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RNP evaluation of alternative implementations for dynamic circuits

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Abstract: This presentation describes the experience of RNP in evaluating alternatives for dynamic circuit provisioning in a hybrid packet-circuit architecture, for future experimental deployment in RNP´s production IPÊ network in 2011.

Keywords: Service Network; Management Network; Hybrid Network; Dynamic Circuits.

1. Introduction

Many research and education networks (RENs) are adopting a hybrid network architecture, where a single communication infrastructure is used both for IP packet routing and end-to-end circuits, usually for applications with high QoS requirements. This presentation describes the experience of RNP in the evaluation of alternatives for dynamic circuit provision in such an architecture, for future deployment as an experimental service in RNP's production IPÊ network in 2011.

The FuturaRNP (Future RNP) programme carried out a study of two alternative technologies for dynamic circuit provisioning, which have been developed for use in NRENs in Europe and North America: AutoBahn [1] and Oscars [2]/Dragon [3], respectively. This presentation includes the consolidated results of the tests were performed by various research laboratories involved in this study, and also presents an analysis of these results, with the objective of identifying the solution that best fits the context of the RNP network.

2. Approach

In order to understand different aspects of dynamic circuit provisioning, this experimental programme was organized as five working groups: HYMAN (HYbrid network MANagement) and MonCircuitos (Circuit Monitoring) worked together to experiment with existing management plane solutions for hybrid networks; TIAMHAT (Hybrid Network Technologies) evaluated hybrid network control planes for existing solutions, and proposed adaptations to Brazilian circumstances; Resiliente (GMPLS Circuit Resilience) was concerned with including a fault recovery mechanism in the hybrid network control plane; and ROTAS (Service Oriented Optical Networks) aimed at evaluating the visualization capabilities for use of dynamic circuits in the UCLP/Argia solution [4].

The objective of the FuturaRNP programme was the deployment and evaluation of the AutoBahn and OSCARS/Dragon solutions in a national scale testbed network called Cipó, an overlay network operating over RNP's IPÊ network and the GIGA experimental network, which together interconnect the participating research laboratories (see Figure 1). The Cipó network was organized into two distinct domains, to permit the study of both intra and inter-domain circuit provisioning of each separate solution. The laboratories on the GIGA domain were connected through static VLANs and the IPÊ domain was built via a VPLS domain, i.e., a multipoint connection service that emulates a tagged VLAN between peers located on the edges of the network. Each laboratory was connected to this VPLS core by a VLAN tunnel using a IEEE 802.1ad Ethernet access network , a standard also known as QinQ (queue-in-queue) [6].

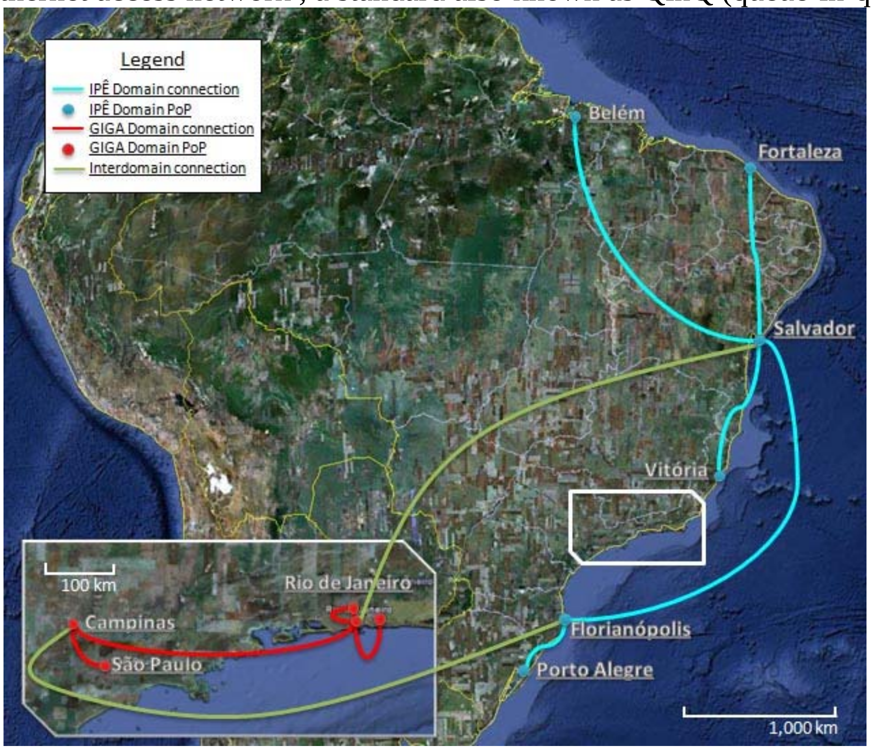

Figure 1. *The Cipó testbed connecting the participating institutions*

The criteria used to compare Oscars/Dragon and AutoBahn was defined by the HYMAN WG, and organized at two levels. The first level defines the general observation criteria of the solutions, and was then broken down into more specific and measurable second level criteria that were validated by extensive tests. A summary of the general comparison criteria is presented in the table below.

