



**Revista Electrónica de
Tecnología, Educación y Ciencia**
ISSN: 2953-5654
<http://retec.unsa.edu.ar>
Universidad Nacional de Salta

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Revista Electrónica de Tecnología, Educación y Ciencia,
Volumen 1, Número 2, pág. 1-7, jun, 2024. ISSN: 2953-5654

Disponible en <http://retec.unsa.edu.ar/>

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Abstract: this article describes the experience of an Internet eXchanges Points (IXP) of the Internet Argentine Chamber for Salta city in Argentina. The initiative was taken by the Catholic University of Salta (UCASal) and the Salta government. The work started in 2018. When the infrastructure was put into operation, the focus was set on inviting local providers to join this IXP. That meant joining theoretical and practical knowledge in order to achieve the proposed objectives. From the University environment, transfer activities were presented through talks and workshops using a network simulation environment based on GNS3. The use cases were exposed on that environment. Training was given to network responsible administrators.

Key words: IXP, Routing BGP.

1. Introduction

Historically, our country has had a good international broadband capacity, allowing us to keep international transit prices relatively low. However, the situation in the interior of the country has been somewhat different, since ISPs (Internet Service Providers) far from the fiber optic routes that connect large cities with Buenos Aires, Cordoba, Santa Fe, etc. faced high internal transit costs, generating much higher access costs in smaller and remote cities than in larger cities [1].

Based on the experience of the Buenos Aires IXP, CABASE began to develop initiatives in the interior of the country, in smaller markets. Argentina currently has 32 IXPs in operation [2]. These points allow operators to exchange traffic locally, and at the same time each IXP from the interior of the country is connected to the CABASE central IXP in Buenos Aires. In the CABASE IXPs, the interchange is open, everybody publishes their networks and receives others' networks. Bilateral agreements are allowed between connected members on the NAT creating a crossconnection between them

In 2018, the CABASE IXP was created by initiative of UCASal and the Salta City Government and local internet ecosystem members were invited to participate. This first step prompted local providers to learn how to connect themselves and take advantages of the IXP benefits. That was the reason why, from the university, courses and transfer activities were proposed in order to clarify doubts and to signal technical aspects.

The amount of partners related to Argentine IXPs is more than 500. That number includes organizations of all sizes, including very large and very small operators, content providers, universities and cooperatives.

In each exchange point, the costs related to the administration, maintenance and operation are shared between the participants. Also each member has to pay an extra fixed fee for

enrolment. Governments and university members pay an annual fixed amount, defined by the institution. There are several content providers associated with IPX, such as Google, Akamai, CDNetworks, AFIP, ARSAT, nic.ar, and soon Netflix, Cloudfare, Limelight and Microsoft.

2. Internet Exchange Traffic Points – IXPs

It is pertinent to provide a succinct definition of what a traffic exchange point is. According to CABASE, *"They are spaces where Internet access providers, government agencies, academic entities, large content providers and other players in the Internet ecosystem interconnect with each other to exchange their network traffic in a more efficient way, with the aim of bringing content closer to the end user. By being closer together, the user experience and browsing speed is noticeably improved by reducing content travel time (latency)."* [3].

Taking as a premise the improvement of the user experience and navigation speed, the actions for the creation of the IXP in Salta have been articulated.

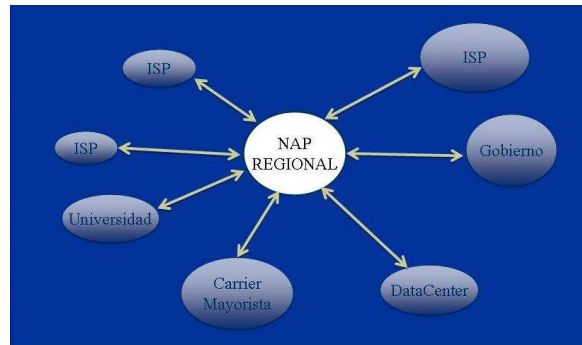


Figure 1: NAP Regional

2.1. What are the IXPs?

When referring to the Internet, we are talking about a variety of independent networks that communicate and connect with each other by means of a common protocol (TCP/IP). If these networks were not interconnected, it would be impossible, for example, for two users located in different parts of the world to exchange information with each other.

