



An Analysis of the African Internet Peering Landscape

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 - State of Local & Regional Traffic Retention

Introduction

AFPIF 2010

African Peering and Interconnection Forum: Unlocking Africa's Regional Interconnection

11-12 August 2010
Nairobi, Kenya

Why it happened: The African Interconnection Challenge

- It has been **13 years** since the first AfPIF, how has the peering ecosystem grown?

Introduction – ARDA Project

Multiple projects Route Collector Projects

RIPE RIS

- RRC19 - NAP Africa JNB

Route Views

- NAP Africa JNB
- JINX
- KIPX

PCH

- Active at 47 IXPs across Africa

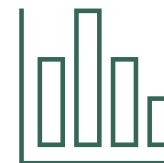
- We are building **ARDA** (African Route Collector Data Analyzer)
- A system to analyze African IXP growth and utilization; as well as evolution of African peering landscape



CAIDAAS Relationships + AS2ORG



Peering DB



Data Analytics

Data Sources For Our Analysis



PCH provides 2 complementary datasets from route collectors

Daily Snapshots – results of "show ip bgp"
BGP updates – archived as MRT format files



Peering DB Historical dumps from 2010



CAIDA AS Rank + AS2ORG



How have IXPs grown over the years?

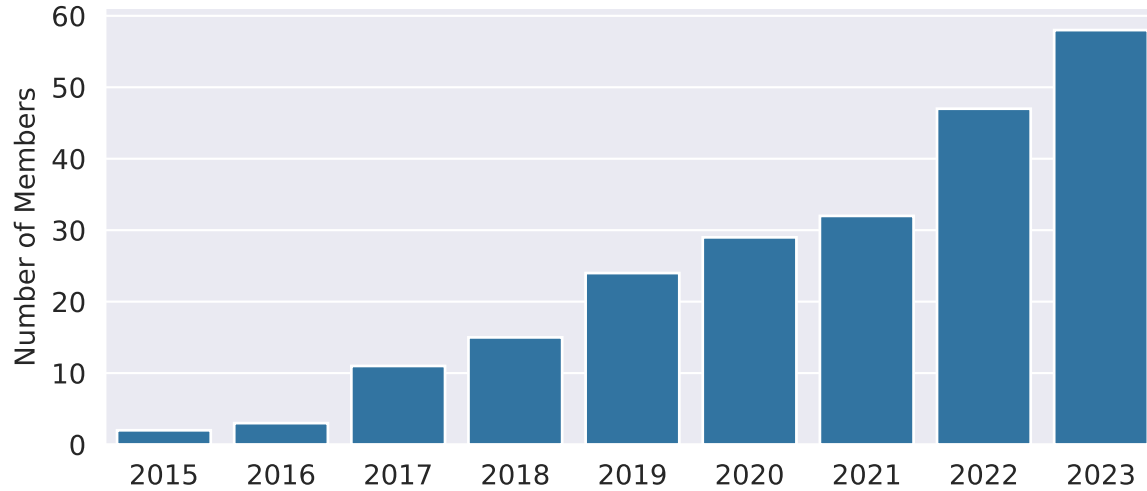
- Membership (Count & diversity)
- Capacity
- Coverage (ASN registered vs present)

Find this Analysis in ARDA

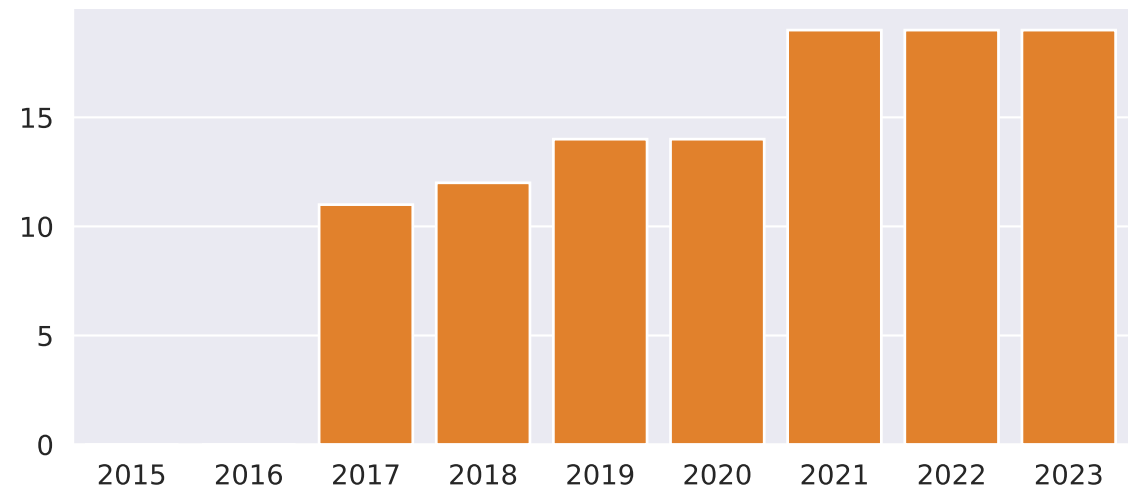
- <https://arda-demo.the-maravian.com>
- <https://arda.af-ix.net>

