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D3
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ABSTRACT

This Final report summarises the findings of the CAESAR project. It reviews the situation of research networking in Latin America, analyses the possibilities and the demand for a regional Latin American research network and an interconnection to the pan-European research network, GEANT, and gives recommendations on how to proceed.

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EXECUTIVE SUMMARY

CAESAR, Connecting All European and South (Latin) American Researchers, is a fully funded IST project carried out by FCCN, RedIRIS and DANTE between March and October 2002.

CAESAR studied the possibilities of a direct interconnection between the pan-European research network, GEANT, and its national counterparts in Latin America. The project reviewed the current status of research networking in the Latin American countries, analysed the technical options for an interconnection together with the associated costs, and carried out a demand analysis and current traffic flow analysis. An important element of the project was the organisation of a workshop between the senior representatives of Research Networks in Latin America and their European counterparts. This workshop was held in Toledo, Spain, in June 2002.

It was clear from the beginning of the project that an interconnection with GEANT would only be efficient, if organised on an inter-regional level. Rather than connecting each individual Latin American research network with its own transatlantic capacity to GEANT, it is more appropriate to create a regional backbone within Latin America and connect this to GEANT. This enables a larger connectivity to be procured, because of the economies of scale associated with telecommunications, and simplifies operational and technical issues. It does however require an intra-regional network within Latin America. CAESAR, therefore, not only studied the interconnection between the two regions, but also has acted as a catalyst for the creation both of an intra-regional Latin American network and an intra-regional Latin American research organisation.

CAESAR has prepared the ground for the work to be carried out within the framework of the EC's @LIS programme (Alliance for the Information Society with Latin America). @LIS is managed by DGEuropeAid and aims at promoting the Information Society in Latin America. One strand of the @LIS programme is the @LIS Interconnection Initiative which aims at providing IP infrastructure within Latin America and towards Europe.

During the initial CAESAR meeting, which the project partners held in Madrid on 1 March 2002, it was not possible to anticipate how much momentum, especially in Latin America, the project would create and how much it would influence Latin American research networking. The CAESAR workshop, which took place in Toledo in June 2002, demonstrated conclusively that CAESAR had a major impact within in Latin America. In Toledo, CAESAR was able to gather senior representatives of the research networking organisations of 12 Latin American countries around one table. Together with the participating Latin American and European NRENs, and the European Commission, a blueprint for future co-operation was established.

The Toledo workshop was decisive for the remaining months of the project. It led directly to the creation of CLARA, "the Cooperacion Latino Americana de Redes Avancadas," the Latin American co-operation to

- i) organise research networking on a regional level within Latin America
- ii) global inter-connection to other advanced research networks.

During the first CLARA meeting which took place in Rio de Janeiro in July 2002, the participating Latin American networks signed the "Toledo Declaration" committing themselves to the cause of a regional network and networking organisation for Latin

America. The CLARA members are currently in the process of agreeing the statutes of the organisation, its legal framework, as well as its future role.

In parallel with these developments in Latin America, the European partners of the CAESAR project completed the work foreseen in the project. The results of all the analyses that were carried out over the past months show:

- i) The plan to create a regional Latin American network and to interconnect it with GEANT is viable.
- ii) There is demand for such a connection in the European research community
- iii) it is financially feasible given the budget that will be available within the framework of the @LIS Interconnection Initiative.

This Final Report of the CAESAR project presents the output of the project in detail and formulates recommendations on how to proceed. It must be emphasised that considerable momentum has been achieved towards the goal of interconnection and it is a main concern to keep the momentum that has been created and to make best use of the willingness of all interested parties to find a solution for the networking requirements of Latin America and the connectivity requirements between the Latin American and European research communities.

1. INTRODUCTION

The telecommunications revolution of the past two decades has created a world, which is becoming smaller by the day. Modern research no longer needs to be undertaken in small and isolated communities. Indeed, to be successful, research communities with similar interests need to co-operate globally. The communications technology to facilitate this is a reality now.

One of the major objectives of the pan-European research network GÉANT, which interconnects National Research and Education Networks in Europe, is to encourage global research co-operation by creating connectivity between European researchers and researchers in other world regions. This objective has been already been achieved between GÉANT and similar networks in North America and Asia Pacific. Building on this experience, the European research community now wishes to connect to other world regions, in particular Latin America.

CAESAR (Connecting All European and South (Latin) American Researchers) is a European Commission funded feasibility study to evaluate the possibility of a direct interconnection between the pan-European research network GÉANT and similar activities in Latin America. The creation and development of national research networks in Latin America, and their increasing interest in global co-operative research, means that it is important to investigate the possibilities of such a direct interconnection. The historical links between Europe and Latin America re-enforce the importance and desirability of this goal.

2. THE CAESAR PROJECT

CAESAR is funded by the EC's DG Information Society. In December 2001, the EC launched the @LIS programme to build an Alliance for the Information Society with Latin America. Like @LIS, the CAESAR study involves co-operation with eighteen Latin American countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. @LIS has a budget to facilitate research interconnection and the results of the CAESAR project will be a major input to the development of the @LIS programme.

The project was originally supposed to last six months, beginning in March 2002. In July 2002, the project partners proposed an extension of the contract until the end of October 2002 to make better use of the project's budget and to strengthen the relationship with the Latin American partners. The extension of the contract has not affected the work programme of the project.

2.1 The Partners in CAESAR

The CAESAR study was carried out jointly by FCCN, RedIRIS and DANTE. FCCN is the Portuguese national research network interconnecting the research institutions, national laboratories, universities and higher education facilities within Portugal. RedIRIS is the Spanish national research network currently interconnecting more than 250 research institutions and universities in Spain. DANTE, the Co-ordinating Partner of the CAESAR project, is a UK based not-for-profit organisation which was mandated by the European national research networks to organise, build and manage international networking services on their behalf.

2.2 CAESAR Objectives

The CAESAR study had four objectives. Firstly, CAESAR analysed the current situation and developments of research networking in Latin America, on a per country basis. The findings

of this analysis have been compiled in the first report of CAESAR, which can be found in Annex 1 of this document.

CAESAR also studied the demand for a connection between GEANT and the Latin American research networks. This demand analysis included an analysis of the current traffic flows between the two regions, as well as a study of current, and potential, user requirements. The project singled out user groups across Europe, that are working in co-operative projects, with one or more countries in Latin America. A questionnaire analysed user demand and enabled CAESAR to define the connectivity requirements between the European research community and Latin America. The findings of the demand analysis are found in Chapter 5 of this Final Report.

Thirdly, to survey the options for connectivity with Latin America, CAESAR addressed potential telecommunications and connectivity suppliers. In this respect, CAESAR established contact with 21 operators, asking them for an outline of their services between Europe and Latin America and within the Latin American region. A key issue for the interconnection is to have a single point of presence, within Latin America, from which all research networks in the region can be reached. In order to be able to reach all Latin American networks through a single point of presence in Latin America, a Latin American regional research infrastructure needs to be built. For this reason, it was especially important to contact those operators that have infrastructure in the region. The results of the supplier analysis are in Chapter 4 of this document.

The fourth objective of CAESAR was to organise a workshop, which brought together the representatives of the Latin American and European research networks and the European Commission to discuss the project, its objectives and future plans. This workshop, which was a very significant success and of great importance to the project, took place at the University of Castilla-La Mancha, Toledo, Spain on 13 and 14 June 2002. The results of the workshop were documented in the second deliverable of CAESAR and can be found in Annex 2 of this document.

3. REVIEW OF DEVELOPMENTS IN LATIN AMERICA

Annex 1 of this Final Report provides Deliverable D1 – Review of Developments in Latin America. This document was delivered to the European Commission on 26 June 2002. Since then there has been activity in Latin America as a region, as well as on a national level in some of the countries. Most of the developments of the recent months resulted from the CAESAR workshop held in Toledo. This workshop brought together 15 representatives of 12 Latin American research networks (or related institutions), the European Commission, the European NREN-PC, as well as the CAESAR partners. The two-day workshop resulted in the commitment of the Latin American networks to co-operate on the creation of a regional Latin American research infrastructure and organisation. The full report of the Toledo workshop (CAESAR Deliverable D2) is annexed to this document (Annex 2).

The following chapters briefly describe the developments after Toledo.

3.1 CLARA

The CAESAR workshop in Toledo in June 2002 was a strong impetus to the Latin American participants to organise themselves on a regional level. Within two weeks of the workshop, a subset of the research networks in Latin America had created CLARA, the Cooperacion Latino Americana de Redes Avanzadas. Under the umbrella of CLARA, the Latin American research networks met in Rio de Janeiro in July 2002 to progress the work that had been started in Toledo. On 16 July 2002, the participating research networks adopted the Toledo Declaration. In order to emphasise the importance of this Declaration, its text is quoted in full.

3.1.1 CLARA Toledo Declaration



(First meeting - Latin American Cooperation on Advanced Networks)

Toledo Declaration

About Research Networks in Latin America

Gathered in the City of Toledo, on June 13th and 14th, 2002, as a result of the initiative of the European Commission, we, the undersigned members of networks in Latin America, recognise:

1. The importance for the academic and research community in Latin America to count on a regional structure of data communication based on advanced networks that permit better co-operation in the academic and research realms.
2. The efforts made by the European Commission in order to develop a project of Global Information Society, where the academic space can be considered in a special way.
3. That it is necessary to make a similar integration effort, not only in the realm of our respective countries, but on a regional and global level.

Based on what was said above we declare:

1. *That the existence of national research and education networks (NRENs) is necessary.*
2. *That it is desirable to establish a Latin American research network, based on the networks existing in several countries.*
3. *That we agree to co-operate for the development of national networks in the countries where they do not exist and to create a co-ordination space for their integration and regional co-ordinated development.*

4. *That due to the possibility of getting financing from the European Commission, through the @LIS program, it is necessary to coordinate efforts regarding the interconnection of the education and research networks and thus establish the creation of a Latin American regional coordination group. For this purpose, Nelson Simões (from Brazil) and Sidia Sánchez (from Panama) have been appointed.*
5. *That before the next workshop that the European Union intends to organise with members of Latin American networks in September, those who were present in Toledo agree to have two regional meetings in order to establish the organisation criteria of the Latin American network.*
The first meeting will be held in Brazil, on July 15, 2002 and the second, one month later.

Signed by:

Nelson Simões
RNP – National Education and Research Network (Rede Nacional de Ensino e Pesquisa)
Brazil

Sidia Moreno de Sanchez
PanNet – Red Académica y de Investigación Nacional
Panamá

Carlos Casasús
CUDI – Corporación Universitaria para el Desarrollo de la Internet
México

Carlos Francisco Frank
Retina – Red Teleinformática Académica
Argentina

Clifford Paravicini Hurtado
Bolnet – Red Boliviana de Comunicación de Datos
Bolivia

Florêncio Igancio Utrera Diaz
Reuna – Red Universitaria Nacional
Chile

Ida Holz Brad
Rau – Red Académica Uruguay
Uruguay

Jorge Luís López Presmanes
RedUniv – Red Universitaria
Cuba

Luis Miguel Vázquez
CNTI-Reacciun – Red Académica de Centros de Investigación y Universitaria
Venezuela

Pablo José A. G. Herken
UNA/CNC – Universidad Nacional de Asunción
Paraguay

Rafael Ibarra
Uca – Universidad Centro Americana José Simeón Cañas/SVNet
El Salvador

Sandro Venturo
Red Científica Peruana
Peru

Adhesion

Santiago Carrasco
SENACYT
Ecuador

Interestingly, the Toledo Declaration was even signed by countries that did not originally participate in the CAESAR workshop in Toledo. It shows the strong co-operation between the Latin American research networks on a regional level.

3.1.2 Summary of Conclusions, Rio de Janeiro 16 July 2002

During the first CLARA meeting in Rio de Janeiro, the participating research networks organised working groups to tackle the issues surrounding regional connectivity, the interconnection to GEANT, the organisational model to be adopted and the funding to be found to match the EC contribution. The following “Acta de la Reunion” summarises the main points:



Summary of conclusions

1. Regional Network

- CLARA NETWORK will offer the Connectivity Service to GTREN (GEANT, Internet2, etc);
- The unitary cost of access (per Mbps) to backbone must be the same one to each partner country and must include all connection costs from backbone to the partner country;

- This organization initiative and backbone network will be used to link other initiatives of advanced networks. Initially, it will support the collaboration proposal with Europe Union related to @LIS.

2. Clara – Organization

- It has the function of representation and coordination. Initially, it is composed by an elected committee and later by a consortium of NRENs;
- It will be the start point to the future regional organization in networks;
- It will start as an informal organization, but it could constitute a formal organization until march 2003, through a model to be proposed with the ensemble of NRENs of Latin America.

3. Proposed Work Plan:

- To establish a coordination and workgroups to the following actions.

3.1. Coordination: Nelson (Brazil/RNP), Sídia (Panamá/PanNet)

Main goals:

- To assure a financing process to the planning phase that can be concluded in the next meeting of the group;
- To divulge information: results and agreement of the 1st meeting; Toledo Statement; adhesion of countries and solicitation of future development to the initiative;
- To define financing, place and date to the next meeting: target: august, 29/30;
- To define action plans to each GT.

3.2. GTs

3.2.1. Organizational models: Ida Holz (Uruguai/RAU), Lito (El Salvador)

Main goals:

- Implementation of phase 2;
- Presentation document;
- Version of Clara's statutes;
- Examination of Use Politics and a proposal of common politics (who could use, to what the network could be use).

3.2.2. Interconnection: Michael (Brasil/RNP), Guillermo (Argentina/Retina)

Main goals:

- Initial vision of architecture and costs;
- To search infrastructure and operators in each region/country;
- Identification of potential providers.

3.2.3. Financing: Florencio (Chile/Reuna), Carlos Casassus (México/Cudi)

Main goals:

- Financing of Phase 2: Participation of NRENs from Europe and LA, multilateral entities BID, CAF, OEA, ProSUL;
- Contact with the responsible of Madrid board in each country;
- Contacts with possible participants to finance BID, IDRC/ICA, UN ICT task force / LACNET;
- 80-20 funding intermediation with European partners;
- Ideas to the organization and financing of Clara;
- The participation of NRENs from LA will be assured by the respective governments.

3.1.3 CLARA Draft Statutes

After the first CLARA meeting in Rio de Janeiro, a subset of the CLARA partners met again in Buenos Aires on 5 and 6 September 2002 to discuss the possible topology of the Latin American network and its funding as well as the organisational set-up of CLARA.

During this meeting, the group developed the draft statutes of CLARA, which are summarised below. These statutes have now been made available to all the Latin American research networks for comments. It is foreseen that the statutes will be adopted by CLARA during their next meeting in Rio de Janeiro, 25 to 27 September 2002.

The English version given below is an informal translation of the original Spanish text which is also quoted below.

CLARA

Meeting in Buenos Aires, 5 and 6 September 2002

The following points were discussed and agreed:

- One network per country can become member of CLARA. This network will have been appointed in writing by the respective country's government
- There will be no distinctions between funding members and those that join at a later stage
- Sponsoring associates will be admitted in a different category and with different rights and duties
- In those cases where in a country does not exist a research network, or where the networks do not have a legal status, it is possible to become observing member as temporary status. The institution of every country, with legal status, which represents the country in CLARA needs to have the respective government's support. The maximum term of its membership will be one year, giving the opportunity to create a national research network in a formal way. It is assumed that the initial number of members will be seven.
- Due to national legislation in the countries, the payment will not be handled as payment for connectivity, but as payment for membership. Additionally, time will be allowed for the legalisation of an organisation of this form, concession of connectivity services, payment of taxes, etc., as well as aid for not-for-profit organisations in each country
- All CLARA decisions will be taken by its members. For this the decision power and range of action of the Directive Council will be revised
- there will not be additional bodies next to the Directive Council, but it is left to this Council to create working groups if necessary
- The meetings of the Directive Council are open to all other members which can express their opinion but will not have the right to vote.

The original Spanish text is as follows:

CLARA

Reunión Buenos Aires, 5 y 6 de septiembre

Se discutieron y tomaron los siguientes Acuerdos sobre los Estatutos:

- Será miembro de CLARA una red por país, que haya sido apoyada, por escrito, por el gobierno de cada país.
- No se harán distinciones entre Miembros fundadores y aquéllos que adhieran posteriormente.

- Se admitirán, en categoría diferente, y con otros deberes y derechos, los Asociados donantes.
- En los casos de los países que no tienen red académica, o que las mismas no tienen personería jurídica, se les hará posible ser Miembros observadores, como estatus temporal. La institución de cada país que, con personería jurídica, represente al país en CLARA, deberá contar con el aval del gobierno, y la vigencia de su membresía será de un año máximo, en la espera de la constitución de la red académica nacional de manera formal. Se presume que la cantidad inicial de miembros será de siete.
- No manejar el pago como compensación por servicios de conectividad, sino como membresía, por temas de leyes de cada país. Además averiguar el tiempo de legalización de una organización de este tipo, concesión de servicios de conectividad, pago de impuestos, etc., así como las prestaciones para las organizaciones sin fines de lucro en cada país.
- Las decisiones de CLARA serán vinculantes para los miembros. Para ello se revisarán los alcances de poder de decisión del Consejo Directivo, y sus ámbitos de ingerencia.
- No habrán instancias adicionales al Consejo Directivo, pero se facultará a éste para crear grupos de trabajo según sea necesario.
- Las reuniones del Consejo Directivo serán abiertas a los demás miembros, con voz pero sin voto.

In addition to the statutes, the Buenos Aires meeting also developed a possible topology for the Latin American regional research network. This topology will be discussed in Chapter 4.

A meeting of all the participating Latin American research networks is planned to take place in Rio de Janeiro on 25 to 27 September 2002. It is furthermore planned that the CAESAR partners, the European Commission and the Latin American research networks will meet in Santiago de Chile on 10 and 11 October 2002.

3.2 Update on National Developments

In addition to the creation of CLARA, there have been national developments in some countries that also resulted from the Toledo workshop. As these developments are recent, they were not reflected in CAESAR Deliverable 1 (Annex 1). They are briefly described below.

3.2.1 Developments in Bolivia

In the months between the first deliverable of CAESAR and its Final Report, the ADSIB (Agencia para el Desarrollo de la Sociedad de la Informacion) was created with the help of the Bolivian national research network BOLnet. BOLnet forms part of ADSIB. ADSIB will have the following characteristics:

- It will be a not-for-profit organisation
- BOLnet is part of ADSIB and will remain the contact for the universities and the research institutions
- there are 42 programme openings of which eight are foreseen for the academic sector, the main activity being the national academic network

BOLnet has signed the Declaration of Toledo and is the Bolivian partner in the CLARA initiative.

3.2.2 Developments in Colombia

Until the CAESAR workshop in Toledo there were problems contacting the national research networks or a related organisation in Colombia. As a consequence of the Toledo workshop, contacts have been established with Jose Fernan Martinez Ortega, a professor of the Universidad de Cauca in Colombia. A meeting was arranged and took place in Madrid on 4 July 2002. As a consequence of this meeting the main funding bodies for research networking on a national level in Colombia, namely ColCiencias and ICFES decided to collaborate and to create a national research networking infrastructure. Jose Fernan Martinez was appointed co-ordinator of this initiative.

3.2.3 Developments in Guatemala

There is currently no research networking infrastructure in Guatemala. While gathering information to put into the first CAESAR deliverable, the contact in Guatemala, Luis Furlan, a professor at the Universidad del Valle in Guatemala mentioned that he could not imagine another initiative to recreate a national research network for Guatemala. However, in the beginning of August 2002, Luis Furlan contacted CAESAR again, stating that he had been appointed to co-ordinate a national effort to build a research network in Guatemala and to co-operate more closely in CLARA. This initiative is driven by several universities across Guatemala. He stated that there have been regular meetings among the nine universities in Guatemala. Luis Furlan will be present during the next CLARA meeting which is planned to take place in Rio de Janeiro on 25-27 September 2002.

3.2.4 Developments in Panama

Within the CLARA initiative, Panama is represented by PANNET. PANNET is the network of the Universidad de Tecnologia de Panama. The representative of PANNET has been chosen by the Latin American networks represented in CLARA to co-ordinate their initiative together with the Brazilian representative.

In August 2002, CAESAR received a letter from SENACyT, the National Secretary of Science and Technology in Panama. In the letter it was stated that CAESAR had chosen the wrong partner and that not PANNET but the national research network of Panama, REDCyT, should be the partner for Panama.

CAESAR responded to SENACyT that the matter had to be solved on a national level. We also asked the PANNET representative for comments.

At the end of September CAESAR met with SENACyT to discuss the issue. Again it was stated that the matter had to be solved on a national level in Panama and that it would be best for all parties if an agreement could be found between PANNET and SENACyT. CAESAR asked SENACyT/REDCyT to complete the Latin American research network questionnaire to get a better understanding of the situation of the REDCyT network. SENACyT has completed the questionnaire and the answers are given below. It can also be added that SENACyT has attended the last CLARA meeting and will co-operate in the activity. SENACyT and PANNET have started the discussion and it is hoped that an agreement between the two parties will be found.

3.2.4.1 REDCyT – the national research network of Panama

- **The Organisation**

REDCYT (Red Científica y Tecnológica de Centros de Investigación e Universidades) is a civil non-profit association with legal status and with direct participation of public and private universities, research centres, government entities and professional associations that promote research and development of the Internet. It is the first successful interinstitutional collaboration (academic, government, private business partners and other sectors) to develop

a national academic and research network, with the full support of the national government. Investment up to date is more than €1 Million which is intended to be expanded with the realisation of an optical fibre ring that eventually will interconnect the majority of the associated members in the next years.

REDCyT is managed by SENACYT (Secretaria Nacional de Ciencia, Tecnología e Innovación).

SENACYT is a decentralised entity, ascribed to the Presidency of the Republic of Panama, in charge of co-ordinating and executing the actions defined by the government of Panama with respect to the organisation and development of science, technology and innovation. It is the entity that serves as direct advisor to the government in science and technology matters.

Funds for the development of the network are provided by the State and contribution of the associated universities and research centres, and by international financial institutions such as the Interamerican Development Bank (IDB).

- **The Network**

The current topology is mainly based on the infrastructure provided by SENACYT for the network, based on a Virtual Private Network (VPN) network working mostly over Frame Relay, with a high-performance communications core.

Affiliated universities and research centres connect to Internet by means of their own providers (Cable&Wireless, Alianza Viva, CableData, etc.) using Frame Relay star topologies or direct ADSL or T1 leased lines. All the internet access providers of the universities and other research centres are interconnected by the INTERED node by means of optical fibre links with minimum capacity of 2 Mbps in a star topology using the BGP-4 protocol.

The network connects six universities, three research institutes, one hospital, one library and one governmental ministry. It is estimated that it reaches more than 47,300 users nationwide, with the majority of users being students and professors. The network is based on IP, VPN, Multicast (IPv6 limited spread) and in INTERED, ATM over SONET with BGP-4 protocol. The network supports Digital Libraries, Point-to-point and Multipoint Videoconferencing, Voice and Data and Distributed databases.

In addition to its co-operation in CLARA, SENACYT is involved in a variety of regional and international projects. In 2000 SENACYT signed an MoU with UCAID for the connection of RedCyT to the Internet2 via AMPATH. Currently the international connectivity is serviced by a variety of Internet service providers. The connected universities have organised their own international connections.

