International Civil Aviation Organization SAM/IG/17-WP/21
South American Regional Office 06/05/16
Seventeenth Workshop/Meeting of the SAM Implementation Group (SAM/IG/17) - Regional Project RLA/06/901
Lima, Peru, 9 to 13 May 2016

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

Follow-up of Chile ANSP test implementation to access the SITA ACARS service through the REDDIG II network

(Presented by SITAONAIR)

SUMMARY

This WP presents a follow up of Chile ANSP test implementation to access the SITA ACARS service through the REDDIG II network and related study of cost benefit**.**

References:

1.1 Performance-Based Air Navigation System Implementation Plan for the SAM Region, version 1.4, ICAO
1.2 Final Report - RLA/03/901 Fourteenth workshop/meeting of the SAM Implementation Group (SAM/IG/14)
1.3 Final Report - RLA /03/901 Eighteenth meeting of the Coordination Committee (RCC/18)
1.4 Final Report - RLA/03/901 Fifteenth workshop/meeting of the SAM Implementation Group (SAM/IG/15)
1.5 Final Report - RLA/03/901 Sixteenth workshop/meeting of the SAM Implementation Group (SAM/IG/16)
1.6 Final Report - RLA/03/901 Nineteenth meeting of the Coordination Committee (RCC/19)

ICAO Strategic Objectives:	*A - Safety* *B - Air navigation capacity and efficiency*

1. Introduction

1.1. SITA proposes the South American ANSPs and the ICAO SAM office evaluate and agree on the ANSP system use of the REDDIG network to access the SITA Brazil ACARS processor to communicate via the SITA ACARS service with its user aircraft, using connection to ACARS processor in Montreal as backup solution.

1.2. The RCC/18 Meeting approved the implementation of the SITA data link service through the REDDIG II beginning trials with Chile what has been confirmed by the Administration of Chile on 15 April 2015. It wast agreed then to test the access to the SITA data service through the REDDIG node in Santiago (with real datalink traffic, keeping the conventional connection as backup). This trial started on 8 October 2015 and a preliminary report was offered by SITA to RCC/19 meeting hold on last March 7-9.

2. Discussion

2.1. The RCC/19 Meeting report updated the Conclusion RCC/18-2 Tests to access the SITA data *link service through the REDDIG II by ANSP* and considered that the process for the performance of the test to access the data link information from ACC oceanic Chile through REDDIG II to Recife REDDIG II node and then through SITA network to the new processing center of Rio had been performed successfully.

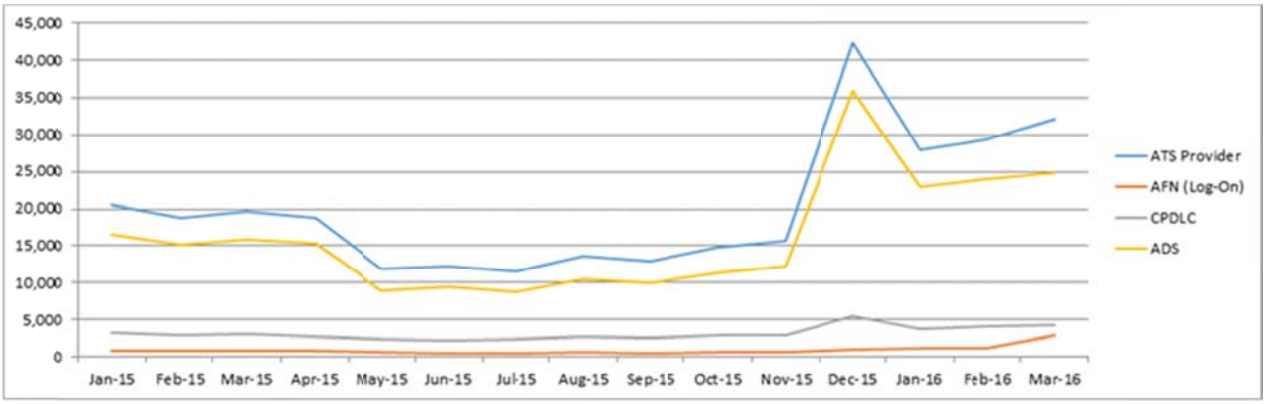
2.2. SITA, DGAC Chile and RCC/19 agreed to continue the trial until first week of May, and present the final report and the study of cost benefit made by Chile and SITA using REDDIG II to transport data link service.

2.3. The RCC/19 meeting was also presented with a network configuration design developed by SITA for operational use by any ANSP willing to connect to SITA using its REDDIG II node as point of access, thus ensuring a profitable use of an ATC dedicated network.

Trial report summary

2.4. During the trial period it was obseved an increase on data link traffic. According to DGAC Chile, these growth is due mainly three reasons:

- the expansion of ADS-C and CPDLC services for an specific airway operated by LAN and Aeromexico;
- Trial and operational process to incorporate UL 780 and UL 302 as air space operated by Delta airlines, American Airlines and LAN; and
- Beginning of Air New Zeland operations.

