Anycast in underserved regions of the world (a WIP)

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Problem statement

“A user in Senegal—a former French colony—may route to an anycast replica in Paris instead of one in Nigeria, even though Paris is 6,000km away. This isn't a bug; it's routing policy following historical infrastructure.”

How should operators deploy anycast infrastructure in underserved regions that experience colonial routing?

What is anycast?

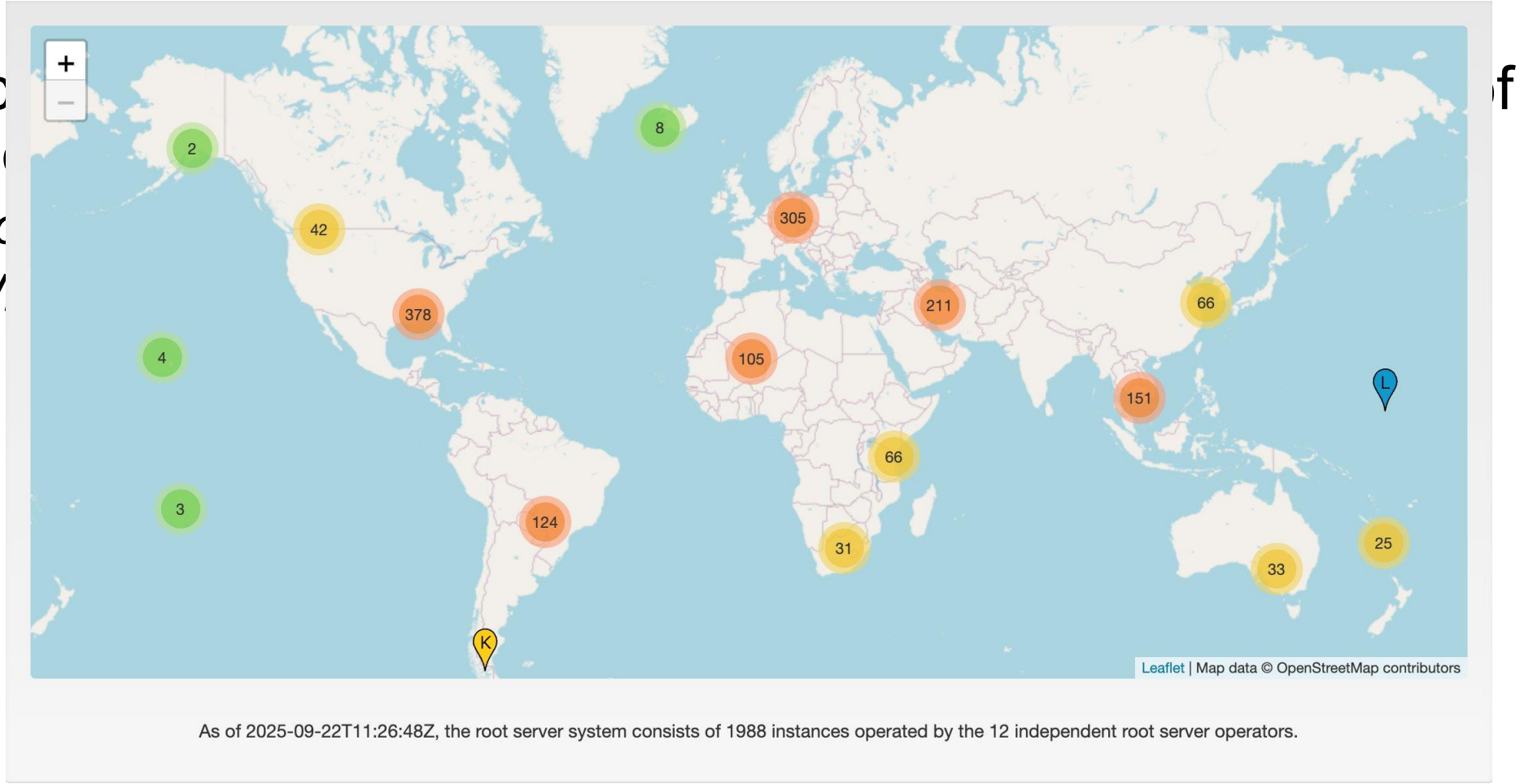
- Anycast: Making an IP address available in multiple Points of Presence (PoPs)
  - *How*? - Announcing an IP prefix at multiple locations using BGP
  - *Why?* - Distribute load, improve resilience, reduce latency

What is anycast?

