besides managing the current services/circuits, the Network Administrator can configure new services or circuits, only coordinating with the participating States, without involving the communication service providers.

❑ The Network Management System (NMS) at the Manaus NCC collects all information from the Local Management Systems of each node and the Network Administration can make remote configuration on the nodes' equipment, if necessary.

15
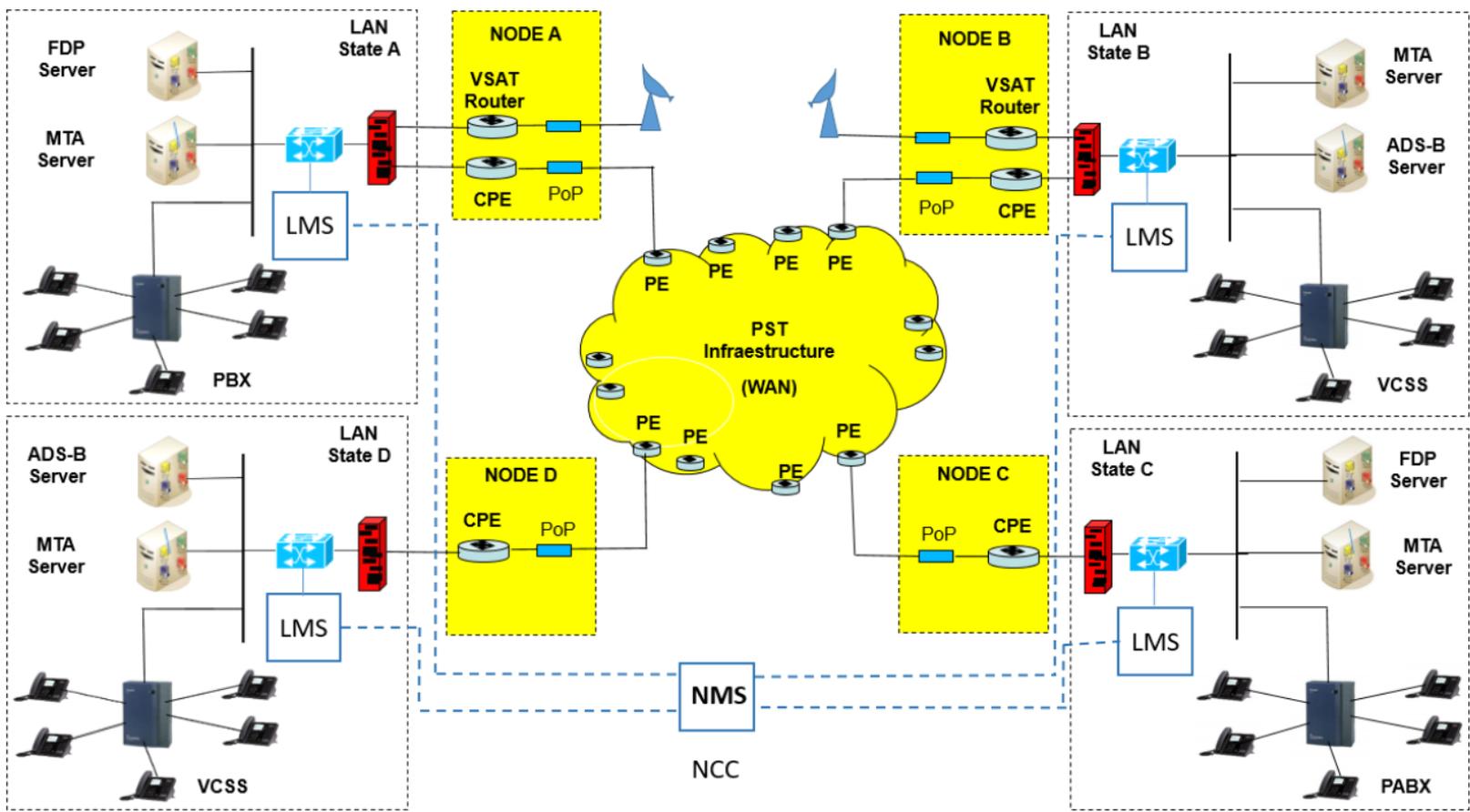
– REDDIG II concept of network management

16

❑ Another important function of the Network Administration is to compute the communication service providers (CSP) outages or link fails. Every month, the Network Administrator informs TCB the amount to be discounted for unavailability of service, applying a formula agreed in the contracted Service Level Agreement (SLA).

