RIPE 70
ISOC Internet Interconnection & IXP Activities

13 May 2015 | Amsterdam, The Netherlands

ISOC | Global IXP & Interconnection/Peering Activities

- **ISOC works with partners throughout the world to build IXPs, human capacity, and bottom-up governance of IXPs**

- **How do we do this:**

  - **With partners: Euro-IX, RIRs (RIPE-NCC, AfriNIC, APNIC, LACNIC), IXPs, Cisco, Comcast, Google, Alcatel, Microsoft, NSRC, PCH, and other global and regional experts**

  - **Through program budgets & grants:**
    - ❖ African Union Grant (AXIS I & II)
    - ❖ IXP Toolkit Grant from Google
    - ❖ Alcatel and Cisco donations & equipment grants
    - ❖ Comcast grant for IXP development and training in Bolivia & Paraguay

Tipping Point | IXP Toolkit & Best Practices Project, AXIS Projects, Grants

- **ISOC awarded a grant by Google to extend its Internet exchange point (IXP) activities in emerging markets.**

  - **Create an IXP Toolkit: A study and Methodology to Identify Best Practices | www.internetsociety.org/ixptoolkitguide/**
    - ❖ Released 25 February 2014 | Rebooting 2ndQ2015

  - **Create an IXP "Portal": Access 2 information & experts | www.ixptoolkit.org**
    - ❖ Released 25 February 2014 | Rebooting 2ndQ2015
    - ❖ IXP Videos & Case Studies

  - **Partner to Conduct Training and Hold Workshops | Building Capacity**
    - ❖ Montenegro (Feb 25-27)
    - ❖ Measurement studies in LAC and Africa
    - ❖ Kyrgyzstan (28 April)

Critical "Infrastructure Layers" for Development and Building Human "Trust" Networks

- **Human | Capacity Development – Training**

  - **Workshops, Knowledge Exchange, Human Peers**

- **Technical | Connectivity & Infrastructure**

  - **Equipment,**

- **Governance | Management – Operations**

Partnerships

Annexes: Interconnection Infrastructure Development

IXP Work in Asia | 2013-2014 & 2015

2014

- **Workshop in Papua New Guinea (w/PNG Regulator & NSRC)**

- **Equipment to support BKNIX – New IXP in Thailand**

2015

- **IXP Launch in Bangkok BKNIX**

- **Discussions with Papua New Guinea, The Philippines, Pakistan.**

- **Vanuatu – APNIC Coordination – Generators (NSRC, ISOC, others)**

IXP Work in Latin America & The Caribbean | 2013-2014

- 12 IXP Workshops | Best Practices, Technical Assistance, Community Building in LAC

- 6 IXPs Launched | Argentina (2), Bolivia, Costa Rica, Honduras, Mexico.

- 6 IXPs "Leveled-up" via equipment donations in LAC | Argentina, Ecuador, El Salvador, Grenada & Panama.

- 11+ Case Studies | Contracted Regional Experts in LAC to Develop Case-studies in South America and the Caribbean

- Fellowships for training events & IXP equipment donations

- LAC IXP Study (Nov 2013): Argentina, Brazil, Colombia & Ecuador

- Bolivia IXP Measurement Study started (2014) & Expanding Activities to Paraguay and Central America (Raspberry Pi deployment)

IXP Work in Latin America & The Caribbean | 2015

- **Additional workshops planned with LACNIC, PCH and local partners**

- **Equipment sent to Paraguay & Mexico (Cisco donation)**

- **Funding received from Comcast for additional work in Paraguay & Bolivia**

  - ❖ **Team will continue baseline measurement studies in Bolivia & Paraguay and likely 3 additional countries in LAC**

  - ❖ **Data here on data collection efforts to date in Bolivia: http://cnet.fi.uba.ar/PIT/**

  - ❖ **Data here on LACNIC/LACNOG/ISOC: http://ite.lacnog.org/**

- **11+ Case Studies | Contracted Regional Experts in LAC to Develop Case-studies in South America and the Caribbean | April/May 2015 on rebooted IXP Toolkit site & Case-studies**

- **LAC IXP Study (Nov 2013): Argentina, Brazil, Colombia, & Ecuador:**

- **Caribbean study (April 2015): 11 Caribbean Countries | IXP analyses included**