IXP Growth – Membership Size

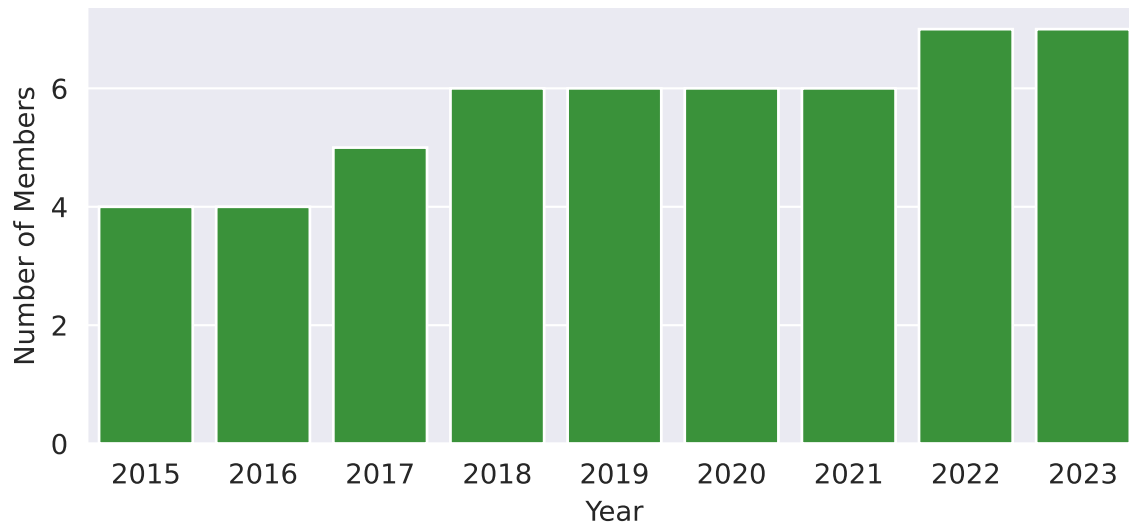
KIPX Nairobi



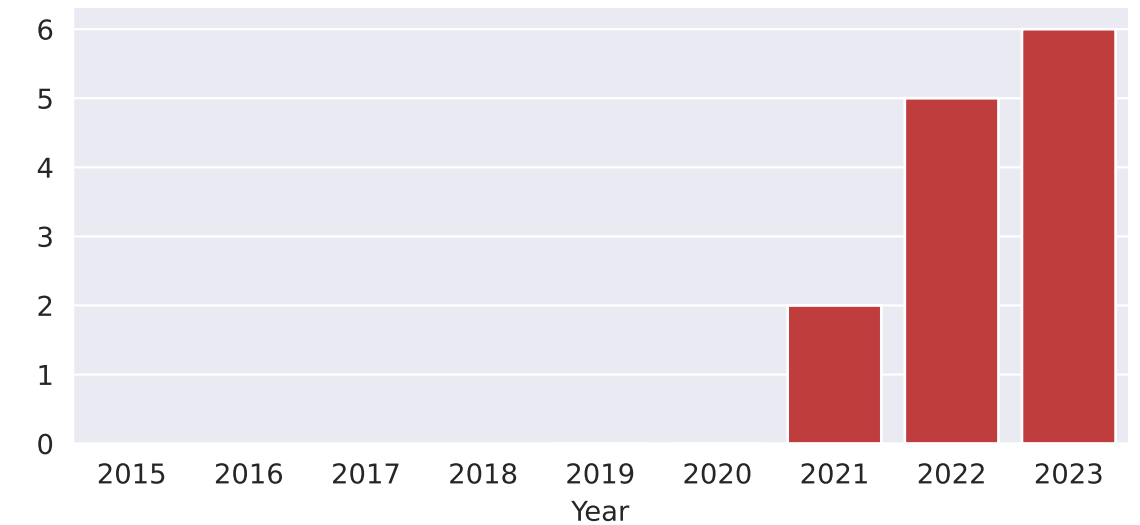
GIXA



RINEX Kigali

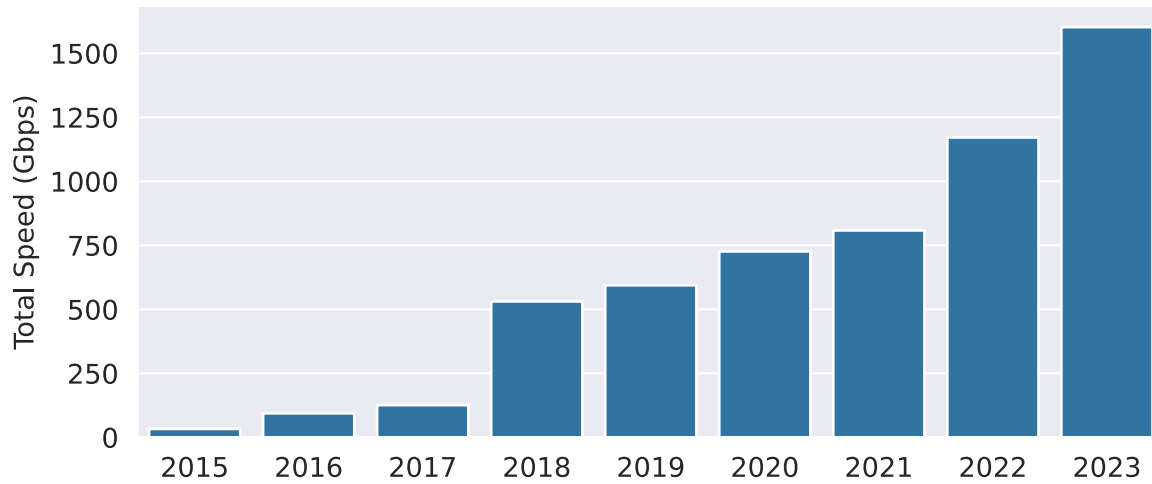


CAMIX Douala

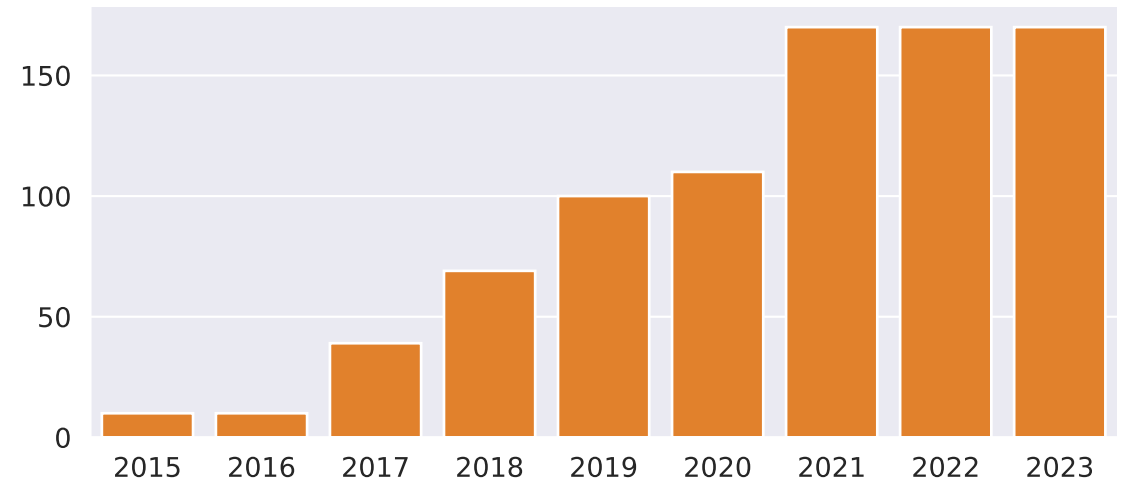


Yearly Growth Of IXPs – Capacity

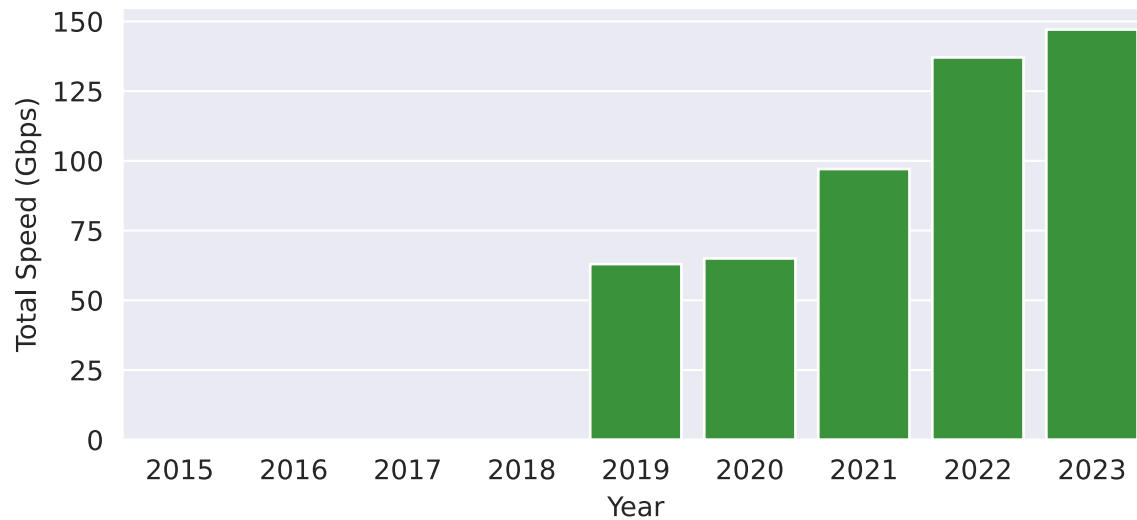
IXPN Lagos



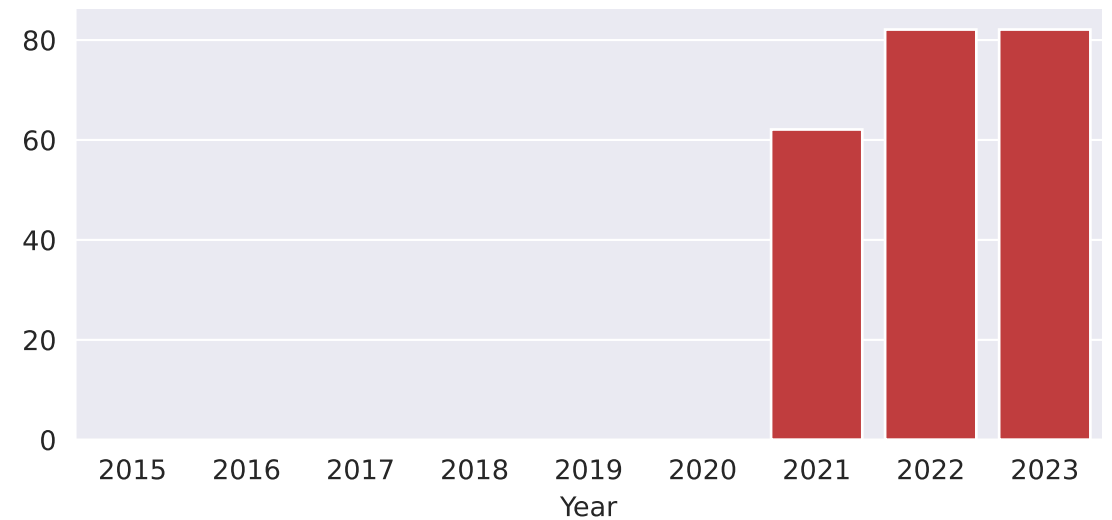
GIXA



BFIX OUAGA

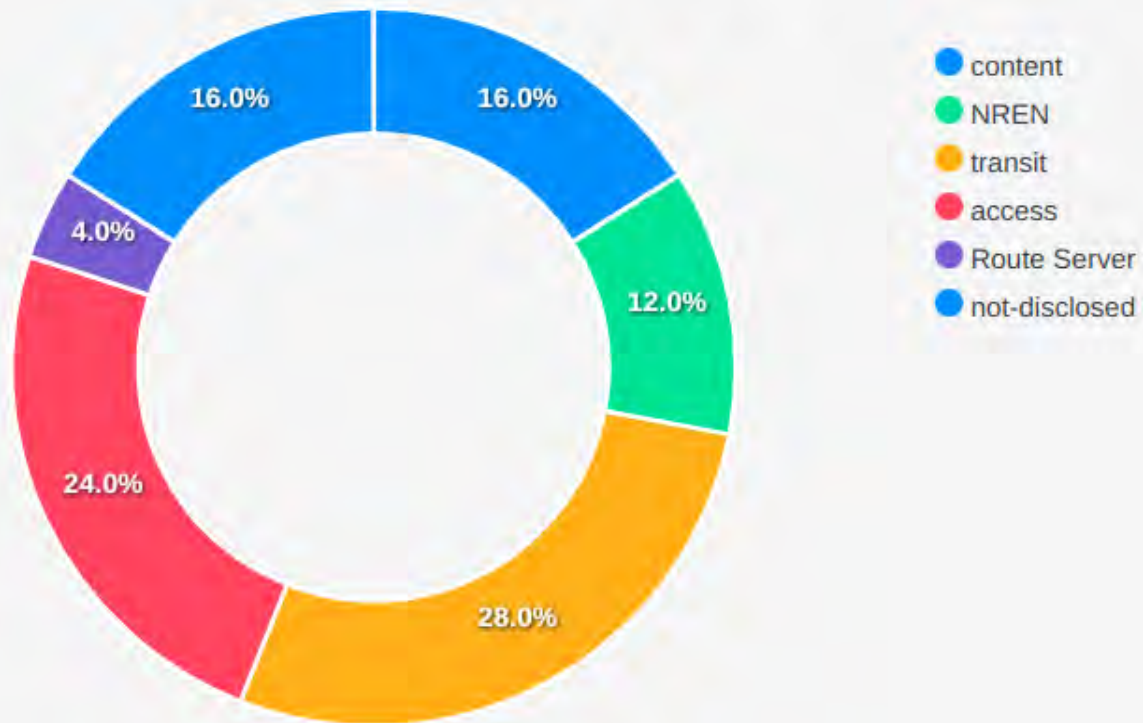


Goma IXP

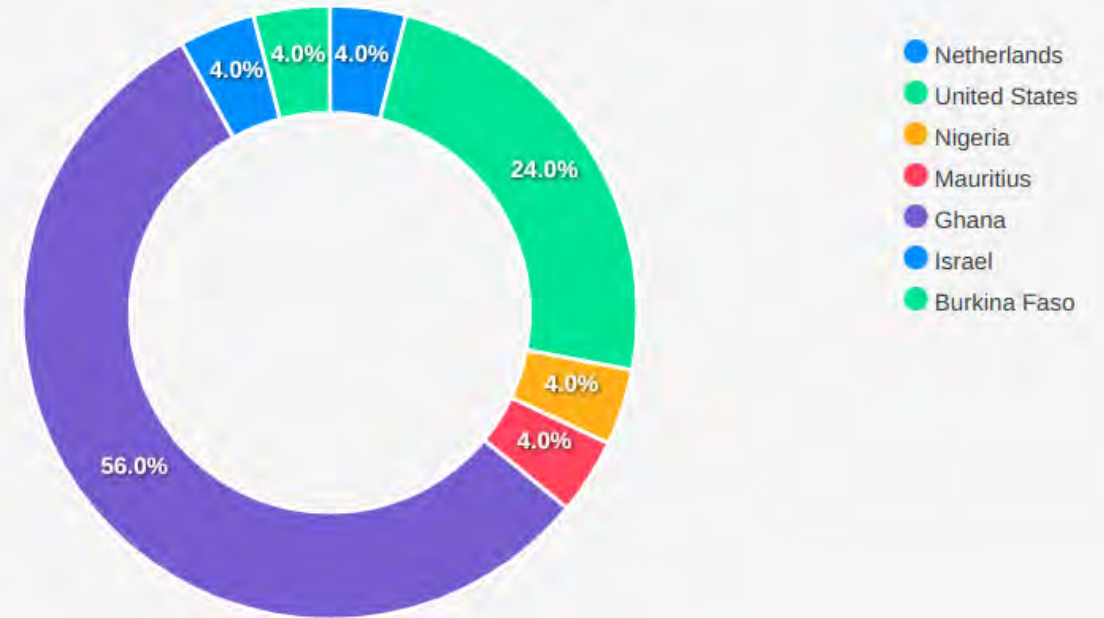