- **The Future**

It was described that there is the plan to connect to the network to one of the submarine cables landing in Panama. After this had been achieved it is the objective to encourage all Universities in Panama to join the network. In terms of infrastructure, a satellite network with 1,000 remote points with a star topology for local wireless services is being installed to provide distance education to students and professors and researchers at remote sites in the field.

- **RedCyT and CAESAR**

SENACYT stated that it was very interested to participate in the CAESAR activity as many universities and research institutions in Panama have close co-operation with European partners (especially in Spain) and would benefit from direct connectivity. It was also pointed

out that many researchers in Panama have responded to the call for proposals for the @LIS demonstration projects.

- **Contact Details**

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Technical support: Ing. Aldo Magallon amagallon@senacyt.gob.pa

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3.2.5 Developments in Cuba

RedUniv informed CAESAR that there are plans in Cuba to interconnect the existing research networks and university networks into a national research networking infrastructure. The national research network of Cuba will be called GRACIA (Grupo de Redes de Avanzada Cubanas Investigativas y Académicas). It was pointed out that research networking in Cuba suffered from the fact that none of the existing submarine cables in the region landed in Cuba.

3.3 Overview of the Latin American research networks

Table 1 gives an overview of the 18 Latin American countries and the status of their respective research networks.

Group	Country	Organisation	Existing NREN?	national connections	external capacity	Number of connected sites	connection to US Internet2
A	Argentina	RETINA	yes	256 Kbps – 34 Mbps	59 Mbps	56	yes
B	Bolivia	BOLnet	yes	64 – 128 Kbps	1.5 Mbps	18	no
A	Brazil	RNP	yes	2 – 30 Mbps (backbone up to 622 Mbps)	202 Mbps	369	yes
A	Chile	REUNA	yes	155 Mbps	45 Mbps	18	yes
D	Columbia		in planning				
B	Costa Rica	CRNet	yes	32 – 512 Kbps	not known	34	no
B/C	Cuba	RedUniv GRACIA (planned NREN)	University network NREN planned	19.2 Kbps – 2 Mbps		23	no
D	Ecuador	FUNDACYT	in planning				no
D	El Salvador	CONACYT	in planning				no
D	Guatemala		in planning				no
E	Honduras	HONDUnet	not known				
A	Mexico	CUDI	yes	2 – 155 Mbps	255 Mbps	77	yes
E	Nicaragua		not known				
B/C	Panama	PANNET	University Network	256 – 512 Kbps	1.54 Mbps	11	no
B/C	Panama	REDCyT	yes	not known		12	no
C	Paraguay	REDUNA	University Network	10/100 Mbps fibre optical backbone	896 Kbps	51	no
D	Peru	CONCYTEC	in planning				no
B	Uruguay	RAU	yes	64 Kbps to 1 Mbps	6 Mbps	46	no
B	Venezuela	REACCIUN	yes	11 Mbps	16 Mbps	78	no

Table 1: The Main Characteristics of the Research Networking Organisations in 18 Latin American Countries

4. ANALYSIS AND COSTING OF THE TECHNICAL SOLUTION

4.1 Methodology

In the first month of the project, the CAESAR partners gathered information on those operators that could provide connectivity in Latin America and on those that could provide direct connectivity between Latin America and Europe. In April 2002, the CAESAR project contacted 21 operators based in Europe, Latin America and the USA, briefly describing the project and asking the operators to provide information on their network as well as indicative prices for connectivity.

Following the initial contact, meetings were arranged with a subset of the operators. Face to face meetings were held with Telecom Italia International Wholesale Services, Telefonica International Wholesale Service, Portugal Telecom and Hispasat. Video-conferences were held with Global Crossing and the Latin American satellite provider Impsat. Contact was also made with the Mexican operators Avantel and TelMex.

In parallel, CLARA contacted several Latin American based providers, such as the national subsidiaries of Telefonica Data and Global Crossing, as well as Embratel (Brazil), TelMex, Avantel (Mexico) and Impsat.

4.2 Initial Costings

By the time of writing the report (September 2002), detailed information on the network scope and capacity, as well as indicative numbers has been received from Telecom Italia International Wholesale Services, Global Crossing and Telefonica International Wholesale Services. There have been detailed discussions on topology, operations and pricing with Telefonica International Wholesale Services and Global Crossing.

It is encouraging to see that the submarine cable systems of the three main potential providers, Emergia (owned by Telefonica International Wholesale services), South American Crossing (owned by Global Crossing) and LanNautilus (Owned by Telecom Italia International Wholesale Systems) reach almost all of the 18 Latin American countries. All three organisations showed the willingness to cover all countries via third party agreements if necessary.

During the meeting with Hispasat, the European satellite operator stated that they had landing rights in all of the Latin American countries and that they had dedicated ground facilities in those countries, where the incumbent operator is a subsidiary of Telefonica. It was stated that Hispasat was very interested in the CAESAR project and very willing to submit a commercial offer once an official network connectivity tender was issued.

From the indicative numbers received, it can be stated that a viable network solution in Latin America, as well as an interconnection to GEANT is possible. This statement is based on the assumption that the building block for the network between the national research networks of Argentina, Brazil, Chile and Mexico is 45 Mbps. It is also assumed that these four countries will form the core of the regional Latin American backbone and that all other countries will connect to one of the core PoPs with speeds between 2 and 10 Mbps. Connectivity to Europe is assumed to be 155 Mbps.

It needs to be pointed out that the above assumption is based on indicative costs received from two operators. A negotiated tendering activity will bring about more competitive offers, i.e. higher bandwidths for the same budget.

4.2.1 Possible Latin American Regional Topology

Figure 1 shows a possible topology for the Latin American regional network and its interconnection with Europe. This topology has been developed by CLARA (Michael Stanton, RNP, Guillermo Cicileo, RETINA).



Fig 1: Draft Topology of Latin American regional network and interconnection to Europe

This draft topology shows the connection of the Latin American core countries and their interconnection to GEANT in red and all other connections in green. At this point in time, it can be foreseen, from the indicative prices received, that the interconnection between the Latin American core countries Argentina, Brazil, Chile and Mexico will be based on DS-3 capacity and that the connection to GEANT will be at 155Mbps. All other connections should be at speeds between 2Mbps and 10 Mbps initially.

Considering the very different levels of development of the Latin American national research networks, it can be foreseen that the network roll-out will take place in consecutive steps. It is very likely that the first countries to be connected in Latin America will be the four core countries, Argentina, Brazil, Chile and Mexico. This core network can be connected in parallel to the pan-European research network, GEANT.

In subsequent steps, all countries which have been clustered in Group B will be connected to the Latin American core network. As Table 1 (page 15) shows, these countries are Bolivia, Costa Rica, Uruguay and Venezuela. Except for Costa Rica, all of these countries have participated in at least one of the meetings that have taken place in the last months and have expressed their willingness to co-operate in CLARA.

It can be assumed that Group C (see Table 1, page 15) countries will be connected alongside Group B countries. These countries are Cuba, Panama and Paraguay.

There is currently no national research infrastructure in Group D and E countries. We can, therefore, assume that these countries will seek interconnection to the regional Latin American network once their national issues have been solved. The time-scale for this is not currently foreseeable.

It can be stated that it should be the objective to interconnect the Latin American core countries among each other and to GEANT by late summer, early autumn 2003. In subsequent steps over the next 12 months Group B and C countries should be connected to the Latin American core.

4.2.2 Budgeted Connectivity Costs until December 2005

Based on the above capacity, roll-out assumptions and the indicative costs received from the operators, it can be budgeted that the costs for regional Latin American connectivity over a 30 months period will be close to US\$ 7 Million. The interconnection to Europe over a period of 30 months will be at US\$ 3 Million.

The Total for connectivity costs as foreseen today amounts to US\$ 10 Million over the period until the end of 2005.

In addition to the connectivity costs, Local Loop costs will be a factor. At this point in time, there are no indications of the costs of Local Loops in the Latin American countries.

The above budget is a very conservative budget. It is based on the current list prices as provided by the operators. It also assumes that all countries will be connected within the first 6 months, which is unlikely. It is very likely, however, that a tender would result in more bandwidth for the same amount of money.

5. DEMAND ANALYSIS

CAESAR carried out a two-fold analysis of the demand for direct connectivity between GEANT and its Latin American counterparts, seen from a European perspective. Firstly, the measurement of existing traffic between European and Latin American universities and research institutions was organised. Secondly, European and Latin American User Groups were approached to determine their current applications and their future connectivity needs.

5.1 Traffic Analysis *(by Esther Robles, RedIRIS)*

5.1.1 Methodology of the Traffic Analysis

At this point in time, most of the Latin American universities and research institutions have some connectivity to the Internet. National research and education networks exist in the majority of the Latin American countries and interconnect the universities and research institutions in the country. These national research and education networks then provide the connectivity to the Internet, and in the case of the national research and education networks of Argentina, Brazil, Chile and Mexico also to the US Internet2 network Abilene. There is also a 2 Mbps link between the Portuguese and the Brazilian research networks.

Before we can have a look at how the traffic is routed between the various networks in Latin America and GEANT, it is important to understand the type of connections the NRENs connected to GEANT have.

The NRENs have a connection to GEANT which provides them with direct connectivity to the European NRENs as well as research networks across the globe, like Abilene, CANARIE, ESnet and NACSIS. In addition to the exchange of traffic with other research networks, the NRENs connected to GEANT also exchange traffic with the commercial Internet. For this exchange of commodity traffic they either have their own connections to the commercial Internet or are using a service provided by DANTE, called DANTE World Service (DWS). Via this service the NRENs can obtain bandwidth for their commodity traffic via GEANT. They do not receive commodity traffic via their own links to a commercial provider, but via their connection to GEANT. GEANT disposes of several connection points with commercial providers.

European NRENs, which dispose of their own connections to commercial providers are DFN, GARR-INFN, NorduNET, RedIRIS, RENATER, SurfNET, SWITCH and UKERNA. For all other countries commodity traffic is sent and received via GEANT.

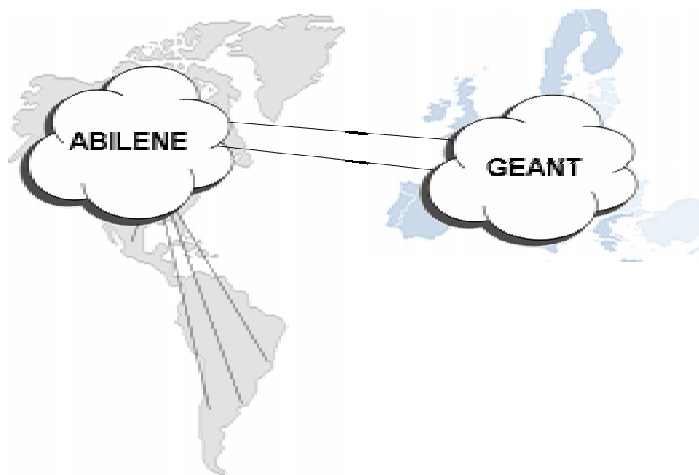
5.1.1.1 Traffic Routes between GEANT and Latin American Countries

The following bullet points give a brief overview about the possible routes for the traffic between Latin American NRENs and related organisations and GEANT NRENs and how traffic was measured.

- **Research links:**

Defined as links interconnecting GEANT with Abilene.

Those Latin American research networks with links to Abilene (Argentina, Brazil, Chile and Mexico) route their traffic to GEANT NRENs through these research links. Accounting filters have been set up on the GEANT gateways with Abilene and GTRN to measure the traffic that follow these links.



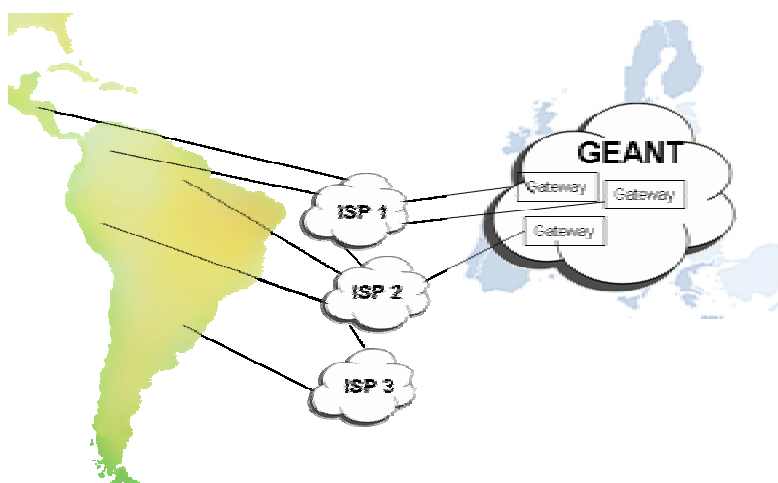
- **Commodity links:**

There are four Latin American research networks with direct connections to Abilene. The rest of the Latin American research networks connect to commercial providers for their connections to the Internet. This traffic is received as commodity traffic in GEANT.

As pointed out above, the NRENs connected to GEANT have two options to connect to the commercial Internet:

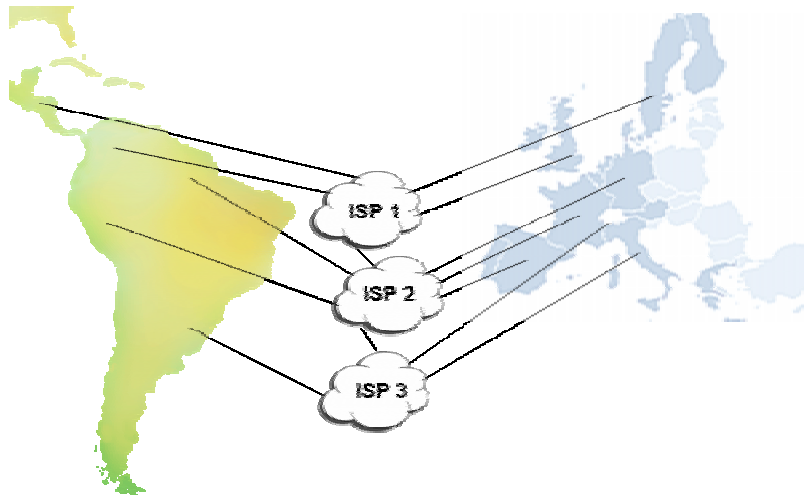
- DANTE World Service (DWS)

As previously explained, GEANT peers with commercial providers at some PoPs to offer commodity traffic to those Europeans NRENs that wish to purchase their commodity traffic solutions from DANTE. These NRENs have no direct links to the commodity Internet, this traffic uses the NREN link to GEANT. In this case, accounting filters need to be configured within the GEANT gateways that peer with commercial providers in order to measure the aggregated exchanged traffic between some Latin American countries and the GEANT NRENs that use the DWS.



- NRENs commodity links:

In addition, there are several European NRENs (DFN, GARR, NorduNET, UKERNA, RedIRIS, RENATER, SURFnet, SWITCH) that have their own commodity links (not shared with its GEANT link as in the previous point) and some traffic to/from Latin America goes through these paths. This implies that in order to measure this traffic, accounting filters should also be set up in these routers that belongs to these NRENs.



In the context of the traffic analysis for the CAESAR project, DFN and RedIRIS are the European NRENs that have configured accounting policies on their routers and have provided information about the exchanged traffic. The other European NRENs apologised for not been able to provide it as the required extra configuration would imply a risky excess cpu load for the router.

5.1.1.2 Latin American Prefixes

The filter counters have been configured using the public information within the well-known RIRs (Regional Internet Registries) route registry databases. But, in order to get a more detailed information and increase the accurate on the measurements, it was required to have confirmed information from each Latin American country. All the IP prefixes that have been used are listed in Appendix 4.

The common rule is that there is an AS number for a group of IP prefixes that are being used by an organisation (Latin American NREN or University). But there are some cases where the organisation does not own an AS number but the AS number belongs to a commercial provider. Even more, there are some exceptions where the IP prefixes are shared between a University and the commercial provider that provides its Internet access. As it is not possible to distinguish the traffic from one and the other, we have considered the whole IP range.

5.1.2 Results of the Traffic Analysis

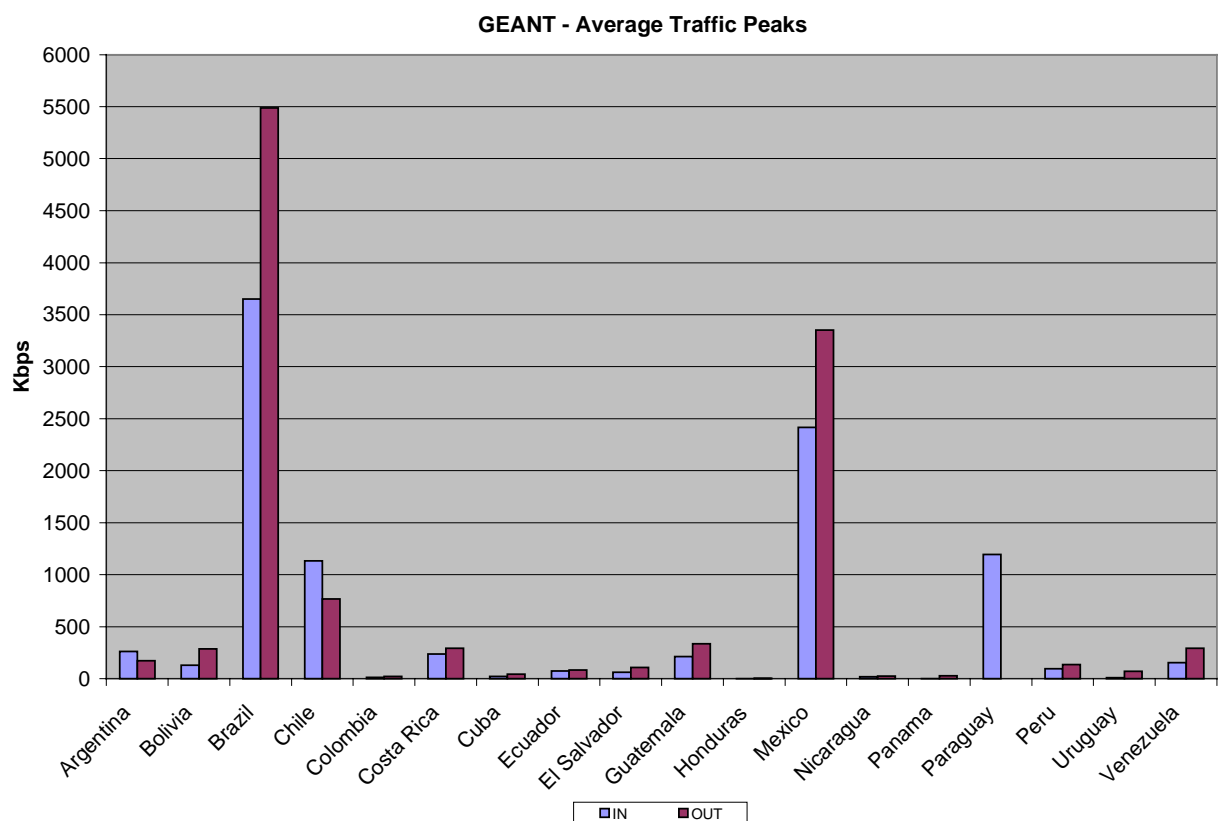
The configured filters can distinguish traffic on a per Latin America country basis. Data for the following graphs has been derived in June 2002.

5.1.2.1 GEANT measurements

As previously explained, accounting filters has been configured on the GEANT gateways with Abilene, GTRN and commodity providers (DWS).

5.1.2.1.1 Average Traffic Peaks

This graph shows the average of the maximum peaks: The average is calculated based on the five top peaks of traffic from each Latin American country. The following graph shows an average of the maximum peaks of traffic between GEANT and Latin American countries on a per country basis.



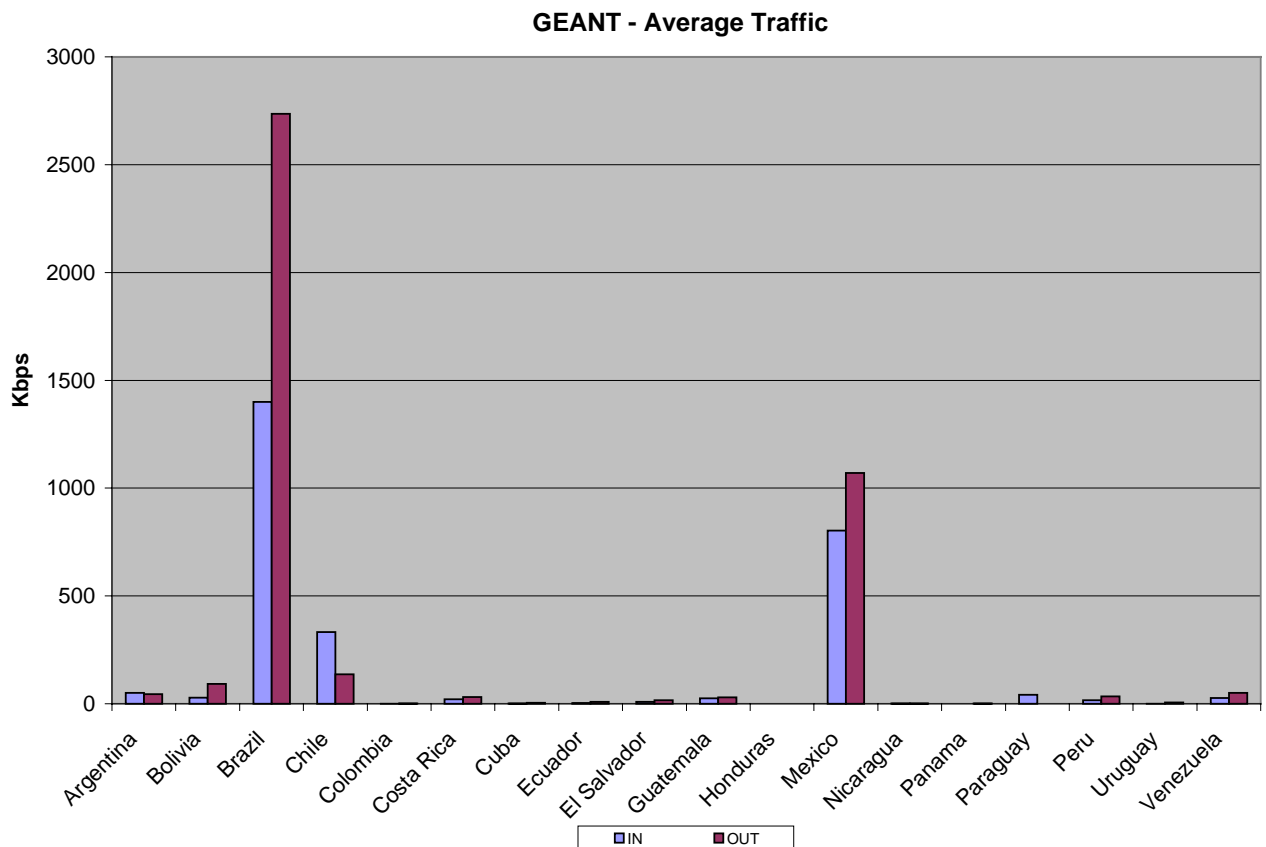
The peak for the total traffic exchanged is:

7.5 Mbps - IN GEANT

9 Mbps - OUT GEANT

5.1.2.1.2 Average Traffic

The following graph shows the average of traffic for each Latin American country.



