



ICAO

International Civil Aviation Organization

**Ninth Meeting of the Common aeRonautical Virtual
Private Network Operations Group (CRV OG/9)**

Video Teleconference, 25 – 27 January 2022

Agenda Item 9: MPLS/IP based inter-regional connection

MPLS/IP BASED INTER-REGIONAL CONNECTION

(Presented by ICAO Secretariat)

SUMMARY

This paper provides current status of discussion being done for potential interconnection of CRV and REDDIG II and CRV and New PENS. It also requests APAC member states to record their interest, willingness, or need for interconnection of the CRV with other regional networks such as REDDIG II / New PENS with the ICAO secretariat.

1. INTRODUCTION

1.1. The Air Traffic Services (ATS) relies on an infrastructure (Aeronautical Telecommunication Network - ATN) to transmit both air-to-ground and ground-to-ground applications. Currently the most common networks that uses the concept of convergence is based on the Internet Protocol Suite (IPS). The International Civil Aviation Organization (ICAO) has developed the Standard and Recommended Practices (SARPS) based on the referred concept which are framework to support the implementation of the System Wide Information Management (SWIM).

1.2. For providing services to the Air Navigation Providers (ANSPs), almost all Communication Service Providers (CSP) use the Multiprotocol Label Switching (MPLS) infrastructure to deliver IP applications. MPLS services are used to implement regional IP networks such as CRV for APAC/MID, New Pan-European Network Service (New PENS) for EUR/NAT and SAM Region Digital Network (REDDIG II) for SAM. Currently, the communication services providers for these networks are PCCW Global (CRV), British Telecom (New PENS) and Lumen (REDDIG II) respectively.

1.3. The paper discuss status of discussion being held for potential interconnection of CRV and REDDIG II and CRV and New PENS.

2 DISCUSSION

2.1 The Common aeRonautical Virtual Private Network (CRV) was developed to improve regional connectivity and to help reduce the cost on telecommunications. In order to enhanced global connectivity among states of different regions, it was suggested to States that connect to the CRV should also connect to other regional networks such as REDDIG and New PENS.

2.2 There are potentially further benefits with implementing interconnections to regional networks such as efficiency in the connection services such as SWIM, reducing costs for states that connect to other regional networks. Some states had already expressed an interest in a connection to other regional networks such as New Zealand to REDDIG II and Singapore to New PENS. Therefore, interconnection among regional networks may be very important to enhanced air navigation capacity and efficiency.

CRV and REDDIG II Interconnection

2.3 There are communications requirements between Asia Pacific (APAC) ANSPs and South American (SAM) ANSPs. The regional IP networks' interconnection, CRV and REDDIG II, may act as a potential solution in order to set up the AMHS P1 connection between AMHS COM Centers of Christchurch (New Zealand) and Santiago (Chile).

2.4 Noting these requirements, early discussion among regional networks service providers for CRV and REDDIG II and the CRV OG has been initiated. It felt that it is also important to discuss the inter regional network connectivity with the Data Communications Infrastructure Working Group of the Communications Panel to align the implementation of this concept with the directions of the this working group.

Requirements for interconnecting AMHS COM Centers of Christchurch (New Zealand) and Santiago (Chile)

2.5 Chile and New Zealand have adjacent oceanic FIRs and plan to implement AIDC for Air Traffic coordination between the oceanic control centers (ACCs). The automation of coordination tasks using AIDC between adjacent sectors improves the quality of information on traffic transiting between sectors and makes it more predictable, thereby allowing reduced separation minima, decreased workload, increased capacity, more efficient flight operations, and enhanced safety. To guarantee an effective AIDC connection, it is also important to have a direct AMHS P1 connection between the two AMHS COM Centers providing message service to the involved oceanic centers. **Figure 1** depicts the basic communication requirement as a reference for the discussion.

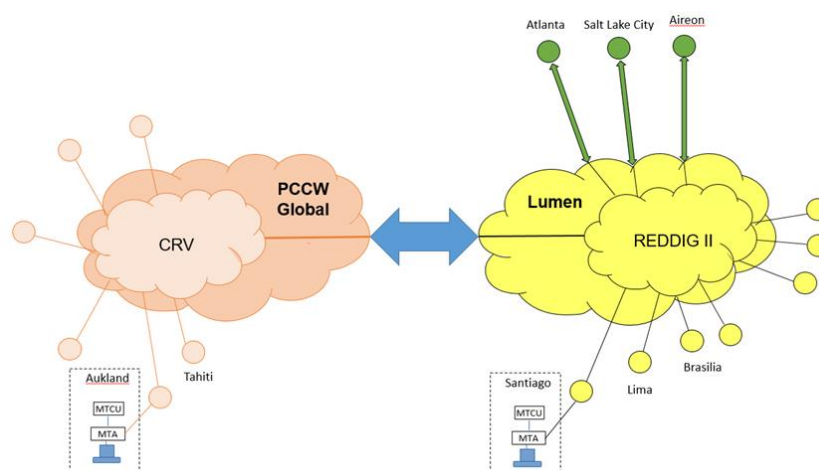


Figure 1 Basic communication requirement

Proposed Solutions

2.6 **Three possible** solutions were envisaged to connect the AMHS COM Centers of Santiago (Chile) and Christchurch (New Zealand):

