AFRINIC
The Internet Numbers Registry for Africa

The Internet Ecosystem in Africa

African Critical Internet Infrastructure & Resources

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Content

- Internet Number Resources
- Root Name Servers
- Internet Exchange Points (IXPs)
- Top Level Domains & Content

The Internet

The Internet has one very simple job:

To move information from one place to another.

In this respect, the Internet works a bit like the postal service. Letters are simply passed from one place to another, no matter who they are from or what messages they contain.

Internet
Number Resources

Internet Number Resources

Return address

Sender's Name
Street Address
City, Country

Destination address

Recipient Full Name
Street Address
City, Country

These addresses must be unique to ensure delivery

Internet Number Resources

In the Internet world these Addresses are the Internet Protocol addresses or IP addresses for short.

192.168.0.1 (IPv4)
2001:42c0:0:310::126 (IPv6)

These IP addresses are part of Internet Number Resources along with Autonomous System Numbers (ASN).

Internet Number Resources

Internet Number Resources are the numbers used to identify devices and networks on the Internet.

These resources include

1) **IPv4**, Internet Protocol version 4

2) **IPv6**, Internet Protocol version 6

3) **ASN**, Autonomous System Numbers

Internet Number Resources

IPv4

Internet Protocol version 4 is the dominant protocol of the internet today. These addresses have to be unique to ensure global reachability. (4.2 billion unique IPv4 addresses)

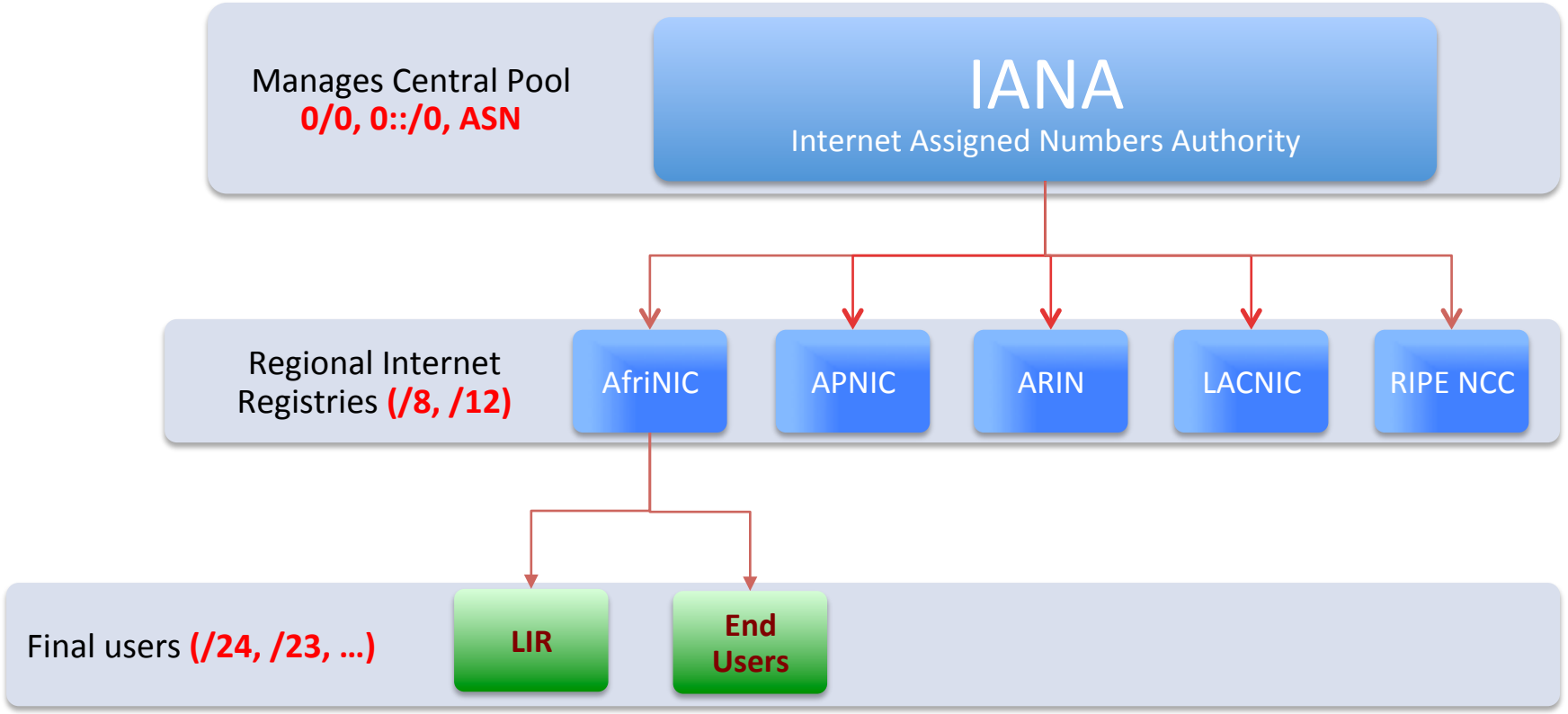
IPv6

IPv6 is the new version of the Internet address protocol that has been developed to supplement (and eventually replace) IPv4. (3.4×10^{38} unique IPv6 addresses)

