About me

- Postdoc at CAIDA/UC San Diego (as of March 12, 2018)
- PhD at IMDEA Networks Institute/UC3M
  - **Thesis:** Methods for revealing and reshaping the African Internet as a case study for developing regions: From Isolated networks to a connected continent
    - **Understand the topology interconnecting:**
      - networks (ASes) operating in the African region
      - those ASes to popular content sources
    - **Understand the performance on the AS paths**
    - **Investigate a potential evolution for the improvement of the African internetwork**
- Brief presentation of a platform resulting from this work

A Route Collectors Data Analyzer to support peering growth in a region: the case of the Internet Frontier

Joint work:

Roderick Fanou, Victor Sanchez, Francisco Valera, Michuki Mwangi, Jane Coffin

Fruit of a 2,5 year collaboration Internet Society-UC3M; Paper under submission

Workshop on Active Internet Measurements (AIMS) 2018

Problem Statement

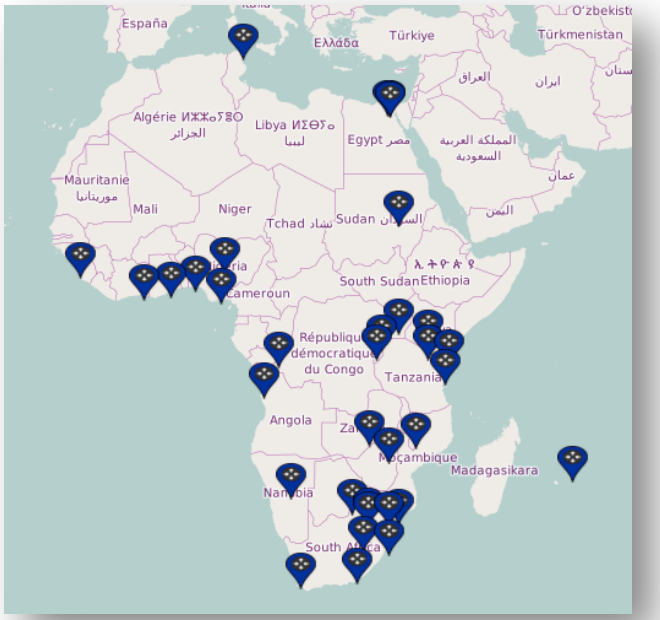
- Several works on IXP facilities mapping, congestion at IXPs, impact of IXPs on the AS-level topology, etc.
- No tool to monitor the evolution of IXPs in an Internet region
- **Possible functionalities:**
  - Constantly collect BGP feeds from existing African IXPs' route collectors ?
  - Constantly assess the growth of those IXPs with pre-defined metrics ?

Problem Statement

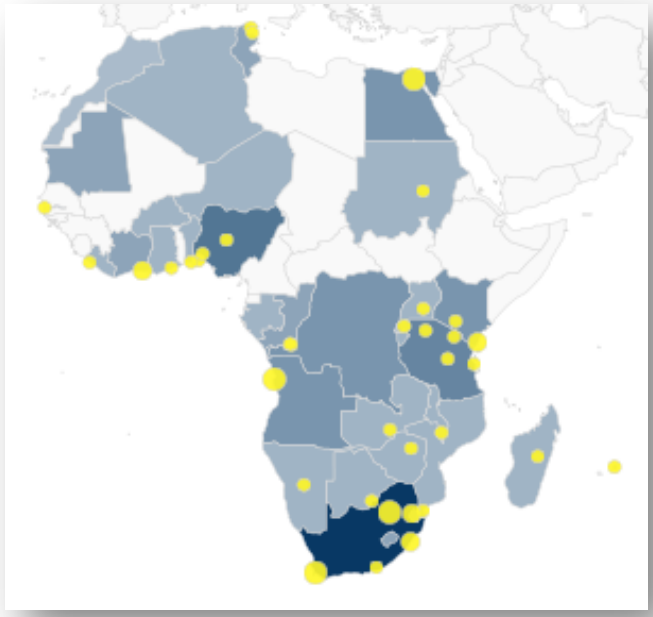
- **Such a compass will help:**
  - Researchers: undertake interconnection studies
  - Network Operators: provide supporting information for peering decisions.
  - Internet Business Development: provide empirical data to support business investment decisions & opportunities in the region, etc.
  - Internet Community: inform development organizations and policy makers on gaps and state of interconnection