- **Caribbean Peering Forum | May 2015 (Barbados)**

- **LACNOG - LAC Peering Forum | October 2015 (Bogota, Colombia)**

IXP Work in Africa | 2013-2014 & 2015

2013-2014

- **60 Workshops | Best Practices & Technical Assistance workshops (African Union AXIS Project)**

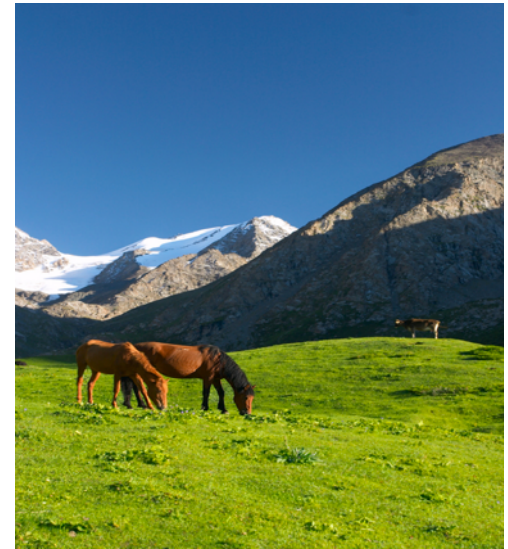- **Equipment sent to DRC-Kinshasa, Egypt, Ghana, Malawi, Tunisia**

2015

- **Follow-on mentoring with partners to be provided to five (5) IXPs**

- **Networking workshops for DRC-Kinshasa, Nigeria & Zambia**

- **African Peering & Interconnection Forum | 25-27 August 2015 (Maputo, Mozambique)**

- **Support to NOGs**

- **Measurement study being planned working with Spanish university & coders from Benin | Encourage data to be published on IX web-sites**

IXP Work in Europe & CIS | 2014 & 2015

2014

- IXP Workshops in Georgia & Montenegro

- Equipment sent to IXP in Armenia

- Supported RIPE SEE & CEE Peering Forum

- Central Asian Internet Symposium December 2014

2015

- IXP Workshop in Montenegro (February 23-27) | RIPE-NCC, France-IX, NIX.CZ, INEX, Cisco, ICANN

  - Equipment to be sent to Montenegro – Q2 2015

- Support of CEE Peering Forum & RIPE SEE

- Workshop in Bishkek, Kyrgyzstan (28 April 2015)