The average total traffic is :

4 Mbps - IN GEANT

5 Mbps - OUT GEANT

Traffic is higher from GEANT to Latin American countries with the exception of Argentina, Chile and Paraguay.

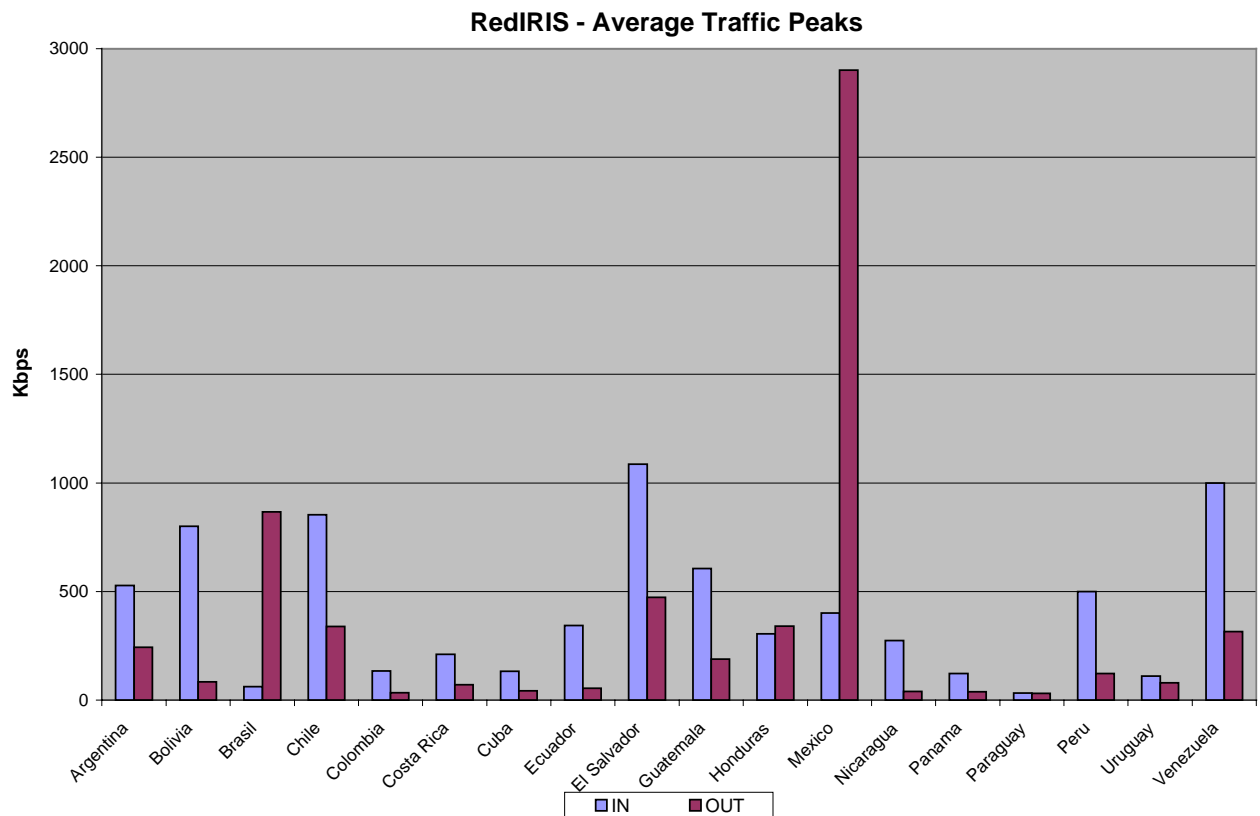
5.1.2.2 RedIRIS measurements

Accounting filters have been set up only on the RedIRIS IP commodity links, as the traffic coming through GEANT to RedIRIS is measured on GEANT gateways and it is included within the GEANT measurements, which are explained in 5.1.2.1.

As the previous section, the first of the following two graphs shows the average traffic peaks and the second the average traffic.

5.1.2.2.1 Average Traffic Peaks

This graph shows the average of the maximum peaks: The average is calculated based on the five top peaks of traffic from each Latin American country. The following graph shows an average of the maximum peaks of traffic between RedIRIS and Latin American countries on a per country basis.



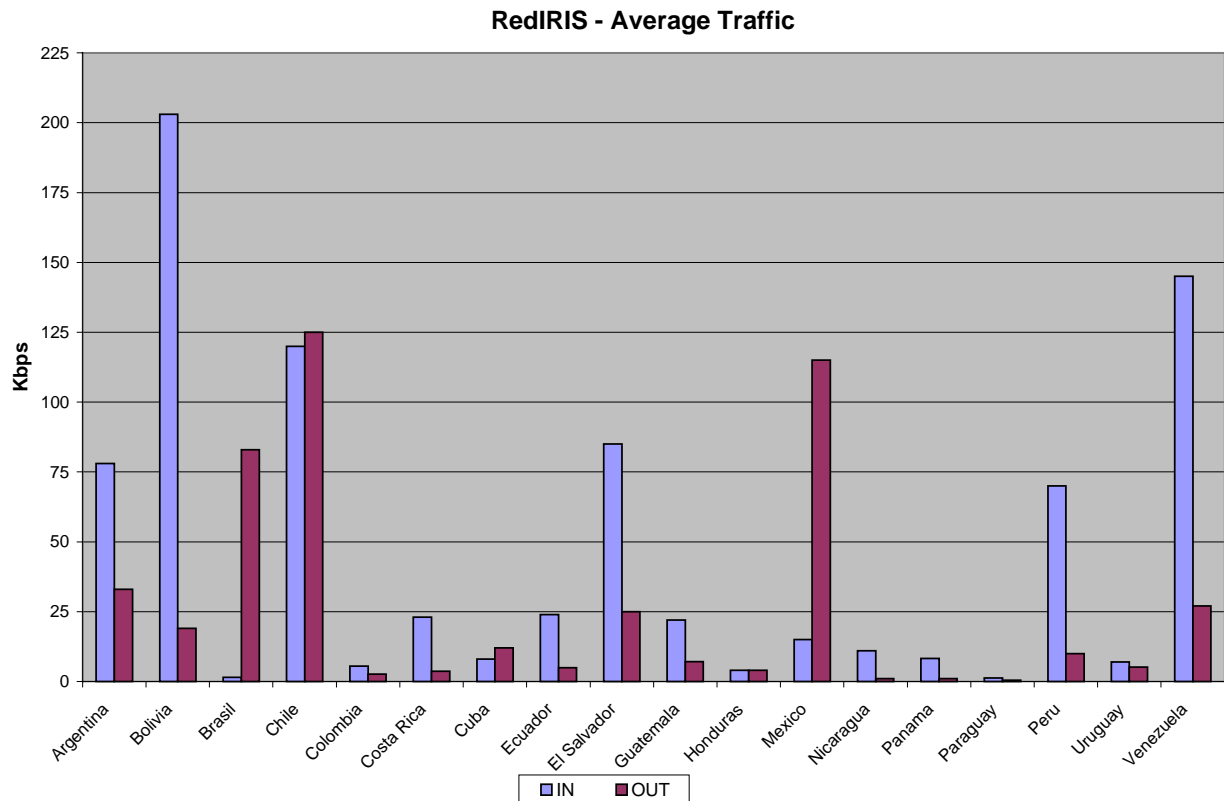
The peak of total exchanged traffic between RedIRIS and Latin American countries is:

1.6 Mbps – IN RedIRIS

3.4 Mbps - OUT RedIRIS

5.1.2.2.2 Average Traffic

The following graph shows the average of traffic for each Latin American country.



The total exchanged average traffic with RedIRIS is :

500 Kbps - IN RedIRIS

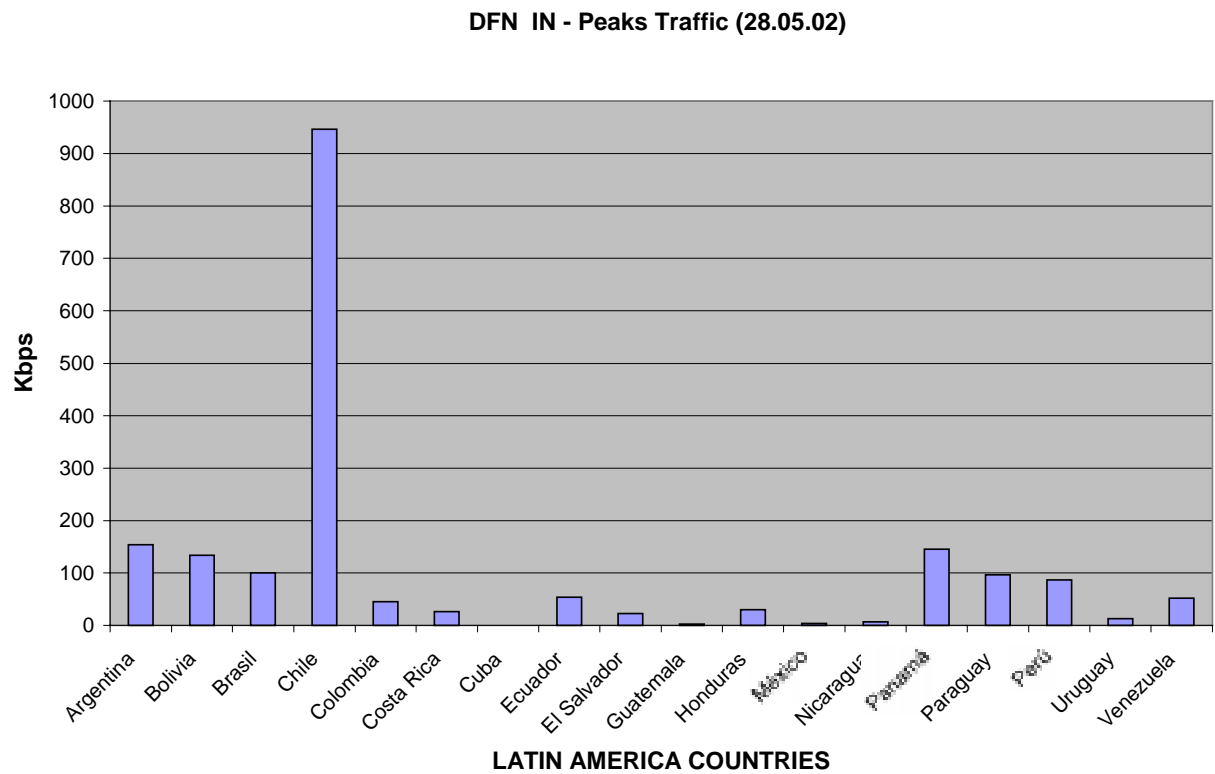
1 Mbps - OUT RedIRIS

As within the GEANT results, the traffic is higher from RedIRIS to Latin America countries although there are also some exceptions: Brazil, Chile, Cuba and Mexico. The cases of Brazil and Mexico stand out, as the difference between in and out is very big.

5.1.2.3 DFN measurements

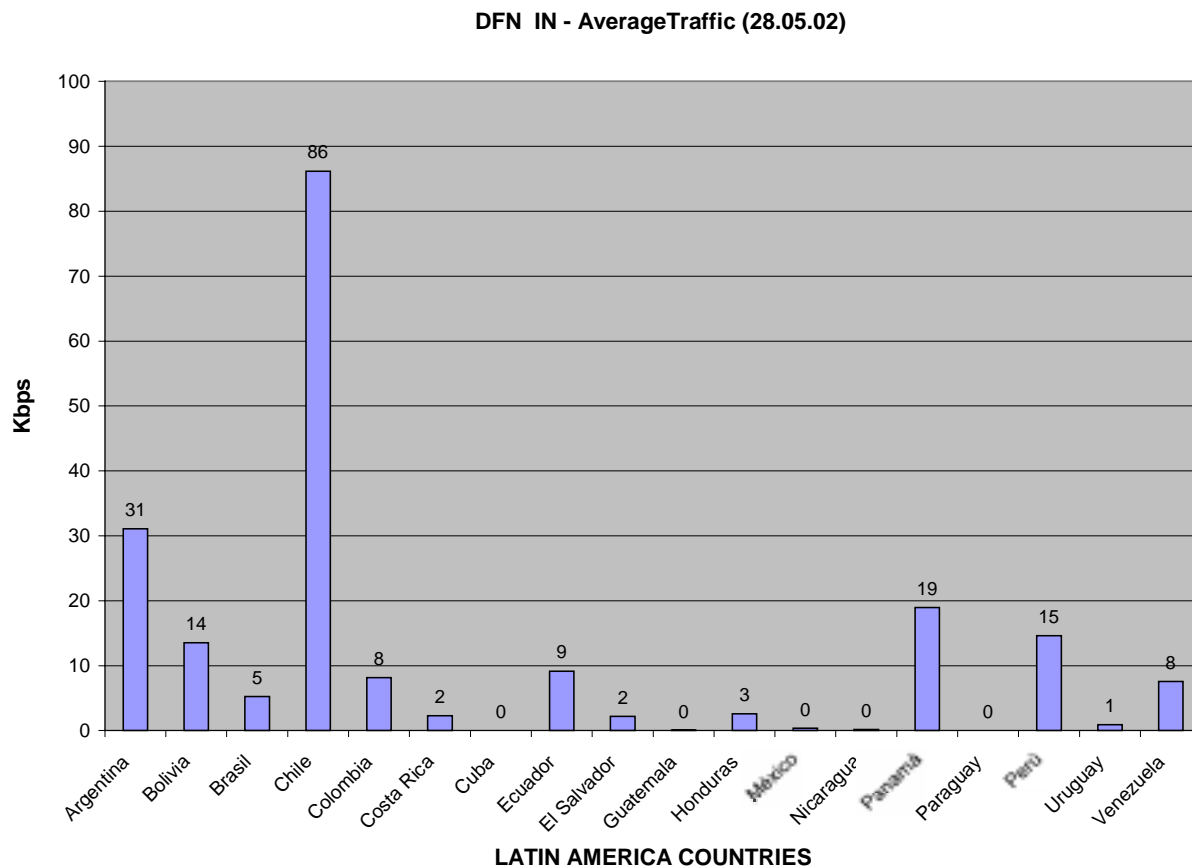
Data from this NREN corresponds to one day in May and it is only traffic going to DFN (IN) through commodity links. As the provided data belongs to one day, it should be considered as very much an approximation of real behaviour.

5.1.2.3.1 Average Traffic Peaks



The peak of total exchanged traffic between DFN and Latin American countries is 1.8 Mbps (DFN IN)

5.1.2.3.2 Average Traffic



The total exchanged average traffic with DFN is 12 Kbps (IN).

5.1.3 Conclusions of the Traffic Analysis

The peak traffic graph and the average traffic graph show that the exchange traffic is very bursty. The average traffic is quite low, but during some periods the traffic can grow up to 20 times the average traffic with some countries as is shown by the measurement of GEANT traffic for Nicaragua, Colombia, Cuba, Ecuador. For Honduras, the difference increases to 48 times. The difference between average traffic and peak traffic is slightly higher in the case of RedIRIS. For instance, Guatemala, Brazil, Mexico, Colombia, Paraguay traffic show a difference up to 25 times at some points. The average of ratios between peak and average traffic is 12 times for GEANT and DFN, and 20 for RedIRIS.

The average traffic of RedIRIS (only commodity links) is about 12.5% of GEANT average traffic for IN and 20% for OUT. For DFN, the average IN traffic is quite low although the traffic reaches peaks similar to RedIRIS. This means that RedIRIS has more consistent traffic with these countries. Approximately, the peaks of traffic for RedIRIS and DFN are identical. If this result is extended to the rest of NRENs with its own commodity links, and with the assumption (very strong assumption) that the peaks of traffic appear at the same time, approximately, the required bandwidth would be at least 34 Mbps today.

Finally, it is very important to keep in mind that although, at this moment, connectivity exists between one university within GEANT and another university in a Latin American country, the connectivity can be improved decisively. An improvement in connectivity will bring about improved collaborative work, which then will be followed by advanced applications, which demand higher bandwidth. For this reason, a substantial increase in the traffic volumes between the two continents can be expected as soon as there is direct and improved connectivity.

5.2 User Group Survey

5.2.1 Methodology of the User Group Survey

Throughout the project, CAESAR has been in contact with User Groups across Europe, to make and keep them aware of the developments and findings of the project. CAESAR gathered contact details of European User Groups in preparation for the CAESAR workshop held in Toledo in June 2002. Because of the large attendance of Latin American research networks at CAESAR workshop, it was decided in not to have User Groups as part of the workshop attendees.

The CAESAR User Group questionnaire was emailed to the representatives of 40 User Groups based in Europe and Latin America in August 2002.

The European User Groups addressed represented the following scientific areas:

- Astronomy
- Space
- High Energy Physics
- Basic Physics
- Weather forecasting
- Climatology and Meteorology
- Grid Computing
- Molecular Biology
- Ocean Geology
- Environmental Protection
- Ocean and Polar Science and Research
- Mining
- Robotics and Automation
- Autonomous Unmanned Air Vehicles (UAV's), Flight Dynamics, Flight Simulation, Flight Control, Robust Control.
- Chemistry
- Databases and E-learning
- Research into Networking

The Latin American User Groups represented the following scientific interest:

- Chemistry
- Computing and Engineering
- Geology
- Energy and Mining
- Distance Learning

In order to receive as many responses as possible, the questionnaire consisted of four questions only. The content of the questionnaire was adapted to whether it was sent to a User Group based in Europe or in Latin America.

The questionnaires are annexed at Annex 5 of this report.

5.2.2 Results of the User Group Survey

The deadline of returning the questionnaire to CAESAR was set at 20 August 2002. By this date, the questionnaire was returned by 13 User Groups (32.5%), of which two were based in Latin America.

By the time of writing this report (September 2002) CAESAR had received responses from representatives of User Groups in the following areas:

- Molecular Biology
- Space
- Astronomy
- High Energy Physics
- Computing and Engineering
- E-Learning
- Distance Learning
- Robotics and Automation
- Weather forecasting
- Energy and Mining
- Polar and Ocean Science and Research

The representatives from the Molecular Biology (EMBL) and Space (ESA) indicated that there was currently no collaborative research activity between their institutions and Latin America. The stated that they would like to keep being informed about the developments of the project.

5.2.2.1 European Results

By the end of August 2002, 11 European User Groups had responded to the CAESAR questionnaire. Considering that it had been sent to 21 User Groups and during the holiday month of August, the high return rate of 53% is an indication of the level of interest European users have in a direct connection to Latin America.

European Responses Received to Question 1:

The first question asked the European User Groups about the countries in which their Latin American partners are based. Out of the 11 European User Groups with collaborative partners in Latin America, 7 stated that one of their partners sites was in Brazil, 5 stated that one of their partner sites was based in Mexico. Chile and Argentina were named 4 times, Colombia 3 times, Costa Rica and Venezuela twice and Cuba and Peru once. Bolivia, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Paraguay and Uruguay were not named by this group of 11 European User Groups.

Country	No. of Nominations
Argentina	4
Bolivia	0
Brazil	7
Chile	4
Colombia	3
Costa Rica	2

Cuba	1
Ecuador	0
El Salvador	0
Guatemala	0
Honduras	0
Mexico	5
Nicaragua	0
Panama	0
Paraguay	0
Peru	1
Uruguay	0
Venezuela	2

Table 2: Per Country Number of Nominations by European User Groups

European Responses to Question 2:

Question 2 asked the European User Groups what kind of applications they currently run between their research site and their Latin American partners' site. The answers received are quoted from the responses received to show the variety of different applications that are already being run between the sites.

User Group 1 (Weather forecasting) stated the following:

“Operational numerical weather prediction (NWP). Deutscher Wetterdienst (DWD) provides its High resolution Regional Model (HRM) to two institutions in Brazil, namely the National Weather Service (INMET) in Brasilia and the Marine Weather Service (Navy, DHN) near Rio de Janeiro.

Both centres receive data from our global weather forecast model GME twice a day, namely from 2.40 until 4 UTC and 14.40 until 16 UTC.”

User Group 2 (E-learning project applying for @LIS support):

“None. Would be set-up for the @LIS Programme.”

User Group 3 (High Energy Physics):

“For the moment only ssh, telnet and other basic applications. The current bandwidth in most of the Latin-American institutes is of 128KB/sec, so is very limited.”

User Group 4 (Robotics and Automation):

“Research on robotics, automation, Integration of systems.”

User Group 5 (Research into Networking):

We have just started a collaborative project called IQoM (Internet Metering for QoS and DiffServ Deployment) with 5 academic institution in Brazil: UNIFACS, UFBA, UFPR, UFRGS, CPQd and UCL(UK). This project will investigate QoS needs for applications and develop/deploy an infrastructure for measurements within the Brazilian academic backbone (RNP2). Some of the experiments will be carried between the UCL (UK) and the partners in Brazil.”

User Group 6 (E-learning):

“We are only using communication tools.”

User Group 7 (Astronomy):

ESO is mainly a service organisation for the Astronomical Community. Links between South America (Chile) and Europe (Germany) are used for typical TCP/IP based traffic (ftp, telnet, http, data transfer, VC, phone, etc).

ESO user access to remote applications and access to ESO applications from remote users is done via Internet access, using normal TCP/IP services."

User Group 8 (Polar and Ocean Science and Research):

"At this point in time our contacts are based on the transfer of material for publication via email and other email exchange."

One User Group did not respond to the question.

The responses received from the European User Groups to Question 2 surprised us a little, as we were expecting the current applications to be only basic communication applications, such as email, ftp, www, ssh and database transfer. It was encouraging to see that some of the European User Groups that responded to the questionnaire were already using specialised applications.

European Responses to Question 3:

Question 3 asked the User Groups which application they would like to use once the connectivity between Europe and Latin America was improved. Again, the responses are quoted, as they vary widely.

User Group 1 (Weather forecasting) stated the following:

"The current amount of GME (Global Weather forecast Model) data sent from DWD to INMET (Brasilia) is: From 2.40 to 4 UTC and from 14.40 to 16 UTC: 25 files of 6.9 MByte each, i.e. 173 MByte in 45 to 70 minutes.

The current amount of GME data sent from DWD to DHN (near Rio de Janeiro) is: From 2.40 to 4 UTC and from 14.40 to 16 UTC: 25 files of size 4.5 MByte each, i.e. 113 MByte plus GME data for the Antarctic region, 25 files of 1.3 MByte each, i.e. 33 MByte in 45 to 70 minutes.

Both transfers are time-critical because short range weather forecasts must be completed in about 20 to 35 minutes wall clock time per 24 hours forecast time.

In Autumn of 2003 the next generation GME will be operational at DWD which will result in a threefold increase of the amount of data sent to Brazil in the same period of time as before."

User Group 2 (E-learning project applying for @LIS support):

"Ideally, we would like to demonstrate an "e-learning/Knowledge Management" tool, which may involve a demo dealing with the capture and collaborative sharing of knowledge (tacit as best practices and explicit as docs), as well as groupware training modules through streaming..."

User Group 3 (High Energy Physics):

"The best application that we would like to have at this moment is "videoconferencing" even in only "one direction" (Europe->Latinoamerica). The possibility of running graphical applications could be also useful but not priority."