- Anycast: Making an IP address available in multiple Points of Presence (PoPs)
  - *How*? - Announcing an IP prefix at multiple locations using BGP
  - *Why?* - Distribute load, improve resilience, reduce latency
- Widely used
  - Critical Internet infrastructure
  - *E.g.,* the DNS

What is anycast?

- Anyc… …f Pres…
  - *Ho…*
  - *W…*



Source: root-servers.org

"All 13 DNS root-letters are deployed using anycast; combined totaling 1,988 sites"

Anycast in underserved regions

- IXP and CDN coverage limited in underserved regions

Anycast in underserved regions

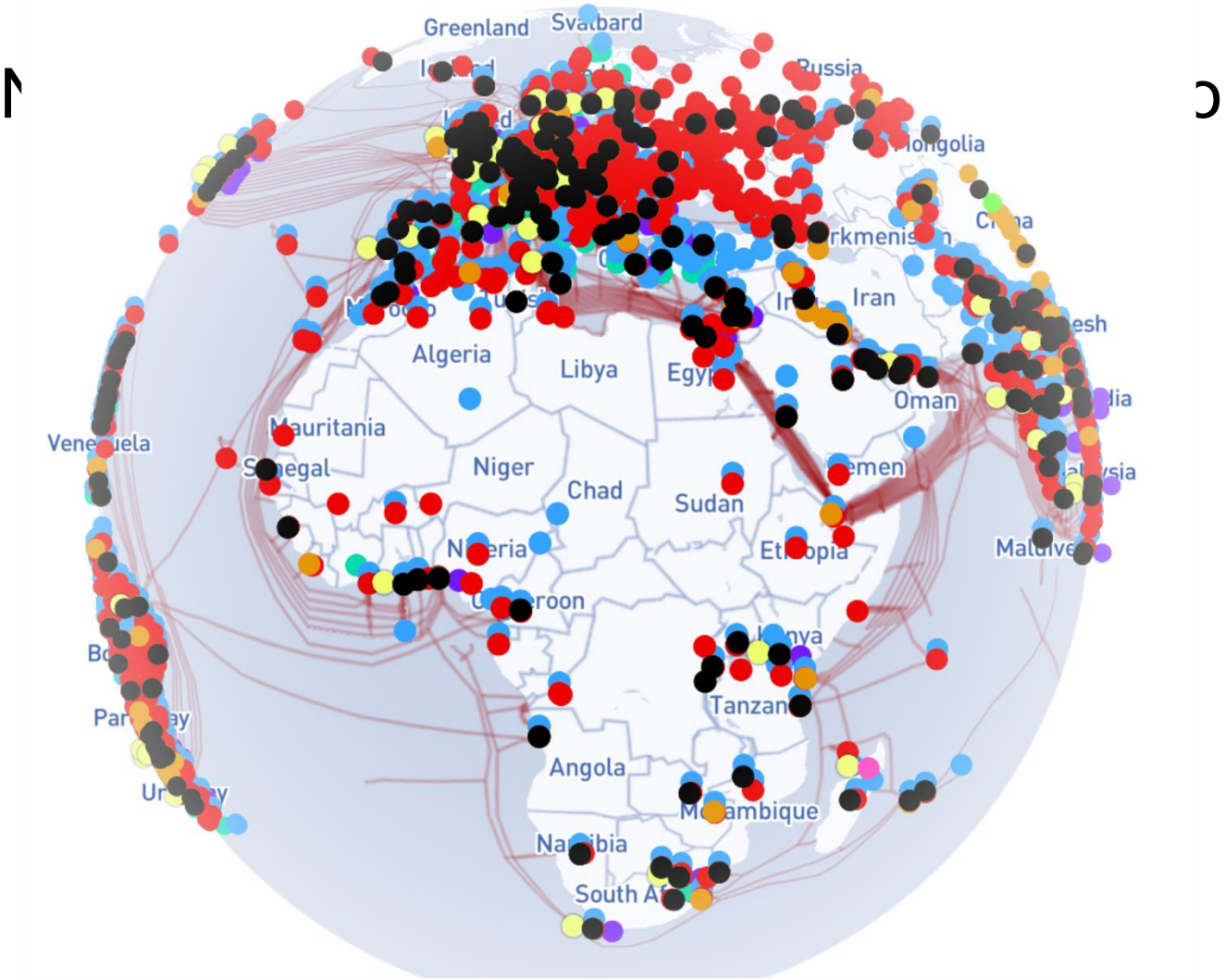
- IXP an



IXPs - internetexchangemap.com

Anycast in underserved regions

- IXP and CDN ons



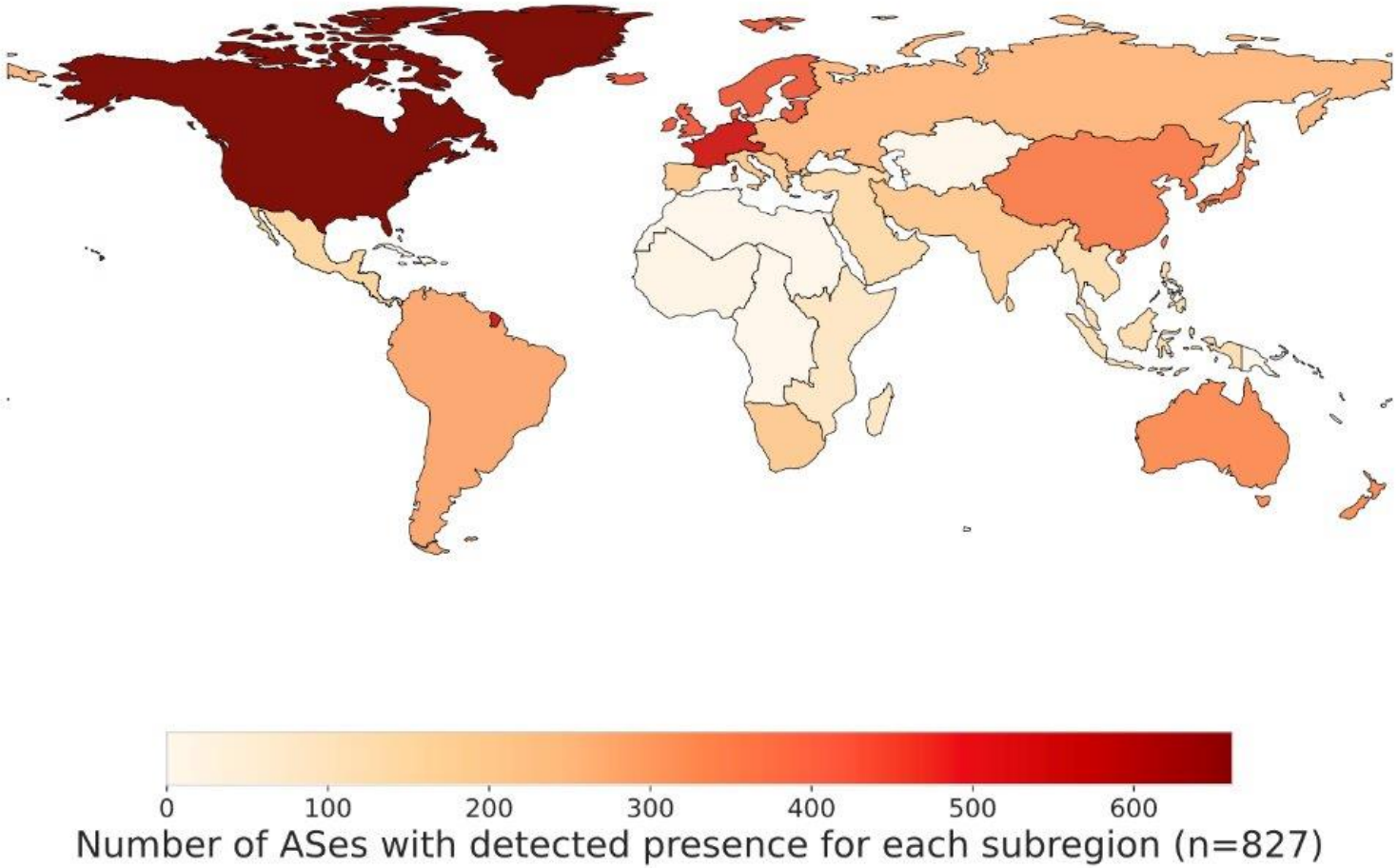
Source https://cdns.nsrc.org/

Anycast in underserved regions

- IXP and CDN coverage limited in underserved regions
- We see this in our anycast census

