



Economics of ICT

(relationship between GDP and ICT)

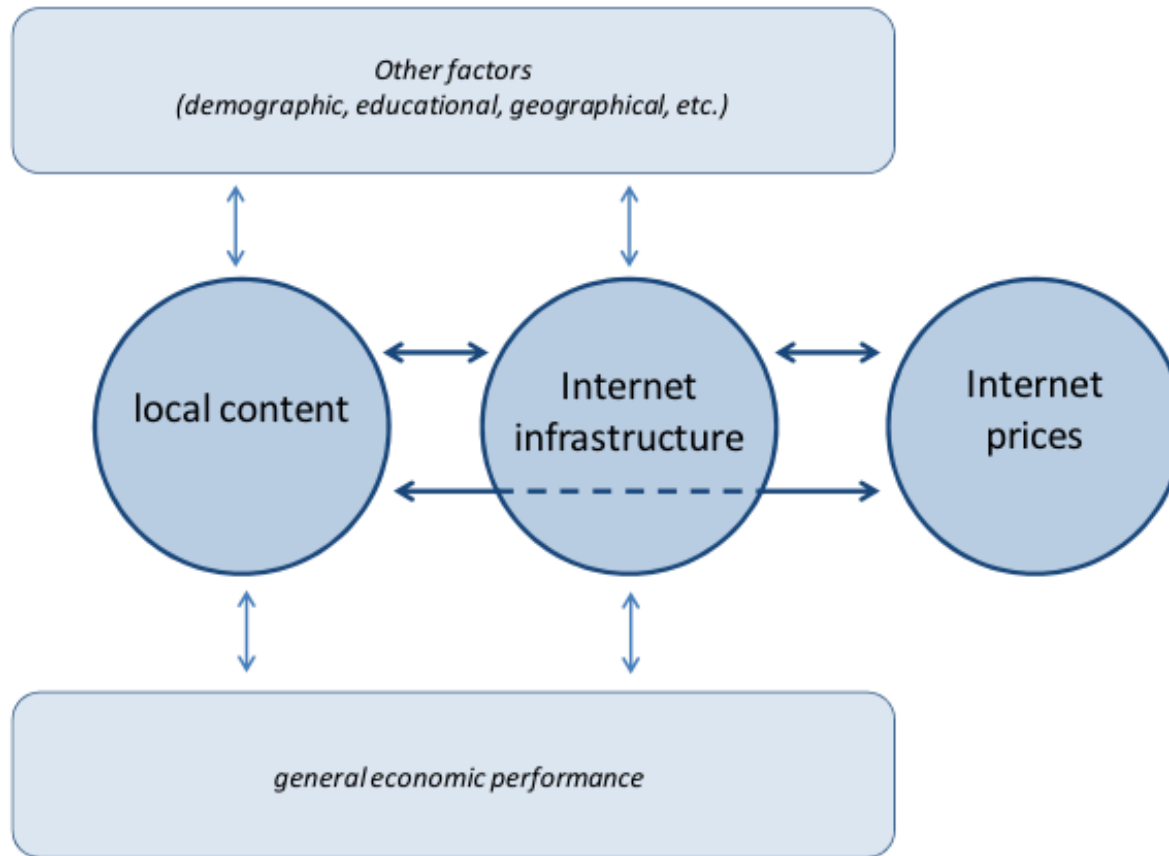
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Source: OECD

Internet exchange Points (IXPs)

- **Latency Impact:**

The presence of the IXP has reduced latencies experienced from between **200 – 400** to sub **10ms**.

- **Cost Savings:**

The wholesale savings of exchanging **300Mbit/s = \$1,080,000** per year

- **Local Content and Hosting:**

West African Examination council Website is locally hosted and accessed.

