

March 2019



# Developing Peering and interconnection through Partnerships in Africa

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GAIA

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IETF 104 – Prague (Remote)

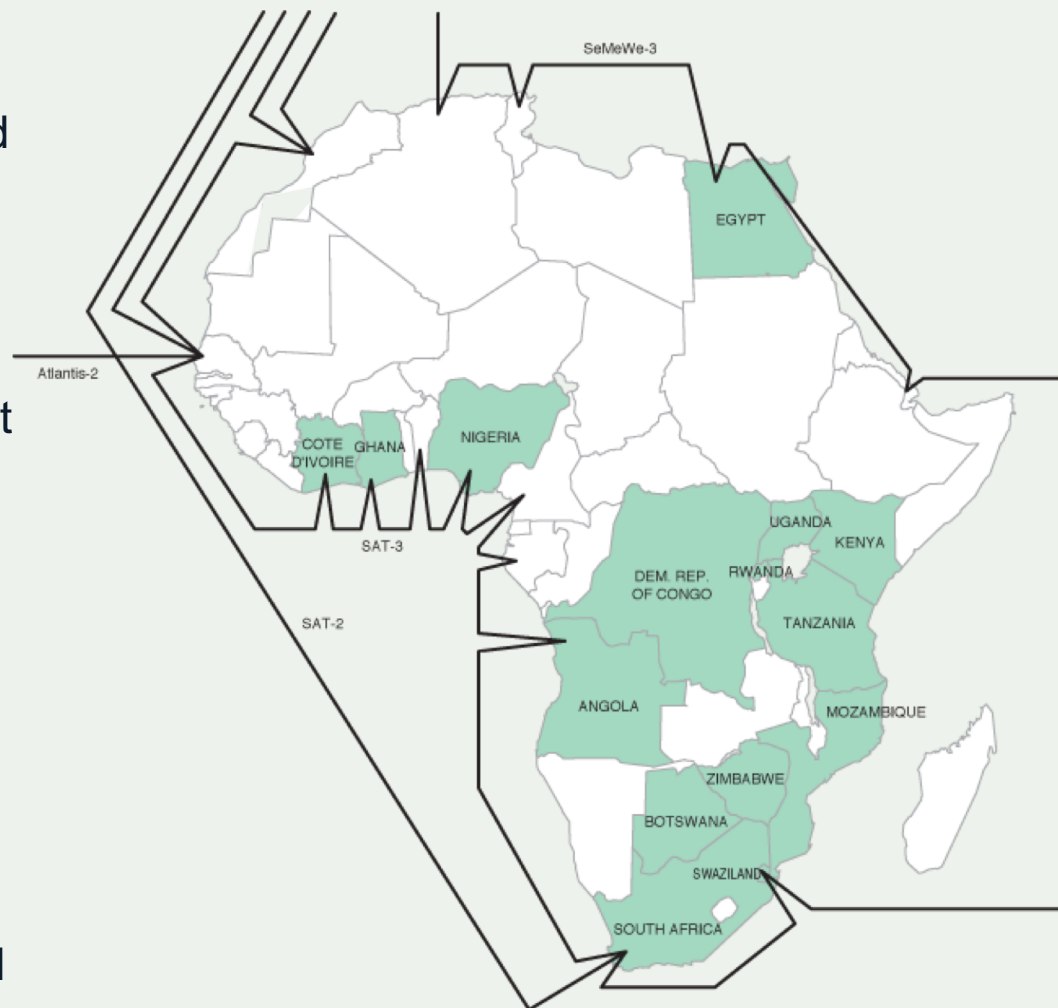
# Background on Africa Peering and Interconnection Landscape:



## 2008 Survey on Status of IXPs in Africa

- 17 IXPs in 15 African Countries
- 12 were considered responsive based on a survey conducted in 2008
- Average number of years across all IXPs was 4.1yrs
- 10 of 12 IXPs provided traffic stats
  - Highest had 200Mbps and lowest was 300Kbps
- 1/3 of the IXPs had an open membership policy. Remaining 2/3's were subject to regulatory or membership set criteria
- 75% of the respondents had a Mandatory Multilateral peering policy
- Copper and wireless connectivity was predominant over fiber
- 41% of the IXPs did not charge fees and the highest fees were \$9,000 and lowest was \$50
- 75% were ran by ISPA. Others by NREN, Govt. and by a not-for-profit (non-ISPA)