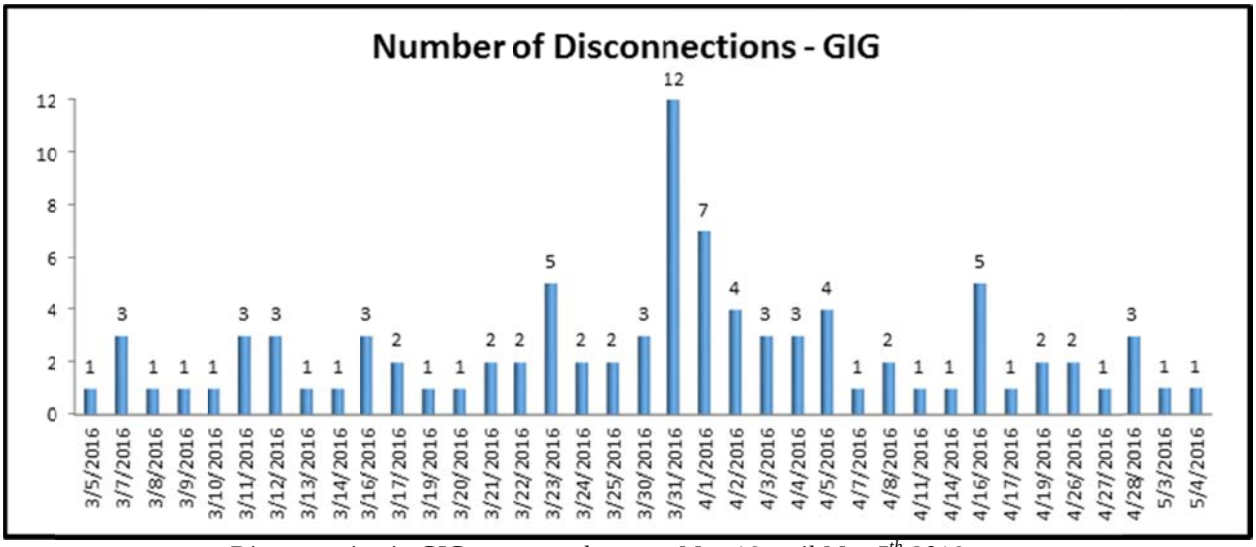


Data link traffic between Jan-15 until Mar-2016

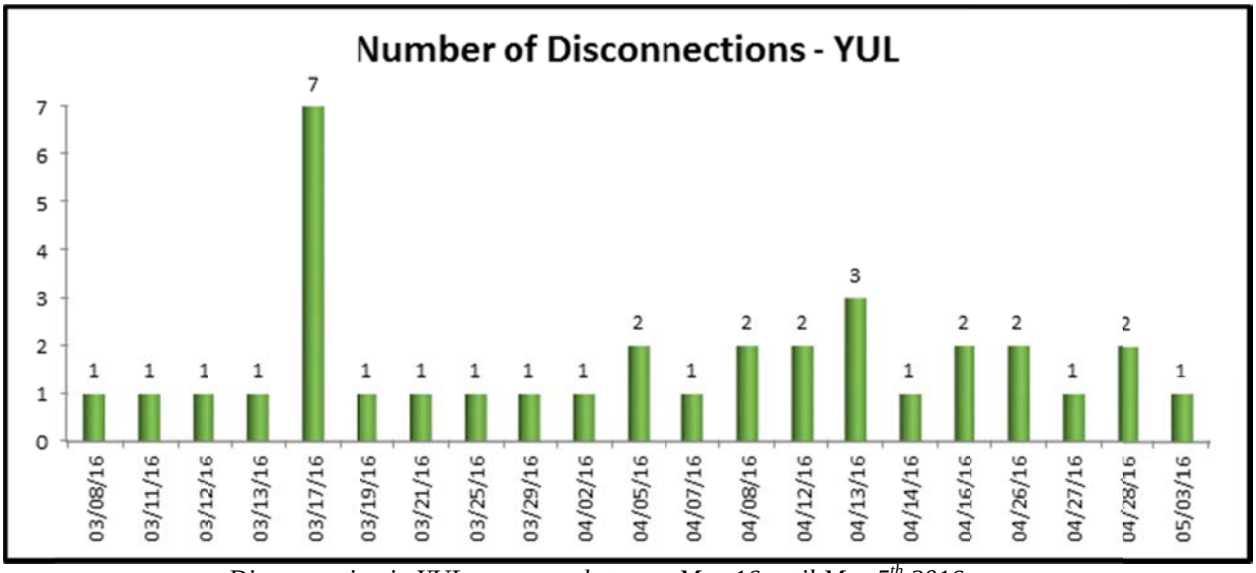
2.5. The connection set up between DGAC Chile FANS server and REDDIG, and between REDDIG and SITA, using a DECEA router in Recife has not been changed.

2.6. The network confirguration and IP addresses allocated for DGAC server and routers related to the trial have not been changed.

2.7. During the trial period of March and April it was observed a decrease in the number of disconnections in GIG processor. DGAC Chile detected one disconenction event happened on March 31th, when the traffic had to be changed from REDDIG to OBS for some hours. SITA operations confirned the event that is still being investigated.



Disconnection in GIG processor between Mar-16 until May 5th 2016



Disconnection in YUL processor between Mar-16 until May 5th 2016

2.8. In order to prevent any other disconnections event, a patch was implemented in SITA data link processors routine, in order to ensure downlink messages are distributed and received by any of the processor in priority to the available local direct link and next on the remote link with the DGAC server. The new asymmetric configuration was implemented on three ADFP systems in Singapore, Montréal and Rio since April 4th.

2.9. The current status is normal for the REDDIG trial access between DGAC Chile and SITA.

2.10. An detailed report updated for the trial is presented in the Appendix A.

Study of Cost benefit

2.11. SITA and ANSP signed commercial agreements for data link service provision in their respective FIRs. The costs estimation take into consideration, among other factors, the amount of ICAO addresses to be served, managed service including operational support, monthly performance reports, etc as well the type of the IP connectivity solution implementation requirement defined by the ANSP (single IP or XoT circuit, or MCS including circuit backup features).

2.12. The connectivity solution between an ANSP and SITA network has variable cost depending on generic IP generic telecom networks that were not designed specifically to support ATC or air-ground communications.

2.13. In the working paper presented in the RCC/18 meeting in 2015, SITA offered a traffic load example using ACC Atlantico data link traffic to demonstrate that the usage of an ANSP accessing SITA data link processor through REDDIG would have very low impact to REDDIG. However a complete verification of traffic load for DGAC Chile during trial period depend on DGAC and REDDIG to review the traffic usage for the period. Currently only global traffic can be verified in each REDDIG node but REDDIG is studying with network operator to have discriminated traffic accounting by application or service in the future.

2.14. Therefore, for based on technical requirements and trial results obtained so far, SITA developed a proposed final connectivity solution to be implemented in case DGAC or any other ANSP option for REDDIG access to SITA data link processor in Rio.

2.15. Also, based on trial demonstration about its configuration and proposed operational solution configuration for REDDIG access, SITA can confirm that the SITA commercial model to be adopted in case an ANSP chooses to be connected via REDDIG to SITA **will not include any SITA** connectivity charges to the ANSP and the only possible charges to the ANSP could be from the REDDIG service provider for the additional REDDIG usage.

2.16. In the case of DGAC Chile, they shall consider current costs with SITA contract that includes high availability connectivity services with dual/diversified access to SITA network via OBS administrated links compared to implement operational connectivity solution with same requirements through REDDIG.

2.17. The SITA ACARS processor is at Rio GIG airport where there is no REDDIG access point so during the trial it has been necessary to install a connection to the DECEA Recife REDDIG access point and to avoid this intermediate network SITA would welcome ICAO and the REDDIG community considering allowing SITA to pay for the establishment of a REDDIG access point at GIG airport to give REDDIG users direct access to SITA.

2.18. A summary for the study of cost benefit analysis is provided in the Appendix B of this working paper.

3. Suggested action

3.1. The Meeting is invited to:

a) Take note of the information presented in this paper;

b) review the final report for the implementation tests conducted by the ANSPs of Chile to access the SITA ACARS service through the REDDIG II network activities and Study of Cost Benefit for DGAC Chile, besides respective Appendixes; and

c) discuss any other related matters as the Meeting may deem appropriate.

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Appendix A – Trial Final Report

DGAC Chile/REDDIG access to SITA

1. Trial objective

The interconnection solution shall enable the flow of data link messages between ground system (DGAC Chile/FANS server) and equipped aircraft during the period of use, by using REDDIG as the IP ground network to connect Chilean server and SITA ACARS processor.

2. Connectivity requirements

The network connectivity solution to support this exercise privileged the following requirements:

- The operational FANS (ADS-C and CPDLC) services provided by DGAC shall not be affected during the trial period;
- SITA, REDDIG and DECEA networks safety and performance are kept without any impact;
- SITA processor located in Rio which supports all data link services provided to DECEA and airlines in Brazil shall not be impacted.

