

GLOBAL IXP Overview and ISOC Work with Partners to Develop IXPs

APID | 19 June 2014

Port Moresby, Papua New Guinea

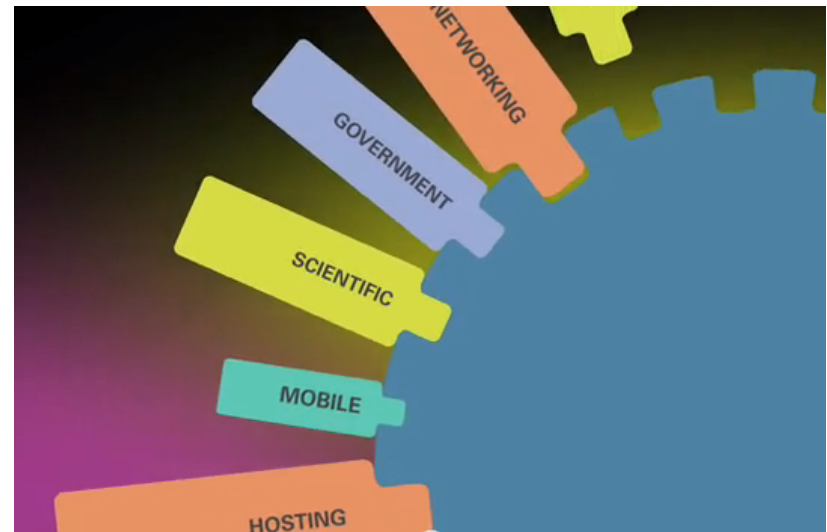
Global Dedicated Independent
Experienced **Responsive**
Credible **Thought-leader**
Internet Advocate Connecting
Authoritative **Transparent**
Accessible
Trusted **Cause-driven**
Collaborative Multistakeholder
Open **Consultative** Sharing

The Role and Effect of IXPS



Role of IXPs

- A primary role of an Internet Exchange Point (IXP) is to **keep local Internet traffic within a local infrastructure** and to **reduce costs** associated with traffic exchange between networks.
- **Improve the quality of Internet services and drive demand** by reducing delay and improving end-user experience
- **Convenient hub for attracting and hosting key Internet infrastructures** within countries
- **Catalyst** for overall Internet development
- Not limited to commercial ISPs, wide range of network or data service can benefit from participating
 - E-Gov, Universities, etc.