Anycast in underserved regions

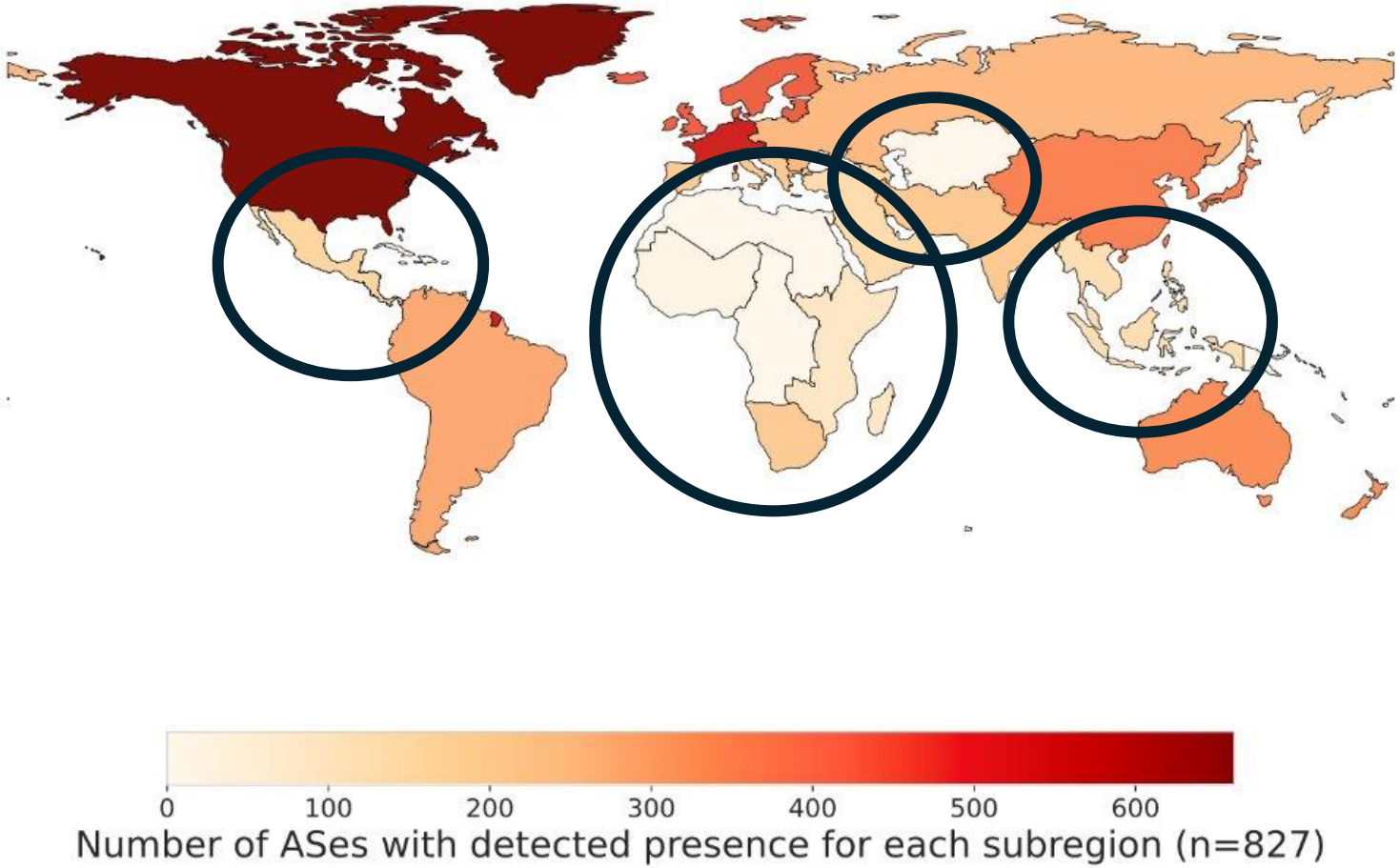
- IXP anc
- We see



Data collected using LACeS (manycast.net)