Installing a CRV node in Chile or a REDDIG II node in New Zealand: Solution-1

2.7 This solution implies in buying service from one of the two providers (Lumen or PCCW Global). **Figure 2** depicts this possibility.

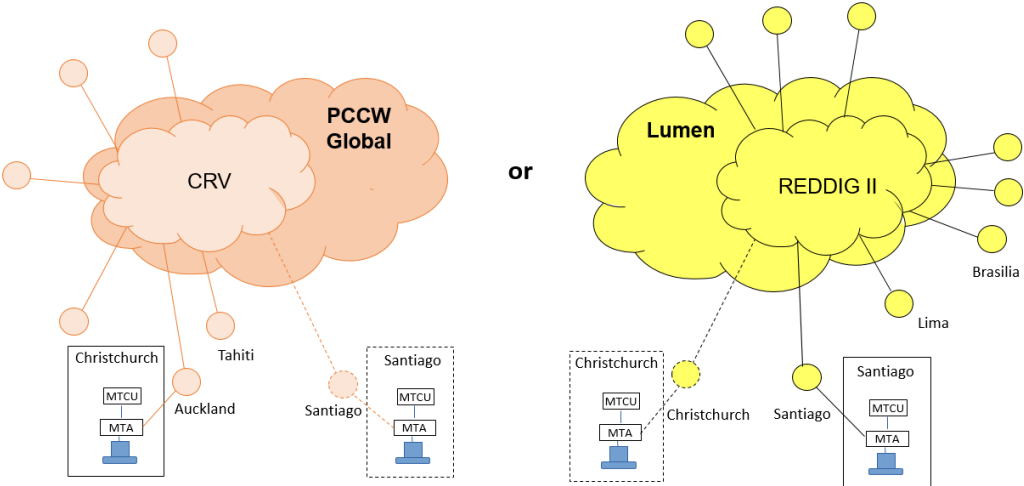


Figure 2 Installing a CRV node in Chile or a REDDIG II node in New Zealand

Using the FAA nodes (CRV and REDDIG II) to redirect packets between the two networks: Solution-2

2.8 The Federal Aviation Agency (United States of America) has deployed nodes of the two networks (CRV and REDDIG II). It can be configured to redirect packets from one network to the other. **Figure 3** depicts this possibility.

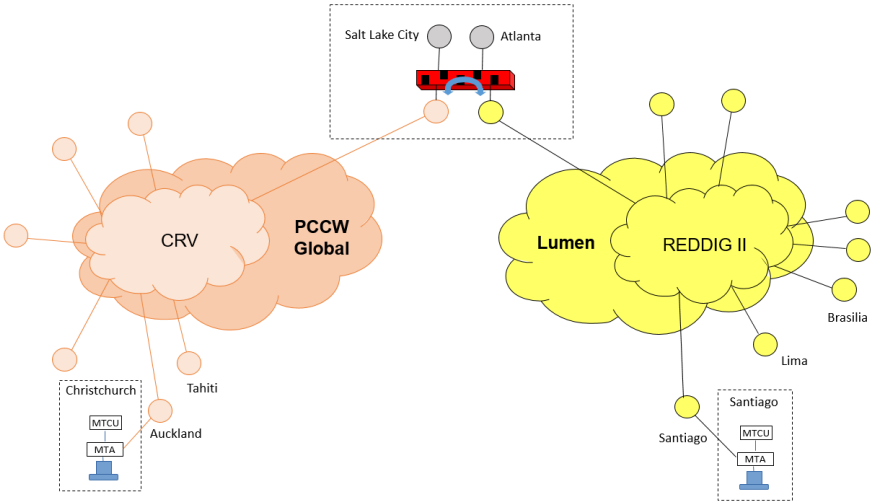


Figure 3- Using FAA nodes (CRV and REDDIG II) to redirect packets between the two networks

MPLS Network-to-Network Interface (NNI): Solution-3

2.9 The Regional IP Networks interconnection by means of MPLS Network-to-Network Interface (NNI) is considered the most classical approach to adopt as solution to interconnect CRV and REDDIG. **Figure 4** depicts this possibility.

