CLARA network overview

CLARA Network Engineering Group

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This document presents the structure of the CLARA organization and describes the hardware components of the CLARA regional backbone network (RedCLARA).

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VERSION MANAGEMENT

This document presents an overview of the CLARA organization and describes the components of the regional backbone network. When new procedures are required or other changes made, it will be updated accordingly, and the new version release will be recorded in the table below.

Version	Modification description	Date	Reviewed by
preliminary	First draft	16-Jul-2004	Eriko Porto
1.0	Corrections and changes	30-Jul-2004	Eriko Porto
2.0	Corrections and changes	20-May-2005	Eriko Porto
3.0	Corrections and changes	01-Jun-2005	Eriko Porto & Michael Stanton
3.1	Corrections and changes	07-Jun-2005	Eriko Porto & Michael Stanton

Summary

1. Introduction

1.1. Document Purpose

This document aims to present a brief description of the CLARA organization and its groups, and to enumerate the hardware components that comprise the infrastructure of its regional backbone network (RedCLARA).

RedCLARA interconnects several Latin American National Research and Education Networks (LA-NRENs), and comprises of many complex hardware components for its operation. This document presents a brief history of the project, the description of the hardware components, and the basic interconnection diagrams.

1.2. History

The European Commission funded in 2002 a feasibility study named CAESAR – Connecting All European and South American Researchers – with the objective of analyzing the situation of the LA-NRENs and their demand for interconnectivity, and to conduct a market study to identify potential connectivity providers and their prices for bandwidth within Latin America and between Latin America and Europe. This study was conducted by DANTE (www.dante.net), organization responsible for building and operating the pan-European network for research and education named GÈANT, together with FCCN and RedIRIS, the NRENs of Portugal and Spain

In October 2002, the CAESAR project published its final report concluding that there was a real demand for intra-regional Latin American connectivity and a direct interconnection between Latin America and Europe. This report also stated that such an interconnection was technically and financially feasible, and based on these results preparations for the ALICE project began.

The ALICE project (América Latina InterConectada con Europa) started on June/2003 and will last for 36 months. The project is coordinated by DANTE and is supported by 4 NRENs from Europe and 18 Latin American NRENs, together with CLARA.

The European partners in ALICE are GARR, FCCN, RENATER and RedIRIS, the National Research and Education Networks (NRENs) of Italy, Portugal, France and Spain, respectively.

In Latin America, ALICE is partnered by the following NRENs or organizing institutions, and their respective countries: RETINA (Argentina), ADSIB (Bolivia), RNP (Brazil), REUNA (Chile), RAC (Colombia), CRnet (Costa Rica), RedUniv (Cuba), REICyT (Ecuador), RAICES (El Salvador), RAGIE (Guatemala), UNITEC (Honduras), CUDI (Mexico), RENIA (Nicaragua), RedCyT (Panama), ARANDU (Paraguay), RAAP (Peru), RAU (Uruguay) and REACCIUN (Venezuela).

CLARA (Cooperación Latino Americana de Redes Avanzadas) is a non-profit international organization registered in Uruguay. The objective of CLARA is to promote collaboration among the Latin American NRENs to encourage scientific and technological development. It is expected that CLARA will develop into DANTE's counterpart in Latin America and will take responsibility for the future of Latin American research networking activities.

The ALICE project receives € 10 Million co-funding through the @LIS program of the European Commission which represents 80% of the total funding of the project. The Latin American partners in ALICE will contribute the remaining 20% of the funding for the project.

1.3.
Overview of the CLARA regional backbone network - RedCLARA

The CLARA organization – Latin American Cooperation of Advanced Networks – is responsible for the implementation and management of a network infrastructure that interconnects the national academic networks of several Latin American countries. With several hundred universities and research centers connected to the CLARA network, many projects that suffered with the lack of an adequate infrastructure to support communication and collaboration are now able to advance, like projects in the area of HEP (High Energy Physics), computational GRIDs, astronomy and atmospheric studies.

The backbone of RedCLARA is comprised of five main routing nodes connected in a ring topology. Each main node characterizes a PoP – Point of Presence – for RedCLARA and is located in a different Latin American Country, as depicted in Figure 1.