3. Network development plan

This network development plan was separated in 3 parts: the connection of DGAC to REDDIG network in Chile (Chile side), the connection of REDDIG to GIG Processor network in Brazil (Brazil side) and the feasibility of the operation through REDDIG network.

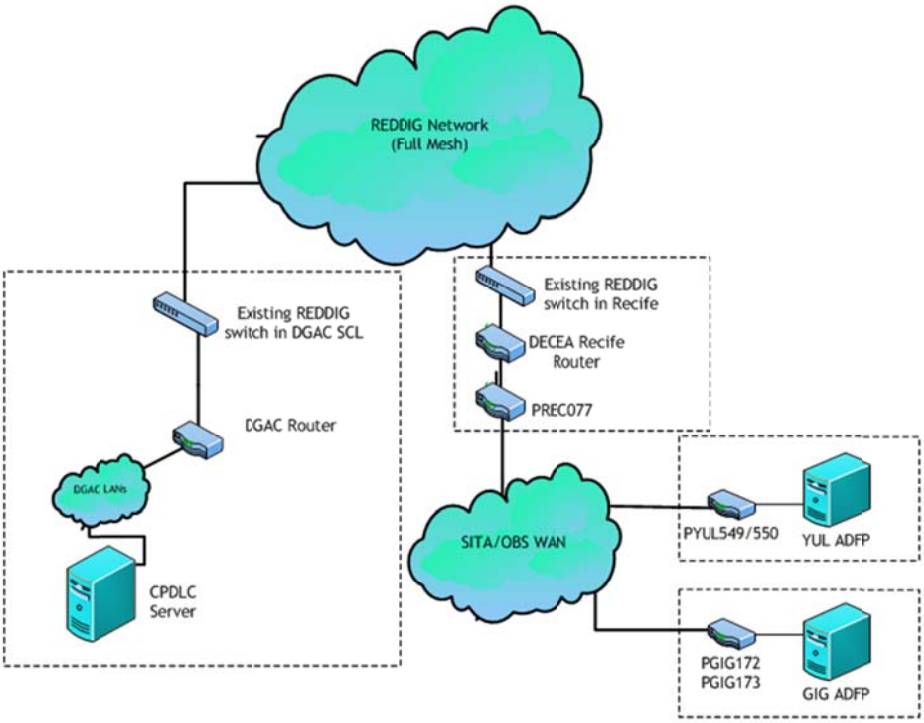

Figure 1: Connection proposal between REDDIG, DGAC and GIG/YUL Processor

4. Connection between DGAC and REDDIG

DGAC and REDDIG's equipment are in the same Equipment Room (Figures 2, 3 and 4) and only for the trial phase, DGAC is responsible for the physical connection between REDDIG switch and DGAC server.

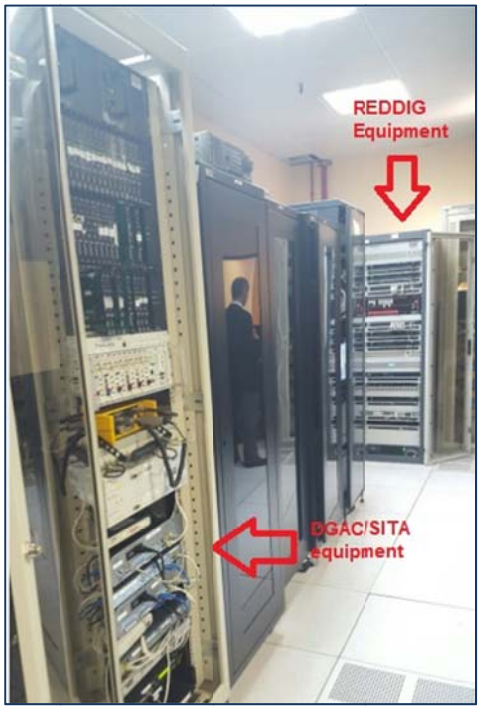

Figure 2: DGAC and REDDIG in ACCO Equipment Room in Santiago.

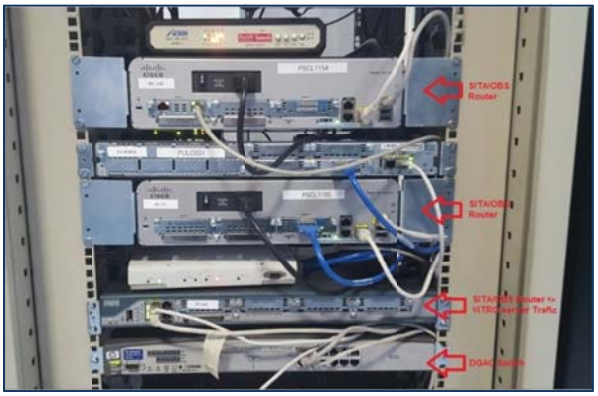

Figure 3: SITA and DGAC Equipment.

Figure 4: Node Santiago REDDIG Equipment.

DGAC made available a new router equipment to connect to VITRO server through DGAC switch to REDDIG switch during the trial period. This configuration allowed the proper configuration and no impact in other services.

5. Connection between REDDIG and SITA

The physical connection between REDDIG network and SITA network was accomplished by the installation of a new DECEA router between REDDIG router and PREC077/SITA router in Recife-Brazil.

6. Network Configuration

A VLAN Test 102 was already configured by REDDIG in Chile and Recife, and no modification was necessary.

DGAC and SITA had to make IP translations to pass the traffic through REDDIG according to Figure 5.

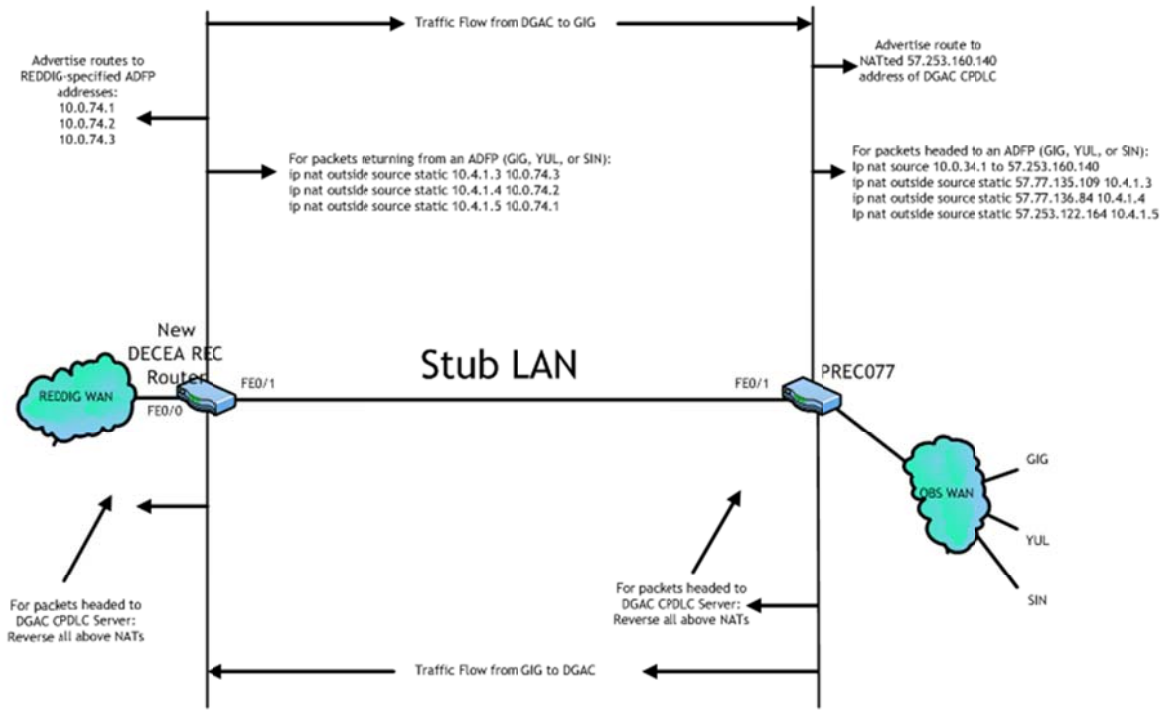

Figure 5: NAT and routings.