ASN

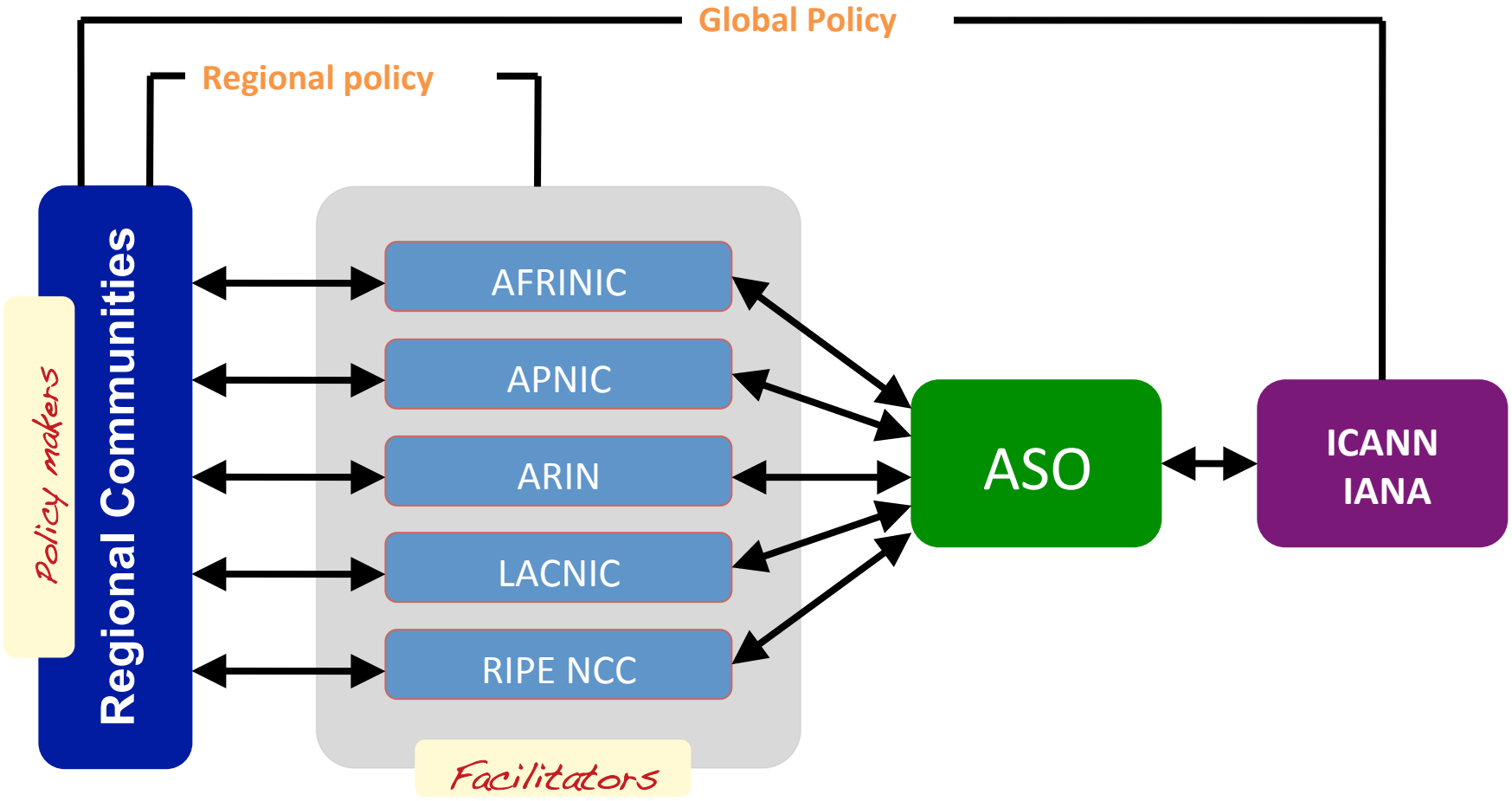
An Autonomous System is a connected group of IP networks that follow to a single unique routing policy. An ASN is a globally unique number used to identify an Autonomous System.

Internet Number Resource Management



Internet Number Resource Management

Policy development



African Regional Internet Registry

Setup in 2004 and headquartered in Mauritius.
Employs 35 full time staff today with staff based in East, North, South & West Africa

Internet Numbers Registry main function

- **Manage IPv4 & IPv6**
- **Manage ASN (2 and 4 byte)**
- **Manage rDNS tree for IP prefixes in use by African Operators**
- **Provide a Public WHOIS**
- **Contribute to IP address Management Global Policy development**

Other Services to the African community

- **Biannual Internet Protocol meeting**: 17 so far in 14 countries
- **Internet Infrastructure reinforcement development in Africa:**
  - IXP
  - DNS Root Server copy
  - Anycast service to support ccTLDs in Africa
- Support to **academic Networks**

Capacity building and training: more than 100 training sessions with over 2000 trained in 40 countries around Africa.

Internet Number Resource Management

IANA IPv4 /8s remaining February 2, 2011 = 0!

RIPE NCC IPv4 /8s remaining September 14, 2012 < 1

Arin IPv4 /8s remaining Feb, 2013 = 2.96

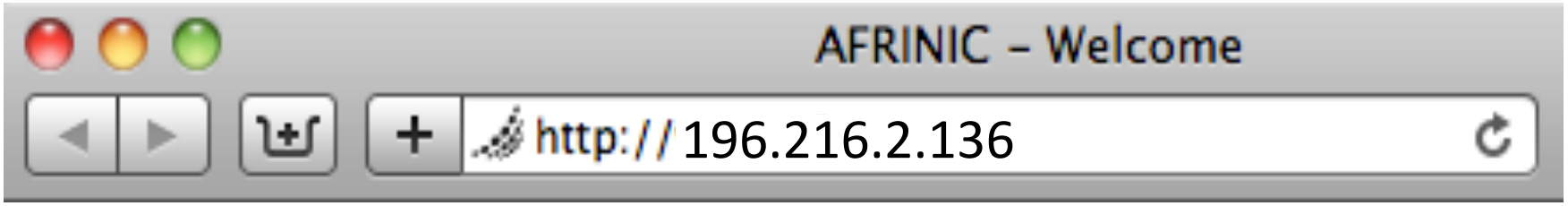
APINIC IPv4 /8s remaining April 15, 2011 < 1

Lacnic IPv4 /8s remaining Feb,2013 = 2.6

AFRINIC IPv4 /8s remaining Feb,2013 = 3.8

Root Name Servers

Root Name Servers



Root Name Servers

The Top Level Domain (TLD)

The most common types of TLDs are “Generic” and “Country Code.”

gTLDs like .com, .net, and .org, are available globally, while ccTLDs like .eg (Egypt) and .za (South Africa) are administered nationally.

Root Name Servers

Second level of the domain name
identifies the the specific and unique administrative owner that registered the domain name in this case “Afrinic”.

