ISSN 0798 1015

REVISTA ESPACIOS

Vol. 39 (Number 16) Year 2018 • Page 6

A study of the Internet and connectivity in South American countries to 2017: An analytical perspective

Estudio del Internet y la conectividad en los países sudamericanos al 2017: Una perspectiva analítica

Jorge VINUEZA-MARTÍNEZ [1]; Mirella CORREA-PERALTA [2]; Denis MENDOZA-CABRERA [3]

Received: 12/12/2017 • Approved: 10/01/2018

Content

ABSTRACT:
The analysis of the Internet performed for this article has been organized into three sections: first, reviewing sources to identify the importance of internet services; second, obtaining, processing and analyzing information from the Global Internet Maps report, TeleGeography, Internet Atlas, Telxius, PeeringDb, Internet Traffic Report of Venezuela, Colombia, Ecuador, Peru, Chile, Argentina, Uruguay, Brazil, Bolivia and Paraguay; and third, understanding the conclusions from the study regarding connectivity, penetration, affordability, fixed and mobile download speed, with special regard to the South American countries of Brazil and Uruguay.
Keywords: Global internet maps, red, conectividad, penetración, asequibilidad.

RESUMEN:
Para este artículo el análisis del internet se organizó en tres secciones: primera, revisión de fuentes para identificar la importancia de los servicios del internet; segunda, obtener, procesar y analizar información del reporte de Global Internet Maps, TeleGeography, Internet Atlas, Telxius, PeeringDb, Internet Traffic Report de Venezuela, Colombia, Ecuador, Perú, Chile, Argentina, Uruguay, Brasil, Bolivia y Paraguay; y tercero, comprender conclusiones del trabajo respecto a la conectividad, penetración, asequibilidad, velocidad de descarga fijo y móvil, destacándose de los países sudamericanos Brasil y Uruguay.
Palabras clave: Global internet maps, red, conectividad, penetración, asequibilidad

1. Introduction

1.1. Importance of the Internet

The Internet has evolved vertiginously since its origins and influenced the daily activities of human beings. Connectivity, bandwidth and heterogeneous devices connected to the network have created a globalization paradigm and connection called "the internet of things" (IoT), establishing intelligent services through the ubiquitous interaction of the information provided through the network as a necessity and challenge. In addition, criteria for security, standardization and governance of technology generate opportunities for R&D of the technological ecosystem, such as applications, architectures, communication networks, data management, perception and business logic in organizations. The term "internet of things" began in the Massachusetts Institute of Technology (MIT) in its effort to standardize electronic technologies, radio frequencies, wireless sensors and emerging technologies to enable what we know today as Service Oriented Architecture (SOA) (Agudelo & Barrera, 2014).

For the management of the internet of things, Fan & Chen (2010) mention the collaboration of a common framework that addresses the treatment of information obtained through devices, encapsulating the service in applications, from capture to transformation and storage of the data provided by the internet. From the internet of things, the concept of the social internet of things (SIoT) is explored, relating exclusively to "intelligent objects" as Alves, André Da Costa, Da Rosa Righi, & Barbosa (2015) reference it in their Mingle model, comparing similarity and integration of information taken from a university social network based on the geographical location of people, access to content and services.

Currently, the IoT is a common philosophy in smart cities and homes or in any connection space that requires a distributed object. However, not all populations have access to the Internet. Taking this into consideration, Meana-Llorian, Garcia, G-Bustelo, Lovelle, & Garcia (2016) propose the union of social networks and integrated subsystems based on the study by Atzori, Iera, & Morabito (2014), applying engineering techniques aimed at models or formal methods from the simulation of the real world (Meana-Llorian et al., 2016). They propose to develop a spontaneous social network made up of people who connect through devices to the location based service (LBS) (Zaupa, Costa, Silva, Barbosa, & Yamin, 2012), based on an evaluation of the technologies considering the frequency and necessary coverage for the internet of things (Banos, Afaqui, Lopez, & Garcia, 2017), where the selection depends on the conditions of the technological equipment and network coverage (Londoño & Céspedes, 2016), speed of response, scalability and mobility (Gordillo, Romero, Abasolo, & Carrera, 2014). In this context, Noguera-Arnaldos, Paredes-Valverde, Valencia-García, & Rodríguez-García (2015) refer to a study of a dialogue system based on instant messaging for the control of devices on the internet of things, ontologically relating an intelligent system with the natural language of the user.

One of the objectives of the European Research Cluster on the Internet of Things (IERC) is to integrate the cooperation of services for the development of an information-based economy from research, coordinating clusters and projects related to technology (Ferreira Da Silva & Oliveira Sa, 2016).

1.2. Internet Infrastructure

The report of the Information Society in Spain (2016) states that 59.3% of people over 65 have accessed the internet with the use of tablets, showing a growth of 13.2% in 2015 to 42.1 % in 2016. In addition, the report highlights: inclusion of Big Data as a technological trend, idea of an increased man to develop human capabilities through technology, increase of instant messaging, intelligent systems, inclusion of sensors, training through the internet, decision making based on published information, use of mobile phones by users between 14 to 19 years old, and the digital marketing revolution with the inclusion of technologies.