Interswitch e-transactions and e-payment system with over 10,000 **ATMs** and **11,000 POS** terminals has started migrating some of services hosted abroad back into Nigeria

- **Latency Impact:**
KIXP members experience between **10ms – 2ms** latencies between their networks compared to between **200ms – 600ms** without the IXP.
- **Cost savings:**
KIXP exchanges **1Gbit/s**
Wholesale saving are at **\$1,440,000** per year.
- **Increased revenues:**
Mobile operators in Kenya charge by the MB for Internet access. Through the KIXP revenues increased of about **\$6,000,000** per year.
- **Local Content and Hosting:**
The Kenya Revenue Authority Online services saves the private sector **\$4.5m**



- **Latency Impact:**
With 3 national IXPs that host 5 different Root Name Servers members experience between **10ms – 20ms** latencies between their networks compared to between **550ms+** without the IXP.
- **Cost savings:**
The 3 IXPs exchanges and aggregate traffic of **7 Gbit/s** Wholesale saving are at **\$25,000,000** per year.
- **Local Content and Hosting:**
South Africa remains the most developed data market with most of the capacity located there and over **800,000** domains under **.ZA**

Region	Country	City	Internet Exchange Name	Participants	Traffic	Prefixes	Established	URL
Africa (25)	Angola	Luanda	Angola Internet Exchange	10	13M	🇸🇰	17 Mar 2006	🔗
		Luanda	Ponto de Intercambio Internet Angola	🇸🇰	🇸🇰	🇸🇰	🇸🇰	🇸🇰
	Botswana	Gaborone	Botswana Internet Exchange	9	🇸🇰	🇸🇰	Oct 2005	🔗
	Burundi	Bujumbura	Burundi Internet Exchange Point	🇸🇰	🇸🇰	🇸🇰	🇸🇰	🇸🇰
	Congo-Kinshasa	Kinshasa	Kinshasa Internet Exchange	11	🇸🇰	🇸🇰	Nov 2002	🔗
	Cote D'Ivoire	Abidjan	Côte d'Ivoire Internet eXchange Point	5	4M	🇸🇰	2006	🔗
Egypt (2)	Cairo	Cairo	Cairo Internet Exchange	8	976M	🇸🇰	May 2002	🔗
		Cairo	Middle East Internet eXchange	7	🇸🇰	🇸🇰	May 2007	🔗
		Cairo	Cairo Regional Internet Exchange	🇸🇰	🇸🇰	🇸🇰	May 2002	🔗
	Ghana	Accra	Ghana Internet Exchange	24	🇸🇰	🇸🇰	18 Oct 2005	🔗
Kenya	Nairobi	Nairobi	Kenya Internet Exchange Point	34	773M	🇸🇰	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	17	5M	🇸🇰	Jul 2002	🔗
Nigeria	Lagos	Lagos	Internet eXchange Point of Nigeria	18	🇸🇰	🇸🇰	May 2007	🔗
		Ibadan	Ibadan Internet Exchange	🇸🇰	🇸🇰	🇸🇰	Mar 2002	🔗
	Rwanda	Kigali	Rwanda Internet exchange	5	114M	🇸🇰	2003	🔗
South Africa (6)	Cape Town	Cape Town	Cape Town Internet Exchange	155	1.7G	🇸🇰	1996	🔗
		Cape Town	NAPAfrica Cape Town	12	630M	🇸🇰	2012	🔗
		Durban	Durban Internet eXchange	🇸🇰	1.85M	🇸🇰	14 Sep 2012	🔗
		Grahamstown	Grahamstown Internet Exchange	6	1.86M	30	13 Mar 2005	🔗
		Johannesburg	Johannesburg Internet Exchange	53	5.8G	🇸🇰	6 Jun 1996	🔗
		Johannesburg	NAPAfrica Johannesburg	29	929M	🇸🇰	2012	🔗
	Sudan	Khartoum	Sudan Internet Exchange Point	🇸🇰	🇸🇰	🇸🇰	🇸🇰	🔗
	Swaziland	Mbabane	Swaziland Internet Exchange	3	128K	🇸🇰	Jun 2004	🇸🇰
Tanzania (2)	Arusha	Arusha	Arusha Internet Exchange Point	6	400K	🇸🇰	26 Jun 2006	🔗
		Dar es Salaam	Tanzania Internet Exchange	24	6.37M	🇸🇰	Jul 2003	🔗
	Uganda	Kampala	Uganda Internet Exchange	8	🇸🇰	🇸🇰	Jul 2003	🔗
	Zambia	Lusaka	Zambia Internet Exchange Point	9	🇸🇰	🇸🇰	Feb 2006	🇸🇰
	Zimbabwe	Harare	Zimbabwe Internet Exchange	5	🇸🇰	🇸🇰	Jul 2001	🔗

