REUNA: How an Academic Network can be Self Funded

Florencio I. Utreras <futreras@reuna.cl>

Abstract

REUNA, the National University Network of Chile has become a commercial Internet Sevice Provider. In this paper we present a brief outline of the main reasons why this network has been successfull in becoming a self funded academic network. In particular, we discuss the foundations of volume REUNA's charging policy.

1.- Introduction

REUNA is an acronysm for Red Universitaria Nacional, a consortia of 19 public and semi-private universities and Chile´s National Sciences Council (CONICYT) that operates and manages Chile´s main access to the Internet. With its national IP network REUNA is also the only public access IP network with national coverage in Chile with connection to the Internet.

REUNA´s network is supported by three major operation centers located in Santiago (the Capital of Chile), Antofagasta (in the north) and Concepción (in the south). These operation centers concentrate the traffic from the points of presence in the capitals of 11 of the 13 Chile´s administrative regions (See map below). The speeds of the connections have been recently updated so that the minimum speed is a 64/32 Kbps Frame Relay connection and the international link is a 512 Kbps IBS circuit to SURANet. The details are given in the connection diagram below.

Using this network REUNA connects over 40.000 users to the Internet among which are private commercial organisations as well as public, non-governamental organisations, private universities, public libraries, schools and individuals.

The growth of traffic to and from the Internet has been growing at impressive speeds, specially in the last months when the growth of new users became over 20% per month. The graph below shows the growth in the traffic of REUNA customers. We have excluded the traffic from member universities and CONICYT. We observe that the growth in this sector is largely over 20%, the average growth is indeed 46.6%.

Figure 1. REUNA's Operation Centers and Points of Presence

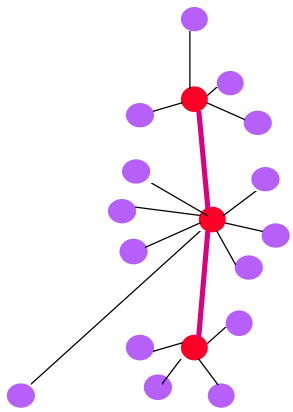

Figure 2. Connections diagram

To cope with the impressive rate of growth REUNA had to upgrade its 56 Kbps IBS circuit to SURANet to 128 Kbps in February 1994 and upgrade it again to 512 Kbps in February 1995. At the current growth rate a T1 circuit should be installed not later than November 1995.

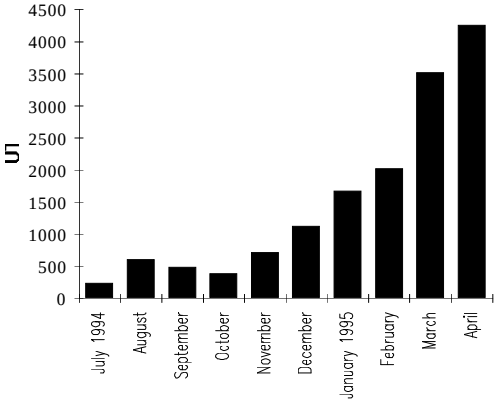

Figure 3. Customers Traffic

How can an Academic Network cope with the cost increase of the upgrades, the requested information services, the new infrestructure, the personel ?. A common answer in the academic sector has always been state support. Unfortunately (or fortunately) in Chile the governement is strongly against any form of subsidy, specially to the universities. Thus a *self funding approach* was established.

Due to this decision, from the very beginning REUNA started to search for external customers. As in many countries these customers were primarily other educational institutions, public organisations and non-profit as well as non-guvernamental organisations. This fact changed dramatically when the new structure of the Internet was adopted making possible a completely commercial approach. From that moment on we started a very aggresive plan to connect all kinds of organisations to the network, multiplying types of access and executing a marketing plan aiming to establish REUNA as the network of choice for commercial and non-commercial use of the Internet.

At present REUNA offers a variety of services including connectivity in several formas: dial-up, digital circuits, Frame Relay and ISDN. We also offer information services, training, consulting and have deals with several hardware providers to simplify the customers approach to the Net.

REUNA is self-funded already and pretends to be a major player in the open commercial competition that is starting to take place in Chile with the installation of several Internet Service Providers that will take place in the fisrt semester of this year.

