

BROADBAND IN BRAZIL

A MULTIPRONGED PUBLIC SECTOR
APPROACH TO DIGITAL INCLUSION

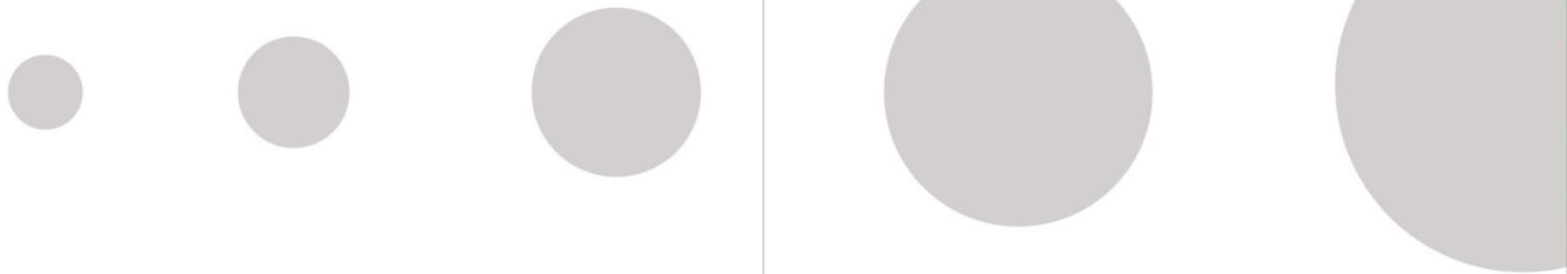


World Bank



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APPROACH TO DIGITAL INCLUSION



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Mike Jensen
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Information for
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Although classed as an emerging economy, Brazil is among the top ten countries worldwide when ranked by total number of broadband users. At the end of 2010 Brazil was in 9th position, with about 15m fixed broadband subscribers, as well as 20m mobile broadband (3G) subscribers. This is not particularly surprising considering that Brazil is the world's fifth most populous nation, but due to the high levels of wealth disparity and the relatively large numbers of poor and rural inhabitants scattered across its vast terrain, broadband penetration in Brazil is lower than in other countries of equivalent income levels (ranked by the World Bank as 57th in the world by GDP/capita - US\$10,710 in 2010).

Regionally, Brazil is slightly above the Latin American average in terms of penetration, but behind Chile, Argentina, and Uruguay. Speed of access follows a similar pattern – Brazil is better than the regional average, but below US or European levels. Likewise, Brazil has relatively good international fibre connectivity, although it is not as well connected as some of its neighbours. Similarly, prices for telecommunication and broadband access are lower than other countries in the region yet still relatively high compared to North America and Europe, especially outside the major cities. Phones, computer and telecommunication equipment costs are also significantly higher, partly due to import duties on IT equipment, further reducing affordability of access among the lower-income groups.

Large variation in access levels: As reflected by the wide variation in income levels, within the country, broadband access is very uneven. At one end of the spectrum there is a high density of access in the industrialised urban areas, mostly in the south east of the country. In these areas, Brazil has recorded some of the world's highest levels of Internet use, and in particular, Brazilians have been early users of social networking services such as Orkut, and now Facebook. At the other end of the spectrum, there are the vast hinterlands of unconnected rural and remote

areas, most particularly in the less wealthy north and west part of the country. For example in the Nordeste, fixed broadband penetration languishes at 1.46%, while it is over 11% in the Sao Paulo region to the south.

The pattern of uneven access also repeats itself at the local level. Most cities have wealthy areas with high levels of domestic broadband access, while close by, in the informal townships (favelas), which house most of the country's poor, there is almost no fixed broadband and residents mostly depend on cybercafes or relatively slow and more expensive 3G connections.

In the last 10 years, the federal government has had little success in disbursing its Universal Service Funds to address the digital divide using, although a variety of state and municipal level initiatives have improved the availability of public access facilities to some extent.

Limited fixed infrastructure: The private sector has invested about USD80bn in telecommunications over the last 12 years, but Brazil's vast size and low population density in the rural areas has resulted in limited national pervasion of telecommunication infrastructure. This presents one of the biggest problems in broadening access to the Internet. The relatively low level of fixed infrastructure, both in the long-haul and in the local loop for DSL-based broadband services is one of the key constraints, and the lack of middle-mile infrastructure necessary to ensure the connection of the 5500+ municipalities to the national backbones probably represents one of the biggest challenges to ensuring equitable broadband access across the country.

Competition in the fixed-line sector is low and fixed line penetration has actually been falling due to mobile subscriber substitution. With the relatively high level of penetration and competition between mobile networks, 3G services are expanding rapidly to fill the demand

for broadband, especially among lower income households. As a result wireless access is likely to be the main growth area for broadband in Brazil, especially now that some of the constraints in access to radio spectrum have recently been addressed.

National broadband initiative launched: In an effort to help to improve coverage and reduce the cost of broadband access, the government has begun a major broadband infrastructure development initiative which has set ambitious targets to triple broadband uptake by 2014. The largest ICT infrastructure project ever carried out in Brazil, called the National Broadband Plan (PNBL¹), it aims to ensure that broadband access is available to low-income households, especially in areas that have so far been poorly served.

In May 2010, when the project was officially announced, it was initially allocated up to R\$1bn (US\$600m) a year until 2014 to ensure broadband reaches the 4000 cities and towns without broadband services, so that at least 40 million homes (or 68% of the population) have access to speeds equal to or greater than 1Mbps, for about USD20 per month.

The new government, under President Dilma Rousseff, has re-affirmed its commitment to the PNBL which was originally developed under the previous President Lula da Silva's administration. To implement the programme, the dormant former state-owned monopoly operator, Telecomunicacoes Brasileiras (Telebras), has been resurrected and given the task, working closely with the national regulator, Anatel, and the Ministry of Communications which has also set up a special secretariat to co-ordinate the PNBL in concert with the government's other digital inclusion programmes.

The initial focus of the PNBL has been to address the deficiencies in the existing telecommunication operator backbones by bringing on the oil and electricity network operators to help fill in the gaps. Local access is now also being addressed through a variety of other measures, such as tax exemptions, reducing broadband license fees, accelerating efforts to make additional radio spectrum available and other incentives to encourage the provision of broadband in rural areas. In May this year (2011), Telebras awarded three operators contracts worth USD43mn to provide transit, wholesale and broadband services in some states.

The Internet sector in Brazil is also supported by a large number of industry, government and civil society groups, both monitoring and promoting access to ICTs. As a result the level of up-to-date information on broadband utilisation is high, and the debate over strategy is widespread.

The resurrection of the old public monopoly operator Telebras to compete with the private sector has not been without controversy, and the extent to which the poorest of the poor get access to broadband remains to be seen. But steadily rising economic prosperity for the less wealthy, along with the flurry of ICT investment made to prepare for the FIFA World Cup in 2014 and the Olympics in 2016, suggests there are much improved prospects wider adoption of broadband in Brazil. The strategies adopted and lessons learned from both public and private initiatives will be valuable for other developing countries planning to promote better access to broadband, and are likely to have special relevance for other large emerging economies, in particular the BRICS countries - Russia, India, China and South Africa.

¹Plano Nacional de Banda Larga <http://www.mc.gov.br/plano-nacional-para-banda-larga>

1. Demographic, Political and Economic Context

Brazil is the fifth most populated and fifth largest country in the world, with over 190 million people and an area of about 8.5 million sq km. Urbanisation levels are relatively high compared to many other emerging economies, and a large majority (84%) live in built-up environments, mostly along the coast. The five largest cities are São Paulo, Rio de Janeiro, Salvador, Belo Horizonte, and the federal capital, Brasília. There are 44 cities of over 500 000 people, and 5,563 municipalities. With almost 30 million people in the rural areas outside municipal services, provision of affordable broadband to this group, which have among the lowest average income levels, presents a particularly severe problem.

Constitutionally, Brazil is a federation of 26 states and the Federal District (Brasília), which can be divided into five regions - the North, North-East, South, South-East, and Centre-West. Each region has its own geography, economic activity,

and culture. Emerging from decades of military rule in 1985, Brazil has since been governed as a democratic republic. The president is elected to a four-year term and each state has a governor and each municipality has a mayor, both being elected directly. Similar to other federal republics, the individual states have a significant degree of financial and policy-making autonomy, resulting in some significant variations public policy support for broadband access.

Brazilians are diverse in origin, with just under half the population being of European descent, while more than 40% are of mixed African and European ancestry. There are an estimated 350,000 to 550,000 indigenous peoples, mainly found in the rain forests of the Amazon River basin. Portuguese is the official language and is nearly universal, while English is widely taught as a second language. None of the other countries in the region speak Portuguese, and the relative

		Unit	Date
Area	8,514,876	Sq. Km.	n/a
Population Density / sq Kms	22	People	2010
Population	190,755,799	People	2010
Annual Population Growth	1	%	2010
Households	67,200,000		2010
Rural Population	29,830,007	People	2010
Urban Population Proportion	84	%	2010
Population of Top 200 Cities	72,409,158	People	2010
Number of cities > 500 000 people	44		2010
Municipal Districts	5,565		2010
GDP (trillion)	2.1	USD	2010
GDP/ capita PPP	11,239	USD	2010
GDP Growth	7.50	%	2010
Unemployment	6.00	%	08/2011
Exchange rate R1	0.6	USD	09/2011

Table 1-1: General statistics
(Source: IBGE 2010 Population Census <http://www.censo21.ibge.gov.br>)

size of the diaspora is very small, resulting in minimal demand for access to Internet content and applications in neighbouring countries or outside the region, and vice-versa, except for the few other Portuguese speaking countries (Angola, Cap Verde, Macau, Mozambique, Portugal and Sao Tome e Principe).