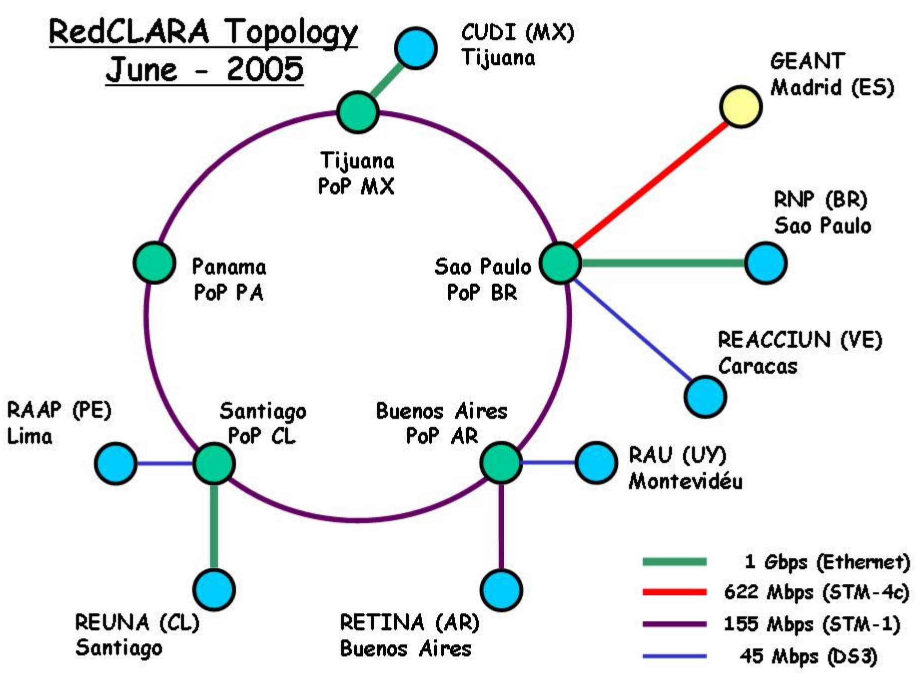

Figure 1: CLARA regional backbone network and currently connected LA-NRENs

The five main nodes are located in São Paulo (BR), Buenos Aires (AR), Santiago (CL), Panama City (PA) and Tijuana (MX). The RedCLARA backbone is interconnected with the multi-gigabit pan-European research and education network, GÉANT, through a connection from the RedCLARA PoP in São Paulo (BR) to the GEANT PoP in Madrid (ES).

When an LA-NREN connects to RedCLARA, this will be done through one of the five RedCLARA PoPs. This connection gives access to RedCLARA backbone for the LA-NREN and its clients.

The CLARA Network Operations Center (NOC) is operated by CUDI (Corporación Universitaria para el Desarrollo de Internet), the Mexican NREN, and performs the day to day operation of RedCLARA.

1.4.
Organizational structure

Figure 2 shows a diagram with the organizational structure and relationship of CLARA groups.

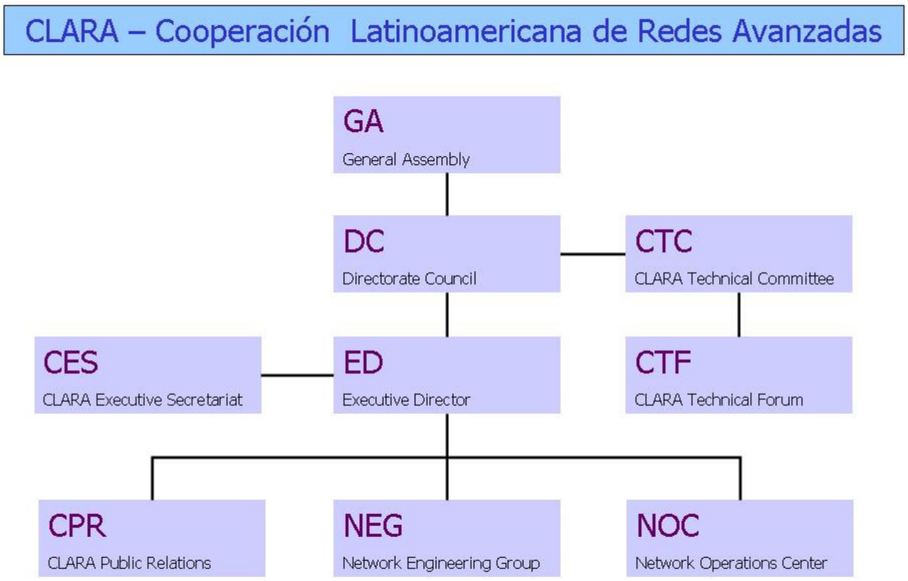

Figure 2: CLARA technical organization structure

The name CLARA refers to the non-profit civil association headquartered in the city of Montevideo (UY) whose members are the participating LA-NRENs, The infrastructure which supports the advanced network is referred as RedCLARA.