At the Internet Frontier

- 42 IXPs in 30+ African countries (Af-IX)
- 23 IXPs host 41 PCH Route collectors in total
- Only 3 have RouteViews collectors (JINX, KIXP, NAPAfrica)
- Less than 50% of all IXPs provide publicly available data on
  - Current traffic statistics
  - Peering ASNs and IP prefixes

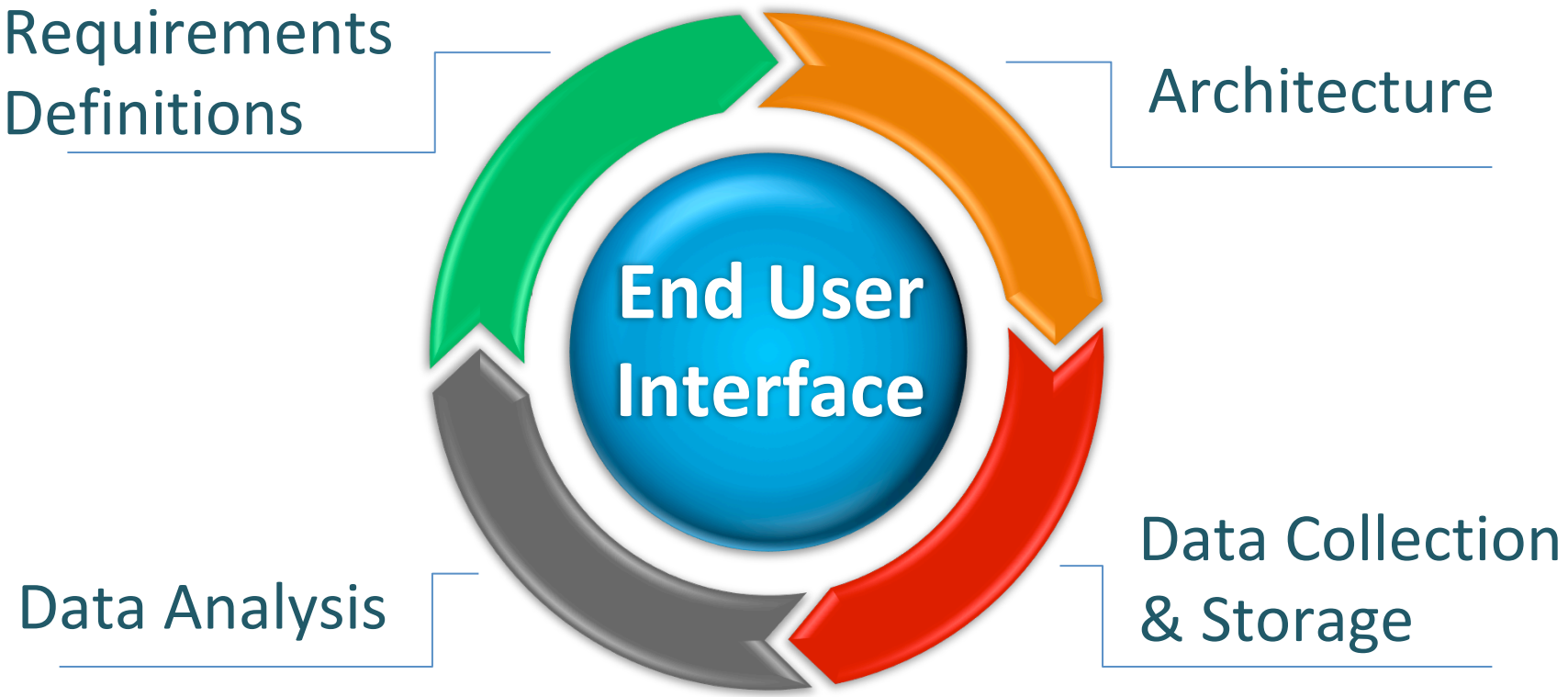


IXPs in the African region, http://www.ixptoolkit.org/ixps/africa, August 16, 2016