With the progressive macro-economic, social support and education policies of the centre-left administrations of the last decade, Brazil's economy has grown steadily, bolstered by the global demand for commodities and the countries relatively advanced industrial export sector. As a result record numbers of poor have entered middle class, unemployment is at an all-time low (6%), and population growth is down to 1% annually. Official statistics divide Brazilian society into 5 classes, A-E, with E being the poorest. Class C, often called 'the new middle

class' by the media, includes people with an individual monthly income of US\$188-\$815 (R\$300 to \$1,300). The growth of this group is one of the most important trends of the last decade, now representing just over half of the population, and expected to reach 60% by 2014. Part of the increasingly influential BRICS² group of large emerging nations, Brazil is now a net creditor to the US and has over US\$300bn in currency reserves. Since early 2009 the value of the Brazilian currency, the Real (R), has been steadily appreciating against the US dollar, rising from about 0.4 to 0.65 USD in August 2011, and by many benchmarks is amongst the most overvalued currencies in the world. Although its value slid by more than 10% in September 2011, the Real is still seen as overvalued, and as a result, the currency's strength needs to be taken into account when making broadband cost comparisons with other countries.

² Brazil, Russia, India, China and South Africa

2. Broadband Market Dynamics

Brazil's broadband market is serviced by a wide range of access technologies deployed by the network operators. These range from fibre to the home, copper cable-based DSL, broadband over power lines and cable-TV, to a variety of wireless and satellite-based systems, but mainly 2.5/3G, MMDS and WiFi.

Similarly there are substantial variations in the types of broadband providers (fixed, mobile and TV network operators, as well as domestic and internationally based companies), and many do not compete directly with each other due to geographic market segmentation of licensing at the four government levels – national, regional, state, and most recently, municipal.

In addition, the sector is going through major transformation, with the merger of a number of the large fixed and mobile operators, and the recent opening up of the subscription/cable TV market to foreign owned telecom operators. Mobile operator Claro, and fixed operator Embratel, are both now majority owned by the Mexican businessman Carlos Slim, and Telefonica of Spain controls the country's leading mobile carrier by subscribers, Vivo Participacoes, as well as Telesp, the incumbent operator in Sao Paulo state.

This web of technologies, multiple licensing regimes, types of service providers, geographic separation and supplier consolidation has created a highly complex broadband market compared with most other countries.

2.1 National ICT sector management - policy and regulation

The main ICT sector policies are determined at a national level by the Ministry of Communication (known as MiniCom) and regulated by Anatel³, the national telecommunication agency. Anatel is also responsible for regulating satellite capacity provision and administering radio frequency channels for use by both telecommunications service providers and broadcasting companies.

Brazilian telecommunications services do not have a unified legislation, and policy is implemented through

many the fragmented directives that have built up over the years to respond to the evolution of the market. The telecommunications legal regime is defined at a high level in the General Telecommunications Law⁴ (LGT) of 1997 which provides the main guidelines on telecommunication services, universal service goals and the functions of Anatel. The licensing regime includes provisions that if an operator does not provide the services it has agreed to in its license the State can take over its operations, including its existing infrastructure. The LGT is supported by a large number of more specific regulations, the major ones of which are outlined below.

In 1998 the General Grant Plan⁵ (PGO), with a 10-year scope, identified which telecommunication services must be provided as a public service, with consequent price controls, quality of service and universal service obligations. At the time PGO only included voice services, and this did not change in the 2008 updated PGO, however MiniCom has since proposed that it be modified to include broadband services. The 1998 PGO also established the basis for privatisation of the state owned monopoly operator Telebras⁶, and divided Brazil geographically into four major areas, limited cross ownership and the number of players in the market.

In addition, the 1998 PGO also established the basis for a universal service fund known as the Fund for the Universalisation of Telecommunication Services (FUST). An additional fund was also established at the same time, aimed at supporting innovation and capacity building to make the Brazilian telecom sector more competitive, called the Fund for Telecommunications Technological Development (FUNTTEL). There is a third fund, the Telecommunication Inspection Fund (FISTEL), to cover the cost of managing the telecom sector. Revenues for the three funds are gathered from the operators licensed to provide public telecommunication services (i.e not ISPs currently, although this would likely change if broadband becomes defined as a public service under the PGO).

³ Agência Nacional de Telecomunicações

⁴ Lei Geral de Telecomunicações

⁵ Plano Geral de Outorgas

⁶ Of interest is that all telecom services were in private hands until 1972, when they nationalised by the military government

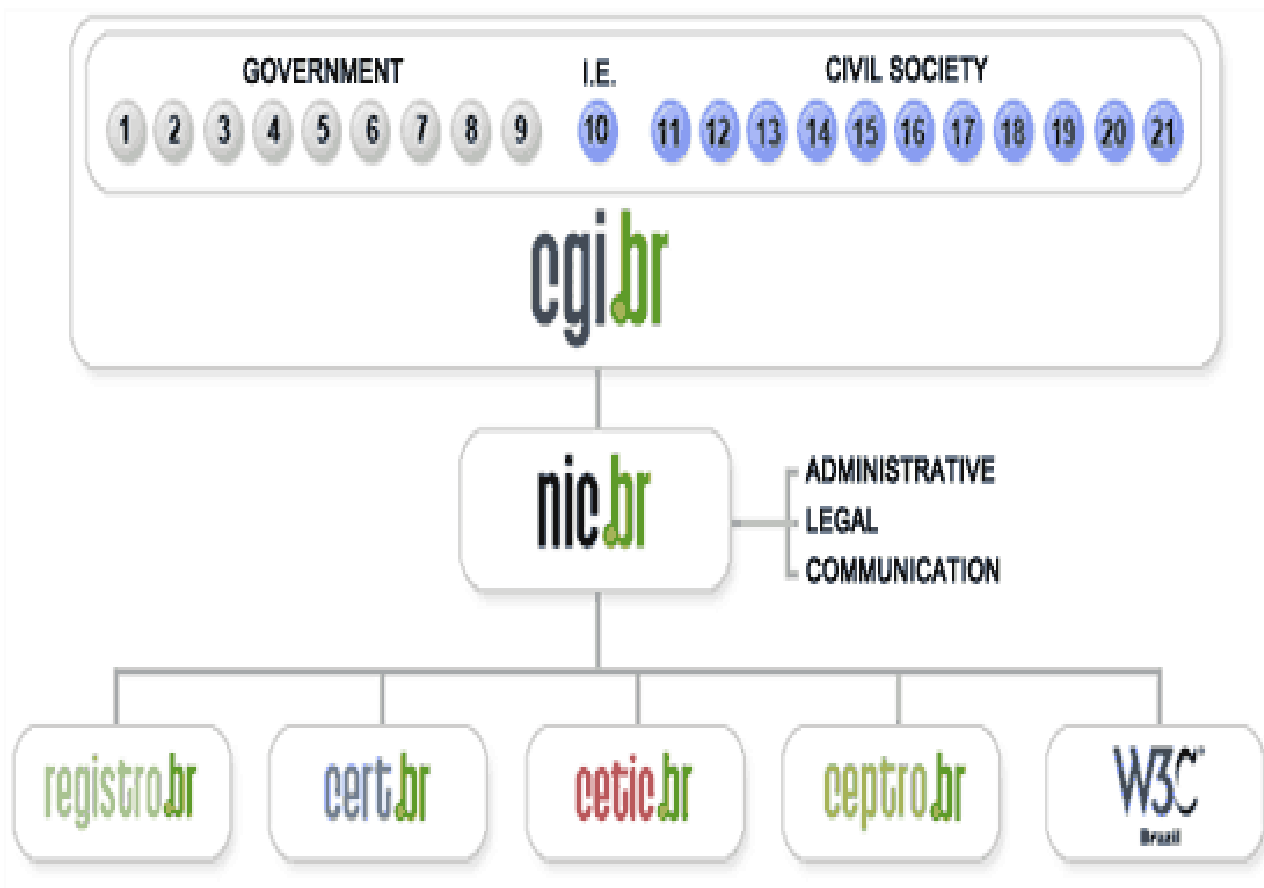


Figure 2-1: CGI.br structure

Universal service objectives (USOs) and obligations are defined in more detail in Anatel's General Plan of Universalization Goals⁷ (PGMU). The PGMU has been updated a number of times, and in September 2010 the PGMU III was adopted, and is expected to cost participating service providers R1.7 billion for the network infrastructure and maintenance costs between 2011 and 2015. While not directly focussed on broadband development, the infrastructure that will be required will naturally be used to support broadband services.

In 2008 Anatel issued the General Update Plan of Brazilian Telecommunications⁸ (PGR) which defined the 10-year strategic vision for the sector and included goals for improving broadband access and establishing mobile virtual network operators (MVNOs). The 1998 PGO restriction which precluded the incumbents from operating in more than one of the authorized regions was also ended at this time.

In August 2009 the Steering Committee for Digital Inclusion Programmes⁹ (CGPID) was established, which laid the groundwork for the National Broadband Plan (PNBL), subsequently announced in May 2010. The PNBL is described in more detail in section 5.

2.1.1 Broadband licensing

Anatel requires a license for all entities that provide broadband access, with the most prevalent licenses being 3G mobile, cable TV and the Multimedia Communication Services¹⁰ (SCM). The latter is the most common public ISP license, allowing service delivery using wireless technologies, and more recently cable technologies, following Anatel's sanction of broadband over power lines (BPL) in 2009.

In addition, the Limited Private Service¹¹ (SLP) permit is available and mainly used by municipalities to provide free access to relevant public information

⁷ Plano Geral de Metas para a Universalização

⁸ Plano Geral de Atualização da Regulamentação das Telecomunicações

⁹ Comitê Gestor do Programa de Inclusão Digital

¹⁰ Serviço de Comunicação Multimídia

¹¹ Serviço Limitado Privada

services (such as for libraries and e-government applications in public spaces). The Private Network Service¹² (SRP) permit is similar, but for corporate entities. The SCM license used to cost R9000 annually (but is being revised – see below), while both the SLP and SRP permits cost R400 per year.

Voice over IP (VoIP) services are permitted, and unlicensed in Brazil, as they do not qualify as a telecommunications service - rather they are seen as value added services that are supported by the underlying telecommunication network.