The ALICE project has as its objective the fostering of collaboration between Europe and Latin America through the deployment of the RedCLARA network, which will result in interconnecting more than 700 universities and research centers in Latin America, stimulating regional cooperation in research, scientific, cultural and educational activities, and providing direct integration with the scientific communities in Europe.

The purpose of the CLARA Technical Committee is to keep the CLARA organization at the forefront of providing advanced IP network services to the Latin American research and education community, by means of activities at both regional and national levels. These include regular meetings of the Technical Forum to discuss future requirements and planning of RedCLARA and the LA-NRENs, and technical training seminars for professionals from the associated LA-NRENs. Finally the Technical Committee provides technical advice to the CLARA Board when requested.

The CLARA Technical Forum is formed by the CTC members together with other representatives indicated by the CLARA project associated LA-NRENs. The CTF get together at least once a year to revise the technical progress of the network, and to suggest new directions, also promoting new initiatives.

The CLARA NOC group, based in Mexico City (MX), is provided by CUDI and is responsible for the day-to-day administration, control, monitoring and operation of all physical and logical infrastructures that comprise the backbone of RedCLARA. The work of CLARA NOC aims to assure a high level of performance and operation of the network and its interconnections.

The CLARA NEG is headquartered in Brazil, within RNP (Rede Nacional de Ensino e Pesquisa) facilities. In conjunction with the CLARA NOC, the CLARA NEG establishes the routine maintenance activities needed to the proper functioning of the network, as well as the problem report procedures, failure recovery procedures, and procedures for escalating the problems to the NEG whenever they cannot be solved by the CLARA NOC on its own.

The CLARA NEG is also responsible for all network engineering including the definition of the IP addressing and routing plan, and of the policies to be adopted within the advanced IP services backbone.

2.
Hardware of RedCLARA

2.1.
Backbone ring configuration

RedCLARA connectivity is provided by SDH (Synchronous Digital Hierarchy) circuits supplied by Global Crossing and distributed as follows:

- STM-1 protected ring between the CLARA PoPs in Buenos Aires, São Paulo, Santiago, Panama City and Tijuana.
- STM-4c protected circuit connection between the CLARA PoP in São Paulo and the GEANT PoP in Madrid, Spain.

The interconnection of the backbone ring node is depicted in Figure 2.

Each of the backbone ring nodes in RedCLARA is based on a Cisco 12006 router (Figure 2), featuring a 6-slot chassis configured with a 4-port OC3 POS (Packet Over Sonet) line card in slot 1 and a 4-port GE (Gigabit Ethernet) line card in slot 2. The router in São Paulo (BR) has an additional 4-port OC12 POS line card for connection with Madrid (ES) and an additional 6-port DS3 line card for connections with LA-NRENs. The router in Buenos Aires (AR) has an additional 4-port OC3 ATM line card for connections with LA-NRENs, and the router in Santiago (CL) has an additional 6-port DS3 line card for connections with LA-NRENs.

Each Cisco 12006 router is configured with 2 PRP (Performance Route Processor) line cards for redundancy. When two route processors (PRPs) are installed in a Cisco 12006 router chassis, one PRP acts as the active PRP, and the other acts as a backup PRP. If the active PRP fails, or is removed from the system, the standby PRP detects the failure and initiates a switchover. During a switchover, the standby PRP assumes control of the router, connects with the network interfaces, and activates the local network management interface and system console.

