



# An Overview of African Internet Exchange Points (IXPs)

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## African Internet Infrastructure Realities

### • **Satellite Infrastructure**

- A reducing number of African countries depend on satellite for
  - International connectivity
  - Domestically to reach rural locations and remote sites
- Cost per Mb of traffic ranges from \$2,000 - \$5,000USD

### • **Submarine Fiber**

- Two main submarine cables in operation since 2001:
  - SAT3 and SAFE serving West Coast and South Africa
- Faster, more bandwidth but can be more expensive
  - \$4,500 – \$12,000 per Mb
- Growing number of cables in the region is expected to bring down the cost.

## African Internet Infrastructure Realities (cont.)

### • **Terrestrial Infrastructure**

- Limited to major urban centers and towns
- Largely owned by incumbents telcos
- Increased investments in recent years in terrestrial fiber
  - by both public and private entities
- Largely between major domestic cities and inter-city
- Circuit prices are usually lower than satellite

### • **Mobile & Wireless Infrastructure**

- More mature and well developed in the region
- Easier to deploy but scalability and capacity issues still constrained due to CAPEX/investment issues
- Circuits costs are higher than fiber and lower than satellite

## African Internet Infrastructure Realities (cont.)

- **Cross-Border Infrastructure**
  - Least developed in the region
  - Subject to cumbersome legal and regulatory approvals
  - Primarily used for voice interconnection between incumbents and mobile operators
  - Regional circuit costs are comparable to satellite

## Resulting Challenges;

### • Limited Interconnection

- National or regional interconnection is almost non-existent
- Local and regional access is ranges from “ok – poor” and is expensive

### • High Operating Costs

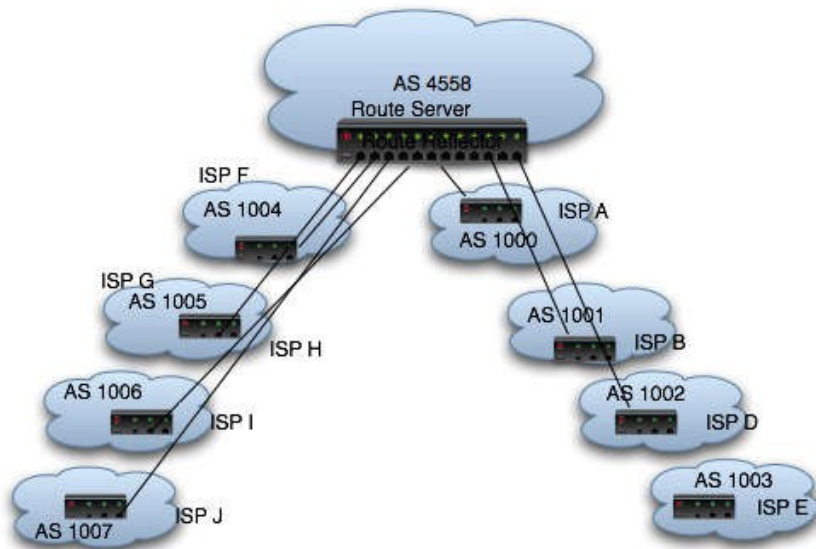
- Cost of Internet capacity is high regardless of mode
- Little local content and few services hosted domestically
- As a result local traffic is billed at same rate with Internationally accessible content

### • Legal and Regulatory

- Operators and providers are subject to significant regulatory approvals and fees
- Lack of competitive choices keeps prices high

# IXPs Facilitate Local Peering

- An **Internet Exchange Point (IXP)** is a hub where ISPs can make **direct connections** locally and exchange traffic with one another





## IXPs Lower Costs and Enhance Infrastructure

- Should aim to keep **local traffic local** through peering.
  - This is achieved by attracting ***non-traditional members*** to the IXP – ***more networks = higher the IXP' s value***
  - The more ISPs can exchange their traffic through IXP via ***peering = lower Internet costs.***
- Should strive to provide **Value Added Services** to enhance the local Internet infrastructure
  - Implementation of ***Root, gTLD and ccTLD- Servers***
  - Authentic ***Time Servers*** for local network time synchronization
  - FTP Mirrors and looking glasses
  - Network ***Measurement tools***

## Countries with IXPs in Africa



source:  
[www.nsrc.org](http://www.nsrc.org)

- 23 IXPs in Africa
- 19 African Countries (35%)
- South Africa (3), Tanzania (2) and Nigeria (2) are countries with more than 1 IXP
- West Africa has lowest number of IXPs in the region (30%).