2.- From BITNET to Internet: The Birth of REUNA

The birth of REUNA goes back to 1986 during National Meeting of Academic Computing Centers and Computer Science Departments of Chilean Universities. Even though the idea of creating an academic e-mail network could be traced back to 1984, it was only during the 1986 meeting that two major facts ocurred. The first one was the announcement by 4 computer science departments of their intention to start a UUCP network instead of the original idea of using X.25 based protocols. This was very important because it was a concrete step that needed almost no investment hence it was really carried out in a short time. The second fact was the donnation of IBM to several universities of all the hardware, software and leased lines needed to establish an SNA network among them. These aparently oposed lines of action were collected under the name of REUNA and plans for a gateway were established. The gateway was working at the beginning of 1987 giving birth to the first e-mail network in Chile. This network included universities from Antofagasta, Concepción, Valparaíso, Santiago and Valdivia.

In December 1986 the UUCP part of the network started to communicate with UUCP thru INRIA in France and after some months of operation moved its entry point to UUNet in the USA. By april 1987 the gateway connecting both netwroks was operating and so REUNA was communicated with the world thru UUCP.

A more stable connection to the growing international networking community was established at the end of 1987 thanks to an agreement between NASA and the University of Chile. The agreement allowed chilean universities to share the use of a voice line connecting NASA's Santiago Tracking Station, operated by the University of Chile, and Goddard Space Flight Center in Bethesda, USA. The line was used for communications of the staff to the US during working hours and also during space missions. The line was thus essentially unoccupied during the nights and on weekends. A switch installed and operated by NASA personnel in Santiago and the US enabled the line for REUNA usage during those hours allowing to connect the University of Chile to the University of Maryland and from there to BITNET.

From the end of 1987 to 1991 the increase in traffic was exponential. The rate of growth was

even larger than international average amounting to a factor of 3 every year.

Already in 1988 the idea of getting connected to the Internet (or to the NSFNet as was essentially known at that time) was present in REUNA. The main problem we faced was the cost of a 56 kbps link to the US, roughly US$ 12,000 per month. The idea of sharing costs was difficult to implement because the need for this new service was not well established in the academic sector. Also CONICYT was not interested at that time and was not willing to add that amount of money to their support for science and technology.

Until then REUNA was only a name for the group of universities involved in the development of the network with no official support and no involvement of university administrators. The idea of creating a consortia associating the interested parties appeared in 1990 when the recently appointed President of CONICYT invited the Rectors (Presidents) of all traditional universities to appoint official representatives to a commitee aimed to establish the bases for a more permanent development of an academic network.

After several months of work an agreement was reached between 19 of the 22 traditional universities and CONICYT. There would be a Non-Profit Organisation called REUNA that would develop, administrate, operate and commercialize an IP network in Chile connected to the Internet. The choice of Non-Profit versus Profit was essentially made to preserve the academic spirit of the network. Nevertheless, it was clear from the very beginning that the organisation should be self-funded and would sell its services commercially to other organisations in Chile.

REUNA's connection to the Internet was established on January 2, 1992 and the first year of operation was funded by CONICYT. Even though some non-member organisations got connected to the Internet during 1992, that year was essentially devoted to complete the network described in the Introduction, install the operation centers and train technicians from member institutions in the use and administration of the Internet.

The commercial start of REUNA was 1993. After a slow beginning the monthly growth rate of 13 % average was reached in 1993 and 17.5 % in 1994. The present rate is larger than 20% per month. This results is not only due to our marketing strategies or technical quality, it is also the effect of a large press coverage during the last year. Nowadays an article on the Internet appears everyday on the newspapers and even TV shows are talking about it.

REUNA is legally existing since August 1994. Since then the personnel has been multiplied by 3 and incomes by 8. Plans for 1995 aim to multiply the number of users and incomes by 4. Even considering the entrance of major commercial competitors. These figures are due to a collection of factors among which our finantial model appears to be crucial. Nevertheless, a major role in this growth has been played by an external factor: the impressive evolution of our telecommunications infraestructure.

3.- Chile´s Telecommunications Evolution

As in many latin-american countries the telecommunications companies were state owned and essentially monopolic until 1985. Essentially two companies served the whole country: Entel, the long distance carrier and CTC, the phone company which was not allowed to install its own long distance facilities. Exceptionally, in the south of Chile the telephone operator was private: Telefónica del Sur, also in part of Santiago's uptown a private operator, Telefónica Manquehue was allowed to serve those customers.

