

A dark grey world map is centered on the slide. Overlaid on the map are several white line-art silhouettes of people in various poses, some standing alone and others in groups. Faint white lines representing latitude and longitude are visible across the map.

Overview of Africa's Internet Interconnection and Peering Scene.

ITU WORKSHOP ON APPORTIONMENT OF REVENUES AND
INTERNATIONAL INTERNET CONNECTIVITY

Presented by:

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Internet Society

Agenda

- Overview of Africa Internet Infrastructure
- Interconnection Analogy
- Addressing the Traffic Imbalance
- The Value of Peering in Africa
- Conclusion

As communication is essential for trade, an increase in trade also increases the demand for communication. For the same reason, improving telecommunications infrastructure and reducing costs leads to higher growth in trading than in non-trading sectors. Dr. Bruckner (ITU/ESCAP/WTO Joint Seminar on Telecommunication and Trade Issues Bangkok, 28-30 October 2003)

Interconnection Analogy:

Airports and IXPs

- Objective of airports is offer an efficient transit point for passengers – Similar to IXPs
- Airlines are traffic driven similar to Internet carriers/operators.
- Destinations for both Airlines and Internet Carriers are predetermined based on the locations value proposition and potential traffic volume
- Most importantly the facility's ability to attract more carriers and efficiently handle the traffic
- Facility features and services are value added services

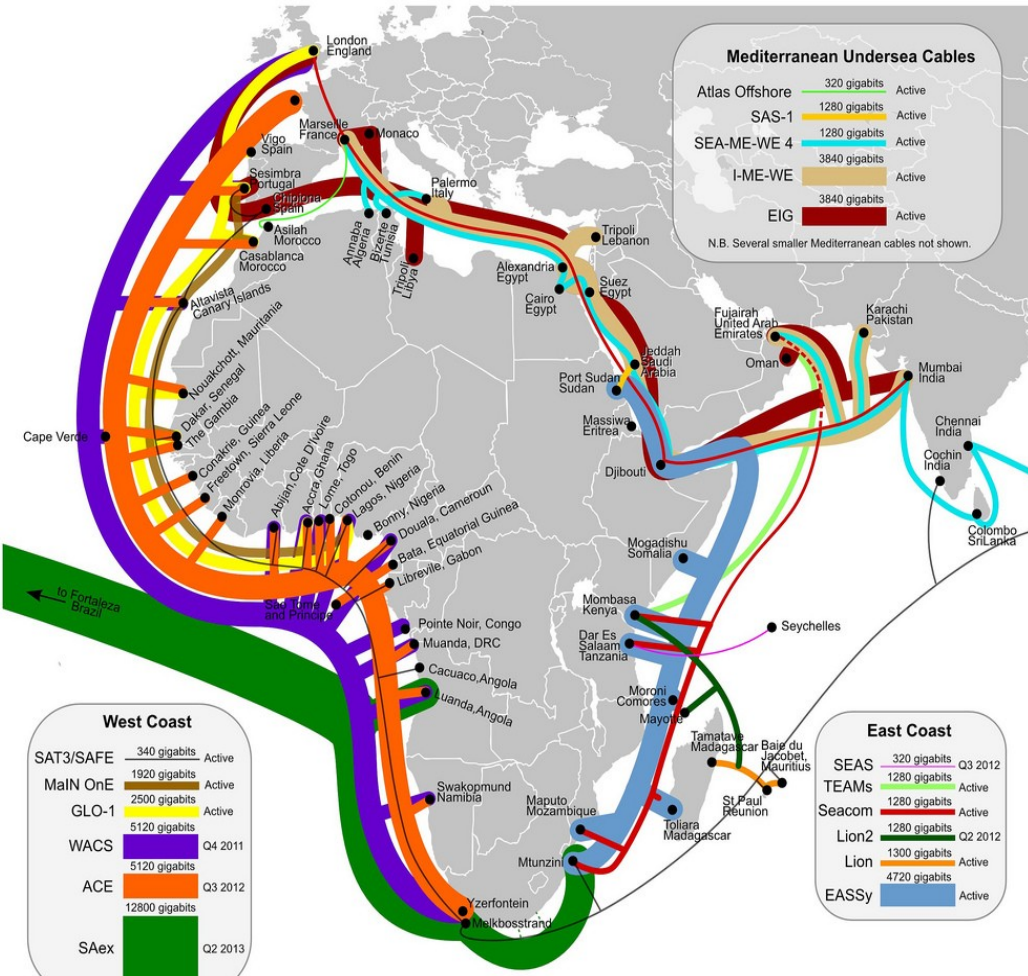
Airport Example: DXB

Growth in traffic at Dubai International Airport^{[59][60]}

Airlines	1986	1990	1994	1998	2002	2006	2010
Passenger movements	3.775 million	4.347 million	6.299 million	9.732 million	15.973 million	28.788 million	47.181 million
Airfreight movements (tonnes)	99,338	144,282	243,092	431,777	764,193	1.410 million	2.270 million
City links	19	36	54	110	170	195	210
Weekly scheduled flights	N/A	N/A	N/A	2,350	2,850	4,550	6100
Airlines	N/A	N/A	N/A	80	102	113	135

- The 4th busiest by International passenger traffic and 14th busiest by overall passenger traffic.
- 6th Busiest by cargo traffic as of 2012
- In 2010 DXB handled over 47.2 Million passengers.
- Plans are underway to extend the airport to handle 80 million passengers by 2012 and 90 million by 2018.
- Shopping, real-estate and regional financial hub status in addition to ease of connecting eastbound and westbound attract passenger traffic

Africa Submarine Infrastructure Status



- Submarine cables reach 4.4% of Africa's population
- 25.8Tbps of Submarine Cable by 2012.
- Overall International capacity went past 520Gbps (sub-sahara went past 208Gbps) in 2010 a 78% Increase from 2009.

