Implementation and Management of Internet Exchange Points (IXP)

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Role of IXP   1

- The primary role is to keep *Local traffic Local* and save international bandwidth which reduce "Costs" to exchange traffic between local ISPs

- Ensure in-border operation continuity in case of international connectivity failure

 (Specially for critical services such as e-Banking, Stock Exchange, e-Gov, …etc)

Role of IXP   2

- Improve QoS (latency ↓)

  (Open new market and business opportunity for delay sensitive applications such as Online-Gaming, VOIP, Streaming multimedia, IPTV)

- Neutral to host any global content provider (CDN, News, DNS), encourage local hosting re-homing of domestic websites/content

- Could grow to become a Regional Hub and exchange traffic among international carriers

Domestic interconnection Cost

- It'll be Cost effective for each ISP/network-operator to reach other local ISPs/network-operators through the **IXP** rather than having a dedicated connection to each ISPs

- IXP could be a Back-up route to Internet in case of International failure
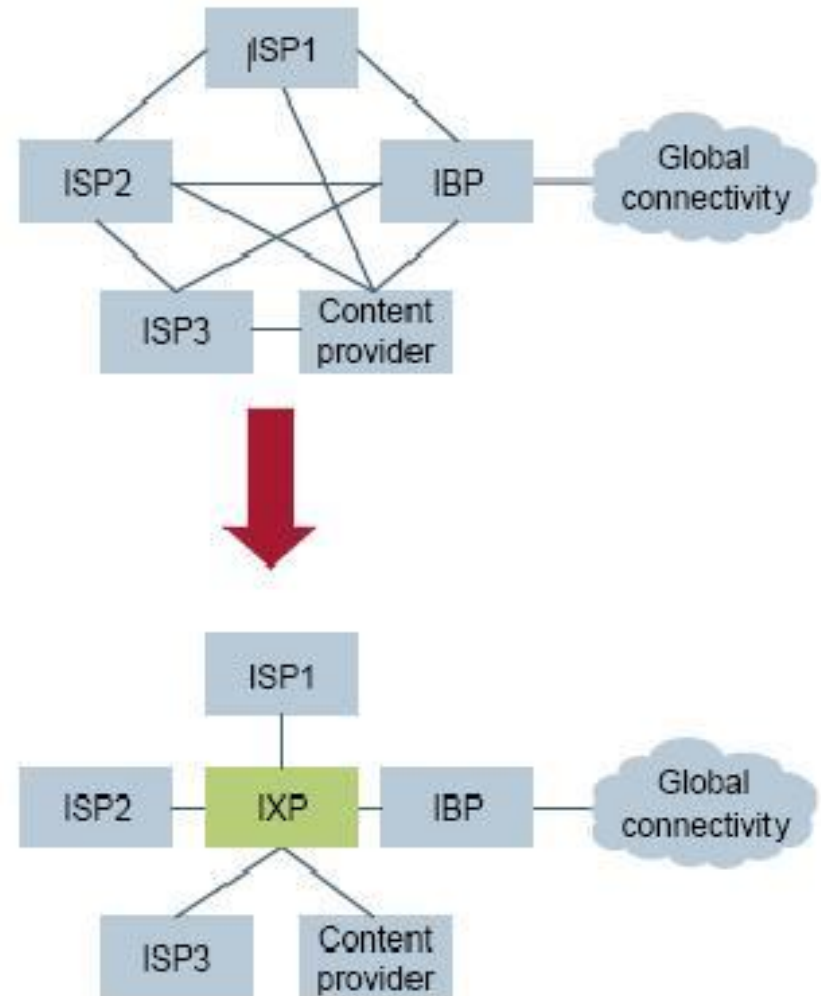
How to Implement an IXP???

1. How many local network operators, the cost of connection to IXP, amount of local traffic?
2. What will be the operational (organizational) model of the IXP?
3. Where will be the IXP (Location)?
4. Who will operate the IXP?
5. Which technical model will deploy?
6. What will be the policies/regulations for Membership?
7. What are the required Licenses or permissions?
8. What is the approx. budget to build the IXP?