The Top Level Domain (TLD)
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Root Name Servers

Third level of the domain name
is used to refer to different servers, such as www or mail.

Second level of the domain name
identifies the the specific and unique administrative owner that registered the domain name in this case "Afrinic".

The Top Level Domain (TLD)
The most common types of TLDs are "Generic" and "Country Code."
gTLDs like .com, .net, and .org, are available globally, while ccTLDs like .eg (Egypt) and .za (South Africa) are administered nationally.

Root Name Servers

196.216.2.136
2001:42d0:0:410::136
www.afrinic.net
Web-server

Root Name Servers

196.216.2.136
2001:42d0:0:410::136
www.afrinic.net
Web-server

ISP's Recursive
Resolver DNS Server

Domain Name lookup
to resolve www.afrinic.net

Root Name Servers

The Nearest
Root Nameserver

196.216.2.136
2001:42d0:0:410::136
www.afrinic.net
Web-server

DNS lookup
www.afrinic.net

Reply with the IP address
of **.NET** nameserver

ISP's Recursive
Resolver DNS Server

Root Name Servers

The Nearest
Root Nameserver

196.216.2.136
2001:42d0:0:410::136
www.afrinic.net
Web-server

ISP's Recursive
Resolver DNS Server

DNS lookup
www.afrinic.net

Reply with the IP address
of **afrinic.net** nameserver