2000 – 2005: SEA-ME-WE-3 Total Capacity 480Gbps



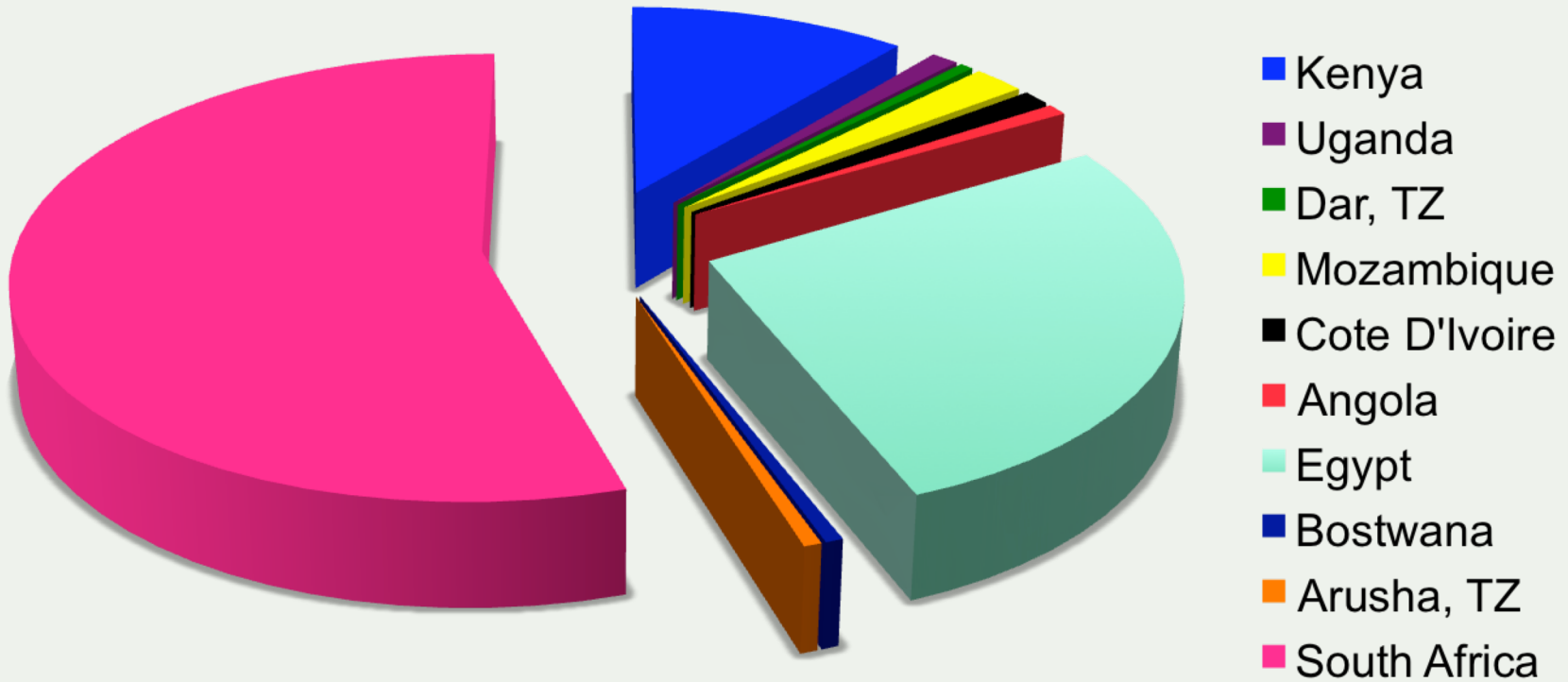
1993 – 2001: SAT2 Total Capacity 560Mbps

2001 – 2008: SAT3 Total Capacity 340Gbps

2001 - 2008: SAFE Total Capacity 440Gbps

# 2008: Traffic distribution across 10 African IXPs

Total 364.5 Mbps



## Gaps identified

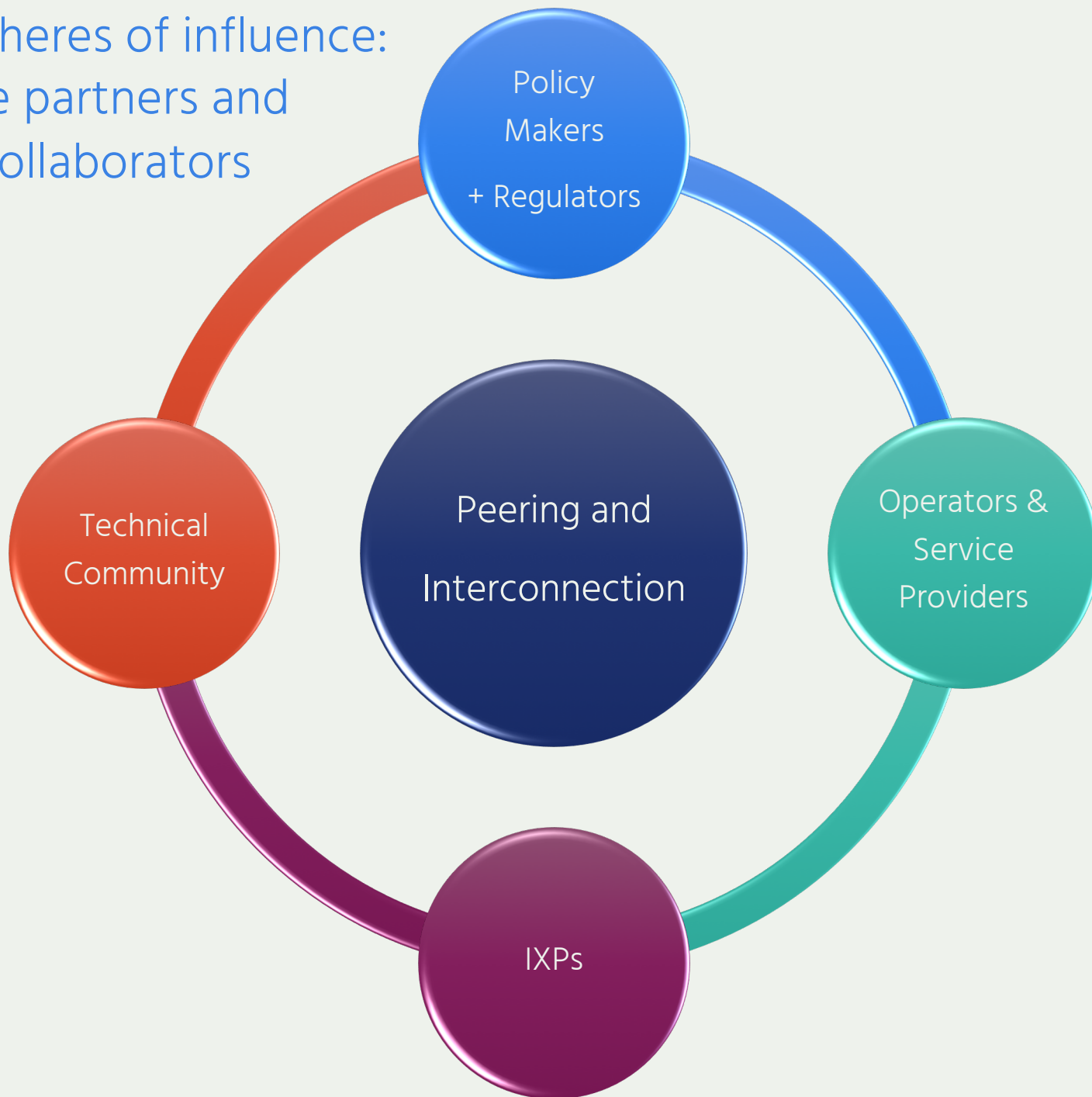
- There was a lack of general knowledge on IXP best practices to enable them grow
- There was no platform for sharing experiences or learning amongst the IXPs and operators
- Cross-border interconnection between networks was almost non-existent
- 30% of the known IXPs were unresponsive for unknown reasons
- Central, North and West Africa were lagging behind in IXP deployment
- Africa has a large “Internet Transit Deficit” in comparison to other regions.



