Internet Society

THE INTERNET
IS FOR EVERYONE

Join us to keep the Internet open, thriving, and benefitting people around the globe.

IXP Workshop & Technical Training

Port Moresby, Papua New Guinea

13 May 2016

What is the Internet Society?

The Internet Society (ISOC) is a cause-based organization that works with governments, industries, and others to ensure the technologies and policies that helped develop and evolve the Internet will continue into the future.

Our programs cultivate an Internet that is open to everyone, everywhere and aim to ensure that it will continue to be a tool for creativity, innovation, and economic growth.

MISSION: To promote the open development, evolution, and use of the Internet for the benefit of all people throughout the world.

VISION: The Internet is for everyone

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Global Presence

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NORTH AMERICA

EUROPE

THE MIDDLE EAST

AFRICA

ASIA

LATIN AMERICA & CARIBBEAN

118+	**80,000+**	**143+**	**5 (6)**	**21/38**
Chapters Worldwide	Members and Supporters	Organization Members	Regional Bureaus	Countries where ISOC Staff Work & Languages

ISOC | Who and What

Home | Connect/Login | Become a Member | Find a Chapter | Blog | News | العربية | 简体中文 | English | Français | Русский | Español

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Who We Are | What We Do | Events | Publications | The Internet | Get Involved | Donate

Why It Matters

Is enough to have Internet access, or must we also ensure that the access is open and unrestricted?

Join us at RightsCon

Deployment of W4C in Nepal in earthquake affected area of Gorkha District (Location of epicentre).

10 Villages connected, including 2 health centres and multiple schools.
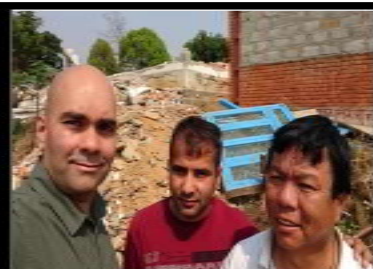
Above: Rajnesh Singh and Babu Ram Aryal
Below: ISOC sponsored Wi-Fi Area

I E T F®

Search

Chat Live with the IETF Community

Kenya IXP Project II

International IXP Development | Associations & Forums

An Internet Exchange Point (IXP) is a network facility that enables the interconnection of more than two independent Autonomous Systems, primarily for the purpose of facilitating the exchange of Internet traffic
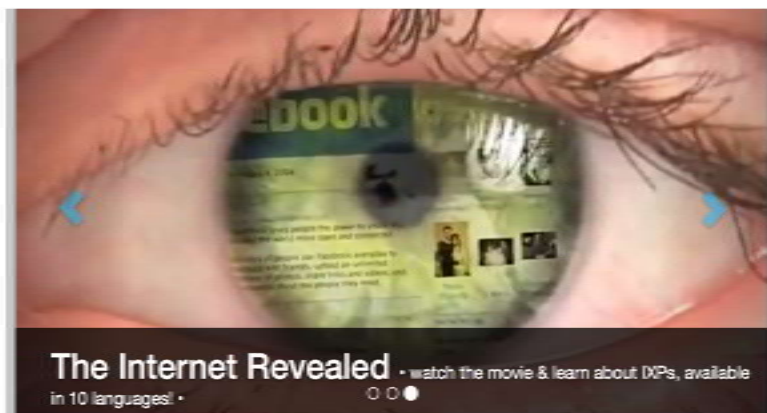

❖ **IX-Federation | http://www.ix-f.net/**

IXP Best Practices and Best Current Operational Practices

https://www.euro-ix.net/ixps/set-up-ixp/ixp-bcops/

IGF IXP Best Practices | http://ow.ly/YYTFZ

IXP Tech Infrastructure & Impact

- ❖ 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.