ITU IIC Workshop
23 - 24 Jan 2012,
Geneva

African Undersea Cables (2013)
<http://manypossibilities.net/african-undersea-cables>
Version 31 - Oct 2011



Africa Terrestrial Infrastructure

- 138 Route-Kms of new fiber networks Enters Service every day
- By Jan 2011, fixed line and alternative operators had over 676,739-kms of terrestrial transmission a 15% increase from previous year.
- Terrestrial infrastructure reaches close to 54 Million close to a Fiber node in Sub-Sahara Africa.



Internet exchange Points in Africa



- 26 IXPs in Africa
- 21 African Countries (39%)
- South Africa (3), Tanzania (2) and Kenya (2) are countries with more than 1 IXP
- West Africa has lowest number of IXPs in the region (30%).
- New IXPs launched in Lesotho and Sudan in 2011

Africa's Aggregate local traffic

Region	Internet Exchange Points				Domestic Bandwidth Production			
	Dec 2010	Dec 2011	Net Change	Percent Change	Dec 2010	Dec 2011	Net Change	Percent Change
Africa	21	21			2.55G	5.26G	+2.7G	+106%
Asia-Pacific	75	76	+1	+1%	1.12T	1.25T	+126G	+11%
Europe	138	138			5.55T	7.62T	+2.07T	+37%
Latin America	34	34			59G	97.3G	+38.4G	+65%
North America	87	88	+1	+1%	847G	948G	+101G	+12%
Total	355	357	+2	+1%	7.59T	9.92T	+2.34T	+24%

Region	Country	City	Internet Exchange Name	Participants	Traffic	Prefixes	Established	URL
Africa (21)	Angola	Luanda	Angola Internet Exchange	10	13M	☑	17 Mar 2006	☑
		Luanda	Ponto de Intercambio Internet Angola	☑	☑	☑	☑	☑
	Botswana	Gaborone	Botswana Internet Exchange	10	☑	☑	Oct 2005	☑
	Burundi	Bujumbura	Burundi Internet Exchange Point	☑	☑	☑	☑	☑
	Congo-Kinshasa	Kinshasa	Kinshasa Internet Exchange	7	☑	☑	Nov 2002	☑
	Cote D'Ivoire	Abidjan	Côte d'Ivoire Internet eXchange Point	5	4M	☑	2006	☑
	Egypt (2)	Cairo	Cairo Internet Exchange	8	302M	☑	May 2002	☑
			Middle East Internet eXchange	7	☑	☑	May 2007	☑
			Cairo Regional Internet Exchange	☑	☑	☑	May 2002	☑
	Ghana	Accra	Ghana Internet Exchange	24	☑	☑	18 Oct 2005	☑
	Kenya	Nairobi	Kenya Internet Exchange Point	34	911M	☑	Feb 2001	☑
			Mombasa	KIXP-Mombasa	☑	☑	☑	☑
	Lesotho	Maseru	Lesotho Internet Exchange	☑	☑	☑	☑	☑
	Malawi	Blantyre	Malawi IXP	36	☑	☑	1 Dec 2008	☑
	Mauritius	Port Louis	Mauritius Internet Exchange	6	☑	☑	Dec 2005	☑
	Mozambique	Maputo	Mozambique Internet Exchange	16	5M	☑	Jul 2002	☑
	Nigeria	Lagos	Internet eXchange Point of Nigeria	18	☑	☑	May 2007	☑
		Ibadan	Ibadan Internet Exchange	☑	☑	☑	Mar 2002	☑
	Rwanda	Kigali	Rwanda Internet exchange	☑	☑	☑	☑	☑
	South Africa (3)	Cape Town	Cape Town Internet Exchange	148	1.5G	☑	1996	☑
			Grahamstown	Grahamstown Internet Exchange	6	4.3M	30	13 Mar 2005
Johannesburg			Johannesburg Internet Exchange	47	3.3G	☑	6 Jun 1996	☑
Hub			☑	☑	☑	☑	☑	
NAPAfrica Cape Town			☑	☑	☑	☑	☑	
NAPAfrica Johannesburg			☑	☑	☑	☑	☑	
South African Internet Exchange			☑	☑	☑	☑	☑	
Sudan	Khartoum	Sudan Internet Exchange Point	☑	☑	☑	☑	☑	
Swaziland	Mbabane	Swaziland Internet Exchange	3	128K	☑	Jun 2004	☑	
Tanzania (2)	Arusha	Arusha Internet Exchange Point	6	400K	☑	26 Jun 2006	☑	
	Dar es Salaam	Tanzania Internet Exchange	25	6.37M	☑	Jul 2003	☑	
Uganda	Kampala	Uganda Internet Exchange	5	24M	☑	Jul 2003	☑	
Zambia	Lusaka	Zambia Internet Exchange Point	9	☑	☑	Feb 2006	☑	
Zimbabwe	Harare	Zimbabwe Internet Exchange	5	☑	☑	Jul 2001	☑	

The Regional Interconnection Challenge

Despite the growth in regional submarine, terrestrial cables and Internet Exchange Points; Routing policies continue to follow the satellite topology

For instance traffic from Rwanda a landlocked country in East Africa to Nairobi, Kenya goes via London despite the fact that the Submarine cable transit points are in Port city of Mombasa in Kenya