Conclusion

❑ All mission-critical operational aeronautical communications between participating States are carried by REDDIG, such as flight plans (FPL), operational messages for aeronautical meteorology (OPMET), advisories to aero-navigators (NOTAM), coordination between air traffic operators of adjacent control centers, coordination between search and rescue centers (SAR) and for aeronautical information (AIS) in general.

❑ All fixed international aeronautical voice services (oral ATS), data circuits (AFTN/AMHS) and surveillance data are carried by REDDIG.

❑ Without REDDIG, all the States of the SAM Region should go to local communications providers to transport services. This modality was carried out before the commissioning of REDDIG, generating a low availability of aeronautical services with interruptions of services for long periods that was completely solved with the implementation of REDDIG.

Conclusion
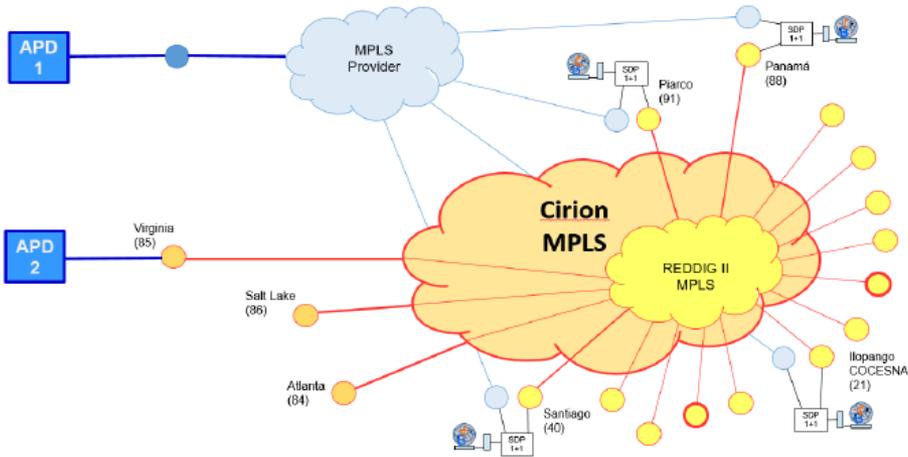
- ☑ All mission-critical communications carried by REDDIG

- ☑ Voice, messaging (AMHS, AIDC), surveillance data (SSR, ADS-B, ADS-C, MLAT), datalink (DATIS, DCL, CPDLC)

- ☑ High availability

- ☑ Low costs

19

The European Regional IP Network (New PENS)

Common European IP-transport Infrastructure for cross-border communication

- Key Technical Enabler for a sustainable and cost-efficient interoperable European Air Traffic Management (EATM) Network

- Provide large-scale IP-connectivity services for the safe, efficient and future proof transport of cross-border communication