In this context, the technological infrastructure in the physical layer is relevant in the access to Internet services, favoring communication —hence, submarine wiring is the basis for global communication by 97%, while 3% is satellite-based (Douglas R. Burnett, Robert Beckman, Tara M. Davenport, 2014). This creates a dependence on submarine wiring for availability, continuity, reliability, safety and incidence in all parts of the planet (Alazri, 2017). In 2009, the International Cable Protection Committees (ICPC) identified 293 sites and 34 oceanic observation areas that use or plan to use submarine cables for data and energy transmission.

Through its online databases, TeleGeography, Internet Atlas, submarinecablemap, among other research firms of the telecommunications market, represent nodes, locations, distances or others, keeping constantly updated information about the available infrastructure to obtain Internet access and the services it provides.

- For TeleGeography, the submarine cable systems include information about the wiring, RFS (date of service), location, distance and owners points, without considering the cables that are not part of the telecommunications industry, but used for other scientific research purposes (ISCP, 2015).
- In Internet Atlas, ESRI, (http://atlas-test.wail.wisc.edu/InternetAtlasLimited/) the RIPE (Réseaux IP Européens) is obtained, presenting tunnels to provide Internet services; the IXP (internet exchange point) as well, improving routing; and tolerance to faults in the Data Centers as shown in Table 1 and Figure 1, where Brazil and Colombia stand out.

Table 1
Internet Atlas, physical Internet repository in South America

	Venezuela	Colombia	Brazil	Uruguay	Ecuador	Peru	Chile	Argentina	Paraguay	Bolivia
RIPE	X	X	X	X						
IXP		X	X		X	X	X	X	X	
DATA CENTER	X	X	X	X			X	X		X

Source: Internet Atlas, October 2017

2. Methodology

2.1. Obtaining information from the Global Internet Maps report of South American countries

This study is of a documentary nature. Its data were taken from the online databases published on the official site of each source consulted. To achieve this, the following was done:

1. Obtaining the report of the Global Map of the Internet of the South American countries, published in https://www.internetsociety.org//map/global-internet-report/ in October of 2017, as a source of information to evaluate the results of: Venezuela, Colombia, Ecuador, Peru, Chile, Argentina, Uruguay, Brazil, Bolivia and Paraguay;

2. Analyzing and evaluating the information obtained from the submarine wiring map published by TeleGeography (https://www.submarinecablemap.com/);

3. Analyzing and evaluating information obtained from the map published by Telxius (https://telxius.com/network/).

3. Results

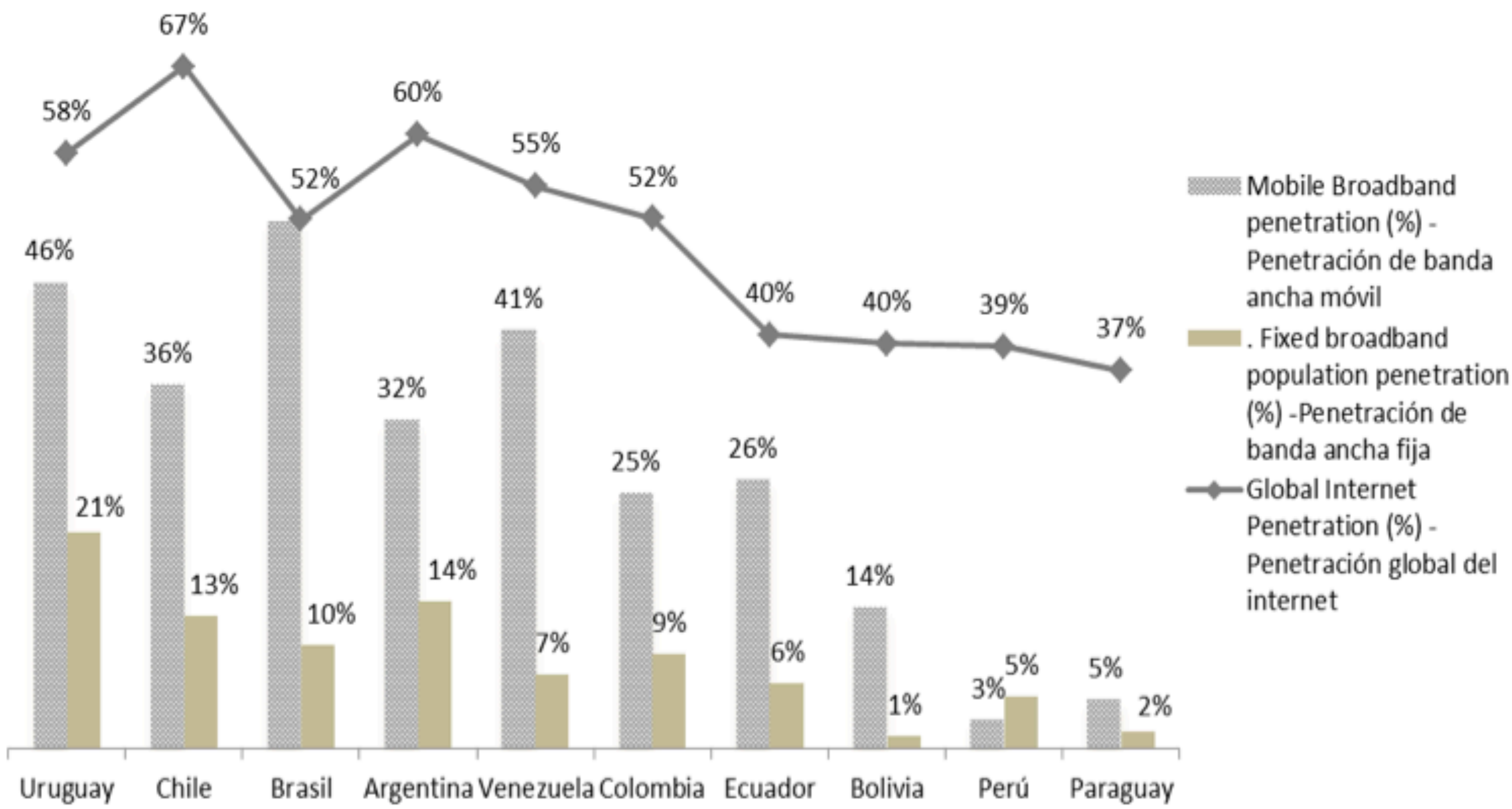
The Global Internet Maps report presents broadband penetration, fixed bandwidth affordability, Internet upload and download speed, resilience or risk of Internet disruption, and total monthly Wikipedia page editions by country.

