Agenda Item 4: Assessment of operational requirements to determine the implementation of improvements to communication, navigation, and surveillance (CNS) capabilities for en route and terminal area operations

ANALYSIS OF ACTIVITIES CORRESPONDING TO REDDIG II

(Presented by the Secretariat)

SUMMARY

This working paper presents information on the activities carried out since the SAM/IG/17 meeting with respect to REDDIG II.

REFERENCES

- Nineteenth meeting of the Coordination Committee of Project RLA/03/901 (RCC/19) Lima, Peru, 7-9 March 2016.
- Seventeenth workshop/meeting of the SAM Implementation Group (SAM/IG/17) Lima, Peru, 9-13 May 2016.
- Fifth technical-operational meeting of REDDIG II (26 and 27 July 2016, WEB teleconference).
- Summary of REDDIG II follow-up teleconferences (21 June, 29 and 30 September 2016).
- Report of the second meeting on AIDC implementation (AIDC/2 Lima, Peru, 21-23 September 2016).

ICAO strategic objectives:	*A – Safety* *B – Air navigation capacity and efficiency*

1 Introduction

1.1 The SAM/IG/17 meeting analysed the activities concerning REDDIG II carried out since the SAM/IG/16 meeting, including the implementation and commissioning of the new REDDIG II node in Brasilia in April 2016, the performance of pending activities in REDDIG II by the network provider (INEO&LEVEL 3 consortium), the conduction of two basic training courses on routers and switches, the security assessment of REDDIG II, and monitoring of results of tests conducted by the DGCA of Chile on access to SITA ACARS services through REDDIG II.

1.2 The Brasilia node, which was commissioned in April 2016 with two sub-networks (satellite and ground), is configured with the following services: one (1) AFTN circuit with Guyana, eleven (11) AMHS circuits with all adjacent countries and with Atlanta through MEVA III, three (3) administrative speech circuits, and four (4) ATS switched speech circuits.

1.3 It was reported that REDDIG II had a stable and highly reliable performance. A pending activity of importance was the implementation of measures to resolve the random freezing of some satellite modems, involving the replacement of LNB (low noise block) devices, initially in six (6) locations (Manaus, Recife, Ezeiza, Lima, Guayaquil, and Cayenne).

1.4 Regarding the REDDIG II training plan, it was noted that two basic training courses on routers and switches had been conducted: the first one, *Interconnecting Cisco Network Devices part 1*, on 9-13 November 2015, and the second one, *Interconnecting Cisco Network Devices part 2*, on 4-8 April 2016.

1.5 Regarding the REDDIG II security assessment, Conclusion SAM/IG/17/01 was formulated: *Actions to maintain the security in REDDIG II* requesting REDDIG member States to analyse the implementation of initial actions as listed in Appendix A to agenda item 4 of the SAM IG/17 meeting, and to submit the results of the assessment to the Twentieth meeting of the Coordination Committee of Project RLA/03/01 (RCC/20 March 2017) for approval.

1.6 As a follow-up to the conduction of trials by the DGAC of Chile for accessing the SITA ACARS service through the REDDIG, Conclusion SAM/IG/17/02 was formulated: *Analysis of the REDDIG II connection configuration for the transport of SITA data link services*, so that REDDIG II member States that have implemented or are in the process of implementing the ground-air data link service, as well as the REDDIG II administration, and SITA may analyse the connection configuration of REDDIG II shown in Appendix B to agenda item 4 of the SAM/IG/17 meeting and submit the results at this SAM/IG/18 meeting.

2 Discussion

2.1 The status of implementation of activities related to REDDIG II since the SAM/IG/17 meeting is shown below:

- REDDIG II Brasilia node
- REDDIG II pending activities
- LEVEL 3 ground network
- Training activities and technical-operational meeting
- REDDIG II security assessment
- Analysis of the connection configuration of REDDIG II for SITA data link services
- Migration of the REDDIG II node of Bogotá
- MEVAIII/REDDIG II interconnection activities

REDDIG II Brasilia node

2.2 Of all the services that should be available at the Brasilia node, the AMHS circuit between Brazil and Peru, the AFTN circuit between Brasilia and Cayenne, and the three administrative speech circuits are operational since the commissioning of the node in April 2016.

2.3 Regarding the AMHS circuit between Brazil and Peru, it is configured at the REDDIG II node in Brasilia since mid September. Previously, the circuit went through the REDDIG II node in Curitiba and arrived in Brasilia through a domestic communication network.

2.4 As to the remaining AMHS circuits at the Brasilia node, the focal point of Brazil has initiated coordination with most of the States at regional and inter-regional level. More information is provided in working paper 12, presented by Brazil.