DGAC had to configure the IP 10.0.34.200/24 in the router port (Figure 6).

DGAC router needed to accept traffic from primary and secondary links all the time and establish the connection to GIG processor through REDDIG as primary and YUL/SIN processor through OBS as secondary.

This configuration allowed contingence between processors (GIG and YUL) and transmission (REDDIG and OBS), but DGAC had to check the following configuration in VITRO Server:

- Add the REDDIG connections to GIG and YUL on top of the existing connections with SIN & YUL ADFP.
- Use ROUTE commands at the OS level to route the packets on separate gateways depending on the destination address.

In summary, the trial consists on having traffic from VITRO Server to SITA Rio processor through REDDIG (SCLCAYA + REDDIG + GIG) and to YUL processor through OBS transmission (SCLCAYA + OBS + YUL), as exhibited on Figures 6 and 7.

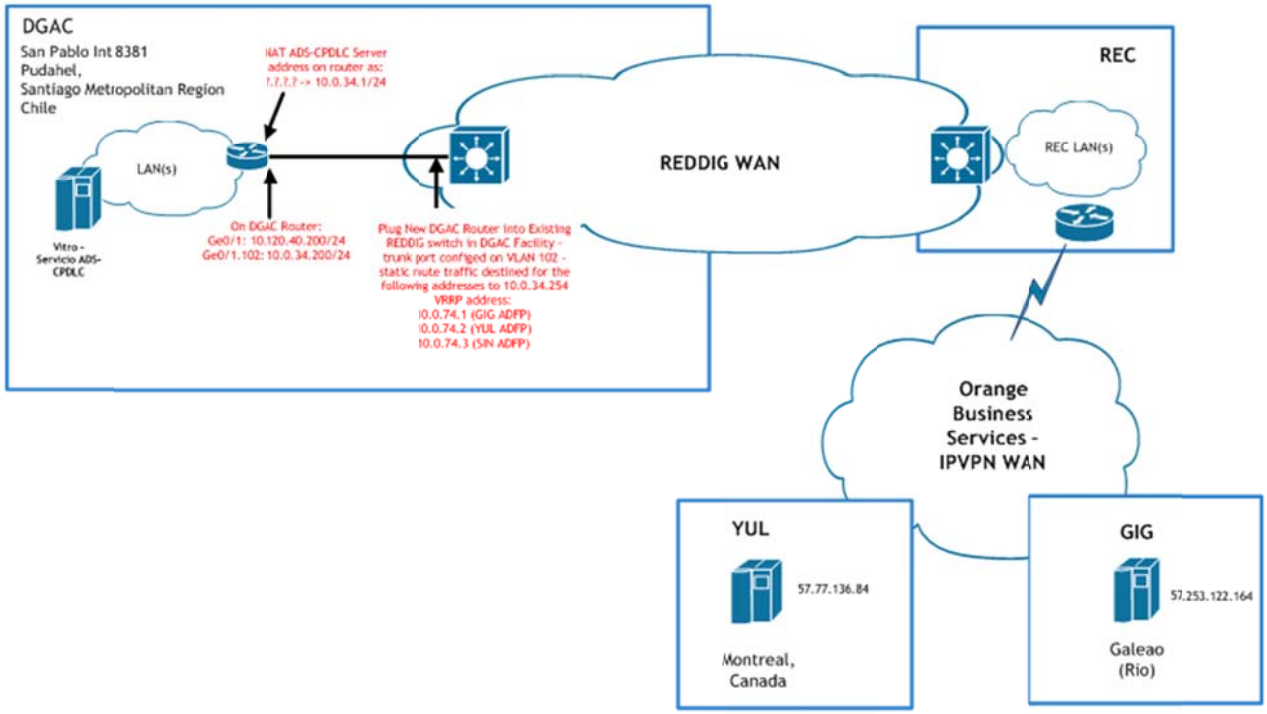

Figure 6: Configuration proposed in ACCO-DGAC.