GIXA Membership Overview

Members Classification By AS Type

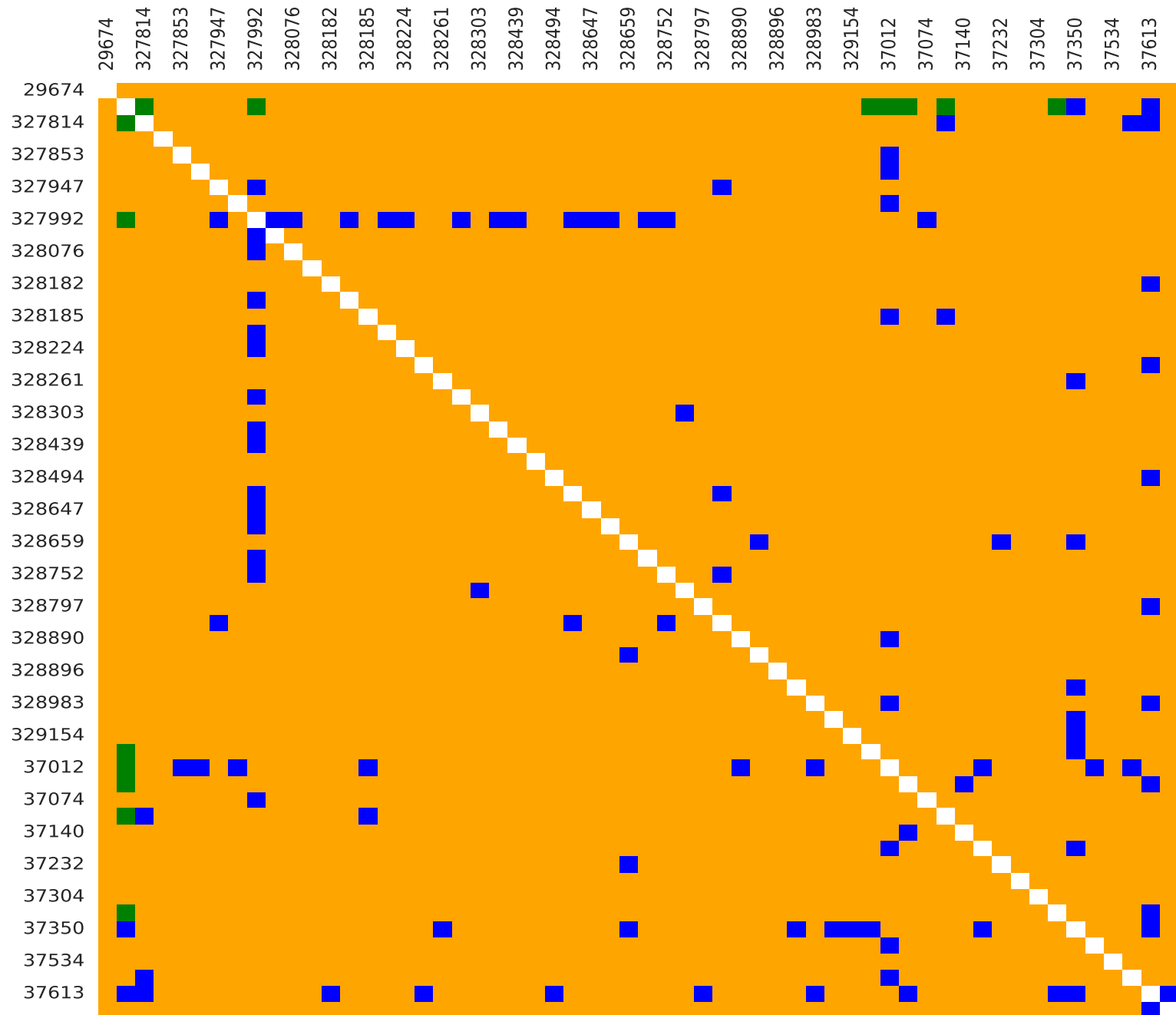


Members Classification By Country of Registration



AS Relationship Inference

- Still an open research problem
- Seminal works
 1. Gao (2001) - **On Inferring Autonomous System Relationships in the Internet**
 2. Di Battista et. al (2003) - **Computing the Types of the Relationships between Autonomous Systems**
 3. Erlebach (2002) - **Classifying Customer - Provider Relationships in the Internet**
 4. Dimitropoulos et al (2007) - **AS Relationships: Inference and Validation**
 5. Luckie (2013) - **AS Relationships, Customer Cones, and Validation**
 6. Jin et. al (2019) - **Stable and Practical AS Relationship Inference with ProbLink**
- Bottom Line
 - The relationships are far from perfect BUT lots of use cases
- We use CAIDA's AS relationships + Others for this analysis
 - <https://www.caida.org/catalog/datasets/as-relationships/>