User Group 4 (Robotics and Automation):

“microelectronics, simulation, telecommunications .”

User Group 5 (Research into Networking):

“It would help us a lot to carry out our measurements experiments. However, as an end user it would very helpful to be able to use VoIP applications in order to effectively communicate with the partners in Brazil.”

User Group 6 (E-learning):

“As we are now interested in e-learning, we would like to be able to share learning content created inside and outside our project.”

User Group 7 (Astronomy):

” Use VPN/IPSEC virtual connection over the Internet to replace or extend existing dedicated links.”

User Group 8 (Polar and Ocean Science and Research):

“During our “Polarstern” expeditions we often have Latin American researchers onboard. It would be interesting to exchange extensive expedition reports, including large tables and images. We would also be interested to exchange our models (partly). However, the models that we are using are much less extensive than climamodels or streamingmodels.”

User Group 9 (Distance Learning):

“We have followed closely the progress of the ISABEL application and the recent usage in the Madrid IPv6 Summit proved that it is become more and more simple to use, quality is improved, and it works on cheaper platforms.”

The answer received to Question 3 clearly indicate that improved connectivity between researchers in Europe and Latin America would improve their collaborative research significantly. New applications would be used and shared between Europe and Latin America. the current knowledge transfer would be improved.

European Responses received to Question 4

Question 4 asked the User Groups about the bandwidth needed for future applications and for their Quality of Service requirements.

This question was only partly answered by the User Groups addressed. Very detailed responses were received from only two user groups and these responses are given below. All other user groups indicated that a bandwidth sufficient for tele- and videoconferencing via the network would be sufficient. The User Group organising their application for the @LIS programme stated that bandwidth would be needed for real-time concurrent streaming, but that the real need could not yet be specified.

User Group 1 (Weather forecasting):

“The bandwidth currently needed is around 173 MByte in 50 minutes per partner, i.e. 461 kbit/s per partner. Both partners have to receive their data in parallel.

From Autumn of 2003 onwards a bandwidth of 1.4 Mbit/s will be needed.

Regarding the quality of service, the reliability of transmission with "guaranteed" transmission times which allow the real-time distributed computing is most important, i.e. the global NWP model GME at DWD is running at the same time as HRM at the partner institutions and is sending lateral boundary data in real time to the HRMs.”

User Group 7 (Astronomy):

“In the current ESO WAN we can identify inter-site links:

1544 Kbps satellite link between GAR and PAO

512 Kbps satellite link between GAR and LSO

512 Kbps leased line between LSO and STGO

1024 Kbps leased line between PAO and STGO

The above values will be increased to 2000, 1000, 2000, 2000 within mid 2003.

and INTERNET links towards the external world:

34 Mbps connection to INTERNET in GAR

10 Mbps connection to INTERNET in SANTIAGO

QoS for WAN links is in place for Videoconference and Phone lines and for some of the services (telnet).

While saying the current and short term numbers is easy, a longer term projection is quite more difficult and mainly depends on a) when some of the planned projects will be completed, b) whether the availability of BW will make competitive to transfer data over a link instead than using removable media and c) how much of the two requirements: data-only transfers and "key-click" applications can be allocated into the same communication channel.

As summary of requirement, I just quote the comment I received from Mr.Quinn, head of the Data Manager Division that is the major customer for the link: "Strategically we should think about moving from 10 MB/s to 30 MB/s for dedicated data-only bandwidth over the period 2003-2005/6 depending a little on the VISTA schedule and probably early ALMA requirements. I would not be surprised if we end up in a situation were we rent/buy a dark fibre and run whatever protocol we want over it (e.g. ATM or gigabit ethernet)"

In addition, the global requirement for an access time in the order of 150-200 ms to enable applications to be used remotely. Clearly, data transfer can have access time quite higher and therefore the correct solution could be a blend of fast-relatively narrow (2Mb/s) channel for applications and a much wider and may be slower data channel.”

5.2.2.2 Latin American results

Although the questionnaire (see Annex 5) was mailed to 19 Latin American User Groups which had been named by the Latin American partners of the CAESAR project, it was only returned by two User Groups, namely a Distance Learning group based in Paraguay and a Group with research interest in Energy and Mining from Guatemala.

Latin American responses to Question 1

Question 1 asked the Latin American partners about the European countries in which their collaborative partners are being based. Spain was named by both User Groups. Austria, Germany, Italy, Portugal and the Nordic countries were named in addition to Spain.

Latin American responses to Question 2

Asked about the current applications, both User Groups stated that they were using the normal communication tools. The User Group from Guatemala added to that the exchange of software and material for publications.

Latin American responses to Question 3

Asked about the future applications, the User Groups named teleconference, continuous learning, distance learning platforms, search engine and retrieval access for libraries and patents.

Latin American responses to Question 4

The User Group from Paraguay stated that ideally they would need one E1 for their institution. The User Group from Guatemala did not respond to this question.

5.2.3 Conclusions of the User Survey

It can be concluded from the User Group survey that European User Groups are interested in improved research connectivity to Latin America. This is evident from the high level of response to the questionnaire, from the quality of the responses and the expressed interest in being kept updated on the developments of CAESAR.

It was encouraging to see that the current applications being run between Europe and Latin America are not only the standard communication tools, but also some specialised applications. Knowledge transfer is already taking place and an improved interconnection will have a basis to build upon.

It was, furthermore, encouraging to see that all User Groups had some applications in mind that they would like to run if connectivity was improved. This clearly shows that research collaboration is, at this point in time, hindered by the lack of organised connectivity. It also supports the assumption that, once the link is implemented, traffic will follow quickly.

Unfortunately, but not at all unexpectedly, the questions about the bandwidth and QoS requirements stayed mostly unanswered. However, the indication received from the German weather forecasters and the European Southern Observatory show clearly that there will be substantial bandwidth requirements in the future.

6. SUMMARY AND RECOMMENDATIONS

The European Commission launched, in December 2001, a programme called @LIS, which stands for Alliance for the Information Society. Within the framework of @LIS, there is a budget for a regional Latin American research infrastructure as well as its interconnection with GEANT.

The CAESAR study has shown that, for most Latin American countries, there are well established research network infrastructures. This is the case for Argentina, Bolivia, Brazil, Chile, Costa Rica, Cuba, Mexico, Panama, Paraguay, Uruguay and Venezuela. In addition, in most of those countries that do not currently have a national research infrastructure, there are active plans for its development. It is very significant that there is considerable Latin American interest in co-operating with one another, and with Europe, to organise a co-ordinated approach to the establishment of connectivity between the two world regions. As part of the CAESAR project, an extremely successful workshop was held in Toledo, Spain, between the project participants and twelve Latin American research networks. As a consequence of this initiative the Latin America networks are developing a co-operative model called CLARA (Co-operacion Latino-Americana de Redes Avanzadas).

Demand analysis has shown that, even with no dedicated, or even organised connectivity, traffic flows in excess of 30 Mbps are taking place between the two regions today. In addition, a CAESAR User Group Survey has indicated that there is significant latent demand

for connectivity between Europe and Latin America that would exploit a direct interconnection.

In order to organise connectivity efficiently, it is appropriate to implement it on an inter-regional basis. In Europe this is relatively easy. The GEANT network provides a simple transport mechanism. In Latin America, however, intra-regional connectivity is currently not developed. Today all traffic flows between two Latin American countries are being exchanged via the United States. Rather than having individual per country connections from any country in Latin America to GEANT, the interconnection needs to be made from one region to the other. The Latin American networks see the opportunity given by CAESAR and the @LIS programme to organise intra-regional connectivity and to connect this to Europe. They are prepared to provide some funding for such an intra-regional connection. It is envisaged that a network connecting Argentina, Brazil, Chile and Mexico, together with a connection from this network to Europe (GEANT), and with connections from Bolivia, Costa Rica, Cuba, Panama, Paraguay, Uruguay and Venezuela into the intra-regional network is an appropriate initial solution.

Preliminary discussions with potential suppliers have suggested that, using DS-3 (45 Mbps) connectivity as the basic building block, it would be possible to fund networking requirements with the given budget over a period of three years. Europe has a strong interest in developing networking links with Latin America to support the @LIS programme and its associated demonstration projects. In view of the fact that, to efficiently achieve this, the Latin Americans are being asked to make an investment in their own infrastructure within the region, the way the balance of costs should fall needs to be carefully considered. To reflect this balance of costs it is proposed that, an overall model where 80% of the costs are contributed by Europe and 20% by Latin America is appropriate. The possibility that all partners in the follow-on activity from CAESAR contribute to the 20% should be considered.

It is recommended that, in order to keep the momentum created in the past months, a follow-on contract with DGEuropeAid in the framework of the @LIS Interconnection Initiative should be signed within 2002. Initial discussions with the Latin American networks have indicated that at least three national research networks in Latin America would have an immediate interest of becoming partner in this follow-on activity from CAESAR.

The contract to be signed under the @LIS Interconnection Initiative should be open to all 18 Latin American countries as named by @LIS. The majority of the research networking organisations in these countries would, most likely, not be willing to partner the contract. Therefore the contract will have to be able to include these organisations as subcontractors to the Co-ordinating Partner.

The contract to be signed within the @LIS framework should be split into two distinct phases to limit the financial risks. This could work in the sense that the subcontracting LA-Partners commit via a Letter of Intent to participate in the first phase and commit a very limited amount of money in this initial phase. During the first phase of the activity the tender takes place and the concrete figures for the amount and costs of connectivity for each LA-Partner will be known. Only after these numbers are known, the LA-Partners then commit to the second phase of the activity and at the same time agree to carry their part of the funding. At this point the LA-Partners should be able to decide, if they want to be connected and at what speed (i.e. cost). They should also have the opportunity to just stay on in the first phase until they feel ready to go to the second phase of the activity. This last option opens the possibility for those countries that are currently planning their national infrastructure to connect to the regional Latin American backbone when it suits them best.

To provide the necessary infrastructure for the twenty @LIS demonstration projects as well as for researchers and students involved in collaborative research between the Europe and Latin America, the CAESAR projects recommends to:

- create a regional Latin American research network infrastructure which interconnects the research and education networks in the region
- continue the excellent collaboration on a regional level in Latin America based on CLARA
- directly interconnect the Latin American research network with the pan-European research network, GEANT.
- closely co-operate between EU-NRENs, LA-Partners and DANTE on all matters concerning the activity within the framework of the @LIS Interconnection Initiative and to aim at signing a contract within 2002
- ensure the success of the activity within the framework of @LIS Interconnection Initiative by basing the funding within the contract on 80:20
- give the Latin American research networking organisations the possibility to become subcontractor of the activity within the framework of @LIS Interconnection Initiative
- split the contract for the activity within the framework of @LIS Interconnection Initiative into two distinct phases to ensure a minimum of financial risk for the LA-Partners and thus its inclusiveness

7. NEXT STEPS AND TIMED ACTION PLAN UNTIL SUMMER 2003

In order to keep the momentum that was created during the CAESAR workshop in Toledo in June 2002, CAESAR recommends that over the next months a set of activities is followed through:

October 2002:

- Formation of the Consortium for the contract to be signed within the framework of the @LIS Interconnection Initiative
- Contract negotiations with DGEuropeAid with respect to the @LIS Interconnection Initiative
- Internal Consortium Discussion on the contract with DGEuropeAid and consultation with CLARA

November 2002

- Second meeting between European and Latin American partners
- Final Stage of Contract Negotiations with DGEuropeAid and signature of contract
- Consortium Decision on Latin American regional network topology and related issues in close consultation with CLARA
- Preparation of Connectivity and Equipment Tenders

January 2003

- Issue of Open Tender for Connectivity and Equipment
- Creation of CLARA as a legal entity

March 2003

- Procurement Recommendations

May 2003

- Agreement with DGEuropeAid, LA Partners and suppliers concluded

Summer 2003

- First Service (Latin American Core network and interconnection to GEANT)

ANNEX 1: DELIVERABLE D1 – REVIEW OF DEVELOPMENTS IN LATIN AMERICA**Contract Number: IST-2001-35412****Project Title: CAESAR****D1****Review of Developments in Latin America**

Contractual Date: 30 June 2002
Actual Date: 26 June 2002
Work Package: WP1
Nature of Deliverable: R - Report
Dissemination Level: Pub –Public Document

Author: Cathrin Stöver, DANTE

ABSTRACT

This document reviews the situation of the national research networks or related organisations in Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela.

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EXECUTIVE SUMMARY

The CAESAR project studies the feasibility of a direct interconnection of Latin American research networks with the pan-European research network GÉANT.

Today, a regional research infrastructure in Latin America interconnecting the existing national research networks is missing. In order to organise an interconnection between Latin America and Europe from region to region and in a cost-effective way, a regional Latin American research infrastructure should be created. In parallel, the organisational set-up will have to be developed. Plans to interlink the research networks of Central and South America reach back to 1996, but have so far not been realised. In the last two years the North American AMPATH project has improved connectivity for the region by offering free connectivity to the Abilene PoP at Florida University in Miami.

The Latin American countries have the great advantage of being able to speak the same language (except for Brazil) and of sharing a similar history and cultural background. However, the state of their economic development and alongside to that the state of their research and development differ widely. The group is led by the comparably rich countries Brazil and Mexico, but also some of the poorest countries in the world, like Guatemala or Nicaragua, can be found in Latin America.

The reader of this study will find that this heterogeneity is reflected in the state of the development of the national research networks. Throughout the project, we have been trying to group the countries. At first into three groups, but now, as the information becomes clearer, we have decided to cluster the Latin American networks into five different groups.

The countries in Group A, Argentina, Brazil, Chile and Mexico, are the most likely countries to be able to form a regional network. All four countries have well established national and international connectivity.

From the organisational point of view, the networks clustered in Group B (Bolivia, Costa Rica, Uruguay and Venezuela) and C (Cuba, Panama and Paraguay), should also be able to join the regional network alongside Group A. It is possible, however, that Group C, due to the fact that they are not single consolidated national research networks could face higher national obstacles to connect to GÉANT via a regional network.

It can be foreseen that eventually also the countries in Group D (Ecuador, El Salvador and Peru) would find ways to connect to the regional backbone and maybe even in parallel build their national research infrastructure. It could also be that the opportunity to connect to GÉANT via a regional backbone would create a momentum that would facilitate the creation of the national research network in these countries.

As for the near future (within the next three years) we can foresee difficulties connecting the countries in Group E (Colombia, Guatemala, Honduras and Nicaragua) to the regional Latin American network in order to connect to GÉANT.

The follow-up from the successful CAESAR workshop in Toledo which was held in June 2002, will help to bring about a clearer picture on the possible solutions for intra-regional connectivity within Latin America, as well as for an interconnection of the two regions. The Final report of the CAESAR project will take these findings into consideration and will make final recommendations.

1. INTRODUCTION

The telecommunications revolution of the past two decades has created a world which is becoming smaller by the day. Modern research no longer needs to be undertaken in small and isolated communities. To be successful research communities with similar interests need to co-operate globally. The communications to facilitate this are a reality now.

One of the major objectives of the pan-European research network GÉANT is to facilitate global research co-operation by encouraging connectivity between European researchers and researchers in other world regions. Between the European research networks and similar activities in North America and Asia Pacific this objective has been achieved. Building on this experience, the European research community is now wishing to connect to other world regions, in particular Latin America.

2. THE CAESAR PROJECT

CAESAR (Connecting All European and South American Researchers) is a European Commission funded feasibility study to evaluate the possibility of a direct interconnection between the pan-European research network GÉANT and similar activities in Latin America. The creation and development of national research networks in Latin America and their increasing interest in international co-operative research means that it is important to investigate the possibilities of such a direct interconnection. The historical links between Europe and Latin America re-enforce the desirability of this goal.

CAESAR is fully funded by the EC's DG Information Society. In December 2001, the EC launched the @LIS programme to build an Alliance for the Information Society with Latin America. Like @LIS, the CAESAR study involves co-operation with eighteen Latin American countries including Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. The project lasts six months, beginning in March 2002.

3.1 The Partners in CAESAR

The CAESAR study is jointly carried out by FCCN, RedIRIS and DANTE. FCCN is the Portuguese national research network which interconnects the research institutions, national laboratories, universities and higher education facilities within Portugal. RedIRIS is the Spanish national research network which currently interconnects more than 250 research institutions and universities in Spain. DANTE, the Co-ordinating Partner of the CAESAR project, is a UK based not-for-profit organisation which was mandated by the European national research networks to organise, build and manage international networking services in their behalf.

3.2 CAESAR Objectives

The CAESAR study targets four objectives. Firstly, and the content of this Project Deliverable, CAESAR analyses the current situation and developments in research networking in Latin America. For this, the project has contacted the presidents and directors of the eighteen national research organisations in the region asking them to complete a two-paged questionnaire. This questionnaire explores the state of development of the national research network, the underlying funding arrangements and, of course, the technology, topology and geographic scope of the network. The exact wording of the questionnaire which was originally drafted in English and then mailed to the Latin American partners in Spanish and Portuguese versions can be found in Annex 1 of this document.

CAESAR also studies the demand for an improved connection between GÉANT and the Latin American research networks. This demand analysis includes an analysis of the current

traffic flows between the two regions, as well as a thorough study of current and potential user requirements. The project has singled out user groups across Europe that are working in co-operative projects with one or more countries in Latin America. A second questionnaire will help analyse the user demand and enable CAESAR to define the connectivity requirements between the European research community and Latin America.

Thirdly, CAESAR has addressed potential suppliers to survey the options for connectivity with Latin America. In this respect, CAESAR has established contact with 23 operators asking them for an outline of their services between Europe and Latin America and within the Latin American region. A key issue for the interconnection is to have a single point of presence within Latin American from which all research networks in the region can be reached.

The fourth objective of CAESAR was to organise a workshop which would bring together the representatives of the Latin American and European research networks, interested European national politicians and the European Commission to debate the project, its objectives and future plans. This workshop took place at the University of Castilla-La Mancha, Toledo, Spain on 13 and 14 June 2002.

4. THE METHODOLOGY

Immediately after the start of the CAESAR project in March 2002, the CAESAR project partners developed a questionnaire which was to be sent to the Latin American research networks and similar organisations. The questionnaire was originally developed in English but then translated to Spanish and Portuguese to facilitate the completion by the Latin American partners. The exact wording of the three versions of the questionnaire can be found in Annex 1 of this document.

The questionnaire was posted to the majority of the Latin American research networking organisations in the w/c 11 March 2002. There were, however, problems obtaining contact details and also in contacting several organisations. In the case of some of the Latin American countries, especially in those countries where research networks do not (yet) exist, it took weeks to identify the right person and even when that person was finally identified, the questionnaire was not in all cases completed and returned.

By the deadline of returning the questionnaire, we had received answers from the following 13 organisations in Latin America:

RETINA (Argentina)
BOLnet (Bolivia)
RNP (Brazil)
REUNA (Chile)
RedUniv (Cuba)
FUNDACYT (Ecuador)
CONACYT (El Salvador)
CUDI (Mexico)
PANNET (Panama)
CNC (Paraguay)
CONCYTEC (Peru)
RAU (Uruguay)
REACCIUN (Venezuela)

From Guatemala we received a description of the situation of research networking in the country, but as there was currently no research network and not even an initiative towards one, the questionnaire was not completed. We were also able to establish contacts with Honduras, but although the return of the questionnaire was originally indicated, it was not returned.

Although we had good contact details for the research networking organisation in Colombia and Costa Rica, we were unable to establish a fruitful contact that would have led to the return of the questionnaire. This is particularly significant and lamentable for Costa Rica as CRNet is one of the more advanced networks in the region. It is therefore very unfortunate that our efforts were not responded. As a spin-off from the Toledo conference, we were able to establish contact with an interested professor at the University of Cauca in Colombia.

As for Nicaragua, we have to state that we were unable to locate a person responsible and to establish any kind of contact. In Nicaragua the RAIN network existed, but today, there is no longer a website available. An email sent to an address of a contact in Nicaragua supplied by the director of PANNET in Panama returned address unknown.

In those countries where contact was established and the questionnaire completed and returned it was followed up with questions when detail of the set-up of the organisation or network was unclear. It has to be stated that over the months very valuable relations were built between CAESAR and the Latin American partners. This also showed during the

CAESAR workshop in Toledo which was attended by 16 representatives from 12 Latin American research networking organisations.

Due to the above mentioned circumstances, this report gives a good overview of the status and developments in 14 Latin American countries (13 that returned the questionnaire and Guatemala). For the remaining 4 countries the information is not complete, as it was not directly derived from the source but is a result of desk research from Europe.

4. LATIN AMERICAN RESEARCH NETWORKS

4.1 Status and Developments in Argentina

4.1.1 General Overview

Inhabitants	36.12 Mio
Gross National Product (GNP)	298.1 billion US\$
Per capita GNP	8,258 US\$
Per capita investment in IT	96 US\$
Internet Users	3.88 Mio ¹⁾
Internet Users is percentage of the population	10.38 ¹⁾

Source: population.com, bfai, Nielsen Net Ratings. All data 1998, except ¹⁾ 07/2001

4.1.2 RETINA - The Argentinean National Research Network

4.1.2.1 The Organisation

RETINA (Red Teleinformática Académica), the national research network of Argentina is a not-for-profit organisation, established under the umbrella of a non-governmental organisation called Asociacion Ciencia Hoy. RETINA was created in 1990 with the financial support of the Fundacion Antorchas. Today the costs of running the network are covered by the fees paid by the institutions connected to it as well as by financial support that RETINA continues to receive from the Fundacion Antorchas for new network developments. Next to RETINA the public national universities have a network of interconnections which is nowadays run by RETINA (formerly known as RIU).

Today 56 institutions are connected to RETINA, of which 42 universities and higher education facilities, 8 research institutions, 5 governmental offices and public services, and one other institution. It is estimated that RETINA reaches 80% of the Argentinean research community.

4.1.2.2 The Network

The topology of the RETINA network is complex due to the heterogeneous demand for capacity and features by the connected institutions. The network topology is star-shaped with links between 256 Kbps in regions with a lesser developed infrastructure to 2 Mbps in the central part of Argentina and up to 34 Mbps within the city of Buenos Aires. The connections are mainly terrestrial and are provided by Telecom, Telefonica, Impsat, Comsat, Techtel and Metrored. The links are transparent with some point-to-point connections or ATM connections. The IP overlay of the network is managed by RETINA. Applications supported consist of Internet Services, such as Newsgroups, hosting, housing, mailing lists, but there are also videoconferencing (H.323 and H.320) and multicast facilities. RETINA also offers consultancy and network training for the network managers in the connected institutions. RETINA is connected to the commercial Argentinean NAP (Network Access Point) and has signed direct peering agreements with the most important commercial providers, such as Impsat, Telecom, Comsat and Global Crossing. The traffic load in the network is currently 15 Mbps external and 40 Mbps total (April 2002).