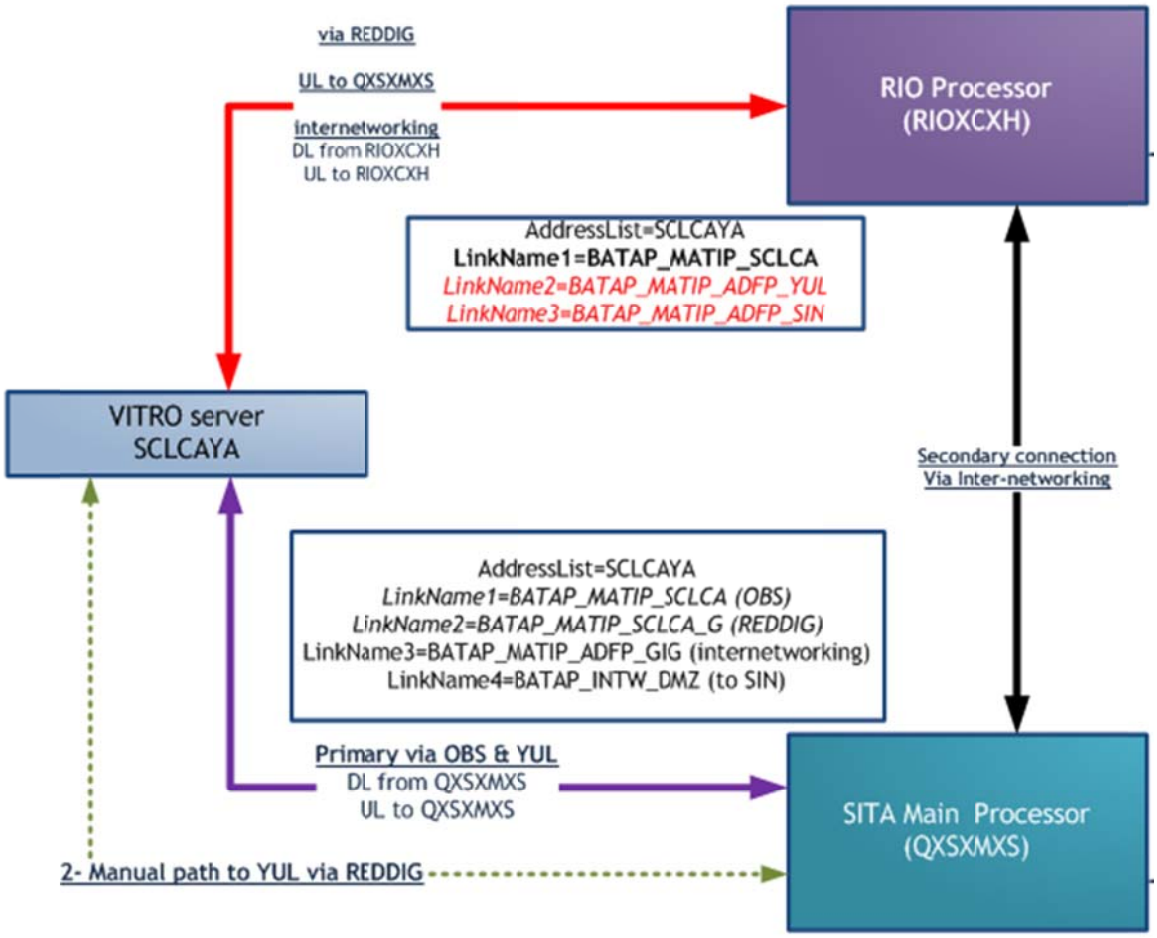

Figure 7: Configuration between VITRO Server, GIG and YUL Processors.

7. DGAC FANS Server

Currently DGAC has two FANS servers: VITRO and TOPSKY. VITRO is used for oceanic traffic and is current connected to SITA YUL/SIN through OBS link. TOPSKY is being used for continental traffic in ACCS, but this system still need software configuration updates in order to be used for data link services.

DGAC had to configure SCLCAYA (VITRO) to accept downlink from RIOXCXH during the test period to establish the communication with GIG ADFP.

8. Trial Setup and schedule

The trial initiated on October 8th 2015 after having all the physical connections in place. The router and server configurations were performed together during the tests according the schedule below:

DAY 1: Thursday, 8th October

12:00 – 15:00 GMT **Installation and configuration of the equipment in Chile**

1.a. Cables and new router installation between REDDIG and DGAC in Chile
1.b. Configuration of the network in DGAC, Recife and SITA.
1.c. Telnet test to check the connections

DAY 2: Tuesday, 20th October

11:00 – 13:00 GMT **Installation and configuration of the equipment in Recife**

2.a. Cables and new router installation between REDDIG and PREC in Recife
2.b. Configuration of the network in DGAC, Recife and SITA.
2.c. Telnet test to check the connections

14.00 – 16.00 GMT **Migration of the traffic**

2.d. Configuration of the CPDLC server to use YUL Processor through REDDIG
2.e. Configuration of the CPDLC server to use GIG Processor through REDDIG
2.f. Observe the traffic through REDDIG to GIG

DAY 3: Wednesday, 21th October

11:00 – 13:00 GMT **Definition of trial duration and back up connection of the network**

3.1 DGAC informed the duration for the trial
3.2 Add the configuration on the CPDLC traffic to YUL processor through OBS
3.3 Observe the traffic

DAY 4: Thursday, 23th October

17:00 – 18:00 GMT **Complete the backup tests between REDDIG and OBS transmissions**

4.1 Configuration at SITA processor to have backup
4.2 Test the backup solution

9. Results and Measures during the trial

Data link message traffic volume

During the trial, SITA used its network monitoring tools in order to verify the volume of data link traffic going through REDDIG and OBS links.

The summarized table below shows the BATAP message traffic volume (both inbound/outbound directions and data/IMA messages) on links MATIP_SCLCA in YUL ADFP and MATIP_SCLCA in GIG ADFP.

The results are presented for the Nov, Dec, Jan and Feb months:

BATAP Message Traffic Volume		
Month	**YUL Processor**	**GIG Processor**
November-15	*	46024
December-15	*	79352
January-16	9718*	56831
February-16	57690	18738**

*Period from Nov 15, 2015 to Feb 24, 2016
** Data until Nov 23th

Logs and Network information

During the trial period, the following significant events were reported:

Jan 14th and 15th, 2016: a message codification issue was found by DGAC and it was fixed by SITA

Jan 15th, 2016: SITA could observe some quick disconnections as Figure 8, but they don't affect the message exchange when less than 1 second. REDDIG informed no issues in their Network on Nov 18th

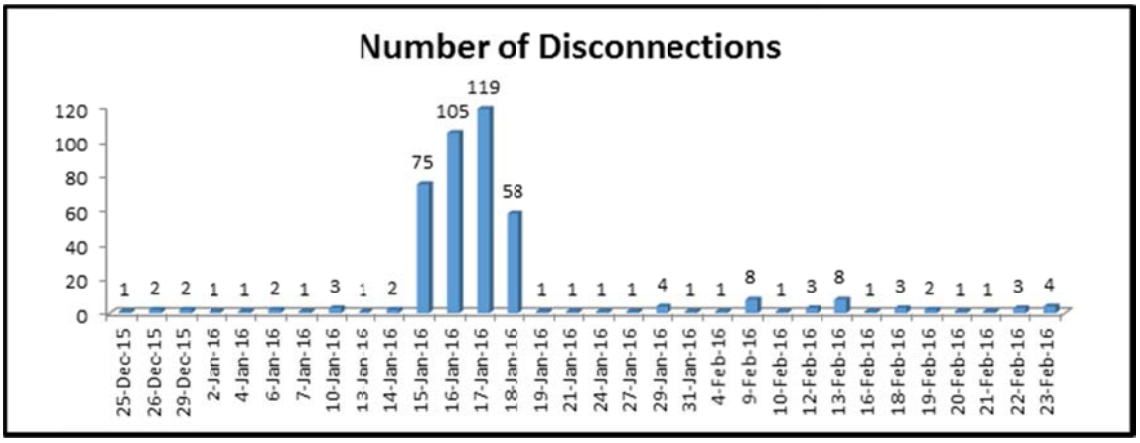

Figure 8: Number of Disconnections

Feb 9th, 2016: upon SITA request, DGAC has fixed the BATAP type of message. This change was necessary to avoid duplicated messages to both SITA processors YUL and GIG.

10. Next steps for the trial

SITA and DGAC agreed on following next steps in order to consolidate the trial results:

- DGAC will forward to SITA their logs, events and traffic since Feb 2016 for investigation purposes on disconnection event from March 17 and 31;
- SITA and DGAC to agree on trial decommissionment procedure and date.

11. Proposed Network Design for operational use of ANSP REDDIG access to SITA

The DGAC/REDDIG/SITA trial is being performed using a network design that considered the aspects described in the items 2 to 6 of this present report.

Based on lessons learned so far and taking into consideration the main requirement of no impact to ANSP, REDDIG and DECEA networks, SITA has developed a proposed network configuration design for operational use by any ANSP willing to connect to SITA using their REDDIG node access, and therefore ensuring to be using a dedicated ATC network under cost effective manner.