VeriSign's
.NET Nameserver

Root Name Servers

The Nearest
Root Nameserver

196.216.2.136
2001:42d0:0:410::136
www.afrinic.net
Web-server

AFRINIC's
Afrinic.net Nameserver

ISP's Recursive
Resolver DNS Server

DNS lookup
www.afrinic.net

Reply with the IP address
of **www.afrinic.net** Web-server

VeriSign's
.NET Nameserver

Root Name Servers

The Nearest
Root Nameserver

196.216.2.136
2001:42d0:0:410::136
www.afrinic.net
Web-server

ISP's Recursive
Resolver DNS Server

AFRINIC's
Afrinic.net Nameserver

Reply with the IP address
of **www.afrinic.net** Web-server

VeriSign's
.NET Nameserver

Root Name Servers

The Nearest
Root Nameserver

196.216.2.136
2001:42d0:0:410::136
www.afrinic.net
Web-server

ISP's Recursive
Resolver DNS Server

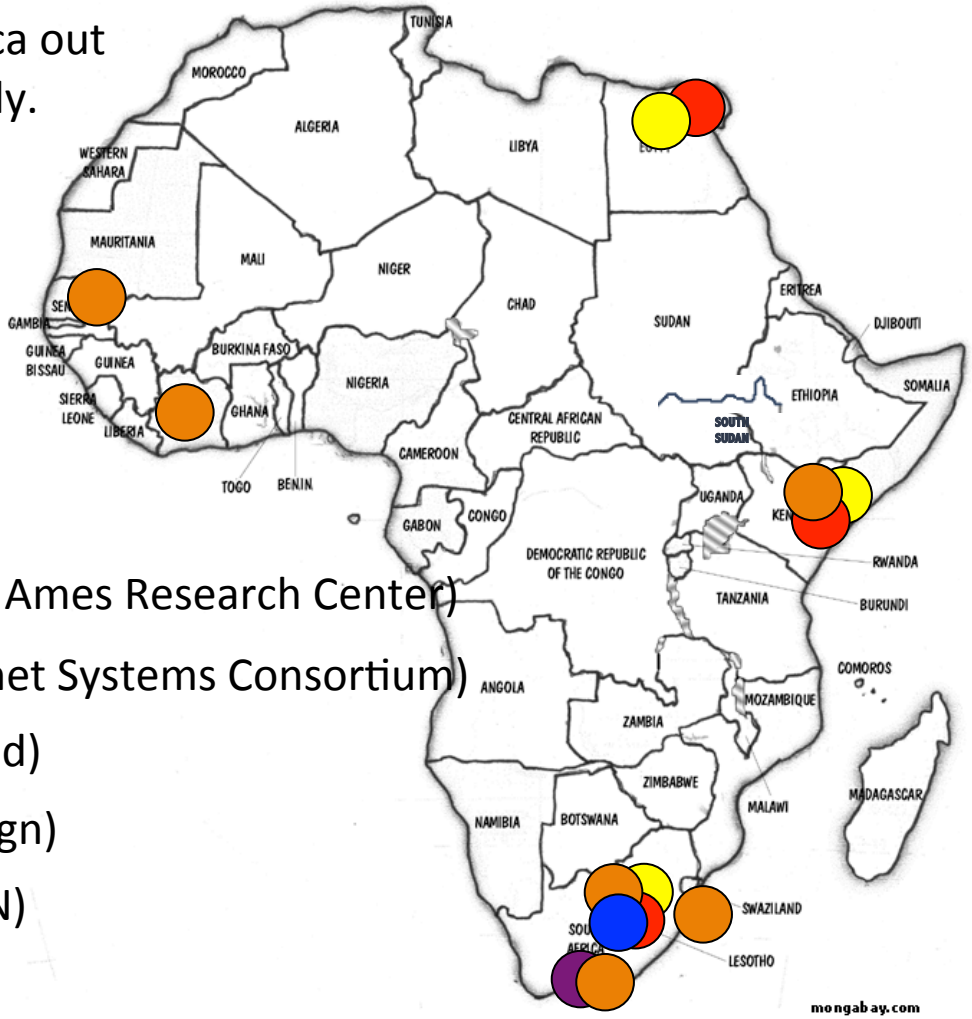
HTTP or HTTPS

AFRINIC's
Afrinic.net Nameserver

VeriSign's
.NET Nameserver

Root Name Servers

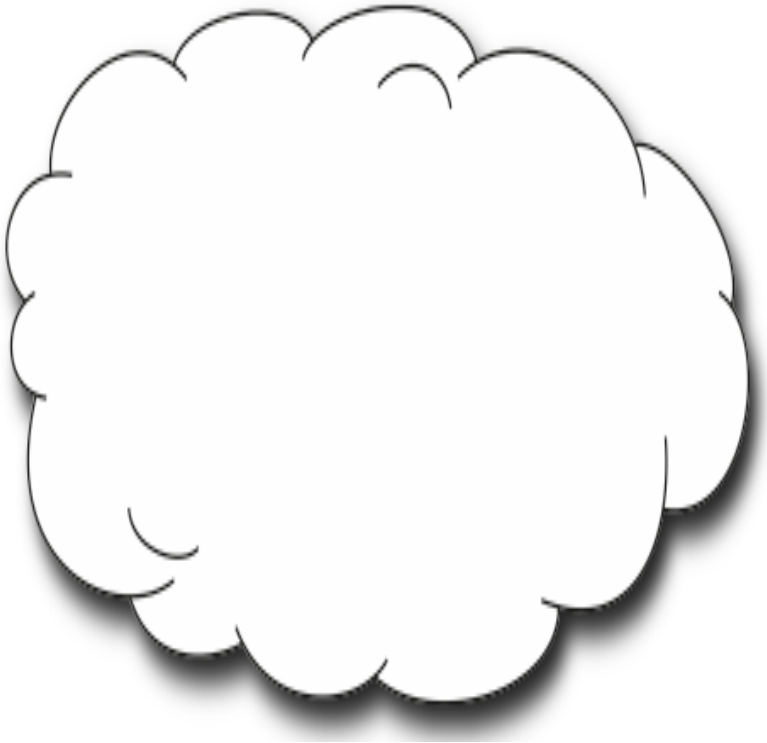
There are only 14 Root Name Servers in Africa out of 350 Servers globally.



- E (NASA Ames Research Center)
- F (Internet Systems Consortium)
- I (Netnod)
- J (VeriSign)
- L (ICANN)

Internet exchange Points (IXPs)

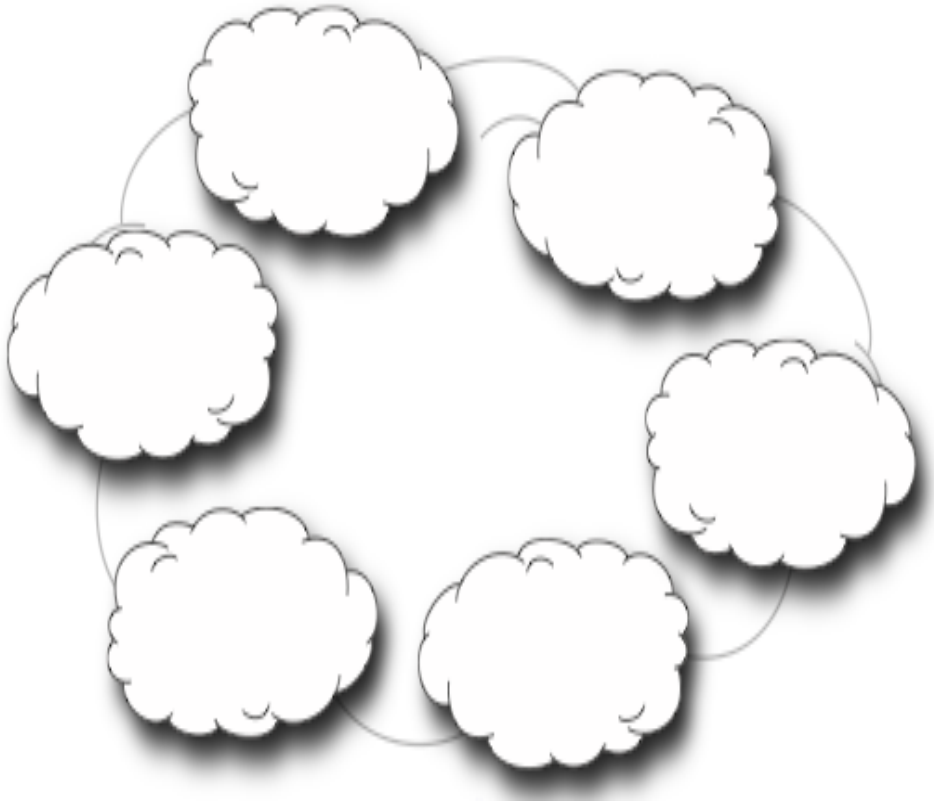
The Internet



The reality is

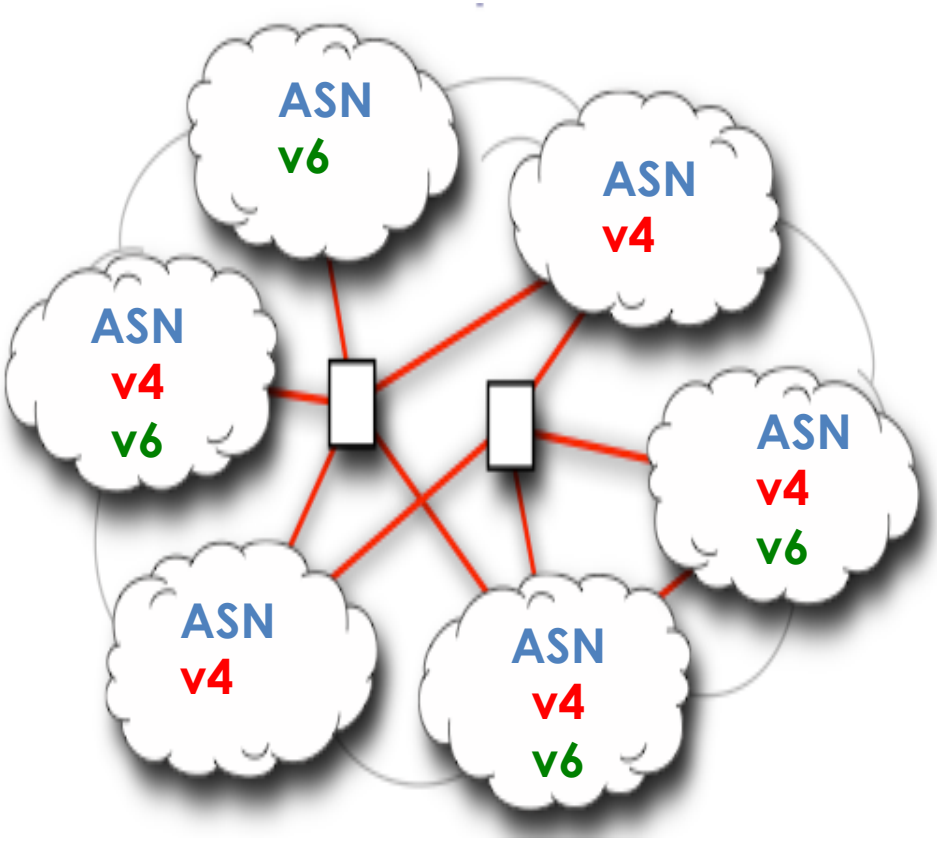
"THERE IS NO ONE BIG INTERNET"