2.1.2 Radio spectrum

SLP and SRP licensees may use the unlicensed Wifi spectrum in the 2.4 and 5.8Ghz bands. SCM licensees may also use these bands, but they can also operate in the 2.5Ghz band using MMDS type services, which are often used for subscription/cable TV, or sometimes WiMax. Spectrum licenses are required for all frequencies in cities larger than 500 000 people, including the WiFi 2.4 and 5Ghz bands. In towns smaller than 500 000 people, licenses for these bands are not required.

Spectrum licenses are required for Wimax (available in the 2.5, 3.5 and 10.5Ghz wavebands) and for 3G in the 800 and 900Mhz. The auctioning of the (1.9/2.1 Ghz) with mandatory sharing of infrastructure, took place in December 2010 despite some operator protests against the inclusion of Nextel, a new fifth player (the band was only to be available to operators with a mobile voice license). The mobile operators have a total of about 340MHz of spectrum allocated, with the maximum amount available per operator being 85MHz.

2.1.3 Internet governance

Management of key Internet resources, such as domain names, the CERT¹³ and Internet exchange points (IXPs), is carried out by the Brazil Internet Steering Committee¹⁴ (CGI.br) which also monitors the uptake of Internet services and helps guide the development of the Internet in the country. As shown below, CGI.br is structured as a multi-stakeholder group comprising an equal mix of government and civil society representatives appointed by Ministerial decree.

¹² Serviço de Rede Privado

¹³ Computer Emergency Response Team

¹⁴ Comitê Gestor da Internet no Brasil

2.2 The broadband ecosystem

2.2.1 Backbone networks

With Oi/Telemar's purchase of Brazil Telecom in 2008, the group now operates the largest fibre network in the country, as well as one of the main submarine cable networks linking the country to the global backbones. The terrestrial network is about 138,000 kilometres of long distance fibre, 30,400 kilometres of metropolitan fibre and the 22,000 kilometre Globenet submarine cable network links Brazil to Venezuela, Bermuda and the USA. As shown in the map below, an indication of the challenges presented by the vast size of the country combined with the low income and population levels in the northern region is that capital of Amazonas was only connected to the fibre backbone this year, and it was more cost-effective to do this via Venezuela's network.

While not even close to the same scale as Oi's network, the incumbent long distance operator Embratel's network is also among the largest in the country, running from the extreme south to Rio



Figure 2-2: Brazil's submarine cable systems (Source: <http://www.cablemap.info>)

Grande do Sul in the north, totalling about 26,000 kilometres of optic fibre.

Aside from Telebras' recently established national network of about 31,000 kilometres combining the infrastructure of the electricity and fuel distribution operators (see Section 5), the other major backbones are operated by AES/AES Electropaulo Telecom, GVT, Geodex and CEMIG Telecom. AES/AES Electropaulo Telecom has a network of about 4,700 kilometres. GVT (owned by Vivendi) has about 25,000 km of optical fibre, while Geodex (owned by UBS, Deutsche Bank and Meridiana Interprises) has a network of 11,000 km. CEMIGTelecom, which changed its name from Infovias in 2010, offers the largest optical fibre network in the state of Minas Gerais.

Internationally, a number of other submarine cables connect Brazil to the region and to North America and West Africa (Sam-1, SAC, Americas-I, Americas-II and Atlantis-2). There are also plans for a large (12Tbps) cable called SAex to connect Brazil with Angola, which will also give it an alternative route to

Europe and Asia via the west African coastal cable systems.

2.2.2 Alternative/complementary infrastructure operators

The operators and owners of overhead electricity pylons and poles, ducts and rights of way for highways and railways are well known for charging high fees for use of these resources for telecommunication fibre cabling in Brazil. It is not uncommon to find a charge for overhead poles as high as R10 per month per pole, compared to R1 in the USA.

The current situation also favours the incumbent operators, which negotiated long-term contracts decades ago, and there may not be physical space available for new entrants or they are charged much more for the more valuable resource that these rights of way have become.

Considering that much of the new investment in backbone infrastructure is going into the more remote



Figure 2-3: OI/Tele Norte Leste backbone fibre network
(Source: <http://www.globenet.net/PDF/Network-Map.pdf>)

and less population-dense areas, where returns are lower, high costs of access to alternative infrastructure are a significant constraint to more rapid deployment of broadband to the peripheral areas.

There are also a variety of large electrical energy generation and transmission companies operating at either the federal or state level that sell telecommunication services directly, usually via a subsidiary. The largest of these are:

- Eletronet, a joint venture between the parastatal Eletrobrás and AES. The Eletrobrás group has subsidiaries in different provinces - Furnas, Chesf, Eletronorte and Eletrosul, with a total of 16,000 kilometres of optical fibre drawn. The network runs through 18 states, but only reaches the outskirts of large cities. In the least well-served area, northern Brazil, the Eletronorte network is now expanding considerably because of plans to distribute hydroelectric energy to many cities due to the construction of new hydroelectric schemes in Amazonia.
- CEMIGTelecom operates a carrier-to-carrier model using the infrastructure of its parent company, electrical energy provider CEMIG in Minas Gerais.
- Petrobras has an extensive fuel distribution network across the country

2.2.3 Interconnection

There are 16 Internet exchange points (IXPs) in Brazil, which improve performance for customers and applications on different provider networks. The IXPs also save on transit fees for broadband providers, reducing the flow of local data that transits externally. The IXP model in Brazil is independent non-commercial, with NIC.br providing financial and capacity building support for establishing IXPs where needed.

The first IXP in the northern region will be inaugurated this year and their deployment in a number of major cities in other states is also underway.

As to be expected the largest is in Sao Paulo city with 185 members exchanging about 50 Gbps of traffic at peak times, with the remaining IXPs exchanging a total of about 10 Gbps of traffic at peak times.

2.2.4 Broadband providers

2.2.4.1 Fixed broadband

The current extent and future growth of fixed line broadband services is mainly limited by the stagnating market for fixed voice services, although this is being increasingly augmented by deployments of subscription/cable-TV services, spread spectrum/Wi-Fi, fibre to the home (FTTH) and broadband over power lines (BPL).

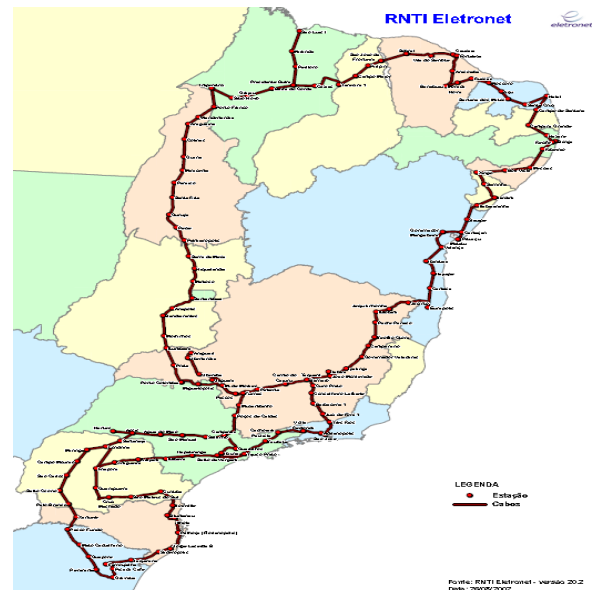


Figure 2-4: Petrobras and Eletronet fibre networks
(Source: ???)

Brazil's fixed-line teledensity is about 23% higher than average for Latin America, but there has been little growth since 2002, partly because fixed line rentals are relatively expensive compared with other countries in the region. The fixed voice market is dominated by three groups which all have substantial foreign ownership - Spain's Telefonica, which owns Telesp (and mobile provider Vivo), Mexico's America Movil, which owns Embratel (and mobile provider Claro) and fixed/mobile provider Oi (Telemar Norte Leste/Telemar), which is owned by Brazilian investors and Portugal Telecom. The market leaders are the two incumbents Oi and Telesp, with 48% and 27% respectively of the fixed lines. Two other companies, the long-distance incumbent Embratel, and Vivendi's GVT, have gained an increasing share of the market with 18% and 5% respectively.

Although there are about 2,700 companies that provide fixed broadband services in Brazil, the five largest hold about 95% of the market, mainly consisting of the incumbent voice operators. According to the government's Institute for Applied Economic Research (IPEA), in June 2011 Oi was the largest broadband provider, with about 36% of the broadband market, followed by NET Servicos (Embratel) with 26%, Telefónica Brazil with 24%, and GVT with 8%.

Until the arrival of Telebras (see below) there has been little structural wholesale/retail separation in the market and the 1,600 small ISPs largely resell (and compete with) capacity from the larger telecom operators.

The principal operators in Brazil's cable/subscription

TV market are Net Servicos, Sky Brasil, Embratel, Telesp, and Oi TV. Net Servicos is the largest multi-service cable provider in Latin America, and is controlled by local media group Globo, although long-distance fixed-line incumbent Embratel owns a majority of the company's stock. Sky Brasil, the largest High Definition satellite TV operator, is controlled by DirecTV, with Globo as a minority shareholder. Independently of Net Servicos, Embratel provides satellite TV services.

All of these companies provide TV/broadband double-play packages, except for Sky, which has a partnership with GVT for broadband services. However Sky will soon enter the broadband market as it is now in the process of establishing one of the first deployments in the world of TD-LTE technology, following its purchase of 2.5Ghz spectrum.

Fibre to the home (FTTH) is now beginning to take off in Brazil's major cities, seeing much increased investment over the last two years. Telefonica Brasil is among the largest providers of FTTH services and is planning to extend its network coverage, initially focussing on Sao Paulo state. Backed by Telefonica of Spain, the group already has fibre coverage of a potential 400,000 households, of which 20,000 are currently signed up to its services. By the end of 2011 it plans to increase coverage to about one million households and boost the actual subscriber base to 70,000, with a long term plan to have one million fibre customers by 2015.