Main network requirements for the operational use:

- ANSP ground server should be connected via REDDIG (primary) to GIG (primary) and YUL (secondary) to make ATC message exchange;

- DECEA's nodes with REDDIG in Recife and Brasília (2 switches with cable and VSAT access each) could be used to connect REDDIG to SITA's processors;

- Equipment and site contingence to provide the communication to SITA's processors as figures 9, 10 and 11.

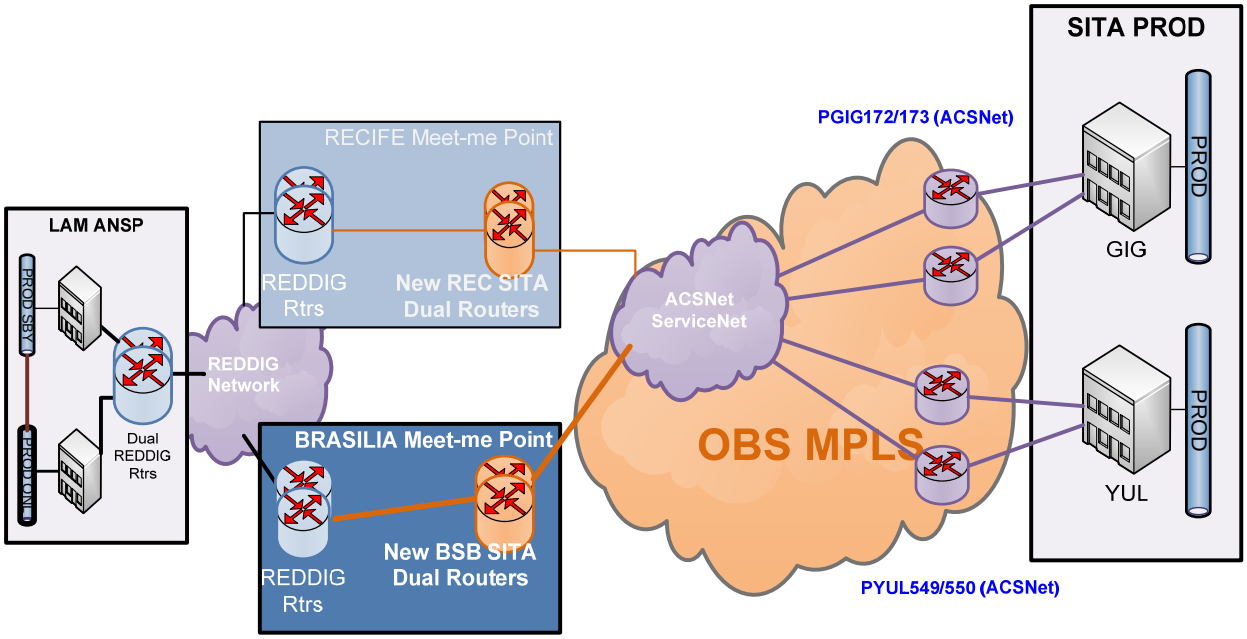

Figure 9: Network diagram for operational use

Proposed Recife Gateway between REDDIG Network and ACSNet Community on OBS Network