IXPs Around the World



Source: TeleGeography World IX Map, <http://www.internetexchangemap.com/>

ISOC IXP Toolkit Maps: www.ixptoolkit.org/maps

IXP toolkit



Home

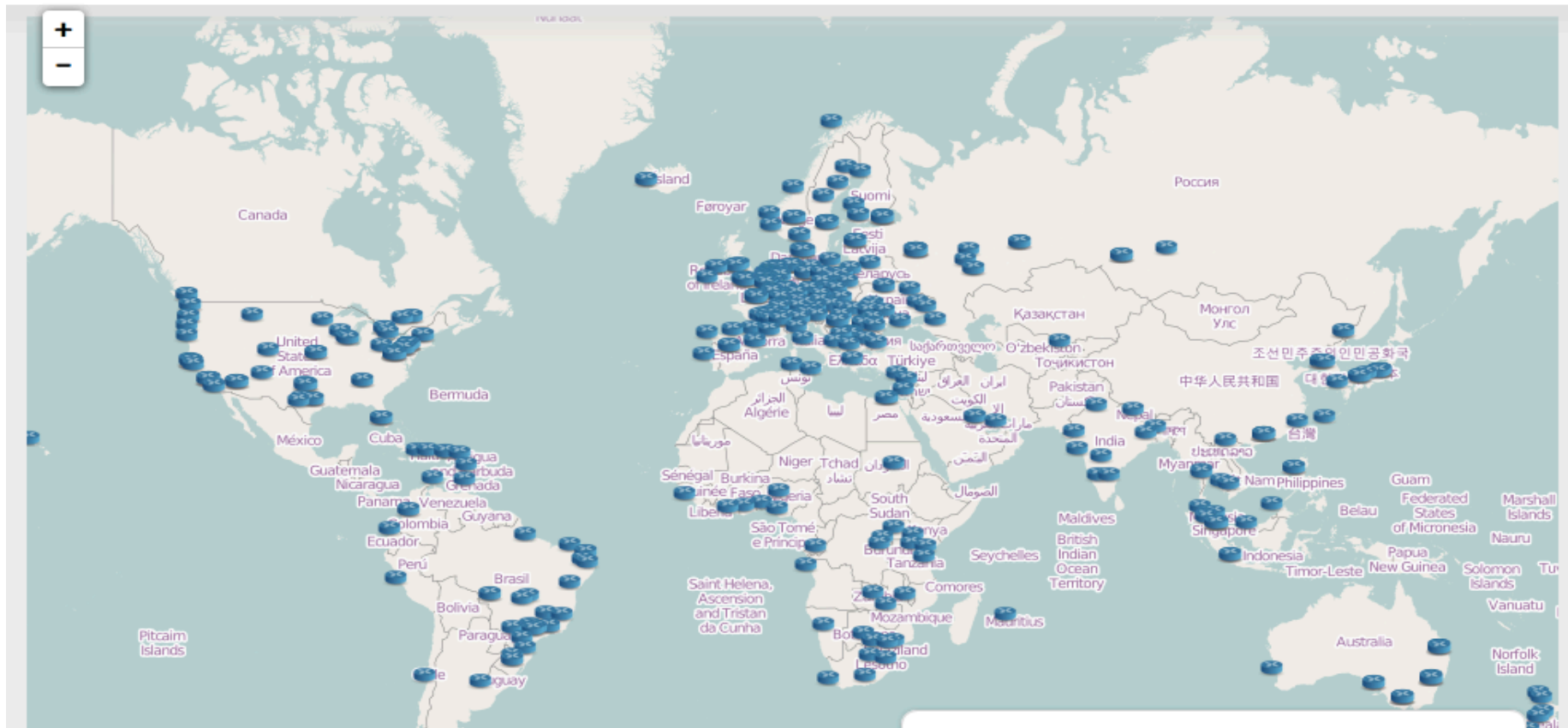
IXPs

Training

Data

Maps

Community



Source: TeleGeography World IX Map, <http://www.internetexchangemap.com/>

Packet Clearing House (PCH) Resources |

<https://prefix.pch.net/applications/ixpdir/>



Log In



Home

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Purpose

Technology

Resources

Calendar

Sponsors

Contact

INTERNET EXCHANGE DIRECTORY

Help

Show inactive IXPs

Hide inactive IXPs

Show summary views

Submit a change

Feature/bug report



Source:

IXP Associations and Partnerships

- Euro-IX | www.euro-ix.net
- ✓ Af-IX |
- ✓ AP-IX |
- ✓ LAC-IX |
- **Community of Interests Come Together**
- ✓ **Best Practices/lessons learned**
- ✓ **Training**
- ✓ **Peering Fora**
- ✓ **Mentoring or Twinning**
- ✓ **Equipment Donations**

IXPs | Examples of Benefits, Studies, Content Driving Uptake

Africa and Latin America Leading Annual IXP Growth Rates

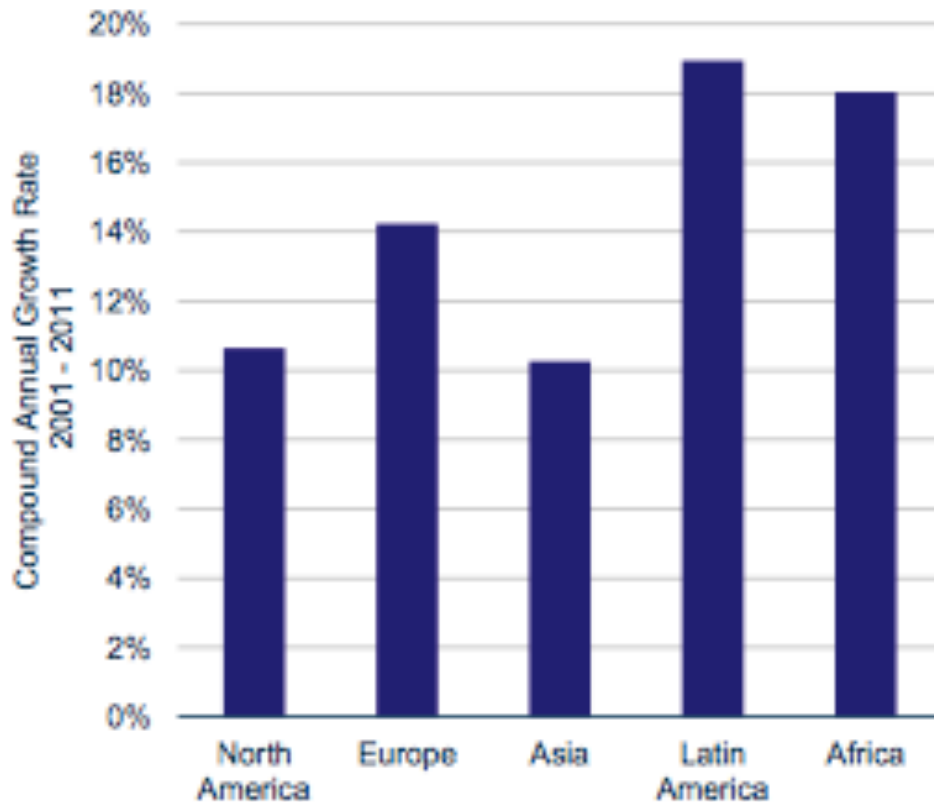


Figure 3.3: Compound annual growth rate in IXPs, by region, 2001-2011 [Source: Packet Clearing House (www.pch.net), Analysys Mason estimates]

Source: Kende, M., Report for the Internet Society:
How the Internet continues to sustain growth and innovation, October 2012
Data from Packet Clearing House and AnalysysMason estimates