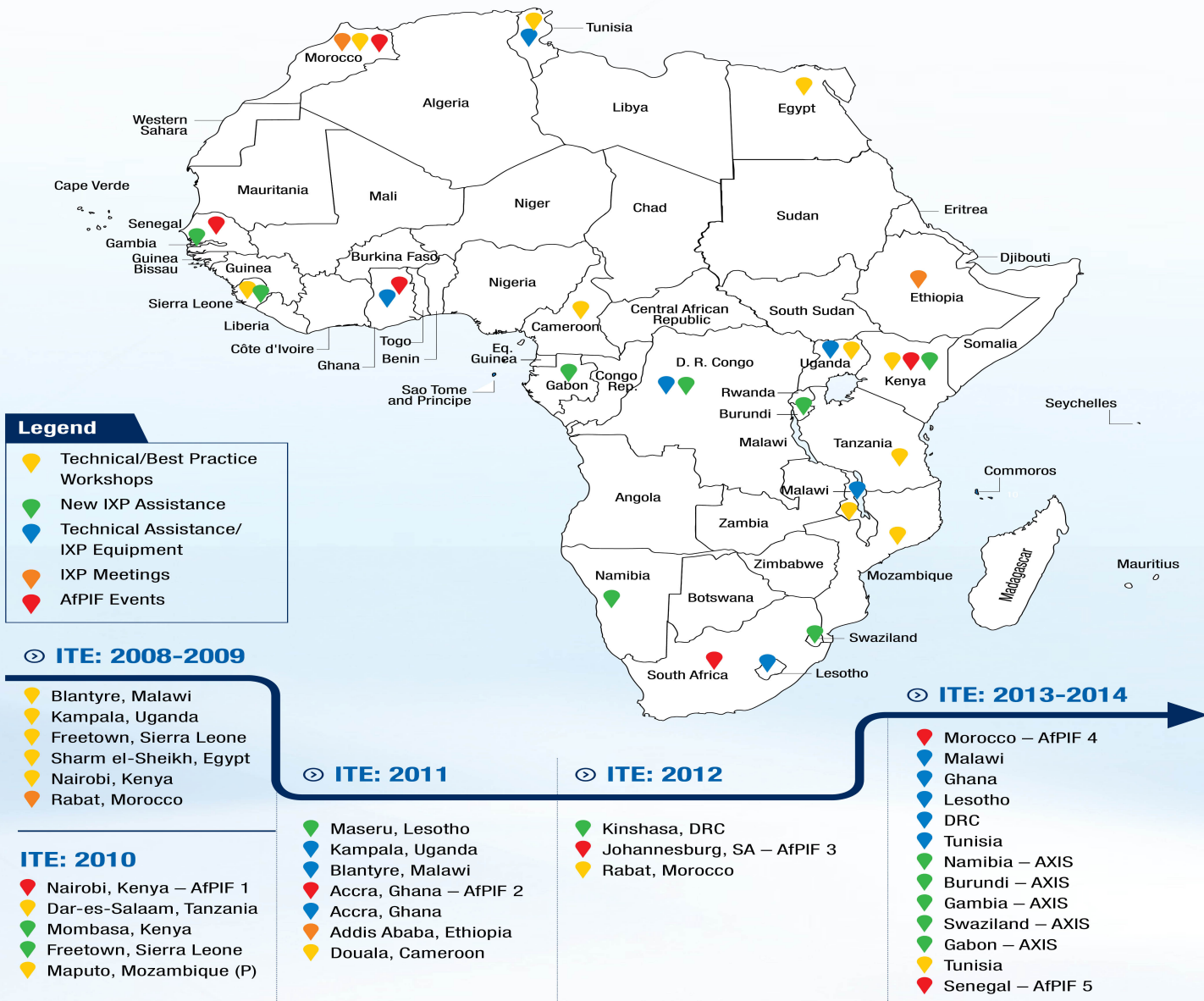
# The work



# The spheres of influence: The partners and collaborators



## Map showing ISOC ITE work from 2008 - 2014 (Excluding AXIS Capacity Building Workshops)





## The activities and partners

- Conducted over 22 workshops in 22 African countries on Technical and policy issues related to IXP development (excluding AXIS) – Technical Community partners
- Workshops trained over 500 engineers and policy makers – Technical Community Partners
- Established and organized 9 AfPIF events – Over 50 organizations have supported AfPIF events since 2010 - see [www.afpif.org](http://www.afpif.org)
- Supported the activities of the Africa IXP Association (Af-IX) – AfNOG, AfriNIC, etc
- Provided technical assistance and equipment support to more than 20 IXPs – in partnership with Cisco, Google, Facebook, among others
- Created awareness with key policy stakeholders i.e UNECA, African Union, Regional Regulatory Associations, Regional Economic Communities (RECs) amongst others
- Commissioned studies on IXP growth and development in Partnership with TESPOK, IXPN, RICTA, Akamai, etc
- The development of measurement tools that enable ongoing assessment of the peering and interconnection evolution in Africa – ARDA in collaboration with PCH, UC3M, IMDEA, AfriNIC, Af-IX, INX-ZA, Route-views, etc
- Overall growth of the African peering ecosystem i.e datacenter development, policy review, etc



- Implementation of the AXIS project in partnership with the African Union Commission

# African Union AXIS Project



## Summary of AXIS Project:

- ❑ From 2012 - 2018
- ❑ New partnership with the African Union
- ❑ Trained over 1500 people in 28 Countries
- ❑ Creation of at least 10 New IXPs
- ❑ Support of 8 IXPs to grow into Regional IXPs
- ❑ Increased awareness on the value of IXPs
- ❑ Policy work on cross-border interconnection