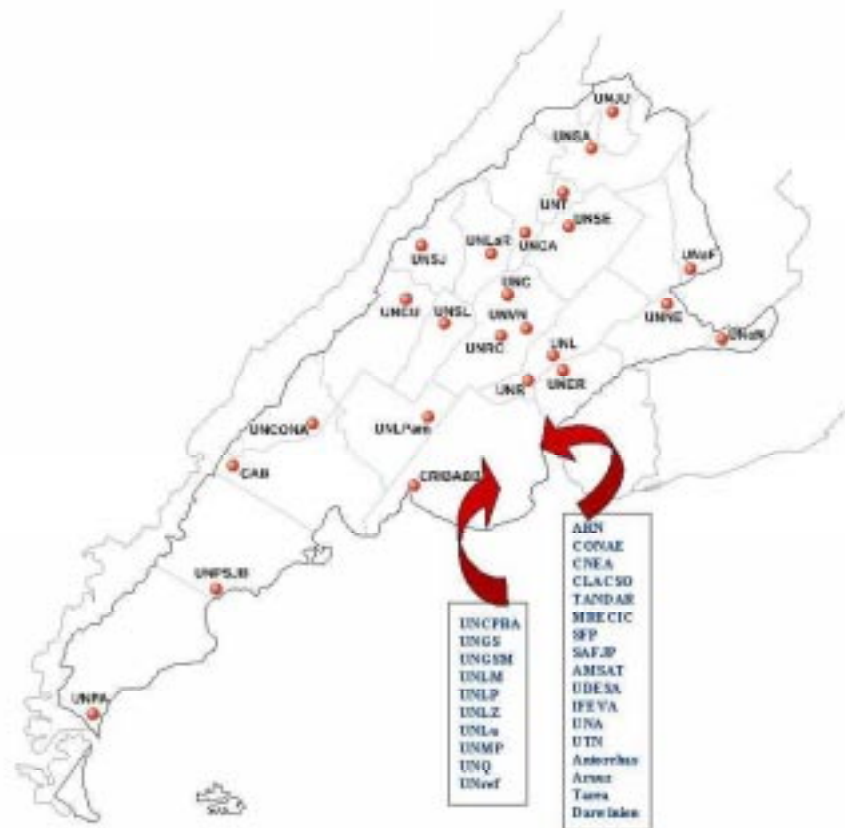


Fig.1: Map of Institutions connected to RETINA (April 2002)

RETINA disposes of two main international connections, namely a 10 Mbps link for the university network and a 49 Mbps link for the academic network. These connections are provided by Impsat and Telecom. RETINA has been a member of the North American AMPATH initiative since April 2001 and disposes of a 45 Mbps link to Abilene.

4.1.2.3 Future Plans

Within the next three years the RETINA management hopes to be able to follow the developments in advanced networking across the world. To achieve this objective, the plan is to upgrade the national connectivity substantially and to improve the quality of the connections. Furthermore there are plans to train technical personal to be able to improve the support of advanced applications running in the network.

Together with the national research networks of Chile, Brazil and Uruguay (REUNA, RNP and RAU respectively), RETINA is working towards regional connectivity within South America.

4.1.2.4 RETINA and CAESAR

RETINA expressed a special interest in connecting to the pan-European research network GÉANT to be able to provide an adequate service to those research projects in Argentina which are heavily linked to European research institutions. These projects can be found in

the areas of Astronomy, Oceanographics, Climate, Global Changes, Distance Learning, Biology, Physics and Mathematics.

It was stated that a direct connection would considerably improve the collaboration between researchers in Argentina and Europe as the speed and quality available for applications would be significantly enhanced. An immediate benefit was foreseen for videoconferencing and distance education applications. It was furthermore stated that improved connectivity would also trigger the progressive growth of distant data processing or the remote management of equipment.

4.1.2.5 Contact Details

RETINA - Red Teleinformática Académica
Corrientes 2835 - 5to A
Buenos Aires
Argentina
Tel: 54-11-4963-3495
Fax: 54-11-4322-8422
<http://www.retina.ar>

Director: Dra. Emma Perez Ferreira, perezf@retina.ar
CTO: Guillermo Cicileo, gcicileo@retina.ar

4.2 Status and Developments in Bolivia

4.2.1 General Overview

Population	7.9 Mio ¹⁾
Gross National Product	8.3 billion US \$ ²⁾
Per capita GNP	994 US\$ ²⁾
Internet Users	78,000 ³⁾
Internet Users in percentage of population	0.98 ³⁾

Source: population.com, ITU. Data ¹⁾ 1998, ²⁾ 2000, ³⁾ 12/1999

The low per capita income and the high illiteracy rate limit the expansion of the Internet in Bolivia. A little less than 1% of the population was connected to the global Internet at the end of 1999. Another reason for the scarce penetration of the Internet is the missing infrastructure, especially in rural areas.

4.2.2 BOLnet – The Bolivian National Research Network

4.2.2.1 The Organisation

The National Research Network of Bolivia, BOLnet, is part of and therefore dependent on the Vicepresidency of the Republic and the Council of Science and Technology of the country. The network is completely self-funding through the sales of connectivity services and information systems.

Currently there are 18 institutions connected to BOLnet of which are 7 universities and higher education facilities, 8 research institutions and 3 governmental offices and public services. It is estimated that 2000 users are connected to BOLnet.

4.2.2.2 The Network

The BOLnet network is star-shaped with the central node in the capital La Paz and secondary nodes in Santa Cruz, Sucre and Tarija. In the short-term it is planned to extend the network to 5 more regions, namely Cochabamba, Oruro, Potosi, Beni and Pando.

The current topology is as follows:

La Paz – Santa Cruz : 128 Kbps
 La Paz – Tarija: 128 Kbps
 La Paz – Sucre: 64 Kbps

These three IP connections are provided by ENTEL S.A. The network supports WWW, FTP, Email, Telnet and Remote Database Access Applications.

BOLnet's international connectivity is based on a connection to the commercial Internet in the USA via three downlinks of 0.5 Mbps which are provided by Transat.

4.2.2.3 Future Plans

Within the next three years, BOLnet plans to finalise its national connectivity by connecting the five remaining regions named above and to interconnect with the national research networks of Brazil and Chile (RNP and REUNA, respectively), as Bolivia is a bridge-nation between these two countries.

4.2.2.4 BOLnet and CAESAR

BOLnet expressed that it was interested in a direct connection to the pan-European research network GÉANT as this would give the network an international connectivity of major importance and would further the completion of the national connections. It was foreseen that applications in the areas of remote database access, Distance Learning, Virtual Libraries and Classrooms would profit most.

4.2.2.5 Contact Details

Red Boliviana de Comunicacion de Datos – BOLnet
Vicepresidencia de la Republica – La Paz – Bolivia
Fax: 591 2 2200750
www.bolnet.bo

Executive Director: Clifford Paravicini Hurtado, clifford@bolnet.bo

4.3 Status and Developments in Brazil

4.3.1 General Information

Population	165.85 Mio
Gross National Product (GNP)	767 billion US\$
Per capita GNP	4,800 US\$
Per capita investment in IT	103 US\$
Internet Users	14M ¹⁾
Internet users in percentage of the population	8.44 ¹⁾

Source: population.com, bfai; all data 1998 except ¹⁾ 2001

The Brazilian telecommunication's sector has been in a constant upswing since the import ban on information technology was lifted in 1992. Since then Brazil can be considered as the biggest Latin American market for information technology. Internet and email are part of the daily life of many businesses, students and researchers. Between 1995 and 1999 the number of Internet domains in Brazil rose from 0.2 to 7.2 per 1000 inhabitants. About 7.3 Million of the 12 Million Latin American web pages have their origin in Brazil, constituting more than 60%. On average 3 Million PCs are sold per year. By mid-2001 about 14 Million Brazilians were able to enjoy access to the Internet which brings Brazil into a respectable 9th position in the world-wide list of number of Internet Users.

4.3.2 RNP – The Brazilian National Research Network

4.3.2.1 The Organisation

The AsRNP (Associacao Rede Nacional de Ensino e Pesquisa) is the entity responsible for the Brazilian National Research Network, RNP. As RNP is a not-for-profit organisation and was mandated by the Brazilian Ministry of Science and Technology (MCT) to execute the Informatics Priority Programme of the government. The RNP network is financed by governmental funds and by investments made by Industry.

RNP is responsible for the provision of national and international connectivity to the university and research community. There are 15 additional State networks providing the extension of the national backbone in the Federal States. These State networks have distinct usage policies and provide connectivity to governmental and non-governmental institutions as well as the academia. RNP provides the interconnection between these State networks, as well as national and international transit according to the respective usage policy.

Currently there is a total of 369 institutions connected to the network, of which 242 are universities and higher education facilities (146 of these universities have their own research centres), 68 research institutions, 6 governmental agencies and 53 schools of basic, medium and technical level. It is estimated that about 760.000 users are connected to the RNP network, of which approximately 58.000 are researchers, professors and students associated to Brazilian research groups.

4.3.2.2 The Network

The RNP network has 27 Points of Presence (PoP) and traffic nodes in the capital cities of each Brazilian State and in the Federal District. The two main nodes are located in the cities of Rio de Janeiro and Sao Paulo. These two points are connected via virtual circuits to all other PoPs. Higher capacity links between 13 PoPs use ATM technology, lower capacity ones are based on Frame Relay (14 PoPs).

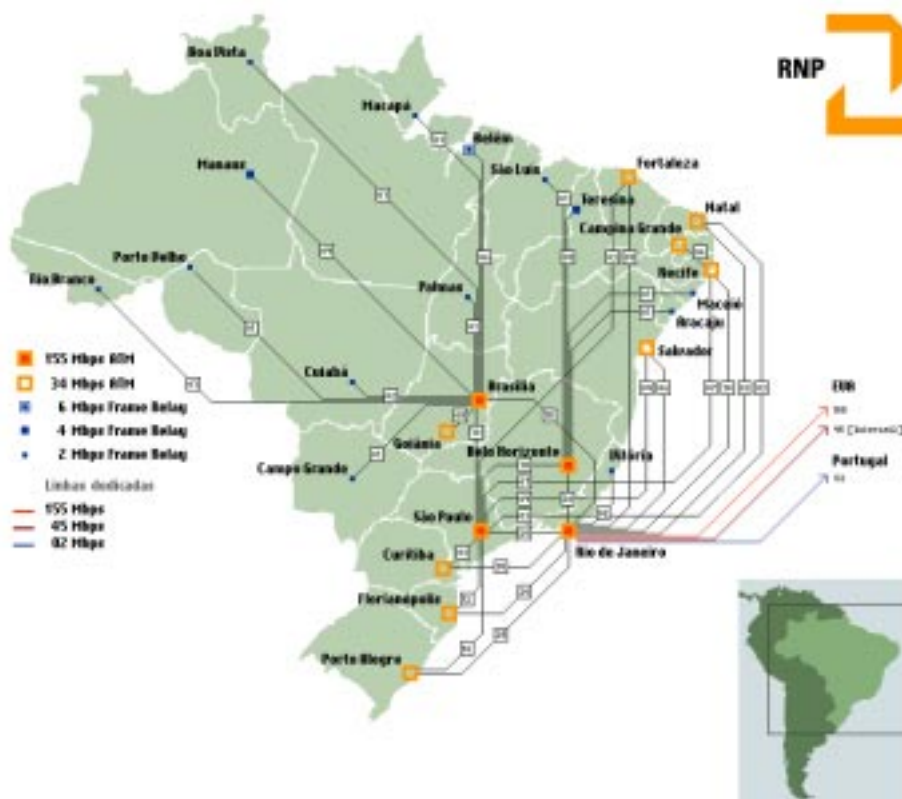


Fig. 2: RNP Network Topology (March 2002)

The Pops of Acre, Roraima and Amapá in the Amazon region are connected via satellite links.

In 13 cities the PoPs are connected to high speed dark fibre metropolitan networks which use ATM switching technologies at speeds up to 622 Mbps. These networks are used by business and academic consortia for experimental purposes or the development of new and advanced applications.

The network is entirely based on IP over ATM for the high capacity links (at speeds between 6 to 30 Mbps) and on IP over Frame Relay on the lower capacity links (1 to 6 Mbps). In addition to this infrastructure an optical technology testbed project is under development using IP over dark fibre for the interconnection of some RNP PoPs. This project is jointly carried out with telecommunications and informatics companies.

The main service offered is the conventional Internet connectivity to the Brazilian higher education and research institutions. This includes IP transit for all the academic and commercial state networks (based on peering agreements), international transit to Abilene and its connected research networks, as well as to the commodity Internet. Additionally, RNP offers native multicast services which is available in all the core routers of the network and IPv6 which is available in some PoPs. IPv6 transit is provided through tunnels to Abilene and the 6Bone project.

The applications supported by the network range from regular communication and collaboration services (Email, database access, discussion groups, file transfer, www, etc.) to the support of extended collaborative applications like high performance processing (the five national high performance centres are connected to RNP), video streaming and conferencing, mainly for educational purposes. Together with universities and research centres, RNP is also involved in the development of pilot applications, either for the introduction of new services to the network or to demonstrate the use of innovative applications in advanced networks. Tests of digital video (telemedicine and TV) and Grid applications were performed last year. Tests of QoSIP, Directory Services, Voice over IP and Video are on the agenda for 2002.

The total bandwidth of the core network is approximately 250 Mbps. Since the circuits are contracted on an ATM / Frame Relay basis these 250 Mbps are almost completely used. Installed capacity for traffic exchange with commercial providers in Brazil is 200 Mbps.

The national connections between the 15 State networks is provided by Embratel, previously a government owned company, now a subsidiary of WorldCom. The State networks as well as the connections to the user organisations are contracted to different providers. Core routing equipment is based on Cisco routers with models ranging from the Cisco 12000 in the Rio de Janeiro PoP to the Cisco 2500 in some smaller PoPs.

RNP disposes of three international connections. A 155 Mbps link provided by Embratel/Cable Wireless connects RNP to the commodity Internet in the US using POS technology. Within the AMPATH project, RNP is connected to Abilene with a 45 Mbps link using IP over ATM. Additionally there is a 2 Mbps link to the Portuguese research network, FCCN which is provided by the Embratel/Portugal Telecom consortia. The international connections add to 202 Mbps and are used at 50%.

There is also a recent joint initiative with the national research networks of Argentina, Chile and Brazil to promote a direct interconnection between these networks and to create a regional South American network.

4.3.2.3 Future Plans

In the short-term changes will be made on the transmission technology of the network. This will involve the replacement of some ATM/Frame Relay links by SDH dedicated circuits, mainly on the higher demand connections.

For the long-term there are plans to convert the present backbone into a number of IP over dark fibre or IP over WDM links, capable of providing a national broadband network to cater for the needs of the researchers and their large scale applications.

International connectivity is planned to comprise direct connections with other national research networks in Latin America and Europe. The link to the USA is foreseen to be upgraded to 622 Mbps and is expected to reach Gigabit speeds in the not so distant future.

As for network services RNP plans to incorporate routine mechanisms for diffserv, Quality of Service measurements, IPv6 routing in the entire network, including translation and interoperability with IPv4. IP multicast services are planned to become available throughout the network to support particularly those applications involving audio and video transmission. At the same time it is planned to introduce new services, such as Voice over IP for user organisations, video content provision, directory services for research and scientific institutions and services to support GRID computation activities.

4.2.2.4 RNP and CAESAR

RNP expressed that an interconnection with GÉANT and the resulting access to the European national research networks was of strategic importance to the development of science and technology in Brazil. It was stated that there are effective and traditional links between the Brazilian scientific community and several European countries, in particular Germany, France, the United Kingdom, Spain and Portugal. Efforts towards the establishment of adequate connectivity with Europe were started in the form of bilateral co-operation with Portugal and Germany, which in the case of Portugal led to a 2 Mbps direct interconnection between the two countries.

The directory for the Brazilian Research Groups kept by CNPq, the National Council for Scientific and Technologic Development, shows 225 institutions and 11,700 research groups in Brazil. 80% of all research done in Brazil is done by public universities which are the main RNP customer group. In 2000, these research groups were involved in 30 research programmes based on co-operations between Brazil and European Union Member countries. Furthermore, there were 2,107 scholarships provided by the two federal agencies, CNPq and CAPES, Coordination and Personal Improvement at a High Level, which represented an exchange of researchers and students in several research areas. Table 1 gives an overview of the scholarships with the European Union and other countries.

COUNTRY	Quantity	Value (US\$ 1.000)
Germany	188	576,84
Austria	2	15,35
Belgium	14	131,69
Denmark	7	21,29
Scotland	7	171,90
Spain	119	457,78
Finland	1	8,03
France	448	1.670,02
Netherlands	43	279,70
England	107	2.644,13
Northern Ireland	0	1,71
Italy	30	149,31
Norway	2	13,92
Wales	1	14,83
Portugal	40	106,89
Sweden	5	59,55
Switzerland	17	179,68
Others	1.076	8.039,73

<u>Total</u>	<u>2.107</u>	<u>14.542,35</u>
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Table 1: Brazilian Scholarships for exchange with the European Union and Other countries

It was expressed that direct connectivity with the countries served by GÉANT would also allow the collaboration in technology, communications and information technology projects developed within RNP and by its users. Co-operation in network projects in the area of advanced services (QoSIP, multicast, IPv6, directories and digital video) would be promoted, and would result in the set-up of a new agenda for collaborative projects in these areas. Interest was expressed in the collaboration with European institutions and initiatives allowing the test, evaluation and usage of new network applications like videoconference in education, GRID processing etc.. A direct connection with a low delay would allow the usage of these innovative applications.

It was said that currently, all the traditional collaborative applications between research groups would benefit from direct connectivity. As for the future, there would be a clear benefit for the advanced network services and applications being tested by RNP. In the first case it can be referred to applications such as data base access, collaborative projects in computational science, (ProTeM-CC Program with InRIA and IST), file transfer, personal videoconference and multicast based services. In the future, GRID based applications as in the case of high energy physics projects (CERN), genetic mapping projects, interaction projects in astronomy and remote manipulation engineering.

4.3.2.5 Contact Details

RNP

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Information Management:

Marta Lealm <mleal@rnp.br>

4.4 Status and Developments in Chile

4.4.1 General Overview

Population	15.04 Mio ¹⁾
Internet Users	2.3 Mio
Internet Users in percentage of the population	15%

Source: Census 2002, REUNA. All data 2002.

New technologies bring market growth to the Chilean economy. Although the prognosis for market growth in Chile for 2001 was 4.5%, it was expected that the telecom sector would enjoy a growth rate of about 7%. The main reason was seen in the growing market for new technologies.

The launch of the Wireless Local Loop in 2001 mainly served the expansion of the Internet usage. However, it was deployed mainly in the most economically suitable areas and did not contribute to bridge the connectivity gap that exists between the main population centres and the rural areas. The government established the goal of connecting 30% Chilean households to the Internet by 2004.

4.4.2 REUNA – The National Research Network of Chile

4.4.2.1 The Organisation

The National University Network (REUNA) is a non-profit, private law organisation whose members are 18 public and private universities in Chile. Research networking in Chile is funded via direct payment of the operational costs by the university members. No direct subsidy is given by any institution towards the costs of operating the network. The backbone bandwidth is provided by Telefonica through an agreement that included the ISP business operated by REUNA until 1997. For some network improvements and special projects funds are obtained through various tenders, of which the majority is managed by CONICYT, the national research, science and technology commission in Chile. Funds are also obtained through the connected universities. The other main source of funds for projects comes from CORFO, a government entity providing funds for the development of innovative business ventures.

REUNA provides national and international connectivity for research and development in Chile, the universities are free to connect to the provider of their choice for their commercial Internet connections.

It is estimated that in the 18 connected universities there are currently about 140,000 users using the REUNA network.

4.4.2.2 The Network

REUNA is a fibre optical network with a linear topology based on 10 backbone nodes from Arica to Osorno. The Network Operation Centre is based in Santiago. The universities are connected via an OC-3 link which uses the ATM protocol over SDH. The national connectivity is provided by Telefonica CTC, Chile. Figure 3 shows the REUNA network topology.

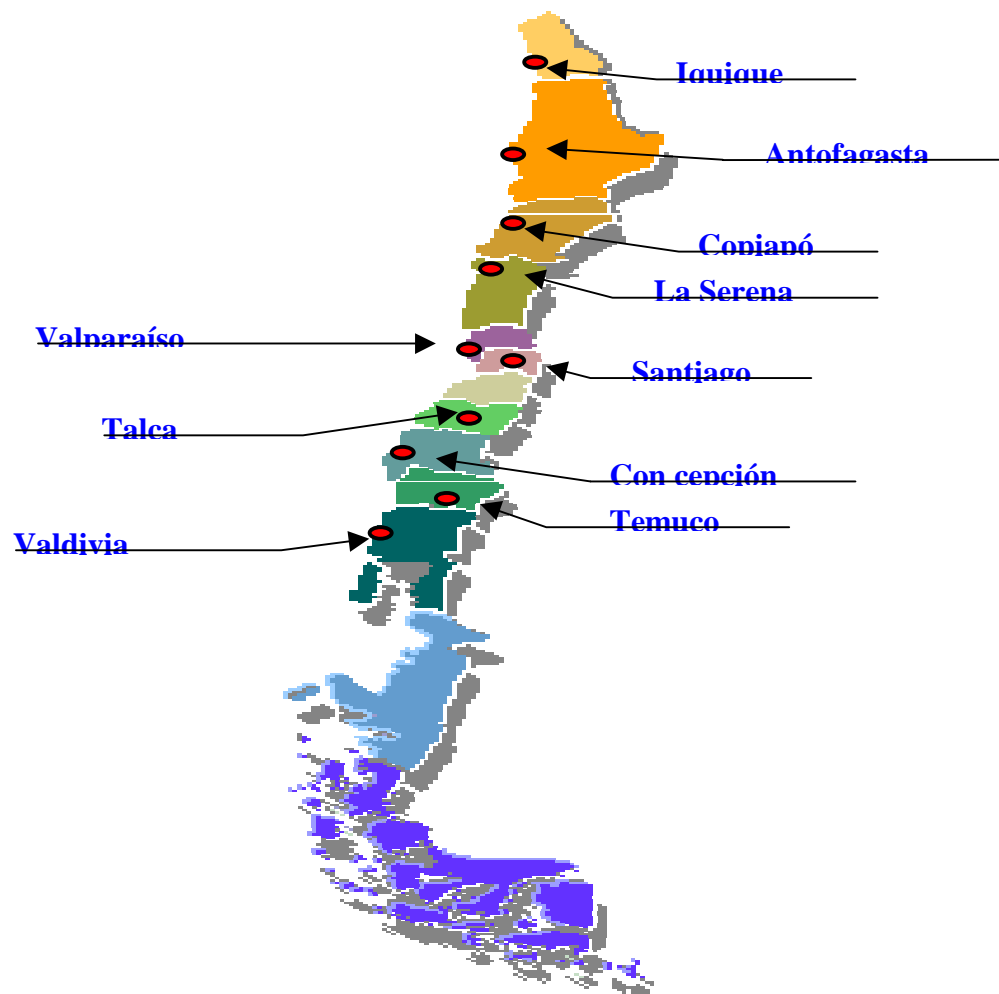


Fig. 3: Backbone Nodes of the REUNA Network

REUNA supports videoconferencing H.323 and ATM, Multicast ATM and IP, video streaming, cache for R&D networks, web services and provides platforms for Distance Education.

The traffic load of the network for R&D networking is currently 45 Mbps external and 100 Mbps total.

REUNA is connected to the North American research networks via a 45 Mbps link provided by Global Crossing in the framework of the AMPATH initiative.