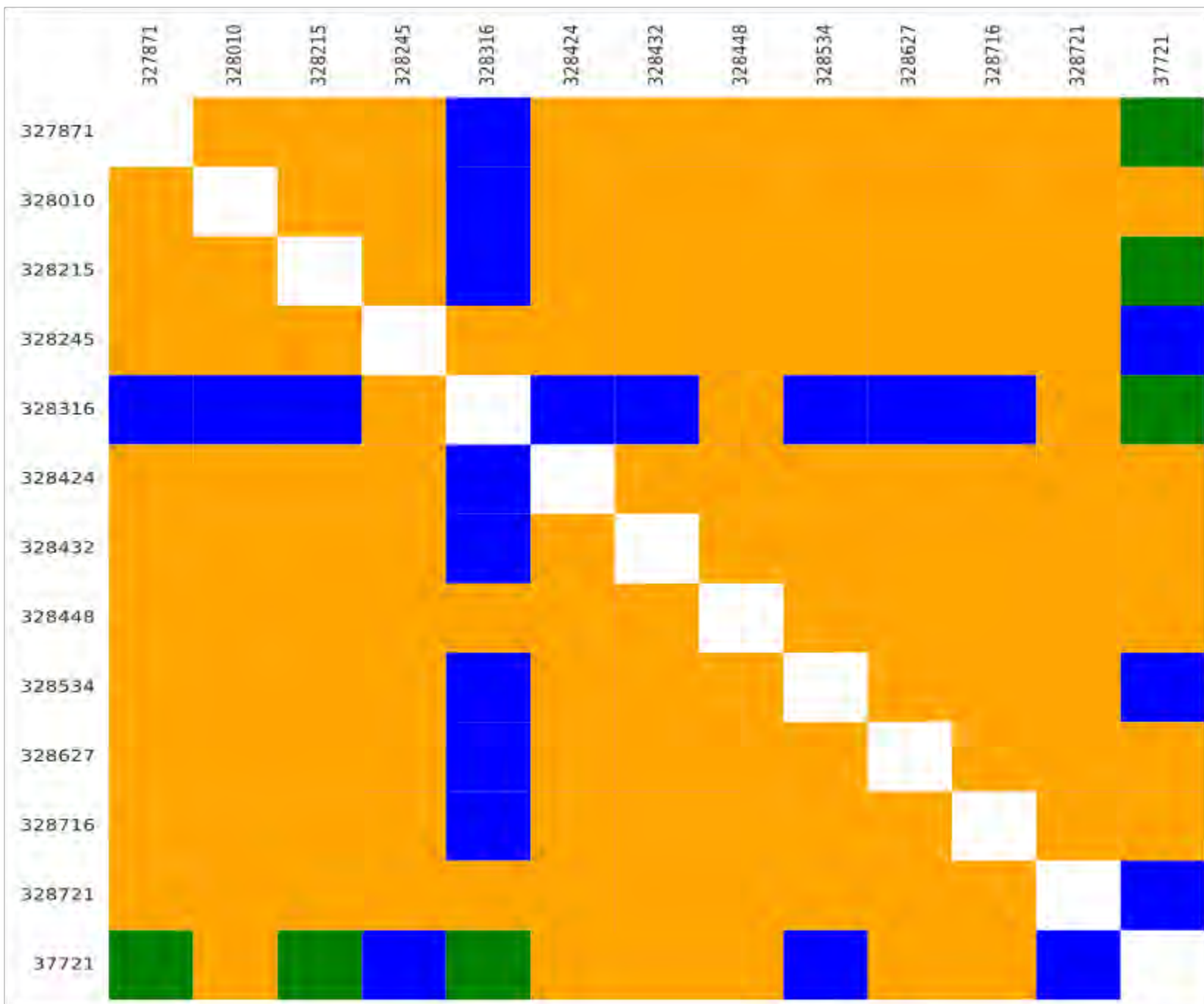
AS Relationships In Ghana



Peer



Customer/Provider



AS Relationships In Burkina Faso

- Peer
- Customer/Provider



Contributions are welcome!

- GITHUB: <https://github.com/UCT-Net4d/frontend.git>

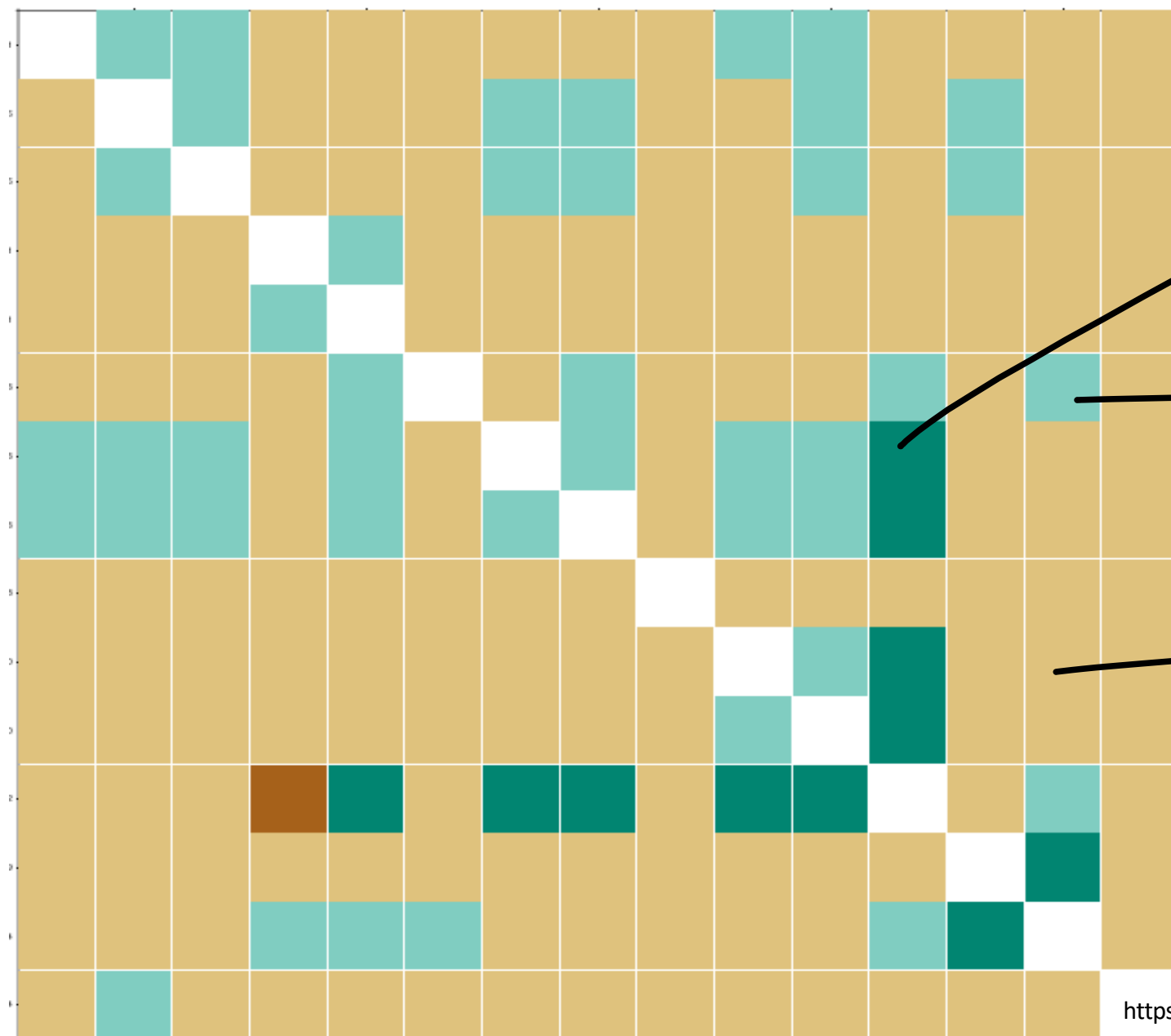




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Are We Getting Better at Retaining Local Traffic?