Measuring the Benefits and Impacts of IXPs: Kenya and Nigeria Case Study

<i>Benefit</i>	<i>KIXP</i>	<i>IXPN</i>	<i>Summary</i>
Latency	Reduced from 200-600 ms to 2-10 ms	Reduced from 200-400 ms to 2-10 ms	Noticeable increase in performance for end users
Local traffic exchange	1 Gbit/s peak	300 Mbit/s peak	Savings on international transit of over \$1 million per year in each country
Content	Google network present locally, along with rehomeing of domestic content	Same as in Kenya	Increase in usage and corresponding revenues for mobile data traffic
E-government	Kenya Revenue Authority gathers taxes online	Usage by education and research networks	Social benefits from e-government access to IXPs
Other benefits	An increasing amount of regional traffic exchanged at KIXP	Financial platforms hosted locally	Further economic benefits resulting from IXPs

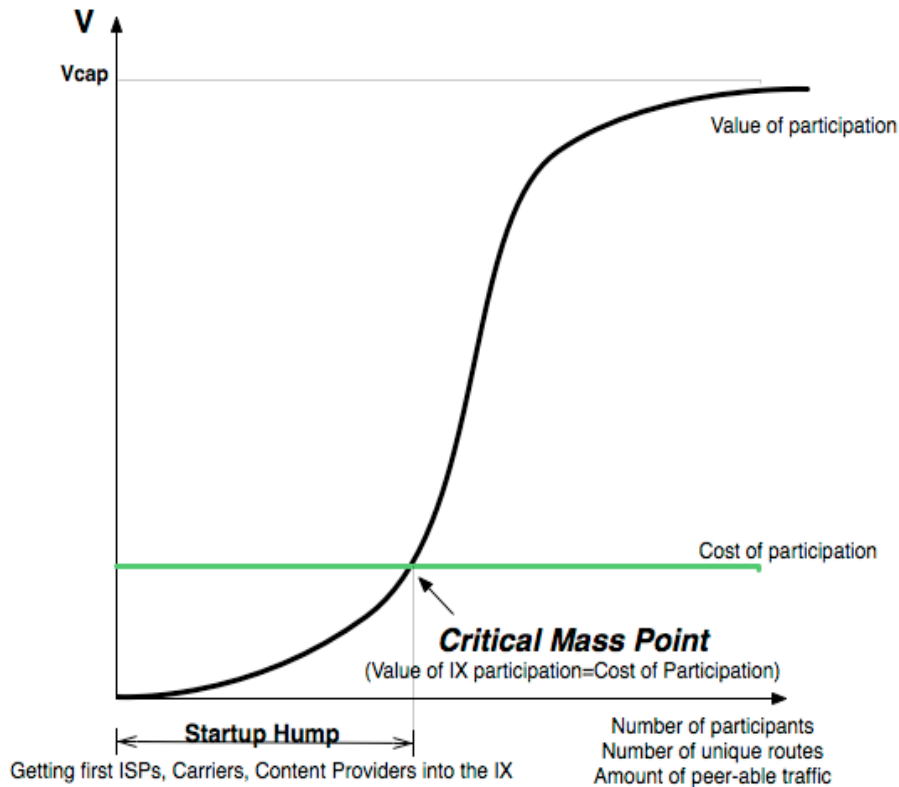
- Reduced latency increasing performance and driving demand -- Especially for data-heavy applications, including video
- Direct savings on international transit (\$1.5M p.a. Kenya, \$1M Nigeria)
- Benefits facilitating e-government and education services -- e.g. Kenya Revenue Authority, West African Examination Council
- Catalyzing local hosting and content industry -- Repatriation of financial platforms in Nigeria, Data center investment in Kenya
- Increased mobile data market by an estimated \$6 million in Kenya; KIXP is attracting regional traffic

Building Participation Incentives Beyond Peering Value

Getting to peering participation break-even can be a challenge in some markets

“Value-added” services and other performance enhancing benefits can provide incentives