The Internet



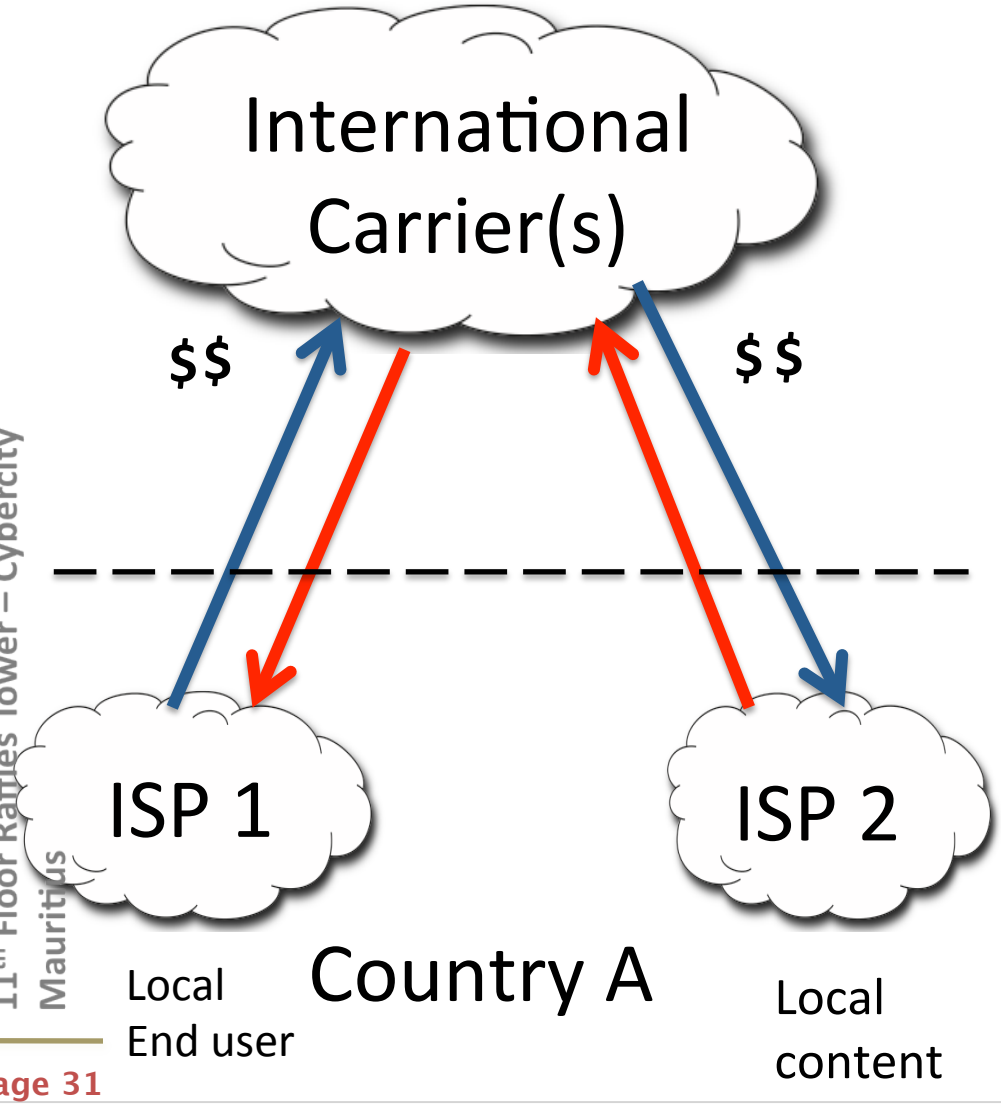
It is **a network of networks** that consists of millions of private, public, academic, business, and government networks, of local to global scope.

The Internet



Internet Number Resources are the numbers used to identify devices and networks on the Internet.

