Before Paulos Nyirenda left for Nairobi, Kenya, to attend the first Africa Peering and Interconnection Forum (AfPIF) in August 2010, he had a problem: traffic routed from the Malawi Internet exchange point (IXP) wasn’t going beyond South Africa. It gave Nyirenda, coordinator at SDNP Malawi, a government program dealing with Internet and information services, a huge headache. The eight ISP members of the Malawi IXP were eager to find a solution. Nyirenda had questions for other IXP operators in the region that he hoped to answer at the conference: Was the problem unique to Malawi? Could network operators from South Africa help solve it?

"At the end of AfPIF, I was able to identify that the problem was at the South Africa Internet Exchange (SAIX) operated by Telkom South Africa [SA], and I was able to devise ways to solve the problem," Nyirenda said.

Nyirenda’s situation demonstrates the challenges that faced attendees of the first AfPIF conference in 2010. Last year’s meeting focused on increasing interconnection among African networks and especially IXPs because they’re a key factor in the Internet’s development in Africa. They’re also likely to attract investment from content providers.

“If you look at the most stable IXPs, they trigger an Internet ecosystem around them with a stable top-level domain name for the country and a growing, vibrant content sector,” said Michuki Mwangi, Africa Development Manager at the Internet Society (ISOC), which led the organization of the event.

However, out of 56 countries in the Africa region, only 15 had functioning IXPs at the time of last year’s forum. For many participants, the topics around interconnection were new, and discussions focused on the challenges facing Internet connectivity and use in the region. Thus, initial discussion focused on increasing understanding of the importance of exchanging content locally, and the economics and other environmental factors required to make IXPs sustainable.

The second AfPIF was held 8–9 August 2011, when nearly 100 Internet engineers gathered in Accra, Ghana, hoping to build on the promise and lessons learned at the inaugural AfPIF event. The recent forum highlighted both the considerable progress made by and challenges remaining for the Internet’s development in Africa.

**Attracting ISPs and Content Providers**

Eddy Kayihura, Lead Technical Manager at the Rwanda Development Board, has built on what he learned last year from other IXPs to run the Rwanda IXP so it’s open to all network operators, thereby increasing its effectiveness in...
promoting local Internet use and content development. Kayihura said, “Last year, the peering game was new to me; I wasn’t sure [about] some of the factors to consider and how to attract more ISPs and content providers to peer at Rwanda IXP. This year, I am way better at the game.”

The discussions at this year’s conference progressed beyond the basics, focusing on topics such as making a business case for IXPs, comparing peering versus transit approaches to Internet traffic, regional IXPs, building critical local content mass at the IXP, and uncovering the factors AfPIF participants consider in deciding who to peer with.

“This year, the discussions progressed to ways that countries can take advantage of the investment in infrastructure, how to cope with policy challenges, and how to make local IXPs effective interconnection points and lower Internet costs,” Mwangi said.

Reflecting a more advanced understanding of the peering game, participants discussed how to attract bigger ISPs. Some shared their frustrations over how some larger ISPs declined to openly peer with smaller ones, instead demanding payment through private peering arrangements, rather than open, settlement-free peering at the IXP.

“Some bigger ISPs have issues exchanging content for free; one must show a case that they have equally large and important content,” said Andrew Alston, CTO at TENET, South Africa’s Tertiary Education Research Network.

South Africa is considered to have the most developed ICT infrastructure in the region, with IXPs in Johannesburg and Cape Town, and a third one coming up in Durban. However, Telkom SA charges fees for local providers to peer. Other ISPs and content providers in the country have been urging Telkom SA to peer freely, but it has been adamant about charging fees. Last year, Mweb, an ISP engaging in one of the most protracted peering battles with Telkom SA, de-peered from SAIX, preferring to exchange content at the London IXP because transit costs were considered cheaper than paying for a connection to Telkom SA.

**Local Peering vs. International Transit**
The availability of free peering attracts service and content providers to IXPs, even though the cost of international transit can be lower, depending on the traffic. For example, in Senegal, government content must go through an international gateway because Senegal Telecom considers it cheaper, according to Mouhamet Diop, CEO at NEXT SA in Senegal.

“If the content is more, then the cost of international transit can be lower, depending on the traffic. For example, in Senegal, government content must go through an international gateway because Senegal Telecom considers it cheaper, according to Mouhamet Diop, CEO at NEXT SA in Senegal.”

Better mobile data plans are making it easier for more people to generate content. This fact hasn’t been lost on Google, which has invested extensively in building Africa’s online content with support to developers

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**Figure 1. Attendees at the second annual Africa Peering and Interconnection Forum (AfPIF). The forum took place in August 2011 and highlighted both the progress made by and challenges remaining for Internet development in Africa (photo courtesy of ISOC).**

The argument for increasing local peering in place of international transit fails to resonate with people in countries where most content is hosted abroad. The availability of local content lets ISPs and content providers make a better case for local peering over international transit. But Africa is usually considered an Internet content consumer, not a provider.

