

Briefing Paper:

Internet Exchange Points (IXPs)

The Internet Society's Briefing Papers are intended to act as an orientation paper for members of the Internet Society on a given topic. They provide background, outline current issues, challenges and opportunities, and provide suggestions as to ways forward. The Internet Society welcomes your comments on this topic. Please send your comments to pubpol-briefing@isoc.org.

Overview

The Internet has become an essential tool for communication, commerce, and development in an increasingly globalized world. Governments around the world have given high priority to the development of their national Internet infrastructure and to achieving higher levels of Internet penetration among their populations. These activities have been supported and catalyzed by national and international stakeholders, including local Internet service providers and other IT businesses and non-profit organizations like the Internet Society that believe that the Internet can contribute substantially to the socio-economic development of people around the world.

An Internet Exchange Point (IXP) is a component of Internet infrastructure that can increase the affordability and quality of the Internet for local communities. IXPs enable local networks to efficiently exchange information at a common point within a country rather than needing to exchange local Internet traffic overseas. In many developing countries, for example, Internet messages need to be exchanged beyond their borders, adding significant costs, because of a lack of connectivity between domestic networks.

IXPs are somewhat analogous to regional airport hubs in the physical world. At a regional airport hub, airlines exchange passengers between domestic flights at a convenient point within the country, rather than exchanging domestic passengers at an international airport overseas. In much the same way as an airport hub, where there is an IXP located within a country, an Internet message originating from and destined to a local user (whether it be an e-mail, web page request or other data message) is routed at a local point within country rather than being exchanged overseas.

Simply put, IXPs enable a message on the Internet to reach a recipient in the same country more easily and efficiently. Furthermore, IXPs can be established with relatively minimal equipment and overhead costs¹.

Opportunities and challenges

The benefits from establishing an IXP are numerous. IXPs can significantly lower the Internet access costs for end users by decreasing the operating costs of Internet Service Providers (ISPs). This can help make the Internet more affordable for a greater portion of the society. IXPs can lower the operating costs of ISPs and ensure that local traffic (such as that from a local sender to a local recipient) uses only the relatively very cheap local connections rather than expensive international links. The cost saving can be significant – easily amounting to 20% or more – since local traffic often makes up a significant portion of overall Internet traffic.

The presence of an IXP can also attract telecommunication operators that may wish to establish a point of presence at an in-country IXP in order to sell services to potential customers located at the exchange, as all parties are reachable at a lower collective cost than they might be individually. In this respect, IXPs can help to encourage the development of infrastructure (such as national and international fibre cables).

At the same time, IXP participants in some parts of the world have found that they can negotiate better deals with upstream providers when a group of networks are located at an IXP. IXPs help reduce transactional costs and improve choice for their members in countries where competitive markets are present. If a domestic network decides to switch transit providers at an IXP, they can do so in a matter of hours and without physical intervention. In the past, this would have involved having a new circuit installed, as well as incurring significant waiting time and financial charges. As such, the flexibility made available by the IXP can encourage greater price competition in competitive markets – further driving down costs for access providers and end users.

IXPs can also improve the quality of access to the Internet for local users. Experience shows that access speeds for local content may improve as much as ten-fold with an IXP in place. Access speed for international content may also improve, albeit less considerably, since with IXPs, local traffic no longer needs to transit the international connection, reducing congestion and freeing up bandwidth on the international link. The level of stability and continuity of access can also improve since, if there is a breakdown in international connectivity, IXPs make it possible for local traffic to continue flowing within country. Moreover,

¹ For more detailed information on IXP set-up issues, please see the Internet Society Report *Promoting the Use of Internet Exchange Points: A Guide to Policy, Management and Technical Issues*. Links to this free report, available in English, French, and Spanish, are provided at the end of this document.

thanks to the possibility of placing mirror root servers at IXPs, even the major international sites can remain accessible to the local users when the international link is unavailable, contributing to business and service continuity and an improved Internet experience.

Finally, IXPs encourage the development of local content and applications. Once an IXP is established, it becomes a natural location to host a variety of other services that reduce bandwidth requirements and improve the speed and reliability of Internet access for local users. The improvement of the access speed for local content often gives incentives for local developers to produce local content and applications. Moreover, it often encourages international content providers to establish themselves in the country. For example, after Kenya and Argentina acquired their national IXPs, Google started hosting its services in those countries. This not only created employment opportunities in those countries, but also improved access speed to Google's services. The development of local content and applications will also make the Internet more relevant to the local population, which makes it more socially and economically beneficial to the country.