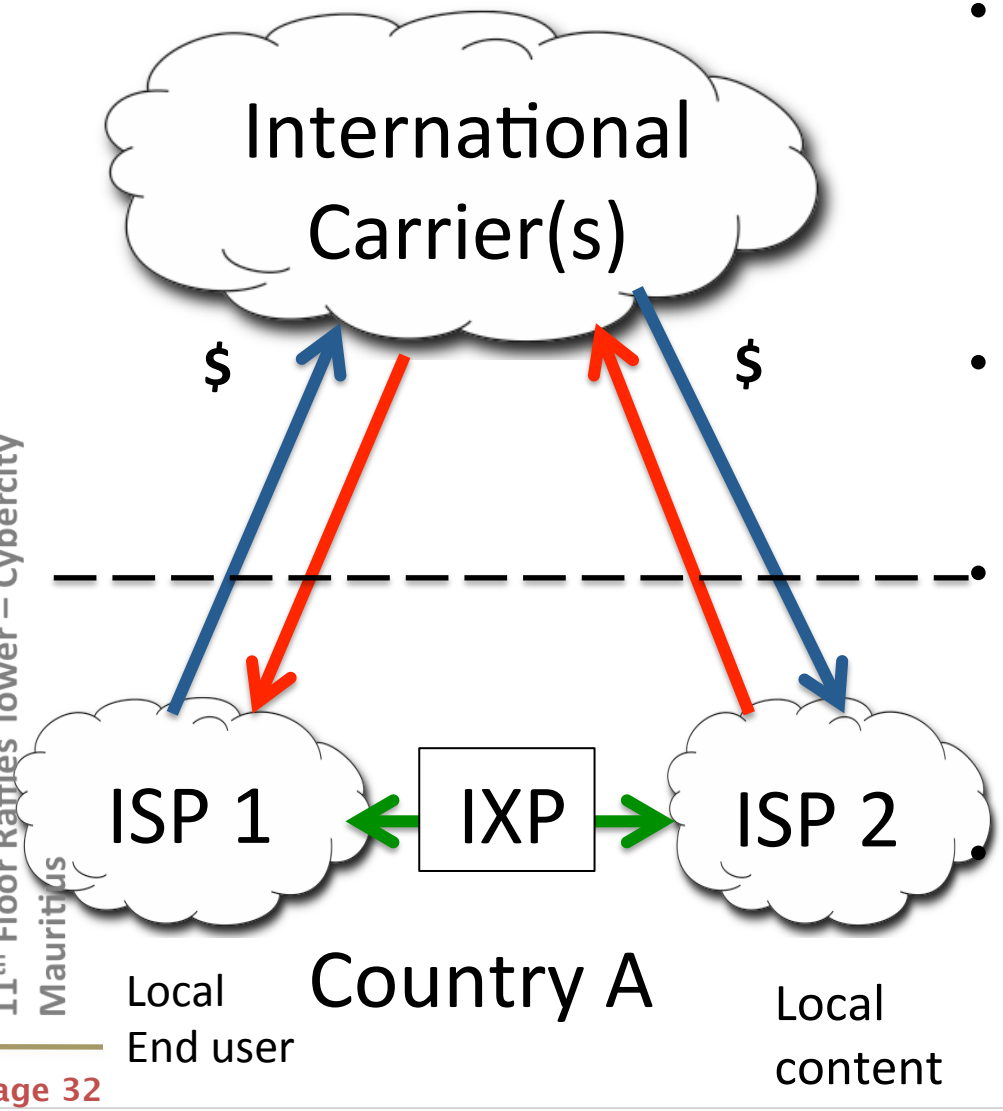
Internet exchange Points (IXPs)



No Internet exchange point (IXP) in a country = local ISPs traffic use International connections to retrieve the local content.

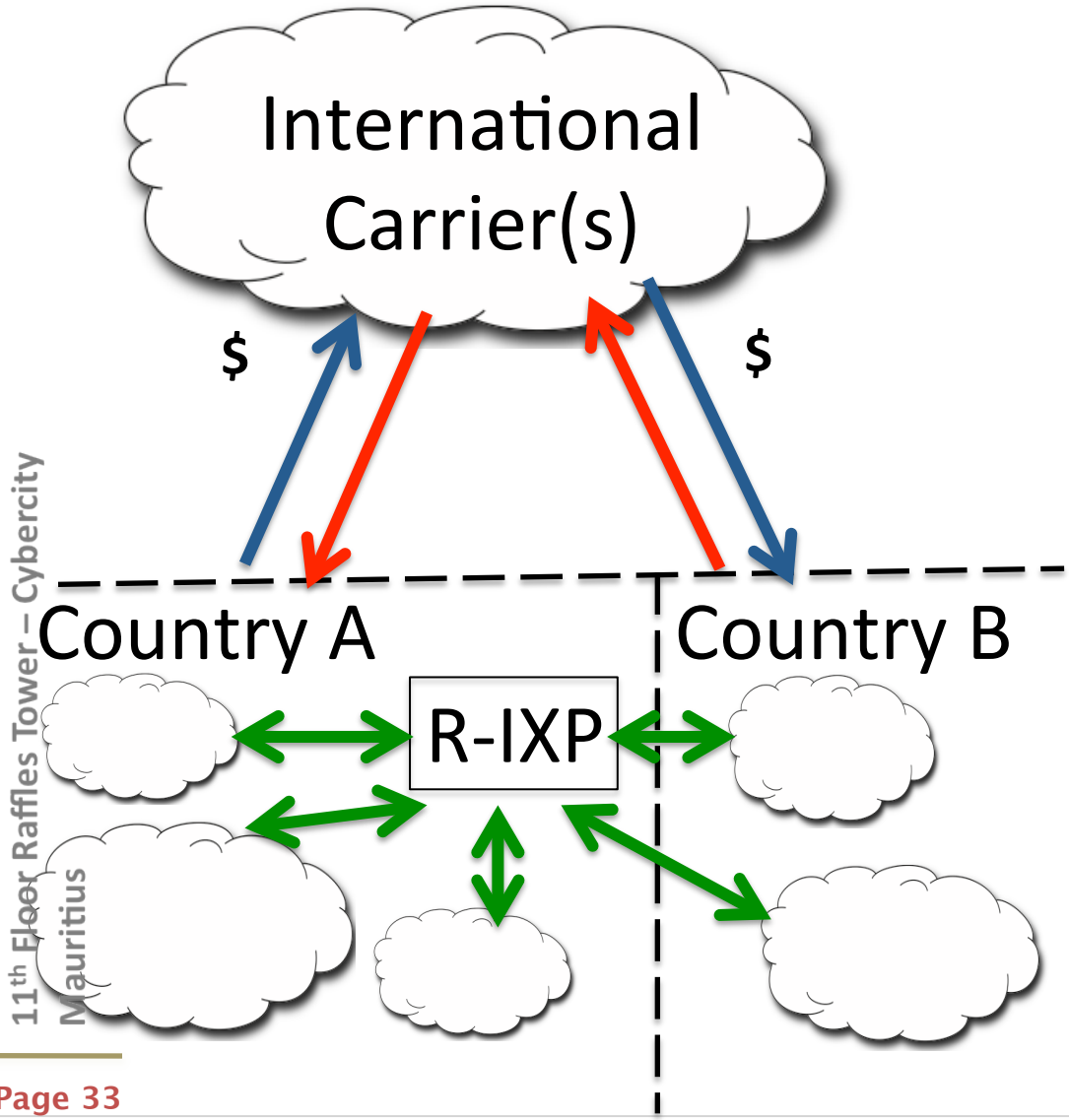
Above = unnecessary costs, latency and worse overall user experience.