3.1. Broadband Penetration

In South America, 49.87% of global penetration of the Internet presents an average growth rate of 13% in the last 3 years, with Chile standing out (ranked 47 worldwide). On the other hand, Paraguay ranks 107 out of 180 countries (world level) with a penetration of 37%, as can be seen in Figure 2. In the case of fixed broadband penetration, the average is only 9%

while for mobile broadband it is 28%, with Brazil and Uruguay standing out and Peru and Paraguay below 5%.

Figure 1
Broadband penetration of South American countries

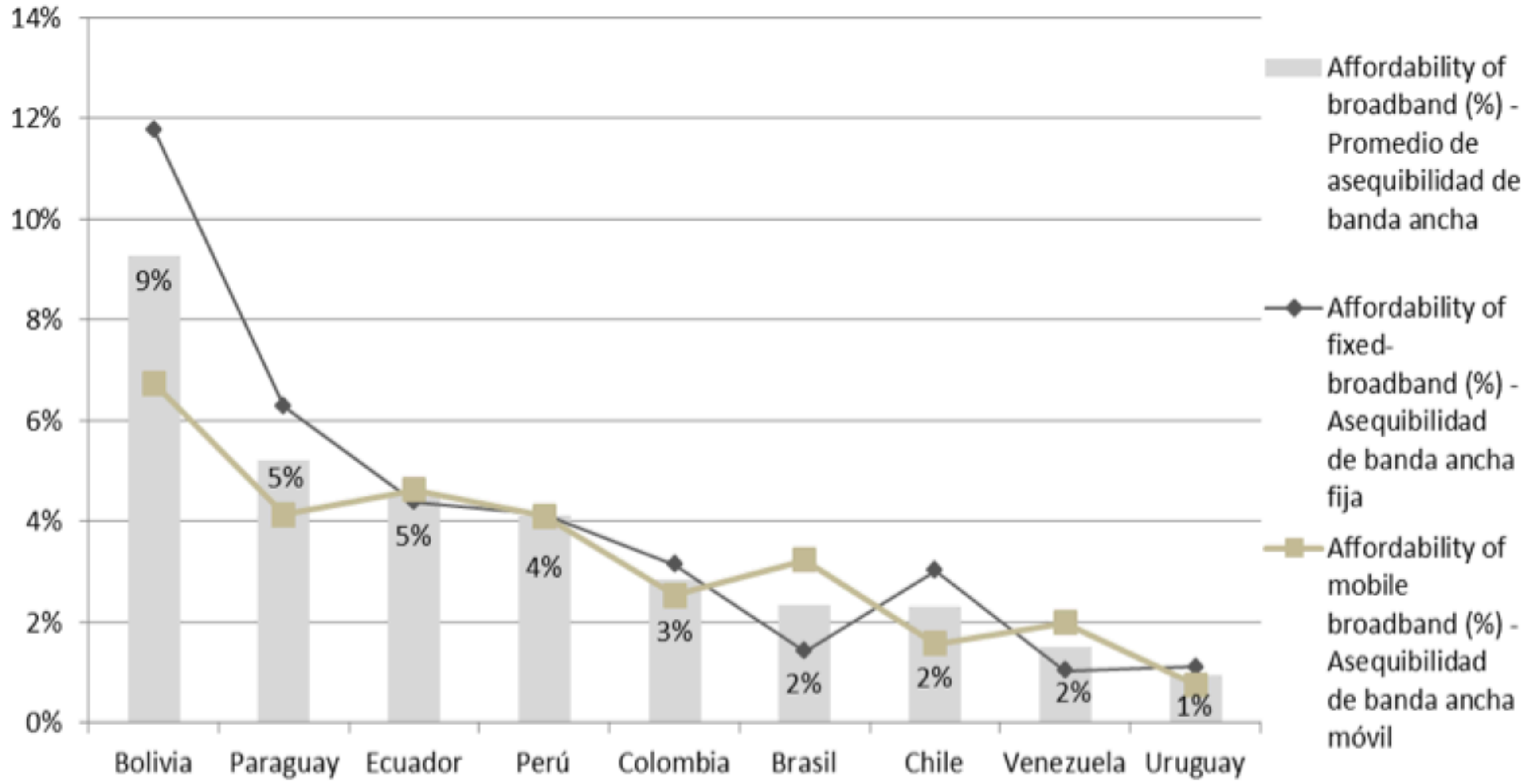


Source: Adapted report from Global Internet Maps, October 2017

3.2. Affordability of broadband

The affordability of fixed-broadband is 4.04%, with a monthly GDP average of $20.60 (October 2017) and the affordability of mobile broadband is 3.30%, with a monthly average of $18.80. The information from the Global Internet Maps did not include Argentina, but highlighted Bolivia (9%), as shown in Figure 3. With average latency of 600-700ms