A Deployment Strategy for Internet Exchange Points as Part of a National Broadband Plan

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BIOGRAPHY

Daniel B. Cavalcanti is a career professional with the Brazilian Government, currently at the National Telecommunications Agency, having previously been on assignment at the Ministry of Communications. He also teaches in the areas of telecommunications networks and wireless technologies. Mr. Cavalcanti holds a M.Sc. degree in Electrical Engineering and an advanced diploma in Telecommunications Regulation.

ABSTRACT

In 2010 the Brazilian Government launched its National Broadband Plan, which includes setting up a new fiber optic backbone to provide additional wholesale IP transport capacity nationwide, as well as implementing a number of regulatory measures designed at stimulating competition. One important point of the plan, in the regulatory field, is to substantially increase the number and geographic distribution of Internet Exchange Points (IXP), with an aim of ensuring non-discriminatory access to the existing backbone and backhaul infrastructure by small and medium-sized network service providers. As a result of the study of current interconnection regulations for the fixed and mobile telecommunications networks, and taking into account the present Internet topology in the country and the location of submarine cable landing stations, a strategy for the phased growth of the national IXPs has been established. This work discusses the key points of this strategy and the policy objectives that are sought.

Keywords

Broadband policy, regulation, Internet, exchange points.

INTRODUCTION

In 2010 the Brazilian Government launched its National Broadband Plan (Brasil, 2010a). The plan points to initiatives in a number of areas, including infrastructure and regulation. In the area of infrastructure, the government has decided to set up a new national fiber optic backbone, based on available dark fiber already deployed by government owned companies. The aim of this new backbone is to provide additional wholesale IP transport capacity nationwide. To this end, one important point of the plan is to substantially increase the number and geographic distribution of Internet Exchange Points (IXP), which are physical locations where networks can exchange traffic via peering or purchase transport capacity from transit providers.

As pointed out in an earlier study (Cavalcanti, 2011) the deployment of IXPs stimulates competition in the wholesale IP transport market and ensures a level playing field for IP interconnection, but also carries the positive externalities of improvement in topology and routing efficiency, increased connectivity and reduction in network latency. It must be noted, however, that the utility of an IXP is directly related to the number of networks that are present at that point. Thus, it is essential that incumbent backbone networks are among those present at these IXPs.

Since the utility of an IXP is directly related to the number of networks that are present at that particular exchange point, and given the fact that large backbone network providers tend to interconnect at a very small number of IXPs, there is a clear opportunity for regulatory action to stimulate the implementation of IXPs and to mandate the presence of all major players in the market at these sites.

THE DEPLOYMENT OF NEW INTERNET EXCHANGE POINTS

The recent study by (Bauer, 2010) notes that, by establishing rules for transactions between different facilities and service-based network operators, policies attempt to level the competitive playing field by standardizing important transactions between players and reducing transaction costs. When analyzing the relative efficiency of horizontal (e.g., interconnection) and vertical regulation (e.g., functional or structural separation), the balance seems in favor of horizontal regulation measures. Nonetheless, as pointed out, it is important that safeguards are in place, allowing access to backhaul and interconnection to backbone networks, since vertically integrated network operators have incentives to discriminate and to exclude competitors that are not vertically integrated. Figure 2 illustrates some of the existing vertically integrated backbone networks in Brazil.