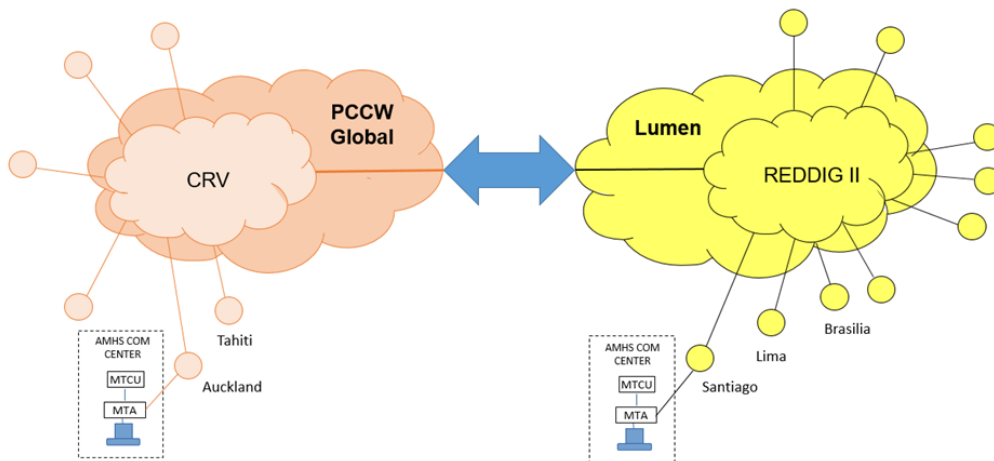


Figure 4 MPLS NNI between Lumen and PCCW Global connecting CRV and REDDIG II

2.10 After further discussion, the interested proposal was *Solution-3*.

2.11 The MPLS service providers interchange IP packets carrying information of Internet applications (emails, video streaming, web services, voice communication, etc.), using the same routing protocols employed in the virtual private networks. It is technically possible for two nodes of different networks (with different providers) to set up an IP connection. In this case, the concept of MPLS Network to Network Interface (NNI) is applied and the CSPs involved with different customers establish agreements, in order to coherently interconnect their own infrastructure. This concept can be applied by the CSPs of CRV and REDDIG II, in order to connect nodes of the two networks. For instance the Auckland node of CRV with the Santiago node of REDDIG II. The **Figure 5** depicts the concept of MPLS-NNI topology.

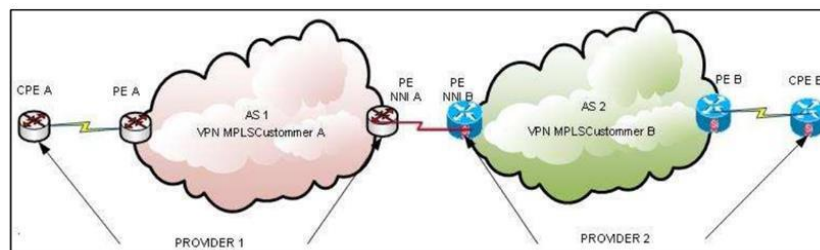


Figure 5-MPLS NNI Topology

2.12 Further discussion on the administrative and technical aspects to establish the required aeronautical communications between APAC and SAM ANSPs through MPLS NNI were done on **3 November 2021** by teleconference. A Lumen representative informed that the first agreed solution of implementing a MPLS NNI using the infrastructure of both CSP in United States resulted as a not feasible proposal (see **Figure 6**). Another proposal was presented with a different approach. **Figure 7** depicts the new Lumen solution to implement interconnection between CRV and REDDIG II users.