as well as Ecuador, Brazil, Argentina, Bolivia and Peru; 300-400 ms in the case of Uruguay and Chile; 500-600ms in Colombia and Venezuela; and more than 1000ms in Paraguay.

Figure 2
Affordability of broadband of South American countries



Source: Adapted from Global Internet Maps Report, October 2017

3.3. Internet upload and download speed

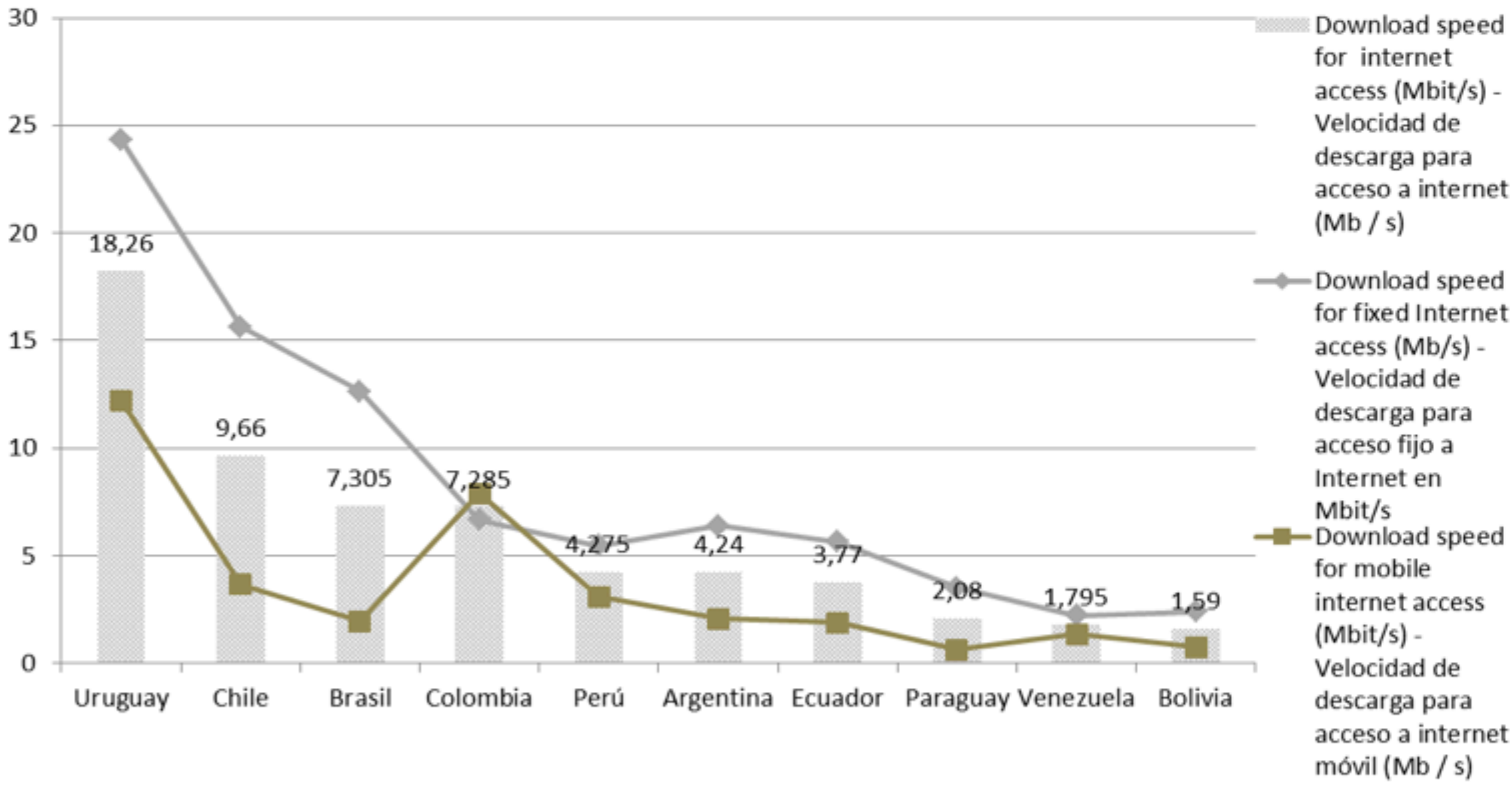
As shown in Figures 3 and 4, regarding the speed of download and upload for Internet access Mb/s of South America, Uruguay stands out in the fixed and mobile Internet access. The average download speed for fixed Internet access is 8.50 Mbit/s and the load is 2.94 Mbit/s, while the average mobile internet is 3.56 Mbit/s download and upload speed 1,24 Mbit/s, with a latency of 627.3ms. In addition, Colombia presents 100% in 3G-technology coverage and Brazil (ranked 7 worldwide) stands out from the other South American countries for having a larger ccTLD domain account, DNSSEC deployment (ccTLD) and allocation of IPV4 addresses in South America.