Indeed some private telecom operators were installed since 1984 in the sector of Packet Switching. A hole in the legislation protecting Entel and CTC had allowed the creation of ChilePac and VTR, two X.25 service providers born from old Telex companies, that could compete against EntelData, the packet switching subsidiary of Entel.

In 1985 Entel and CTC were sold to the private sector and a limited competition was allowed in the long distance services. Telex Chile, the company owning ChilePac installed their own satellite service and started serving part of long distance phone calls from CTC customers. The phone company was the one determining how much traffic would gto thru Entel and which one thru ChileSat.

It was the starting point of a series of private investments in the telecommunications sector that allowed several advances in a few years:

- Creation of three digital data networks in Santiago in 1990. This was a crucial change for the installation of networks, before that only voice quality leased lines were installed for data transmission and no guarantee was provided by the operator. CTC Data Red, VTRNet and Teleductos

quickly installed a network of fiber that covered the city making it possible nowadays to obtain a 64 Kbps link or faster in less than 30 days. Either alone or associated with other operators the three companies now offer the service country wide.

- Cellular phones are available since 1989 and its use is widespread since 1992. Four companies offer their services nationwide.

- VSAT services started to be installed in 1990 and are offered by three different companies. Among protocols used are X.25 and TCP/IP.

- The telephone network is fully digital since 1992.

- ISDN services are available since 1993 and are becoming an insteresting way to access Internet services.

- Frame Relay networks are operating since 1994. An important cost reduction lead REUNA to choose this service for its national network. Speeds rangin from 32 Kbps to 2 Mbps are possible.

In 1994 deregulation was pushed to the limit when long distance services were opened on a free competition per call basis. This means that the final customer can choose the long distance carrier for any call he wishes to make either nationally or internationally. No contract is necessary and the carrier number is need in any long distance call. Of course the customer can choose to have a contract with one of the carriers but he can change at any moment.

This deregulation produced at least three interesting facts: a) Prices were dramatically reduced; b) Investements in fiber optic infraestructure have created a tremendous telecommunications backbone in the country; c) Investors from abroad were atracted by the business oportunity. Among new investements several companies are launching a PCS service in June.

The final deregulation step was announced last January when local phone systems were opened for competition. In July 1995 at least two companies are starting a local phone service in Santiago, new services will soon come in other cities.

It is clear that avalilability of telecommunication services is key to the development of any kind of MAN or WAN. Clearly the development of the Internet in Chile is not only due to the marketing strategies of REUNA, the coverage given by the press or even the agreements signed by the governement with the US in order to expand the use of the Internet. The basis for the development is this wonderfull telecommunications infraestructure developed by the private sector.

4.- The REUNA Project

In 1991 the group of universities coordinated by CONICYT was willing to establish an IP network, but many member were reluctant to make the necessary investement in equipment, personel and infraestructure to deploy that network. Indeed at that time the benefits of the Internet were not clear enough to everybody so that priorities could be changed in all the universities. It was necessary to obtain some kind of support to start the network. The support came from a recently established National Fund for Private Sector-University Relations: FONDEF (Fondo de Fomento).

The idea of FONDEF was to contribute with funding for research, the development of an infraestrcture or the establishment of a service that would benefit not only the universities or the research institutions, but mainly the private sector. It was conceived as some kind of technology transfer process. The grant was to be spent in 4 years at most at a clear proof of economic value had to be given.

The consortia agreed to submit a project to FONDEF in July 1991. This fact produced several definitions inside REUNA. Among them: a) the service had to be offered to the private sector; b) a self funding structure had to be adopted to guarantee economic value.

A brief summary of the finantials of the project is:

a) Investment by FONDEF

Equipement provided	US$ 700,000
Infraestructure,Training,etc.	US$ 300,000
Total Grant by FONDEF	US$ 1,000,000

b) Investement by the Consortia Members (4 years)

US$ 900,000

Total Investement Money US$ 1,900,000

As a counterpart REUNA had to generate incomes from the private sector so that the Internal Return Rate was at least 13%. Indeed the economic evaluation of the project lead to an IRR of 43% in a 10 years evaluation period. Moreover, the real figures have been well over the estimates so that

the 43% IRR is really going to be reached in a 5 years period.