Value of the Internet Exchange Point



Internet Root Servers Mirrors

ccTLD / gTLD servers

Network Time Servers

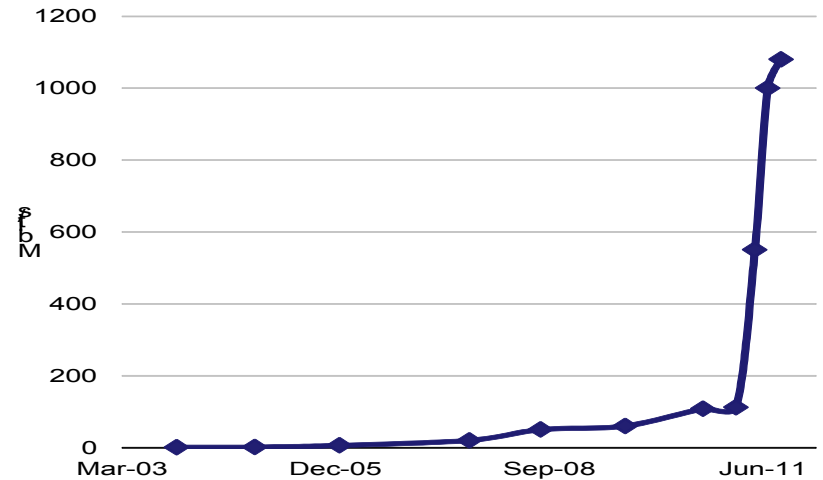
Network Monitoring Tools

Increased quality of service

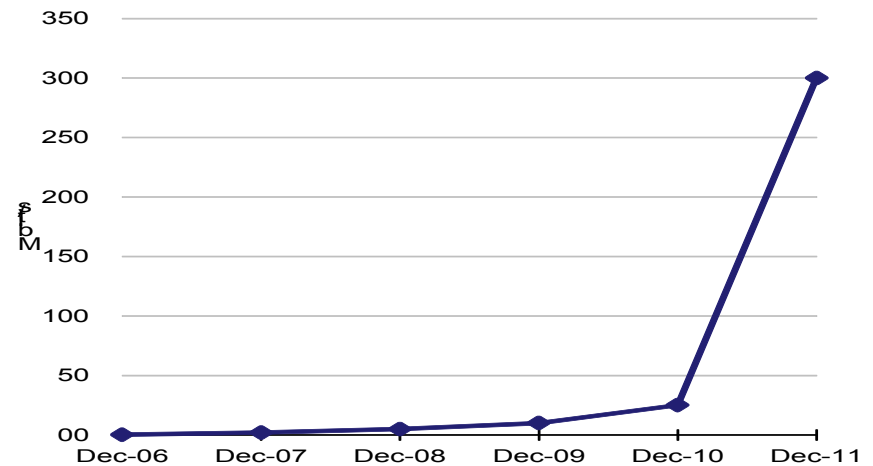
Local service resiliency

CDN Caches: Localizing International Content

- In addition to creating local hosting, local caching of Content Delivery Network content is a key opportunity
- Implementation of Google Caches and pops has had an impact on local traffic growth
- Localized Google traffic represents more than 50% of traffic exchanged at KIXP and IXPN
- CDNs report that the existence of a robust IXP is a key decision factor in decision making on cache/pop locations

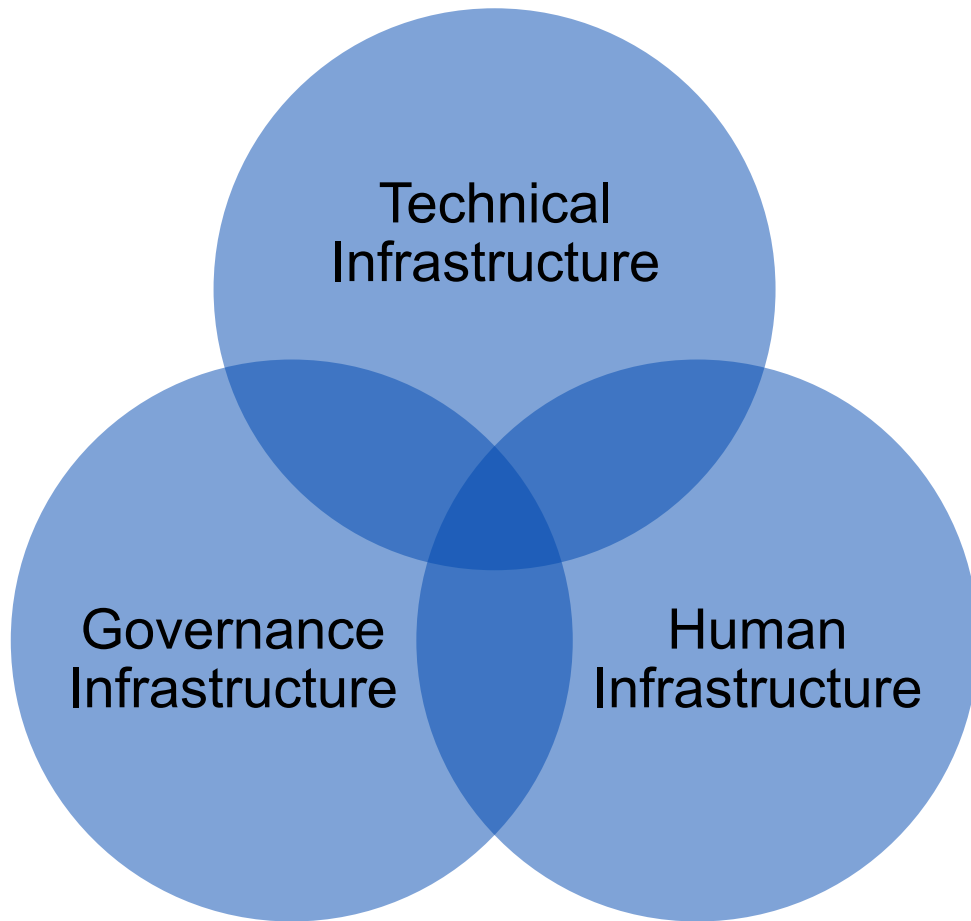


KIXP



IXPN

Formula for Development: What kind of infrastructure is needed for an IXP?