- ❖ Bottom-up Community Development

- ❖ Technical Capacity Building

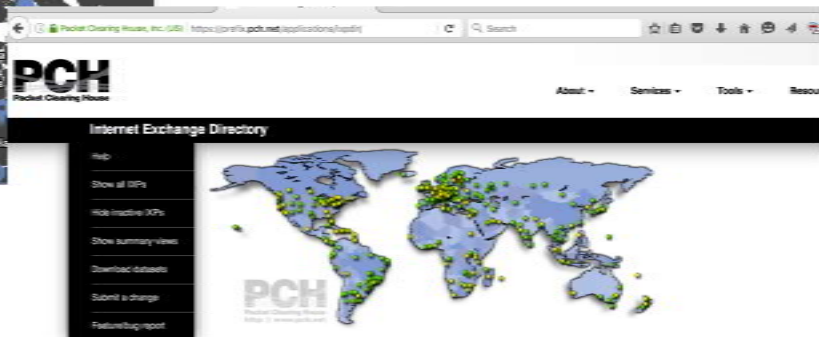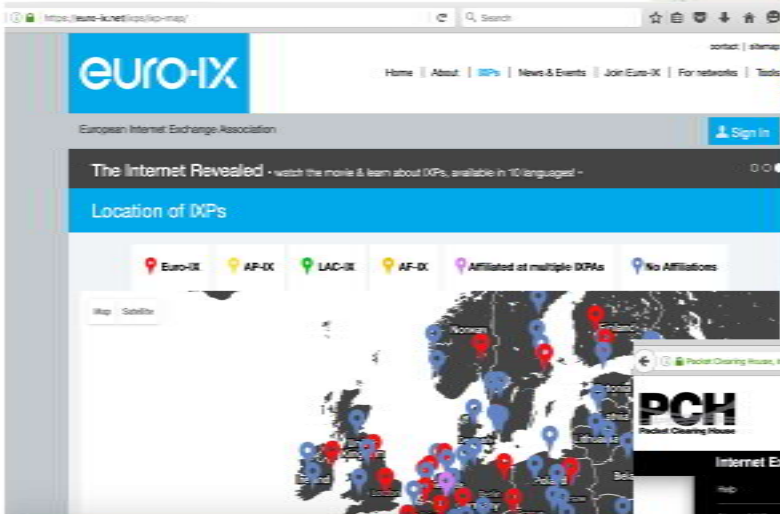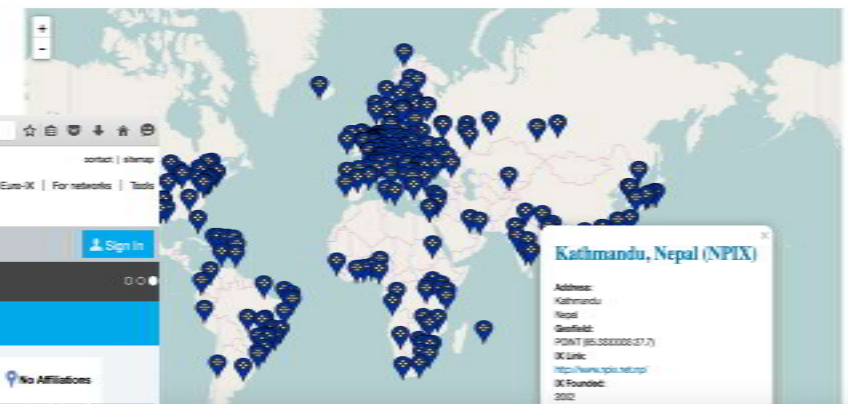- ❖ Local traffic cheaper, latency decreases, quality better

The Internet Revealed · watch the movie & learn about IXPs, available in 10 languages! ·