Local Operators / Content/ Connectivity

To maximize the cost-benefit of building an IXP, it's recommended to:

- – Have at-least three network operators are willing to become members of IXP

- – Assess the local content and the amount of local traffic exchanged

- – Cost of domestic interconnection bandwidth to the IXP is less than the cost of same bandwidth to international provider

"Meeting with Stakeholders"

Organizational Model of IXP

There are Three common organizational models
for operating IXP:

– Not-for-Profit organization (commonly ISPA)

Based on Cost-Recovery (one-off joining fee + operation fee based on
port speed or traffic volume)

– For-Profit organization (commercial neutral operator)

– Government subsidized IXP (could be MCIT, TRA, or

University)

IXP Location   1

• Accessibility to the IXP is a very important Cost factor (CAPEX) that should be taken into consideration while planning for IXP, so the location of IXP should "Neutral" and have the following features:

– Near to potential network operators

– Stable redundant electric power feeders with backup generator

– Suitable air-condition

IXP Location   2

- Ease to deploy interconnection links (copper-fiber-wireless)

- Safe and Secure (monitoring and fire fighting systems)

- Accessible to members (24*7*365) to install and maintain their equipment

Technical expertise

- IXP technical operators will vary depend on the organizational model; (OPEX)
  - Not-for-Profit model, in this case the ISPA members own the IXP facility and operation run by a committee of their expertise
  - For-Profit model, in this case the operation run by the provider neutral company based on defined technical policies well-known to members
  - For Government model, in this case the operation run by the existing technical staff of Gov. entity

Technical operational Model of IXP

There are two technical models for IXP: (CAPEX)

- Layer2 Model (low cost, low technical expertise); where all members are connected to a layer2 switch and each member is responsible for opening the peering sessions with other members

- Layer3 Model (high cost, high technical expertise); where all members should peer with the IXP router only, and the technical team of IXP control the peering policies and could managed the exchanged traffic

"Decision depend on cost and stakeholders status"

Management Policies and regulations for IXP   1

There are two common agreements for routing traffic among IXP members depending on the technical operational model of the IXP and other telecom regulations;

- Mandatory Multilateral Peering Agreement (MMLPA), where regulator mandates that each network operator should peer with other operators through IXP

- Bilateral Peering Agreement (BLPA),

  where network operator enters into bilateral agreement with other network operators (common for Transit traffic)

"Mix or Hybrid of the two agreements give more flexibility to network operators"

Management Policies   2

Other basic policies should cover:
- – Connectivity to IXP, cost and deployment responsibility
- – Membership fees
- – Who allowed to be member
- – Allocation of scarce resources (IPv4 & IPv6 addresses) (AFPUB-2006-GEN-001)
- – Peering policies, Rack space usage, Sever hosting and Cabling
- – Traffic Analysis, Graphs, looking glass, routed networks information
- – Insurance and Liability for operation outages

License

It depends on each country Government and TRA regulations, However, it's recommended that policies for infrastructure sharing and open competition for deploying domestic access networks, leased lines and wireless connections, will help lower costs associated with connecting to an IXP

Budget

- According to ISOC report the approximate budget to build an IXP is USD40,000

- Normally IXP could be established with less budget by using less sophisticated equipment at start-up and co-locate in data-center or CO

- Practical cost of starting-up the Egyptian IXP in 2002 was only USD10,000. Co-locate in main CO where all local operators have PoP, international providers exist and all IXP Location features fulfilled

Impact of IXP on Domestic Internet eco-system

Benefit	KIXP (Kenya)	IXPN (Nigeria)	CAIX (Egypt)	Summary
Latency	Reduced from 200-600 ms to 2-10 ms	Reduced from 200-400 ms to 2-10 ms	Reduced from 600-2500ms to 50-250 ms	Noticeable increase in performance for end users
Local traffic exchange	1 Gbit/s peak	300 Mbit/s peak	1.15 Gbps peak	**Savings on international transit of over $1M per year**
Content	Google network present locally, along with re-homing of domestic content	Same as in Kenya	Copy of DNS root-servers	Increase in usage and corresponding revenues for network operators
E-Gov	Kenya Revenue Authority gathers taxes online	Usage by education and research networks	Education, Health, Taxes, …etc.	Social benefits from e-Gov. access through IXP
Other benefits	An increasing amount of regional traffic exchanged at KIXP	Financial platforms hosted locally	Financial platforms, News & Media content hosted locally	Further economic benefits and business opportunities resulting from IXP