- Important to think of IXPs beyond the “Boxes and Wires”
- **3 types of infrastructure**
 - **Technical**
 - **Governance**
 - **Human**
- IXP projects are most vulnerable when the key focus is on physical infrastructure
- Human infrastructure and capacity building is the key driver of success and sustainability
- 80/20 Rule (some say 90/10)

Technical Infrastructure



LIXP – Lesotho

IXPs need not be expensive to be effective.

The London Internet Exchange, the now the largest IXP in the world, started with 5 members on a donated switch.



KIXP – Kenya



IXPN - Nigeria

Governance Infrastructure

- Not-for-profit, member-driven governance model is most common globally
 - From small IXPs to some of the largest in the world. For-profit/commercial IXPs generally limited to exceptionally strong markets.
- Neutrality and transparency are key
 - Including IXP not competing with its members/participants,
- Inclusive policies and processes
 - Encourage NRENs, e-Gov Networks, etc.
 - Sustain member engagement / development beyond start-up, vision for the future.
- Mandatory Multilateral Peering vs Bilateral Peering Policy

Human Infrastructure

- The *most important factor* for start-up and sustainability.
- Understanding the value proposition
- Trust and relationship building is essential
- Technical Capacity Building
 - Both at the network operator/IXP participant level and the IXP operations level.
- Building local and regional communities of practice to sustain and grow knowledge. International cooperation.
- Reducing the information asymmetry to empower local and international opportunities



IXP 80/20: “80% Social Engineering, 20% Technical Engineering”

Keeping IXPs in Context...

- IXPs can be a catalyst of a robust Internet environment and market.
- Many other issues are involved in promoting a robust interconnection and traffic exchange environment in a country / region.
- Barriers and bottlenecks along the service chain are various and challenging:
 - Backhaul and Leased Capacity
 - More costly to send traffic from Abuja to Lagos, than Lagos to London. Cape Town to Jo'burg similar
 - Cross-border connectivity, policy and licensing issues
 - International gateways, landing stations
- With falling international capacity prices (including around Africa), there is also opportunity to take advantage of international peering opportunities.
- ISOCs situates its IXP work within the broader interconnection and traffic exchange (ITE) context.

Interconnection and Traffic Exchange (ITE): Programmes and Projects



ITE

Our Interconnection and Traffic Exchange (ITE) Programme is multifaceted, and aims to address a broad range of challenges related to improving the situation in these countries. Activities under the ITE Programme include:

- Assisting universities, government network operators, and ISPs to gain the world-class knowledge and skills needed to build reliable, cost-effective, and interconnected networks,
- Assisting the launch of new Internet Exchange Points (IXPs) in developing economies, and helping stakeholders maximize the use of IXPs already in place,
- Facilitating multi-stakeholder collaborations on these issues, including initiating and organizing the African Peering and Interconnection Forum (AfPIF) <http://www.internetsociety.org/events/african-peering-and-interconnection-forum-afpif>) and supporting the Latin American and Caribbean IXP Association (Lac-IX), and
- Assisting policy-makers and regulators to develop approaches to expand the Internet and to create a beneficial interconnection and traffic exchange landscape.

Examples of ITE Work

ISOC's expertise and experience in ITE includes the following (II):

- ***Technical training*** on the establishment, operation, and administration of IXPs, including providing a training kit, traveling technical laboratory, and relevant follow-up workshops
- ***Studies and Reports Financial/equipment support*** for the establishment of IXPs
- ***Convener/Facilitator of multi-stakeholder buy-in and cooperation***

IXP Toolkit Project

IXP Toolkit & Best Practices Project

- **The Internet Society was awarded a grant by Google to extend its Internet exchange point (IXP) activities in emerging markets. (A/C Briefing March 2013)**
- **The IXP Toolkit Grant builds on the Internet Society's previous efforts in this space and will:**
 - **Create an IXP Toolkit | A study and Methodology to Identify Best Practices**
 - **Create an IXP "Portal" | A Door to Doors**
 - **Partner to Conduct Training and Hold Workshops | Building Capacity**

IXP Toolkit & Portal Launch – APRICOT 37! 25 February

www.ixptoolkit.org | SOCIAL MEDIA

www.internetsociety.org/blog/development/2014/02/we-need-your-feedback-ixp-t

Google

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We Need Your Feedback: IXP Toolkit And Best Practices Guide