AFRINIC Internet Transit Deficit

- Based on International traffic capacity (520Gb) and aggregate traffic measured across African IXPs (10.3Gb) its safe to say that **almost 2% of Africa traffic is local.**
- **98% of the content** consumed by the over a 100 Million Internet Users **in Africa is imported.**
- **3 Countries** South Africa, Kenya and Egypt contribute to **99% of Africa's local traffic.**
- This creates an Internet traffic Trade deficit or “**Internet Transit Deficit**” – where significantly less traffic is generated locally than access internationally.

Internet bandwidth costs will remain high until the Transit deficit is addressed.

The **African Internet Exchange System (AXIS)** project evolved as a result of the **Addis Ababa declaration** on information and communication technologies in Africa. In the declaration, the heads of state and government of the African Union undertook to strengthen national programmes and regional cooperation for the deployment of regional internet exchange points. They also expressed the need to intensify the activities of the African Union Commission to implement the African Regional Action Plan on the Knowledge Economy (ARAPKE). One of its flagship projects is AXIS.

The International Trust fund (ITF) allocated a grant of **€ 5.1 million** in April 2010, out of a grand total of **€ 208.9 million** for grant operations approved for the 2007-10 period.

It is in the interests of all countries in Africa to find ways of **optimizing Internet traffic**, to support **intra-continental traffic flows** and **create opportunities for private sector investment** in these areas.



End-User Assignment to critical Infrastructure

Ref. Name: AFPUB-2006-GEN-001

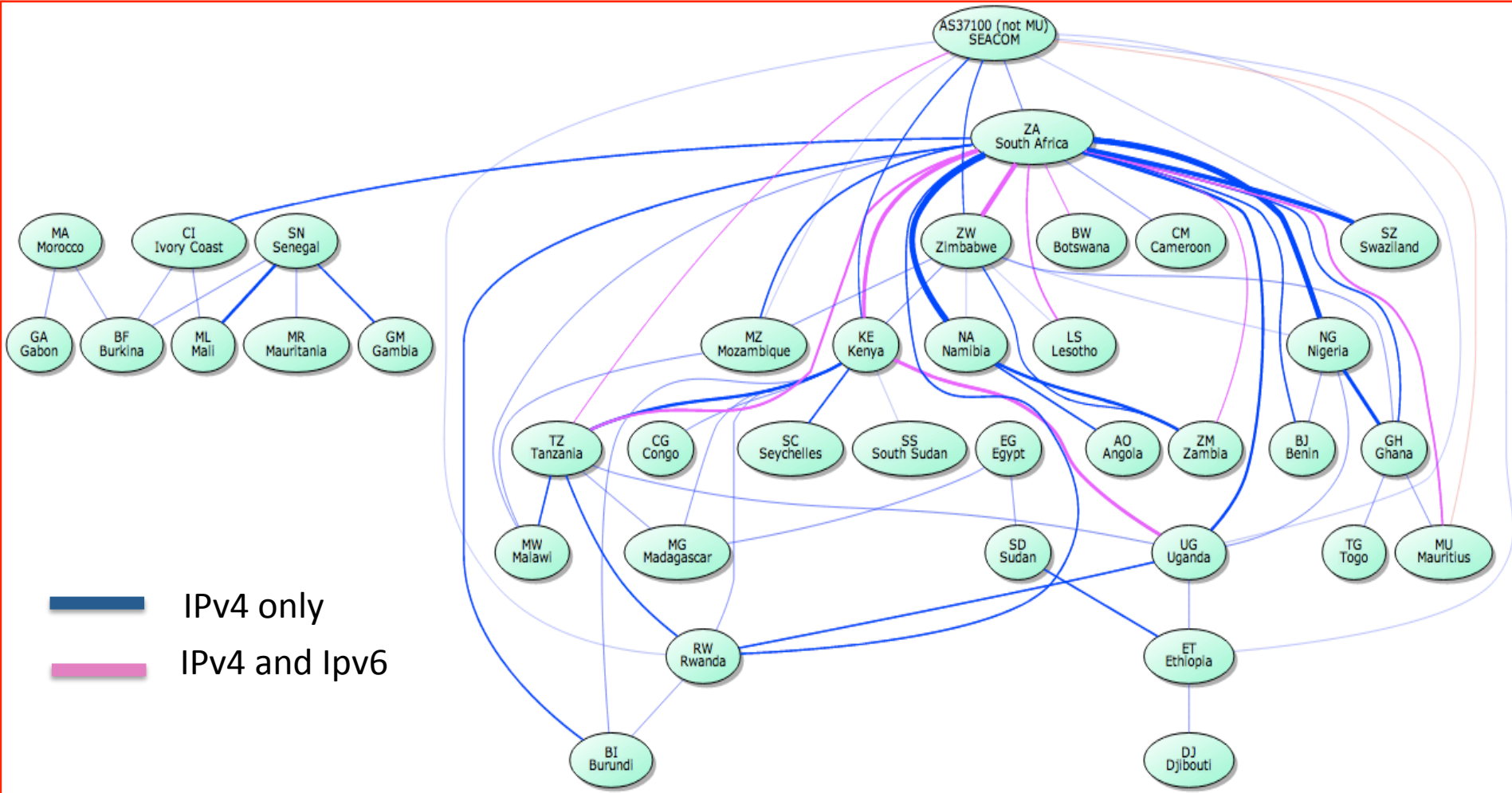
AfriNIC will make End-User assignment to **critical infrastructure** providers of the Internet such as **public exchange points and core DNS service providers**. These allocations will be no longer than a /24 using IPv4. Multiple allocations may be granted in certain situations. Exchange point assignment **MUST** be assigned from specific blocks reserved only for this purpose.