2.5 On 29 September, coordination started for the implementation of the AFTN circuit between Brasilia and Cayenne through the REDDIG II nodes of Cayenne and Brasilia. The configuration was analysed by the focal points of Brazil and French Guiana and sent to INEO for its configuration and activation in REDDIG II, and was commissioned on 3 October 2016. With this implementation, the AFTN circuit between Cayenne and Manaus through the REDDIG II nodes in Cayenne and Manaus was decommissioned. **Appendix A** to this working paper contains the configuration of the AFTN Cayenne-Brasilia circuit in REDDIG II.

Pending activities of REDDIG II

2.6 In order to solve the random freezing problem at some nodes of REDDIG II, INEO has taken the following action:

- Change of LNBs and establishment of redundancy of the 10MHz signal transmitted by the Skywan equipment (one at a time) to the IBUC equipment and the new LNBs. This was done at six (6) stations: SAEZ-Argentina, SBMN-Manaus-Brazil, SBRF-Recife-Brazil, SOCA-French Guiana, SPIM-Peru and SEGU-Ecuador. INEO will make the changes in the LNBs of the remaining 11 nodes in view of the improvements obtained with the changes made.

- Re-configuration of the 'profile' of the entire Skywan network, which was completed on 20 July 2016. The satellite network went into an assessment phase.

    - SLLP station-Bolivia: Configuration of the administrative 6-digit channel.
    - SGAS station-Paraguay: Configuration of the administrative IP channel.
    - SBBR station-Brasilia: Configuration of the IP telephone and administrative channels.
    - Procedure for calculating usage of the satellite bandwidth (BW or 'Payload') of each network station.
    - Software/files for initial installation of NMS servers and "WhatsUp Gold" in all network stations.

2.7 It is expected that INEO will complete all of the aforementioned activities before the end of 2016 so as to proceed with the final acceptance of REDDIG II.

LEVEL 3 ground network

2.8 The REDDIG Administration has programmed and added 'Active Monitors' in the monitoring and control application of the Manaus, Ezeiza, and Lima stations, in order to monitor the availability of all Level 3 circuits. The availability of three locations improves precision when calculating circuit availability.

2.9 Since January 2016, this tool is being used for calculating the monthly (numerical and graphical) availability of each of the ground circuits of Level 3, which, in turn, is used for analysing compliance with the respective SLA (Service Level Agreement).

2.10 Appendix B to this working paper contains reports on monthly availability at some ground circuits, obtained using the monitoring tool.

2.11 Level 3 also sends its respective reports, and monthly meetings are being held with a representative of Level 3 either at the Lima Office or through teleconferencing, to analyse SLA compliance.

Training activities and technical-operational meeting

2.12 As part of the training activities for REDDIG II, a Basic course on REDDIG II operation and maintenance was held for personnel responsible for maintenance of REDDIG nodes that had not participate in the courses conducted by INEO in 2015.

2.13 The basic course was conducted in two versions, one for Spanish-speaking REDDIG member States, including Brazil, held at the facilities of the *Centro de Instrucción, Perfeccionamiento y Experimentación* (CIPE) of ANAC, at the "Ministro Pistarini" International Airport of Ezeiza, province of Buenos Aires, Argentina, on 5-9 September 2016, and another for English-speaking States, held at the Cheddi Jagan Timehri International Airport in Guyana on 26-30 September 2016. Technical personnel of all REDDIG nodes participated, with the exception of Colombia. The list of topics covered during the course appears in Appendix C to this working paper.

2.14 The Fifth technical-operational meeting of REDDIG II (RTO/5) was held *via* WEB teleconferences on 26 July for Spanish-speaking States and on 27 July for non-Spanish-speaking States. This meeting addressed aspects related to the performance of REDDIG II, the review and updating of REDDIG II maintenance and operation procedures, and the security assessment of the REDDIG, and its recommendations.

Security assessment of REDDIG II

2.15 Pursuant to Conclusion SAM/IG/17/01: Implementation of actions to maintain the security in REDDIG II, the RTO/5 meeting analysed general aspects related to REDDIG security, such as the updating of antivirus software in the servers, the classification and analysis of 'threats', and the respective recommendations.

2.16 Regarding the antivirus software in REDDIG II NMS servers, INEO performed the update in July 2016. Some stations have not yet installed the antivirus software in their servers. Consequently, the REDDIG Administration requested at the RTO/5 meeting that they coordinate such installation as soon as possible.

2.17 The RTO/5 meeting considered that 'threats' or risks should be classified into two groups, internal and external to REDDIG, as follows:

- Internal level. Potential risk factors to be taken into account and the respective recommendations to eliminate or minimise such factors.

