AFIX Decision-makers' Workshop: Session 2

IXPs in Africa: Case Studies

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Introduction

Internet Exchange Points (IXPs) are a very effective way to reduce the cost of Internet connectivity and improve the quality of service in developing countries. An IXP enables three or more ISPs to exchange traffic at a single local facility, eliminating the wastage that occurs when neighbour ISPs exchange traffic via third party transit providers in other countries.

This document presents case studies of three African IXPs to illustrate some of the benefits, as well as some of the pitfalls, of setting up a new IXP in a country where none exists. The three countries studied are Mozambique, South Africa and Kenya.

1. The Mozambique Internet Exchange Point (MoZIX)

History

The idea of creating an IXP for Mozambique came about after staff members from the Universidade Eduardo Mondlane (UEM) took part in a backbone routing course organized by the Internet Society in San Jose, California, in 1999. The course included specific material relating to IXPs, particularly

technical implementation and the BGP routing protocol. A visit to one of the biggest IXPs in the US, MAE-West in Silicon Valley, cemented the decision.

Implementation

On returning to Mozambique, the UEM staff held a series of discussions with interested parties to explain the idea of setting up an IXP and the advantages it would bring. Eventually, the idea was understood and accepted.

UEM offered a location at zero cost, but funds were still required for the equipment and to furnish the room that would house the IXP; in early 2002, DFID donated monies to this end.

In April 2002, training of the local ISPs was organized through the Swedish Project, which provided a team of students to carry out the training. At the same time, the equipment purchased with assistance from DFID was received.

On May 14 2002, the first bits of traffic flowed through the exchange fabric between the two initial participating ISPs, UEM and TropicalNet. Within a fortnight the IXP grew to five members, adding Virconn, TDM and NetCabo.

Current Status

The MOZIX uses an open policy and all ISPs are encouraged to join, once they are connected the IXP operates using a full mesh topology so each ISP can set their own peering agreements.

Gradually, more members joined the exchange, and by the end of 2004 the IXP had 10 members, with only one major ISP still not connected to the exchange. The reason for their reluctance is not known -- they took part in the initial training -- but members of the IXP believe a management decision has been made to stay out.

Since inception, the IXP hasn't experienced any major downtime with the exception of an incident where a power surge burned a router and blew a few ports on the IXP switch.

Traffic statistics can be viewed at http://www.mozix.org.mz/mrtg

Constraints

One of the issues is procuring bandwidth to connect to the exchange. Since most ISPs rely on the local telco's leased lines, which are prohibitively expensive, growth of capacity to the IXP is inhibited. ISP's are gradually moving to wireless as a way to access cheaper bandwidth to the IXP.

Having said that, wireless has been plagued with serious reliability issues, and while the ideal situation would be to install fibre, the incumbent retains a monopoly on this type of infrastructure. The only ISP that owns fibre connectivity to the IXP is NetCabo, who are authorized because of their cable TV service.

Future Plans

At present, the IXP does not operate under any governing laws nor is it officially registered as an official entity, mostly because of insufficient time on members' hands. Plans are to subcontract this task, but funds are not currently available.

MOSIX plans to have one or two technicians to monitor the IXP and to be available during business hours in the event of any need. The team also feels there is a need to start selling service through the exchange in order to make it a sustainable. However, this will require staff and consequently the exchange may need to be registered as a company.

The IXP also needs to be relocated to a more neutral location that will allow easy access to members as well as foster increased trust.

2. The Kenya Internet Exchange Point (KIXP)

Introduction

The Telecommunications Service Providers Association of Kenya (TESPOK), a non-profit ISP association representing the interests of ISPs and other telecommunication service providers, was

started in August 1999. In early 2000, TESPOK undertook an initiative to implement and operate a neutral, non-profit IXP for its then 6 members.

Technical Model

TESPOK commissioned a technical committee to propose a viable design for the KIXP. After careful evaluations and consultations with various IXP experts, the committee proposed a Route Server topology model for the KIXP. IP addresses and AS number were sourced from the EP.NET IXP block allocation.