AfriNIC will make a list of these blocks **publicly available**.

Exchange point operators must **provide justification for the allocation**, including: connection policy, location, other participants (minimum of three total), ASN, and contact information. This policy does not preclude exchange point operators from requesting address space under other policies such as becoming LIR.

African Interconnection

African Interconnection BGP Map



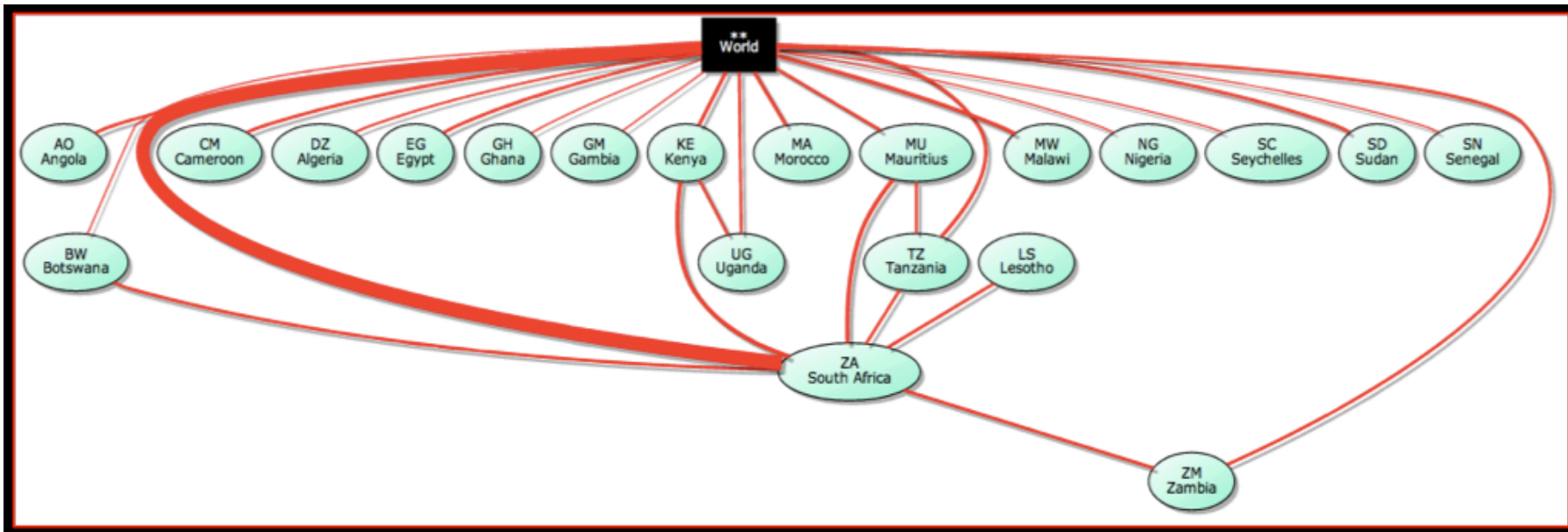
* Africa BGP Map, curtsy of Hurricane Electric, September 2012.