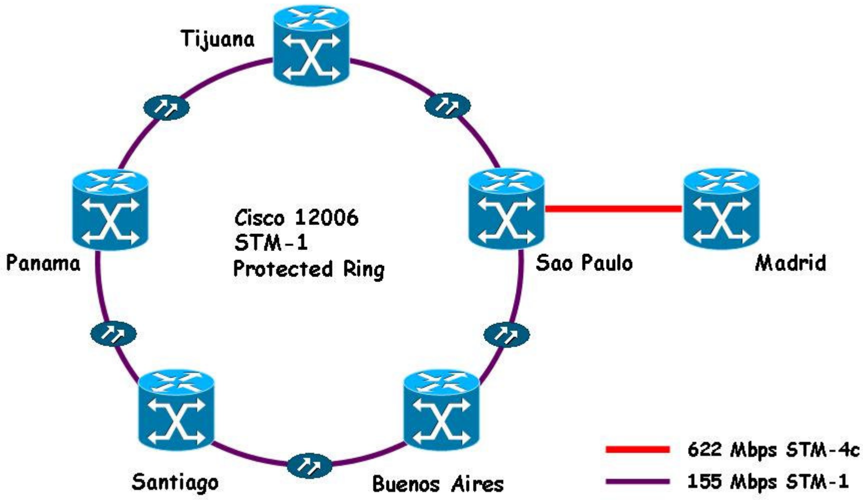

Figure 2: Interconnection diagram of the backbone ring nodes

The configuration of each backbone ring node will be using the RPR+ feature available on Cisco IOS, which maintains the standby PRP fully initialized and configured. This allows RPR+ to dramatically shorten the switchover time if the active PRP fails, or if a manual switchover is performed.

2.2. PoP additional hardware configuration

In order to support the PoP infrastructure, some additional equipment will be available for configuration, performance and security management on the backbone ring nodes, and also to collect traffic statistics for the network links.

Each PoP has been configured with the following hardware beside the Cisco 12006 router (Figure 3):

- A Cisco Catalyst 3550 switch with 24 10/100base-TX ports and 2 GBIC-based Gigabit Ethernet ports configured with 1 GBIC SX mode for connection with the Cisco 12006 router.
- A Cisco 2610 One 10/100 Ethernet router configured with 16 port Asynchronous Module, 1 port Analog Modem and 1 port ISDN WAN (dial and leased line).
- Two PC Servers Pentium 4 - 3.4 GHz, each one configured with two Fast Ethernet adapters.
- Two Sentry Remote Power Management and Distribution modules. The first one is a 70 Amps module for providing power feed to the Cisco 12006, and the other one is a 35 Amps module to feed the other equipment

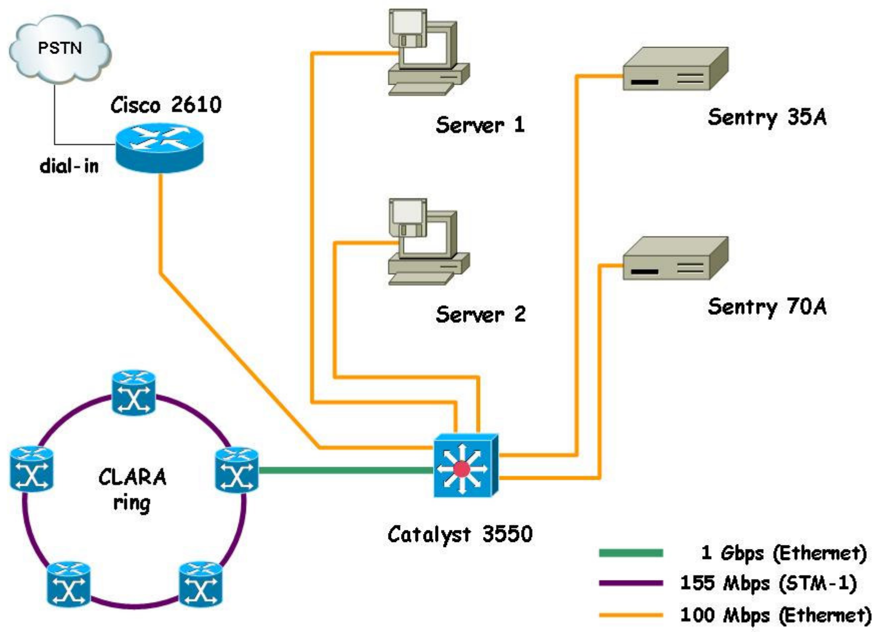

Figure 3: Interconnection diagram of PoP equipment

The switch will be used to deploy a Local Area Network (LAN) in the PoP facilities in order to achieve equipment interconnection for the purpose of in-band and out-of-band management, and network setup. The PC Servers will be installed with all the necessary software for network management and operation from the CLARA NOC. The Cisco 2610 router will be used mainly for out-of-band network operation and maintenance.

The router and the servers will be connected to the switch using the Fast Ethernet ports available in all equipment and the Cisco 12006 router is connected to the switch by a Gigabit Ethernet connection.

The Sentry modules provide DC power feed to the hardware of the PoP and allow remote access through TCP/IP, enabling remote power-up and power-down of the other hardware units in the PoP.