- Enabler for inter-regional information exchange

- Address a wide variety of stakeholders
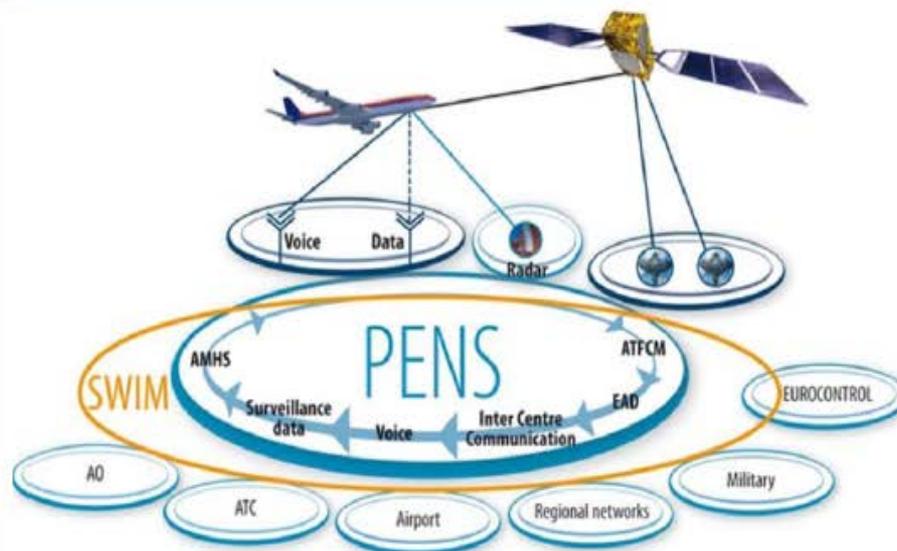
Supporting the Operations of the EATM Network by enabling the reliable, secure and safe exchange of critical and common ATM information among the PENS Users

PENS - A Closed User Group Network

- IP transport solution is end-to-end managed by the Service Provider

- Built upon

  - ➤ A highly resilient MPLS core
  - ➤ Access nodes (sites or Service Delivery Points)

- Virtualisation provides logical separation between groups/types of ATM flows (voice, data, surveillance.....)

- Stringent security requirements apply to the network service provider (including their underlying supply chain)

- Only explicitly authorised traffic is allowed on the network – it is otherwise forbidden

PENS and IPv6 Addressing

- PENS is IPv6 enabled (dual IPv4/IPv6 stack available)

  - To date IPv6 is primarily used for FMTP following European Regulation

- Each individual PENS User is assigned (upon request) 4x /48 IPv6 public ranges by EUROCONTROL where

  - Two ranges are for operational purposes (OPS)

  - Two ranges are for pre-operation purposes (TST)

    Note: The PENS Service Provider is using their own IPv6 address space

22

PENS –Vision, Mission and Ambition

❑ **<u>Service Provision organised under market conditions</u>**

✓ whilst taking into account the safety demand of air space users (procured under EUROCONTROL Contract Regulations / European Public Procurement Rules).

✓ Open to the wider ATM community (civil/military, ANSPs, CSPs, meteo providers, industry partners

✓ Offer differentiated IP connectivity services built upon standard telco(s) feature sets

❑ **<u>User driven services through multi-stakeholder governance</u>**

✓ Evolve with technology and business requirements

❑ **<u>Pay per Use Principle –Strict Use Policy</u>**

✓ Up to 99,99(9)*% availability –Cybersecurity precautions

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- Number of PENS Users: 44
- Pending deployment: (SAKAERONAVIGATSIA – ONDA – ESSP – KNMI)

	NewPENS Users	Country		NewPENS Users	Country		NewPENS Users	Country
1-2	EUROCONTROL (NM - MUAC)		20	ENNA	Algeria		ONDA	Morocco (pending connection)
3	ALBCONTROL	Albania		ESSP	(pending connection)	36	ORO NAVIGACIJA	Lithuania
4	ANA	Luxemburg	21	FinTraffic ANS	Finland	37	PANSA	Poland
5	ANS CR	Czech Republic	22	IAA Ireland	Ireland	38	Ports of Jersey	Jersey
6	AUSTROCONTROL	Austria	23	IAA Israel	Israel	39	RNLAF	The Netherlands
7	AVINOR	Norway	24	ISAVIA	Iceland		SAKAERONAVIGATSIA	Georgia (pending connection)
8	AZANS	Azerbajan		KNMI	The Netherlands (pending con.)	40	SKEYES	Belgium
9	BULATSA	Bulgaria	25	LFV	Sweden	41	SKYGUIDE	Switzerland
10	CROCONTROL	Croatia	26	LPS SR	Slovakia	42	SLOVENIACCNTROL	Slovenia
11	DCAC	Cyprus	27	LGS	Latvia	43	SMATSA	Serbia and Montenegro
12	DFS	Germany	28	LVNL	The Netherlands	44	ROMATSA	Romania
13	DHMI	Republic of Türkiye	29	M-NAV	Republic of North Macedonia			
14	DSNA	France	30	MATS	Malta			
15	EANS	Estonia	31	NATS	United Kingdom			
16	ENAIRE	Spain	32	NAV Canada	Canada			
17	HCAA	Greece	33	NAV Portugal	Portugal			
18	HUNGAROCONTROL	Hungary	34	NAVIAIR	Denmark			
19	ENAV	Italy	35	OACA	Tunisia			