    - Level 3 network
      That the ICAO Office request Level 3 to confirm compliance with standard RFC 5920 concerning the security of its service, using MPLS technology. Regarding RFC 5920, Level 3 informed that more than defining technical aspects, it defined the best security practices. In this sense, Level 3 noted that all its procedures were based on best practices. See **Appendix D.**

- VPN access *via* Internet
  Currently, INEO is using VPN access in a recurrent manner in Manaus, Ezeiza, and Brasilia to correct network issues or to update equipment configuration, and will continue using this access until final acceptance of the network. After that, all Internet connection cables will be withdrawn from all VPN routers in the network, and the operating modality will change to on-demand access (the Internet cable will be connected when needed). This modality will apply to all VPN routers of the network.

- Human factors
  The RTO/5 meeting recommended not to copy any file from/to the NMS server using a USB port without first verifying (antivirus scanning) that the portable device ('pen drive') is free of virus.

  Regarding the password to access NMS servers after network reception, the REDDIG Administration will change the access passwords of all network servers. Thus, personnel responsible for station maintenance will only have access to the equipment of their own station.

- External level

  - This level refers mainly to users and their equipment connected to the REDDIG. In this regard, the RTO/5 highlighted the importance of standardising the connection to REDDIG, which will also permit standardisation of security policies in the router/border switch equipment of the States. By way of example, mention was made of the implementation at the SCEL station-Chile, explaining the general connection diagram for IP native services, as shown in **Appendix E.**

  - The RTO/5 also considered as a 'threat' to network operation and security the radiofrequency interference that could occur in REDDIG stations, causing degradation or even interruption of aeronautical communication services. In this sense, it was recommended to pay attention to any installation by public telecommunication operators in the surroundings of the REDDIG station, and to keep in close communication and coordination with local authorities in charge of managing the radio electric spectrum.

Analysis of the connection configuration of REDDIG II with SITA data link services

2.18 Pursuant to Conclusion SAM/IG/17/02: *Analysis of REDDIG II connection configuration for the transport of SITA data link services,* the teleconference scheduled for 21 June 2016 was held among REDDIG member States, the REDDIG Administration, and SITA. The corresponding graphical schemes are contained in **Appendix F** to this working paper. Likewise, the configuration was discussed during the RTO/5 meeting, resulting in the following comments:

- SITA does not have any equipment of its own on the client side.
- The connection link (client node-gateway node) is exclusive between REDDIG nodes.
- SITA should install its router(s) 'behind' the router/border switch of the gateway node, and not directly to the REDDIG switch.
- For redundancy purposes, SITA requires two (2) simultaneous connections on line in two (2) gateway nodes. In this regard, the REDDIG Administration noted that it

would continue optimising REDDIG resources in terms of use of ports and satellite bandwidth for current and future services to be carried over the network.

- The delegate of Chile noted that Chile would analyse and assess SITA's proposal, taking into account the overall dual connection scheme locally available in Chile.

Migration of the REDDIG II node in Bogotá

2.19 The activities for the transfer of the REDDIG II node of Bogota have been postponed to another date, according to information provided by Colombia during the teleconference held on 30 September 2016 among representatives of LEVEL 3, Colombia, and the Colombian Administration. The transfer would be carried out during the first quarter of 2017. Operations in the new Bogota ACC are scheduled for early October 2016. The technical personnel of Colombia has conducted activities to provide ATS speech and data communication services from REDDIG II and the interconnection to adjacent States in the SAM Region.

MEVAII REDDIG II from the current position of the REDDIG II node in Bogota

2.20 Regarding scheduled activities related to the MEVA III/REDDIG II interconnection, an ATS direct speech circuit (hot line) was implemented and commissioned in late August 2016 between the Maiquetía ACC and the San Juan ACC. Prior to that, three teleconferences were held on 2, 19, and 24 of August among representatives of Venezuela (REDDIG II focal points), the FAA, the MEVA III provider (Frequentis), and the REDDIG II Administration.