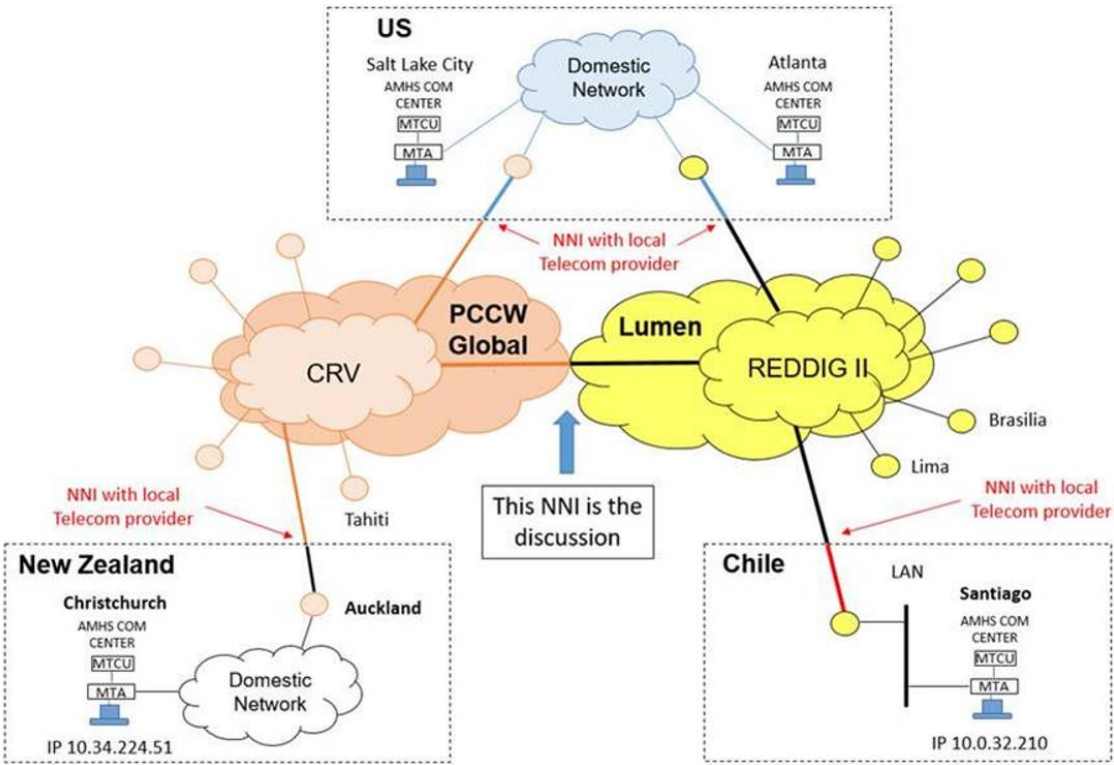


Figure 6 – First proposed solution

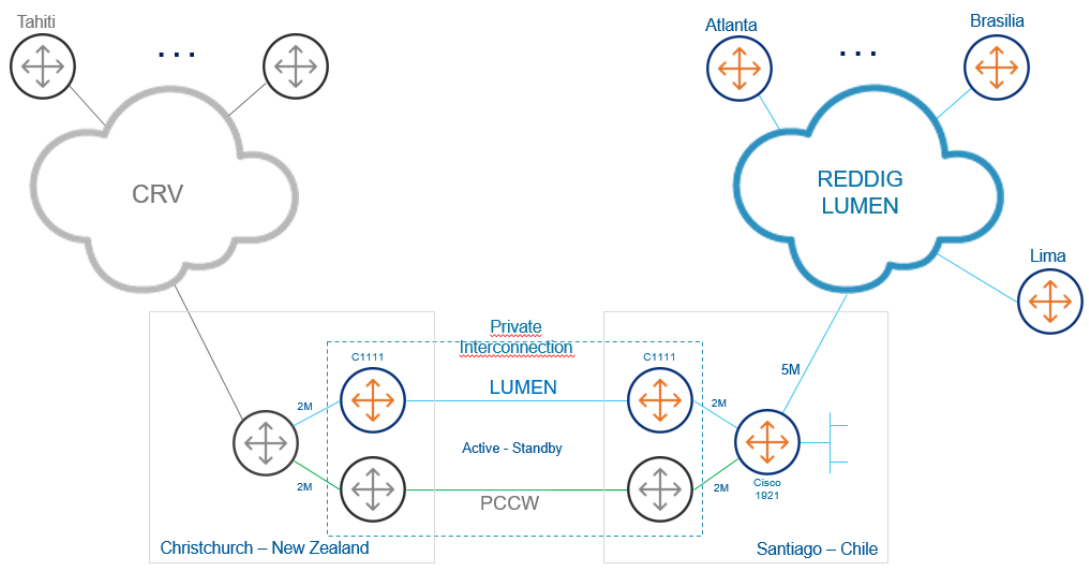


Figure 7 – Lumen's proposal

2.13 Basically, the proposal consisted of setting up two direct connections between Christchurch and Santiago, provided by the two telecommunication providers, by means of different paths, allowing an Active - Standby redundant interconnection for the two AMHS COM Centers.

2.14 PCCW Global representative also presented a proposal, depicted in **Figure 8**, that takes the advantage of the existence co-located Data Centers of both telecommunication providers.