PENS –Timeline

❑ 2006-2007 –Opportunity arise to create a common IP network infrastructure to meet the needs of both EUROCONTROL and the ANSPs of the EUROCONTROL Member States.

❑ EUROCONTROL was requested to conduct a Common Procurement on behalf of interested ANSPs.

❑ **1st Call for Tenders published in November 2007**
✓ Contract awarded to SITA for 8,5 years, ending on June 7, 2018 –later extended for 2 years to accommodate the transition to the second-generation contract (NewPENS)

❑ **2nd Call for Tenders published in November 2016**
✓ Contract awarded to BT for 10 years end April 17, 2018

❑ 3rd Call for Tenders preparation anticipated to start in 2024
✓ Anticipated timeline for 3rd generation contract awarding 2026

PENS Directives (existing and in-preparation)

❑ **Directive 07/70 –dated 24 October 2007** –authorizes the Common Procurement of PENS on behalf of EUROCONTROL and interested ANSPs.

❑ **Directive 13/81-dated 12 July 2013** –extends the scope of PENS to other States within the ICAO EUR/NAT Region and bordering States.

❑ **Directive 15/88 –dated 21 May 2015** –further enables the use of PENS by any interested Parties from the EUROCONTROL Member States and other States within the ICAO EUR/NAT Region and bordering States.

❑ **Directive xx/xx –pending approval** –aims to instantiate the PENS Governance as unique and stable governance, provide the necessary tools to do multi-sourcing (establish different and complementary contracts) and enable access to the PENS Contract(s) to public and private entities of non EUROCONTROL Member States as well as international organizations.

The PENS Governance
A User Driven Multi-Stakeholder Governance
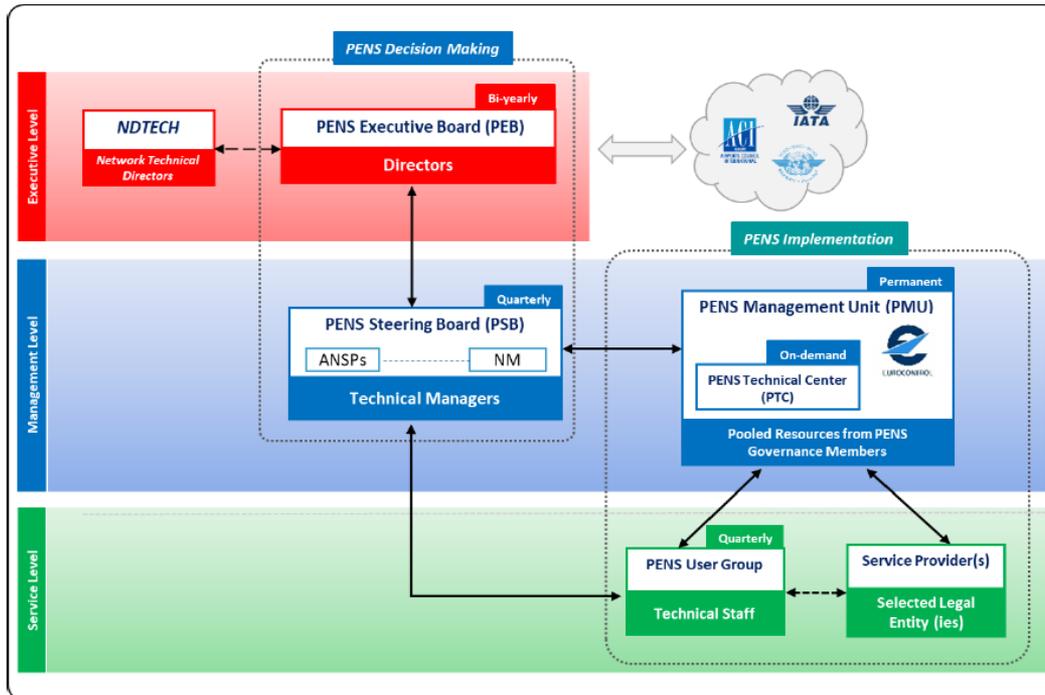
PENS Governance & Operating Model