Regardless of whether two users belong to two different networks or service providers, the attraction of the Internet is its ability to transmit information to other users. For the Internet to function efficiently as a "network of networks", it is necessary to have an IXP structure that allows interconnecting the traffic that circulates through the networks of different Internet Service Providers (ISPs).

In commercial terms, the Internet is made up of a multiplicity of global, regional and local providers, which basically interrelate in two ways: a) they sell transit services to other operators for the traffic passing through their networks, or b) if they have a similar position and size in the market (they exchange the same amounts of traffic), they enter into peering agreements or voluntary interconnection without payment. These two options can take place directly between

two networks or through an independent exchange point. Broadly speaking and in simplified terms, there are three ways in which the various networks that make up the Internet can operate as one:

- Every network connects to the Internet via a cloud connection, which allows traffic to be passed between users of different networks (option 1).
- If two independent networks are located in the same country or city, then it is convenient in terms of speed and cost to use a direct connection, sending local traffic directly between them (option 2).
- When there are more than two local networks that need to exchange traffic, then it is more efficient to generate an exchange point to which all networks connect, which is called IXP (option 3).

The Internet end user wants to have a positive user experience, with the lowest possible latency and cost. IXPs play a fundamental role in this, allowing information to be routed locally, reducing unnecessary distances to overseas equipment. By routing within the same territory, Internet speed is increased and quality of service is improved.

Then, an IXP works as a confluence center generating that the local traffic of any network goes through a single connection to the exchange point. Without the existence of the IXP, the management and telecommunications costs of direct links between each individual network would be higher, in addition to increasing the number of "nodes" or steps that traffic would have to take to reach another local network, reducing its performance.

2.2. IXPs Advantages (stability y resilience)

Among the main benefits that have been generated with the installation of several IXPs in Argentina under the orbit of CABASE, we can highlight the following:

- Local traffic is routed locally.
- Lower latency for applications.
- Lower costs.
- Possibility of implementing Content Delivery Networks (CDNs, equipments that host content from the most important generators).
- Traffic from one region/country/zone is not seen from other regions/countries, (if required).
- Introduction of new technologies (IPv6, RPKI, etc.).
- Sense of "community". Sharing problems, strategies, common actions. [4]

2.3. IXPs Relevance

- Increased stability and resilience to Internet traffic
 - Improved connectivity, redundancy, stable connections.
 - Facility for installing DNS root servers.
- Security
 - Traffic more controlled, localized, less subject to inspection.
 - Possibility of exchanging incident information.
 - Common actions to mitigate attacks.

- Training and coaching: focused group.
- Introduction of RPKI and IPv6 pilots facility.
- Possibility of research and traffic statistics.
- Internet growth and development in the region [4]

3. Test envirement used

At the time of considering the test scenario to be used, we were faced with the complexity of deploying a topology involving tier 1 and tier 2 ISPs, implementing BGP sessions, and handling more than 800,000 routes that make up the Internet routing table. [5]

All the complexity mentioned above was obtained by using the network simulation software tool GNS3. The test scenario was simulated on a Windows 10 platform with 8Gb of RAM and a 6th generation Intel I7 microprocessor. The first observation we could make was that for an efficient use of processor resources it was necessary to start one by one the simulated devices and not all together, since the processor consumption is too high in the second case.

For the simulation of the edge routers, the Mikrotik Cloud Hosted Router version was used, which is freely distributed, with the limitation of being able to traffic up to 1Mb per interface, which for a simulation does not imply any inconvenience. The simulation of content servers was performed on the Linux version called Tiny, which has as its main feature the minimum consumption of resources, both memory, processor and disk space.