- Study with Partners in Kyrgyzstan re Infrastructure Development

IXP& Other Work in Middle East | 2014 & 2015

2014

- **Equipment provided to TUNIXP (July 2014)**

- **ME IXP Workshop in Tunisia (Nov. 2014)**

- **Support to MENOG**

- **Arab IGF**

2015

- **Support to MEDNSF (Mar. 2015)**

- **Support to MENOG (Mar. – Apr. 2015)**

- **Support to BIX (Lebanon) & PIX (Palestine)**

- **New Bureau Director to be hired for ME**

Tech Infrastructure & Impact

LIXP – Lesotho

KIXP – Kenya

IXPN - Nigeria

- ❖ **IXPs need not be expensive to be effective.**

- ❖ **LINX, now one of the largest IXPs in the world, started with 5 members and a donated switch.**
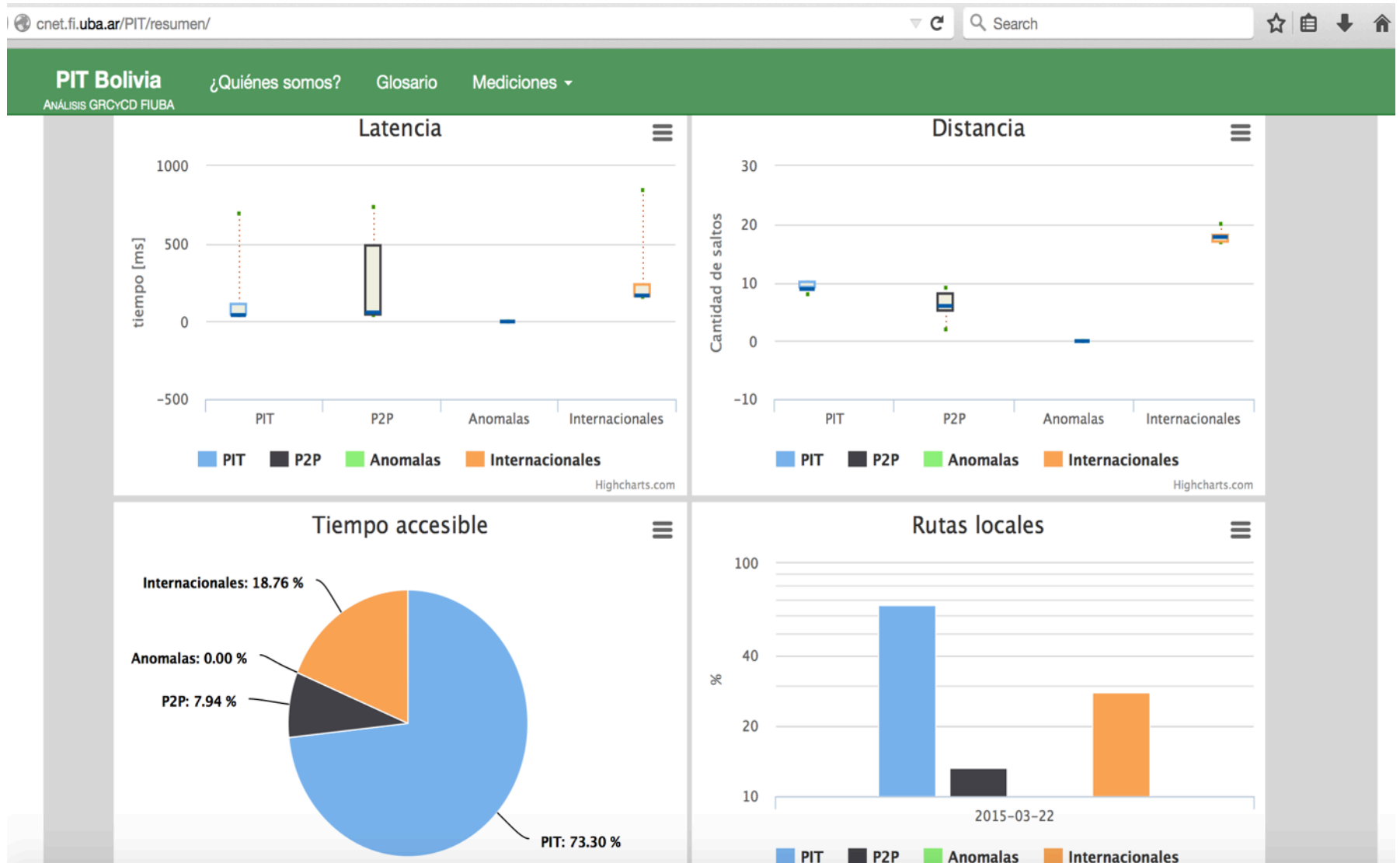
IXP Impact: LAC Study | November 2013

- **LAC Findings:**

  - Argentina: In one city → $100.00 per Mbps pre IXP/ down to $40.00 per Mbps post IXP

  - Brazil: NIC.br | PPT Metro System 26 IXPs attracting investment/content | 600Gbps at Peak

  - Ecuador: (Pre) International transit was $100 Mbps | (post) Local traffic costs $1.00 Mbps
    - ❖ Now running RPKI
    - ❖ After CDN cache installed in Quito in 2009 -> traffic up 700%

- **Additional Activities & Studies**
  - ❖ Measurement Study in Bolivia | Raspberry Pi deployment
  - ❖ Network efficiency Study in Argentina | Cabase and University of Buenos Aires

LAC IXP Study can be found here: http://bit.ly/1k6NaO0

LAC Measurement Study

- **Objective: Pre & Post IXP Assessment**

- **Bolivia IXP Paper: http://ow.ly/Jiw5X**

- **Bolivian IXP Data: http://cnet.fi.uba.ar/PIT/**

- **LACNOG Hosted BGP Data for 4 IXPs: http://ite.lacnog.org/**
  - Argentina, Chile, Colombia, Ecuador