JANE COFFIN

Director, Development Strategy



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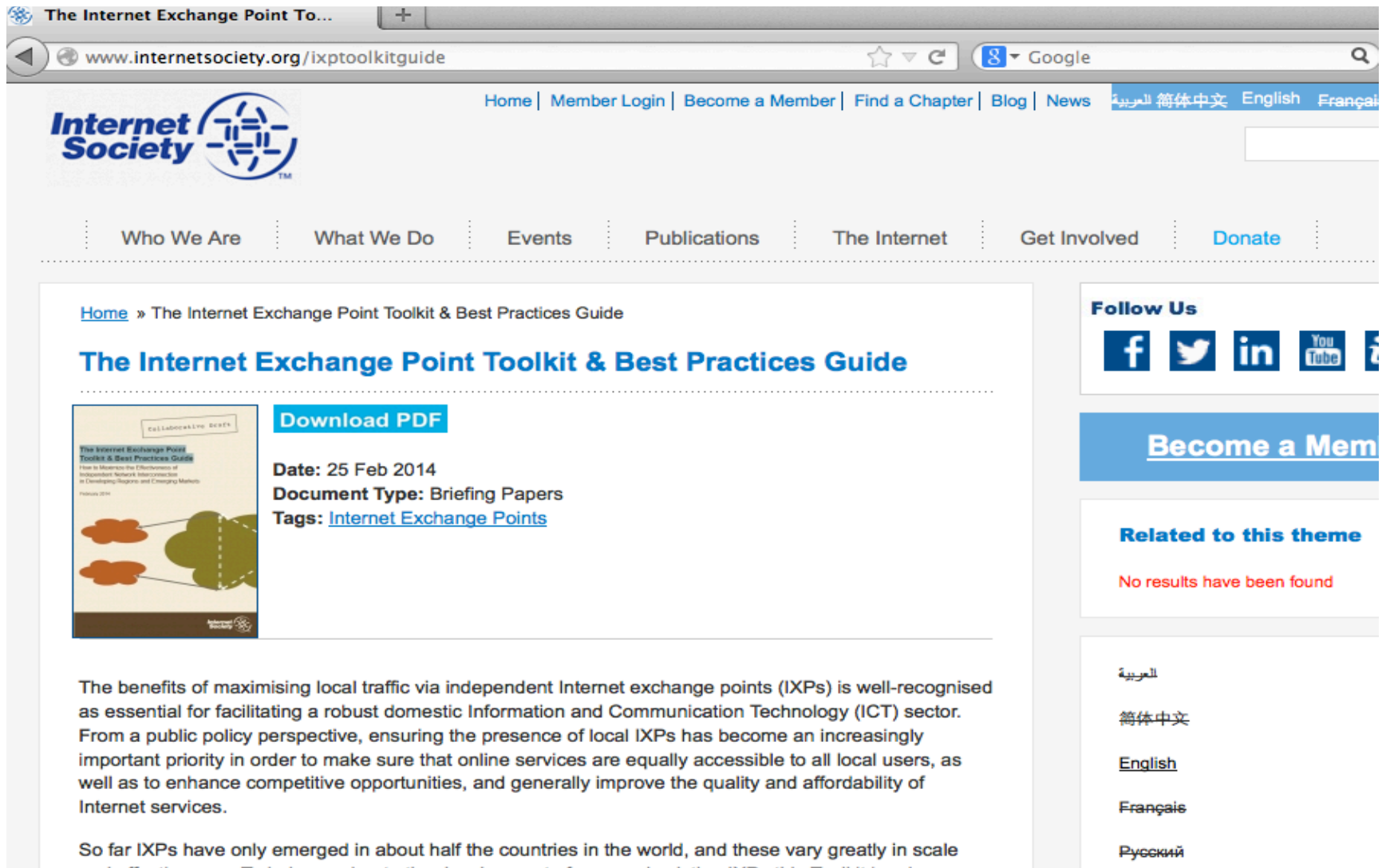
IXP Toolkit & Portal Launch – APRICOT 37! 25 February | ISOC Main web site

The screenshot shows the Internet Society website with the following elements:

- Browser Address Bar:** www.internetsociety.org
- Navigation:** Member Login | Become a Member | Find a Chapter | Blog | News | 简体中文 | English | Français | Русский | Español
- Search:** Search bar with a magnifying glass icon.
- Menu:** Who We Are | What We Do | Events | Publications | The Internet | Get Involved | Donate
- Main Content Area:**
 - IXP Toolkit:** Internet Society releases a working draft of the IXP Toolkit and we need your help to make it great. [Send your feedback](#)
 - Follow us:** Social media icons for Facebook, Twitter, LinkedIn, YouTube, and i!.
 - Join:** Join today and help shape the future of the internet.
 - Deploy360:** Get real-world help with IPv6 and DNSSEC deployment.
- Image:** Two women in traditional headscarves looking at a laptop.
- Thumbnail Strip:** A row of five small images showing various people and activities, including a 'Vote' button.
- Video Player:** A blue bar at the bottom with play/pause and next/previous buttons.

IXP Toolkit & Portal Launch – APRICOT 37! 25 February

www.ixptoolkit.org | Link to Collaboration Draft




The screenshot shows a web browser window displaying the Internet Society website. The address bar shows www.internetsociety.org/ixptoolkitguide. The page features the Internet Society logo and a navigation menu with links for Home, Member Login, Become a Member, Find a Chapter, Blog, News, and language options (العربية, 简体中文, English, Français). A secondary menu includes Who We Are, What We Do, Events, Publications, The Internet, Get Involved, and Donate. The main content area is titled "The Internet Exchange Point Toolkit & Best Practices Guide" and includes a "Download PDF" button, a date of 25 Feb 2014, a document type of Briefing Papers, and a tag for Internet Exchange Points. A sidebar on the right contains social media links, a "Become a Member" button, and a "Related to this theme" section with no results found. Language options are listed at the bottom of the sidebar.