3. Suggested action

3.1 The Meeting is invited to:

a) take note of the information presented herein;

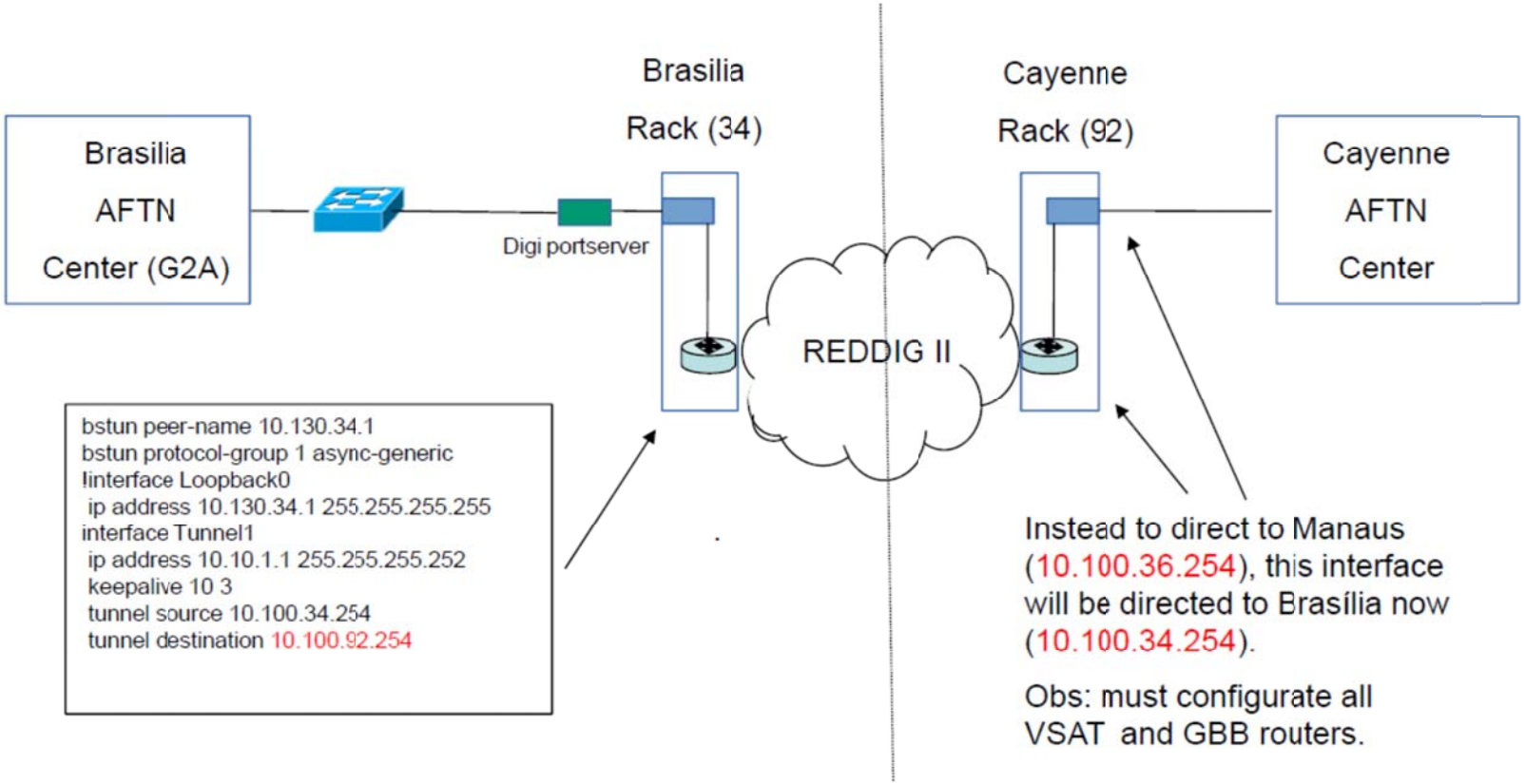
b) review REDDIG II activities carried out since the SAM/IG/17 meeting, as shown in section 2 and the associated Appendices; and

c) discuss any other matters it may deem appropriate.