“Africa has been largely a consumer of content produced abroad, but that is rapidly changing with government records digitization projects, more education and media content going online, and the number of Internet users growing every day, bolstered by the growth of mobile networks,” Mwangi said. Affordable mobile data plans are making it easier for more people to generate content.

This fact hasn’t been lost on Google, which has invested extensively in building Africa’s online content with support to developers.
through app competitions, university content development projects, a project to promote the creation of Wikipedia articles in Kiswahili, map development, and the establishment of Google caches at leading African ISPs. For IXPs, Google's decision to set up cache servers has been beneficial in attracting members to peer with each other. Some ISPs with Google caches peer openly with other members, meaning YouTube videos and other Google services resolve faster, which attracts consumers to their networks.

“Google cache has been a major attraction; telcos are advertising how YouTube videos do not buffer and download faster on their network, but it is only because they are peering at the exchange,” said Ayitey Bulley, during a presentation about the Ghana IXP.

**Challenges in Attracting Investment**

Although many IXPs have found Google easy to approach, it hasn’t been as easy to attract other content providers such as Akamai, mainly because IXPs don’t always know the number of Internet users they serve and they can’t justify a business case. The result is that content providers haven’t invested in the region, citing lack of statistics on Internet use, poor infrastructure, lack of carrier-neutral data centers, and erratic and high-power costs.

In the time between the first AfPIF conference and this year’s event, significant progress has occurred on some of these issues. SEACOM, a major undersea cable operator, has invited content providers such as Google and carriers to partner in countries where infrastructure exists. In Kenya, SEACOM is hosting the Mombasa IXP, which connects ISPs and content providers in the coastal city. The port of Mombasa is the largest in Eastern Africa, with clearing agents serving Kenya, Uganda, Tanzania, Ethiopia, South Sudan, Rwanda, Burundi, and the Democratic Republic of Congo.

This interest was highlighted in the presentation by SEACOM’s Willem Marais at the second AfPIF as he talked about the company’s extensive infrastructure in Africa, including landing stations in four African countries, partnerships with West African cable providers for alternative capacity routing in case of breakdown along the Eastern Africa coast, and an extensive IP infrastructure within land-locked countries to support its Pan African IP network plan.

One reason for the low statistics is attributed to ISPs using private IP addresses and network address translation (NAT) to share public addresses among different end devices, instead of allocating individual public IP addresses to each end device. This makes it difficult to know how many Internet users an ISP or IXP is serving, and could significantly underrepresent users in many measurements. For example, it’s common in Africa for an institution to acquire only one or two public IP addresses, which it then shares among 2,000 or more Internet users.

“There are many Africans accessing the Internet via mobile phones, but if the mobile company does not allocate each one a public IP, then the numbers will appear few on the Internet,” Mwangi said.

AfriNIC, the Regional Internet Registry in Africa that allocates IP addresses, is expecting the situation to change with the deployment of IPv6, which should increase content and content providers in the region.

“While AfriNIC is still allocating IPv4, focus should be on the importance of deploying IPv6 and the benefits it can bring to our networks; some mobile networks, like Safaricom in Kenya, are already running IPv6 on their core infrastructure,” said Adiel Akplogan, AfriNIC CEO.

According to Akplogan, governments have committed to ensuring faster IPv6 deployment, but the agencies responsible for pushing ICT strategies haven’t managed to entrench deployment in key government policy documents, except in Mauritius, where AfriNIC has been able to successfully work with the government agency.

IPv6 deployment is expected to complement improved access and reflect a closer estimate of actual user numbers, but Akplogan sees a role for governments and regional organizations in setting policies that allow for smoother translation and enable companies to roll out infrastructure from one country to another. For example, some countries have ICT policies, whereas others don’t.

**Fostering coordination highlights a less technical, but equally important aspect of both AfPIF forums: the social connections that have provided increased opportunities for interaction, and allowed participants like Paulos Nyirenda to share problems, solutions, and successes. As the momentum behind the interconnected ecosystem of African Internet grows, so do the personal relationships among those in the community.**

Karen Rose is Senior Director of Strategic Programmes at the Internet Society. Her past work has focused on Internet and e-commerce issues as well as the coordination of Internet naming and addressing functions, including the domain name system, ENUM, and IPv6. Rose has an MA in telecommunications science, management, and policy from Northwestern University and an MBA from the University of Auckland. She’s been an active participant in Internet discussions in various international governmental and nongovernmental organizations including the ITU, the Organization for Economic Cooperation and Development (OECD), and ICANN.