https://www.youtube.com/watch?v=QuBde4Sn3f0

It Starts with a Handshake

https://www.youtube.com/watch?v=5oliP-p4zJM

IXPs Global Landscape

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IXPs | Global

Internet Exchange Point (IXP) Maps

IXPs | Global
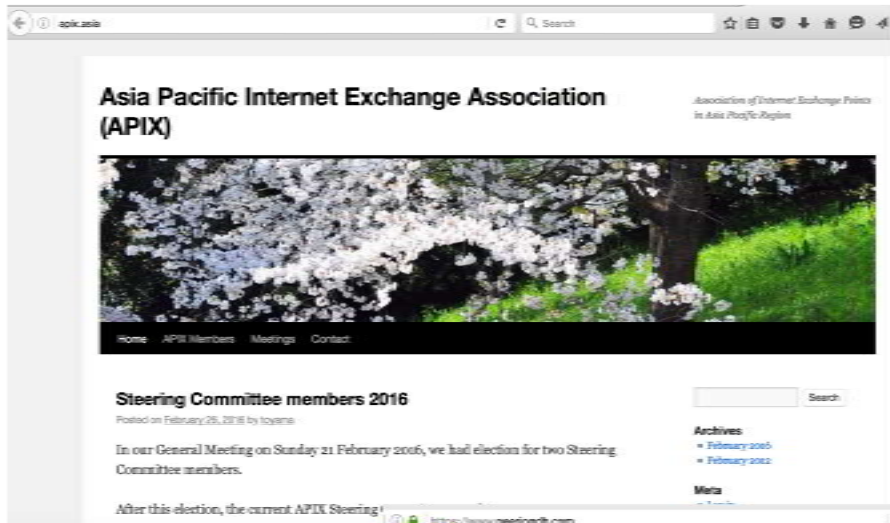
IXPs | IXP Associations & Peering DB

Af-ix.net
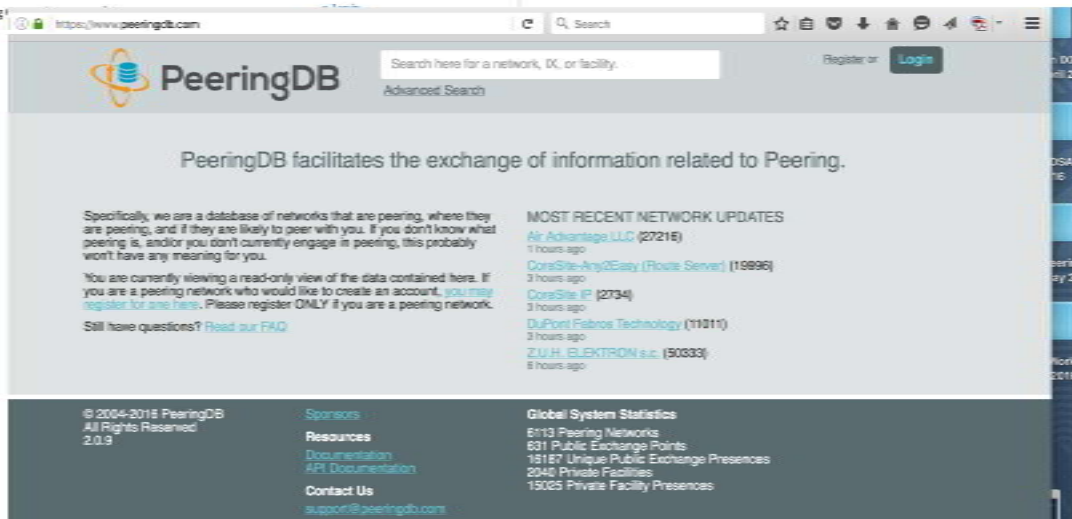
Ap-ix.net

Euro-ix.net

Lax-ix.org

IXP Development | Peering Events & Network Operator Group Meetings
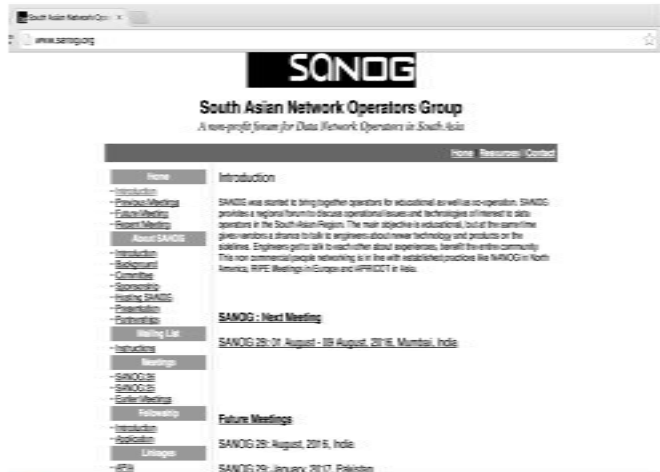
Internet Ecosystem – Impact | IXPs