Internet exchange Points (IXPs)



- Local IXP country = local ISPs connect directly together = exchange domestic traffic, typically with settlement-free peering
- above = reduced costs on international transit = reduced latency
- Domestic websites hosted abroad may 'come home' in order to reduce foreign hosting and transit charges.
- IXPs also help build ccTLDs and e-gov.

Internet exchange Points (IXPs)

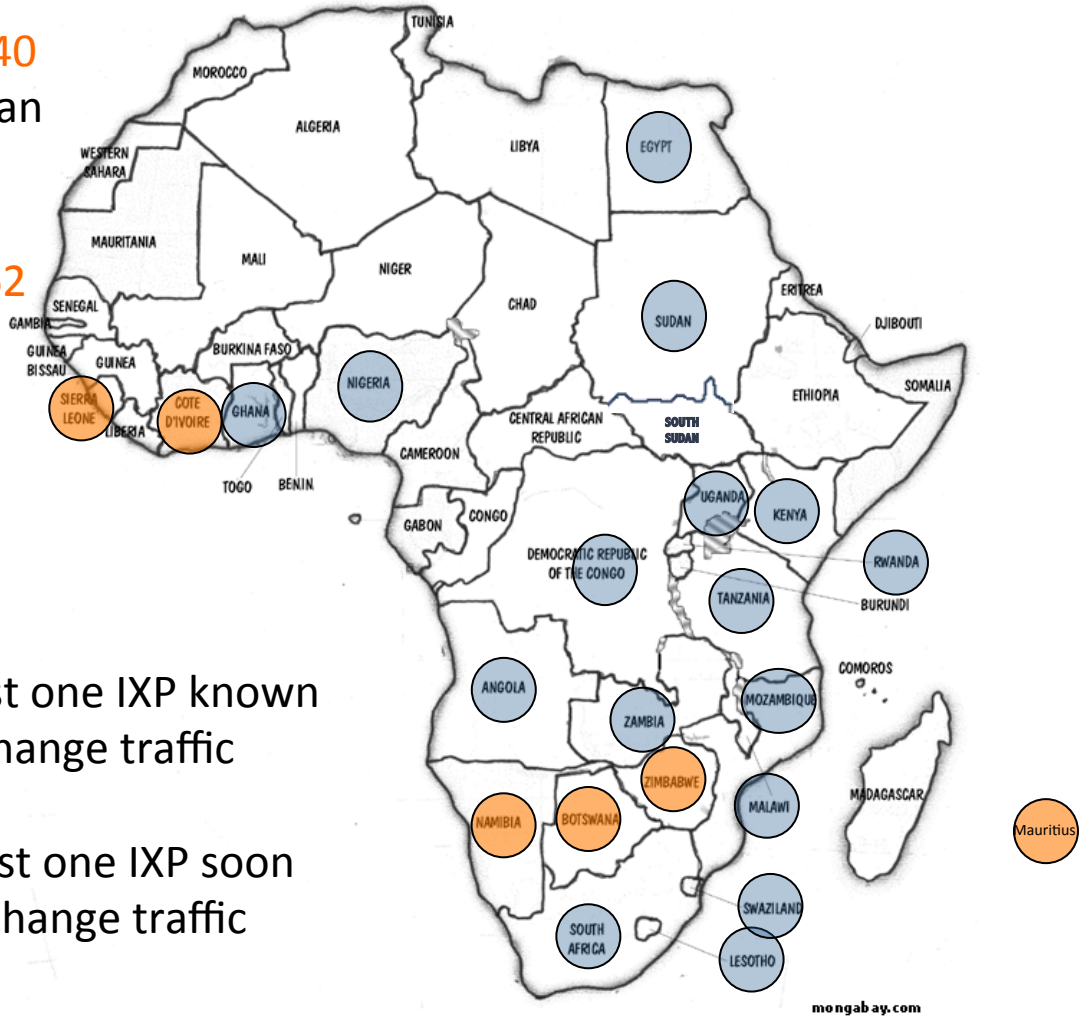


When the IXP begins to build critical mass, it will also begins to attract content providers, along with business, academic, and government users. Thereby it becomes the center of a vibrant Internet ecosystem in the country or region.

The IXP can begin to attract international content and connectivity providers, becoming a regional hub for Internet traffic.

Internet exchange Points (IXPs)

African Group 25
Asia-Pacific Group 64
Eastern European Group 40
Latin American & Caribbean Group (GRULAC) 38
Western European and Others Group (WEOG) 262