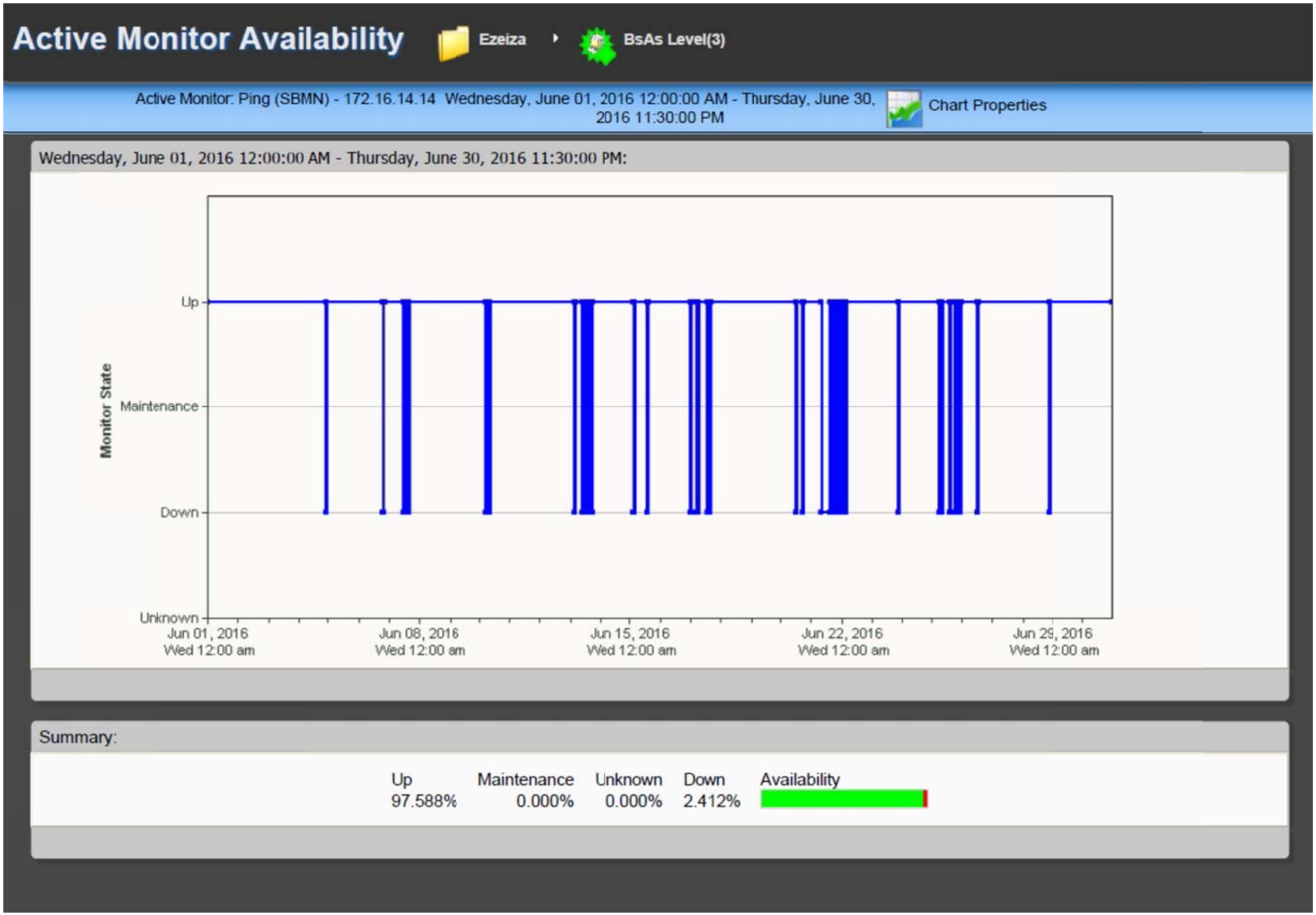
APPENDIX A

AFTN Circuit

Brasilia/Cayenne



APPENDIX B


Active Monitor Availability
Ezeiza
BsAs Level(3)
Active Monitor: Ping (SBMN) - 172.16.14.14 Wednesday, June 01, 2016 12:00:00 AM - Thursday, June 30, 2016 11:30:00 PM
Chart Properties
Wednesday, June 01, 2016 12:00:00 AM - Thursday, June 30, 2016 11:30:00 PM:
Monitor State
Up
Maintenance
Down
Unknown
Jun 01, 2016 Wed 12:00 am
Jun 08, 2016 Wed 12:00 am
Jun 15, 2016 Wed 12:00 am
Jun 22, 2016 Wed 12:00 am
Jun 29, 2016 Wed 12:00 am
Summary:
Up 97.588%
Maintenance 0.000%
Unknown 0.000%
Down 2.412%
Availability

APPENDIX C

REDDIG II OPERATION & MAINTENANCE

Content

1. Arquitecture of the REDDIG II

- Satellite network
- Support ground network
- Global Plan for Addressing IP

2. REDDIG II Nodes

- Types and Components
- Local IP Addressing Plan

3. RF Equipment

- IBUC + Redundancy
- LNB + Redundancy
- HHT and TCP/IP (Web) Access

4. Modem Skywan

- Model 7000
- Model 1070
- Redundancy
- 'Telnet" and "Line-up Manager" Access
- Performance

5. Ethernet Switch Netgear

6. Cisco Reuter

- Interfaces
- VRRP redundancy protocol
- OSPF routing protocol
- VLANs
- Commands on line
- Interfaces monitoring
- Settings