Intelig, a subsidiary of TIM Brasil (owned by Telecom Italia), has recently launched broadband and fixed telephony services using broadband over powerline

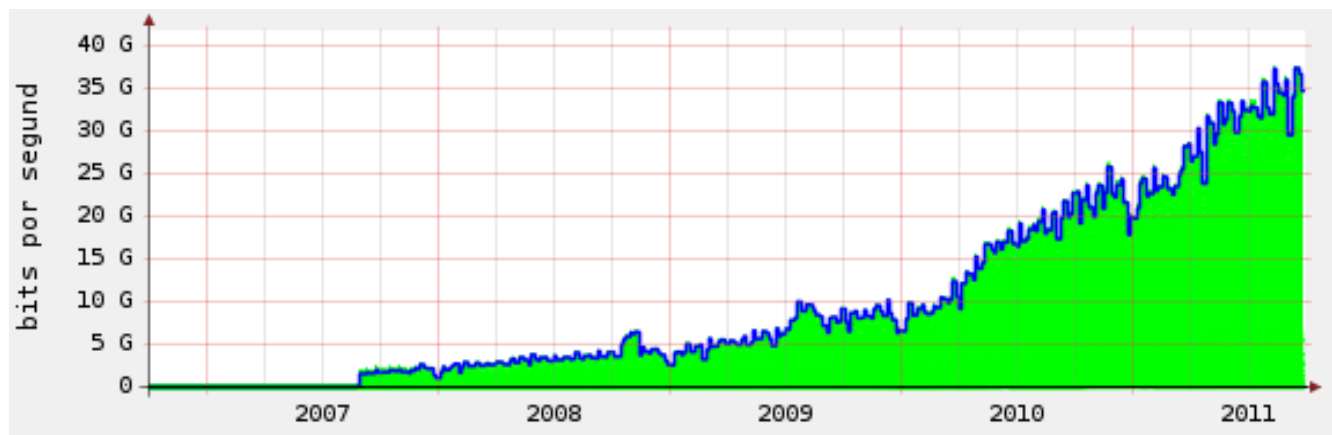


Figure 2-5: Growth in average traffic exchanged on Brazil's IXPs
(Source: ????)

Technology	Users (1000s)
xDSL	10222
Cable Modem	4121
Ethernet	794
Spread Spectrum/Wifi	647
ATM	383
Fibre	185
HFC	151
Satellite	40
FR	24
FWA	23
WIMAX	19
MMDS	10
BPL/PLC	0
Total	16619

Table 2-1: Broadband users by type of technology, 1000s, February 2011 (Source: Anatel)

(BPL) technology in selected areas of Sao Paulo city, provided over the infrastructure of local power utility Eletropaulo.

Triple-play bundles (voice, Internet and IPTV) and quad-play bundles (plus mobile) are becoming increasingly available, following recent consolidation of fixed, mobile and subscription-TV providers. The triple-play leaders in this area are GVT in partnership with Sky, and TVA (owned by the Abril Group and Telefónica), while Oi launched the first, and so far only, quad-play service in the country in 2008.

2.2.4.2 Mobile broadband

There are seven GSM operators in Brazil – Vivo, Claro, TIM, Brasil Telecom, Oi, Sercomtel and CTBC (now Algar Telecommunications). By August 2011 they had rolled out 3G services in 28% (1,588) of the 5,565 municipal areas, which covers about 144 million people, or 76% of the total population. Vivo is the dominant player in terms of numbers of subscribers and also in terms of coverage - it is present in over

Speed	0-512Kbps	512Kbps-2Mbps	2Mbps-12Mbps	12Mbps-34Mbps	> 34Mbps	Total
Subscribers	2977	6961	4215	1972	496	16621

Table 2-2: Fixed broadband subscribers by speed of access, 1000s, February 2011 (Source: Anatel)

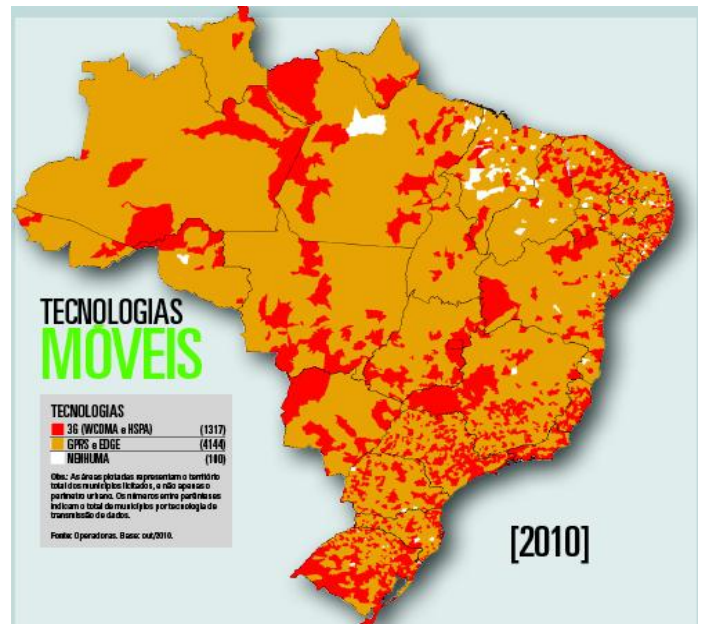


Figure 2-6: Mobile coverage in Brazil (Source: <http://www.teletime.com.br>)

1,500 municipal areas, while it's nearest rival, Claro, is present in only about 500 so far.

Having heavily invested in new 3G spectrum (a total of R2.7 billion was realised in the H band auction in December 2010), the mobile operators are now rapidly expanding their 3G networks, which should cover at least 2,000 municipalities by 2012. In the H band auction a new operator, Nextel, acquired frequency in virtually all of Brazil and will soon become a new specialised 3G competitor in the market.

The government is looking to ensure that 4G/LTE networks are in place in time for the FIFA World Cup in 2014, and it has already identified about R200 million worth of investments to encourage this. Bidding for 4G mobile network licenses is scheduled for April 2012.

2.2.4.3 Satellite

Because of the remoteness of many areas in Brazil,

the country has an extensive satellite sector. Three companies operate national satellites: Star One, Telesat Brasil, and Hispamar. Star One was the first to provide satellite services, and is the market leader. Star One C3, scheduled for launch in 2012, will cover all of South America including Brazilian territorial waters. The launch of Telstar 14R (known as Estrela do Sul 2 in Brazil), was launched in mid-2011 and covers the whole Brazilian territory as well as delivering services to the rest the Americas.

2.2.5 Access devices

PCs and laptops are also becoming more widely present in households, although smartphones are now the dominant consumer broadband access device in Brazil. In total it is estimated that there are 60 million PCs and laptops in use in Brazil, rising to 100 million by 2012. However not all of these are connected to the Internet and many are in businesses or large households which share the Internet connection.

In contrast, there is a closer match between the number of 3G phones and the number of 3G broadband subscribers, although again the match is not 1:1. In a field survey, Grupo Mobi estimated in February 2011 that there were 19 million smartphones in Brazil; this is also higher than the number of 3G subscribers due to the large number of subscribers with multiple phones, and many using smart phones on 2/2.5G subscriptions. The survey found that 41% of their sample of mobile phone users in general, and 83% of the smartphone users used their phone to go online.

The federal government has a long history of support for local industry to develop low cost access devices. In 2000 strong efforts were made to establish reference models for low-cost open-source based PC manufacture. As a result Linux is widely available as an option on locally made desktop and laptops from the major white-goods chain stores and other outlets. In 2010 it was estimated that about 14 million, mostly locally made computers, had been sold in Brazil, often on instalment plans provided by the major retailers.

Recent plans to provide tax incentives to promote the local manufacture of low-cost tablet devices echo these earlier efforts, and have attracted Taiwanese computer manufacturer, Foxconn Technology, to produce Apple's iPad tablet in the city of Jundiá in Sao Paulo state. In addition Motorola, Samsung and Asus have also expressed interest in producing tablets locally.

2.2.6 Public access facilities

Internet cafes, or *LAN-bouses*, as they are commonly called in Brazil, are widely used throughout the country and are present in virtually every community, either to serve the youth in the richer areas, or to serve the general population in the poorer areas. Privately run, usually by small businesses (90% of which are informal), the Cetic.br¹⁵ estimated in 2010 that there were about 100,000 in the country, serving 30-35 million people. This is a slight decline on previous years, most probably because of the increased penetration of broadband in homes and on mobiles.

Provision of public access facilities for those who cannot afford their own equipment and connections has also long been part of the Brazilian government's digital inclusion strategies. The largest of these is government parastatal Serpro's¹⁶ digital inclusion programme (PSID¹⁷) which has rolled out over 8,000 telecentres, providing free access in 98% of municipalities. Part of Serpro's remit is to facilitate citizens' relations with the government, including the development of e-government applications and under this responsibility the PSID was launched in 2003. The programme includes donation of computers to public and civil society institutions.

Serpro is now developing a new programme with the Ministry of Agricultural Development which will support integrated management of telecentres, called the Brasil Digital Network¹⁸ which will be used to support the digital inclusion initiatives of both institutions. The proposal is to form a central database with information from a variety of digital inclusion initiatives in order to generate inputs for the implementation of government policies.

In addition to a tool kit for the management of the telecentres, the Brasil Digital Network provides the coordination of a digital inclusion panel with information necessary for decision making. The data are presented in reports and graphs, as well as geo-referencing. So there is a mechanism for monitoring

¹⁵ Center for Studies on Information and Communication Technologies

¹⁶ Formed in 1964 to modernise the strategic sectors of the Brazilian Public Administration, Serpro is one of Brazil's largest public companies, responsible to the Ministry of Finance.

¹⁷ Programa Serpro de Inclusão Digital
<http://www.serpro.gov.br/inclusao/oprograma>

¹⁸ Rede Brasil Digital <http://www.serpro.gov.br/inclusao/rede-brasil-digital/> <http://www.serpro.gov.br/inclusao/rede-brasil-digital/>

and tracking of benefits to the population and the variables that hamper the smooth operation of telecentres in Brazil.

Serpro's PSID is also collaborating with the government's Casa (House) Brazil project¹⁹, Broadband in Schools²⁰ and One Laptop per Student programmes²¹.