The project was approved in September 1992.

From a technical point of view the project planned to install three Operation Centers in Santiago, Antofagasta and Concepción and connect all university members in a year period. Even considering that bureaucratic process produced a considerable delay in the provision of the equipement, all technical goals were reached by December 1993, two months after receiving the routers and workstations.

The rapid growth of the Internet in the world and the already described rates in Chile lead REUNA to make a second investement in equipement, marketing and personel. This time all the investement is coming from the benefits of the operation: US$ 400,000.

With the new investements more dial-up access have been installed as well as ISDN for digital access and E1 connections to the main carriers. The project has gone well beyond its original goals.

5.- The Financial Model

The telecommunications facilities described in paragraph 3 are certainly very important and allow the deployment of a good network. Yet the prices are not as good as what can be got in the US. Below we list some prices for illustrative purposes:

19.2 Kbps inside Santiago	US$ 180 -US$ 234
64 Kbps inside Santiago	US$ 234 -US$ 322
64 Kbps Santiago-Concepción	US$ 700
64 Kbps Santiago-Antofagasta	US$ 965

These prices are certainly higher than those in the US. So it is not surprising that final costs of Internet access would be higher. Yet, the main problem is not the local cost. The cost of a satellite access to the US, cheaper than to Europe and same that to any country in South America, is the real high cost that has to be considered in developping a funding model. The following is a list price for IBS services:

9.6 Kbps	US$ 4.180
64 Kbps	US$ 7.600
128 Kbps	US$ 12.320
256 Kbps	US$ 21.120
512 Kbps	US$ 30.980
1.048 Kbps	US$ 49.280
1.510 Kbps	US$ 63.360

Since most of our traffic goes to the international link, which we pay completely, we must consider the increase in the nessary international badwitdth when defining our prices. Thus, even if a new customer pays for his own link to REUNA's operation center, our cost due to the use of international links will not be fixed. The fact that 95% of our traffic goes to the Internet makes it possible for a 64 Kbps user to use as much as 61 Kbps of international traffic. A realistic flat rate should consider a high price for it, specially when the total international bandwidth is not large enough to get substantial discounts for additional 64 Kbps portions.

Another important factor to consider is the fact that a very low speed line, like a 2.4 Kbps is absolutely not appropiate for IP access. Such a portion of bandwidth could be priced at a flat rate and a reasonable price, but who would like to access a WWW server using such a link ?. A real minimum access speed for a router connection should be 19.2 Kbps. The point is that people would love to have fast access to the Internet when they want, but are not ready to pay the price of a permanent unlimited traffic link at a high speed.

The only solution that we found to this puzzle was to establish a per traffic fare. We are aware of the fact that this implies to pay even for the traffic that a user's ftp server generates. It is unfair to charge a person who is willing to share information with other people for free. Yes, but it is also unfair that Chile's traffic to the Internet has to be paid by Chile in both directions.

Of course a per byte charge is something people would like to avoid since even a mistake during a given month could produce a large bill that could destroy the institution's budget. Our solution to that problem was a mix of flat and per traffic rates: *the Virtual Bandwidth*.

The customer chooses the amount of Megabytes that its institution will be committed to use among a set of possibilities. Let us say for example that he chooses the upper limit of 160 Mbytes. During the following 6 months the institution will be charged at the flat rate corresponding to that limit without regard to the real amount of international traffic they use. After 6 months the average traffic is calculated. If that average exceeds the limit by 10%, the institution will automatically be moved to the next choice of virtual bandwidth. No payment is made for the excess traffic during the preceding 6 months.

In this way, a customer can choose a virtual bandwidth say corresponding to a physical 2.4 Kbps, and pay that amount, but his access can be fast when he needs it.

In the table below we give examples of virtual bandwidths and their current prices in US dollars. An 18% VAT tax must be added.

Virtual Bandwidth	Cost
UT 5	US $ 45.43
UT 10	US $ 84.53
UT 20	US $ 121.90
UT 40	US $ 182.91
UT 80	US $ 307.62
UT 160	US $ 517.35
UT 320	US $ 870.08
UT 640	US $ 1,463.30

Where 1 UT equals 1 Mb during workin hours and 2 Mb during non-working hours. This means that during non-peak times the price of 1 Mb is halfed.