2.3. Equipment list

In order to provide advanced IP services through the backbone it is important to use components with high availability and performance. The following tables list the equipment that is used in order to deploy RedCLARA.

Table 1: Configuration of the auxiliary equipment

Item	Item Quant.	Quant.	Part Number	Description
			Racks	
1	5	1	RACKS	600 x 800 x 2200 mm standard 19" racks
			Cisco 12006 – Core Router	
2	5	1	GSR6/120-DC	GSR6/120 w/ 1PRP, 3SFC, 1 CSC, 2Alarms, 1 DC Power Supply
		1	PRP-1	Cisco 12000 Series Performance Route Processor
		1	MEM-PRP-512M	Cisco 12000 Series 1x512M SDRAM
		1	MEM-12KRP-FD64M	Cisco 12000 Series 64MB PCMCIA ATA Flash Disk
		1	PRP-1/R	Redundant PRP-1 chassis upgrade option, factory only
		1	MEM-PRP-512M	Cisco 12000 Series 1x512M SDRAM
		1	MEM-12KRP-FD64M	Cisco 12000 Series 64MB PCMCIA ATA Flash Disk
		1	GSR6-CSC/R	Redundant CSC for GSR6/120
		1	GSR6-PWR-DC	Power Supply for redundancy
		1	S12KZ-12.0.27S	Cisco 12K Series PRP IOS SERVICE PROVIDER
		1	4OC3/ATM-IR-SC=	4 port OC3/STM1 ATM Line Card intermediate reach, spare
		1	4GE-SFP-LC=	4 port-GE line card for Cisco 12000
		1	GLC-SX-MM	GE SFP, LC connector SX transceiver
			Cisco 2600 – Terminal Server	
3	5	1	CISCO2610XM-DC	One 10/100 Ethernet Router w/ Cisco IOS IP – DC
		1	S26CK9-12306	Cisco 2600 Ser IOS IP PLUS IPSEC 3DES
		1	NM-16A	16 port Asynchronous Module
		1	WIC-1AM	One-port Analog Modem WAN Interface Card
		1	WIC-1B-S/T	1-Port ISDN WAN Interface Card(dial and leased line)
		1	CAB-OCTAL-ASYNC	8 Lead Octal Cable (68 pin to 8 Male RJ-45 s)
		1	CAB-OCTAL-KIT	8 Lead Octal Cable and 8 Male DB-25 Modem Connectors
		1	CAB-S/T-RJ45	Orange Color Cable for ISDN BRI S/T, RJ-45, 6 fee
		1	MEM2600XM-96U128D	96 to 128MB DRAM factory upgrade for Cisco 2600XM
		1	MEM2600XM-16U32FS	16 to 32 MB Flash Factory Upgrade for the Cisco 2600XM
		1	COM-OSP-26XX	OSP Svc,2600 Series Ethernet Modular Router w/IOS IP s/w
			LAN Switch – Cisco Catalyst 3550	
4	5	1	WS-C3550-24-DC-SMI	24-10/100 + 2 GBIC ports(DC-Pwrd): SMI
		1	WS-G5484	1000BASE-SX Short Wavelength GBIC (Multimode only)

Table 2: Accessories

Item	Item Quant.	Quant.	Part Number	Description
Fiber Patch panel				
1	5	24		1U rack mount patch panel, SC singlemode with 24 ports
Power control modules				
2	5	1	4870-XL-4	Remote Power Manager - 4 output ports @ 70-amps max
		1	4835-XL-4	Remote Power Manager - 4 output ports @ 35-amps max

Table 3: Server 1 configuration

Item	Item Quant.	Quant.	Part Number	Description
PC Server #1				
1	5	1		Dell PowerEdge 1750 server
		1		Dual Intel Xeon 3.2 GHz processor
		4		1 GB SDRAM DIMM
		1		1 MB L2 and 1 MB L3 cache
		2		146 GB SCSI disk
		2		Fast Ethernet adapter
		1		48 DC power supply (redundant)

Table 4: Server 2 configuration

Item	Item Quant.	Quant.	Part Number	Description
PC Server #2				
1	5	1		Dell PowerEdge 1750 server
		1		Single Intel Pentium 4 3.4 GHz processor
		2		1 GB SDRAM DIMM
		1		1 MB L2 cache
		2		76 GB SCSI disk
		2		Fast Ethernet adapter
		1		48 DC power supply (redundant)