Casa Brazil is a similar but much smaller project, also established in 2003. Working in poor communities, the project provides computers and connectivity to communities, focusing mainly on use of open source technologies to promote culture, art, entertainment, popular participation and community liaison. A Casa Brazil typically has a telecentre, a reading room, an auditorium and several laboratories and workshops where use of digital technologies can be made. About 100 units have so far been established with support from the Ministry of Science and Technology, in partnership with other government agencies, the private sector and municipalities.

Banco Brazil and other large businesses are also donating computers to public access programmes such as the above to support digital inclusion efforts.

2.2.7 Content and applications

With a large population and advanced electronic and print media market, along with the relatively high number of wealthy people, Brazil's local online content market is well-developed. This has been encouraged by the lack of Portuguese content elsewhere (except to a certain extent in Portugal), the popularity of local social networking, and the substantial efforts by government to provide services online.

In addition, e-commerce services for consumers are widespread, partly due to the relatively high proportion of the population that have bank accounts and credit cards²². It is expected that e-commerce will have a turnover of US\$18.7 billion at the end of 2011, representing an increase of around 26% compared to 2010. By the end of 2011 it is expected that about 32 million people will have made at least one purchase online.

¹⁹ <http://www.casabrasil.gov.br>

²⁰ Banda Larga nas Escolas

²¹ Um Computador por Aluno

²² The reasons for this date back to the years of hyper inflation in the previous century, where funds kept in bank accounts were index linked to maintain their value.

Another indication of trends in Brazilian applications and content is that Google Brazil's revenues grew 80% in the last year, bringing in close to US\$500 million.

2.3 Patterns of broadband utilization

As of mid-2011 there were an estimated 43 million broadband subscribers in Brazil, representing a penetration rate of about 23% of the population. With about 74 million Internet users in the country, this brings the proportion of broadband subscribers to about 60%.

The rate of broadband uptake also appears to be accelerating fast - new activations hit a record in the month of August 2011 when there were 2.2 million additions, compared to the average of about 1 million a month between July 2010 and July 2011. As a whole, broadband subscriber growth over the last year was about 60%. In the last year 3G broadband overtook fixed broadband subscriptions. Telebrasil's August 2011 assessment indicates that fixed broadband grew by 25% in August 2011, while mobile broadband had a growth rate of 87%. Other features of broadband uptake in Brazil include:

About 27.4% of households had Internet access of some form in 2009 according to IBGE's National Household survey, while 12% of households had broadband access in 2010, estimates IPEA.

Regional variations in access to broadband are large, mainly reflecting the pattern of income levels and population densities. About 80% of broadband users are concentrated in the Southeast, while the Northeast and Midwest have 9% each, and the North, only 2%. Subscription/Cable TV had about 11.1 million subscribers in mid-2011, representing a growth of 31.8% over the last 12 months.

A number of projections have been made on the future levels of broadband uptake. These include:

Mobile chip manufacturer QUALCOMM estimates that there are likely to be over 107 million 3G subscribers in Brazil by 2014.

Telecom industry group SindiBrasil estimates that if investments of about R145 billion are made in network infrastructure and services, broadband penetration could reach 78 million subscribers in 2014 and 153.6 million in 2020. If no action to encourage

Fixed line subscribers	42.0	million
Mobile Subscribers	224.0	million
Fixed Broadband Subscribers	15.2	million
3G Phone Users	22.8	million
3G Modems/Data Terminals	5.6	million
Total 3G users	28.4	million
Total 3G + Fixed Broadband subscribers	43.61	million
Broadband penetration	23	%
Internet users	74	million
Broadband users as % of total Internet users	59	%
Municipal Districts with 3G	1594	
Average 3G speed	769	Kbps
Broadband subscriber growth Aug 2010-Aug 2011	60	%
Subscription/Cable TV Subscribers	11.1	million
Cable TV broadband subscribers (Q4 2010)	3.7	million
Computers in use	60	million

Table 2-3: Key features of the broadband market in Brazil
(Source: Anatel, Teleco) Note: Data are for end of Q2 2011 unless otherwise stated.

public or private investment takes place, this expansion would be limited to 57.3 million in 2014 and 93.2 million in 2020.

The IPEA estimates that if the price for broadband is reduced to the PNBL target of R35/month (see

next section), the number of households connected would rise to 35 million (52% of total households).

Brazil also has had an extensive 'Broadband in Schools' program which has resulted in about 84% of Brazilian students having access to free broadband in urban public schools.

3. The PNBL

Beginning with the PGR in 2008, the Federal and State governments have adopted extensive and wide ranging strategies for supporting improved access to broadband. These efforts emerged from earlier efforts to promote the uptake of ICTs more generally in Brazil, prior to the advent of 'broadband Internet'.

The first systematic effort by the Government took place in 2000 when the then President Henrique Cardoso issued a decree to establish the Secretariat for Logistics and Information Technology in the Ministry of Planning, Budget and Management (SLTI/MP), as the lead agency for developing and implementing Brazil's 'e-strategy'. SLTI/MP served as the secretariat for an inter-agency committee chaired by the President's Civilian Chief of Staff²³ - the Executive Committee on e-Government, to which a number of inter-agency technical groups reported.

ICT development at the Federal level continued during the first administration of President Lula da Silva (2003-2006), and some progress was made in digital inclusion, with the development of an interoperability framework and other aspects of e-applications development. E-strategies also advanced at lower levels of the federal system, albeit unevenly in the 26 states and the Federal District, as described further below.

Developed by the Lula government in 2010, the culmination of earlier efforts toward digital inclusion is the PNBL (*Programa Nacional de Banda Larga*, National Broadband Program), which, after about a year of preparation, marked its first deployment in August 2011. The five key objectives of the PNBL are to:

- Broaden access to broadband-based Internet services
- Accelerate economic and social development
- Promote digital inclusion
- Reduce social and regional inequalities
- Promote job creation and income

To implement the programme, the dormant former state-owned monopoly operator, Telecomunicacoes Brasileiras (Telebras), was revived and given the task, working closely with the national regulator, Anatel, and the Ministry of Communications. Telebras has

also been made responsible for ensuring that connectivity is provided for some of the 2014 World Cup stadiums.

The government owns 89.88% of Telebras shares with voting rights, and 72.67% of the share capital. In June 2011 it was announced that additional private investment in Telebras can be made, but that government would still maintain control. Telebras' business model envisions it to be cash flow positive by its 2nd year.

Aiming to cover 40 million households or 68% of the population by 2014, Telebras core activity will be to act as a 'wholesale' operator, providing infrastructure and network capacity for the broadband providers, as well as the administrations of the federal government, the states and Federal District, municipalities and non-profit organizations such as universities, schools, hospitals, community telecentres and other points of public interest. The deployment of a national fibre network which will eventually reach 3,045 municipalities without access to fibre.

In essence the overarching strategy with the revival of Telebras has been to create a public broadband operator that will compete with the private operators in order to lower prices and improve service levels. The government's view is that the private broadband providers are not competing effectively and therefore charging too much and giving poor service. MiniCom cites as evidence for this the fact that average broadband prices have already dropped by 50% since the announcement of the PNBL strategy, even prior to any actual roll-out of services.

Not unexpectedly, the larger providers have criticised the entry of a state funded entity into their market arguing instead that the government's role should be restricted to stimulating demand, such as through provision of improved online services and perhaps subsidising users. Nevertheless some of the larger providers have signed agreements with Telebras, and a large number of the smaller operators have approached Telebras, seeing the opportunity to break the control of the larger operators on the market.

The service is expected to be particularly useful to small broadband providers operating in the smaller towns and more remote areas that have not been reached effectively by the large operators. So far about 600 broadband providers have registered their

²³ Ministro da Casa Civil

interest on the Telebras web site, with 1000 registrations expected by the end of the year.

The other key actions being taken by Telebras and the government agencies to achieve the PNBL objectives above are:

- The establishment of a broadband price/performance target of R35 per month for a 1Mbps connection
- The provision of broadband services directly to consumers where other operators are not present or providing inadequate services
- Provision of soft loans to small broadband providers to expand their services²⁴
- Freeing up additional radio spectrum for use in broadband provision
- Tax exemptions for equipment and providers meeting local manufacturing or performance objectives

The PNBL also aims to support the development of the Brazilian ICT equipment and related services industry, which is seeing strong international competition especially from China. Telebras is able to give preferential treatment to Brazilian firms by allowing Telebras' procurement process to select local companies even if the cost is higher than the bids of foreign companies.

A consortium was formed in July 2011 to promote the development of local Brazilian ICT equipment sector, called GENTE²⁵, which consists of companies that each invest more than R150 million of their sales in R&D (about 20%). This includes Gigacom, CPQD, ASGA, WXBR, Trópico, Icatel, Parks, Digital e Datacom and PadTec. Padtec recently won Telebras' R68 million tender for hardware to support the PNBL rollout. The company is a subsidiary of the Centre for Research and Development in Telecommunications (CPqD), a private foundation that was the technology arm of Telebras prior to its dissolution following privatization of the telephone sector. Telebras still holds a 65.7% stake in Padtec.

The scope of the PNBL may widen further if the PNBL adopts the September 2011 recommendations of the IPEA. The IPEA proposes a series of measures to address those at the bottom of the pyramid who

cannot even afford the R35/month target price for broadband. These include extending tax breaks to mobile phones and television sets, more public support for additional public access/telecentre facilities, and offering prepaid plans and fractional prices (weekly rates for example).

The key elements of the envisaged activities outlined above, along with other related government initiatives are described in more detail below.

3.1 Price and performance targets

The R35/month target was determined by field research which indicated that the 70% of the Brazilians that are still offline would be willing to pay this amount for the connection. As mentioned above however, the September 2011 IPEA indicates that even this price is still too high to be affordable by the poorest segment of the population. In addition the R35/month target does not include the cost of the subscriber equipment, and this could also be a significant barrier to entry unless bundled into long-term contracts.