* Thicker lines indicate more BGP sessions

* Not all links will show within these graphs, due to the limited number of collectors in Africa

African Interconnection IPv6 only BGP Map

A hand full of countries interconnect together over IPv6



- * Africa IPv6 BGP Map, curtsy of Hurricane Electric, September 2012.
- * Thicker lines indicate more BGP sessions
- * Not all links will show within these graphs, due to the limited number of collectors in Africa

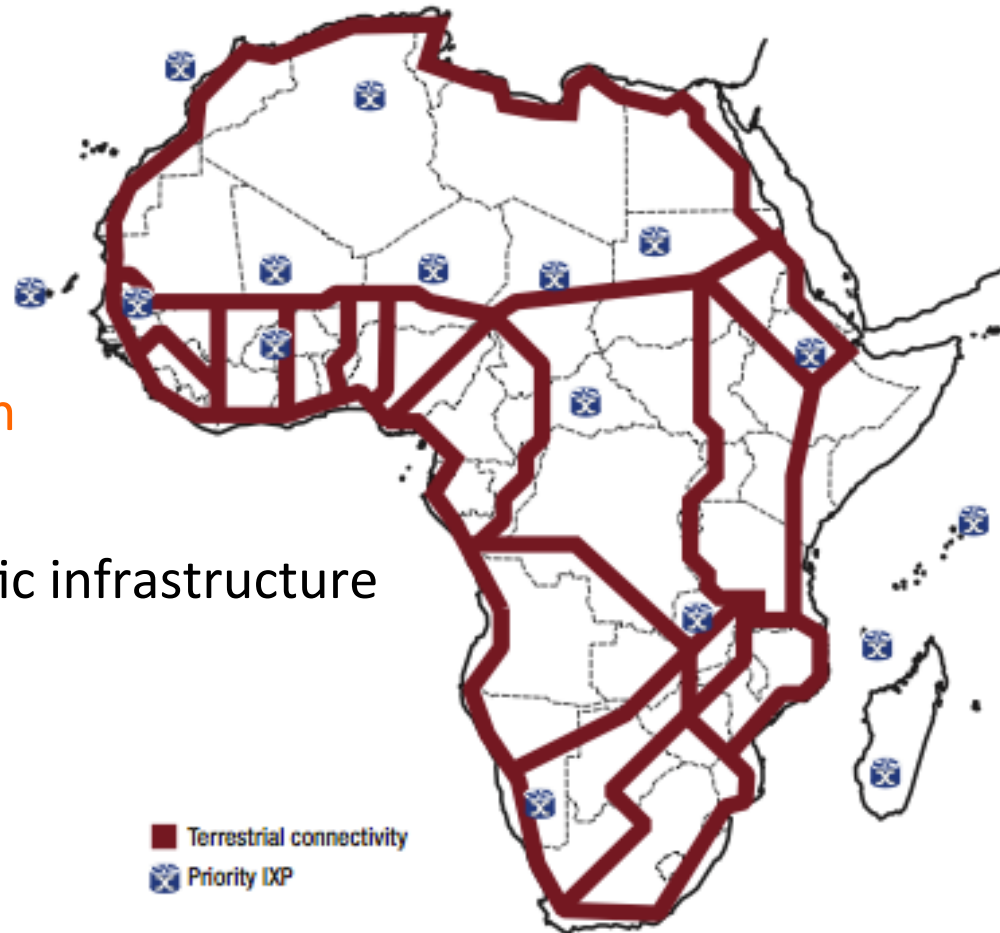
Programme for Infrastructure Development in Africa (PIDA)