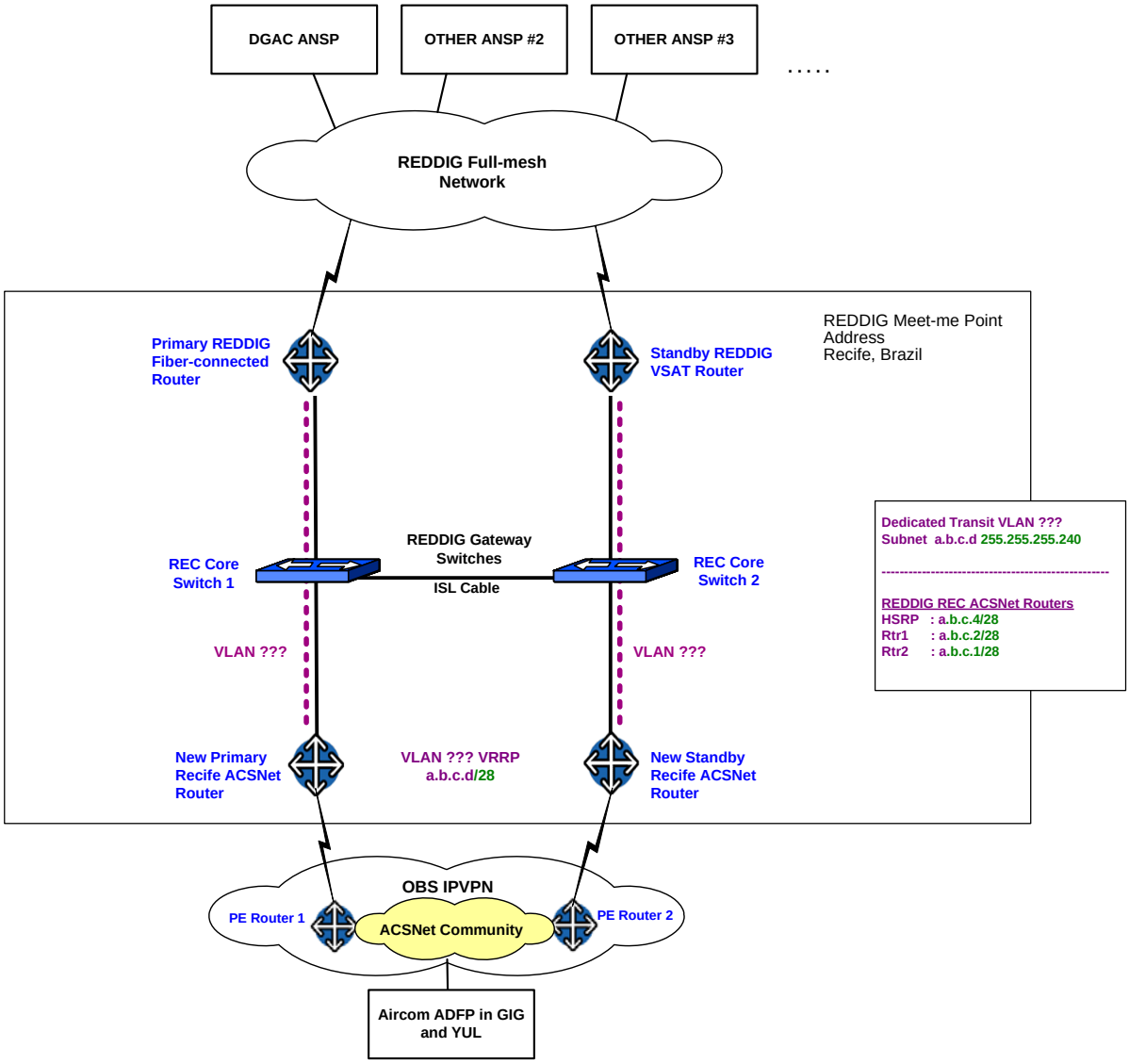

Figure 10: Proposed network solution – Recife site

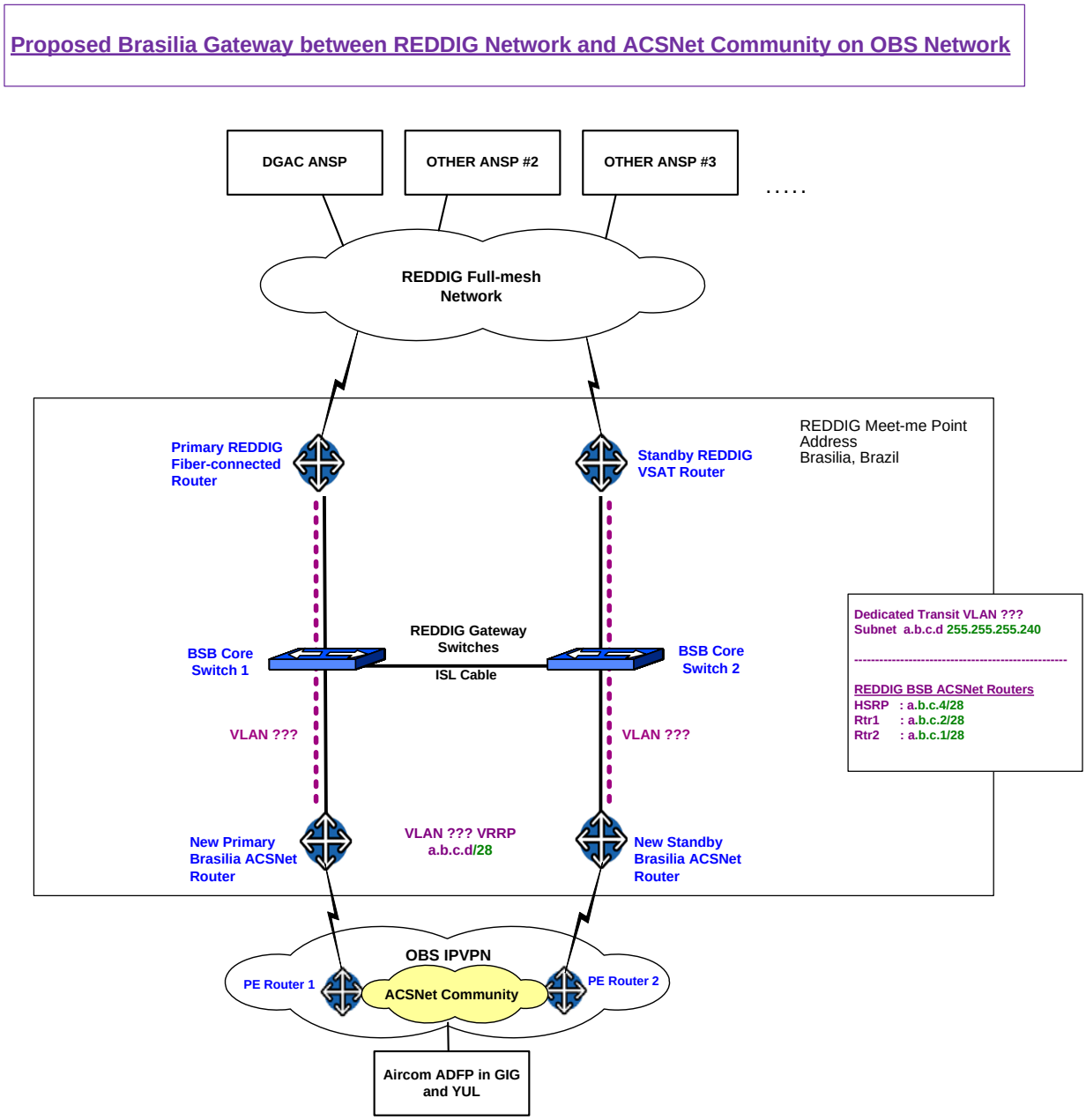

Figure 11: Proposed network solution – Brasília site

Appendix B

Study of Cost Benefit

DGAC Chile/REDDIG access to SITA

DGAC Chile access to SITA AIRCOM

Appendix B - Cost benefit analysis for REDDIG access

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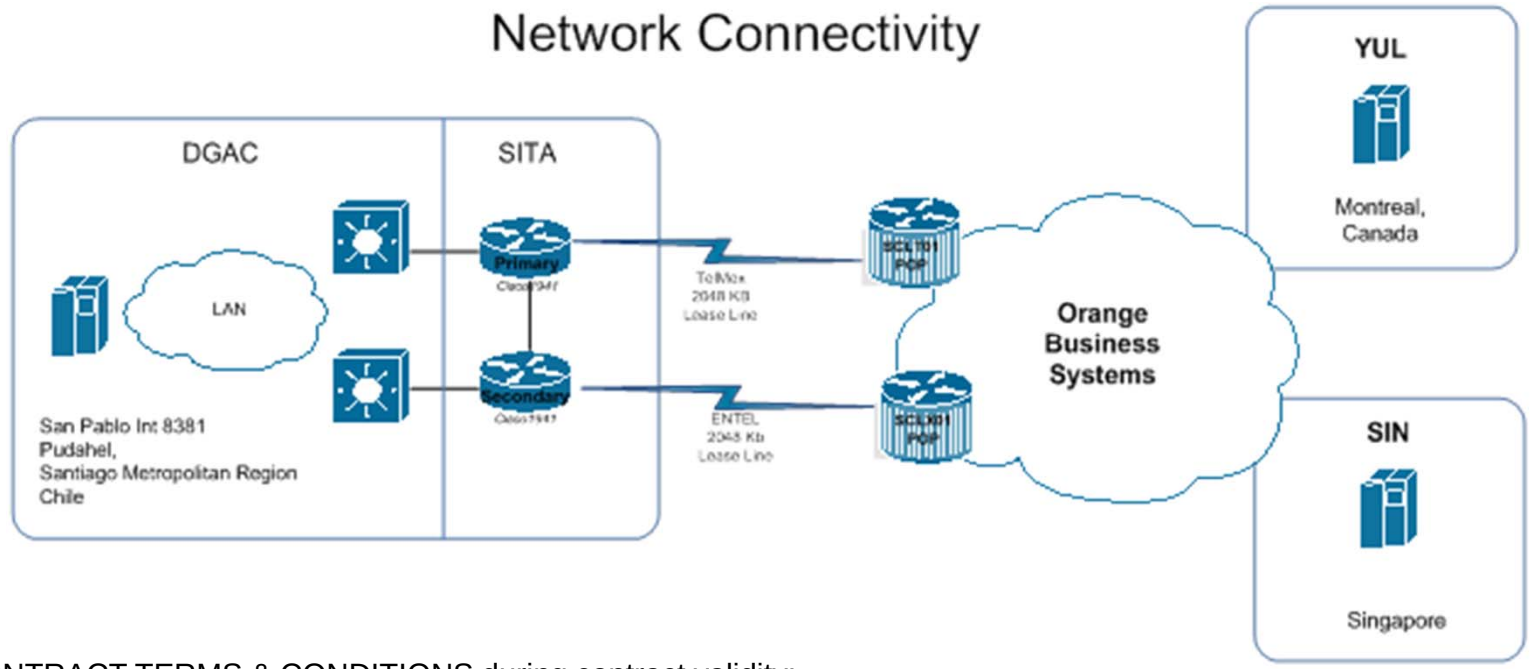
1. Connectivity solution as per existing contract