- **2015: Continue Bolivia Study & Expansion to Paraguay & Central America**

- **Raspberry Pi's +**

- **Compliment additional data sources**

- **Establish data collection at IXPs as a regional "standard" and collaborative activity**

Bolivia IXP Data | http://cnet.fi.uba.ar/PIT/

Africa IXP Measurements

IXPs have two main reasons for conducting network measurements
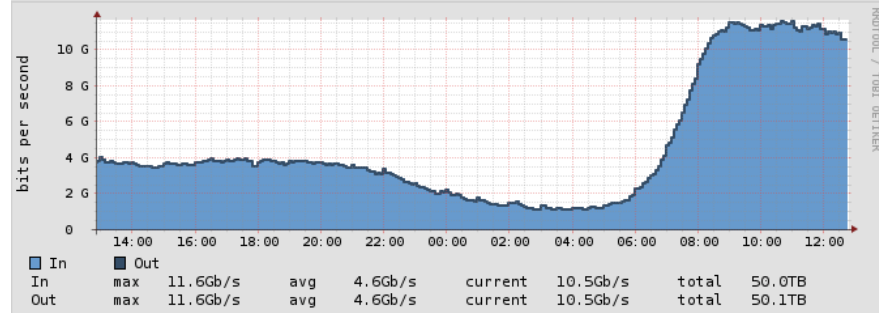
- **Technical Operations**
  - Network trouble shooting
  - Network efficiency and optimisation

- **Inform IXP Business Development**
  - Growth forecast & planning
  - Marketing and Awareness

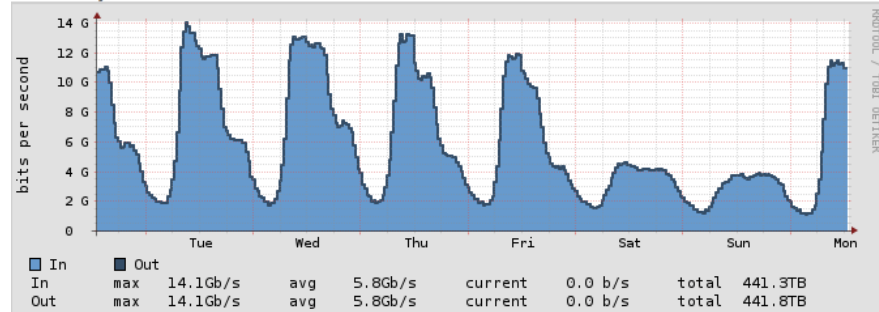**Measurements information can also be used to;**