The initial speed target is perhaps the more difficult component to derive, since 'broadband' is such a rapidly evolving area²⁶, and in fact the initial speed target for the PNBL was 512Kbps, but this was subsequently increased to 1Mbps shortly after the Rousseff government took over. Operators using the Telebras network are initially required to provide a minimum of 20% of the target speed of 1Mbps.

The government is also planning to ensure the speed of offerings of all broadband connections in the country is guaranteed. Currently most broadband users receive considerably less capacity than advertised. As a result Anatel has proposed that providers with more than 50,000 customers will have to deliver to users at least 60% of average contracted plans. The rule also provides for raising the requirement to 70% in 12 months, and 80% after the following year.

Efforts are also being made to monitor and benchmark the quality of available broadband services. In mid-2011 Anatel proposed the establishment of a broadband speed test service which would be available to subscribers directly, and the test is now available on the NIC.br web site. However Sinditelebras, the national lobby group of

²⁴ Lines of credit have been made available by the National Development Bank (BNDES) with interest rates of 1% per month and no collateral requirements.

²⁵ Grupo de Empresas Nacionais de Tecnologia

²⁶ It may be recalled that the maximum speed only a decade ago was 56Kbps dialup or GPRS was the standard

telecom operators and service providers, has objected to using this as a benchmark because it believes that the variable capacity of the end-user access devices²⁷ will distort the test and make it unreliable in providing an accurate assessment of broadband quality. Sindibrasil has made an alternative proposal that the ISPs should provide speed measurements directly.

Although Telebras' speed target is expected to rise to 5Mbps by 2014, a major limitation currently is the total traffic download limits allowed by Telebras. This is only 300Mbytes/month for fixed links and 150Mbytes for mobile links (after which users will be responsible for paying additional usage fees). This places a major restriction on the extent of use for the fixed fee of R35, especially as speeds increase. For example, this would only allow a download of one 45minute video²⁸ per month. As a result this aspect of the PNBL strategy has come under criticism from civil society groups and a number of the broadband providers who have indicated that this will limit their interest in using the Telebras network, pointing out that many of their low-end packages already offer better value. For example GVT's basic service is 5Mbps for R49 per month and NET offers a triple-play package in Sao Paulo, including 1Mbps internet for R29.80 per month, taking advantage of the VAT exemption.

At the wholesale level, Telebras is selling dedicated capacity on its network for R230/Mbps/month, which is currently about half the available price from the commercial providers. This is a significant decrease and will no-doubt put downward pressure on the wholesale market, and should therefore be good value for the small providers. However some have observed that combined with the minimum price/performance stipulations the economics of the offering do not yet make business sense. They point out that with the 20% minimum performance target this means only 5 subscribers can share the 1Mbps upstream capacity purchased, thereby only generating a revenue of R175/month (R35/month/subscriber).

3.2 Coverage targets

As indicated above the primary target is to ensure that 40 million households or 68% of the population are able to access broadband by 2014.

²⁷ Such as CPU speed, memory, viruses, botnets, downloads running in background etc

²⁸ Using a rough estimate of 600Mb for a 90minute video in a standard compression format such as the AVI codec

In May 2010, the first 100 under-served cities were identified and the availability of PNBL services from Telebras' wholesale facility announced. With a combined population of 14 million, most of the cities are in the Northeast (58) and Southeast (30). The states with the most cities listed are Bahia, Minas Gerais and Rio de Janeiro, with eight listed in each.

By the end of 2011 at least 300 cities should be covered. These have been selected as those at the bottom of the Human Development Index (HDI) and in states that have exemption from sales tax.

3.3 Backhaul/backbone network development

To establish its national backbone fibre network, Telebras is leasing capacity from traditional and alternative infrastructure fibre operators (mainly the energy distribution parastatals). So far it has established a fibre network of about 35 000kms, having reached agreement with Eletronet and Petrobras.

Telebras is in the process of making similar arrangements with other wholesale fibre operators, such as electrical energy distribution group CEMIGTelecom in the state of Minas Gerais.

3.4 Promoting increased broadband competition

In July 2011 Anatel approved rules to increase competition in the telecom sector with the introduction of the General Plan for Competition²⁹ (PGMC) which applies only to the large telecommunication and subscription/cable TV companies with Significant Market Power (SMP). The regulation allows Anatel to compel the operators to share network infrastructure with smaller players who must be offered lower wholesale prices than the SMPs offer at the retail level. In the area of subscription TV, users would be allowed to purchase their own decoders at retail prices. A form of local loop unbundling is also being considered that would allow any provider to sell services on the last mile if the operator that installed it is not providing services. In addition broadband providers will also will be required to implement 51 new internet exchange points IXPs.

²⁹ Plano Geral de Metas e Competições

The PGMC also aims to create three organizations funded by the operators. One will compare the offers from retail services to give more transparency to the consumer and pinpoint the best options for them. Another will provide a representative forum for operators without significant market power, and a supervisory body will be create a centralized database of wholesale offers and to promote conflict resolution between operators.

Finally, operators are expected to provide a range of backhaul capacities, depending on the city size – 32 Mbps (for municipalities of up to 20 000 inhabitants), 64 Mbps (for 40,000 inhabitants), 128 Mbps (60,000) and 256 Mbps (over 60 000 inhabitants). Where there is capacity available companies will have 60 days to install the link.

In August 2011 Anatel announced proposed revisions to the SCM license (the main broadband service provision license), which aimed to make it easier for small providers to enter the broadband market. The main changes are to relax the criteria for evaluating the credentials of the licence applicant and to create new licenses with smaller geographic scope – state and municipal level licenses. Previously there was only the national licence costing R9000 per year, the price of which remains unchanged, while the annual fees of the new licenses are R1200 for a state license and R400 for a municipal license.

Other planned changes include:

- Companies without SCM licenses would be able to partner with an existing SCM license holder to provide niche services such as broadband-based home security systems
- The individual costs of bundled services (such as broadband with IPTV or voice telephony) are to be made explicit and operators required to allow any part of the service bundle to be cancelled by the subscriber
- Above the 50 000 subscriber threshold the quality of the provider's service will be regulated and increased time limits imposed on subscriber data retention³⁰.
- The concept of net neutrality would be upheld, whereby providers are not allowed to limit the speed of any of the data passing to the subscriber

³⁰ Currently only about 13 SCM licensees have more than 50 000 subscribers.

3.5 Use of satellite

A network of free broadband services via satellite, known as the GESAC Program, has been incorporated as part of the national broadband strategy. In November 2010 new contracts were signed between MiniCom and a private satellite operator to expand the number of ground stations in schools, community telecenters and other public or community entities in areas not served by other broadband services. The number of ground stations will be expanded by 1,460 to a total of 13,379, operating at speeds between 512 kb/s and 2 Mb/s.

In addition, the auction of four satellite positions for private use took place in September 2011, should reinforce the availability of satellite capacity for remote areas by 2014. In the same month broadband provider Ozônio Telecomunicações announced it planned to invest US\$1.2bn in a satellite based internet service for the Amazonas, using the O3b satellite network which is to be launched in 2013. IPEA has also proposed that the feasibility of a national satellite to complement PNBL be examined.

3.6 Extension of mobile services to remote areas

Another strategy that is being discussed by Anatel to support the PNBL is to improve mobile network coverage in the more remote and rural areas that are currently under-served. The two options under consideration are either to provide some type of subsidy to encourage the existing operators to extend their networks, or to establish a shared wireless infrastructure managed by a third party which would lease services to the existing operators.

3.7 Universal service

This year (2011) Anatel has been conducting a 5-year review of voice telephony (PSTN) licenses, the concessions for which expire in 2025. This includes reviewing the licensees' universal service objectives to ensure they are in line with updated requirements for meeting outstanding connection needs in remote and rural locations³¹. In May 2011, Anatel held a series of public consultations on the license review which culminated in new USO proposals. Supporting the objectives of the PNBL, they included expansion of

³¹ 1,894 police stations and federal and state roads, 82,301 rural schools, 7,945 settlements, 10,989 health posts, 2,224 Indian villages, 824 maroon communities, 741 public airfields, 300 conservation and sustainable use offices and 1620 military camps.

the fixed telephony network to support broadband services by ensuring a minimum transmission capacity of 2.5 Gbps to all municipalities with more than 30 000 inhabitants. In addition the proposals, if adopted, will allow operators to apply their license renewal fees directly toward universal service projects.

3.8 Content and applications

Demand for local government services is to be supported by the PNBL with Federal government plans to establish a cloud services platform for use by municipalities. This strategy has also generated some controversy among some members of the private sector which have said the provision of application services should be left to the private sector, as with broadband service provision.

3.9 Radio spectrum liberation

Anatel is accelerating the process of making more radio spectrum available for broadband, and a number of spectrum bands have already been released. With its long-distance transmission characteristics, the 450Mhz band has been opened for rural communications, previously held by a number of state agencies. In the 3.5Ghz band Anatel also expects to allocate a specific segment for the PNBL. The availability of the 3.5Ghz band was initially delayed in court by the fixed line operators, which challenged Anatel's plan to make the band available for only for new competitors³², but their protest was unsuccessful.

Unused parts of the 1.9 GHz band are to be issued to new mobile operators with the requirement that 3G services be provided with coverage in all municipalities of 100,000 inhabitants or more, even although mobile services are not under PGO public service regulatory regime. Similar requirements are likely to be imposed on operators seeking authorizations to operate in parts of the 3.5 GHz band.

Other spectrum liberation activities include:

- Frequencies above 6 Ghz will be made available for Telebras to provide point-to-point links in municipalities using high-speed radios
- The designation of the 2.170-2.182Ghz band, and the 2.5-2.690Ghz band has been

³² The license for the 3.5Ghz band does not allow existing fixed line operators to use it in their market areas.

changed, in order to foster broadband access, and has published public consultations regarding the designation of other radio frequency channels, with similar objectives.

3.10 Subscription/cable TV broadcasting

The opening up of the subscription/cable TV sector has been under discussion for some time but this intention appears to have been accelerated following the announcement of the PNBL. In August 2011 the government announced the removal of the legal limitation that prohibited majority foreign owned telecommunication companies from operating in the subscription/cable-TV market. This will allow entry by some of the major telecom providers who are foreign owned, notably Embratel, Telefonica, GVT and Sky.