7. Baseband Commuter (RSS) and "Patch Panel"

8. NMS – WhatsUp Gold

- NMS Central Server
- NMS Remote Server (Local)
- Web access
- Modules and displays
- Monitors
    - Active Monitor
    - Performance Monitor
- Alarms

APPENDIX D

Level(3) COMMUNICATIONS

Connecting and Protecting the Networked World

Lima 25 de Agosto del 2016

Señores
INTERNATIONAL CIVIL AVIATION ORGANIZATION
Av Victor Andres Belaunde No 147 - Edificio Real 4 Piso 4

San Isidro

Atención : Onofrio Smarrelli

Referencia : Consulta Técnica

Estimados Sres.:

Por medio de la presente respondemos su consulta sobre conocer los estándares de seguridad que tiene implementado Level 3 en sus procedimientos, en relación al cumplimiento con la RC 5920.

La RFC 5920 nos brinda una reseña de las mejores prácticas de seguridad, en tal sentido confirmamos que Level 3 aplica las mejoras prácticas en temas de seguridad no solo en relación al cumplimiento con la RFC debido a que existen practicas adicionales las cuales no están consideradas en dicho documento y que venimos aplicando activamente .

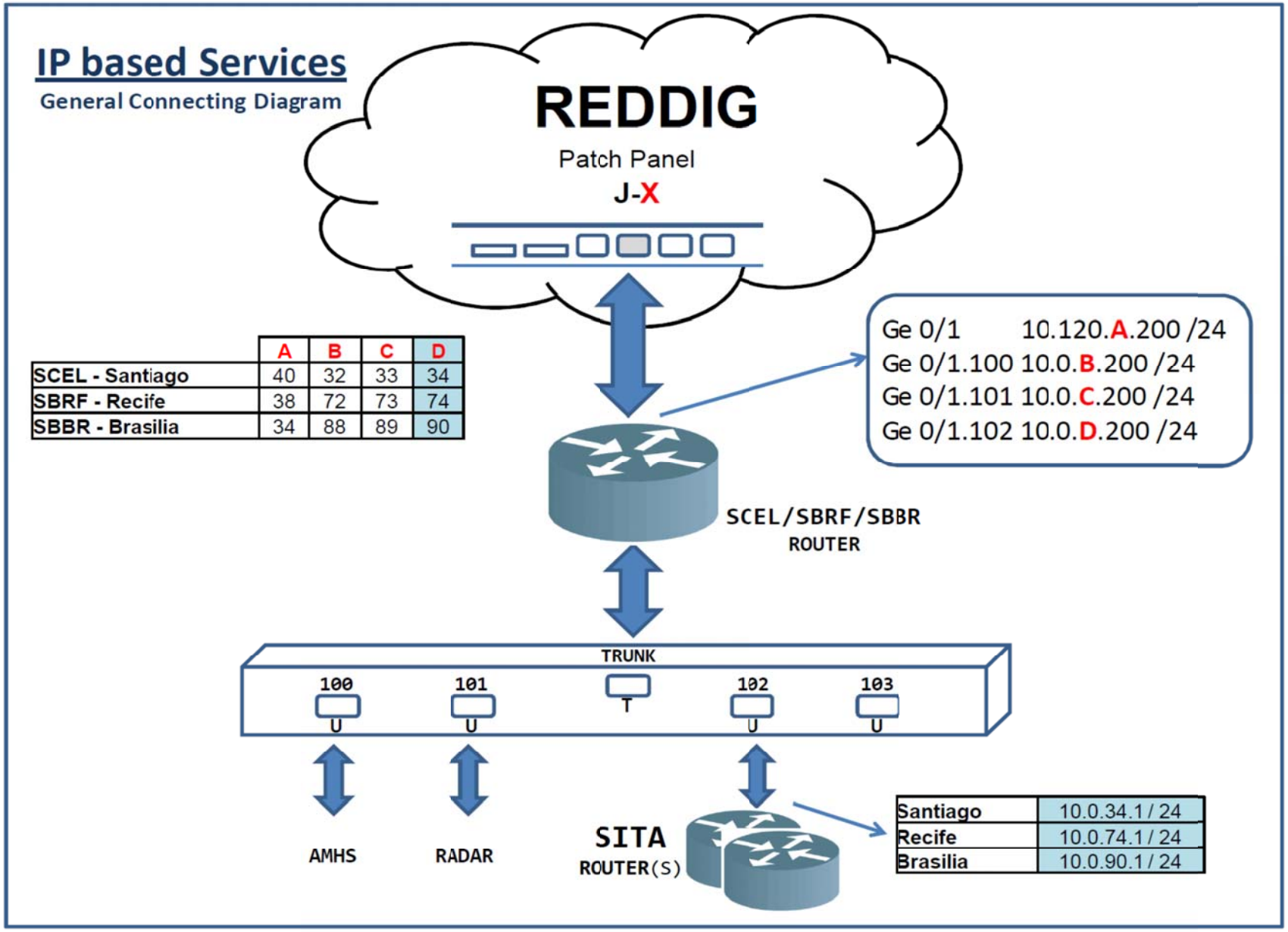
Debido a políticas de confidencialidad y de seguridad propiamente dicho , no podemos detallar nuestros estándares, justamente para no generar ninguna vulnerabilidad ni poner en riesgo los servicios que brindamos.