Figure 3
Internet upload and download speed (Mb/s) in South America

	1. Download speed - Descarga		2. Upload speed - carga	
	Download speed for fixed Internet access (Mb/s) - Velocidad de descarga para acceso fijo a Internet en Mbit/s	Download speed for mobile internet access (Mbit/s) - Velocidad de descarga para acceso a internet móvil (Mb / s)	Download speed for fixed Internet access (Mb/s) - Velocidad de descarga para acceso fijo a Internet en Mbit/s	Download speed for mobile internet access (Mbit/s) - Velocidad de descarga para acceso a internet móvil (Mb / s)
Uruguay	24,33	12,19	6,33	3,6
Chile	15,66	3,66	3,59	1,31
Colombia	6,66	7,91	3,09	3,7
Brasil	12,65	1,96	3,97	0,73
Ecuador	5,65	1,89	4,06	0,46
Perú	5,46	3,09	1,11	1,43
Argentina	6,39	2,09	1,82	0,39
Paraguay	3,52	0,64	3,52	0,21
Bolivia	2,42	0,76	1,34	0,27
Venezuela	2,23	1,36	0,6	0,29

Source: Global Internet Maps Report, October 2017

Figure 4
Internet download speed (Mb/s) in South America



Source: Global Internet Maps Report, October 2017

3.4. Resilience of the Internet

From the criterion of resilience or risk of interruption of the Internet, Colombia, Argentina and Brazil occupy the first place; in the case of the distribution of autonomous system numbers (ASN), border and national, Brazil occupies the first place.

Table 2
ASNs of South American countries

Country	**# of Border ASNs**	**# of Domestic ASNs**
Venezuela	26	44
Colombia	58	85
Ecuador	22	51
Peru	14	19
Chile	32	132
Argentina	92	327
Uruguay	10	16
Brazil	305	2679

Bolivia	8	16
Paraguay	6	22

Source: Global Internet Maps Report, October 2017

3.5. Resilience of the Internet

In addition, Brazil stands out for the content limit with the largest monthly editions of the Wikipedia pages, ranking seventh worldwide.

Table 3
Content Limits of South American countries

Country		Freedom on the net (Overall score)	Obstacles to access (Score)	Violations of user rights (Score)
Venezuela	Partially free	56	17	21
Colombia	Free	30	8	14
Ecuador	Partially free	37	9	17
Brazil	Free	30	7	16
Argentina	Free	27	7	11

Source: Global Internet Maps Report, October 2017

3.6. Interactive network map TeleGeography Submarine Cable Map

The submarine wiring published by TeleGeography (https://www.submarinecablemap.com/ interactive map of global network of communications service) consists of 32 cables with 59 points located in the South American countries that are connected mainly with the United States, as it is observed in Table 4. The largest wiring installation of South America-1 (SAm-1) with 25,000 km is owned by Telxius, South American Crossing (SAC) / Latin American Nautilus (LAN) and Pan American (PAN-AM), with 227,327 Km of the cable in the South American countries, as shown in Table 5.