At least one IXP known to exchange traffic

At least one IXP soon to exchange traffic

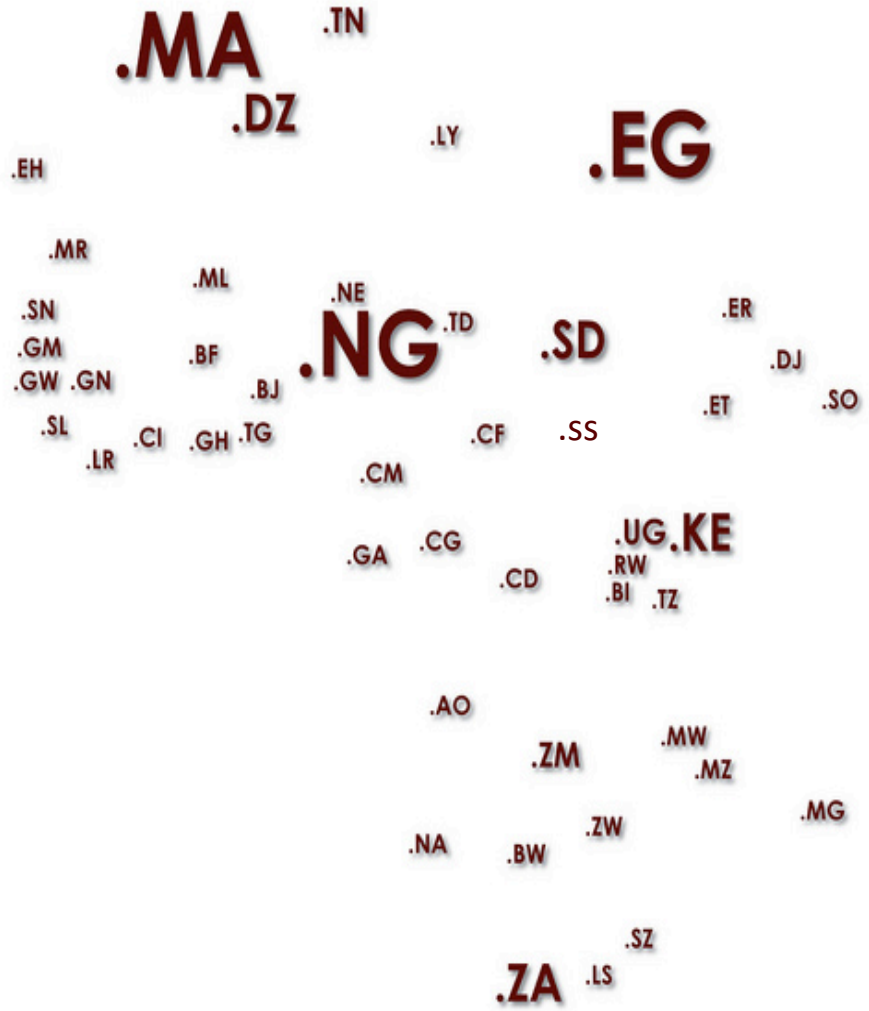
Top Level Domains & Content

Top Level Domains & 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.

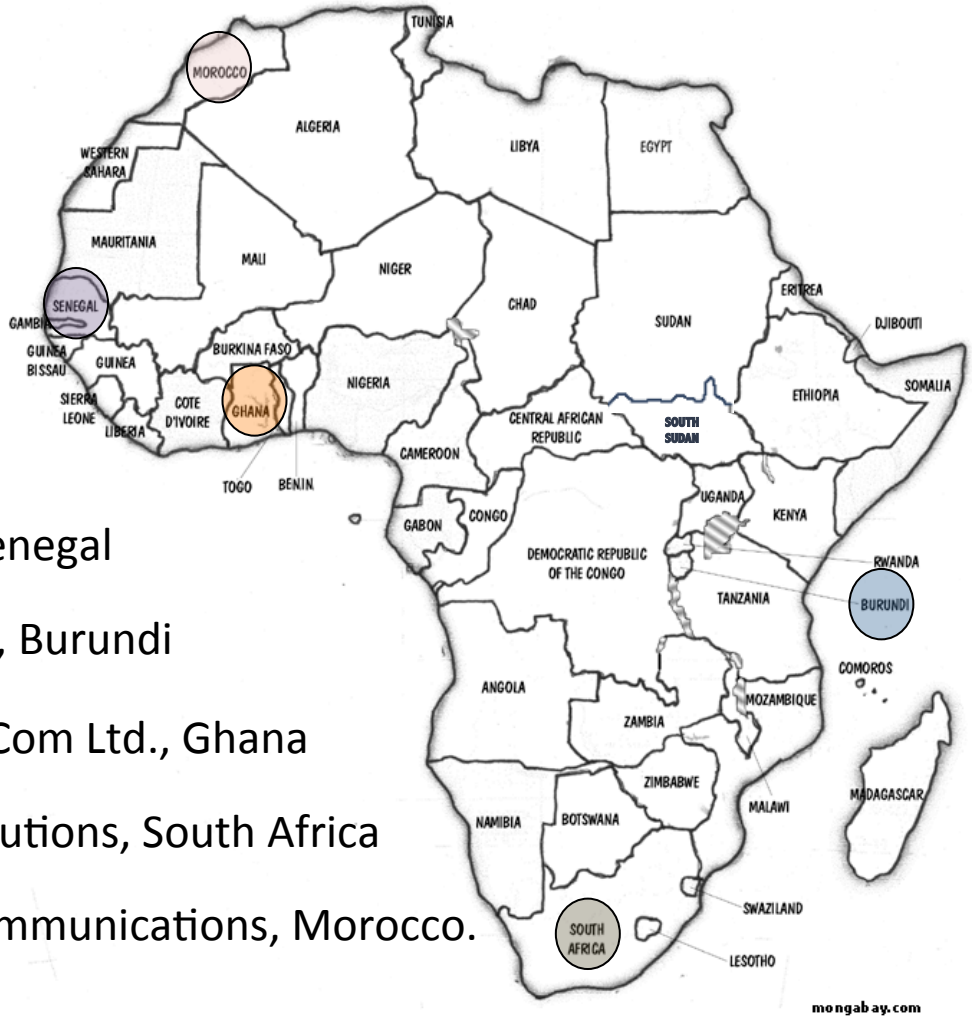
- ccTLD registries are necessary for projects such as e-Government, e-citizenship, e-education, e-health.

- No generic TLD registry at moment in region



Top Level Domains & Content

There are only 5 ICANN Accredited registrars in Africa out almost 1,000 ICANN Accredited registrars globally.



- Kheweul, Senegal
- AfriRegister, Burundi
- Ghana Dot Com Ltd., Ghana
- Internet Solutions, South Africa
- Genious Communications, Morocco.

Critical Internet Infrastructure & Resources

Countries must have Root Name Servers instances, country-code Top-Level Domain (ccTLD) Name redundant Servers, and Internet exchange points (IXPs) within their borders in order to maintain autonomy and internal connectivity during periods when international cables are damaged.

Thank you

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References

http://www.nro.net/

http://www.afrinic.net/

http://www.he.net/

https://www.peeringdb.com/

https://prefix.pch.net/applications/ixpdir/summary/

http://root-servers.org/

http://www.icann.org/registrar-reports/accredited-list.html