SITA CONTRACT TERMS & CONDITIONS during contract validity:

- **Connectivity solution based on OBS links (installation one-off charge + monthly charges)**
- FANS managed services (monthly charges)

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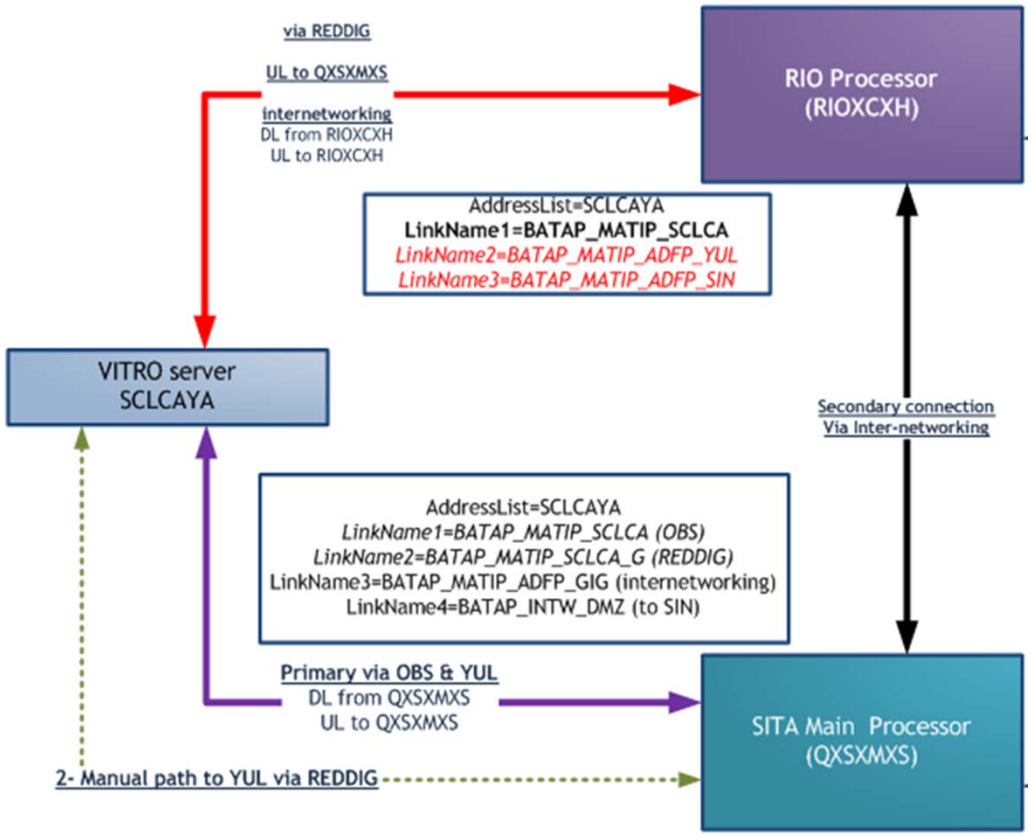
2. Connectivity solution for REDDIG trial (FoC)



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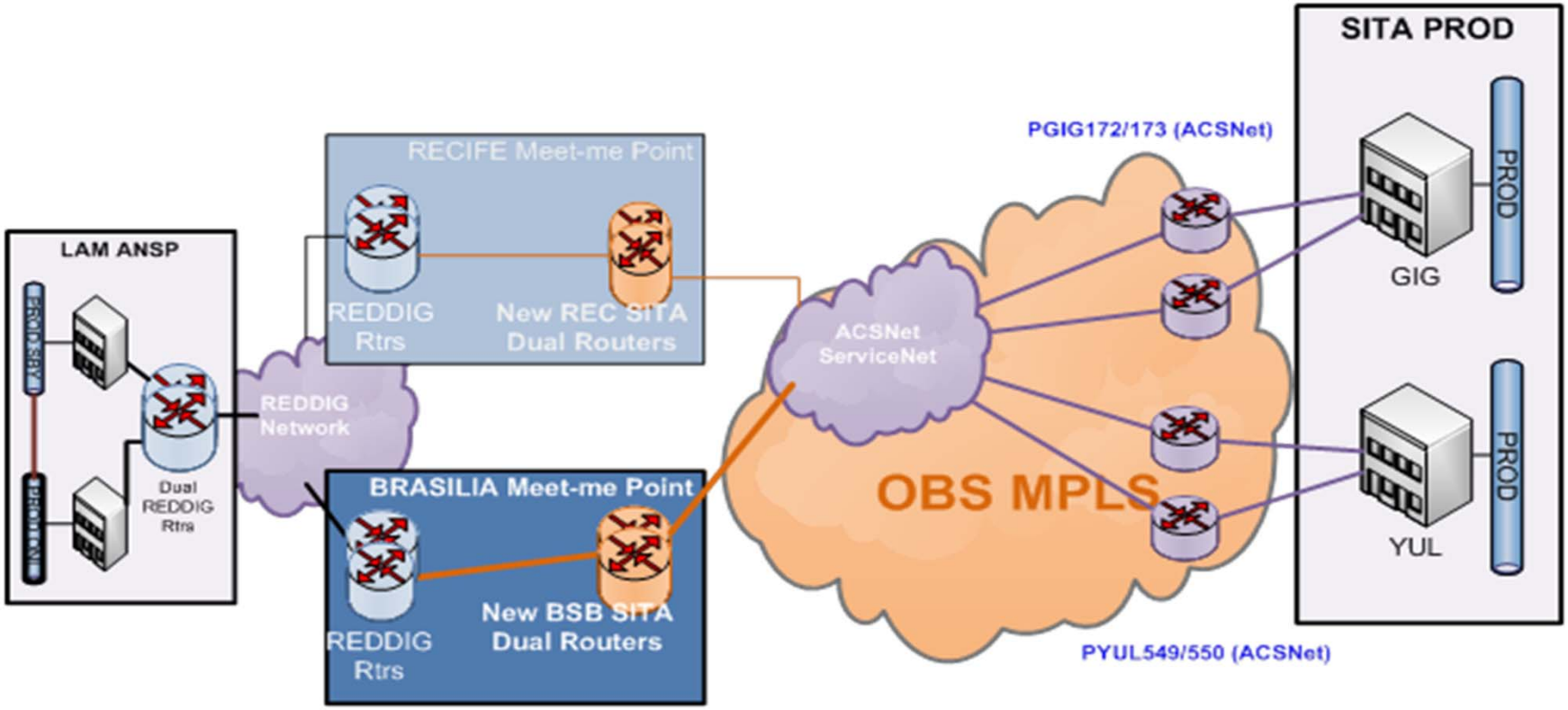
3. Proposed connectivity for operational use (FoC)



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