The following is a description of the functionality of each of the devices that are part of the test scenario:

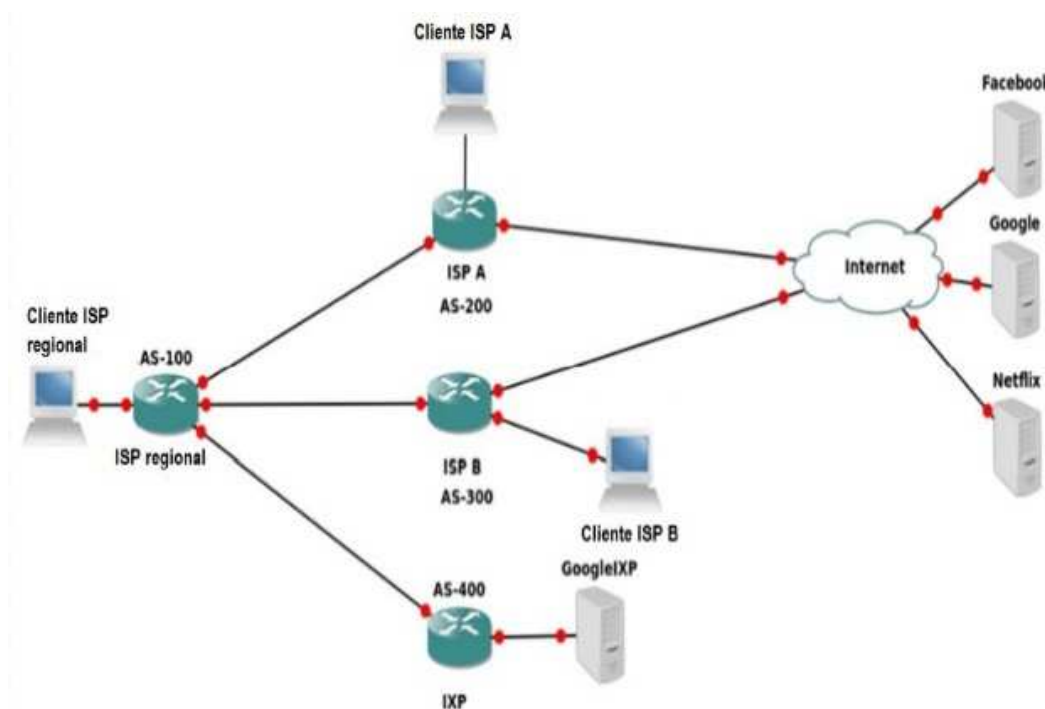


Figure 2: Scenario BGP

Device	Description
AS-XXX	Autonomous System Number
IXP	Exchange point
ISP X	Internet tier 2 provider
ISP regional	Local Internet provider
Facebook	Content server
Google	Content server
Netflix	Content server
Google IXP	Content server connected to a IXP
Nube Internet	Internet tier 1 provider

Figure 3: Device Description

The test scenario was completed with the configuration of the BGP protocol on the edge routers required for: [6].

- Session establishment.
- Route exchange.
- Creation of security filters
- Application of BGP attributes to influence traffic.

4. Results Obtained/Expected

In the proposed scenario the case of improvement in the browsing experience for the Client connected to the regional ISP is exposed, in situations where it requests contents from the Google IXP server, since it deployed such contents in the IXP infrastructure. Likewise, it was possible to test and expose all the aforementioned configurations, where BGP sessions were established between routers, routes were exchanged and through security filters, for example, the Client connected to ISP A could not access the contents deployed on the Google IXP server.

It should be noted that all routing and configuration tests were performed over IPv4, because at the time of the presentation about 30% of the Internet content was not reachable with IPv6, consequently, it is a necessity for Internet providers to continue implementing IPv4 in order to reach this content. However, tests were carried out on IPv6 and the case presented can be transferred to this alternative without any inconvenience.

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