4.4.2.3 Future Plans

REUNA plans to reach a backbone capacity of at least 622 Mbps within the next three years. The objective is to eventually have a backbone capacity of 2.4 Gbps. It is also foreseen to connect to the international research networks in Europe, Asia and North America with speeds of at least 155 Mbps. REUNA hopes to have a regional network of 45 Mbps built in South America.

4.4.2.4 REUNA and CAESAR

REUNA expressed an interest in a direct connection to the pan-European research network GÉANT in order to improve the integration with the scientific community in Europe. Asked about the applications that would benefit most from such a direct interconnection REUNA named videoconferencing, Interactive Classrooms, Access to scientific instruments, access to European observatory sites and medical centres.

4.4.2.5 Contact Details

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Technical Manager:	Sandra Jaque sjaque@reuna.cl

4.5 Status and Developments in Colombia

4.5.1 General overview

Population	38.9 Mio
Gross National Product (GNP)	89.8 Mio US\$
Per capita GNP	2,311 US\$
Per capita investment in IT	30 US\$
Internet Users	300.000 ¹⁾
Internet users in percentage of the population	0.77 ¹⁾

Source: population.com, bfai; all data 1998 except ¹⁾ end 1997

The sector of Information Technology in Colombia still has a backlog demand and therefore shows a dynamic growth rate. Most sectors were seriously harmed by the grave economic crisis of 1999, the sector Information Technology and its related fields could however count on a stable demand. In 1998 there were about 30 Internet providers registered in Colombia. In 1997 the Colombian Telecom started to interlink the national providers in order to avoid traffic having to go via the USA.

4.5.2 RedCETCol – The Colombian Research Network?

In Colombia, the CAESAR questionnaire was sent to RedCETCol as well as the Colombian Ministry of Communications, but unfortunately not returned to us. In addition to this, RedCETCol does not have a web presence. After the CAESAR workshop in Toledo, we were, however, approached by a professor from the University de Cauca in Columbia. He stated that the situation of RedCETCol was unclear and that he would need a couple of weeks to investigate the situation and would be in contact with us again. Unfortunately, his input can not be considered in this report, but will be part of the Final Report.

4.5.2.1 Contact Details

CETCol

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4.6. Status and Developments in Costa Rica

4.6.1 General Overview

Population	3,84 Mio ¹⁾
Internet users	250,000
Internet users in percentage of the population	6.74

Source: population.com, ITU. All data 12/2000, except for ¹⁾ 1998.

Costa Rica is one of the Latin-American countries with the lowest illiteracy rate and one of the highest per capita incomes. For these reasons the demand for Internet access is very high. Up until 2001 there was only one provider for Internet services, the ICE (Instituto Costarricense de Electricidad) subsidiary RACSA (Radiografica Costarricense). In 2001 ICE announced a further expansion into the Internet market with a planned DSL network that was to connect 100.000 users. ICE had already collected experience in the field when it connected a couple of private enterprises and universities in April 2001.

4.6.2 CRNet – The National Research Network of Costa Rica

Unfortunately also Costa Rica did not return the CAESAR questionnaire. This was surprising to us, as CRNet is known as one of the more progressive research networks in the region and its President Guy de Teramond is known for his initiative. We also send mail requesting information to a technical person in CRNet, but also the mail was not answered.

The CRNet website from which this information is taken was created in 1996, the most recent information dates back to 1998. In his position of Costa Rica's Science and Technology Minister (until the beginning of 2002) Guy de Teramond gave an interview to the Linux Journal in January 2002. The existence of CRNet as a national research infrastructure was confirmed in this interview. However, due to the fact that most information given in this chapter is probably from the year 1996-1998 it has to be handled with caution.

4.6.2.1 The Organisation

CRnet was created as a not-for-profit organisation in 1993. The website states that there are 25 connected universities, research centres and governmental institutions. The Linux Journal Interview reported, however, that there are 24 connected universities and 10 governmental organisations.

4.6.2.2 The Network

Figure 4 shows the CRNet network topology as presented in the CRNet website. The sites are connected with speeds ranging between 32 Kbps and 128 Kbps. The website states that a couple of links are to be upgraded to 512 Kbps. The national connectivity is provided by the monopolistic provider ICE (Instituto Costarricense de Electricidad), the international connectivity is provided via a PanAmSat satellite link.

As we have not received any information from CRNet directly, we cannot give any information on their future plans or how they judge the CAESAR project.

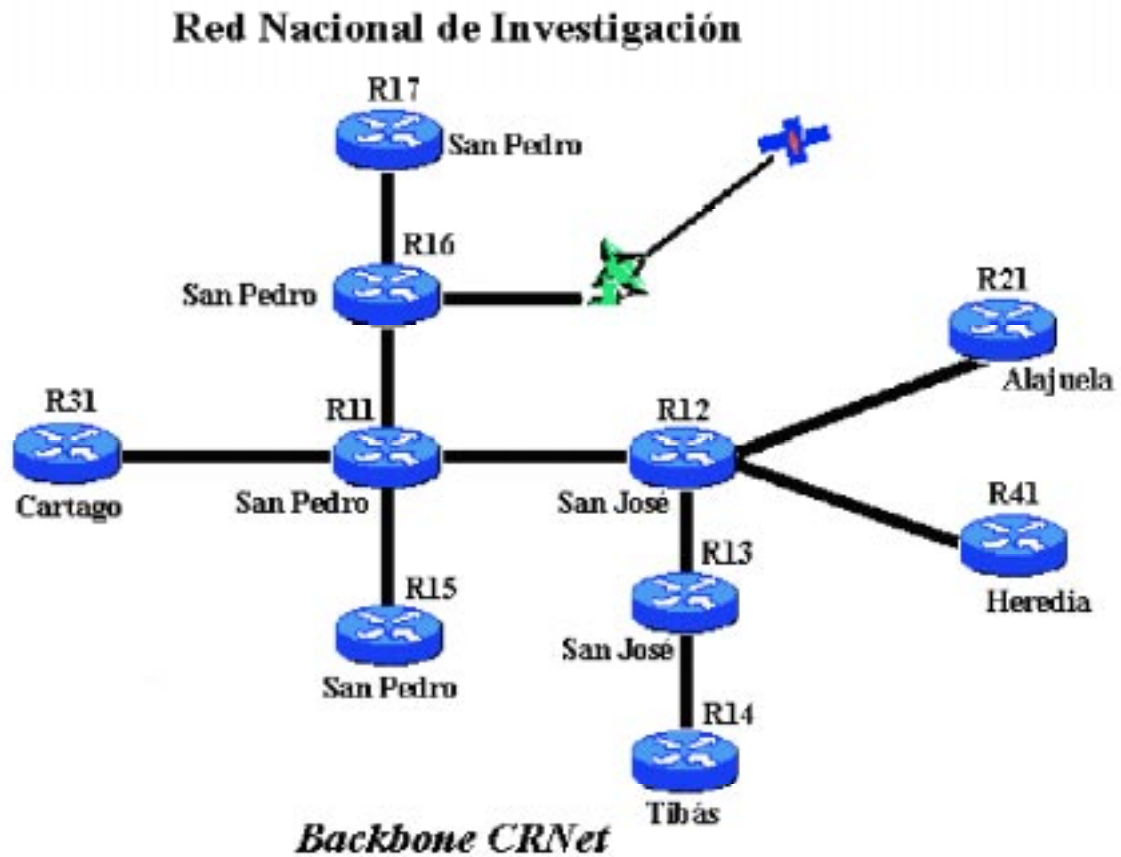


Fig. 4: CRNet backbone

4.6.2.3 Contact Details

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 CTO: Abel Gmo. Brenes Arce, abrenes@ns.cr

4.7 Status and Developments in Cuba

4.7.1 General Overview

Population	11.11 Mio ¹⁾
Internet Users	60,000
Internet Users in percentage of the population	0.54

Source: population.com, ITU. All data 12/2000, except for ¹⁾ 1998.

The change to the modern information society is slow and difficult in the socialist republic of Cuba. However, with the turn of the Millennium, information technology was given a new priority, especially in the areas of public health, education and formation. Cuba has been connected to the Internet since 1996. Since 1997 the government is putting more emphasis on the usage of the Internet.

4.7.2 RedUniv – One of Cuba's national research networks

4.7.2.1 The Organisation

RedUniv is one of several research networks in Cuba and is the network of the Ministry of Higher Education. The RedUniv network interconnects 17 university centres, 5 research institutions, all of national character, and the network of the CENTIC, the Centre for New Information Technologies and Communications of the Ministry of Higher Education in Habana. Included in these organisations are approximately 60 libraries, all engineering universities, a great majority of the faculties for natural science and mathematics and the social science faculties. It is estimated that about 7,000 professors and scientists which represent more than half of the science conducted in Cuba are interconnected via the RedUniv network.

The various research networks that connect the universities and research centres are in different stages of development. Next to RedUniv, there are the networks of the Ministry of Public Health and of the Ministry for Science, Technology and Environment. The Ministry of Education (which is different from the Ministry of Higher Education) is at this point in time constructing its network. There are also research centres belonging to productive organisations that have their own links to similar organisations.

Scientific research is funded in various different ways. In the case of RedUniv the funding is derived from the resources of the connected centres, from collaborative work and from the central state funding bodies.

4.7.2.2 The Network

RedUniv connects at least one university or research centre in each of the Cuban provinces. For this reason the network covers the entire country. The connection speeds at this moment range from 19.2 Kbps to 2 Mbps, depending on the size of the connected institution. This is to be raised to 128 Kbps to 3 Mbps in the near future.

Moreooooers



Fig. 5: Map of the Cuban research network RedUniv

The base technology of the network is IP. It is hoped that in the future there will also be use of ATM and WDM technologies as the technologies itself are already available in the country. There are many applications running in the network, these are mainly Virtual Libraries (as there is a library in each connected centre), interactive platforms, scientific-technical databases, normal Internet services (such as WWW, email, FTP, etc.), Distance Education (where the infrastructure is available), cultural content and formation for professionals to post-graduate level (in some provinces).

The national connectivity is provided by INFOCOM, which belongs to ETECSA, the incumbent Cuban telecommunications provider.

The RedUniv network is currently not connected to any of the advanced research networks around the globe. There are connections to the commercial Internet via satellite.

4.7.2.3 Future Plans

The research networks in Cuba develop in parallel, RedUniv can currently be considered as the most advanced of the Cuban research networks. It is foreseen that in the next three years all research networks connect to a 1 GBps Cuban national backbone, with the connections within the country upgraded to at least 25 Mbps. International connectivity should move from satellite based to submarine cable based which would lead to an increase in bandwidth and stability.

4.7.2.4 RedUniv and CAESAR

It was stated that RedUniv was very interested in a direct connection to GÉANT. This would bring an immediate benefit to those researchers connected to RedUniv and a future benefit to all researchers as it could speed up the interconnection between the various national networks.

It was stated that there are currently important collaboration programmes running between Cuba and several European countries (mainly Spain, but also France, Germany and the UK).

A direct interconnection would facilitate the use of Distance Education Programmes, Virtual Libraries, joint research programmes and more.

4.7.2.5 Contact Details

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Manager of Information Management: Dr. Raúl Torricella Morales, torri@reduniv.edu.cu

Administrator of the RedUniv Node in the MES: Ms. C. Jorge Daniel Villa,

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4.8 Status and Developments in Ecuador

4.8.1 General Overview

Population	12.17 ¹⁾
Internet Users	180,000
Internet Users in percentage of the population	1.39

Source: population.com, ITU. All data 12/2000, except for ¹⁾ 1998.

4.8.2 FUNDACYT – working towards a research network for Ecuador

4.8.2.1 The Organisation

A national research network infrastructure does not exist in Ecuador at this point in time. FUNDACYT, the Foundation for Science and Technology in Ecuador organises an information network for Ecuadorian research activities (REICYT) and is working towards the creation of a national infrastructure.

FUNDACYT is a non-profit organisation created to support science and technology in Ecuador. It belongs to the Vicepresidency of the Republic. A second organisation is called SENACYT. This is the policy making body, FUNDACYT is the executive body.

REICYT (the Ecuadorian Information Network for Science and Technology) was created with funds received via a loan granted by the International Development Bank for the development of science and technology in Ecuador. Additionally, REICYT receives national support.

REICYT was formed by 29 universities and higher education institutions, 3 research institutions and one governmental office.

4.8.2.2 The Network

All REICYT institutions have their own independent connectivity to one of the commercial providers in Ecuador. The bandwidth of these connections ranges from 64 Kbps to 256 Kbps.

The technology used in these connections is based on IP and Frame Relay.

In the REICYT agreement every institution agreed to develop information services useful for their own institution and to provide bibliographical information (?) CHECK, Anita?.

There is no organised connectivity to the global Internet.

4.8.2.3 Future Plans

FUNDACYT and REICYT are working towards the development of a national research infrastructure in Ecuador.

4.8.2.4 FUNDACYT and CAESAR

It was stated that REICYT is an information network in which the connected universities and institutions develop different information services. The aim is to use the given infrastructure to create a research network. It was said that FUNDACYT and REICYT are very interested in a direct connection to GÉANT as this would give researchers access to updated

information for their research, remote databases, as well as the possibility to join collaborative activities.

4.8.2.5 Contact Details

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 FUNDACYT System Engineer: Anita Herrera, aherrera@fundacyt.org.ec

4.9 Status and Developments in El Salvador

4.9.1 General Overview

Population	6.03 ¹⁾
Internet Users	40,000
Internet Users in percentage of the population	0.65

Source: population.com, ITU. All data 12/1999, except for ¹⁾ 1998.

4.9.2 CONACYT – Working towards a research network for El Salvador

4.9.2.1 The Organisation

Research networking in El Salvador is organised by CONACYT, the Council for Science and Technology. CONACYT is a public law organisation, mainly autonomous, not-for-profit and decentralised. It is the authority for matters concerning Science and Technology in El Salvador. Research networking is funded by the Central Salvadorian government.

There is currently no research infrastructure in El Salvador. CONACYT is working towards such an infrastructure in the framework of the REDISAL project. It is foreseen that 30 universities and research centres will eventually connect to the network.

4.9.2.2 The topology

As there is no network, a topology can not yet be given. CONACYT, however disposes of a 386 Kbps dedicated link that is provided by TELECOM and a satellite link provided by SPRINT.

There are 15 ISP currently offering services in El Salvador. The main technology used is IP.

There is currently no direct connectivity to any of the advanced research networks in the world.

4.9.2.3 Future Plans

It is foreseen to create a national infrastructure for research and to keep upgrading and updating the information provided on the REDISAL website on universities and research centres. It is also planned to develop a database with a platform accessible to other research networks. Furthermore CONACYT would like to connect to the advanced research networks around the globe and to promote research networking within the country and abroad.

4.9.2.4 CONACYT and CAESAR

It was stated that there is a high interest in a direct connection with GÉANT. The benefits for the at this point in time rather isolated academic and research community would be countless. National researchers in El Salvador would have exposure to international science and would be able to exchange with researchers in similar areas of investigation.

4.9.2.5 Contact Details

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Lic. Ana Delmy Garay	agaray@conacyt.gob.sv	International Co-operation Assistant

4.10 Status and Developments in Guatemala

4.10.1 General Overview

Population	10.80 ¹⁾
Internet Users	65,000
Internet Users in percentage of the population	0.51

Source: population.com, ITU. All data 12/1999, except for ¹⁾ 1998.

4.10.2 Research Networking in Guatemala

4.10.2.1 The Organisation

The national research network of Guatemala, MayaNet, was created in 1995 and existed as a research network for almost 5 years. Its members were the five existing universities, two regional research institutes and the National Council of Science and Technology (CONCyT). However, in 2000, CONCyT decided to take matters into its hands and developed a policy of letting government dependencies be a part of MayaNet. Soon, MayaNet no longer was academic/scientific but mostly governmental. Most of the original 8 members have retired from MayaNet. There is currently no initiative in the country to recreate a research infrastructure.

4.10.2.2 Contact Details

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4.11 Status and Developments in Honduras

4.11.1 General Overview

Population	6.14 Mio ¹⁾
Internet users	40,000
Internet users in percentage of population	0.64

Source: population.com, ITU. All data 12/1999, except ¹⁾ 1998.

In 2002, the question whether to privatise or to liberalise the telecommunication sector is again at the top of the governmental agenda in Honduras. Although public-owned HONDUTEL is the company with the highest turnover in Honduras, so far it seems impossible to find an interested buyer for it.

In 1999 Honduras had about 300.000 installed telephone lines and a demand of another 425.000. HONDUTEL, however, is not in a position to cover the demand. HONDUTEL has an average of newly installed telephone lines per employee of 17, whereas in neighbouring Costa Rica and Guatemala, the rate is 150 to 180 per employee. This is one of many reasons why there is a big demand for the privatisation of HONDUTEL or the liberalisation of the telecoms sector in the country. In December 1999, 40,000 users were connected to the Internet, which means about 0.64 % of the population.

4.11.2 Research Networking in Honduras

Although we were at first promised a swift answer, we never received the CAESAR questionnaire back from Honduras. Therefore the following information has been gathered from the HONDUNET website. It is not entirely clear whether HONDUNET can be considered a national research network or not. The institutions that are connected to it, speak for an inclusion as a research network. However, the important involvement of the national provider HONDUTEL cast a doubt and leave the question whether or not Honduras has a research network open.

In 1993 the Hondurian Council for Science and Technology (COHCIT), co-ordinated the structure and formulation of the project HONDUNET. This was achieved through the participation of some academic institutions, such as the Pan-American agricultural school of Zamorano and the autonomous national university of Honduras (UNAH), the Honduranian telecommunications provider Hondutel and with the financial help of the Organisation of American States under the Red Hemisferica project. HONDUNET is the digital network of Honduras which provides connectivity between the academic institutions, laboratories and research centres, technology-driven companies as well as national institutions. HONDUNET interconnects these institutions based on Internet technology and via the HONDUTEL network. The backbone is based on CISCO routers in various points of presence throughout the country.

In 1995 Honduras was connected to the global Internet. The equipment was financed by the Organisation of American States and is located in the premises of Hondutel, the UNAH and COHCIT. Access can be achieved via a dedicated or a shared service. Currently only HONDUTEL, UNAH and COHCIT have dedicated access, with the Universidad Pedagogica de Honduras being in a trial period for dedicated access. A good number of other institutions have asked for direct access, such as academic and research centres, information centres, and various governmental organisations as well as governmental offices. Currently the network supports email, file transfers and access to the WWW. Every users is asked a symbolical fee of \$12 per month.

4.11.2.1 Contact Details

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4.12 Status and Developments in Mexico

4.12.1 General Overview

Population	95.83 Mio
Gross National Product	426 billion US\$
Per capita GNP	4,392 US\$
per capita investment in IT	42.33 US\$
Internet Users	3.42 Mio ¹⁾
Internet users in percentage of the population	3.36 ¹⁾

Source: population.com, bfai, ITU; all data 1998, except ¹⁾ 07/2001

In the past 8 years, the Mexican telecommunications' sector grew four times as fast as the rest of the Mexican economy. The overall still low penetration of information technology in business, education and public services and the pressure of conformance with US standards exerted by Mexico's integration into the North American Free Trade Area (NAFTA) offer continuous great potentials for the future. The Internet grew between 1995 and 2000 from

94,000 to 2.7 Mio users and is projected to reach 9.5 Mio by 2004. The number of Internet Service Providers increased from 29 in 1995 to 248 in 2001. President Fox plans to launch the ambitious Internet project “e-Mexico” in 2002. Following the Singaporean example of “Singapore-One”, “e-Mexico” aims at installing public Internet access facilities in 10,000 communities.

Mexico’s telecommunications market is totally deregulated but still dominated by the de facto monopoly of Telmex, who still owns 94% of the terrestrial telephone network, 78% of the mobile sector and 60% of all Internet accesses.

4.12.2 CUDI – The National Research Network of Mexico

4.12.2.1 The Organisation

The Corporación Universitaria para el Desarrollo de Internet (CUDI) and its national research infrastructure is financed via company sponsoring and payments received from the associated centres. Scientific and technological research in Mexico is initiated by the National Council for Science and Technology (CONACyT). CUDI membership currently numbers 70 universities or higher education facilities and 7 research institutions. It is estimated that about 1.4 Million students, professors and researchers study in CUDI member institutions.

Next to CUDI, the interconnection between research or education centres is based on private networks owned by the university connecting the institutions or also via the commercial Internet.

4.12.2.2 The Network

The topology of the CUDI network is based on three different levels. Level 1 is the 8000 km backbone that connects 22 main population centres in Mexico via 155 Mbps links. Level 2 is the access network for associated academic institutions via 34 Mbps and Level 3 the access network for affiliated institutions via links that have at least 2 Mbps. All links are terrestrial and supported by the optical fibre networks of the Mexican network operators. The backbone connectivity and the majority of the access links have been donated by Telefonos de Mexico S.A. and Avantel. These companies also rent some access lines to the affiliated institutions.

The network is currently based on IP, IP+ATM and ATM technologies. CUDI is in the process of developing VPNs. The network also supports IPv4 and IPv6. The networks supports applications in the areas of Distance Learning, Digital Libraries, Health, Earth Sciences, Robotics, remote laboratories and Astronomy.

The average weekly traffic load on the network currently amounts to 20 Mbps.

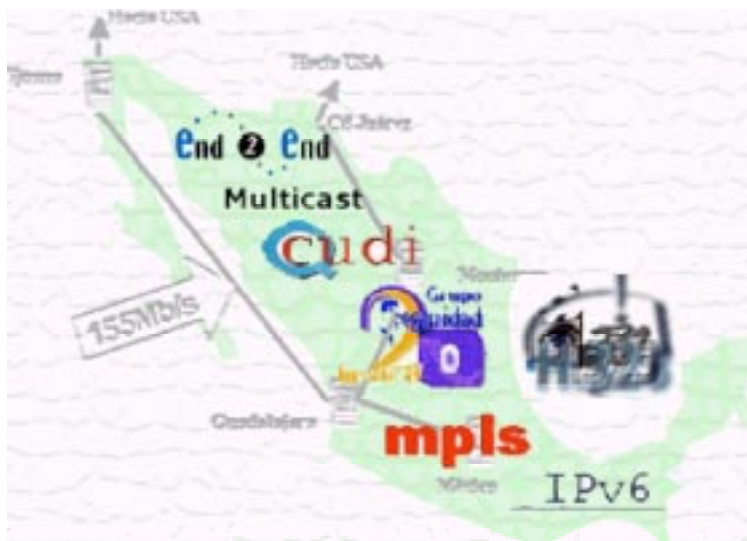


Fig. 6: The CUDI network

CUDI is very well connected to the North American advanced research networks with a 155 Mbps link to CENIC in San Diego and a 100 Mbps link to University of El Paso in Texas.

As a private research network, CUDI, does not have any interconnection with the commercial Internet. This exchange with the commercial Internet is organised by every University to its own needs.

4.12.2.3 The Future

It was stated that the objective of CUDI in the next three years is extend its reach to all higher education and research campuses in the country and to develop meaningful applications and collaborations.

4.12.2.4 CUDI and CAESAR

It was stated that as CUDI already has connectivity with GÉANT via Abilene, a direct connection would be seen as an alternative route towards the European destinations. The direct connection would improve the reliability of the already existing connection to GÉANT.