- The PENS Governance manages the PENS Service Provision and the strategic needs of the users

- The strategic evolution of PENS is coordinated as part of the EUROCONTROL CDM working arrangements, with the Network Directors of Technology (NDTECH) group of the Network Management Board (NMB)

27

(New)PENS – Charging Scheme
Pay Per Use Principle

NewPENS Operating Costs (i.e. PMU & PTC)
Common to all PENS Users

Shared among all PENS users on basis of agreed Global Sharing Key (GSK)

Invoiced by EUROCONTROL

Infrastructure Costs (Supplier Costs)

Service Management, tooling and NewPENS Service Desk
Common to all PENS Users (setup & recurring)

Shared among all PENS users on basis of agreed Global Sharing Key (GSK)

NewPENS Site & Features
User Specific (setup & recurring)

- User specific costs
- Site Sharing Key allows to distribute costs between users sharing common infrastructure elements

Invoiced by the Service Provider

- **Circuit costs are geographically dependent**
- Most cost units are common to all PENS Users (e.g. routers, VPN activation......)

28

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	PEB	NewPENS Boards	PMU	Service Provider	PTC	NewPENS User
Service Strategy						
Strategy Generation	A,R	S	C			C
Service Portfolio Management	A	R	S	S		C
Demand Management	A	R	S	S		
Financial Management	A	R	S	S		I
Service Design						
Service Level Management		A	R	R,S	C	I
• Service Measurement			A	R,S	C	
• Service Reporting			A	R,S	C	
• Service Analysis			A	R,S	C	
Service Catalogue Management		A	R	S	C	I
Capacity Management			A	S	R	I
Availability Management			A	S	R	I
IT Service/Business Continuity		A	A	A	R	I
Information Security Management		A	R	S	S	I
Supplier Management		A	R	S		I
Service Transition						
Change Management		C	A,R	S	C	
Service Asset and Configuration Management			A	R,S		
Release and Deployment Management			A	R,S	C	
Validation and Testing Management			A	S	R	
Transition Planning and Support		A	R	S	S	C,I
Service Operations						
Incident Management			A	R,S		C,I
Event Management			A	R,S		I
Request Fulfilment			A	R,S		C,I
Problem Management			A	S	R	C,I
Access Management			A	S	R	I
Technical Management			A	S	R	
Operations Management			A	R,S		
Service Desk Function			A	R,S		
Continuous Service Improvement						
Continuous Service Improvement		A	R	S	C	I

R: Responsible — **A**: Accountable — **S**: Resource Allocated — **C**: Consulted — **I**: Informed

Table 3: NewPENS Process Framework RASCI

29

Pre-requisites to joining PENS

❑ The requesting Party must be in scope of **Directive N°15/88** dated 21.5.2015 of the EUROCONTROL Permanent Commission.

❑ The right to use the network is formally granted by the PENS Governance on a per use case basis considering expected benefits for the EATM Network, costs, possible alternatives and potential risks.

❑ Core principle –What is not explicitly allowed by the PENS Governance is prohibited.