Programme Focus:

- ICT
- Transport
- Transboundary Water
- Energy

The ICT programme will establish an enabling environment for

- completing the land fiber-optic infrastructure
- connecting each country to two different submarine cables to take advantage of the expanded capacity.



Goal 1: **Interconnect all African capitals** and major cities with ICT broadband infrastructure and strengthen connectivity to the rest of the world.

Goal 2: **Connect African villages to broadband ICT services** and implement shared access initiatives such as community telecentres and village phones.

Goal 3: **Adopt key regulatory measures** that promote affordable, widespread access to a full range of **broadband ICT services**, creating national Internet Exchange Points (IXPs) and implementing **competition** in the provision of international Internet connectivity.

Goal 4: Support the **development** of a critical mass of **ICT skills** required by the knowledge economy.

Goal 5: Adopt a **national e-strategy**, including a **cyber-security** framework, with the aim of making multiple e-government and other e-services widely available by 2015.

AFRINIC Terrestrial capacity

- As shown, there **has been significant investments** on the **broadband** and **Fiber Optic infrastructure** in the region.
- **Despite these investments the cost of terrestrial capacity has not come down** to comparative levels with the rest of the world
- This is **largely contributed** to diversity that drives **competition**.






As a result, we encourage Internet users to access content hosted abroad over locally hosted content