Source: <https://au.int/en/axis>

# Example: AfPIF partnership and collaboration

The African Peering and Interconnection Forum



Forum africain sur le peering et l'interconnexion

Venue: The Westin, Cape Town, South Africa | Date: 21<sup>st</sup> – 23<sup>rd</sup> August, 2018

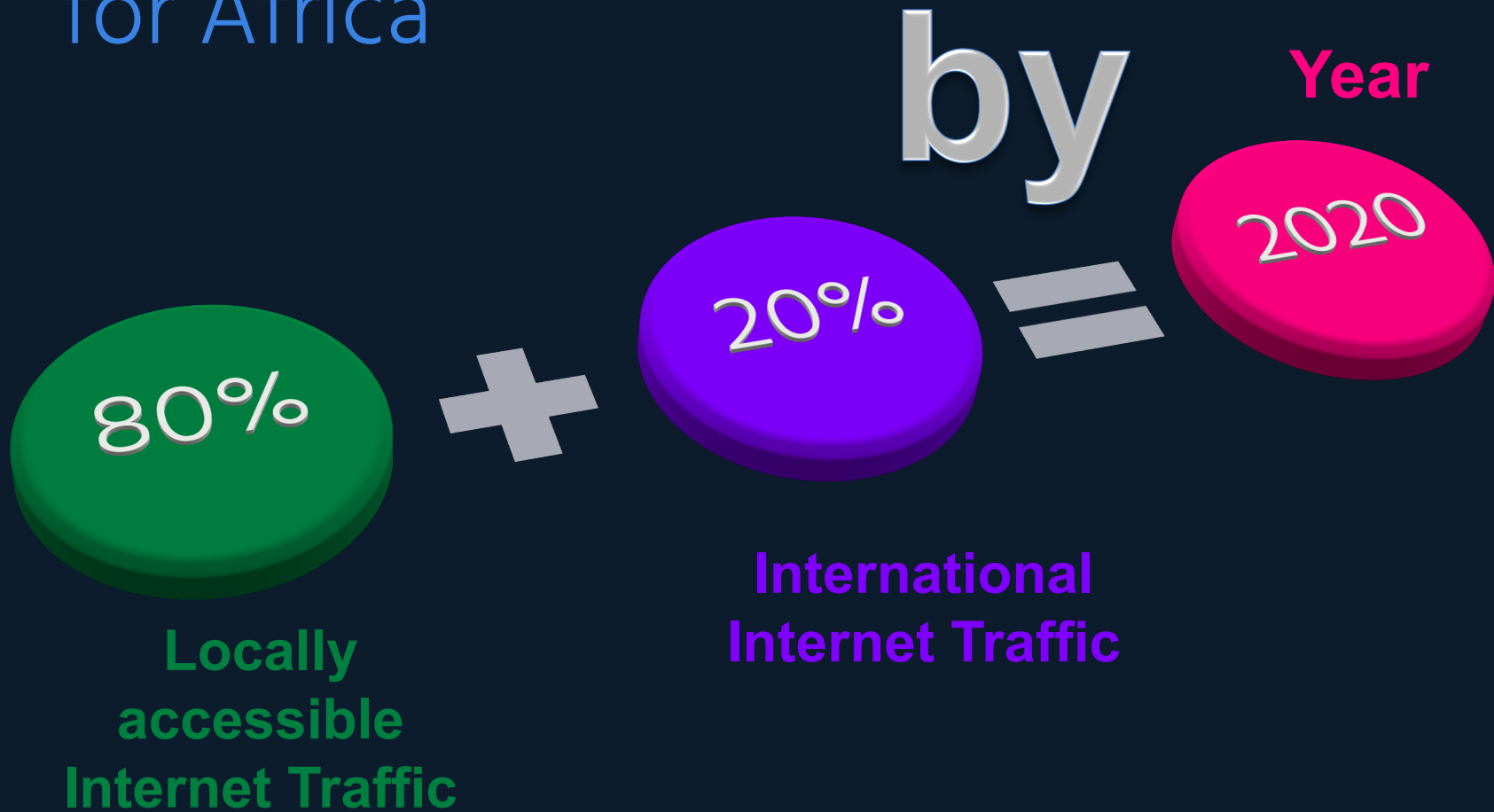
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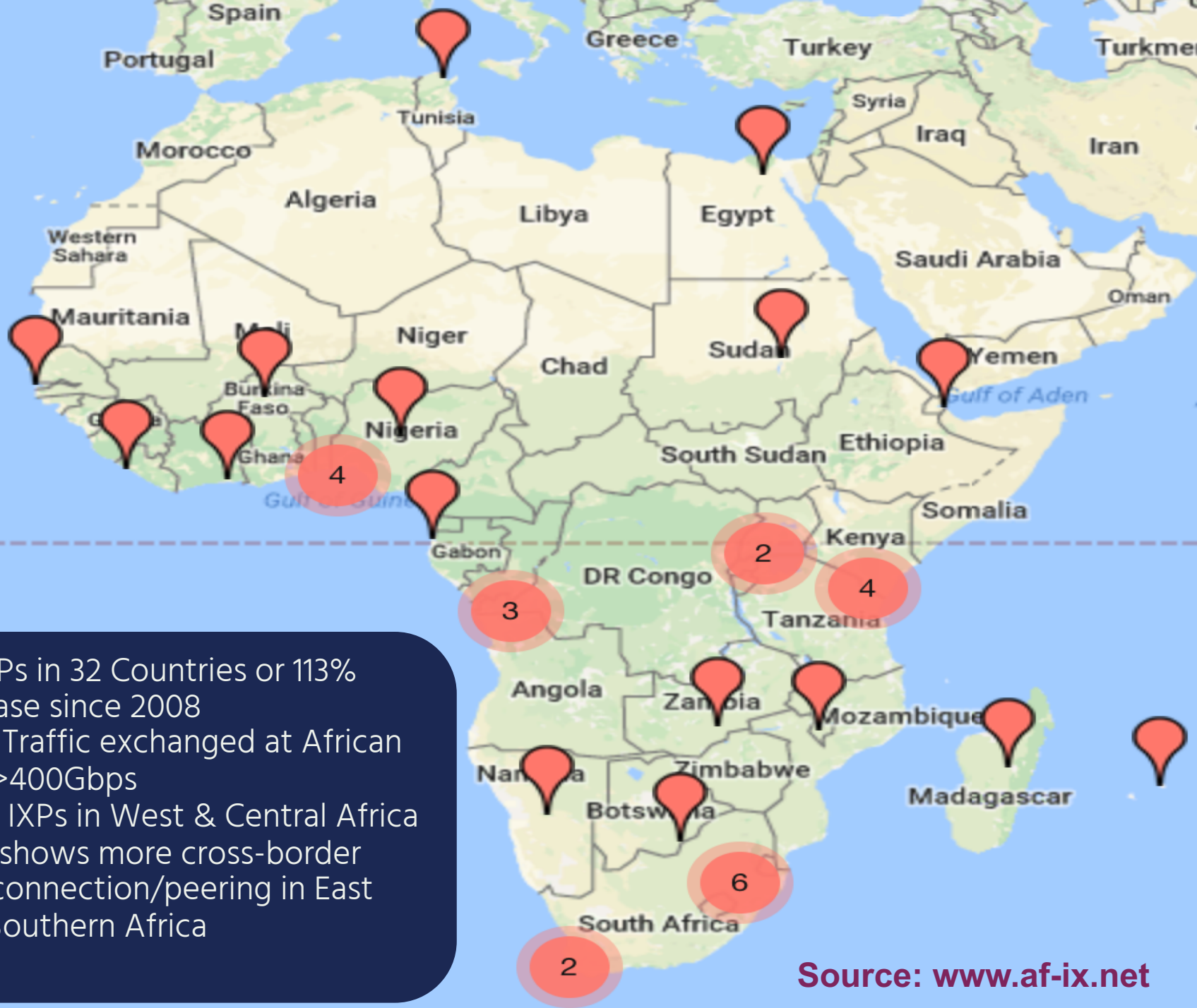