How does one practically become a PENS User

1. Pre-requisites to joining PENS

2. Contractual/Legal

   ✓ Become a party to (sign) the Common Procurement Agreement and,

   ✓ Become a signatory to the NewPENS Contract with the Service Provider (by accession amendment)

3. Order your connectivity to PENS / Order your PENS site

4. The Service Provider deploys the site then hands it over to the requesting Party after successful completion of basic acceptance tests *(community defined and agreed)*

5. Optional (strongly recommended): The requesting Party has then two weeks to perform extended acceptance tests *(community defined and agreed)* before the site is formally accepted.

6. Upon formal acceptance of the site the requesting Party becomes a PENS User and is ready to establish communication over PENS in accordance with approved used cases.

New PENS Project Update

- MIDANPIRG/18 agreed, through Conclusion 18/37, that the ICAO MID Office, with the support of concerned Sates, initiate discussions with EUROCONTROL, in order to explore the possibility of joining the NEWPENS project as an alternative solution for establishing a MID IP Network.

- ICAO MID requested EUROCONTROL to extend the New PENS to MID States

- New PENS Webinar conducted (10 November 2021)

- Eight (8) States (Bahrain, Egypt, Jordan, Lebanon, Kuwait, Oman, Saudi Arabia and UAE) confirmed their interest to join the EUROCNTROL IP Network Project (New PENS)

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EUROCONTROL Member States should cast their vote on the project extension by April 28th.

The results of the voting will be announced by 4th May.

The Common aeronautical Virtual Private Network (CRV)
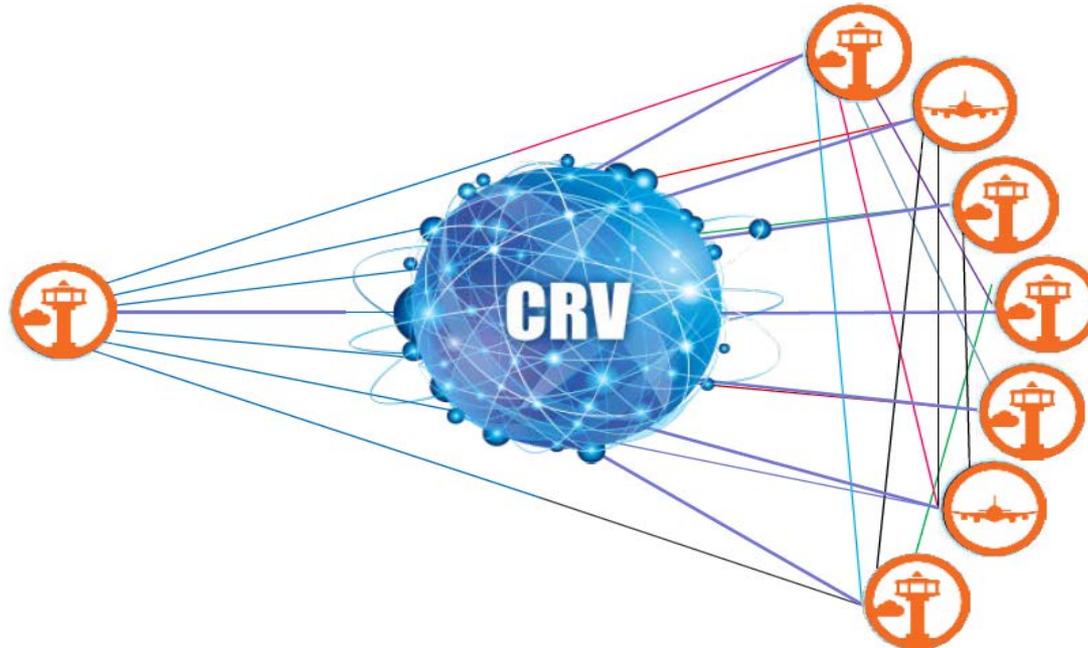
Safe

- Resilient network consists of multiple nodes and trunks riding on diverse cable systems
- Contingency plan to maintain high availability