Table 1. *Criteria used to compare the dynamic circuit provisioning solutions.*

Criterion	Description	Weight (%)
Deployment	Identify the minimum hardware infrastructure necessary for each service to become available and the difficulty to deploy a new node.	5
Maintenance	Determine the complexity to maintain the service running.	7
Programming API	Evaluate the existence and flexibility of the programming API of each solution.	5
Consistency and fault tolerance	Evaluate the consistency, reliability and the behavior of the solutions in an anomalous scenario.	15
Security	Identify the level of protection against malicious users.	15
Graphical User Interface	Evaluate the usability of the graphical interfaces of the solutions.	10
Circuit visualization	Properly planned views allow users to get a more accurate and intuitive perception of the current state of the dynamic circuit network.	7
Allocation management	Identify how circuits are reserved by end users and how they are managed by the network operator.	20
User profiles	Support for user profiles with different permissions, such as operators of the physical infrastructure, virtual overlay network managers or end users, with different circuit allocation policies.	7
Popularity and user base	Map the popularity of the solutions, such as the user base associated with each tool, the existence of discussion forums and wiki, and the quality of the documentation.	9

The weight of each criterion was determined through group discussions at several meetings. Some criteria were validated through practical tests (for example, installing and configuring the solution, reserving several circuits with conflicting requirements, etc.) while others were evaluated by theoretical studies. Practical tests were planned, specified and executed by members of the participating laboratories. The mean value of the results was used to reach the final decision on the solution to be used during the next phases of the FuturaRNP programme.

3. Results

An important result of Project HYMAN was the integration into both the Oscars/Dragon and Autobahn platforms of the QAME (QoS-Aware Management Environment) tool [5], a Web-based QoS management and monitoring environment, which provides an interface for circuit provisioning management tasks.

The MonCircuitos goal was to examine, test and evaluate management plane software and approaches for dynamic circuit networks. In particular, this activity was mainly concerned with the development and evaluation of new services included in the perfSONAR monitoring platform [7] to deal with dynamic circuit enabled networks, including topology and circuitry discovery, and the use of monitoring information to assist in circuit provisioning and fault recovery.

Resiliente developed a fault recovery solution for the GMPLS control plane software. This solution considers operations in multiple domains and includes a traffic engineering algorithm for the calculation of alternative routes. It provides fault detection, notification of failures and proactive switching to alternative routes.

4. Conclusions

A dynamic circuit experimental service is expected to be deployed in the RNP's IPÊ backbone and in some partner regional networks as the next phase of the FuturaRNP programme, and will be available at first only to selected users. The experience acquired during the establishment of the Cipó testbed network was particularly useful for understanding the requirements to build a service of this kind on a national scale.

Using the above criteria to evaluate the solutions, the Oscars/Dragon combination achieved a better result than Autobahn and has been adopted for RNP's experimental dynamic circuit service. However, the main result of this study has been the identification of the dynamic circuit service that needs to be ported for the equipments used on the core and edges of the IPÊ backbone with a user interface adapted for RNP's requirements, such as language internationalization, support for user profiles and concentration of all circuit management operations on a single centralized interface, while still remaining compatible with the solution adopted by other NRENs.

References

1. Bandwidth on-demand (AutoBAHN) <http://www.geant2.net/server/show/nav.756>. May 2011.

2. The OSCARS web page. <http://www.es.net/oscars/>. May 2011

3. Dragon: Lehman T, Sobieski J and Jabbari B. DRAGON: A Framework for Service Provisioning in Heterogenous Grid Networks. In Communications Magazine, IEEE, Vol:44 Issue:3, 2008.

4. Grasa E, et al. UCLPv2, a Network Virtualization Framework built on Web Services. In IEEE Comm. Magazine, Feature Topic on Web Services in Telecommunications, vol. 46; num. 3, pp. 126-135, 2008.

5. Granville, L, et al. QAME - QoS-aware Management Environment. Computer Software and Applications Conference, COMPSAC, 25, 2001.

6. IEEE 802.1ad – Provider Bridges, 2006. Available in <http://www.ieee802.org/1/pages/802.1ad.html>. May 2011.

7. perfSONAR. <http://www.perfsonar.net>. May 2011.

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