Reported Capacity Costs

South Africa

	STM-1/pm	STM-4/pm
JHB-CPT	~\$32,815	~\$82,037
JHB-LON	~\$31,553	~\$78,882

Kenya

	STM-1/pm	STM-4/pm
NBO-MSA	~\$3,100	~\$11,196
NBO-LON	~\$23,250	~\$74,640

South Africa

Local STM-4/pm = \$131/Mbps

International STM-4/pm = \$126/Mbps

Kenya

Local STM-4/pm = \$18/Mbps

International STM-4/pm = \$120/Mbps

Regional/Cross-Border Costs < STM-1/pm

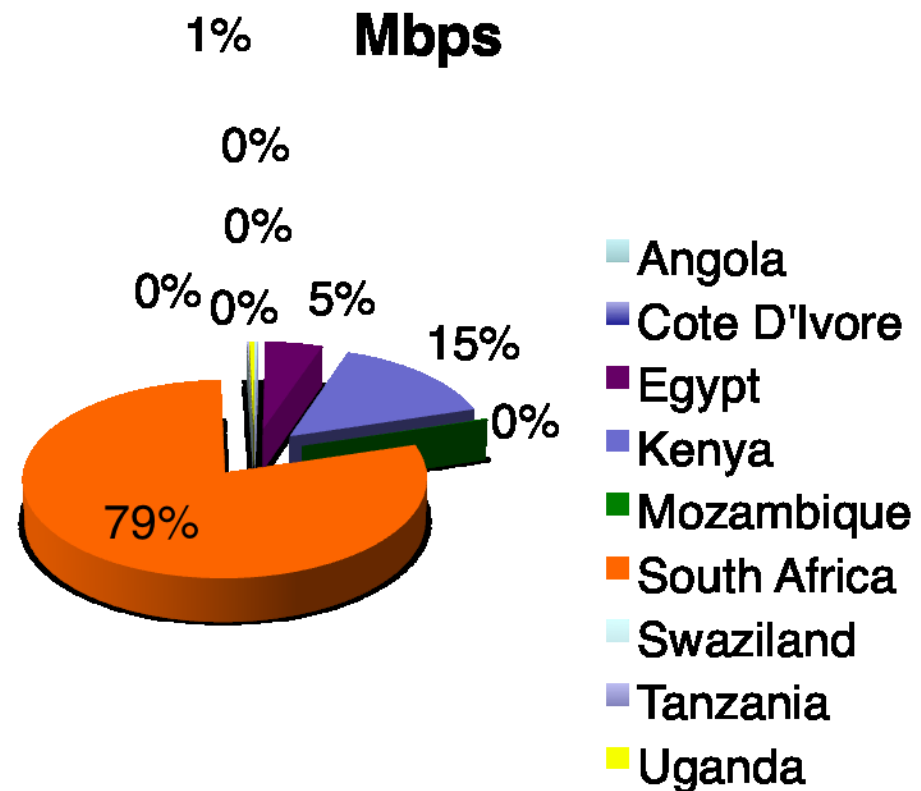
DAR-NBO = \$183/Mbps

KPL-NBO = \$75/Mbps

JHB-NBO = \$110/Mbps

Observations

- Based on International traffic capacity (520Gb) and aggregate traffic measured across African IXPs (5.26Gb) it's safe to say that only 1% of Africa traffic is local.
- 99% of the content consumed by the over 118M Internet Users in Africa is hosted outside the region.
- 3 Countries South Africa, Kenya and Egypt contribute to the majority of the traffic
- The different cable models affect the pricing
- Observed cost savings on terrestrial circuits measured against the content available locally moots national, regional & cross-border Interconnection options.