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The Internet Exchange Point Toolkit & Best Practices Guide

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Date: 25 Feb 2014
Document Type: Briefing Papers
Tags: [Internet Exchange Points](#)



The Internet Exchange Point Toolkit & Best Practices Guide
How to Maximize the Effectiveness of Independent Network Interconnections in Developing Regions and Emerging Markets
February 2014

The benefits of maximising local traffic via independent Internet exchange points (IXPs) is well-recognised as essential for facilitating a robust domestic Information and Communication Technology (ICT) sector. From a public policy perspective, ensuring the presence of local IXPs has become an increasingly important priority in order to make sure that online services are equally accessible to all local users, as well as to enhance competitive opportunities, and generally improve the quality and affordability of Internet services.

So far IXPs have only emerged in about half the countries in the world, and these vary greatly in scale and effectiveness. To help accelerate the development of new and existing IXPs, this Toolkit has been

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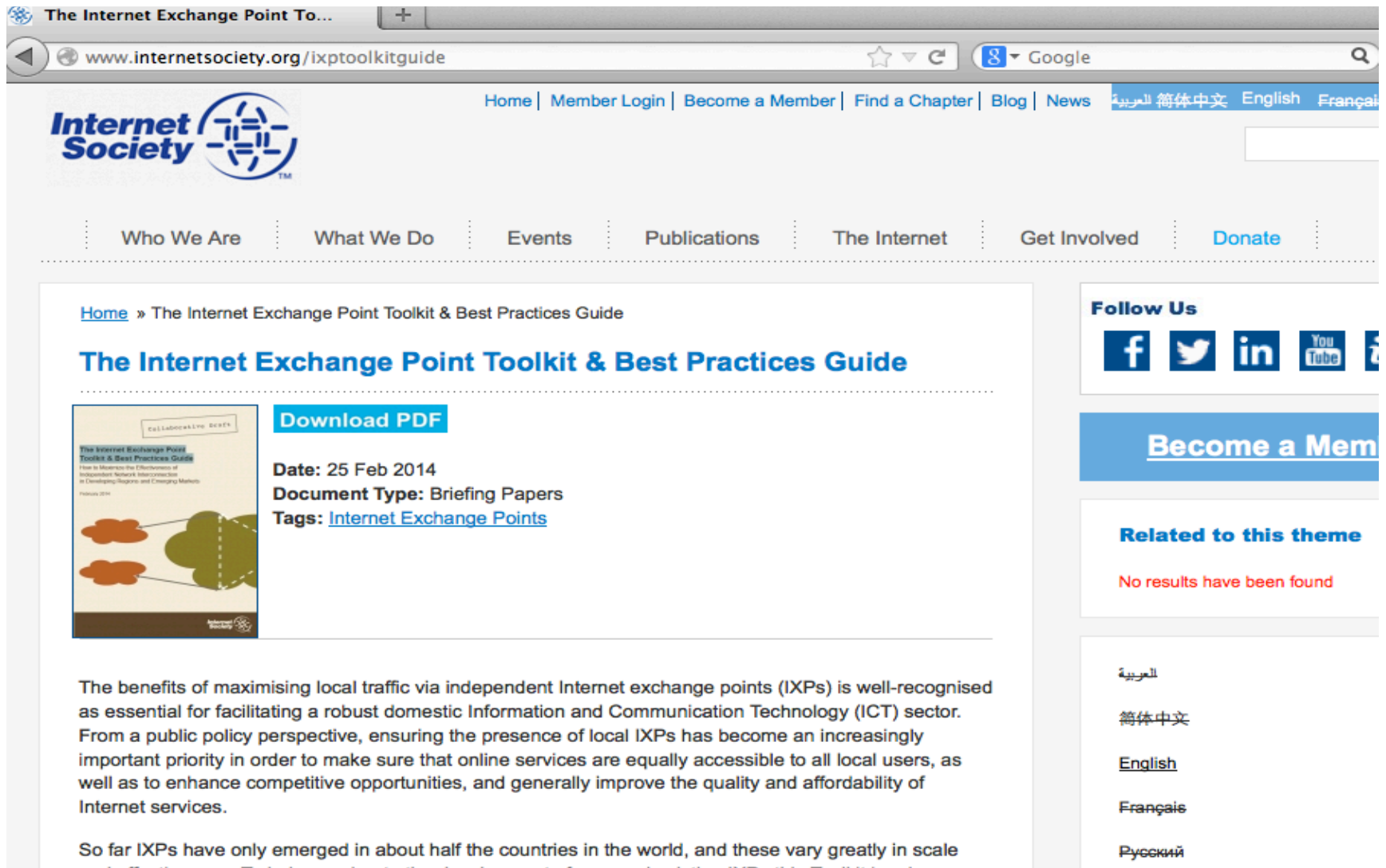
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The Internet Society

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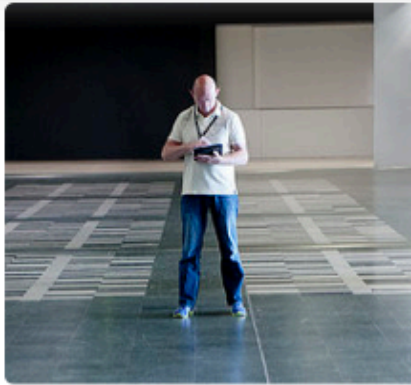
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Work with us to improve this Website.