The way forward

The Internet Society has been contributing its share in promoting the development of IXPs by organizing workshops on best practices for IXP development at the regional level (in Africa, for example) but also at major international forums such as the Internet Governance Forum (IGF). It has also prepared educational materials on IXPs to raise the awareness of the Internet community and governments. The Internet Society is also currently undertaking an IXP initiative to help establish IXPs in developing regions and provide training on IXP operations and management issues.

The establishment of an IXP requires the collaboration of many actors, not least of which are the Internet Service Providers (ISPs) and other data providers that will be exchanging traffic at the IXP. While some ISPs may express initial reluctance to collaborate with potential competitors, the Internet Society believes that experience to date in establishing IXPs clearly demonstrates that with proper institutional policies established for the IXPs, there is significant upside to working cooperatively to minimize traffic routing costs. These policies can ensure that there is a fair distribution of the benefits amongst the participating ISPs and can alleviate competitive concerns².

Financially, the cost of the equipment required to establish an IXP is generally minimal, which often makes the establishment of an IXP an affordable local project. Furthermore, the monthly operating costs can often be covered by the ISPs that benefit from using the IXP through a sustainable funding model. External assistance in the form of set-up advice and training may be desirable in many instances, especially at the initial phase, and the Internet Society stands ready to assist stakeholders in developing countries that wish to set up an IXP.

² For example, payment for the cost and management of the link between the network and the IXP (including a redundant link if required) is usually the responsibility of the member of the IXP. However, some IXPs have adopted policies to smooth these costs so that each member pays the same amount to access the IXP. This helps to ensure that commercial operators who happen to be located in the same building as the IXP do not have an unfair advantage.

Clearly, there is no-one-size-fits-all model approach to implementing an IXP – different organizational models have been used by different IXP operators with varying degrees of success. In many developing countries, collaborative, not-for-profit partnership models have proven to be particularly beneficial and effective. This approach seeks to foster cooperation amongst all stakeholders in the initial establishment process, the development of IXP policies, and in ongoing operations, and often includes the participation of local ISPs, data providers, and government.

The Internet Society believes that governments and ICT policy and regulatory agencies play an important role in facilitating and encouraging the establishment and seamless operation of IXPs. In particular, governments can 1) signal support for the development of IXPs within their country as a general ICT policy objective, 2) encourage competitive access to leased lines and wireless connections that will help lower costs associated with connecting to an IXP, 3) abstain from imposing onerous licensing requirements on IXPs and mandating peering and other operational IXP policies, 4) discourage and restrain attempts by large carriers to block the development of IXPs, and 5) provide general assistance and support to organizations seeking to establish collaborative IXPs in their country.

In conclusion, the Internet Society believes that the deployment of IXPs can have a considerable positive impact on the economic development, business and societal wellbeing of a nation while contributing to the overall global development of the Internet. It also enables a more efficient use of national infrastructure resources and encourages communications growth. We believe that it is of paramount importance that governments and other stakeholders of countries that do not have IXPs work together for their establishment.

For further information

The Internet Society has published a number of papers and reports related to the benefits and implementation of Internet exchange points. These are available for free download on the Internet Society website:

1. *Promoting the Use of Internet Exchange Points: A Guide to Policy, Management, and Technical Issues*, by Mike Jensen.
English: <http://www.isoc.org/educpillar/resources/docs/promote-ixp-guide.pdf>
French: <http://www.isoc.org/educpillar/resources/docs/promote-ixp-guide-fr.pdf>
Spanish: <http://www.isoc.org/educpillar/resources/docs/promote-ixp-guide-es.pdf>
2. *A Summary Report Promoting the Use of Internet Exchange Points: A Guide to Policy, Management, and Technical Issues* (short summary of the article above).
English: <http://www.isoc.org/educpillar/resources/docs/promote-ixp-summary.pdf>
French: <http://www.isoc.org/educpillar/resources/docs/promote-ixp-summary-fr.pdf>
Spanish: <http://www.isoc.org/educpillar/resources/docs/promote-ixp-summary-es.pdf>
3. *Report from the IGF Rio Best Practices Session Internet Traffic Exchange in Less Developed Internet: Markets and the Role of Internet Exchange Points*.
English: <http://www.isoc.org/educpillar/resources/docs/igf-ixp-report-2007.pdf>
French: <http://www.isoc.org/educpillar/resources/docs/igf-ixp-report-2007-fr.pdf>
Spanish: <http://www.isoc.org/educpillar/resources/docs/igf-ixp-report-2007-es.pdf>
4. *Transcript from the IGF Rio Best Practices Session*
English: <http://www.isoc.org/educpillar/resources/igf-ixp-transcript-2007.shtml>