the Internet is for
everyone

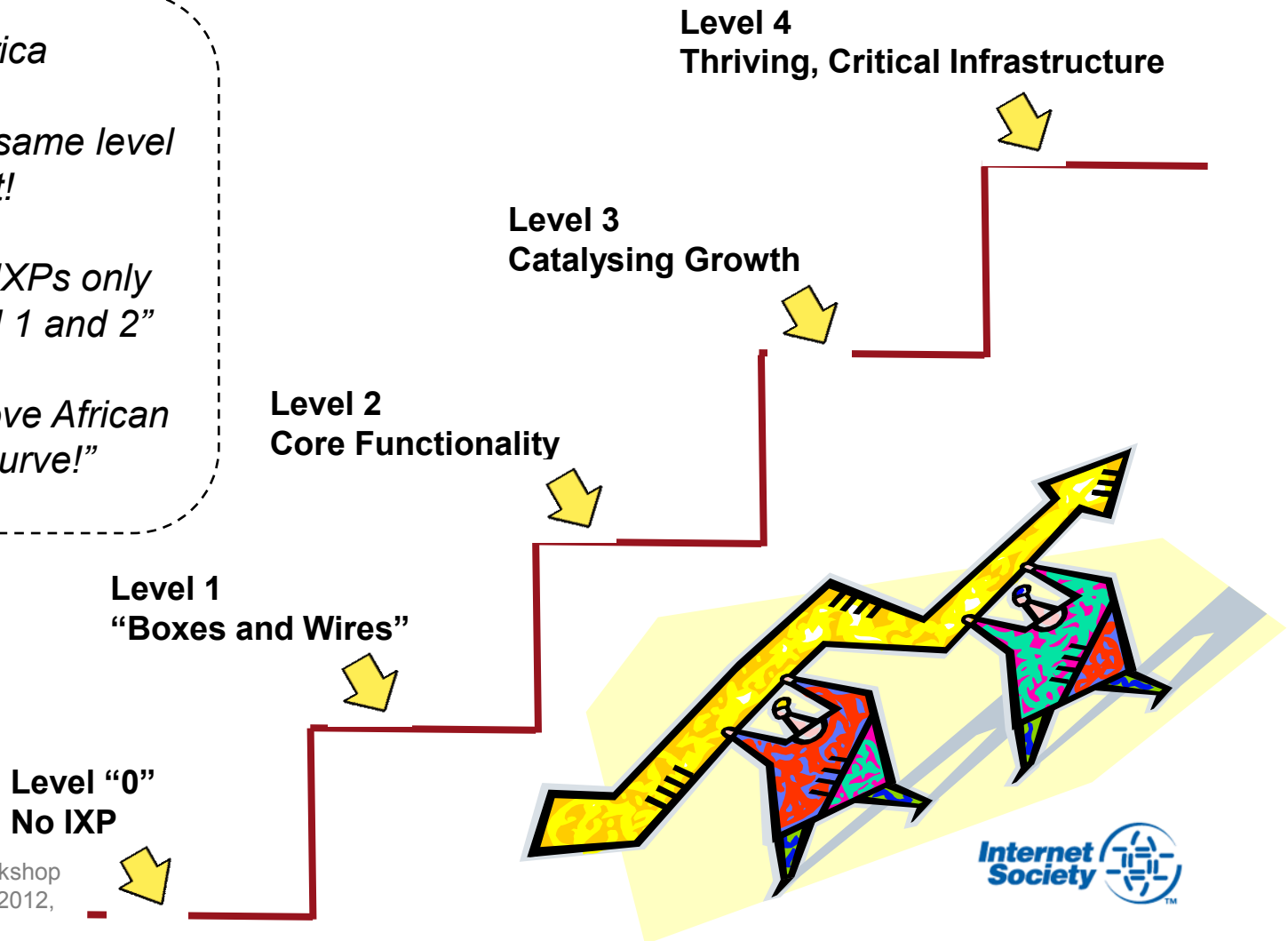
Addressing the Traffic Imbalance



InternetSociety.org

Advancing the Value and Viability of IXPs in Africa

- 24 IXPs in Africa
- Not all at the same level of development!
- Most current IXPs only between “Level 1 and 2”
- We aim to move African IXPs “Up the Curve!”



1. Building New IXPs: 61% of Africa lacks IXPs

- The cost of building national IXPs is low for instance;
 - The Lesotho Internet Exchange Point was established on 26th August 2011
 - The Lesotho Communications Authority spearheaded the setup of the IXP and spent a total of R50,000 (~\$4,500) for;
 - IXP Room Air conditioning
 - IXP Room burglar proofing
 - Meeting expenses during the technical training and stakeholder meetings
 - The IXP is hosted at the National University of Lesotho in a room donated by the University
 - The equipment rack was donated by the Ministry of Communications
 - The IXP Switches and Routers were donated by Internet Society in partnership with Cisco Systems.
 - IP Address space and Autonomous System Number are free from AfriNIC under the Critical Infrastructure Policy
- Therefore the cost of setting up an IXP is significantly low due to readily available support and partnership from Internet organizations.
- Estimated costs are less about ~\$10,000

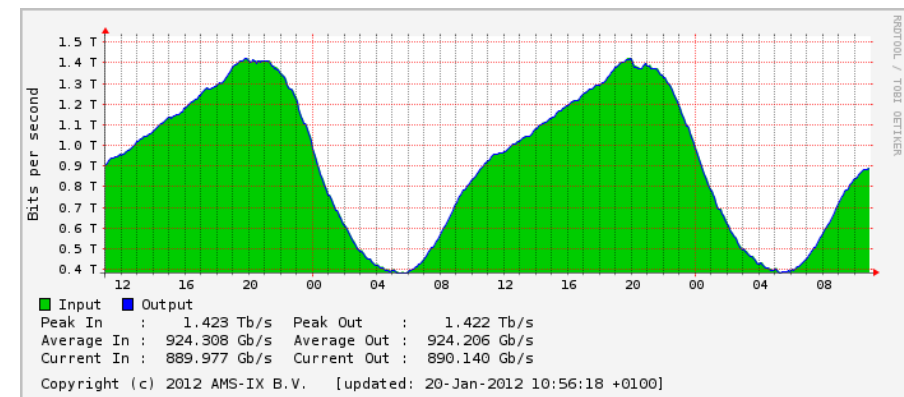
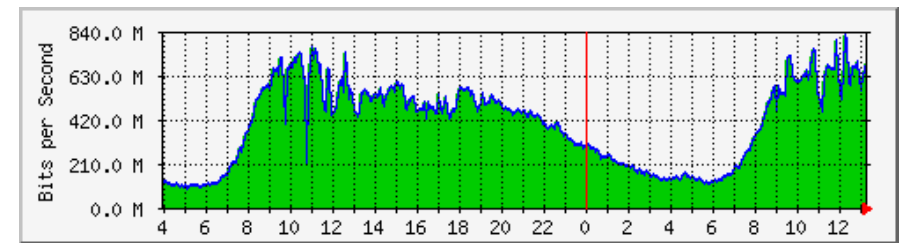
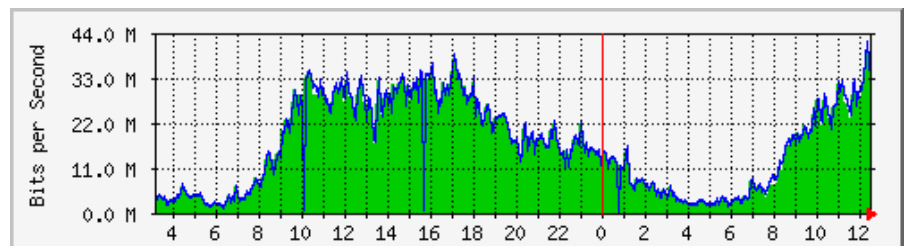


2. Enhance Value and Grow Critical Mass: 3 countries contribute to 98% of Africa's local traffic.

Enhancing Value of IXPs:

- Opening an IXP beyond the traditional ISP Members
 - NRENs
 - E-Government Services such as Customs, immigration, etc should
- Competition on last-mile, national and cross-border terrestrial services for high speed/fiber optic links
- Leveraging eyeball networks, infrastructure providers and content providers
 - Installation of Content providers Caching servers
 - Build Carrier Neutral Datacenters
- DNS Services such as Root-Server instances and national ccTLD

Where would you prefer to Peer?