# The Outcome



# An accepted Interconnection Vision for Africa





- 44 IXPs in 32 Countries or 113% increase since 2008
- Total Traffic exchanged at African IXPs >400Gbps
- More IXPs in West & Central Africa
- Data shows more cross-border interconnection/peering in East and Southern Africa

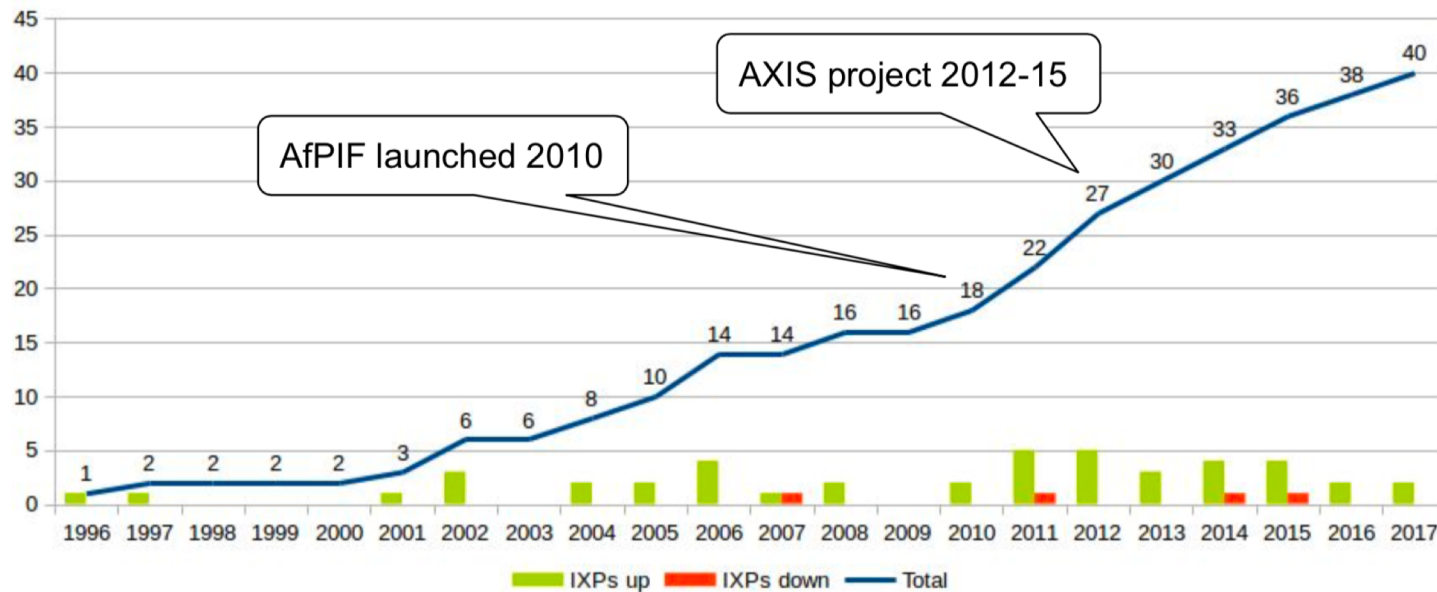
Source: [www.af-ix.net](http://www.af-ix.net)

# Growth in Africa



**African IXPs: Total Number of Active IXPs by Year**

Source: African IXP Association (2017)