Table 4
Submarine wiring in South American countries

Country	Total	Cable
Brazil	16	Tannat, South America-1 (SAm-1), Monet, Americas-II, South Atlantic Cable System (SACS), ARBR, Junior, Atlantis-2, Seabras-1, Brazilian Festoon, South American Crossing (SAC)/Latin American Nautilus (LAN), BRUSA, South Atlantic Inter Link (SAIL), EllaLink, America Movil Submarine Cable System-1 (AMX-1), GlobeNet
		Pacific Caribbean Cable System (PCCS), South American Crossing

Colombia	12	(SAC)/Latin American Nautilus (LAN), San Andres Isla Tolu Submarine Cable (SAIT), ARCOS, Maya-1, AURORA, Pan American (PAN-AM), Colombia-Florida Subsea Fiber (CFX-1), South America-1 (SAm-1), Deep Blue Cable, America Movil Submarine Cable System-1 (AMX-1), GlobeNet
Chile	8	South American Crossing (SAC)/Latin American Nautilus (LAN), South America Pacific Link (SAPL), Segunda FOS Canal de Chacao, Fibra Optica Austral, South America-1 (SAm-1), FOS Quellon-Chacabuco, AURORA, Pan American (PAN-AM)
Argentina	7	ARBR, South American Crossing (SAC)/Latin American Nautilus (LAN), South America-1 (SAm-1), ARSAT Submarine Fiber Optic Cable, Unisur, Atlantis-2, Bicentenario
Venezuela	6	GlobeNet, South American Crossing (SAC)/Latin American Nautilus (LAN), Pan American (PAN-AM), Americas-II, ALBA-1, ARCOS
Ecuador	4	South America-1 (SAm-1), Pan American (PAN-AM), AURORA, Pacific Caribbean Cable System (PCCS)
Peru	3	Pan American (PAN-AM), South American Crossing (SAC)/Latin American Nautilus (LAN), South America-1 (SAm-1)
Uruguay	3	Bicentenario, Unisur, Tannat

Source: TeleGeography Submarine Cable Map obtained: https://www.submarinecablemap.com, October 2017.

Table 5
Submarine wiring by longitude in South America

Cable	Cable length (Km)
ALBA-1	1,860.00
America Movil Submarine Cable System-1 (AMX-1)	17,800.00
Americas-II	8,373.00
ARBR	n.a.
ARCOS	8,600.00
ARSAT Submarine Fiber Optic Cable	40.00
Atlantis-2	8,500.00
AURORA	n.a.
Bicentenario	250.00
Brazilian Festoon	2,543.00

BRUSA	11,000.00
Colombia-Florida Subsea Fiber (CFX-1)	2,400.00
Deep Blue Cable	12,000.00
EllaLink	10,119.00
Fibra Optica Austral	3,000.00
FOS Quellon-Chacabuco	350.00
GlobeNet	23,500.00
Junior	390.00
Maya-1	4,400.00
Monet	10,556.00
Pacific Caribbean Cable System (PCCS)	6,000.00
Pan American (PAN-AM)	7,050.00
San Andres Isla Tolu Submarine Cable (SAIT)	826.00
Seabras-1	10,800.00
Segunda FOS Canal de Chacao	40.00
South America Pacific Link (SAPL)	17,600.00
South America-1 (SAm-1)	25,000.00
South American Crossing (SAC)/Latin American Nautilus (LAN)	20,000.00
South Atlantic Cable System (SACS)	6,165.00
South Atlantic Inter Link (SAIL)	5,900.00
Tannat	2,000.00
Unisur	265.00

n.a.= non available information
Source: TeleGeography Submarine Cable Map obtained: https://www.submarinecablemap.com, October 2017.

3.7. Internet information analysis in TELXIUS, PEERINGDB, INTERNET TRAFFIC REPORT

The Telxius interactive map reflects the SAM-1 cable present in IP services, capacity services, and location. Connections are found in Brazil, Chile, Argentina, Peru, Ecuador and

Colombia.

The exchange of information and direct interconnection between networks, known as "peering", presents 30 connections in Brazil, 22 in Argentina, 8 in Chile, 4 in Ecuador and 1 in Peru, Paraguay, Colombia and Bolivia (https://www.peeringdb.com/advanced_search).

Internet traffic report (http://www.internettrafficreport.com) South America presents 3 routers in Argentina, Colombia and Peru.

3.8. Analysis of the Internet in South American countries

In Venezuela (National Institute of Statistics, INE) there is an increase of 55.68% (2013), mainly in social networks (54.49%), electronic mail (33.83%), documents of interest (32.05%), distance education and training (25.04%).

In Colombia (National Administrative Department of Statistics, DANE) there is an increase of 44.5% (2014) to 45.5% (2015) and is reflected with access to the Internet with a fixed connection (82.4%).

In Ecuador (National Institute of Statistics and Census, INEC) populations have cellphones (75.5%), Internet access (11.8%), modem/telephone access (33.1%) and cable/broadband (57,4%) with connection to 29% (2010).

In Peru (National Institute of Statistics and Informatics, INEI) 28% of the populations of 6 to 16 years old use the Internet in their homes, 40% in booths, 1.6% landline telephone and 25% of households oscillate between 512Kbps a 1024Kbps.

In Bolivia, according to the National Institute of Statistics in the 2012 census, 23.6% of the population has a computer; between 2016 to 2017 there was an increase of 3.7% in connections.