65 PCH Route Collectors at African IXPs, https://www.pch.net/ixp/dir, August 16, 2016

Methodology Overview: 5 steps



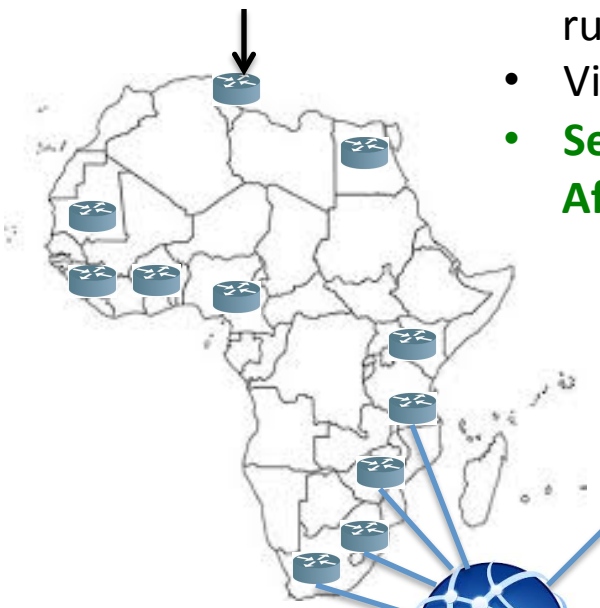
Requirements Definition

- **Develop an open source web platform**
  - Provide an IXP data collection system
  - Define a common structure to store existing Route collectors data
  - Define and periodically compute statistics under different vantage points namely;
    - **IXP View**
    - **National View**
    - **Regional View**
- **Possibility to support Route-Collectors from other regions, sources and formats**

Architecture of the system

- Data Downloader & Storage
- Statistics compu-tations with scripts run periodically
- Visualizations
- **Server hosted at an African IXP**