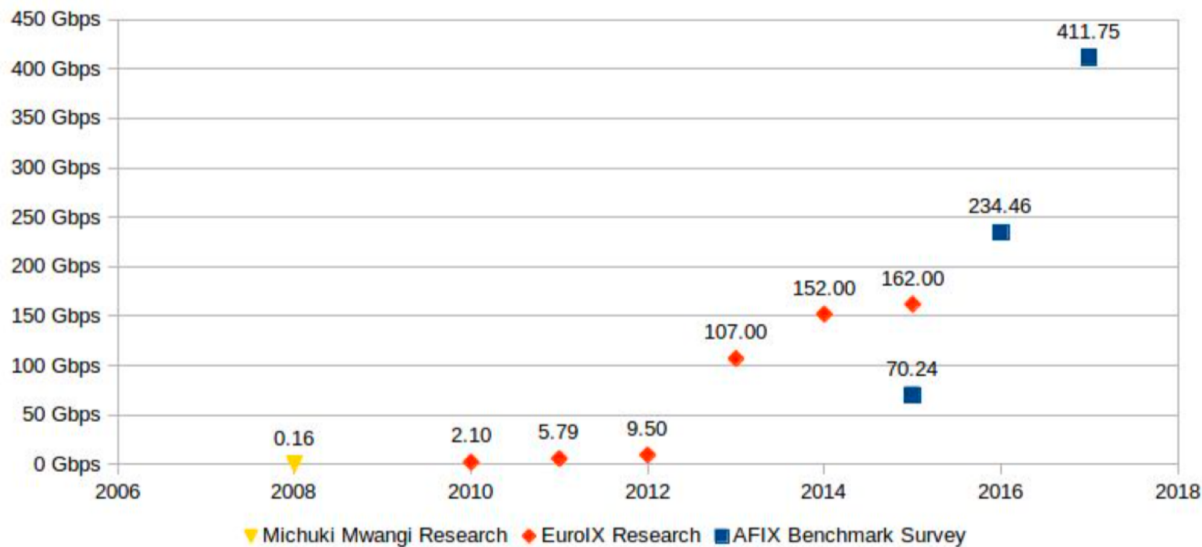
Source: [www.af-ix.net](http://www.af-ix.net)

# Traffic



## African IXPs: Aggregate Regional Peak Traffic

Source: African IXP Association (2017)



- No traffic data-sets are fully comprehensive
- Not all IXPs have and/or publish traffic statistics
- Inconsistent accounting of peak traffic statistics (e.g. monthly vs. daily)
- Some IXPs carry significant transit traffic

Source: [www.af-ix.net](http://www.af-ix.net)

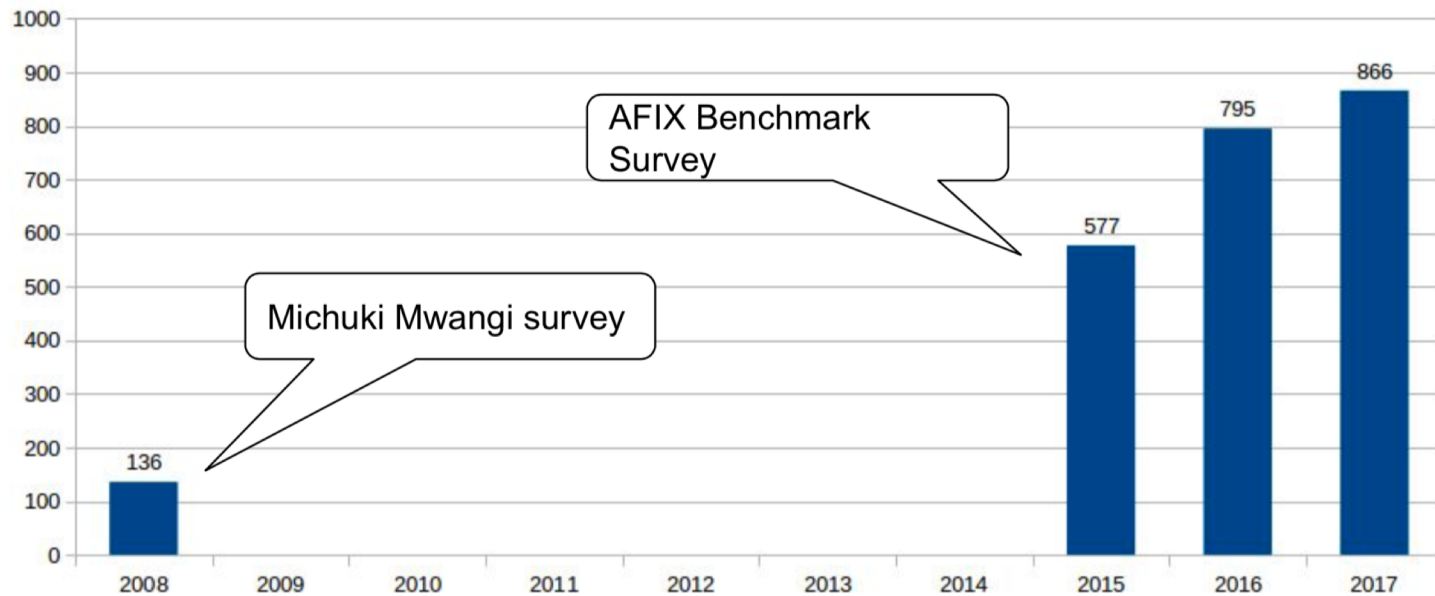


# Connected Networks



**African IXPs: Total Number of Networks Connected**

Source: African IXP Association (2017)

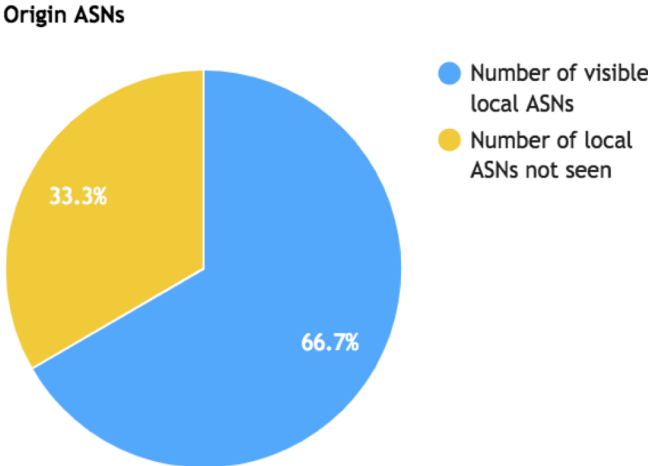


Source: [www.af-ix.net](http://www.af-ix.net)