- Support technical & policy research

  - Provide empirical data for scientific research

- Provide market environment indicators

  - Growth information on local content and cross-border interconnection, etc

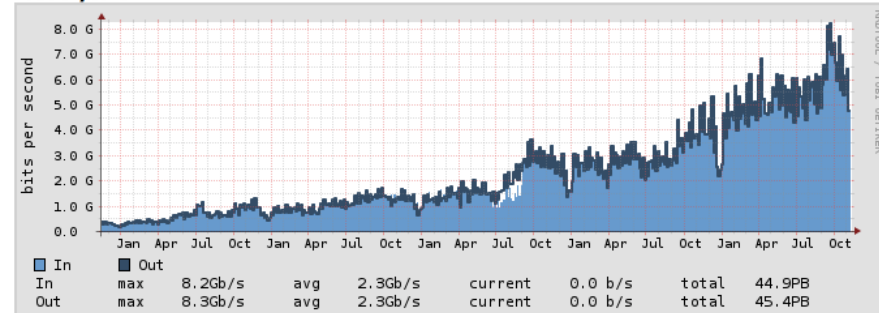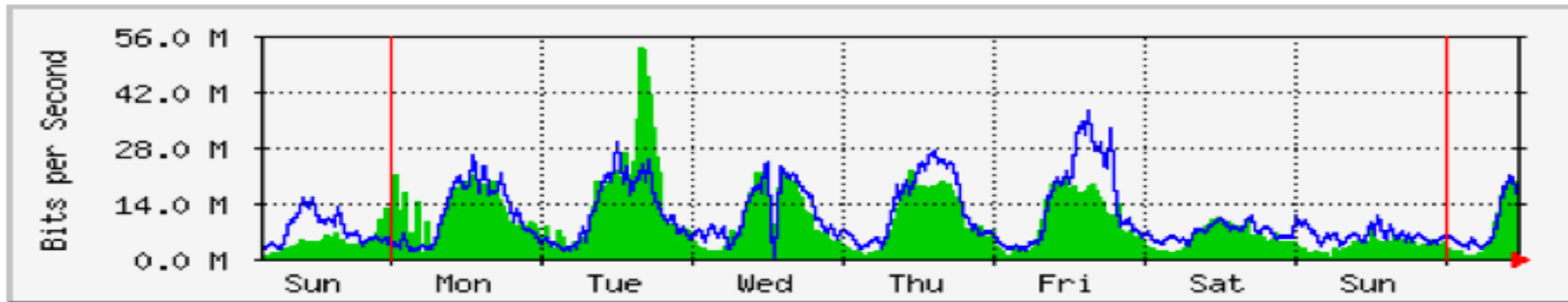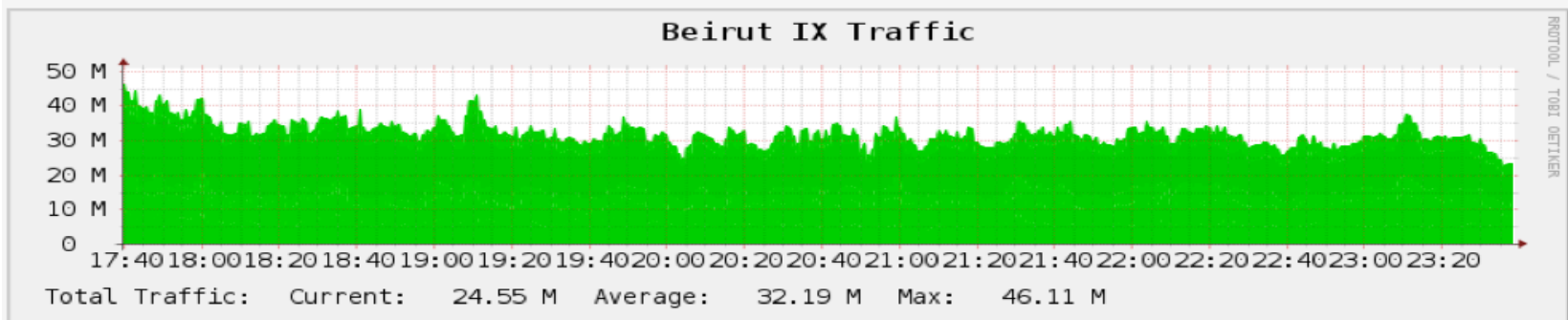# IXP Measurement: Traffic Statistics & Other info

- **Of the 31 operational IXPs less than 50% publish traffic stats on their website**

- **Only one IXP publishes historical traffic stats beyond 1 year**

- **Most of them do not publish ASN, Prefix, Ports and other useful information**

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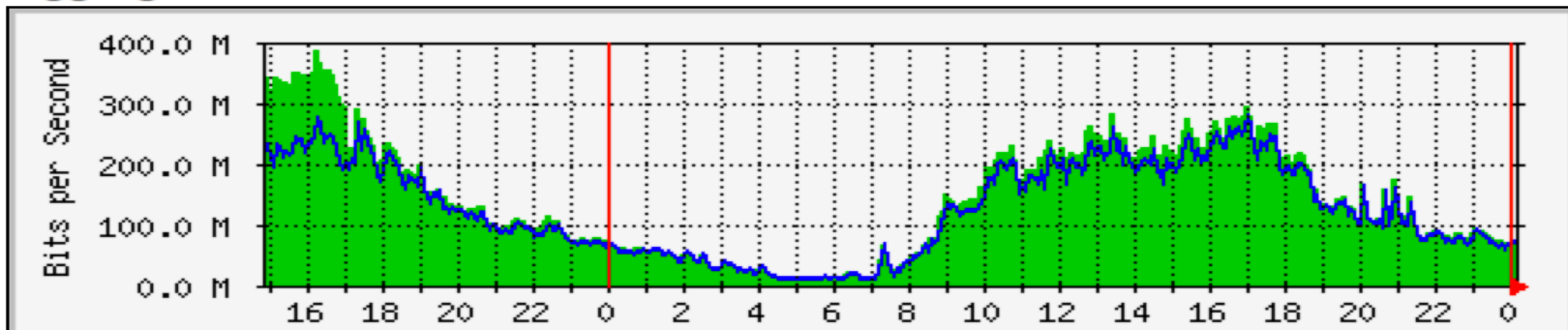# Africa Route and Prefix Analysis Program (ARPAN)