3. Communities of Practice



- Communities of practice provide a platform where stakeholders can meet and share experiences and best practices.
- In Africa such forums have had resounding success on the technical capacity building front and policy development such as AfNOG, AfriNIC, etc.
- The Africa Peering and Interconnection Forum (AfPIF) is an open forum that is aspiring to contribute to the growth of national and cross-border interconnection.
- AfPIF also helps bridge the information asymmetry on Interconnection economics for the benefit of Regulators, Governments, Operators, Research and Education Networks amongst others.
- The forum further offers opportunities to exchange ideas and learn more about the global trends on interconnection.
- More information is available www.afpif.org

4. Build Regional Interconnection & Transit “Hot Spots”

Franco-West Africa

- Senegal
- Multiple Cable landings

North-Africa (Egypt)

- Egypt
- Undersea Cable Crossroads

East Africa

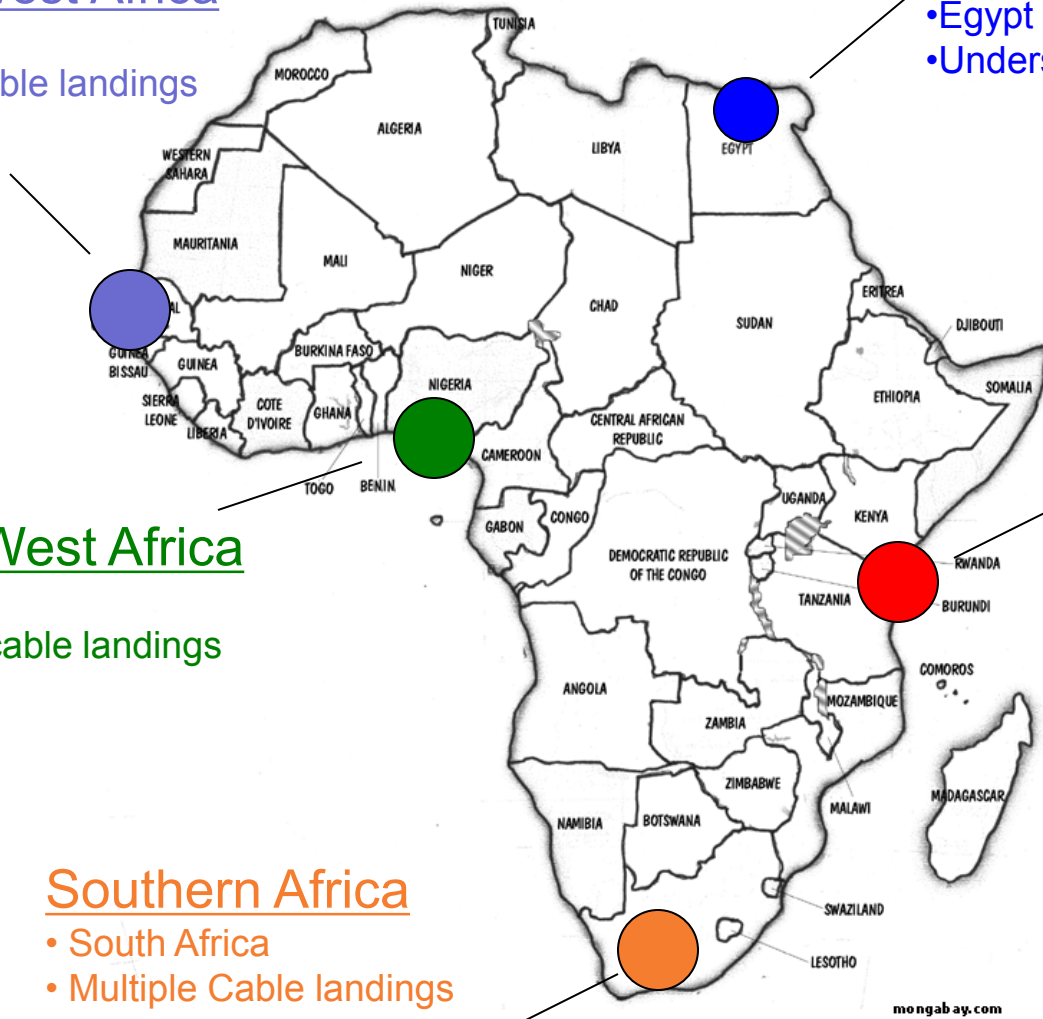
- Kenya
- Multiple Cable Landings

Anglo-West Africa

- Nigeria
- Multiple cable landings

Southern Africa

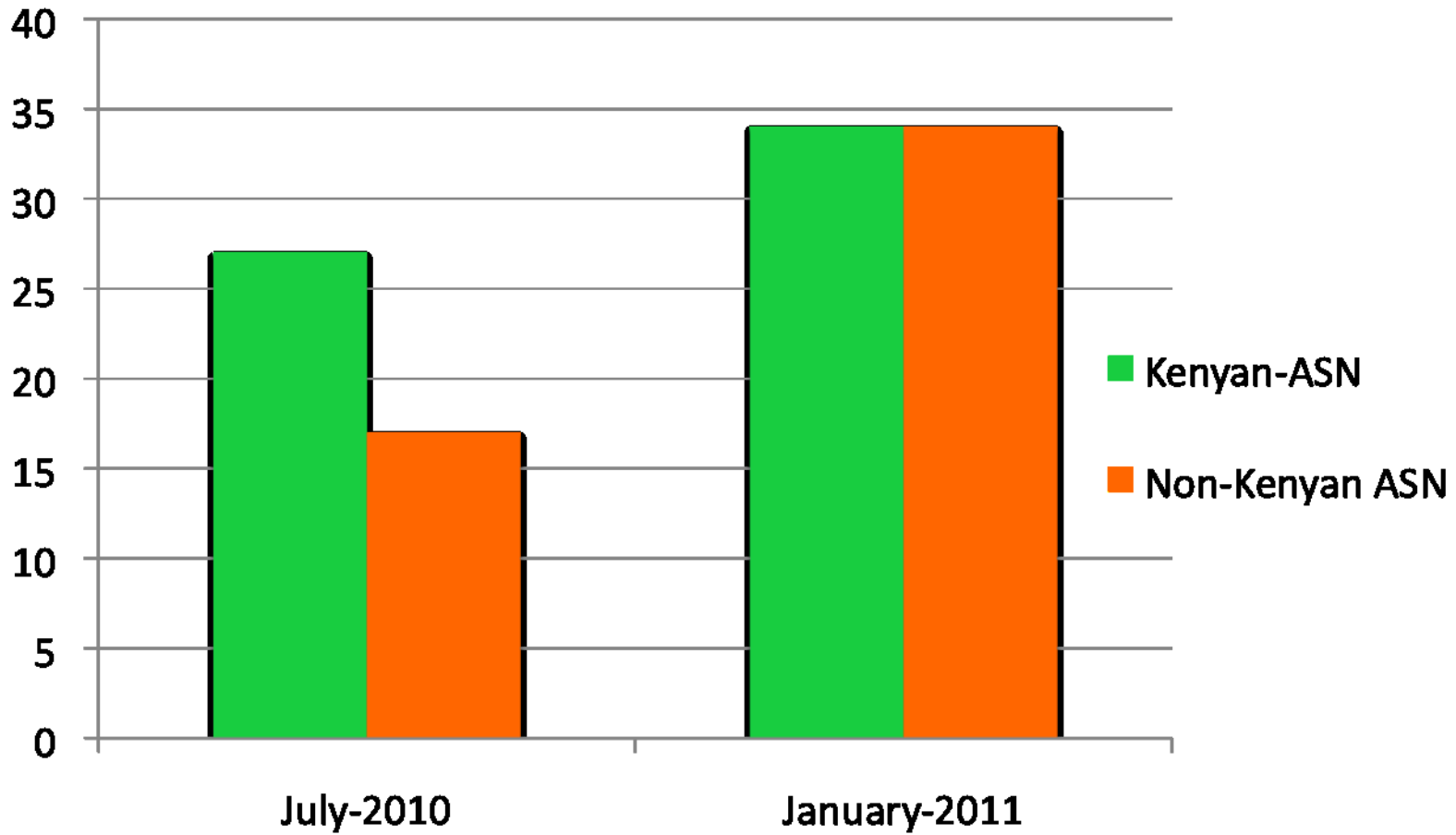
- South Africa
- Multiple Cable landings



mongabay.com

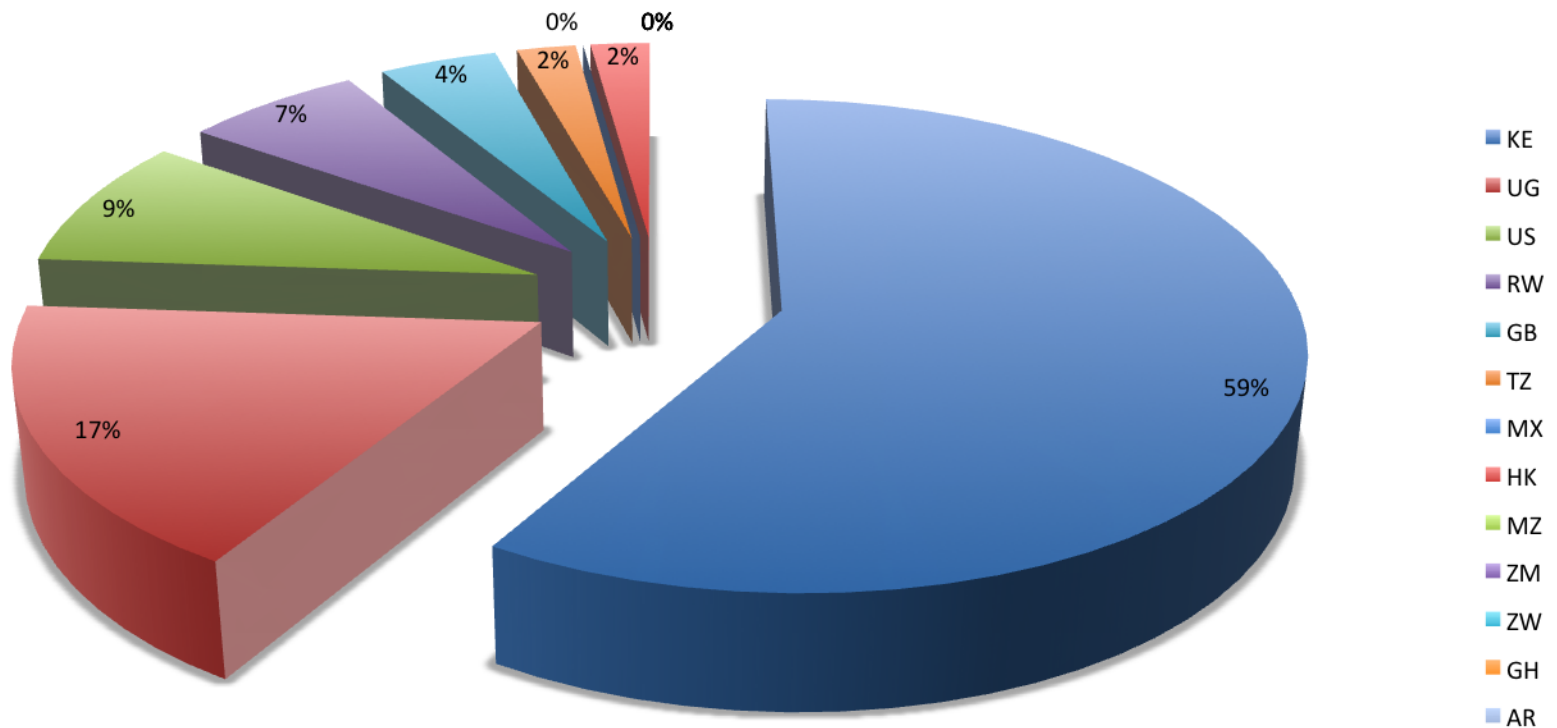
By evolving National IXPs into Regional Peering and Global Transit points.