Anycast in underserved regions

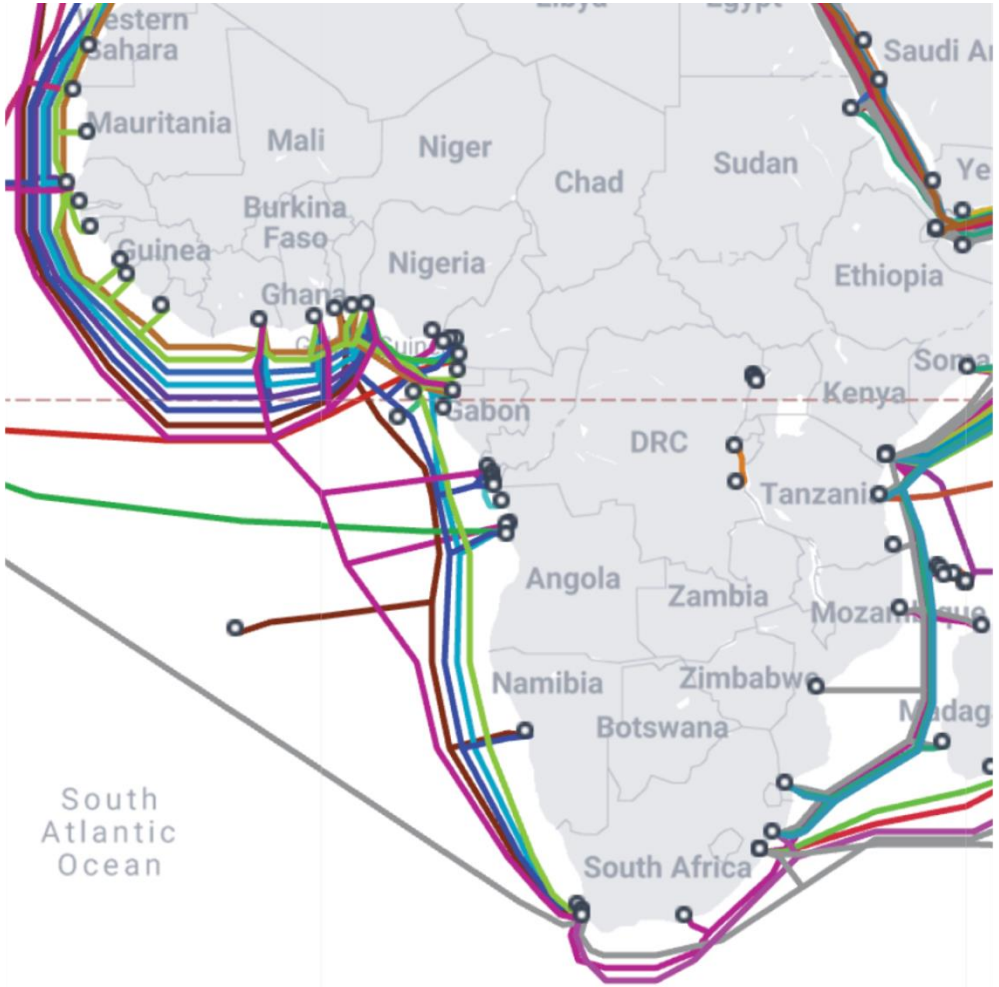
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Colonial routing