Route-collector

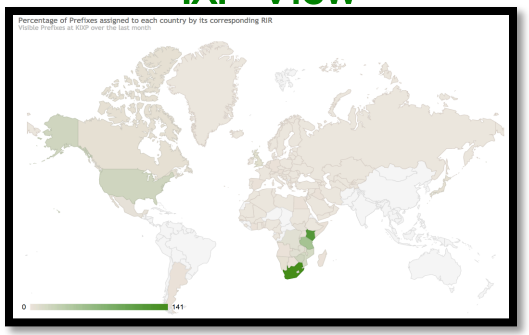


ARDA Admin

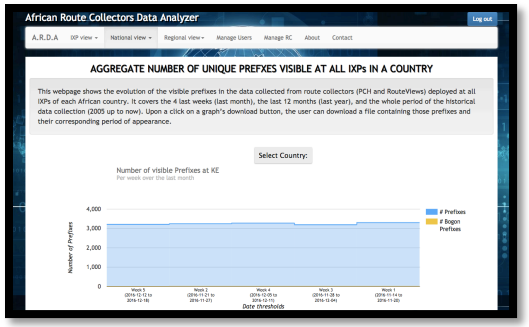
ARDA Users

ARDA Views

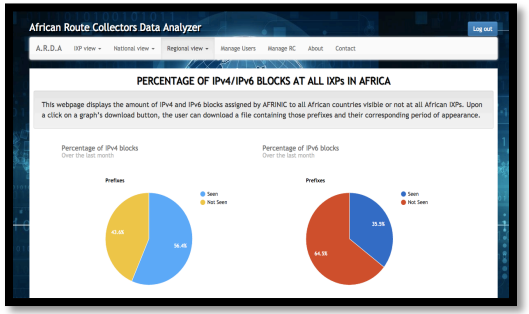
IXP View

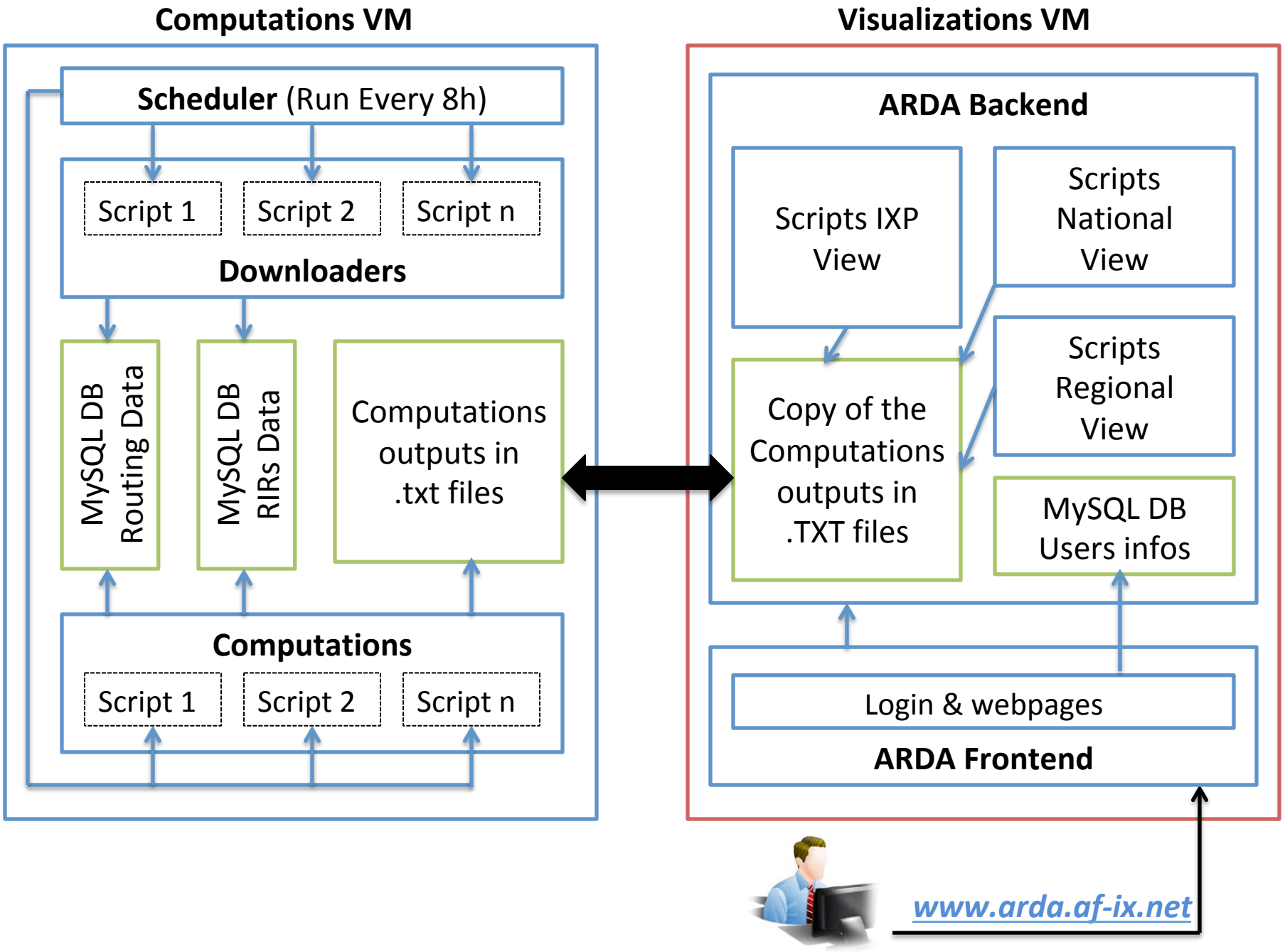


National View



Regional View




Computations VM
Visualizations VM
Scheduler (Run Every 8h)
Script 1
Script 2
Script n
Downloaders
MySQL DB Routing Data
MySQL DB RIRs Data
Computations outputs in .txt files
Computations
Script 1
Script 2
Script n
ARDA Backend
Scripts IXP View
Scripts National View
Scripts Regional View
Copy of the Computations outputs in .TXT files
MySQL DB Users infos
Login & webpages
ARDA Frontend
www.arda.af-ix.net

Data Collection & Storage

- **Data Sources**
  - Geolocation databases: OIM, MM, RDNS, TC.
  - Geolocalized PCH collectors, PCH & RouteViews (RV) collectors
  - RIRs assignments databases [1]
  - Philip Smith, BGP Routing Table Analysis, July 2016 [7]
- **Historical data collection**
  - (v4 & v6) historical & Daily snapshots (show IP bgp on PCH route collectors)
  - (v4 & v6) historical & daily RouteViews data collected with open-source CAIDA's BGPstream [6] framework
- **PCH & RV Daily download & parsing run everyday**
  - 24mn – 240mn for daily RV data (1 col.)
  - Around 60mn for daily PCH data (41 col. + random sleeping)