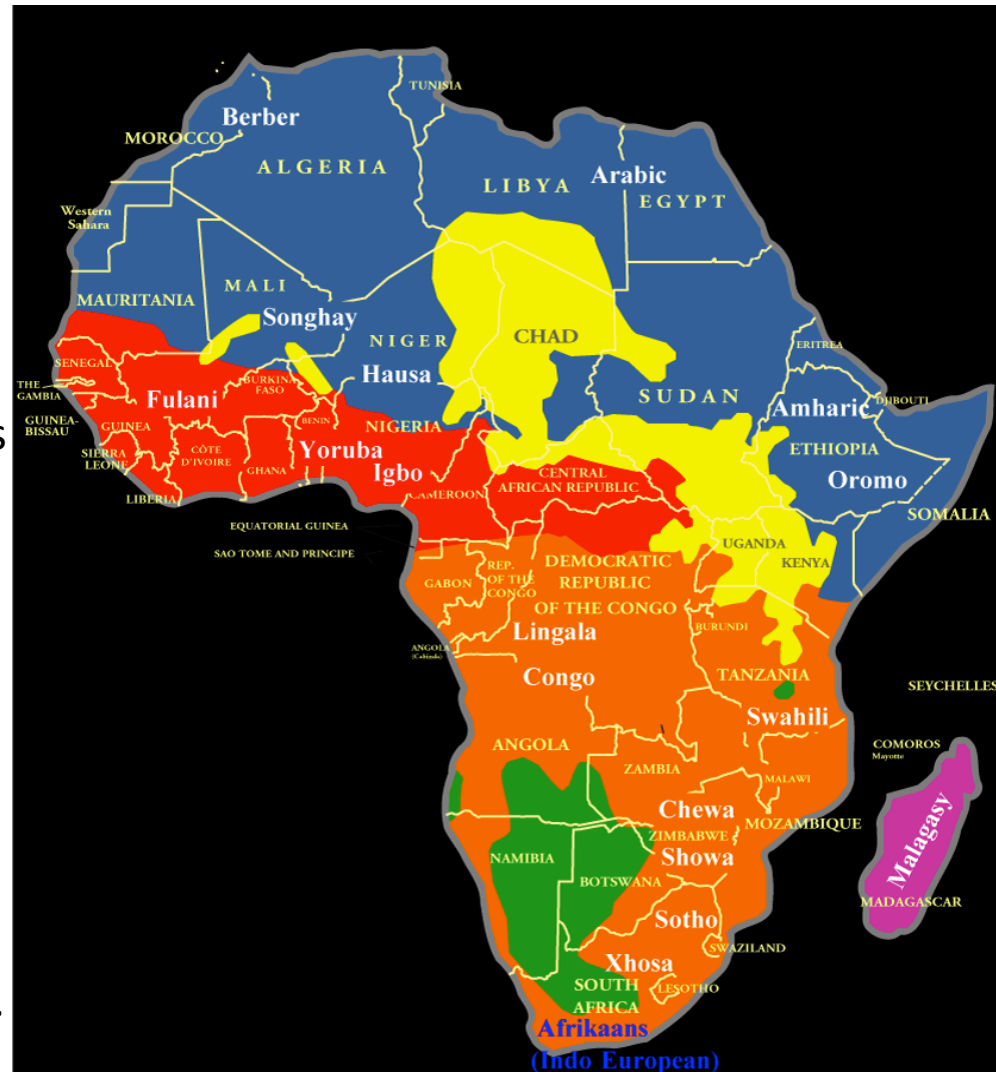
Local Content

- UNESCO has defined **local content** as an expression and communication of a community's locally generated, owned and adapted knowledge and experience that is relevant to the community's situation.
- These communities are defined by their **location, culture, language or area of interest**.
- The idea of relevant content in the speaker's **own language** is called **local content**.
- There may be cases where relevant information exists but not in a **language** that is accessible. In other cases, **illiteracy** poses a significant problem for transmitting knowledge.

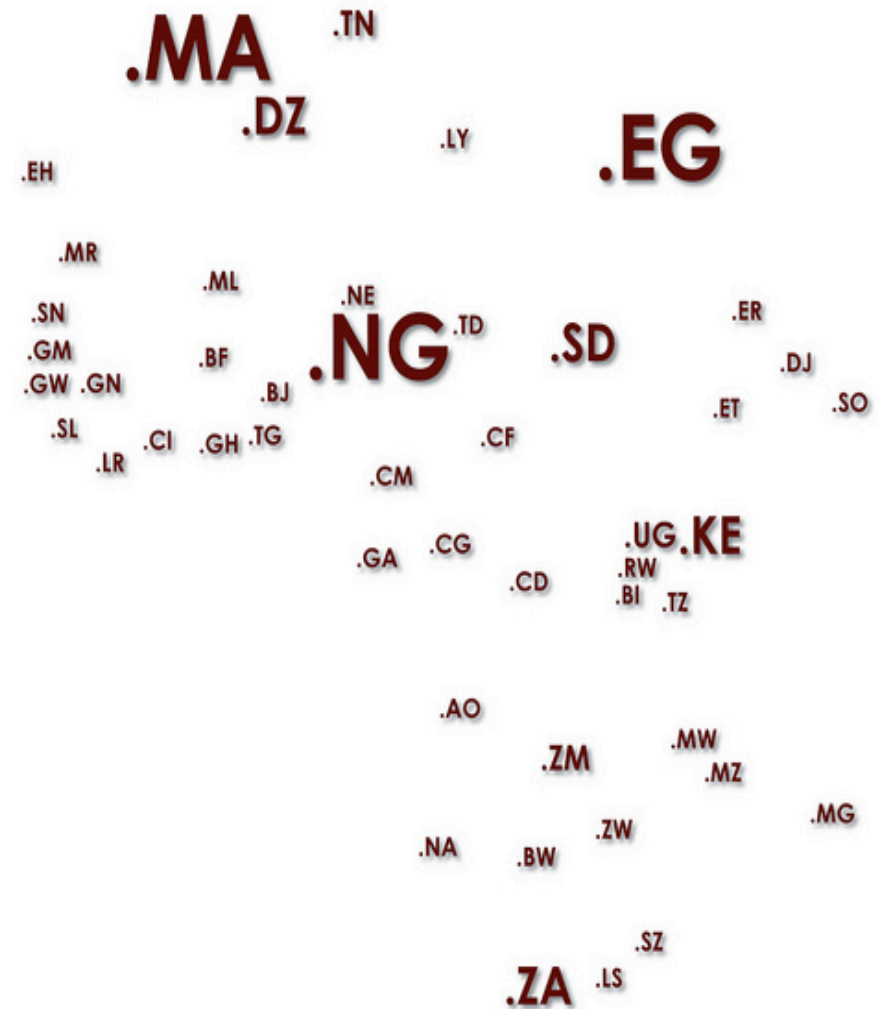
AFRINIC Language Diversity

Africa is a continent with a very high linguistic diversity, there are an estimated 1500-2000 African languages.