- **ARPAN is an Internet Society initiative aims to support IXPs in Africa to provide basic measurement information.**

- **The basic measurement information will enable stakeholders to monitor growth of regional interconnection towards the 80/20 by 2020 goal in real-time.**

- **The basic measurement information being considered under the ARPAN initiative is;**

  - **Aggregate Bandwidth Statistics for IPv4 & IPv6 traffic**

  - **Information on Peering Members such as their ASN**

  - **Number of ASN's and IP prefixes at the IXP and their origin Country/Region**

  - **Percentage of ASN's and IP Prefixes assigned by RIRs that are visible at national, regional and continental level**

  - **Other matrix measurements from route-collector data**
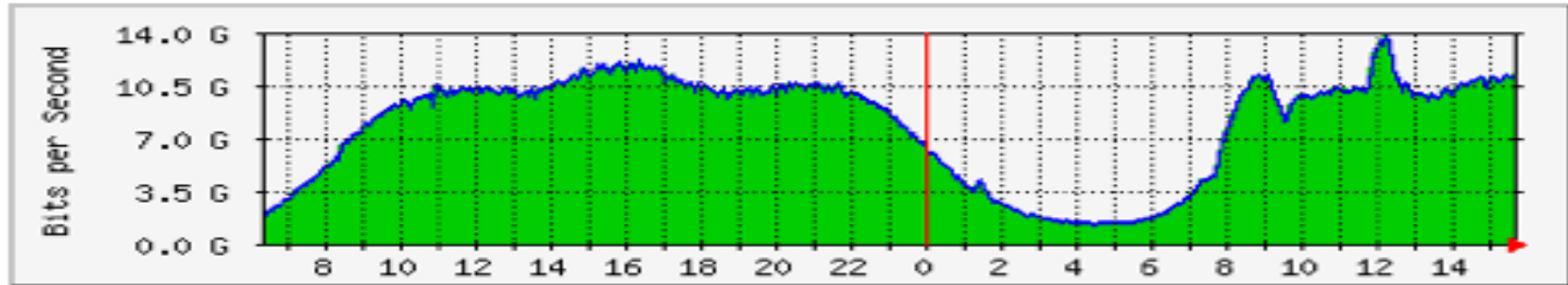
IX Traffic Graph Snapshots

Beirut IX Traffic

Total Traffic: Current: 24.55 M   Average: 32.19 M   Max: 46.11 M

Lebanon – 50.0 M | Nigeria – 56.0 M | Mozambique – 400.0 M

Aggregate Traffic -- MOZIX

IX Traffic Graph Snapshots

Ecuador-Quito – 14.0 G

Jo-burg – 13.0 G

Last 7 days

■ In	■ Out						
In	max	13.2Gb/s	avg	5.0Gb/s	current	5.2Gb/s	total	381.3TB
Out	max	13.3Gb/s	avg	5.1Gb/s	current	5.2Gb/s	total	382.1TB

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Thank you for your attention!

The Internet Society | www.internetsociety.org

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Resources

- **LAC IXP Study | "Connectivity In Latin America and the Caribbean: The Role of Internet Exchange Points http://ow.ly/Jiw8s**

- **Bolivia IXP Study | "Do Internet Exchange Points Really Matter? Evidence from Bolivia" http://ow.ly/Jiw5X**

- **IXP Toolkit | http://www.internetsociety.org/ixptoolkitguide**

- **Africa IXP Study | "Assessment of the Impact of Internet Exchange Points (IXPs) – Empirical Study of Kenya and Nigeria http://www.internetsociety.org/ixpimpact**

- **Lifting Barriers to Internet Development in Africa | Suggestions for Improving Connectivity http://ow.ly/Jiwhx**

- **Rwanda Content Study | "Promoting Local Content Hosting to Develop the Internet Ecosystem" http://ow.ly/JiwAE**