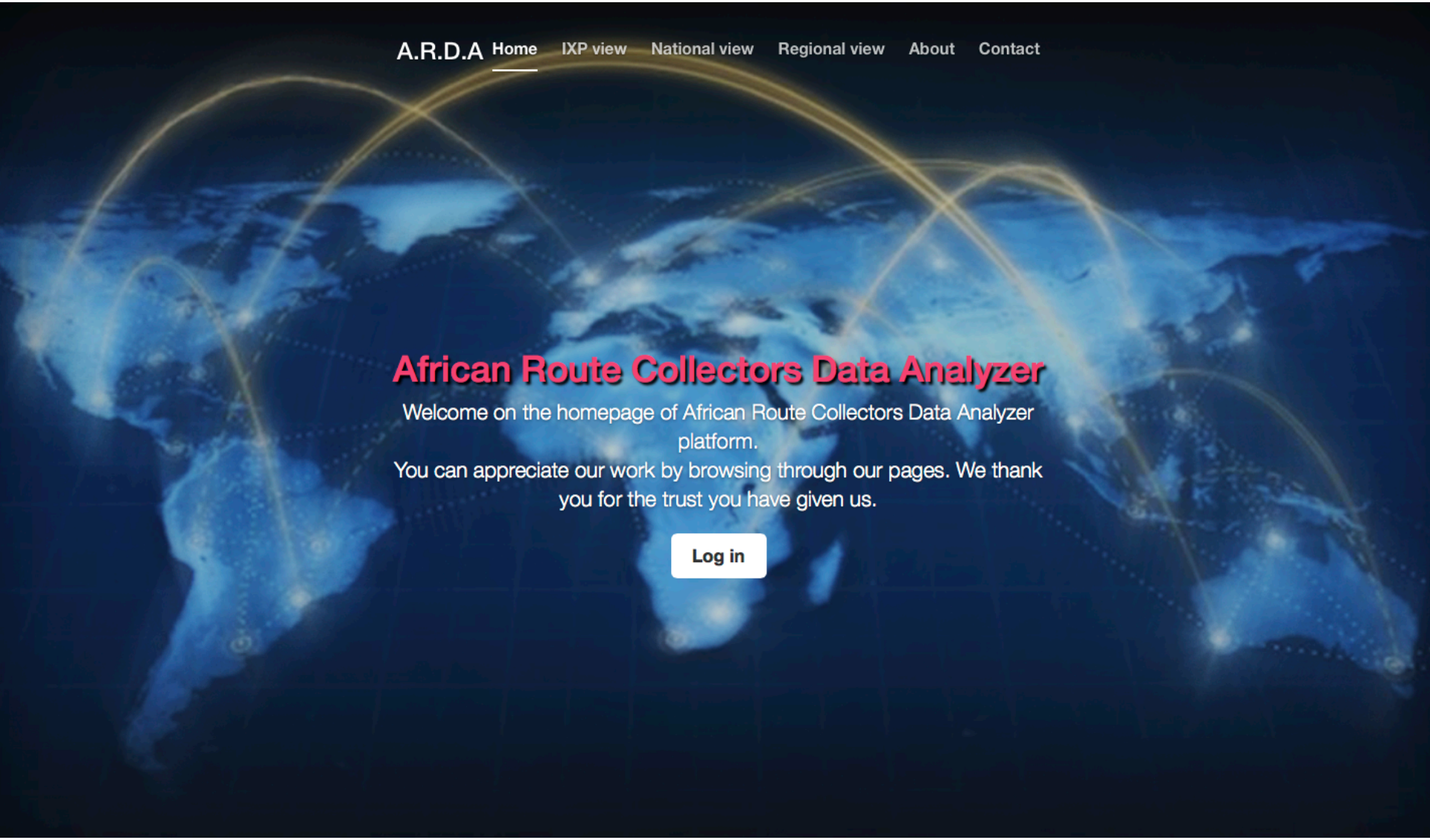
Data Analysis

- Enumeration of all useful metrics for stakeholders
- Every metric is computed over the data
  - 4 last weeks (Last month) split into weeks
  - 12 last months (Last year) split into months
  - from 2005 up to current date (Multi-year) split into years
  - Scripts frequently executed by a scheduler

ARDA functionalities

- **IXP growth and Business potential**
  - Graphical view of the visible networks at an IXP
  - Can be used by IXPs to market their features
  - Identify regions that are connected to a particular IXP
- **Interconnection development progress & gaps**
  - Monitor local and regional interconnection growth
  - Identify IXPs that are facing potential challenges
  - Track local and regional policy and regulatory impact on interconnection development
- **Technical support**
  - Report on networks that are likely to have routing inefficiencies at the IXP

ARDA publicly available at https://arda.af-ix.net (Demo)



Summary

- An open-source application that assesses IXPs growth using route collectors data
- Launched in April 2017
- A research-enabler on the African IXP substrate
- Provides up-to-date and freely accessible statistics on peering ecosystem from 2005 to now
- Displayed under 3 points of view to serve various goals for the community
- Can be replicated for other Internet regions

What's next?

- ARDA (ongoing)
  - Release the code on GitHub
  - Transfer to the Makerere NetLabs (Uganda) with as goal to transition towards an open source community
- My Current research interests (TBD)
  - In the context of the PANDA project
    - Getting used to new technologies
    - Integration of the congestion mapping and detection module and AS Rank one
  - Internet Measurements
  - More interesting topics coming soon …

References

[1] AFRINIC, AFRINIC database, ftp://ftp.afrinic.net, 2016

[2] ARIN, ARIN database, ftp://ftp.arin.net/, 2016

[3] APNIC, APNIC database, ftp://ftp.apnic.net/, 2016

[6] CAIDA, BGPstream, https://bgpstream.caida.org, 2016

[9] D. Meyer, University of Oregon, https://routeviews.org, 2016

[4] LACNIC, LACNIC database, ftp://ftp.lacnic.net/, 2016

[8] Packet Clearing House (PCH), Daily Routing Snapshots, https://www.pch.net/resources/Routing_Data/, 2016

[7] Philip Smith, BGP Routing Table Analysis, http://thyme.rand.apnic.net, 2016

[5] RIPE NCC, RIPE NCC database, ftp://ftp.ripe.net/, 2016

Thank you!
Questions?
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