The key reaons for this approach were;

1) It was easier to implement in an environment where most technical personnel were not experienced on BGP implementations.
2) The Route Server topology had been tested at the Hong Kong IXP and could scale to more than 60 ISP (peering members)
3) The model presented an environment for multi-lateral peering agreements as opposed to bilateral agreements in an environment where ISPs were trying to develop and establish mutual trust relationships.

Sustainability

A financially sustainable model of operation was needed to ensure the success and continuity of the exchange point. As a result, it was proposed that the KIXP would be run and operated by the ISP association and hosted at the TESPOK offices. To ensure the continuity of the operations, all TESPOK members willing to join the KIXP were subject to an initial connection fee of approximately US$1,500 in addition to the monthly $250 membership association fees. The level of fees was set to meet the operational costs of both the IXP and the ISP association.

TESPOK also sought the support of CISCO Systems and UNESCO to procure the necessary hardware and switching fabric. All ISPs were to provide their own routers at the KIXP and cater for their local loop link charges (then only provided by the incumbent Telkom Kenya).

After nearly a year of preparatory work, including the design and implementation of a capable technical operation, funding model, and legal framework, the KIXP was launched in late November 2000. Almost immediately, Telkom Kenya filed a complaint with the Communications Commission of Kenya (CCK) arguing that the KIXP violated Telkom Kenya's exclusive monopoly on the carriage of international traffic. Within two weeks, the CCK concluded that the KIXP required a license, and ordered that it be shut down as an illegal telecommunications facility.

Until KIXP, all Internet traffic in Kenya was exchanged internationally – but, according to TESPOK, roughly 30% of upstream traffic was to a domestic destination. During the two weeks of KIXP's operation, measurements indicated that latency was reduced from an average of 1,200-2,000ms (via satellite) to 60-80ms (via KIXP). Likewise, monthly bandwidth costs for a 64Kbps circuit dropped from US$3,375 to US$200, and for a 512Kbps circuit from US$9,546 to US$650.

After nearly a year of intensive efforts, including public pressure, threats of litigation, and private diplomacy, TESPOK finally received the approval of CCK in the form of a license, granted in November 2001. The commission's licensing order represented a fairly dramatic turn-around in the CCK's thinking, stating: “An IXP is not an international gateway but a peering facility that enables ISPs to exchange local traffic. The Internet is expanding very fast and since Telkom Kenya has demonstrated that it has some apparently insurmountable difficulty in rolling out Internet facilities, it would be in the best interest of the market to allow other companies to offer IXP services in the country.” See:

http://www.cck.go.ke/headline/releasenews/head2001.htm#kixp

On February 14th 2002, the KIXP went live for a second time and a consequent re-launch was carried out on 18th April of the same year with five Kenyan ISPs actively exchanging traffic.

Conclusion

At present there are 13 members peering traffic at the KIXP, constituting 85% of the ISPs in Kenya. In addition, the incumbent monopoly Internet backbone provider, Jambonet, and Kenya's Domain Name

Registry Operator are interconnected at the KIXP thereby improving the overall network latencies for local content significantly below 100ms. This has further prompted the review of the KIXP membership policy to include non ISPs and a downward review of the joining fees to below US$400.

The average aggregated traffic at the KIXP is measured at over 4Mbps per second during peak time, translating to a cost saving of approximately US$30,000 per month for the ISPs. As liberalisation of the Internet market in Kenya takes root, additional local loop providers have been licensed and consequently provided alternative connection options to the KIXP. It is anticipated that in the coming months, 100Mbps connections will be available to the KIXP for less than $500 per month.

3. The Johannesburg Internet Exchange (JINX)

The South African Internet Service Providers Association (ISPA) was established in 1995 in response to incumbent monopoly telco Telkom SA entering the ISP business. Fortunately, since Telkom made a relatively late entrance, the industry was able to establish itself before the incumbent took up the majority of the market share.

Initial ISPA activity was largely legal and focused on ensuring that the industry remained competitive. Although private peering started in 1996, the industry had recognized the need for a central IXP by 1996. The Johannesburg Internet Exchange Point (JINX) was created in November 1996.