Multiple cables

Multiple POPs

● PCCW Global PoP (IP)
── PCCW Global IP Backbone

Multiple NOC
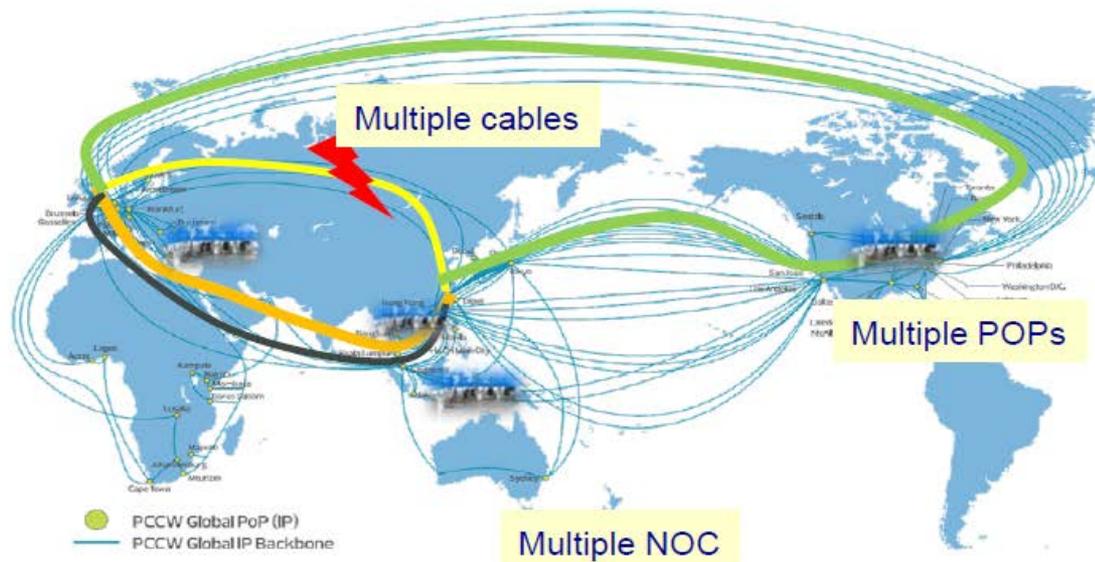
<u>Brief history</u>

❑ APANPIRG Decision APANPIRG/24/32 established a Task Force consisting of the Subject Matter Experts (SME) to study regional virtual private network (VPN) and develop a detailed proposal by January 2016.

❑ APANPIRG Decision APANPIRG/ 27/33: Creation of the Common Aeronautical VPN (CRV) Operations Group (CRV-OG) in 2016.

❑ The services provider for CRV network is PCCW Global. / Tender warded in January 2017 .

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CRV Implementation Status

Under Operation

Australia, Bhutan, China, Fiji, Hong Kong China, India, Indonesia, Japan, Malaysia, New Zealand, Philippines, PNG, Republic of Korea, Singapore, Thailand, and USA.

16 states

Under Provisioning

Nepal, Mongolia, Vietnam

Hot Prospects in 2023

Sri Lanka, Pakistan and New Caledonia

CRV Governance

Current CRV Governance

APANPIRG

01

Address global and region-specific air navigation-related matters

CNS SG

02

Ensure continuous and coherent development of the ASIA/PAC Regional Air Navigation Plan in the CNS field in accordance with the Global Air Navigation Plan and Global Aviation Safety Plan

ACSICG

03

Complete implementation of APAC ATN and ensure the underlying communications backbone continues to support the evolving ICAO operational requirements for the exchange and management of aeronautical information and data

CRV OG

04

Provide oversight of the function and performance of the CRV and the performance of the Service Provide

ICAO
Headquarters
Montréal

European and
North Atlantic
(EUR/NAT) Office
Paris

Asia and Pacific
(APAC) Sub-office
Beijing

Middle East
(MID) Office
Cairo

Western and
Central African
(WACAF) Office
Dakar

North American
Central American
and Caribbean
(NACC) Office
Mexico City

Asia and Pacific
(APAC) Office
Bangkok

South American
(SAM) Office
Lima

Eastern and
Southern African
(ESAF) Office
Nairobi

Thank You