Regional Interconnection at a National IXPs is starting to take place; - recorded at KIXP



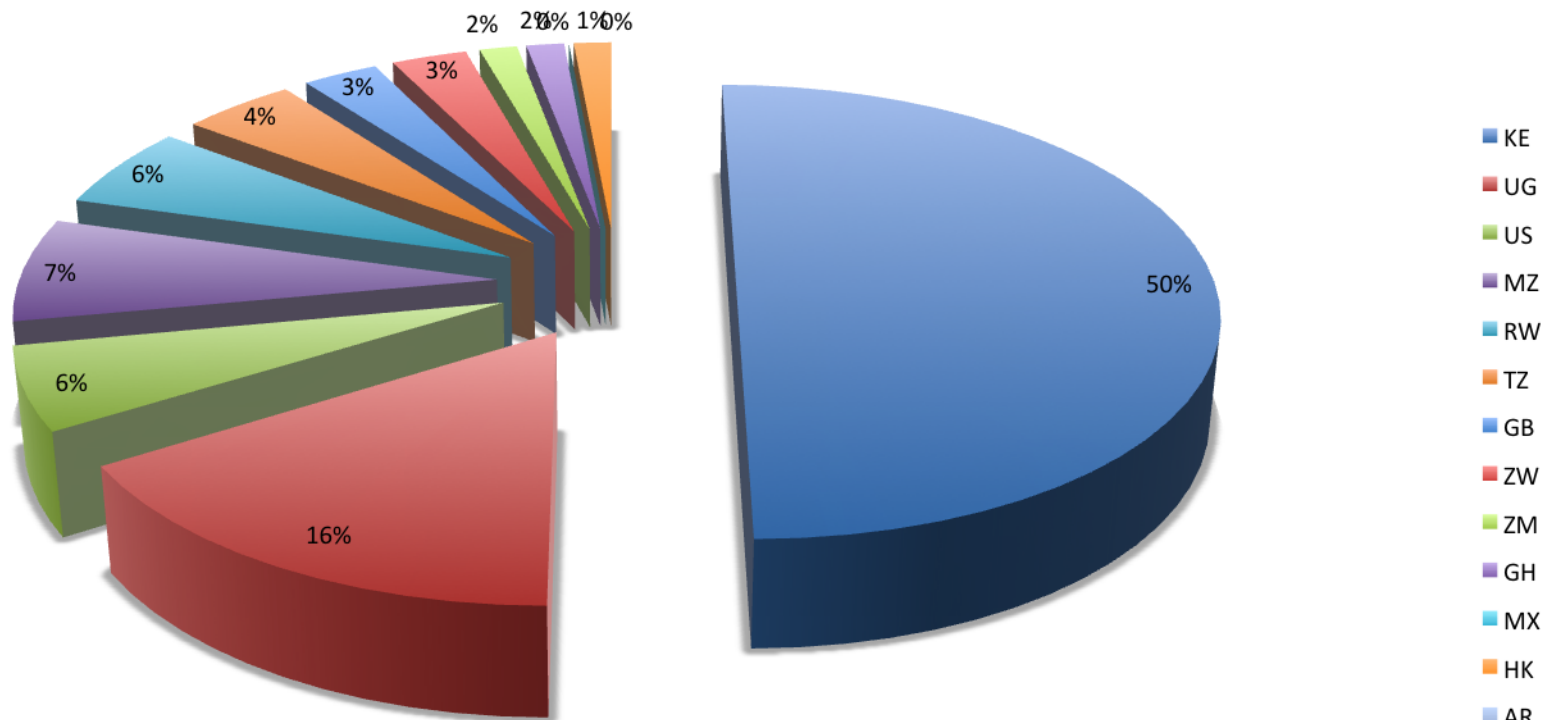
KIXP ASN - July 2010

Distribution Based on Origin Country



KIXP ASN – Jan 2011

Distribution based on Origin Country

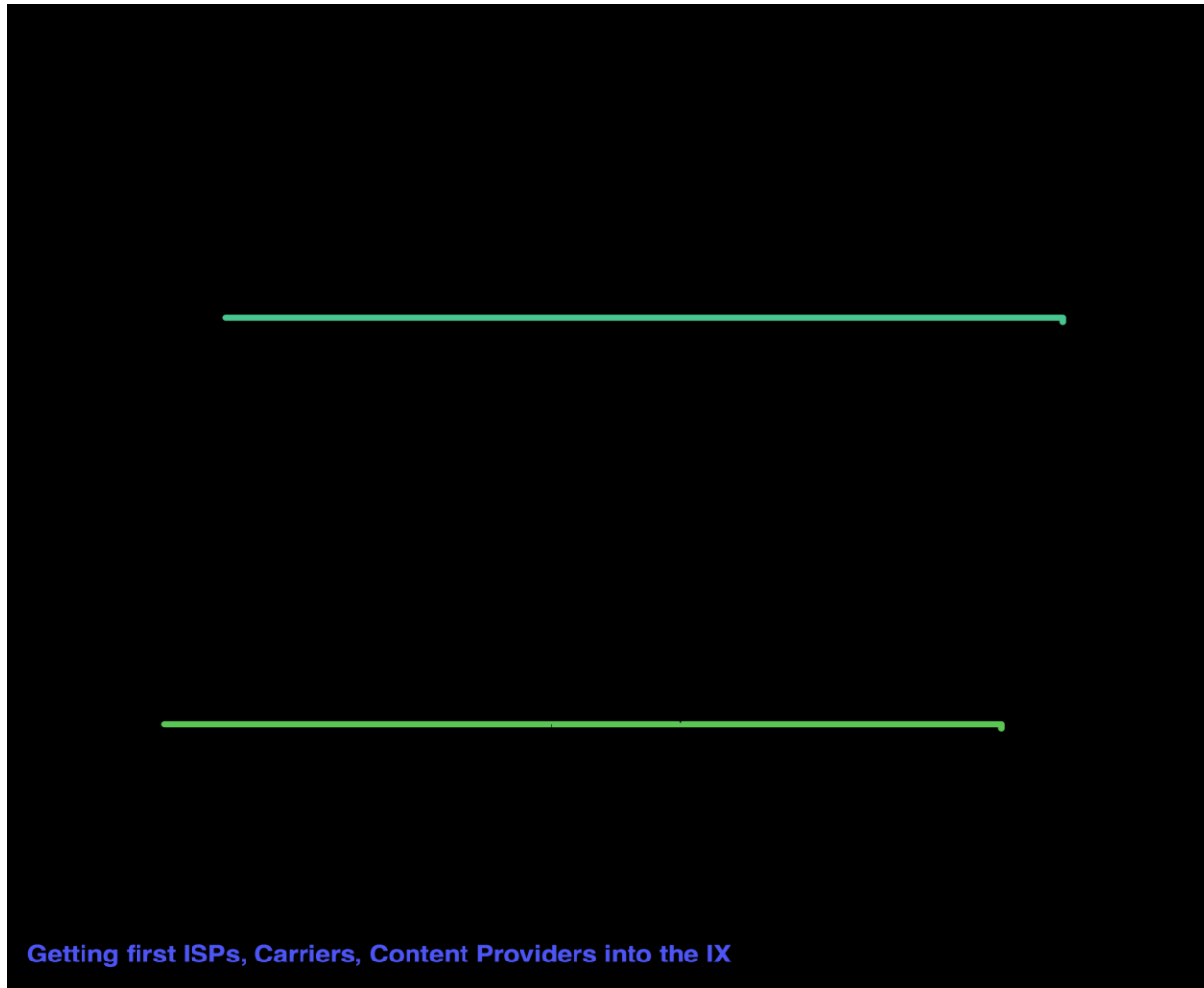


KIXP ASNs Jan 2011



What is the present Value of Peering in Africa?

Calculating Interconnection Cost Savings



$$\frac{1}{2} \text{ unitCostOfPeering} = \frac{\text{monthlyCostOfPeeringAtIXP}}{\text{amountOfTrafficExchangedAtIXP}}$$



Value of Peering across to IXPs

Mozambique (MOZIX)

- $ValueOfMOZIX = AmountOfMoneyPeeringAtMOZIXSaves$
- $AmountOfMoneyPeeringatMOZIXSaves = CostOfTransit - CostOfPeeringAtMOZIX$
- $CostOfTransit = \$600.00 / Mbps * 30 Mbps = \$18,000$ per month
- $AvgMonthlyCostOfPeeringAtMOZIX = \1 (MOZIX does not charge for peering)
- $CostOfPeeringAtMOZIX = \$1$ per month * 15 peers = \$15 per month
- $ValueOfMOZIX = \$18,000 - \$15 = \$17,985$ per month
- Under all of these assumptions, the peering population in aggregate benefits from the MOZIX about **\$17,985 per Month**

Kenya (KIXP)

- $ValueOfKIXP = AmountOfMoneyPeeringAtKIXPSaves$
- $AmountOfMoneyPeeringatKIXPSaves = CostOfTransit - CostOfPeeringAtKIXP$
- $CostOfTransit = \$120.00 / Mbps * 900 Mbps = \$108,000$ per month
- $AvgMonthlyCostOfPeeringAtKIXP = (\$3,600 / 12) = \$300$ per month
- $CostOfPeeringAtKIXP = \$300$ per month * 28 peers = \$8,400 per month
- $ValueOfKIXP = \$108,000 - \$8,400 = \$99,600$ per month
- Under all of these assumptions, the peering population in aggregate benefits from the KIXP about **\$99,600 per Month**

Conclusion: The 70-30% Vision

- The long term objective for Africa should be aim for a traffic imbalance of 70% local/regional against 30% International.
- The more traffic and content accessible via IXPs the higher the value of peering in the region will be.
- The regional capacity costs will have to be revised by the various carriers and operators to be more attractive for regional interconnection and peering
- Operational IXPs need to provide statistical data to measure growth of peering and interconnection in the region.
- Investments in affordable and reliable power infrastructure.

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