The IPEA's analysis of the impact of this measure on broadband-use indicates it should boost the number of subscribers significantly. The agency said in a September 2011 research report that the presence of a subscription/cable-TV provider could increase broadband subscribers in the location by up to 35%.

3.11 Fiscal incentives and subsidies

Tax levels on equipment and services are relatively high in Brazil, and according to the telecom industry lobby group Telebrasil, the government tax on broadband services currently increases the cost to the consumer by 43%, while taxes on imported modems adds 78% to the price. Some tax exemptions on connectivity services pre-dates the PNBL in some states, however the government at both federal and state levels is now adopting a broad a range of tax exemptions to promote the uptake of broadband and other ICTs.

Concerned that the backbone and middle-mile networks will not be sufficient to cope with rising local demand for broadband, in August 2011 the Ministry of Finance agreed to forfeit an estimated R4 billion in tax revenue to encourage operators and suppliers to make R70 billion worth of investment in the construction of fibre-optic networks over the next four years. Priority will be given for projects that include coverage of North and Northeast regions.

Due to import substitution promotion, foreign ICT equipment is subject to 50% duties and this is encouraging efforts to develop more advanced local manufacturing facilities to help reduce the cost of

computers, phones and other telecommunication equipment. In 2009, the government announced that the exemption on taxes for strategic capital goods, including computers and tablets, would be extended to 2014. For computers alone, this was expected to cost the government about R1.6bn in 2010. In addition all taxes and import duties have been waived on computers for the public school system.

To further reduce the cost of tablets and related network access devices, in May 2011 the government announced its intention to exempt locally made hardware from industrial taxes which, when combined with sales tax exemption, this could reduce prices to consumers by 30-40%. The bill was passed by the lower house in September and is expected to be approved by Senate shortly. Also in September, IPEA published a report proposing that tax exemptions be extended to mobile phones and televisions if universal access to the Internet is to be achieved.

A growing number of states are exempting broadband from sales taxes. In 14 of the 26 states (which have a total of 49% of the population) agreement to exempt broadband from sales tax (VAT) has recently been reached. However of these, only seven have signed the exemption in local law - Sao Paulo, Rio de Janeiro, Espirito Santo, Parana, Goias, Pernambuco and Pará. The remaining states where this is pending are Distrito Federal (Brasília), Acre, Amapá, Ceará, Rio Grande do Sul, Santa Catarina and Sergipe.

Brazil's lower house has given approval to a proposed measure offering tax breaks for national production of tablet computers. The bill, which still must gain final approval in the Senate, would offer manufacturers full exemption from industrial manufacturing and retail taxes, as well as import taxes for electronic components. According to government estimates, the tax breaks could help reduce the final cost to consumers by 20%-30%.

To promote deployment of broadband to remote and under-served areas the government is currently discussing the possibility of subsidising the cost of providing connections to the end user.

The government also plans to discuss with the energy distributors the possibility of offering lower electricity prices to small broadband providers.

3.12 State and municipal efforts

Prior to the PNBL there have been a variety of number of municipal and state supported efforts to improve access to the Internet, including the use of tax incentives and provision of low cost, or even free, broadband services in public access facilities and schools. These efforts are now accelerating following the PNBL. A growing number of municipalities are participating in the PNBL and partnering with Telebras for use of network infrastructure. In the agreement, the Telebras will use the municipal networks and offer access in cities where broadband is not widely available.

An example is the state of Sao Paulo which has exempted broadband from sales tax for the last two years but in August 2011, the State announced that a complete mapping of the investment by operators would be made, including capacity and locations covered. From this, the department will mount a public investment plan for municipalities not covered. The goal is to ensure that in the next two years, all municipalities of less than ten thousand inhabitants in urban areas, have broadband access – this is expected to be about 230 cities. Where current operators indicate they are unlikely to cover these cities within two years, the state will offer finance and tax incentives to other operators to ensure that access is provided.

The State of Paraná has been taking a different approach to improving connectivity for its citizens, using the state energy company, Copel³³, as its primary vehicle for this. The Paraná State Plan for Broadband was adopted In August 2010 and in February 2011, Copel announced that it would use its 17 000 km fibre optic network to provide 100Mbps broadband connections. With an investment of R100 million, the company plans to ensure 100% coverage of all municipalities by 2012. Paraná State is allowing Copel to defer its tax payments in return for a) ensuring the wholesale 1Mbps price is R230 or less, b) reserving 15% of capacity for low-income groups paying R15/month or less, and c) reserving another 15% of capacity for services at R30 per month. In addition a 10:1 contention ratio is specified by the state.

The State of Ceará is also amongst the most advanced in its efforts to ensure broadband access for its citizens. In 2008, the state government decided to

³³ Companhia Paranaense de Energia

create its own fibre optic and WiMax infrastructure, with the aim of providing broadband access in major cities. Coverage of 92% of the population was expected by July 2011. Known as the Ceará Digital Belt³⁴ (CDC), with an investment of R65m, a ring of 2500 km of fibre has been established linking all 56 metropolitan areas. Free access is provided to all public institutions in the state.

At the city level, the mountain municipality of Canela with about 40 000 inhabitants near Porto Alegre has become a digital city role model. In March 2011 Canela planned to open a 1 Gbps network, developed in partnership between city and federal governments and private enterprise. The network has been established mostly with support from the private sector in provision of infrastructure.

³⁴ Cinturão Digital do Ceará

4. Lessons Learned

When the Cardoso government promoted the privatisation of the telecommunications sector in Brazil in 1998, the promise was that increased competition would bring down prices. While the extension of services has reached most areas for voice services, prices have remained relatively high, and the availability of new services such as broadband have been slower and more costly than expected. In addition the telecom sector has become more concentrated among fewer dominant players which are mostly owned by foreign operators. The PNBL is clearly responding to this market environment, aiming to reduce costs, increase coverage and support local Brazilian industry.

It is notable that the PNBL did not come out of nowhere and builds on much prior experience, including in sector regulation. However most direct initiatives concentrated on public access facilities (telecentres), e-applications development and low cost access equipment – open source, locally manufactured desktop computers. Since then the environment has moved on, broadband has become a priority, local applications development has continued to take place and access devices have switched to laptops, smartphone and tablets which are a once-off cost and becoming increasingly affordable. As a result lowering broadband costs and improving performance is rightly seen as the key priority to achieve digital inclusion and leverage the benefits of ICTs for development.

The operators' mixed reactions to the PNBL has highlighted the continuing tension between public and private sectors, and between the dominant players and the small ones, in defining the best way forward. The technical and market complexity of Internet provision generally, and in Brazil in particular, has not helped either side to identify a clear collaborative strategy, and as elsewhere in the world, this is an ongoing area of debate.

The discussion over the role of the public versus the private sector is also taking place within different parts of the federal government. Subsequent to the announcement of the PNBL, which was largely developed by the Ministry of Planning, some other parts of government have indicated that they are not entirely in agreement with the strategy, and similarly to the private operators, have indicated their preference for a model focussing on subsidising the

cost of providing connections to those who cannot afford current market rates.

In any event the 'proof will in the pudding' and it remains to be seen how effective Telebras will be in competing with the private sector to drive down prices and extend the range of services. However it seems that simply the threat of this type of initiative has already caused the private operators to respond by lowering prices and increasing their coverage targets.

In Brazil, as in China, the role of the state is notable in equipment development and the efforts of the government to support local manufacture of equipment are extensive, ranging from R&D support, tax breaks and import barriers for foreign equipment. The effectiveness of import barriers is as yet unclear, but currently the cost of much of the consumer equipment available in Brazil is higher than it is in Europe or North America. This has also resulted in a small but significant grey market in ICT goods, either bought from tourists, or while travelling abroad, and sometimes even smuggled in.

Among the other key issues that the initiatives taking place in Brazil have drawn attention to so far are:

- The setting of performance targets for the quality of broadband services under the PNBL has highlighted discussion of the relative importance of speed versus traffic limitations. Many have said that with low monthly traffic caps, access to higher broadband speeds is largely meaningless.
- Price target setting needs to be able to take into account the bundled service offerings which can extend the basic broadband service to double and triple-play, where TV and voice services may be part of the broadband package. In fixed line ADSL services, the bundling of voice telephony subscriptions is also very common, but increasingly unneeded due to the availability of mobile telephony.
- If the setup cost for the access equipment (modem and terminal device) is not taken into account, and remains at market -related prices, the lowest income-groups will likely find the cost of entry unaffordable. Some operators have initially responded by making

a USB modem free if a contract is signed, but this is not guaranteed to continue indefinitely.

- Brazil's experience also show that tensions between broadcast and telecom sectors, and between fixed and mobile sectors needs to be anticipated. The broadcast sector will resist opening up to telecom operators and the subsequent debate over network neutrality can slow down implementation of effective solutions.
- Technically, the debate over the ability of mobile operators to service the demand for high speed broadband (>5Mbps) continues. Clearly, in developing and emerging markets where the penetration of fixed infrastructure is low, mobile wireless will have a vital role to play for some time to come. But even in these markets, notwithstanding the lack of experience with LTE, fixed-line infrastructure – fibre to the home in particular, may well be the ultimate evolutionary path to cope with exploding demand for capacity.
- The consolidation of fixed, TV and mobile operators in single integrated companies offering triple- and quad-play services also appears to be becoming a world trend, improving operator profitability with economies of scale, streamlined management and better optimization of investments. Demand for broadband is also an accelerator of this process in the mobile sector - with 3/4G mobile broadband, the only way to scale services sufficiently is to use fibre in the backhaul transmission to connect their cell sites. These conclusions seem to be gaining wider acceptance as underlined by the merger of Embratel and Claro, the purchase of GVT by Vivendi and the efforts of Telefonica to buy Portugal Telecom's share in Vivo. A similar dynamic is also evident between the broadband and TV broadcasting sectors.
- Fiscal measures such as tax exemptions for equipment and broadband services are a key plank in Brazil's broadband strategy but do not seem to be as well recognised elsewhere. Brazil's approach is even more innovative in that it proposes to exempt operators who reduce the cost of their offerings by a significant margin. In a federal system such as Brazil, the variation in the extent of

exemptions underscores the need for buy-in at each level of government.