-  **Afro-Asiatic**
(approximately 200 languages)
covering nearly Northern Africa.
-  **Nilo-Saharan**
(approximately 140 languages)
with some eleven millions speakers
in Central and Eastern Africa.
-   **Niger-Saharan (Niger-Congo)**
(approximately 1000 languages)
covering the two thirds of Africa
with 200 millions speakers.
-  **Khoisan**
(approximately thirty languages)
in Western part of Southern Africa.



- There is a correlation between local domain names and local content.
- South Africa has over 800,000 domains under .ZA
- Kenya has over 20,000 domains under .KE
- Egypt, Sudan and Tunisia have their Arabic IDNs.
 مصر؛ السودان؛ تونس
 and expect to see more traffic on those domains as a result of literacy in Arabic.





Based on Alex's top 100 websites per country

- **Cameroon**
 - Google.cm (2/100)
 - Google.fr (3/100)
 - Google.com (4/100)
 - 2 .CM sites in top 100
- **Madagascar**
 - Google.mg (2/100)
 - Google.fr (3/100)
 - Google.com (6/100)
 - Google.es (43/100)
 - Google.it (91/100)
 - 5 .MG in top 100 sites
- **Egypt**
 - Google.com.eg (2/100)
 - Google.com (4/100)
 - 3 .EG in top 100
- **Morocco**
 - Google.co.ma (2/100)
 - Google.com (3/100)
 - Google.fr (9/100)
 - 5 .MA in top 25 and 12 in top 100



Based on Alex's top 100 websites per country

- **Nigeria**
 - Google.com.ng (2/100)
 - Google.com (3/100)
 - 7 .NG in top 100
- **Sudan**
 - Google.com (2/100)
 - Google.com.eg (31/100)
 - 2 .SD in top 100
- **Kenya**
 - Google.com (2/100)
 - Google.co.ke (3/100)
 - 8 .KE in top 25 and 18 in top 100
- **South Africa**
 - Google.co.za (1/100)
 - Google.com (3/100)
 - 8 .ZA in top 25 and 25 in top 100

African Local Content potential

- Promoting digitization or creation of local content is important in catalyzing local content growth
- Egypt, Kenya, Uganda have initiated projects to grow local content;
 - * Digitizing the National Archives of Egypt one of the oldest archives in the world. Over 25 million out of the 90 million documents are available online.
 - * Kenya launched a USD 4 million grant to promote the development of local content and applications. In the 1st phase 15 projects were awarded funding.
 - * AppLab initiative in Uganda aims to encourage development of mobile applications to address the local needs.
- Nigeria and Egypt have enormous potential due to the large film industry “Nollywood” and “Cairo”

Thank you

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- <http://ispa.org.za/inx/>
- <http://www.internetsociety.org/ixpimpact>
- <https://prefix.pch.net/applications/ixpdir/summary/>
- http://www.itu.int/ITU-D/ict/statistics/at_glance/KeyTelecom.html
- <http://www.businesswire.com/news/home/20120301005826/en/African-Data-Centre-Market-Examined-Tariff-Consultancy>
- <http://www.africa-eu-partnership.org/successstories/axis-%E2%80%93-developing-african-internet-system>
- <http://www.he.net/>
- <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/PIDA%20note%20English%20for%20web%200208.pdf>
- <http://www.itu.int/ITU-D/afr/CMS/index.asp>
- <http://www.afrinic.net/en/library/policies/127-policy-for-end-user-assignments-in-afrinic-service-region>
- <http://www.alexacom/topsites/countries>