Agradecemos su atención prestada, sin otro particular quedamos de ustedes.

Atte,

Katherine Quezada Rosales
Service Manager
Level 3 Perú

APPENDIX E



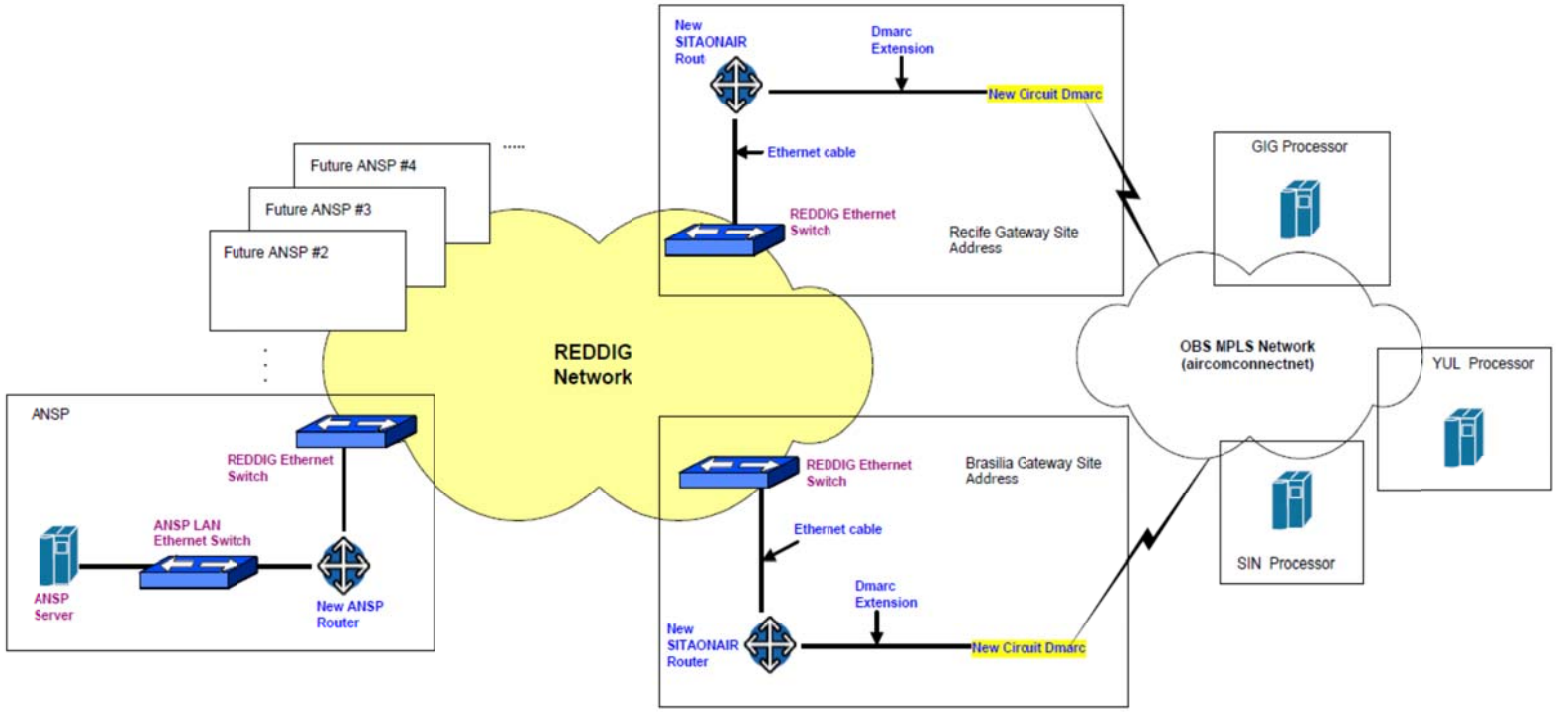
	A	B	C	D
SCEL - Santiago	40	32	33	34
SBRF - Recife	38	72	73	74
SBBR - Brasilia	34	88	89	90