- Top-level support from government has been observed as a key feature of many of the more successful national broadband plans and Brazil is no exception. The PNBL was devised under the previous President Lula's close leadership and reaffirmed by the current President Rousseff, who said, in her first public address to the population following her taking of office earlier this year, that the implementation of the PNBL would be accelerated. At the other end of the spectrum, the efforts of a number of municipal governments to support broadband development, and even provide free broadband services, are noteworthy, highlighting the important role of municipal governments in provision of broadband as a utility, just like water, electricity and sanitation. Finally, the variation in activities of the federal, state and municipal governments also calls attention to the need for all levels of government to co-ordinate their efforts to ensure the most effective use of resources and to make affordable high speed broadband available as quickly as possible.
- The opportunity to massively reduce the costs of broadband network deployment by ensuring access to other complementary infrastructure sectors – namely power and transport, has not gone unnoticed by Brazilian broadband policy makers - one of Telebras' first actions was to secure access to the fibre infrastructure of the petroleum and electricity distribution networks. However little discussion has so far taken place for the future advantages of ensuring that ducts are provisioned in every new road, and ensuring smooth and low cost access to rights of way for fibre cable.
- In making additional radio spectrum available for broadband, the tensions with the dominant players, and incumbent mobile operators in particular, to use control over access to spectrum as a way of staving off competition signals the importance of forward planning in spectrum management and the need for strong independent policy-making.

In conclusion, although it is early days in the PNBL programme, developments over the coming year will be watched with keen interest by policy makers, civil society and providers wherever the promotion of

access to ICTs has become a national policy issue. In this respect the Brazilian experience is and will continue to be a valuable one for most other countries planning broadband strategies.

5.1 A timeline of events relating to the PNBL

August 2009. The Steering Committee for Digital Inclusion Programmes is formed, which lays the groundwork for the PNBL.

May 2010. The PNBL is officially announced by Government decree 7.175.

June 2010. Supported by the CGPID, a series of public consultations on the PNBL takes place with civil society, private sector and government officials.

24 Aug 2010. Complementing the 16 State capitals already announced, Telebras publishes the list of the next 100 cities that will receive broadband access by end 2010. It said a further 1063 cities are planned for 2011.

November 2010. Padtec, a Campinas based Brazilian equipment supplier, wins Telebras' R68m tender for hardware to support the PNBL roll-out.

A consortium of 29 operators, represented by SindiBrazil, files an objection in the Federal Court in Rio de Janeiro claiming that Telebras does not hold the power to provide services for the Federal government, and saying that the use of Telebras as a state company is "anticompetitive". The claim is not upheld.

Anatel approves measures allowing operators to apply their license renewal fees directly toward universal service projects.

The government announces plans to host cloud-based applications in support of the PNBL to make it easier for municipalities to provide online content.

January 2011. The budget for the PNBL is revised – Initially, R600 million was to be released to Telebras in 2010 and R400 million in 2011. Now, Telebras is to have R316million for 2010 and an additional R273 million in capital investment in 2011.

Federal development bank, Banco Nacional de Desenvolvimento Economico e Social (BNDES), provides credit lines without collateral requirements to small Internet providers participating in the PNBL.

Telebras is issued with an SCM license and thereby authorised by Anatel to provide services to the last mile.

February 2011. The new Secretariat for Digital Inclusion is inaugurated by the federal Government Ministry of Communications.

Fibre optic cable reaches Manaus (the capital of the Amazonas) via Venezuela in a joint project with Brazil to interconnect the power and fibre networks of the state utilities of Eletrobrás and the Compañía Anónima Nacional Teléfonos de Venezuela (CANTV).

Seven Brazilian state governments agree to eliminate state taxes for broadband service provision and tablet computers will also be exempt from federal taxes, in line with the existing exemption on PCs and laptops.

April 2011. Telebras announces that it had invested R166m in equipment and services to establish itself as a broadband provider.

May 2011. Telebras reaches agreement with Petrobras and Eletrobras (Furnas, Chesf, Eletrosul and Eletronorte) to use the fibre networks of their energy distribution grids.

Government announces intention to reduce taxes on locally manufactured tablet computers.

June 2011. Government moves to encourage additional private investment in Telebras.

The 'Broadband is Your Right' campaign is launched by a coalition of civil society groups.

August 2011. The cable TV market is opened to telecom operators and others with foreign-ownership exceeding 49%.

After public consultation Anatel releases the proposed revisions to the SCM license which aims to make it easier for small providers to enter the broadband market.

The Ministry of Communication announces that it plans to ensure that at least 80% of metropolitan areas will have 4G coverage by 2014 (in time for the FIFA World Cup). To achieve this, tenders for the provision of 4G are being speeded up and the first set of tenders will be issued in April 2012.

Telebras announces that budget cuts for the PNBL programme this year from R1bn to R350m will delay the roll out but that 250 cities should be covered by end 2011.

Mobile operator Claro announces that it will join the PNBL and is now able to provide a 1Mbps service based on 3G in 515 cities for R29.90 / month (with a 200Mb/month traffic cap). Claro also said that by the end of 2011 the service will be available in 1017 cities.

The city of Santo Antônio do Descoberto in Goiás state is the first to see the rollout of PNBL with residents able to obtain the 1Mbps service.

The Federal government says it will provide tax exemption for the deployment of new telecommunication networks in areas which are not yet served.

Telebras signs a contract with the state of Ceara to use its 740km of its 2500km fibre backbone for the PNBL.

September 2011. Brazilian manufactured tablets become available.

Brazil's government (lower house) agrees to exempt locally manufactured tablets from the federal taxes, which is expected to reduce tablet price by 30%. The bill now goes to Senate.

Telecom operator GVT, part of the Vivendi Group, announces it will invest U.S.\$300–500 million to build a backbone network International in partnership with international carriers.

Telebras announces that it has signed contracts to supply network infrastructure for more than 20 Internet service providers and expects to close the year with more than one thousand ISPs registering their interest on the Telebras web site (currently about 600 have registered).

5.2 Relevant links

5.2.1 Government agencies

Cabinet Office of the President <http://www.casacivil.gov.br>

Ministério das Comunicações (primary broadband policy maker) <http://www.mincom.gov.br>

Anatel (National regulator) <http://www.anatel.gov.br>

PNBL – <http://www4.planalto.gov.br/brasilconectado/pnbl>

Multistakeholder Internet Management

CGI.br (Internet governance) <http://www.cgi.br>

CETIC.br (Internet Metrics) <http://www.cetic.br>

PTT.br (Internet Exchange Points) <http://www.ptt.br>

ICT and broadband market information sources

Teleco <http://www.teleco.com.br>

Teletime <http://www.teletime.com.br>

Anatel <http://www.anatel.gov.br>

CETIC.br & NIC.br - Reference centres for indicators and statistics on the use of ICTs in Brazil

<http://cetic.br> <http://nic.br>

Digital Cities Guide <http://www.guiadascidadesdigitais.com.br>

5.2.2 Major broadband and telecommunication operators active in Brazil

AES Com <http://www.aescomrio.com.br>
Cemig Telecom <http://www.infovias.com.br>
Claro <http://www.claro.com.br>
CTBC <http://www.ctbc.com.br>
Dialdata <http://www.dialdata.net.br>
Diveo <http://www.diveo.net.br>
Dsli vox <http://www.dsli.com.br>
Easytone <http://www.easytone.com.br>
Eletropaulo Telecom <http://www.eletropaulotelecom.com.br>
Embratel <http://www.embratel.com.br>
Engevox <http://www.engevox.com.br>
Epsilon informática <http://www.epsilon.com.br>
Global Crossing www.globalcrossing.com
Global Osi <http://www.globalosi.com.br>
GT Group <http://www.gtgi.net>
GVT <http://www.gvt.com.br>
IDT <http://www.idtlatinamerica.com>
Nextel <http://www.nextel.com.br>
Oi/Telemar <http://www.oi.com.br>
Portugal Telecom Brasil <http://www.portugaltelecom.pt>
Sdw <http://www.sdwtecnologia.com.br>
Sercomtel <http://www.sercomtel.com.br>
Sky <http://www.sky.com.br>
Telebras <http://www.telebras.com.br>
Telefonica <http://www.telefonica.net.br>
Tellfree Brasil <http://www.tellfree.com.br>
Tim <http://www.timbrasil.com.br>
Tmais <http://www.tmais.com.br>
Transit do Brasil <http://www.transitbrasil.com.br>
Vivo <http://www.vivo.com.br>

5.2.3 Industry Associations

Abramulti³⁵ ISP industry association <http://www.abramulti.com.br>
Abranet Brazilian Internet Association <http://www.abranet.org.br>
Abrater³⁶ Rural telecommunication providers association <http://www.abrater.org.br>
Abrint Association of Brazilian Internet and Telecommunication service providers <http://www.abrint.com.br>
Campaign for Universal Broadband <http://campanhabandalarga.org.br>
Conapsi³⁷ Internet Service Providers Association <http://www.conapsi.org.br>
SINDITELEBRASIL³⁸ Lobby association of the 40 largest telecom operators
<http://www.sinditelebrasil.org.br>
TelComp³⁹ Telecom industry association <http://www.telcomp.org.br>
Telebrasil⁴⁰ Association of Brazilian Telecom operators <http://www.telebrasil.org.br>

³⁵ Associação Brasileira dos Provedores de Internet e Operadores de Comunicação de Dados Multimídia –

³⁶ Associação Brasileira de Telecomunicações Rurais

³⁷ Conselho Nacional das Entidades de Provedores de Serviços de Internet

³⁸ Sindicato Nacional das Empresas de Telefonia e de Serviço Móvel Celular e Pessoal -

³⁹ Associação Brasileira dos Prestadores de Serviços de Telecomunicações Competitivas

⁴⁰ Associação Brasileira de Telecomunicações