Data plane peering matrix for West Africa - 2018



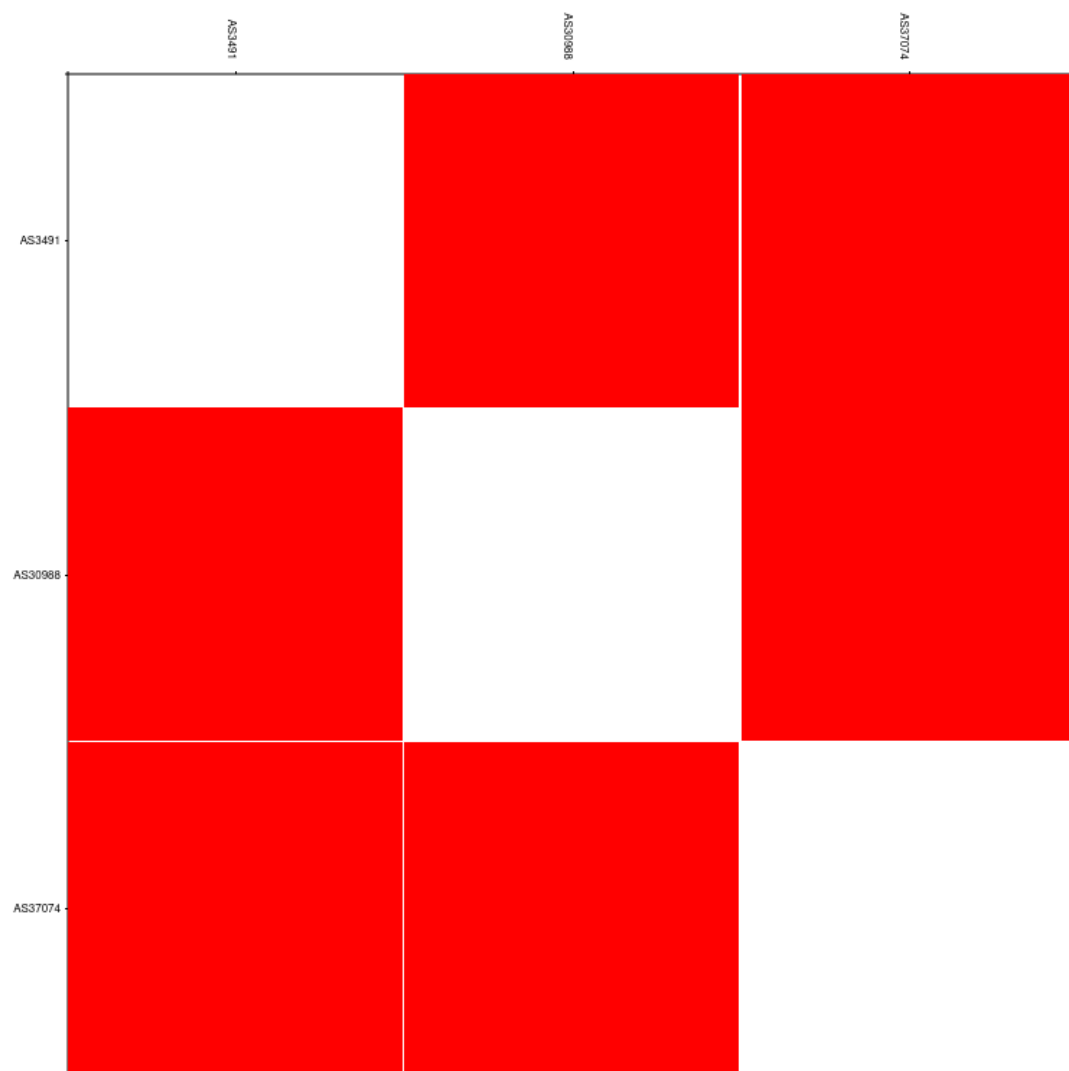
Local IXP found: YES,
out-of-country IPs: NO

Local IXP found: YES,
out-of-country IPs: YES

Local IXP found: NO,
out-of-country IPs: NO

Local IXP found: NO,
out-of-country IPs: YES

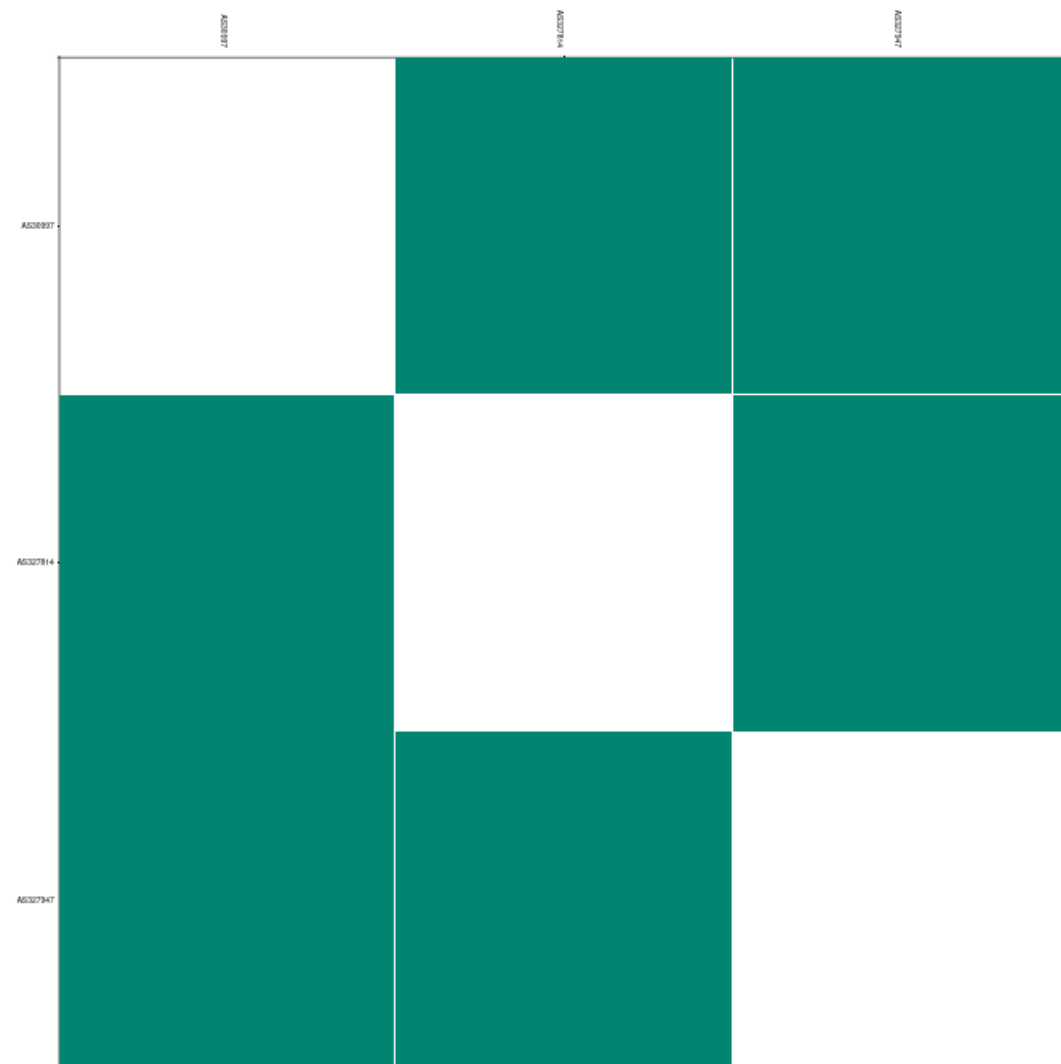
Data plane peering matrix for Ghana – 2017 vs. 2021