In Chile (National Institute of Statistics), between January and September of 2017 Internet access increased from 6.2% to 7% for technological improvements, increase in connection speed and improvement in the supply of fiber optic services.

In Argentina (Economic Social Observatory) data traffic exceeded 260 Gbps in August 2017 with the highest ADSL connection.

Uruguay (National Institute of Statistics), in the 2010 census, reflected that 69% of the population has personal computers and 45% access to the Internet.

In Paraguay (General Directorate of Statistics and Census), 22.7% (2015) has access to the Internet, and 22.5% of households have Internet access.

In Brazil by June 2012 45.6% were Internet users and in 2015 with population penetration of 57.6%.

4. Conclusions

This document describes the data from the websites of Global Internet Maps, TeleGeography, Internet Atlas, Telxius, PeeringDb, Internet Traffic Report of Venezuela, Colombia, Ecuador, Peru, Chile, Argentina, Uruguay, Brazil, Bolivia and Paraguay as instruments, with the objective of identifying the importance of the service, infrastructure and internet coverage in South American countries. The results obtained show a penetration of 49.87% with 4.04% of affordability of fixed broadband and 3.30% of affordability of mobile broadband, and average download speed for fixed access in 8.50 Mbit/s and the load in 2,94 Mbit/s. In the case of mobile internet, the average is 3.56 Mbit/s download speed and 1.24 Mbit/s load with a latency of 627.3ms with a connection of 110,725.00Km. Regarding connectivity, it includes published information, where it is clear that the physical layer will generate an expansion or transport of internet services. Although the objective is to analyze the connectivity and the services generated by the Internet. In the future, services should be compared according to the wiring connectivity such as ARBR, BRUSA, South Atlantic Inter Link (SAIL), South Atlantic Cable System (SACS) for submitting an RFS (service date) to 2018.

Bibliographic

Agudelo, J. P., & Barrera, H. E. C. (2014). Approach for a congestion charges system supported on Internet of Things. *In 2014 IEEE Colombian Conference on Communications and Computing, COLCOM 2014 - Conference Proceedings.* Bogota: IEEE Computer Society. https://doi.org/10.1109/ColComCon.2014.6860424

Alazri, A. S. (2017). Telecommunication traffic through submarine cables: Security and vulnerabilities. *In 2016 11th International Conference for Internet Technology and Secured Transactions*, ICITST 2016 (pp. 372–375). Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/ICITST.2016.7856733

Alves, T. M., André Da Costa, C., Da Rosa Righi, R., & Barbosa, J. L. V. (2015). Exploring the social Internet of Things concept in a univeristy campus using NFC. In C.-V. E. Cuadros-Vargas A. Cancela H. (Ed.), *Proceedings - 2015 41st Latin American Computing Conference, CLEI 2015.* Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/CLEI.2015.7360014

Atzori, L., Iera, A., & Morabito, G. (2014). From “smart objects” to “social objects”: The next evolutionary step of the internet of things. *IEEE Communications Magazine*, 52(1), 97–105. https://doi.org/10.1109/MCOM.2014.6710070

Banos, V., Afaqui, M. S., Lopez, E., & Garcia, E. (2017). Throughput and Range Characterization of IEEE 802.11ah. *IEEE Latin America Transactions,* 15(9), 1621–1628. https://doi.org/10.1109/TLA.2017.8015044

Burnett, D., Beckman, R., & Davenport, T. (2014). *Submarine Cables: The Handbook of Law and Policy. Boston: first edition, Martinus Nijhoff.*

Departamento Administrativo Nacional de Estadística, DANE. (2017). *Dane Información Estratégica*. Retrieved November 13, 2017, from http://www.dane.gov.co/

Dirección general de Estadística, encuestas y censos Paraguay. (2017). *Dirección general de Estadística, encuestas y censos*. Retrieved November 14, 2017, from http://www.dgeec.gov.py/

Esri. (2017). *Atlas Internet.* Retrieved November 1, 2017, from http://atlas-test.wail.wisc.edu/InternetAtlasLimited/

Fan, T., & Chen, Y. (2010). A scheme of data management in the internet of things. *In Proceedings - 2010 2nd IEEE International Conference on Network Infrastructure and Digital Content, IC-NIDC 2010* (pp. 110–114). Beijing. https://doi.org/10.1109/ICNIDC.2010.5657908

Ferreira Da Silva, F. J., & Oliveira Sa, J. (2016). Internet-of-Things: Strategic research agenda evolution [Internet-of-Things: Evolução das Agendas Estratégicas de Investigação]. In C. M. P. G. R. S. O. S. Rocha A. Reis L.P. (Ed.), *Iberian Conference on Information Systems and Technologies, CISTI (Vol. 2016–July).* IEEE Computer Society. https://doi.org/10.1109/CISTI.2016.7521526

Fundación Telefónica. (2016). *La sociedad de la información en España 2016.* Barcelona: Editorial Ariel.