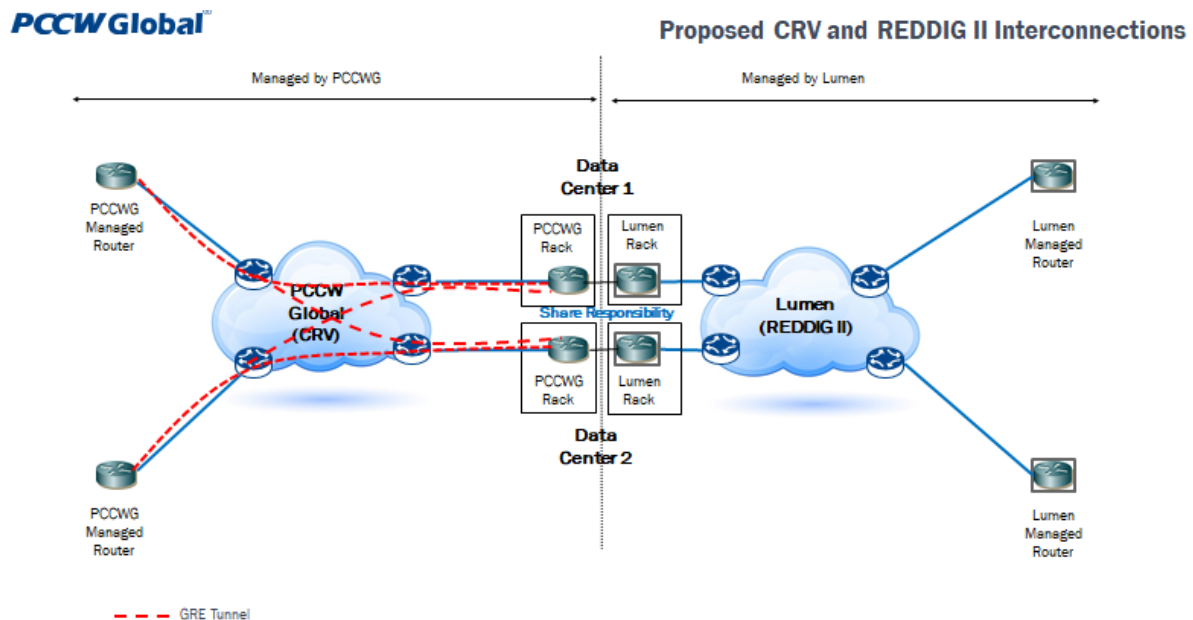


Figure 8 – PCCW Global’s proposal

2.15 This proposal allows the implementation of communications (voice and/or data) with other States/Organizations participating in both networks (CRV and REDDIG II), which have communication requirements due Flight Information Regions adjacencies.

2.16 The teleconference participants agreed that the proposal presented by PCCW Global would be more adequate and should be better elaborated by the telecommunication providers, in order to present a definitive proposal for analysis of the CRV and REDDIG II participants. It was agreed that *Lumen and PCCW Global will work on the proposal and will present a document, not later than December 15th 2021, in order to be analyzed by the Board/Committee of both networks (CRV and REDDIG II).*

2.17 It was also recommended that in the document detailing the proposal, the telecommunication providers must provide all necessary information and aspects involved in the implementation of the CRV- REDDIG II Interconnection proposed, allowing a decision by the CRV and REDDIG II participants, interested in the interconnection.

2.18 PCCWG submitted final technical proposal agreed by Lumen on 15th December 2021. The proposal will be presented by PCCWG by WP/07.

CRV and New PENS

2.19 The Third Meeting of the **European Aviation System Planning Group (EASPG)** took place in the ICAO EUR/NAT premises in a hybrid format from 30 November to 2 December 2021 adopted following conclusion:

EASPG Conclusion 3/15 – Coordination on the Interregional AFS Gateways

That, the ICAO Regional Director, Europe and North Atlantic, to initiate necessary interregional coordination with other Regions (i.e. APAC, SAM) **in order to support the AFS to SWIM Transition Task Force (AST TF) to:**

- a) Develop proposals for the existing system to improve the interregional AFS Gateways (e.g. in terms of bandwidth, capabilities, etc.); and
- b) Discuss and propose **on the methods for inter-connection of the Regional networks, with the involvement of appropriate responsible groups (i.e. PSB).**

2.20 In response ICAO APAC Office and ICAO EUR/NAT Office coordinated internally as well as with the service providers of regional network in respective region.

2.21 PCCWG is working on to submit necessary information required from British telecom, service provider of New PENS, to initiate the potential interconnection discussion. ICAO Secretariat will do coordination after receiving of information required from PCCWG.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information contained in this paper;
- b) provide need/willingness/interest to join other regional networks; and
- d) discuss any relevant matter as appropriate;