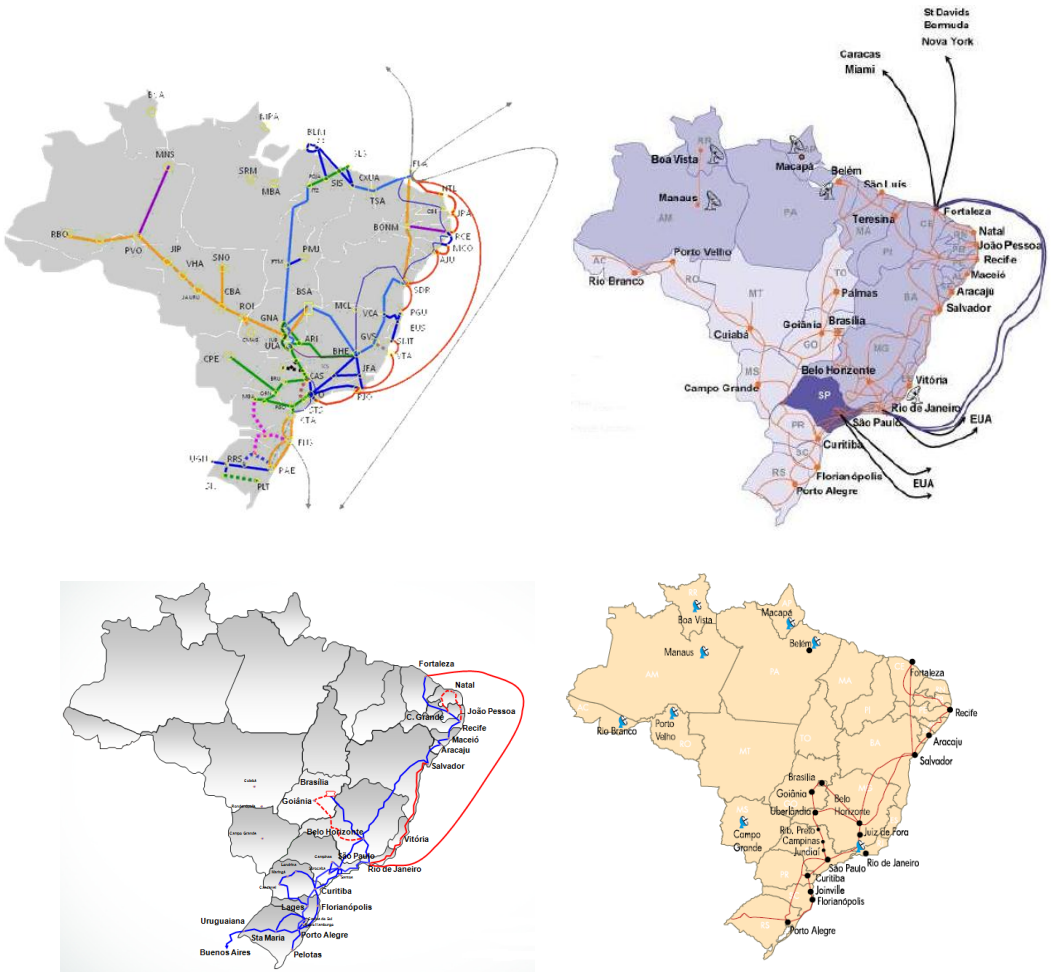

Figure 1. Some of the existing backbone networks in Brazil

One of the key elements of the National Broadband Plan (Brasil, 2010b) is setting up a new fiber optic backbone to provide additional wholesale IP transport capacity, as well as implementing a number of regulatory measures designed at stimulating competition, including a much wider deployment of Internet Exchange Points (IXP).

This new backbone takes advantage of extensive OPGW (*Optical Fiber Protected Overhead Ground Wire*) fiber optic infrastructure already deployed in the country, associated with the electric power transmission grid. Figure 2 illustrates this new backbone that closely matches the topology of the high voltage power transmission grid in Brazil.

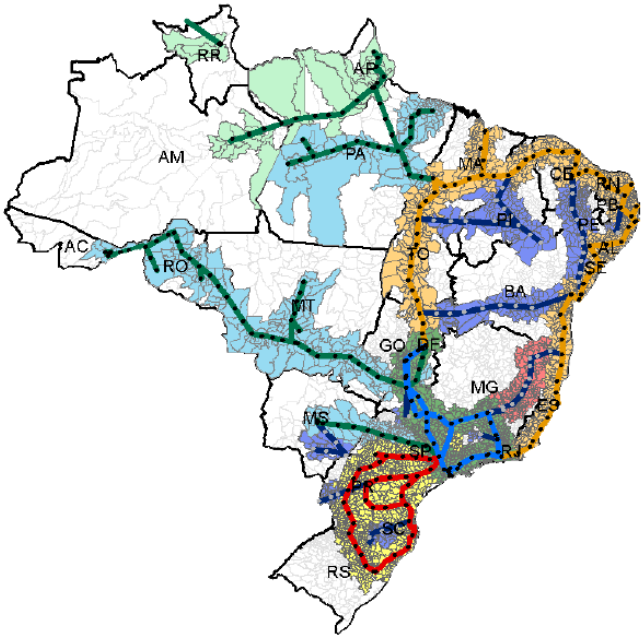

Figure 2. The new fiber optic backbone in Brazil

With the current migration to Next Generation Networks (NGN), incumbents tend to be less interested in reaching neutral interconnection points and will tend to preserve a system that maintains and enhances the asymmetrical condition in their favor. As pointed out by (Marcus and Elixmann, 2008), although both access and interconnection will be implemented using IP, they will not necessarily be implemented using the same points of interconnection.

Given this scenario, the National Broadband Plan provided a unique opportunity to take advantage of the deployment of a new nationwide fiber optic backbone in order to establish regulatory measures that can stimulate competition among players in this new converged IP environment, by selecting key locations for IXPs. Determining the required number and location of these IXPs resulted from the study of current interconnection regulations for the fixed and mobile telecommunications networks, and taking into account the present Internet topology in the country, as well as the location of landing stations of the submarine cables serving the country.