Gordillo, R. X., Romero, C. G., Abasolo, S. E., & Carrera, M. A. (2014). Testbed for evaluating reference models of Internet of Things (IoT). *In 2014 IEEE Colombian Conference on Communications and Computing, COLCOM 2014 - Conference Proceedings.* Bogota: IEEE Computer Society. https://doi.org/10.1109/ColComCon.2014.6860426

IERC European Research Cluster on the Internet of Things. (2016*). IERC European Research Cluster on the Internet of Things.* Retrieved November 1, 2017, from http://www.internet-of-things-research.eu/

INEC. (2017). *Instituto Nacional de Estadística y Censos INEC*. Retrieved November , 2017, from http://www.ecuadorencifras.gob.ec/institucional/home/

Instituto de Estadística de la UNESCO. (2009). *Medicación de las Tecnologías de la Información y la Comunicación (TIC) en Educación - Manual de Usuario - Documento Técnico*

No. 2. Canada: UNESCO Institute for Statistics. Obtenido de http://unesdoc.unesco.org: http://unesdoc.unesco.org/images/0018/001883/188309s.pdf

Instituto Nacional de Estadística. (2017). *Instituto Nacional de Estadística INE Uruguay*. Retrieved November 14, 2017, from http://www.ine.gub.uy/

Instituto Nacional de Estadísticas de Chile. (2017). *Instituto Nacional de Estadísticas INE*. Retrieved November 13, 2017, from http://www.ine.cl/

Instituto Nacional Estadístico de Bolivia. (2017). *Instituto Nacional Estadístico INE*. Retrieved November 14 2017, from http://www.ine.gob.bo/

Internet Society. (2017). *Global Internet Maps.* Retrieved November 2, 2017, from https://www.internetsociety.org//map/global-internet-report/

Internet Traffic Report. (2017). *Internet Traffic Report.* Retrieved November 17, 2017, from http://www.internettrafficreport.com/samerica.htm

ISCP. (2015, Mayo 21). *International Cable Protection Committee*. Retrieved August 2, 2017, from https://www.iscpc.org/cable-data/scientific-cables/

Londoño, D., & Céspedes, S. (2016). Performance evaluation of CoAP and HTTP/2 in web applications. In B.-J. J. Hevia A. Cespedes S. (Ed.), *CEUR Workshop Proceedings* (Vol. 1727, pp. 25–27). CEUR-WS. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-84999142225&partnerID=40&md5=c9d09d3aff77c10c6147a108c71df34e

Meana-Llorian, D., Garcia, C. G., G-Bustelo, B. C. P., Lovelle, J. M. C., & Garcia, V. H. M. (2016). IntelliSenses: Sensing the Internet of Things [IntelliSenses: Sintiendo Internet de las Cosas]. In C. M. P. G. R. S. O. S. Rocha A. Reis L.P. (Ed.), *Iberian Conference on Information Systems and Technologies, CISTI* (Vol. 2016–July). IEEE Computer Society. https://doi.org/10.1109/CISTI.2016.7521551

Ministerio del Poder Popular de Planificación. (2011). *Instituto Nacional de Estadística*. Retrieved November 16, 2017, from http://www.ine.gov.ve/

Noguera-Arnaldos, J. Á., Paredes-Valverde, M. A., Valencia-García, R., & Rodríguez-García, M. Á. (2015). Instant messaging-based dialog system for device control in the internet of things [Sistema de diálogo basado en mensajería instantánea para el control de dispositivos en el internet de las cosas]. *Procesamiento de Lenguaje Natural*, 55, 173–176. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-84941200348&partnerID=40&md5=6308a70145cb16a6cd1a328c9eb9cce3

PeeringDb. (2017). *www.peeringdb.com.* Retrieved October 13, 2017, from https://www.peeringdb.com/advanced_search

Perú Instituto Nacional de Estadística e Informática. (2017). *Instituto Nacional de Estadística e Informática INEI*. Retrieved November 13, 2017, from http://www.inei.gob.pe/

TeleGeography. (2017, Noviembre 1). *Submarine Cable Map.* Retrieved November 3, 2017, from https://www.submarinecablemap.com

Telxius. (2017). *Telxius.* Retrieved Noviembre 12, 2017, from https://telxius.com/network/

Universidad Nacional de Rosario. (2017). *Observatorio Económico Social UNR*. Retrieved November 14, 2017, from http://www.observatorio.unr.edu.ar/acceso-estadistico/

Zaupa, D., Costa, C., Silva, J., Barbosa, J., & Yamin, A. (2012). Implementing a spontaneous social network for managing ubiquitous interactions. *In Proceedings - 13th Symposium on Computing Systems, WSCAD-SSC 2012* (pp. 163–170). Petropolis, RJ. https://doi.org/10.1109/WSCAD-SSC.2012.19

---

1. Universidad Estatal de Milagro, Milagro, Ecuador. Contact jvinuezam@unemi.edu.ec

2. Universidad Estatal de Milagro, Milagro, Ecuador. Contact mcorreap@unemi.edu.ec

3. Universidad Estatal de Milagro, Milagro, Ecuador. Contact dmendozac2@unemi.edu.ec

---