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List of IXPs in AFRICA

CGIXP / Brazzaville, Congo / May 2013	Lusaka IXP / Lusaka, Zambia / Jun 2006	SLIX / Freetown, Sierra Leone / Jun 2010	MIXP / Ebene Cybercity, Mauritius / Jun 2006
TunIXP / Tunis, Tunisia / 2011	NIX / Windhoek, Namibia / 2005	KIXP-MSA / Mombasa, Kenya / Aug 2010 (non-operational)	KINIX / Kinshasa, DRC/ Sep 2002, Nov 2012
DINX / Durban, South Africa / Sept 2012	CINX / Cape Town, South Africa / 2009	KIXP / Nairobi, Kenya / Nov 2000	AIXP / Arusha, Tanzania / 2007
LIXP / Maseru, Lesotho / Aug 2011	HBIX / Helderberg, South Africa / 2008	MIX / Blantyre, Malawi / Dec 2008	RINEX / Kigali, Rwanda / Jul 2004
SIXP / Khartoum, Sudan / 2011	JINX / Johannesburg, South Africa / Dec 1996	CI-IXP / Abidjan, Côte d'Ivoire / Jun 2007 (non-operational)	GIXP / Accra, Ghana / May 2005
NeutrINX / Centurion, South Africa / Sept 2011	GINX / Grahams town, South Africa / Mar 2005	SZIXP / Mbabane, Swaziland / Jun 2004	ZINX / Harare, Zimbabwe / July 2001
IXPN / Abuja, Nigeria / Jul 2011	UIXP / Kampala, Uganda / May 2003	Moz-IX / Maputo, Mozambique / May 2002	Angola-IXP / Luanda, Angola / 2006
IXPN / Lagos, Nigeria / 2006	CAIX / Cairo, Egypt / 2002	TIX / Dar es Salaam, Tanzania / Jan 2004	BINX / Gaborone, Botswana / 2006

AXIS Project

- African Internet Exchange System (AXIS) Project aims to keep African Internet traffic local to the continent by providing capacity building and technical assistance to facilitate establishment of National Internet Exchange points, Regional Internet Exchange Points and Regional Internet Carries

- The Program on Infrastructure Development in Africa (PIDA) in its priority action plan has also highlighted the need to establish Internet Exchange Points in Africa continent

- **Objectives of AXIS project:**
  - To support the establishment of;
    - Internet exchange points (IXP) in Member States of the African Union
    - Regional Internet Hubs
    - Regional Internet Carriers
  - To establish a real-time and historical traffic data accessible via web-based visualization system
  - To develop a certificate curriculum on Internet Exchange technologies

- In April 2010 the ITF allocated a grant of €1.35 million out of a grand total of €208.9 million for operations approved to develop the ICT broadband infrastructure network for the African continent during the 2007-10 period

Implement and Manage IXP can be summarized into four phases 1

- **Feasibility**
  - Assess amount of local traffic, local networks, Cost of local and international connectivity and regulatory policies
  - Review international best practice
  - SWOT analysis for different operational models (technically and financially)
  - Study the impact of IXP on local Internet ecosystem
  - Develop a strategic plan for implementation
- **Planning**
  - Prepare the business plan
  - Choose the best operational model (technically and financially)
  - Decide the optimum location
  - Conduct meetings with stakeholders

Implement and Manage IXP Summary 2

- **IXP Policies**
  - Develop policies for IXP membership
  - Develop the IXP technical and operation policies
  - Seek the consensus of stakeholders on the developed policies
- **Deployment**
  - Apply for the required License from TRA (if any)
  - Obtain the optimum location and facilities
  - Hire the technical staff
  - Obtain the required equipment, Internet resources and build the IXP physical network

Thanks

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