It is thus up to the telecoms regulator to ensure that, in a converged IP environment, a sufficient number of interconnection points do exist. Furthermore, there must be provisions so that they are open and neutral, and that networks are able to interconnect for all types of traffic.

The strategy aims at ensuring that these goals are simultaneously achieved, by making existing major telephony interconnection points coincide with the location of the IXPs in the IP backbone mesh. Figure 3 illustrates the 67 geographical areas in the Brazilian telephony area code numbering plan. This will be the basis for a new proposed regulatory requirement of at least one IXP per area code, and determining mandatory presence at these specific locations for all IP backbone network providers with significant market power (SMP). The requirement will be not only to provide interconnection, peering and transit services - as is already stated in existing regulation - but to provide these services at these specific locations.

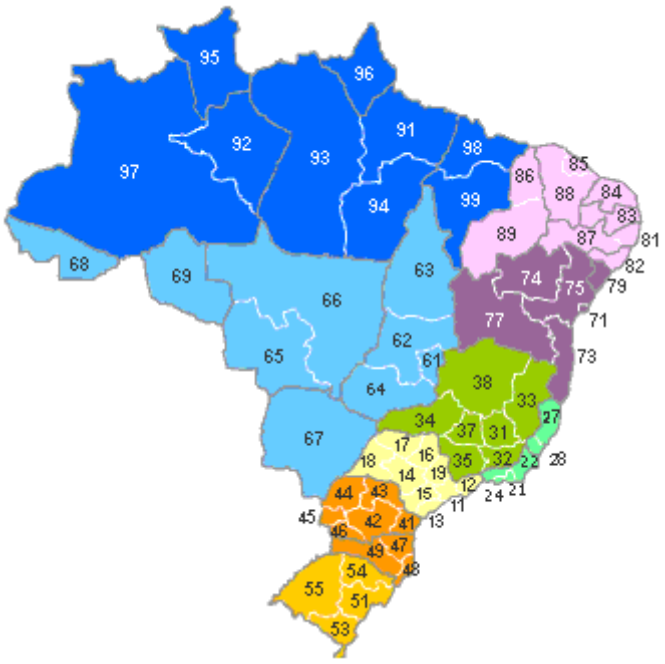

Figure 3. National telephony area codes in Brazil

THE OPERATIONAL SIDE

The Brazilian Internet Steering Committee (CGI.br), which currently operates IXP points of presence (known as PTT – *Pontos de Troca de Tráfego*) in fifteen major cities across the country, has been selected as the neutral operator for the current expansion. CGI.br became a natural choice, given their substantial experience and track record in this area, combined with the fact that they are a multi-stakeholder organization.

Within the next four years, at least fifty-two new Internet Exchange Points will be added to the fifteen existing ones, so as to provide national coverage. All of these IXPs are to be independently operated by the CGI.br. As part of the strategy, a review of the technical and regulatory conditions for their operation has led to new provisions, so as to ensure non-discriminatory traffic exchange through peering (including secondary peering), and the offer of competitive transit services at these locations.

The new IXPs will become operational gradually and based on demand. In a recent survey by CGI.br, in anticipation of the new regulatory requirements, there has been identified immediate demand for at least twenty new IXPs, including, in some cases, more than on IXP within the same geographical area in certain area codes.

The rationale behind the deployment of IXPs is gaining momentum, and the bottom line is that exchanging traffic reduces the costs to end users and increases control over quality of service. Moving from a market where only two options existed - settlement-free peering and paid full transit agreements - to a new environment of easier interconnection will stimulate the emergence of newer types of contracts that will provide efficient options for smaller networks, such as partial transit and secondary peering.

CONCLUSION

Although the most visible initiative in the Brazilian National Broadband Plan is the activation of a new nationwide fiber optic backbone, the plan also includes a key regulatory measure to stimulate competition in the wholesale IP transport market – the extensive deployment of Internet Exchange Points. This policy decision expands on the very successful experience of the Brazilian Internet Steering Committee (CGI.br) of operating IXPs in a relatively small number of major cities in the country. Determining the optimal number and location of these IXPs required taking into account the interconnection regulations for the fixed and mobile telecommunications networks, the Internet topology and the location of landing stations of the submarine cables serving the country. As a result of this study there is a new proposed regulatory requirement of at least one IXP per geographical area in all telephony area codes, and mandatory presence at these specific locations for all IP backbone network providers with significant market power, in order to provide interconnection, peering and transit services at these specific locations.

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