- **Internet Community Multiplier Effect**

- **Internet & Fibre Infrastructure Development**

- **Local technical community development & strengthening**

- **Train the trainer**

- **Network Operator Group (NOG) Development**

- **Mentoring Opportunities**

- **Economic Development & Investment | Additional Sustainable Infrastructure Projects**

- **Bottom-up Governance & Amplifier Across Local Ecosystem**

IXPs Best Practices & Regional

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Challenges - IXPs

Collaboration and building trust. The establishment of an IXP requires the collaboration of many actors, many of whom are competitors that will be exchanging traffic at the IXP. **Neutral location and management.**

Best practices have shown that IXP location and management should be as neutral as possible and agreed upon by all IXP participants. Ideally, the location of an IXP and an IXP manager/operator should be independent of outside commercial or governmental influences. Unfortunately, some incumbents and/or governments want to control all aspects of an IXP. When this happens, the IXP often fails, as confidence and trust in its management and operations is lost.

Enabling environment. IXPs are sensitive to local constraints associated with the lack of an enabling Internet-connectivity environment, including investment and tax constraints, the high cost of local terrestrial fibre, and complicated rules for network deployment.

Best Practices - IXPs

Guiding Principles

Government actors can play an active and critical role in championing the development of IXPs and removing roadblocks to their growth and success. Guiding principles for policy makers and regulators include:

- **Support IXPs** and speed their development with information and communications technology (ICT) policy objectives that promote an enabling environment for interconnection via policy and regulatory frameworks.

- **Provide as much policy and regulatory transparency** as possible to encourage regional and international entities to participate in the local interconnection and peering environment.

- **Encourage competitive access to wired and wireless connections,** which will help lower the costs associated with connecting to an IXP.

Best Practices - IXPs

Guiding Principles

- **Promote local investment opportunities** via tax holidays, and reduced duties on the equipment needed to build IXPs and operator networks (e.g., switches, routers, and servers). Provide clear guidance about local business rules and practices.

- **Foster relationships with IXPs to learn more** about local interconnection environments and the sustainability and technical management of an IXP.

- **Work with existing IXPs and expert organizations to avoid the mistakes** that other IXPs have made, obtain start-up assistance and equipment donations, and learn more about training and human-capacity development opportunities.

- **Refer to the Internet Society online Interconnection information for a general set of guiding principles** that enhance overall network interconnectivity (http://www.internetsociety.org) and our report on *Lifting barriers to Internet development in Africa: suggestions for improving connectivity*: http://www.internetsociety.org/doc/lifting-barriers-internet-development-africa-suggestions-improving-connectivity/

Best Practices - IXPs

Below are best practices from some of the practical work we have done with partners around the world:

- **Local Champion(s):** A champion is needed to help develop the IXP and build a community.

- **Neutrality:** As noted above, a neutral location and management of the IXP is critical to sustainability. All organizations at the IXP should agree on location and IXP management.

- **Simple Management Structure:** Many very large IXPs have been established on a basis of a simple management structure, a governing board made up largely of customers, and a volunteer staff, with customer fees set to just cover costs ('not-for-profit').

- **Equal Partners:** All peers at an IXP should be treated equally. Founding partners should not vote in or out members or have a weighted vote.

- **Establish Operating Principles:** Establish operating principles and publish them.

- **Website:** It is critical to have a web-site that includes, at a minimum, basic location and contact information, peering policies, traffic statistics, peers at the IXP.

Best Practices - IXPs

Below are best practices from some of the practical work we have done with partners around the world:

Redundant Power Supply: Always have a redundant power supply and test switching over to it frequently.

Fibre to the IXP: Allow operators to bring their fibre to the IXP

Redundant POP: Establish a redundant Point of Presence (POP).

Numbering Resources: Work with your regional Internet registry (RIR) to obtain IP addresses for peering and IXP management, and obtain and ASN from the RIR.

Host Value-added Services: Host value-added services to increase the value of the IXP for peers (i.e., time servers, root server instances, CDN caches).