Santiago	10.0.34.1 / 24
Recife	10.0.74.1 / 24
Brasilia	10.0.90.1 / 24

APPENDIX F

Proposed REDDIG Gateways Network Topology

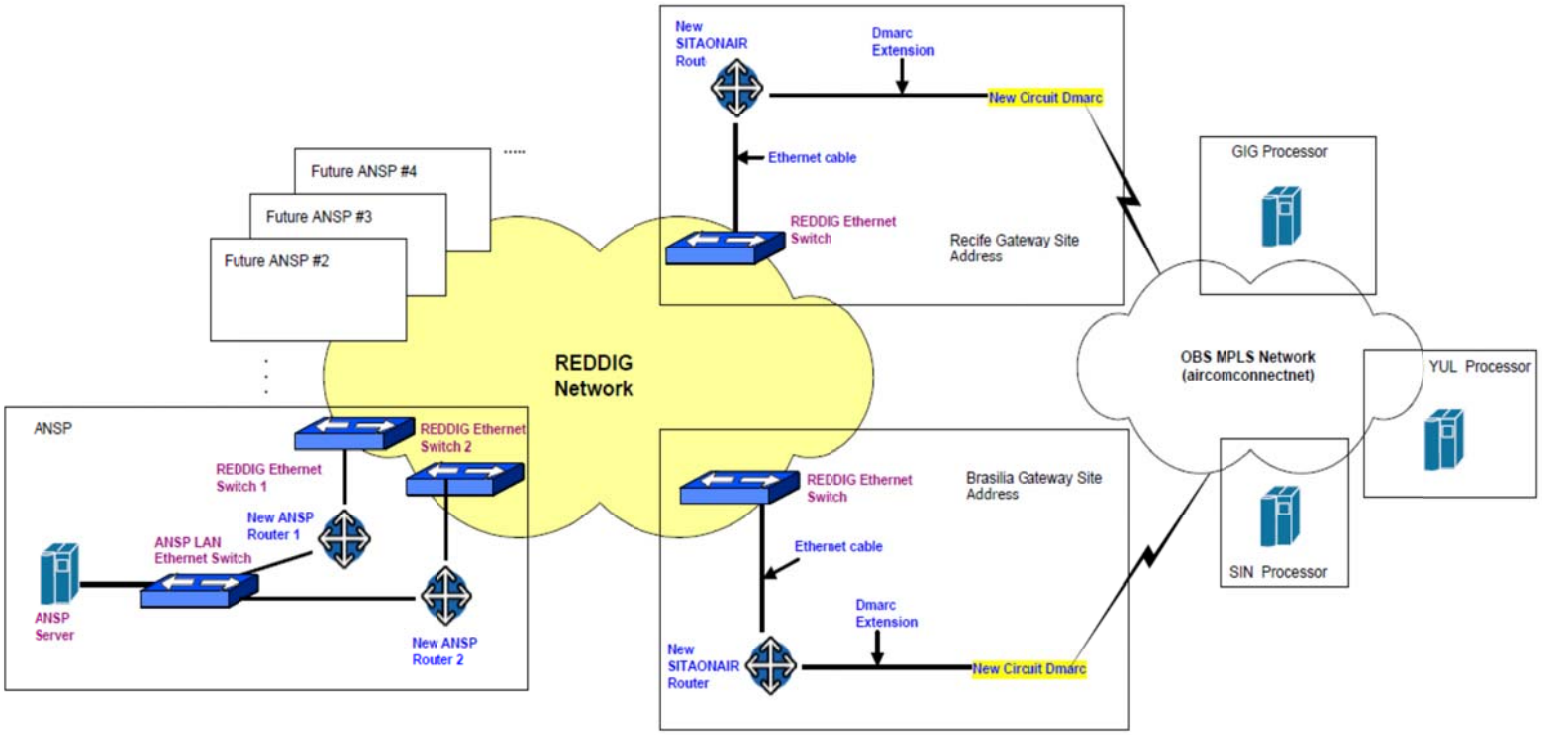
SITAONAIR



Description:	Proposed REDDIG Gateways Topology	
Initial Design:	B. Bryant	06/30/2016
Last Update:	B. Bryant	06/30/2016
File:	ProposedREDDIGGatewaysOverviewANSPArgentina - Router config sent by Reddig.vsd	

Proposed REDDIG Gateways Network Topology

SITAONAIR



Description:	Proposed REDDIG Gateways Topology	
Initial Design:	B. Bryant	06/30/2016
Last Update:	B. Bryant	06/30/2016
File:	ProposedREDDIGgatewayOverviewANSPdualRtrs - ANSP Config Recommended.vsd	