## ISPs appearing in more than IXP in Africa

- At least 4 ISPs peer in more than one IXP in Africa
- However they peer using different AS Numbers – Each operation has a different ASN
- Others have through acquisitions and mergers (ASNs seen at IXP as transit)

## Africa Aggregate Traffic in IXP

Region	Internet Exchange Points				Domestic Bandwidth Production			
	Jul 2009	Jul 2010	Net Change	Percent Change	Jul 2009	Jul 2010	Net Change	Percent Change
Africa	22	22			848M	2.4G	+1.55G	+183%
Latin America	29	31	+2	+7%	31.5G	50.4G	+18.9G	+60%
North America	88	88			373G	503G	+130G	+35%
Asia-Pacific	72	72			1.07T	1.11T	+44.4G	+4%
Europe	125	130	+5	+4%	2.9T	4.02T	+1.12T	+39%
<b>Total</b>	<b>336</b>	<b>343</b>	<b>+7</b>	<b>+2%</b>	<b>4.37T</b>	<b>5.69T</b>	<b>+1.32T</b>	<b>+23%</b>

Source [www.pch.net](http://www.pch.net)

## Growth Stats per Country

Country	Internet Exchange Points				Domestic Bandwidth Production			
	Jul 2009	Jul 2010	Net Change	Percent Change	Jul 2009	Jul 2010	Net Change	Percent Change
Bulgaria		2	+2	new		33.4G	+33.4G	new
Netherlands Antilles	2	2			10K	2.28M	+2.27M	+22710%
South Africa	3	3			541M	2.04G	+1.5G	+277%
Ukraine	5	5			41.5G	134G	+92.2G	+222%
Greece	1	1			4.39G	11.6G	+7.23G	+165%
Iceland	1	1			3.07G	7.95G	+4.88G	+159%
Russia	11	11			104G	249G	+145G	+140%
Canada	3	3			15.3G	33.9G	+18.5G	+121%
Nepal	1	1			21.3M	45.6M	+24.3M	+114%
Croatia	1	1			221M	457M	+236M	+107%
Kenya	1	1			48.6M	88.6M	+40M	+82%
Brazil	14	16	+2	+14%	25.8G	43.7G	+17.9G	+69%
Tanzania	2	2			5.32M	8.61M	+3.3M	+62%
Switzerland	3	3			8.07G	12.8G	+4.76G	+59%
Ireland	3	3			4.18G	6.31G	+2.13G	+51%
Germany	14	14			660G	978G	+318G	+48%
Czech Republic	3	3			75.3G	109G	+33.9G	+45%
Slovakia	2	2			16.4G	23.6G	+7.16G	+44%
	5	6	+1	+20%	51.4G	72.2G	+20.8G	+40%

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Source [www.pch.net](http://www.pch.net)

## Root-Servers in Africa



- 5 African countries with Root-Server Instances
- Root-Server installations done in Operational IXPs
- AfriNIC Anycast Program is leading the implementation
- ISOC supports the program

## IXP Ripple Effects: Other Network and Developmental Benefits

- Reduced dependence on International Links
  - ***Outages on International links*** (Satellite and Fiber) does not affect local traffic flow
- **Reduced capital flight** resulting from savings made on peered traffic
  - **Only transit traffic capacity** is bought from upstream providers
- ***Skilled technical capacity*** resulting from exposure to Interconnection techniques
- ***Competitive pricing*** for local links It costs about \$75 per Mb in Kenya for a local loop link on Fiber

# Building Internet Exchange Points (IXPs)

## • The Technical Resources

- A **Neutral facility/location** with stable power, Internet infrastructure and security
- The IXP Infrastructure normally **a Switch** –
- **IP resources** (IP address and ASN) from RIR
- **Technical Capacity** needs to be developed

## • The Social Challenges

- Ownership and **trust concerns**
- IXP can be viewed to present competitive advantages to others
- Monopoly Incumbents are often opposed to IXP implementations

## • The Sustainability Model

- Financial stability yields **autonomy** which is vital for sustaining the neutral position of the IXP
- This enables the IXP to grow its **resources and provide efficient services**



## Internet Society's African IXP Development Initiative

- 4 complementary programs based on the stage and requirements of each country:
  - Technical Training and Capacity Building
  - New IXP Implementations
  - Value Adding Services
  - Regional IXP Forums and Communities of Practice
- Project collaboration is key to success
  - Several Financial Sponsors and Implementation Partners are assisting
  - Additional support sought to grow and strengthen efforts





**Questions? Comments?**

**ISOC IXP Information Page:**

**<http://www.isoc.org/educpillar/resources/ixp.shtml>**

**Resources in English, French, and Spanish**

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