The price strategy is completed under the following conditions:

a) Given that 95% of the traffic goes to the international link, there is no interest in charging national traffic separetely. A uniform flat fee is used. This contributes to incentivate national traffic.

b) All News traffic as well as listserv's is considered part of REUNA service, provided it is peered thru REUNA's hosts.

c) E-mail is also considered a service and no charge is made for that traffic provided it is routed thru REUNA's mail exchangers.

This strategy has succeeded in at least two aspects:

i) The increase in number of customers and consequent traffic increase, as well as traffic increase due to new internal users of the customer institutions, has been followed by increase in international and national bandwidth.

ii) Customer acceptance has allowed a greater market share.

It is clear that our solution to volume charging is not of universal use. Nevertheless we feel it is of use in the case of high international costs and has proved to be a successfull mean of atracting an increasing amount of customers.

6.- Operation Centers: A Key to Success

REUNA has certainly been succesfull in starting a comercial service in Chile. Competitors will soon challenge its market share and future success will depend on many factors, among which quality of service will certainly be one of the most important. We feel that REUNA is ready to face that competition too. The main reason for this assurance is that we are sure that our service satisfy the following quality of service characteristics:

a) Availability. A 24 hours a day, 7 days a week continuous operation is assured thru dedicated personel. An extended working day going from 7 AM to 23 PM and an off hours alarm system is possible because our operators work only in providing Internet connectivity, no other service must be assured. Operation centers separeted from the member universities is key in providing this service.

b) Support. Thru the operation centers our customers receive the support they need, they do not compete with other services. Again the dedication of the personel to these tasks is crucial.

c) Information Services. Our Information Department guides the users in navigation thru the Internet making it possible to new comers to start using it painlessly.

d) Accesibility. The diversified telecommunications possibilities makes it easy to reach REUNA from various platforms.

In the first three aspects we feel that a dedicated technical personel has been the key to success. No university computing center could successfully carry out these tasks without weakening the services given to their natural customers: the academic comunity of their institution. As in every university activity, the mixture of external and internal services is usually a bad mix. From our point of view, Internet Service Provision is an activity that should be isolated from the academic support.

On the other hand, the relationship between REUNA and its university members has also been crucial in the development of training seminars with the cooperation of university staff. Both, customers and university staff have benefitted from these activities. During the last three years we have developped several seminars in Santiago and cities in the north and south of Chile. These activities have been important not only in the training of customers, but also in the obtention of new ones.

In this last point the legal structure of REUNA is very important. Indeed a cooperation between non-profit organisation is very natural thru a non-profit structure. Additionally, in the case of networking it is clear that manu resources are needed to continue the upgrade of links, servers, routers, etc. The obligation to re-invest the proffits appears as a very convenient way to impose upgrades on the network instead of using them for other university activities. Under this philosophy REUNA becomes a space for the development of networking beyond the use of the Internet itself.

7.- Conclusion and Perspectives

The creation of REUNA and the adoption of a mixture of volume charging and flat rates has been crucial to the development of Chile's Internet. With the largest number of host/population in Latin-America and a development rate of over 20% per month this service is becoming a service of choice for networking in Chilean community.

The attention atracted over the Internet by the Press and service providers marketing strategies have made it an attractive business oportunity for carriers and other investors as cable companies, new service providers are expected to appear during 1995 to serve the business community.

The largest journals of Chile are already preparing their commercial edition over the Internet. Experimental services should appear during the second semester of 1995.

Information providers are rapidly becoming connected to the Internet. A large amount of chilean commercial information is expected to be available on a per fee basis also during the second semester of 1995.

Despite the competition from carriers and other service providers REUNA feels that it is in good position to maintain its rate of growth and keep a reasonable market share in an expanded universe of potential customers. If the number of customers is only doubled every year there should be 1,000,000 users by the year 2000. There is room for many providers!

Author Information

Florencio I. Utreras is Executive Director of REUNA and Full Professor of Numerical Analysis in the Mathematical Engineering Department of the University of Chile.

Utreras got his Mathematical Engineering degree in 1975 from the University of Chile and his Doctor of Engineering degree in 1979 from the University of Grenoble in France.

Utreras has 7 years of uninterrupted work in the networking area. He first conducted the connection of the University of Chile to BITNET in 1987 and then the connection of REUNA to the Internet in 1992. Its experience include the direction of University computer centers and consulting in the networking field.