<https://jedi.ripe.net/history/2021-10-01/GH/ixpcountry/index.html>

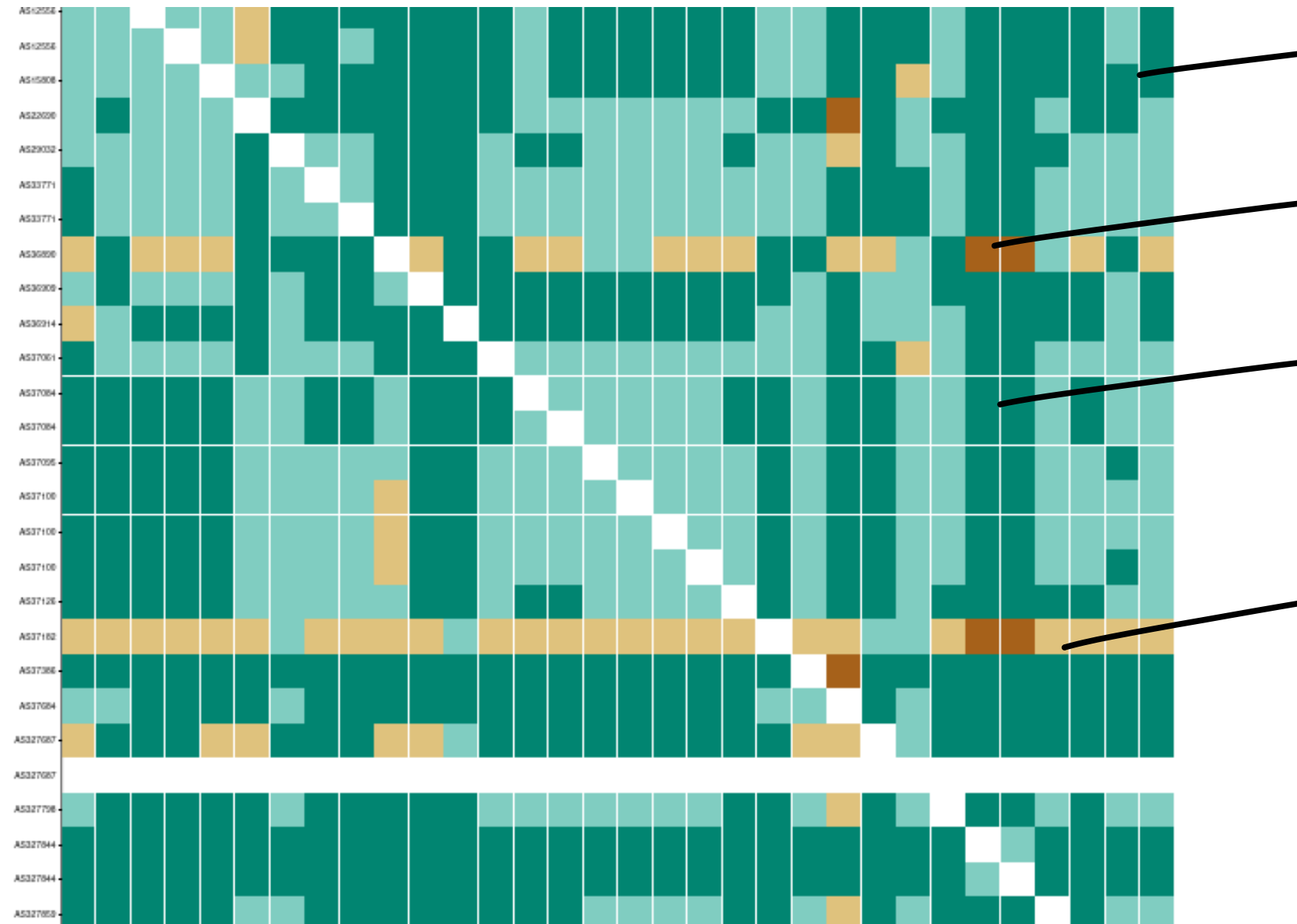
Local IXP found: NO,
out-of-country IPs: YES

Local IXP found: YES,
out-of-country IPs: NO



<https://jedi.ripe.net/history/2017-01-01/GH/ixpcountry/index.html>

Data plane peering matrix for Eastern Africa - 2019



Local IXP found: YES,
out-of-country IPs: NO

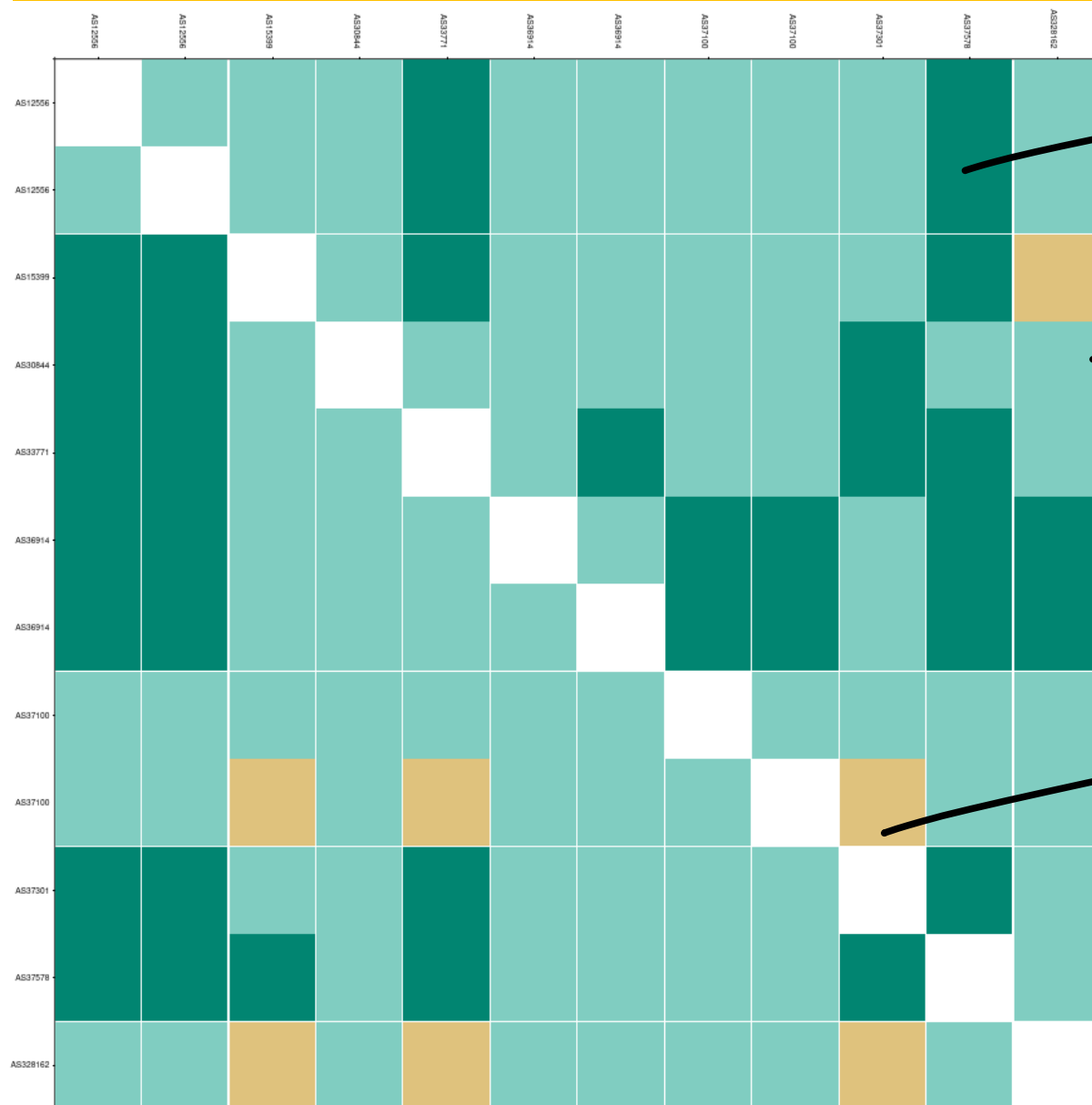
Local IXP found: YES,
out-of-country IPs: YES