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Improve the Toolkit

Send us your input and comments on the IXP Toolkit!

[Click here to send us your feedback](#)

Learn More About IXPs:

Watch this video from [Euro-IX](#) and learn some of the Basics ->

And, click [here](#) for the Euro-IX video in over 8 languages.

Click to see a picture of the set-up of the [Nepal IXP!](#)

Click below for videos of African IXP experts and lessons they learned:

- [Kenya 1](#)
- [Kenya 2](#)
- [Egvt](#)



CASE STUDIES

Kenya

Nigeria

South Africa

Tanzania

Rwanda

Zambia

Uganda

Reunion

Mayotte

Case Studies

In this section, our goal is to provide you with resources to help you learn more about IXPs around the world. The videos and case-studies on this page provide insight and information about lessons learned when setting up an IXP, insight into running and managing an IXP, and general advice. Country specific case studies show the range of national market and policy environments that IXPs may be required to operate within, the types of institutional models and interconnection policies adopted by IXPs, and how IXPs evolve over time. Do you have a case-study that you would like us to include on this site? Have we made any mistakes? Please send any case-studies or queries to us at: feedback@ixptoolkit.org

IXPS

[What Are IXPs](#)

[Getting Started](#)

[Physical Infrastructure](#)

[Benefits and Impact](#)

[IXP Models](#)

[Business Case](#)

[For Policy Makers and Regulators](#)

[Case Studies](#)

IXP Toolkit & Portal | Partnerships & Community

Community

The IXP and Internet Community



You will find a wide-range of technical experts, practioners, and policy and regulatory experts involved in the IXP Community and the broader Internet technical community.

Communities are built to provide support. There is an excellent IXP community out there. You may need an introduction or two, or to attend meetings, or join on-line groups for technical collaboartion. But once you find these amazing resources, options open up for collaboration, technical development, and simple assistance trouble-shooting problems.

IXP Toolkit & Best Practices Project

- **Toolkit & Best Practices Guide | See above!**
- **Training**
 - **Best Practices & Technical Assistance Training | Hands-on**
 - **We ask | What do you need?**
 - **We work with international experts to provide the training**
- **Equipment | Getting Started + Leveling-up**
 - **Switches & Routers**
 - **Power & Security**

IXP/Peering Related Upcoming Events | Partnership Opportunities | 2014

- **RIPE SEE | Sofia, Bulgaria | 14-15 April**
- **LACNIC/LACNOG | Cancun, Mexico | 4-9 May**
- **AFNOG/AIS | Djibouti | 25 May – 6 June**
- **AfPIF | Dakar, Senegal | 26-28 August 2014**
- **Regional Training (with partners!)**
- **Partners and Orgs Doing great IXP work:**
 - ✓ **Packet Clearing House (PCH), APNIC, Euro-IX, RIPE, Independent Experts (Philip Smith, Mike Jensen)**

African Internet Exchange System (AXIS)

AXIS

- The Internet Society has been contracted by the African Union to conduct 60 capacity building workshops in 30 African Union Member States that do not have IXPs (AXIS Phase I)
 - 30+ Best Practice Workshops and community mobilization
 - 30+ Technical Aspects workshops (hands-on)
- The AXIS project supports the establishment of a continental African internet infrastructure.
- The overall AXIS project aims to create an African internet system by setting up:
 - Internet exchange points in 33 African countries
 - five regional internet hubs
 - five regional and three continental internet carriers

Africa Peering and Interconnection Forum (AfPIF)

AfPIF

- The African Peering and Interconnection Forum addresses the key interconnection, peering, and traffic exchange opportunities and challenges on the continent and provides participants with global and regional insights for maximising opportunities that will help grow Internet infrastructure and services in Africa
- AfPIF aims to foster national and cross-border interconnection opportunities by providing a forum where key players from infrastructure and service providers, IXPs, regulators and policy makers can engage in a relaxed but business like environment, sharing their experiences and learning from experts in the field
- **AfPIF – 5:** 2014 Date and Location – 26-28 August 2014, Dakar, Senegal

Latin America and Caribbean Peering Forum

LAC PEERING FORUM

- Partnerships for capacity building and training
- Foster national and cross-border interconnection opportunities by providing a forum where key players from infrastructure and service providers, IXPs, regulators and policy makers can engage
- Build “trust” networks
- ✓ Meet experts, connect with colleagues, build communities

Curacao – Week of October 28

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The Internet Society