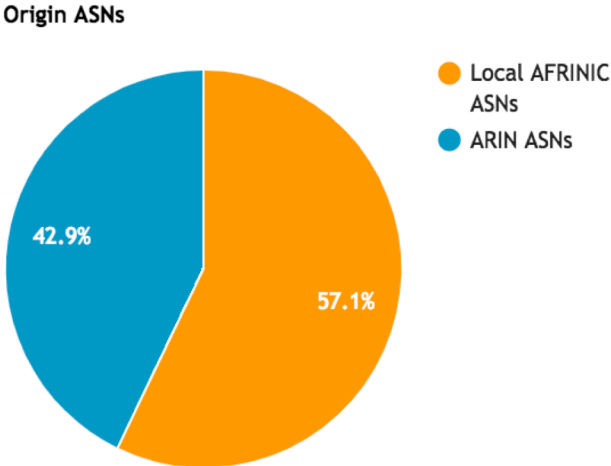
# Local Peering: Percentage of ASNs (origin ASNs) by country assignment

LIXP (LR)

Percentage of ASNs allocated to LR visible or not at LIXP  
As Origin ASNs over the last month



Percentage of ASNs assigned by each RIR visible at LIXP  
As Origin ASNs over the last month



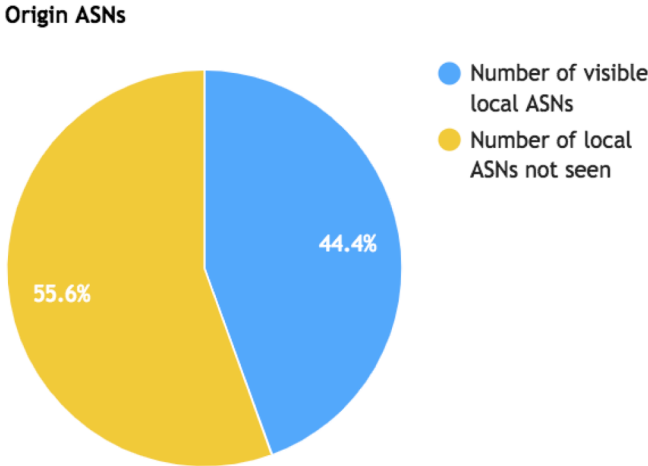
Percentage of ASNs assigned to each country by its corresponding RIR  
Visible at LIXP as Origin ASNs over the last month

Source: <http://arda.af-ix.net>

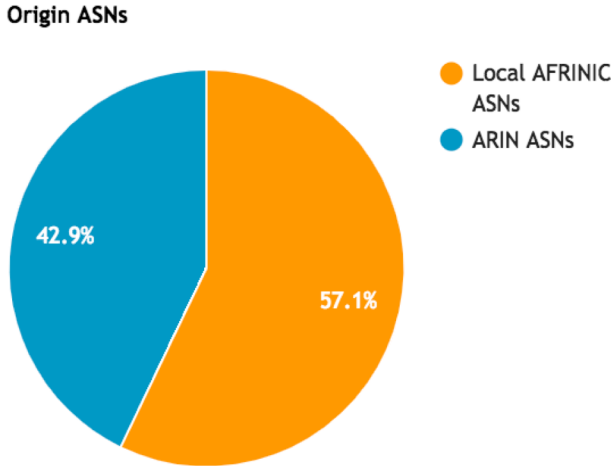
# Local Peering: Percentage of ASNs (origin ASNs) by country assignment

BeninIX (BJ)

Percentage of ASNs allocated to BJ visible or not at BeninIX As Origin ASNs over the last month



Percentage of ASNs assigned by each RIR visible at BeninIX As Origin ASNs over the last month



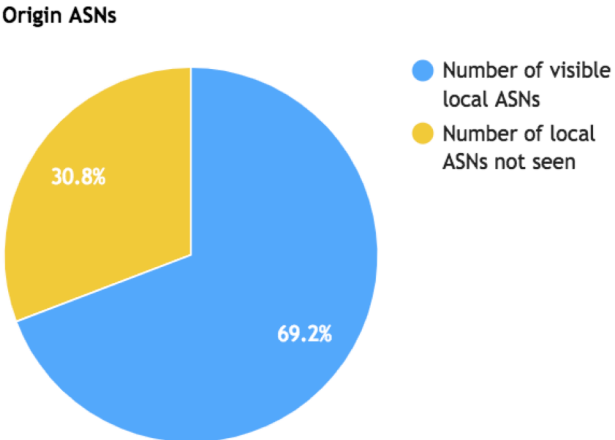
Percentage of ASNs assigned to each country by its corresponding RIR Visible at BeninIX as Origin ASNs over the last month

Source: <http://arda.af-ix.net>

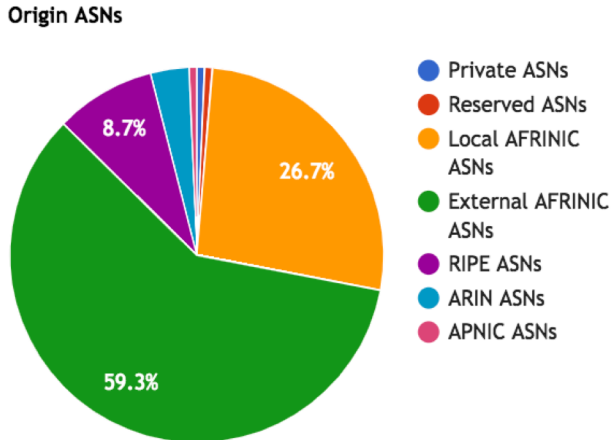
# Cross-Border: Percentage of ASNs (origin ASNs) by country assignment

TIX (TZ)

Percentage of ASNs allocated to TZ visible or not at TIX As Origin ASNs over the last month



Percentage of ASNs assigned by each RIR visible at TIX As Origin ASNs over the last month



Percentage of ASNs assigned to each country by its corresponding RIR Visible at TIX as Origin ASNs over the last month