4.12.2.5 Contact Details

Corporación Universitaria para el Desarrollo de Internet (CUDI)
Vicente Suárez 92, Col Condesa CP 06140, México DF, México
Teléfono: +52 (55) 52113060
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<http://www.cudi.edu.mx>

Director General:	Carlos Casasús López Hermosa ccasasús@cudi.edu.mx
General Coordinator:	José Antonio Ramírez Vidal jarv@cudi.edu.mx
Network Committee:	Gabriela Medina Galindo gabym@noc.unam.mx
Network Control:	Hans Ludwing Reyes hans@internet2.unam.mx

4.13 Status and Developments in Nicaragua

4.13.1 General Overview

Population	4.8 Mio ¹⁾
Internet Users	20,000
Internet Users in percentage of the population	0.42

Source: population.com, ITU. Data 12/1999, except ¹⁾ 1998.

With only 0.42% of the population having access to the global Internet in December 1999, Nicaragua forms the rear light of Internet usage in the Latin American countries. Nicaragua also had the lowest penetration of fixed telephone lines with only 30 lines per 1000 inhabitants in April 2001.

In March 2001, the Nicaraguan government announced a reduction of the minimum requirements for possible buyers of the monopolistic telecommunications provider ENITEL. This gave new momentum to the privatisation efforts which could lead to an improvement of the sector.

4.13.2 Research Networking in Nicaragua?

Over the last four months, we have not been able to establish contact to the research networking community in Nicaragua. In the beginning we tried to contact RAIN (Red Academica y de Informacion Nicaraguense) which was named as the national research network organisation in Nicaragua. However, the RAIN website (<http://ns.ni/rain.html>) is no longer accessible. In the next step, we asked the Director of the PANNET network in Panama whether she had a contact in Nicaragua. However, mail to the contact given to us returned, address unknown. In the beginning of May 2002, a DANTE employee attended a conference in Santo Domingo and brought home the contact details of a person in Nicaragua who works for the country's NIC, but although the mail this time was not returned, it remains unanswered.

For these reasons, we cannot comment on the situation in Nicaragua.

4.14 Status and Developments in Panama

4.14.1 General Overview

Population	2.76 Mio ¹⁾
Internet Users	45,000
Internet Users in percentage of the population	1.6

Source: population.com, ITU. All data 12/1999, except ¹⁾ 1998.

In 1998, the national telecom operator of Panama, INTEL, was privatised. The British provider Cable & Wireless acquired 49% of the INTEL shares. In accordance with the contract, Cable & Wireless modernised the telephone system of Panama and in 2002 all telephone exchange points were for example digitalised. There are about 500,000 terrestrial telephone lines installed in the country which gives Panama one of the highest penetrations of terrestrial telephone lines in Latin America.

It is foreseen that the situation in the telecommunications sector will improve even further when the monopoly that Cable & Wireless holds will fall in 2003. This will bring new players into the market and it is expected that especially the Internet sector will profit as

Cable & Wireless is currently the only Internet Service Provider in the country. The opening of the market is not only to bring down prices but it is also expected that new applications and new technologies will be made available.

4.14.2 PANNET – A University Network in Panama

4.14.2.1 The Organisation

There is no single research network in Panama. Each university, research centre or governmental organisation has its own network and connections. However, the PANNET network which is managed by the Technical University in Panama has a great importance in the country and also manages the .pa domain registry. The Universities and their networks are in general funded by the central state government.

The PANNET network interconnects the Technical University of Panama which has more than 10 connected research centres. It is estimated that PANNET is currently used by about 7,000 users.

4.14.2.2 The Network

The PANNET network is of extended star-shape. Every centre is connected via Frame Relay links. As there are centres of the Technical University in many regions of the country, the network covers the whole of Panama. The links are between 256 and 512 Kbps, with one 1.54 Mbps satellite link to the commodity Internet and one 1.54 Mbps link to the main PANNET node. The network is based on IP technology and also supports Multicast. Applications supported are the normal Internet services, such as Email, FTP and WWW as well as videoconferencing and virtual libraries.

Cable and Wireless Panama have donated both the national and international connectivity.

The traffic load per month on the network is 180 GB external and 22 GB in total.

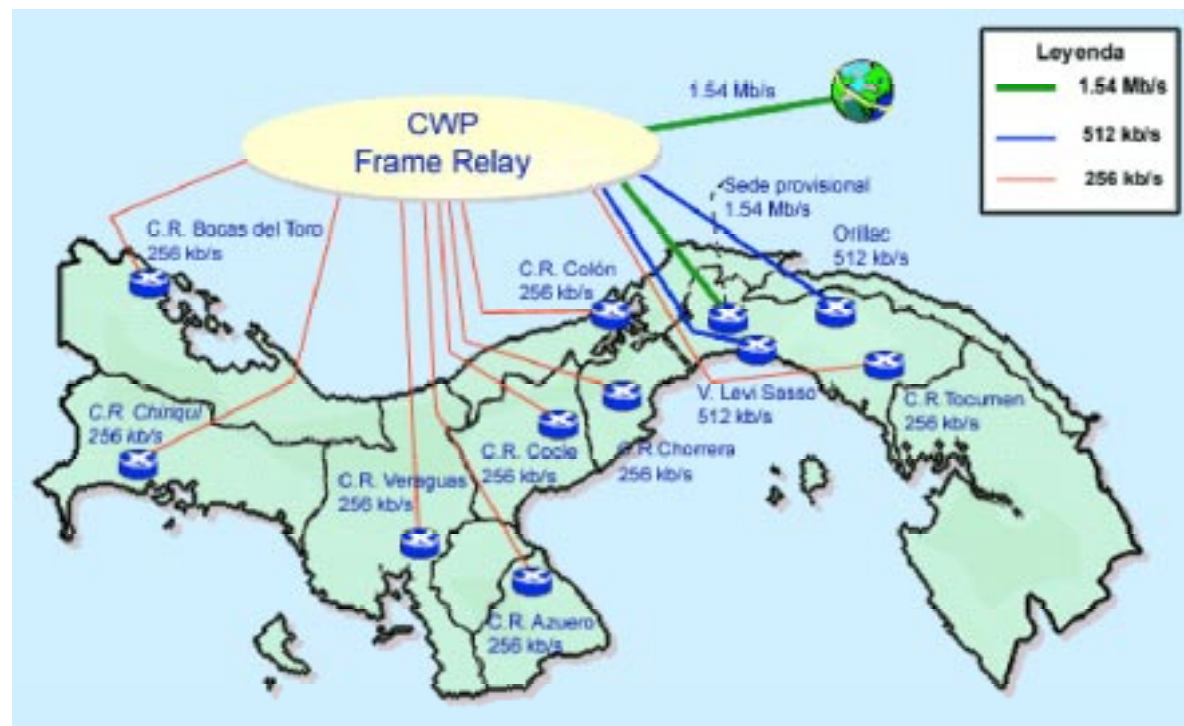


Fig. 7: The PANNET network

4.14.2.3 Future Plans

PANNET is planning to at least triple the current connectivity within the next three years to support the academic and research projects in Panama.

4.14.2.4 PANNET and CAESAR

It was stated that PANNET is interested in investigating the possibilities of a direct connection to GÉANT as the access to high-speed networks would optimise research in Panama in every sense. Today the network only interconnects the Technical University in Panama and there are no connections to other institutions nationally or internationally. A connection to GÉANT would improve the situation dramatically.

4.14.2.5 Contact Details

Universidad Tecnologia de Panama
Ave Manuel Espinoza Batista, campus, Octavio mendez Perreira, Sede Provisional
www.utp.ac.pa (University)
www.pannet.pa (Academic Network)

Director PANNET and administrative contact for the .pa domain:

Sidia Moreno de Sanchez , ssanchez@pannet.pa

Director of Networks and Communications:

Fernando Castillo, fcastillo@pannet.pa

4.15 Status and Developments in Paraguay

4.15.1 General Overview

Population	5.2 Mio ¹⁾
Internet Users	75,000
Internet Users in percentage of the population	1.36

Source: population.com, ALADI Workshop, 2001. All data 2001, except ¹⁾1998.

Paraguay suffers from a great lack of communications infrastructure. Only about 6% of the population is covered by the national telephone network. This factor has of course seriously hampered the development of the Internet in the country. However, in the last years some more ISPs were able to bring their services to the market which led to an improvement of connectivity also for users who live outside the Capital Asuncion.

4.15.2 REDUNA – The Network of the Universidad de Asuncion in Paraguay

4.15.2.1 The Organisation

For many years, the National University of Asuncion has worked towards connecting its faculties to an academic research backbone. Today, 80% of the faculties are connected via a fibre optical network which is called REDUNA (Network of the Universidad Nacional de Asuncion). REDUNA is managed by CNC the National Computing Centre at the University de Asuncion. CNC has collaborated in this project since its beginnings and has supported the work in the areas of network design, development and implementation. In 1996 CNC has also established the connection to the commodity Internet via a satellite link.

The staff at CNC is highly technical and able to deliver technical solutions to the connected faculties. The group has achieved the first connection from Paraguay to the international Internet and today also is responsible for the .py domain.

The funds for the networks are obtained via consulting services, assistance and support for network development and implementation, as well as through courses given for professional formation and through the supply of Internet services to the academic community and the general public. There are currently 16 faculties at the University of Asuncion, 5 research centres and 30 governmental offices connected to the backbone. It is estimated that about 1,500 users are regularly using the network.

The national ISPs offer Internet services to the public and also connect various universities and research institutions.

4.15.2.2 The Network

The University network consists of the fibre optical backbone and various subnetworks of the academic entities. Via a satellite antenna which is managed by CNC connections are established between REDUNA and the Internet as well as the Metropolitan Network of the Public sector (RMSP). The fibre optical backbone is 10/100 Mbps. The local networks are based on 10/100 Mbps Ethernet networks. The connection to the Internet for the users of the Campus network is provided via an 896 Kbps satellite connection. The network is based on IP technology. ATM is used in the interconnection with the RMSP network and VPNs and Dial-Up connections are used to connect those academic institutions that are not located within the University campus.

The network supports the normal Internet services, such as WWW. Email or FTP, but also Distance Education applications.

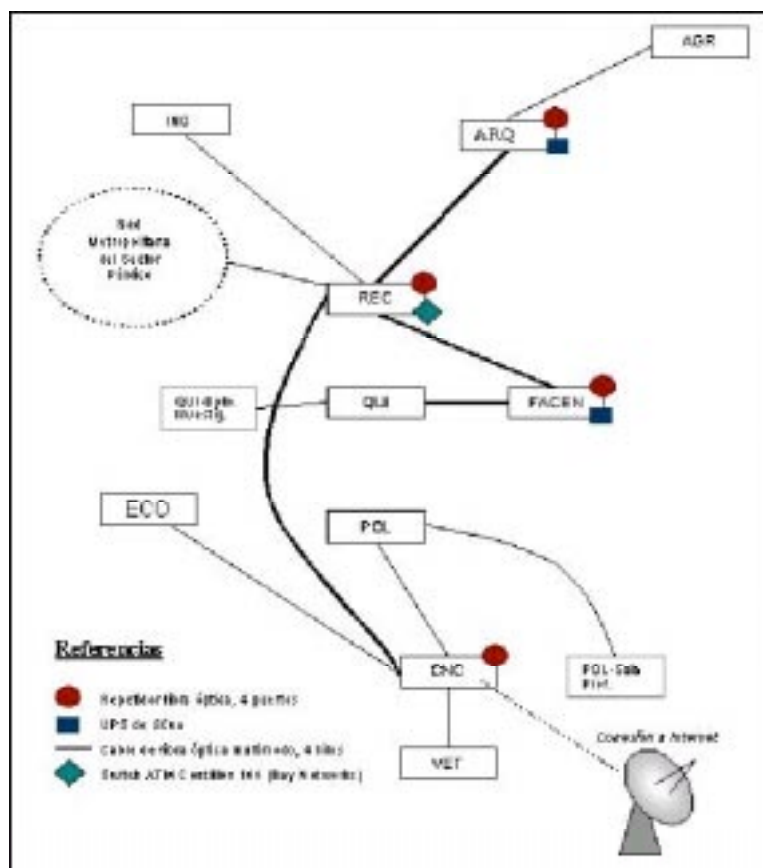


Fig. 8: The Network of the Universidad Nacional de Asunción

There is currently no connection between REDUNA and a national Internet provider, however, it was mentioned that CNC is planning to upgrade its satellite connection which is provided by PanAmSat. The upgrade will include a connection to the national NAP which is connected to a national network of ISPs.

CNC is part of ENRED, the Forum of networks in Latin America and the Caribbean. The institutions also collaborate with the Ibero-American Network for Software Technologies which is organised by CYTED. It was also stated that there is an active exchange with various Brazilian Universities and that CNC is associated to CLEI and actively participates in its informal network which brings CNC close to the research networking organisations in more than 12 countries.

4.15.2.3 The Future

It was stated that in Paraguay many projects which aim at promoting new technologies are planned, but that due to the economic situation it was very unlikely that any of these projects would see an implementation.

4.15.2.4 CNC and CAESAR

CNC stated that it was interested to connect directly to GÉANT, as this would bring benefit to the academic research community in Paraguay and that European researchers would certainly also benefit from the knowledge exchange. It was furthermore stated that the biggest advantage for researchers in Paraguay would be that they would no longer need to

travel as information would be available through the network. As resources are extremely scarce in Paraguay and academics are paid very low salaries, an interconnection with GÉANT would bring communication to a completely new level. CNC stated that they would be very willing to use their resources for the best of the community and to create as well as participate in educational programmes and international conferences using the network which would be beneficiary to all participants. The hope was expressed that a connection to GÉANT would create synergies which would improve the level of research and development in Latin America as well as in Europe.

It was stated that at this point in time bandwidth in the country was very limited and therefore videoconferencing could not yet be supported by the network. It was hoped that as bandwidth increases and with a connection to GÉANT, videoconferencing would be one of the applications to benefit. CNC also stated that their national GRID project would benefit substantially from a direct connection to GÉANT.

4.15.2.5 Contact Details

Centro Nacional de Computación
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Technical Director: Lic. Juan Segovia, jsegovia@cnc.una.py

4.16 Status and Developments in Peru

4.16.1 General Overview

Population	24.79 Mio ¹⁾
Internet Users	2 Mio
Internet Users in percentage of the population	8.1

Source: population.com, OSIPTEL, Peru. All data 2002, except ¹⁾ 1998.

The estimates on how many people in Peru are currently able to connect to the Internet are very diverging. By mid 1999 the Red Científica de Peru (RCP) connected about 120,000 users, Telefonica de Peru an additional 100,000 users. It was estimated that in 1997 about 240,000 users could connect to the Internet using their own computer at home and that that figure had risen to about 400,000 by the beginning of 2000 and to 2 Million in 2002.

To improve the situation RCP investigated the forming of alliances with Telecom Italia as well as consortium of banks called WorldTel. The objective of the alliance was to build a optical fibre network in Peru's Capital Lima.

4.16.2 CONCYTEC – working towards a national research network for Peru

4.16.2.1 The Organisation

There is currently no national research infrastructure in Peru. Various universities and national research institutions, like the Institute for Nuclear Energy, the National Institute for Telecommunications, the Ocean Institute, the Institute for Fishing Technology and the Institute for Agricultural Research among others collaborate in various thematically

organised networks. In order to interact these groups use the commercial Internet services provided by various commercial vendors in Peru.

CONCYTEC, the National Council for Science and Technology, leads the “Grupo Promotor de la Sociedad de la Informacion en el Peru” which is also participated by the President of the Council of Ministers, the Ministry for Transport and Communications, the National Institute for Statistics and Information, the National Institute for Telecommunication’s Research and the supervising body of the private investment into telecommunications. The group’s objectives are to make proposals and plans for the development of the Information Society in Peru and to promote its uptake.

In the context of the development of the Information Society, the role of the creation of a national research network infrastructure and organisation is seen as very important.

Commercial Internet Services are provided by Telefonica del Peru, Millicom, Terra, Red Cientifica Peruana (RCP), Diario El Comercio and others.

CONCYTEC pointed out that in Peru, there are 76 universities, of which 31 are public and 45 private universities. The main population centre is the Capital Lima where 26 universities are located. Overall, it is estimated that there are 280,000 students in Peru. Within the university campuses there are a total of 215 libraries and 1169 laboratories.

4.16.2.2 The Future

It was stated that there are plans to create a national research network for Peru. At this point in time, CONCYTEC is gathering data about the public and private research institutions, to understand their situation and the potential for development in relation to research. The survey also includes an analysis of the connectivity and information requirements of these institutions. Based on the results of the survey, the next steps will be planned.

4.16.2.3 CONCYTEC and CAESAR

CONCYTEC expressed an interest in connecting to GÉANT. It was stated that this would allow Peruvian researchers to collaborate and exchange information in an international environment. The Centre for Materials Research and the Centre for Biotechnology were named as organisations with a great potential to collaborate.

4.16.2.4 Contact Details

Consejo Nacional de Ciencia y Tecnología CONCYTEC
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Dr. Benjamín Marticorena Castillo, President,
Dr. Juan Sierra, Executive Director
Ing. Miguel Arestegui Matutti, Manager of the National Centre for Information and Documentation of Science and Technology
Dr. Nelson Manrique Gálvez, Manager of the Information Society Programme,

4.17 Status and Developments in Uruguay

4.17.1 General Overview

Population	3.2 Mio ¹⁾
Internet Users	370,000
Internet Users in percentage of the population	11.1

Source: population.com, Jupiter Communications. All data 02/2000, except ¹⁾ 1998.

Within a regional comparison the level of education in Uruguay is very high. Expenses for Research and Development reach 0.5% of the GNP, also a high number in comparison with other countries in the region. The terrestrial telephone network is 100% digitalised. 26 of 100 inhabitants have a terrestrial telephone line, 3.4% a mobile phone and by 2000, more than 11% had access to the Internet.

Until today Administracion Nacional de Telecomunicaciones (ANTEL) is the only provider of national data communication. A slow process of liberalisation and demonopolisation has started which will eventually improve the situation, but so far the results are very limited. It is to be noted that Uruguay is a country with only about 3 Million inhabitants and a significant and increasing level of poverty which might make investments little attractive.

4.17.2 RAU – The National Research Network of Uruguay

4.17.2.1 The Organisation

The Red Academica Uruguay (RAU) is managed by the Univeridad de la Republican Montevideo. The university is autonomous and receives its funds from the government. RAU was created in 1990 by the Central Information Services of the Universidad de la Republica after it had received an important investment in equipment. The objective of RAU is to bring information and communication services to the academic community of Uruguay.

4.17.2.2 The Network

The RAU network topology is star-shaped with the central node situated in the Information and Communications Services (SeCIU) section of the Universidad de La Republica. SeCIU itself is connected to the local telecoms provider ANTEL which supplies the national and international Internet connections. In Montevideo there are

34 links of 64 Kbps
 6 links of 128 Kbps
 5 links 256 Kbps
 1 link of 1 Mbps

At this point time RAU migrates all 64 Kbps links and some of the 128 Kbps to 256 Kbps links. Some of the 256 Kbps links migrate to 1 Mbps.

Intra-regional there are the following links:

2 links of 128 Kbps
 1 link of 64 Kbps
 One 512 Kbps in the process of being implemented

Links to the national provider Antel

Additional there is a 2 Mbps link for the traffic with the rest of Uruguay as well as for regional traffic to Brazil and Argentina. International connectivity is achieved through a 4 Mbps link. The international network connections are managed by ANTEL.

The network offers access to the Internet for academic institutions, non-governmental institutions and state entities. RAU also manages the .uy domain, offers web-hosting as well as email services for professors and academic staff.

4.17.2.3 The Future

It was stated that at this point in time, the RAU network seeks connectivity with the North American Internet2 networks. This connectivity is supposed to be achieved via the research networks of Brazil or Argentina which are connected to Abilene via AMPATH. It was stated that the most important obstacle of this connection are the high prices offered by ANTEL for connectivity of more than 2 Mbps bandwidth.

It was stated that RAU has launched an important publicity activity within the academic community to make the RAU activities more known. The activity also aims at pointing out the difficulties that still exist with access to the Internet. All Rectors of the Universities, as well as all Directors of the Research Institutions in Uruguay are currently signing a document which highlights the problems reaching the Internet 2 because of high prices for telecommunications. This paper will be presented to the President of Uruguay in a press conference.

4.17.2.4 RAU and CAESAR

It was stated that RAU was interested in connecting to GÉANT and very interested in connecting to a regional Latin American network. This would foster regional and international collaboration and would open important opportunities for researchers at universities and research institutions in Uruguay.

4.17.2.5 Contact Details

RAU

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Uruguay

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Fax : (5982) 401 58 43

URL: www.rau.edu.uy

Ida Holz, Director, holz@seciu.edu.uy

Luis Castillo, Coordinator Hardware and Communications

4.18 Status and Developments in Venezuela

4.18.1 General Overview

Population	23.24 Mio ¹⁾
Internet Users	950,000
Internet Users in percentage of the population	4.04

Source: population.com, ITU. All data 02/2000, except ¹⁾ 1998.

4.18.2 REACCIUN – The National Research Network of Venezuela

4.18.2.1 The Organisation

REACCIUN, the national research network of Venezuela is managed by the National Centre for Information Technology (CNTI), which belongs to the Ministry of Science and Technology in Venezuela. The network is funded by the state government via the budget given to the universities and research organisations which are connected to the network. Currently there are 78 institutions connected to REACCIUN, 30 of which are universities or higher education facilities, 10 are research centres and 38 are governmental institutions or private companies whose research supports the academic research and development of the country.

4.18.2.2 The Network

The REACCIUN network is star-shaped with a central node in CNTI from where the network is managed.

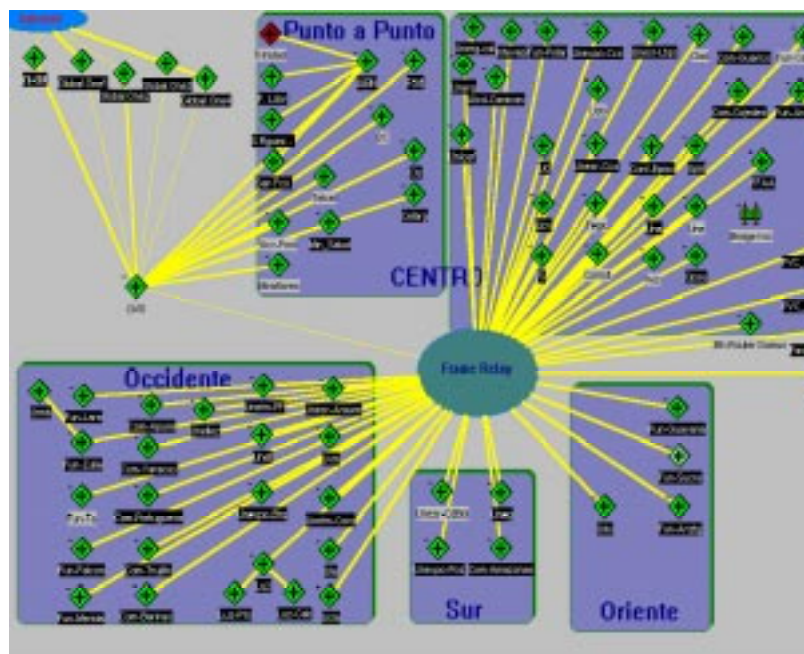


Fig. 9: The REACCIUN Network

The network is based on IP technology using Frame Relay and Wireless, and supports all application supported by IP. Traffic in the networks amounts to 16 Mbps total. The provider of the national connectivity is Compania Anonima Nacional Telefonos de Venezuela (CANTV).