Staffing: Some IXPs function with volunteers. Others have part-time or permanent staff. Take a look at models that may work for you, recognizing your staffing may shift as the IXP grows.

Diverse players: Allow diversity at your IXP -- banks, regional and international operators, content delivery networks, research and education networks, cloud-service providers (gaming, social media), and government networks.
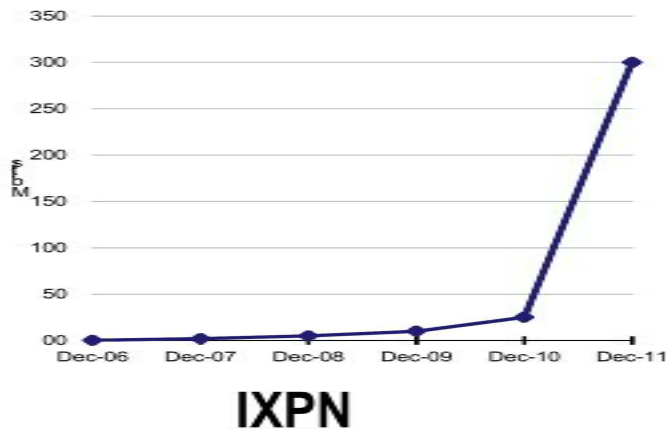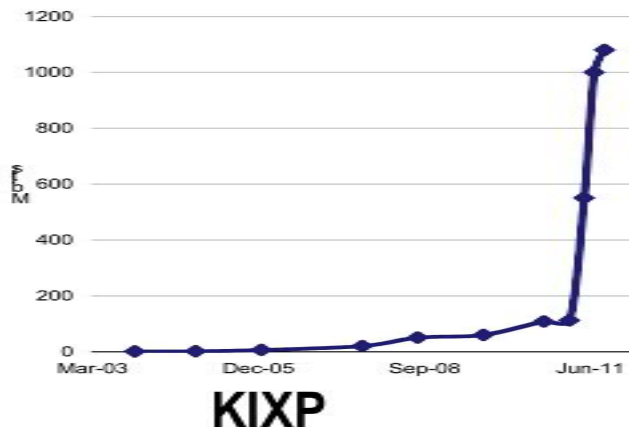
IXPs : Cost, Legal & Dispute Resolution

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

Benefit	KIXP	IXPN	Summary
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 rehoming 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

CDN Caches: Localizing International Content

- In addition to creating local hosting, local cashing of Content Delivery Network content is a key opportunity.

- Implementation of Google/Akamai and other Caches and pops has had an impact on local traffic growth

- Localized CDN 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

Cost, Legal & Dispute Resolution

- **Start-up Costs: Covered by Philip**

- **Donated equipment, racks, space**

Legal

- **Clear with PTA and Other Agencies: local, international**

Dispute Resolution

- **Take care not to impose heavy pre-regulation on IXP**

- **Potential "foundational document"**

Thank you for your attention!

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The Internet Society | www.internetsociety.org

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Annex: Additional Background

IXP Workshop April 5-6, Tunis, Tunisia

The Internet Society | www.internetsociety.org

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Resources | Studies & Surveys

- **ASEAN: Unleashing the Internet in SouthEast Asia**
  http://www.internetsociety.org/doc/unleashing-potential-internet-asean-economies

- **Asia Pacific: Mobile Internet Survey |** http://www.internetsociety.org/doc/mobile-internet-usage-trends-asia-pacific

- **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

Resources | Videos

- IXP: Africa | AfPIF - Peering & IXPs: It Starts with a Handshake - https://www.youtube.com/watch?v=5oliP-p4zJM

- IXP Toolkit | Videos from Africa & Canada – IXP Development - http://ixptoolkit.org/content/ixp-videos-0

- W4C: Mexico | Guerrero – Building the Internet in Guerrero - https://www.youtube.com/watch?v=RNOjPQoxSCQ

- W4C: India | Digital Empowerment Foundation – Building the Internet through Community Wireless Networks – Ocean in a Drop - https://vimeo.com/147451465

Kenya IXP Project II