Organisational Structure

The JINX and CINX (Cape Town Internet Exchange Point, established soon after JINX) are – and have always been - operated under the auspices of the ISPA. ISPA is a non-profit membership association. There are no employees, as all work is either contracted by the ISPA or performed by the staff at the host location.

CINX was shut down a few years back. On the surface this was because of a lack of support from members for CINX, it is suspected that the reason for lack of support from members was due to the exorbitantly high costs of local telecoms infrastructure versus the relatively low cost of national transit.

Physical

The JINX facility consists of a number of racks housing ISPA members' equipment and Telkom equipment, plus supporting infrastructure such as power and air-conditioning. The equipment was initially hosted at one of the ISPs. In 1998, the IXP equipment was upgraded due to growing demand and was moved to a neutral location.

In the middle of 2002 the JINX was moved back to an ISP as it was realized that a neutral ISPA managed location was not as efficient as hosting at an established fully provisioned data-centre. The main reason for this is that an IXP requires little maintenance and being in an isolated location was not as convenient as a well-established accessible ISP location.

Since there is both advantage and cost for the hosting ISP, an RFP process was used to determine the new location. Organisations interested in submitting hosting proposals for the JINX facility were invited to do so. The minimum requirement for the site was that it must have:

- 24 hours on-site access for all ISPA members using the INX
- Fully redundant air-conditioning systems
- UPS and power reticulation systems including back-up generators and fire protection system
- Full access to the Telkom connectivity services: Martis, SDH and ATM.

The Internet Solution won bids in 2000 and 2002 for the hosting of JINX, and on both occasions contracted with ISPA to continue to provide this service for 24 months extendible to 36 months by mutual consent.

Financial elements

The fees for members to join the ISPA were initially based on the association’s legal focus: large ISPs paid higher membership fees than medium and small ISPs. This model remains in place.

In order to join JINX an ISP must become a member of ISPA. Initially they were required to pay a contribution to the initial equipment costs as well as additional monthly fees proportionate to the speed of their connection as a ratio of the overall connectivity. Initially JINX was established with three ISPs each connecting with 256kb/s and two with 64kb/s connections. The costs of the connections between the ISPs and the IXP were pooled together and then divided proportionally (i.e. those with 256kb/s lines paid 256/896 or 28.5% of the total monthly costs and those with 64kb/s lines paid 7.1%).

The initial model was changed to allow the ISPs to procure and pay for their own connections to the IXP. This simplified the management of the costs and IXP and coincided with the move to a neutral location (so that there was not an ISP host that obtained extra benefit by being the host since the host need not pay connectivity costs). Since JINX moved back to an ISP hosted environment, the hosting organisation has been required to pay the equivalent line charges for direct connections between their network and the hosted INX whenever they made use of the INX facility.

Even though there is an equivalent line charge as well as numerous direct costs to the hosting organization, experience has shown that there is fierce competition between the ISPs to provide this service, which demonstrates that there are numerous non-tangible benefits.

Technical

JINX has always operated using bi-lateral agreements in a full mesh configuration.

From 1996 when the IXP was started with five ISPs and a total of 896kb/s of connections to 2000, the IXP grew to nine ISPs connecting with a total of 6,784kb/s. Today there is a more mature local content environment that includes extensive airline and other travel reservations, banking, online supermarkets and vast e-commerce, online events ticketing and various e-learning applications. As such the JINX now has many hundreds of Mb/s of connections with peak periods where over 33Mb/s is exchanged through the switch fabric.

For more info see http://www.ispa.org.za/jinx/

Conclusion

Although the costs of telecommunications – especially data connectivity - have risen in South Africa to become some of the highest on the continent, the management of local traffic exchange has been most successful. Whilst this has not removed the economic drag created by the incumbents' artificial pricing regime, a competitive ISP market has been encouraged and supported through the availability of a IXP which in turn has certainly contributed to the ability of privileged South Africans to join and actively participate in the knowledge economy and information society.