International connections are provided by Verestar and Equant. One connection is based on a satellite link and allows for a direct connection to the USA. The other link is based on microwave technology to the PoP of a national provider which then provides connectivity to the US commodity Internet.

4.18.2.3 The Future

It was stated that at this point in time the research network is working towards becoming an “Internet2”, which entailed a significant upgrade of the national and international connectivity. It was added that REACCIUN is currently in the process of affiliating itself with the North American AMPATH initiative.

4.18.2.4 REACCIUN and CAESAR

It was stated that REACCIUN could consider affiliating itself with the CAESAR project for direct connectivity to GÉANT as this would allow researchers in Venezuela access to information about similar research projects around Europe.

4.18.2.5 Contact Details

Centro Nacional de Tecnologías de Información (CNTI)
Avenida Abraham Lincoln, piso 6, plaza Venezuela, Caracas.
Phone: +58-212-794-0695.
WWW: <http://www.cnti.ve>.

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Technical Manager:	Luis Miguel Vázquez, lvazquez@reacciun.ve .

5. FIRST CONCLUSIONS

The Final conclusions of the CAESAR project can only be drawn once the data from the traffic and demand analyses has been gathered and evaluated, the information received from the operators has been analysed, the findings of the CAESAR workshop in Toledo been taken into account and in-depth discussion with the Latin American partners have taken place .

However, we feel that at this stage first conclusions can be given.

The main conclusion from the study so far is that there is a need for regional connectivity within Latin America. In order to interconnect Latin America and Europe from region to region and in a cost-effective way a regional research network infrastructure needs to be created. In parallel, the organisational set-up that such a regional network would need, will have to be investigated and planned.

Throughout the project, we have tried to group the countries and their research networking activities into different clusters to reduce the amount of different approaches from 18 to a smaller number. At first we thought that we should probably have three different clusters, but now, having analysed the situation in each of the countries, we came to the conclusion that a more precise grouping would consist of 5 different clusters.

Table 2 provides a quick overview of the main characteristics of the NRENs or related organisations in the 18 Latin American countries.

Country	Organisation	Existing NREN?	national connections	external capacity	Number of connected sites	connection to US Internet2
Argentina	RETINA	yes	256 Kbps – 34 Mbps	59 Mbps	56	yes
Bolivia	BOLnet	yes	64 – 128 Kbps	1.5 Mbps	18	no
Brazil	RNP	yes	2 – 30 Mbps (backbone up to 622 Mbps)	202 Mbps	369	yes
Chile	REUNA	yes	155 Mbps	45 Mbps	18	yes
Columbia	RedCETCol	not known				
Costa Rica	CRNet	yes	32 – 512 Kbps	not known	34	no
Cuba	RedUniv	University Network	19.2 Kbps – 2 Mbps		23	no
Ecuador	FUNDACYT	in planning				no
El Salvador	CONACYT	in planning				no
Guatemala		non-existent				no
Honduras	HONDUnet	not known				
Mexico	CUDI	yes	2 – 155 Mbps	255 Mbps	77	yes
Nicaragua		not known				
Panama	PANNET	University Network	256 – 512 Kbps	1.54 Mbps	11	no
Paraguay	REDUNA	University Network	10/100 Mbps fibre optical backbone	896 Kbps	51	no
Peru	CONCYTEC	in planning				no
Uruguay	RAU	yes	64 Kbps to 1 Mbps	6 Mbps	46	no
Venezuela	REACCIUN	yes			78	no

Table 2: The Main Characteristics of the Research Networking Organisations in 18 Latin American Countries

Group A is formed by the big (in bandwidth) and relatively advanced research networks with already existing connectivity to GÉANT via their established connections to the US Internet2 networks. Argentina, Brazil, Chile and Mexico form this Group A. Their research networking activities are comparable to what is done in many European NRENs at this moment.

Group B is formed by those networks that can be found in Bolivia, Costa Rica, Uruguay and Venezuela. Like Group A, these countries have consolidated national research networks. Their infrastructure is based on less bandwidth and they have not yet achieved connectivity to other global research networking activities.

Group C is very similar to Group B, with the important difference that in Cuba, Panama and Paraguay there is not a single research network infrastructure, but various networks in the case of Cuba and in the case of Panama and Paraguay university networks that are more or less developed. In all three cases the networks approached by CAESAR, RedUniv, PANNET and REDUNA respectively, are leading the research networking activities in their country.

Group D is formed by Ecuador, El Salvador and Peru. In these countries there is no research infrastructure (yet), but there are governmental organisations working towards the creation of one.

Group E is made up of those countries where there is currently no research network infrastructure and also a lack of political interest to create one. Colombia, Guatemala, Honduras and Nicaragua are clustered into this group.

The countries in Group A are the most likely countries to be able to form a regional network. All four countries have well established national and international connectivity. From the organisational point of view, the networks clustered in Group B and C, should also be able to join the regional network alongside Group A. It is possible, however, that Group C, due to the fact that they are not single consolidated national research networks could face higher national obstacles to connect to a regional network.

It can be foreseen that eventually also the countries in Group D would find ways to connect to the regional backbone and maybe even in parallel build their national research infrastructure. It could also be that the opportunity to connect to GÉANT via a regional backbone could create a momentum that would facilitate the creation of the national research network in these countries.

As for the near future (within the next three years) we can foresee difficulties connecting the countries in Group E (Colombia, Guatemala, Honduras and Nicaragua) to the regional Latin American network in order to connect to GÉANT.

The follow-up from the successful CAESAR workshop in Toledo which was held in June 2002, will help to bring about a clearer picture on the possible solutions for intra-regional connectivity within Latin America, as well as for an interconnection of the two regions. During the workshop the representatives of the 12 Latin American research network organisations present committed to deal with the issue of a Latin American research networking organisation and regional connectivity. The Final report of the CAESAR project will take these findings into consideration and will make final recommendations.

ANNEX 2: DELIVERABLE D2 – REPORT ON THE CAESAR WORKSHOP**Contract Number: IST-2001-35412****Project Title: CAESAR****D2****Summary of results of workshop between Europe and interested parties in South America**

Contractual Date: 31 July 2002
Actual Date: 31 July 2002
Work Package: WP4
Nature of Deliverable: R - Report
Dissemination Level: Pub –Public Document

Author: João Cunha, FCCN
Lino Santos, FCCN

ABSTRACT

This document summarises the results of the workshop held in Toledo, Spain, in June 13-14 2002, bringing together representatives of European and Latin American national research networks. The main objective of this workshop was to establish a dialogue between the research networking players of both regions in order to evaluate the need for and the feasibility of direct inter-regional connectivity.

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<i>Annex XI – Presentation: Support for new and small NREN's</i>	<i>Error! Bookmark not defined.</i>

EXECUTIVE SUMMARY

The CAESAR project targets four objectives: to review the current situation and developments in research networking in Latin America; to study the demand for an improved connection between GÉANT and the Latin American research networks; to survey the options for regional connectivity within Latin America as well as connectivity between that region and Europe; to organise a workshop bringing together the representatives of the Latin American and European research networks, interested European national politicians and the European Commission.

This deliverable presents the results of the workshop held at the University of Castilla - La Mancha, Toledo, Spain, in June 13-14 2002.

The workshop was attended by 16 representatives from 12 Latin America countries. This high level of participation from Latin America is in itself a success. The programme included presentations on European research networking, the CAESAR project and the @LIS programme, as well as open discussions on Regional Latin American networking, Intercontinental connections from Latin America and support for new and small NREN's in Latin America.

The workshop provided extensive opportunities for discussion between the Latin American representatives and the European participants representing the research networking community and the European Commission. The Latin American participants also took the opportunity to meet between themselves and decide on a short-term schedule to develop a proposal for the implementation of some kind of regional networking structure.

At the end of the workshop it was possible to agree on a number of important issues, namely the need for intra regional connectivity in Latin America, the importance of establishing a direct connection between the Latin American and European research networking infrastructures and the need to raise the awareness of politicians.

A preliminary planning for the next steps after the completion of CAESAR, under the @LIS programme, was also established.

INTRODUCTION

The telecommunications revolution of the past two decades has created a world which is becoming smaller by the day. Modern research no longer needs to be undertaken in small and isolated communities. To be successful research communities with similar interests need to co-operate globally. The communications to facilitate this are a reality now.

One of the major objectives of the pan-European research network GÉANT is to facilitate global research co-operation by encouraging connectivity between European researchers and researchers in other world regions. Between the European research networks and similar activities in North America and, to some extent, Asia Pacific this objective has been achieved. Building on this experience, the European research community is now wishing to connect to other world regions, in particular Latin America.

CAESAR (Connecting All European and South American Researchers) is a European Commission funded feasibility study to evaluate the possibility of a direct interconnection between the pan-European research network GÉANT and similar activities in Latin America. A brief presentation of the project is included as annex I to this document.

WORKSHOP OBJECTIVES

The basic objective of the workshop is to develop the case for research inter-connectivity between the two regions. From a European perspective, we do not want separate connections to individual countries. This, therefore, requires some inter-regional connectivity in Latin America which is organised on a co-operative basis.

The workshop should contribute to these objectives in several ways, namely by providing an unpaired opportunity for bilateral discussions between Latin American and European players. These discussions are expected to help in:

- understanding the Latin American willingness to co-operate towards the creation of a Latin American regional network;
- understanding the level of interest of the Latin American partners in a direct connection between Latin America and Europe;
- understanding in how far a direct connection to Europe could be competing with direct connections to the American Internet2 networks;
- creating confidence between the European and Latin American partners;
- defining possible next steps after CAESAR.

WORKSHOP PREPARATION

The workshop preparation included the choice of date and venue, the definition of the programme and the preparation of the list of invitees. The issue of official language of the workshop was considered, and the decision to have simultaneous translation between Spanish and English took into account that: i) most of the participants were Spanish native speakers; ii) Portuguese native speakers were known to be reasonably fluent with English. The logistics of the workshop was co-ordinated between RedIRIS and DANTE.

4.2 Date and venue

The choice of venue and date took into account the international agenda on research networking and information society, the need for good flight connections with Latin America and the potential attraction of a city with good historical liaisons with these countries. Since RedIRIS offered to take care of logistics as well as to co-fund the event, the search for a convenient location was centred on the neighbourhood of Madrid. The final choice fell on Toledo, where the University of Castilla-La Mancha offered to host the event in its facilities free of charge. It was decided to have the event in the week following the TERENA Conference, starting with a dinner on June 12, followed by two days of working sessions.

4.3 Workshop programme

The definition of the workshop programme considered the objectives of presenting full descriptions of the CAESAR project, @LIS programme and European Research Networking developments. The workshop also had to cover both intra-regional and inter-regional connectivity topics. Latin American delegates should have effective participation, so it was decided that at least two sessions should be chaired by LA delegates and most part of the sessions should have an open session format. In order to facilitate the dialogue between attendees there was a decision for longer breaks between sessions.

Individual presentations from the Latin American participants were not part of the programme as an overview of the research networks in Latin America was circulated prior to the meeting.

The Toledo Workshop programme makes an Annex to this document.

4.4 Invitees

The list of invitees formed three different groups: the CAESAR project members and other European NREN representatives, the European Commission representatives and most important for the success of this workshop, the Latin American representatives that had been identified during WP1 evolution.

The possibility of inviting a group of end users has been seriously considered but has been abandoned when it became clear that the number of Latin American representatives would be large and the available time slots should be allocated to the typical problems of interconnecting NREN's.

The complete list of attendees for the Toledo workshop is included as Annex III to this document. The fact that there were 16 representatives from 12 Latin American countries is in itself a success.

4.5 Financial support for participants

Payment of travel expenses was offered to Latin American participants from the CAESAR budget. Funds provided by RedIRIS were partly used to pay for the accommodation of Latin American participants and for the catering costs during the event.

WORKSHOP MINUTES

Opening Session

The workshop was opened by Manuel Hermenegildo, Director of Research, Spanish Ministry of Science and Technology who expressed his pleasure and privilege at being present at this event, which he considered to be of great historic importance. The importance of the development of networks in science and technology between Europe and Latin America was emphasised, along with the importance of interconnecting Latin American networks to a regional network within Latin America to allow the research community faster and more efficient means of exchanging data. His message was one of encouragement, of global thinking and ambition.

Fernando Liello welcomed the group in his role as chairman of the European NREN Policy Committee. He stated the objectives of the GÉANT Network and gave examples of researching collaboration within Europe and between Europe and Latin American countries.

Mario Campolargo welcomed the participants. He emphasised the importance placed by the European Commission on events such as this, stating that the connection of LA networks will eventually provide global co-operation with all scientists and researchers. He gave thanks to RedIRIS for their support and to the group to their attendance.

Research Networking in Europe

This presentation by Dai Davies, from DANTE, started with a description of the evolution of European networking, covering the last 15 years. Special emphasis was given to the organisational and funding issues as well as to the effects of the developments in the telecommunications market. Global connectivity was discussed and the need for inter-regional rather than country-to-country connectivity was stressed. Possible steps beyond CAESAR were outlined.

Comments received from the floor emphasised the need to raise awareness among politicians of the importance of research networking and the importance of international co-operation, as done in CAESAR, to achieving that goal.

CAESAR Project: Objectives and status report

This presentation by Victor Castelo, from RedIRIS, described the objectives, methodologies and current status of the CAESAR project .

Several comments from the floor stated the potential benefits from CAESAR for national and regional initiatives. The preparation of a white-paper on Research Networking to be submitted to politicians was suggested.

@LIS programme: Network for researchers

In this session EC officials attending the workshop explained the @LIS programme and the opportunities for research networking.

Elena Vilar, from DGEuropeAID, focused her presentation on the framework and objectives of the @LIS programme and announced funding for twenty demonstration projects that can prove benefit to the social environment through education and culture. Some Latin American attendees advised of problems experienced with the receipt of official information on the project.

Mario Campolargo, from DG Info Soc, presented the EC vision on research networking and global connectivity, underlined the dual approach of @LIS focusing both on applications and infrastructure, and pointed out that this is a great challenge and also a great opportunity for the participants in this workshop and the countries they represent.

Regional Latin American Network

Florencio Utreras from REUNA chaired a discussion on a potential regional Latin American research network. His presentation started with an historical view of regional networking in South America and finally presented both existing connections and cable infrastructure around and to South America.

The presentation was followed by a highly participated open discussion, where the Latin American attendees explained the situation in their respective countries and exposed their views on the issue of both regional and intercontinental connectivity.

International connections from Latin America

Nelson Simões from RNP made a presentation on international connections from/to Latin America, defining the motivations to implement a direct connection to Europe and describing the strategic, economic and political opportunities behind it. The connectivity to Europe should be a means to reach other research communities with GÉANT providing transit. Nelson also issued the need for a commitment on defining a plan and execute it. The foreseen funding balance for the implementation of this connection was mentioned to be unfair as it is equal to the cost sharing of the GTRN connection between Europe and the US.

Comments were received stating that application issue is very important. There should be a wider awareness to show that transfer of data and videoconferencing is possible rather than travelling with data tapes. Also, the funding issue was mentioned to say that a cost sharing on a 50/50 basis does not recognise the additional burden involved on Latin America in order to build their regional network.

Funding Issues for regional and intercontinental connectivity

Bernhard Fabianek, from DG Info Soc, made a presentation on research networking within the @LIS programme. Key issues of his presentation were the organisational and co-funding requirements. Some kind of consortium structure in Latin America is needed to define and implement a regional network, potentially connecting the 18 countries of the region, to which the European GÉANT network will be connected. Co-funding of 50% by the EC is foreseen in @LIS. A two phase approach was suggested: a planning phase with a duration in the order of 6 months followed by an implementation phase. The network should be operational, at least partially, by the end of 2003.

The cost sharing between EC and LA countries was a key issue in this session. Several comments were received stating that the 50/50 basis is not realistic, as the Latin American part has to build the regional infrastructure and, in the case of several countries, also the national network.

Support for new and small NREN's in Latin America

João Cunha, from FCCN, offered an historical overview of the Portuguese National Research Network focusing on the different stages of evolution and the catalytic effect coming from co-operation with other European countries and participation in EC funded initiatives. Suggestions for co-operation included technical support, the preparation of a research network white paper to be sent to national politicians and the use of political events like Latin America summits to raise the awareness on the importance of national research networks.

In the subsequent discussion the issue of AUP's (Acceptable User Policies) was recognised as being of utmost importance for co-operation between NREN's. Also the need not to forget education in favour of research was raised from the floor.

Meeting of Latin American attendees

The Latin American representatives expressed interest in meeting between themselves prior to the final session. The need for ad-hoc group meetings was already foreseen in the programme.

Conclusions and next steps

After the meeting between Latin American participants, the closing session, chaired by Dai Davies, was quite effective and a set of conclusions, including some well defined commitments, was approved. These conclusions are dealt with in the next section.

WORKSHOP CONCLUSIONS

4.6 Statement declaration

The Toledo workshop participants agreed on the following statements:

- Potential benefit of an early approach to connection between Latin America and Europe
- Need to develop intra regional connection and organisation in Latin America
- Latin America countries recognise their need to enhance national networks in order to collaborate with this advanced networking initiative
- Wish of Latin America Research and Education Networks to develop direct connection with Europe
- Additional point of co-funding needs to be negotiated
- Recognise need for open and incremental approach to development of connectivity
- CAESAR can act as catalyst to create and augment budgets required for the project
- @LIS funding significant to success of project
- The latent need for connectivity is recognised
- Political support including that from the EC and the European NREN's is vital to the success of this project
- A statement of publicity and visibility is needed. CAESAR project to undertake some initial work on this
- Latin America countries commit to have, within a period of 2 months, an agenda to deal with the issue of Latin America organisation. To consist of three points:
 1. to clearly define the aims to interconnect within the Latin America region;
 2. examine the need of interconnection with Europe and the expectations of that interconnection;
 3. commit to propose some type of structure to establish a dialogue.
- CAESAR report will be on the basis of consultation with all participants.

4.7 Next steps planning

It was also defined that the establishment of a direct connection between Europe and Latin America countries should proceed in three different phases. The first phase, the information gathering phase, will produce the CAESAR deliverables and a Latin-American proposal of organisation. This phase must be complete by the end of September 2002.

The second phase, the planning phase, consists on the establishment of a technical plan, a financial plan and a cost sharing plan. The funding for this phase will be submitted under

@ALIS programme, based on 50/50 cost sharing basis. Expected duration from three up to six months.

Finally, the third phase, the implementation phase, is deeply dependent on the results of phase two and needs a cost sharing agreement and a connect agreement in order to contractually commit to the telecommunications suppliers. The Latin America countries recognise the need for cost sharing but indicate that the proposed 50/50 cost sharing places too heavy a burden on them in relation to the overall costs and benefits of the activity. Prior to the implementation phase there needs to be a fair resolution of this issue.

Finally, it was agreed to make a follow up workshop to be held in Latin America by the end of September or early in October.

ANNEX 3: PROJECT DISSEMINATION

The two versions of this Final Report that are delivered to the EC in printed copy will contain the CAESAR brochure as issued by the project. The CAESAR brochure was distributed during the

- GEANT Launch Event in Brussels, May 2002
- @LIS Information Days held in Latin America, June-August 2002
- @LIS Information Day held in Brussels, September 2002

CAESAR established a web page for the project within the DANTE website. This web page can be found at <http://www.dante.net/caesar> . The page gives general information on the project and links to the three public deliverables of the project. The CAESAR brochure can be ordered free of charge from the CAESAR web pages.

ANNEX 4: LATIN AMERICAN PREFIXES

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 - 168.96.0.0/16;
 - 170.210.0.0/16;
 - 199.248.144.0/24;
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 - 200.9.75.0/24;
 - 200.9.147.0/24;
 - 200.10.202.0/24;
 - 200.12.132.0/22;
 - 200.12.136.0/23;
 - 200.16.16.0/20;
 - 200.16.240.0/23;
 - 200.49.224.0/20;
 - 200.51.55.0/24;
 - 200.69.144.192/29;
- BOLIVIA (BOLNET)
 - 166.114.0.0/16;
 - 200.9.167.0/24;
 - 200.9.168.0/24;
- BRAZIL (RNP)
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 - 143.106.0.0/15;
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- CHILE (REUNA)

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204.87.169.0/24;

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- COSTA RICA (CRNET)
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- CUBA (REDUNV CENIAI CIGBNET)
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- ECUADOR (ECUANET, as provided by FUNDACYT)
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- EL SALVADOR (SVNET)
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- GUATEMALA (MAYANET)
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- HONDURAS (HONDUNET)
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- MEXICO (CUDI)
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- PERU (RCP)
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- URUGUAY (RAU)
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159.90.0.0/16;

ANNEX 5: USER GROUP SURVEY QUESTIONNAIRE TEXTS**CAESAR User Group Questionnaire (Europe)**

Dear Mr ,

following please find four brief questions concerning your connectivity requirements with Latin America. We would be very pleased if you could spare 5 min of your time to answer these questions. It will help the project CAESAR (see below) to succeed and will help to improve connectivity and collaborative research between Europe and Latin America.

Please let me have your response by 20 August 2002.

1. Please mark in which country (countries) your collaborative research partners are based:

- Argentina
- Bolivia
- Brazil
- Chile
- Colombia
- Costa Rica
- Cuba
- Ecuador
- El Salvador
- Guatemala
- Honduras
- Mexico
- Nicaragua
- Panama
- Paraguay
- Peru
- Uruguay
- Venezuela

2. What kind of applications are you currently running between your research site and your Latin American partners' site?

3. What applications would you like to use if the connectivity between Latin America and Europe would be improved?

4. How much bandwidth is needed for these applications? Do you have special Quality of Service requirements (jitter, delay, etc.)?

Please feel free to add information about your collaborative research with your Latin American partners and your connectivity requirements. Although we tried to keep this questionnaire very short, we are nevertheless very interested in any additional information that you would like to share.

You can find more information on CAESAR and also its first project report on <http://www.dante.net/caesar/> .

The following email was sent to 19 Users in Latin America:

CAESAR User Group Questionnaire (Latin America)

Dear Mr ,

following please find four brief questions concerning your connectivity requirements with Europe. We would be very pleased if you could spare 5 min of your time to answer these questions. It will help the project CAESAR (see below) to succeed and will help to improve connectivity and collaborative research between Europe and Latin America.

Please let me have your response by 20 August 2002.

1. Please mark in which country (countries) your collaborative research partners are based:

- * Austria
- * Belgium
- * Croatia
- * Czech Republic
- * Cyprus
- * Estonia
- * France
- * Germany
- * Greece
- * Hungary
- * Italy
- * Ireland
- * Israel
- * Latvia
- * Lithuania
- * Luxembourg
- * Netherlands
- * Nordic Countries (Denmark, Finland, Iceland, Norway and Sweden)
- * Poland
- * Portugal
- * Romania
- * Slovenia
- * Slovak Republic
- * Spain
- * Switzerland
- * UK

2. What kind of applications are you currently running between your research site and your European partners' site?

3. What applications would you like to use if the connectivity between Latin America and Europe would be improved?

4. How much bandwidth is needed for these applications? Do you have special Quality of Service requirements (jitter, delay, etc.)?

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