Local IXP found: NO,
out-of-country IPs: NO

Local IXP found: NO,
out-of-country IPs: YES

<https://jedi.ripe.net/specials/2019-06-Africa-Eastern/ixpcountry/index.html>

Data plane peering matrix for Kenya Now

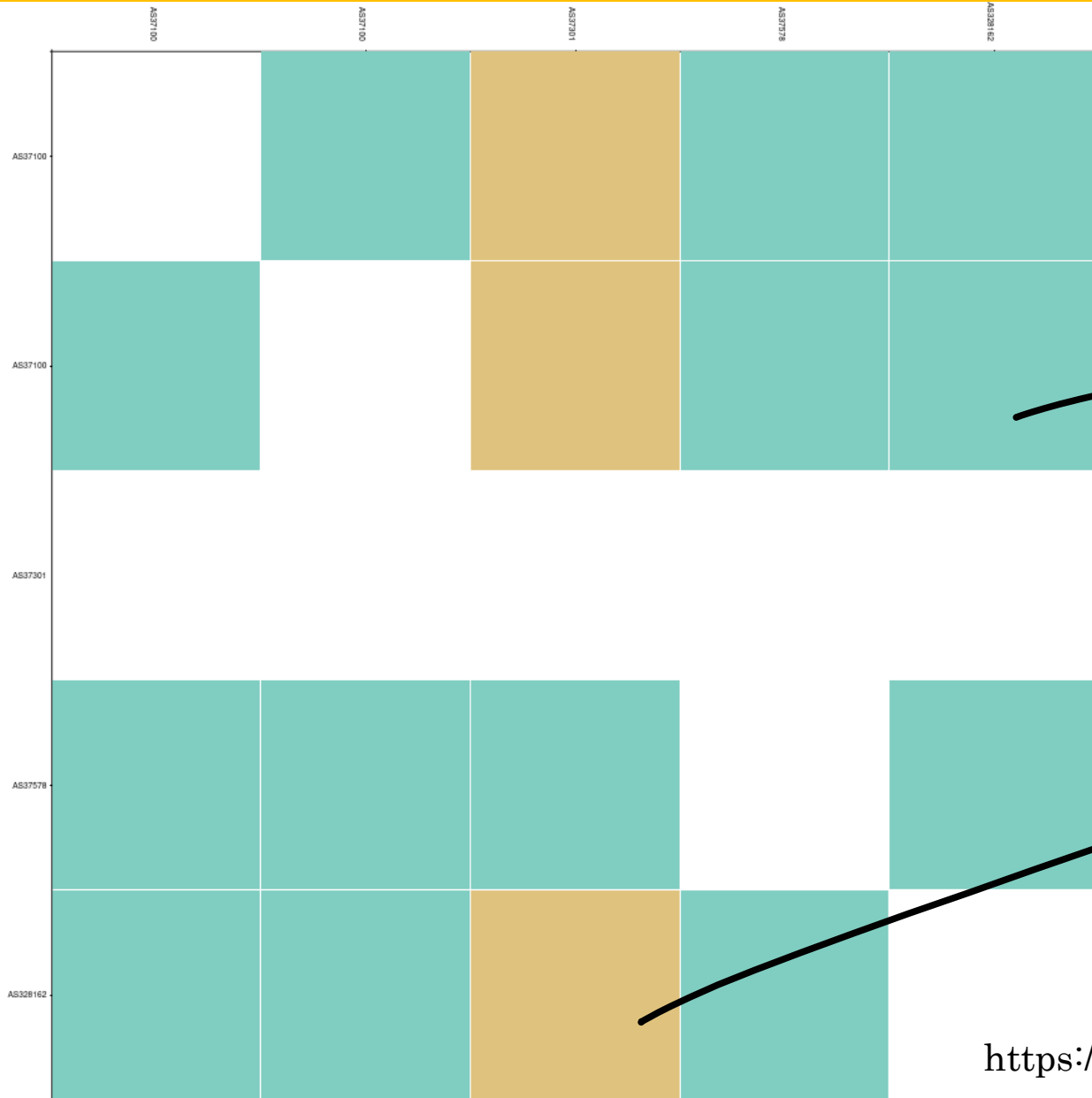


Local IXP found: YES,
out-of-country IPs: NO

Local IXP found: NO,
out-of-country IPs: NO

Local IXP found: NO,
out-of-country IPs: YES

Data plane peering matrix for Kenya - IPv6



Local IXP found: YES,
out-of-country IPs: NO

Local IXP found: NO,
out-of-country IPs: NO

Local IXP found: NO,
out-of-country IPs: YES

<https://jedi.ripe.net/latest/KE/ixpcountry/index.html?ipv=v6>

Key Takeaways

- Huge improvement in keeping local traffic local traffic
 - Some traffic still detouring to Europe – Bug or feature?
- Hosting a RIPE Atlas Probe is an awesome way to contribute to data plane measurements
- ARDA
 - Let us know what metrics are useful
 - What other features you want to see
 - Join the development! - Django + React

Thank you!