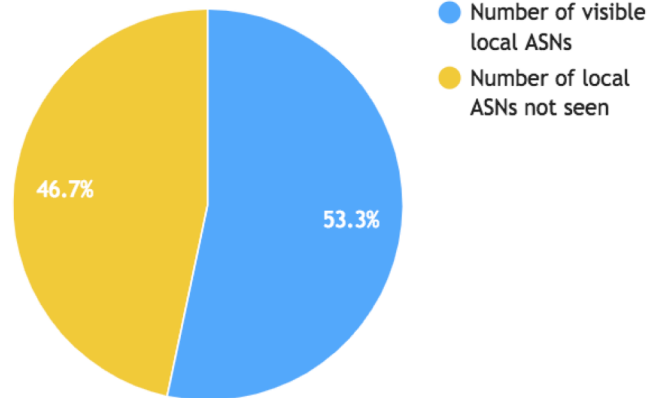
Source: <http://arda.af-ix.net>

# Cross-Border: Percentage of ASNs (origin ASNs) by country assignment

NIXP (NG)

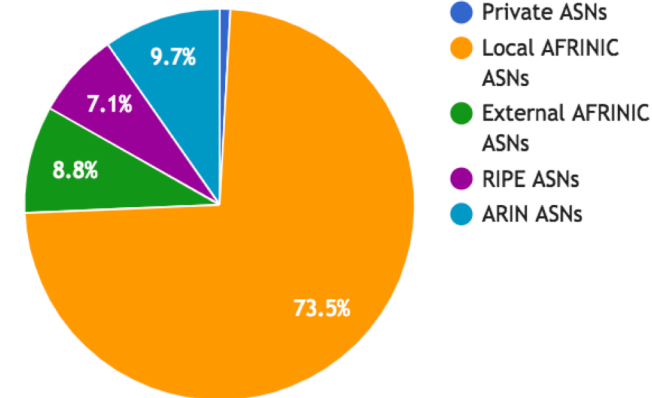
Percentage of ASNs allocated to NG visible or not at NIXP  
As Origin ASNs over the last month

Origin ASNs



Percentage of ASNs assigned by each RIR visible at NIXP  
As Origin ASNs over the last month

Origin ASNs



Percentage of ASNs assigned to each country by its corresponding RIR  
Visible at NIXP as Origin ASNs over the last month

Source: <https://arda.af-ix.net>

# IXP Development Challenges



# 1. Local & Cross-border Infrastructure

- **Terrestrial Infrastructure**

- Lack of competition on terrestrial fiber infrastructure
- High pricing on terrestrial fiber
- Limited services on terrestrial fiber i.e no dark fiber, managed (layer 2) fiber services, less than 1GE services available, etc from licensed operators
- Slow roll out of terrestrial fiber due to social political barriers

- **Carrier Neutral Data Centres**

- Lack of carrier neutral data centers
- Availability of carrier owned data centers
- Lack of full spectrum of data center services where facilities are present

- **Cross-border Interconnection**

- Limited options for cross-border interconnection
- Higher pricing for cross-border point-2-point capacity resulting in preference for transit/tromboning for inter-country traffic
- Unfavorable policy and regulation on cross-border interconnection

## 2. Managing Stakeholder Interests

- **Government involvement in the IXP development process leads to some new challenges**
  - Leadership ambiguity where the operators expect the government to drive the process and vice versa
  - There are other similar initiatives i.e World Bank sponsored infrastructure projects that include IXP development and are lead by the government
  - The presence of funds inadvertently leads to interests in “gold plating” the IXP



## 3. IXP Operational Issues

- **Volunteerism vs. Paid Staff**

- Getting committed individuals to volunteer their time to the IXP is not easy and faces long term sustainability concerns
- Hiring FTE or Part-time staff requires the IXP to have a revenue stream – difficult to achieve during the startup phase

- **Business Sustainability**

- It is difficult to convince IXP members to pay for peering services at the initial phase

- **Good Governance obligations**

- Compliance with constitutional obligations such as quarterly and annual meetings
- Compliance with statutory laws i.e taxation and audits
- Consistency in membership engagement and communications

## 4. CDN Cache Deployment

- **CDN Cache location**

- Lengthy discussions on location of the CDN cache between IXP members i.e hosting at IXP or at ISP network
- Hosting at IXP affects introduces new challenges to existing hardware resulting in need for equipment upgrade
- Hosting at ISP network raises concerns of entrenching dominance of the large or incumbent operators

- **Cache Transit**

- There is no ideal model for sharing the cost of the cache transit capacity

- **Not all benefit**

- Due to cost share model, not all ISPs at the IXP are able to benefit from the local CDN cache
- Routing issues and peering relationships lead to ISPs getting the CDN caches over transit links as opposed to peering link

## 5. Measurement & Information

- There is no perceived interest or benefit in collecting and sharing of data for measurement purposes
- It remains difficult to access or collect data from the region
  - AF-IX survey initiated in 2015 received responses from 24 of 33 IXPs (~73%) but rate is increasing after years of persistence
  - About ~80% of IXPs publish stats and info on their websites
- Where data is available, accuracy of the information received needs to be cross-checked or verified with other sources

The work continues



# Ongoing work

- **IXP Assistance**
  - Equipment and Technical Assistance
  - Capacity building (Technical and Best Practices)
  - New IXPs being established
- **AfPIF & AF-IX**
  - AfPIF-2019 in August, Port Louis, Mauritius
  - Af-IX meetings at AIS and AfPIF
- **Measurements**
  - Africa Measurements work with AF-IX, IMDEA
  - Deployment of Ripe Atlas Probes and Anchors with AfriNIC/Ripe NCC
- **Policy Engagements**
  - Regional organizations (EACO, AUC, ECOWAS, CRASA, etc)

# IXP Development in Partnership with Facebook

- Partnership signed in mid 2018 and spans two years
- **Scope of partnership covers;**
- **Training and Community mobilization Workshops**
  - Best Practice Workshops
  - Technical Aspects training
- **IXP Infrastructure Development and Support**
  - Server requirements
  - Switches and routers
  - Optical transceivers
  - Others
- **Peering Ecosystem and Community Development**
  - Local Peering Roadshow conferences
  - AfPIF events
- **Catalyzing Content Growth**
  - Subsidizing CDN Cache fill links over a period of 3 years

# Thank you.

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