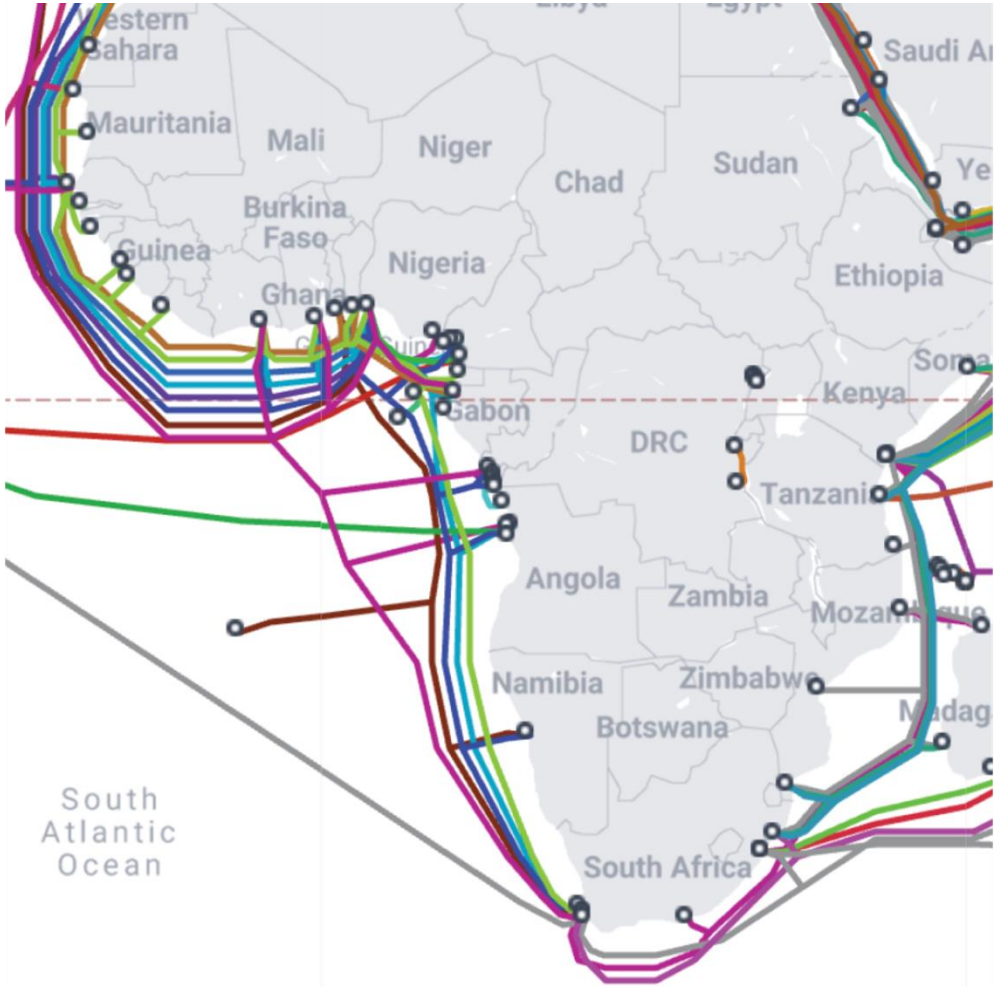
- Limited peering between countries
- Reliance on submarine cables
  - Often follow colonial history
  - *E.g.,* former British colonies connect with a cable to London



submarinecablemap.com

Colonial routing

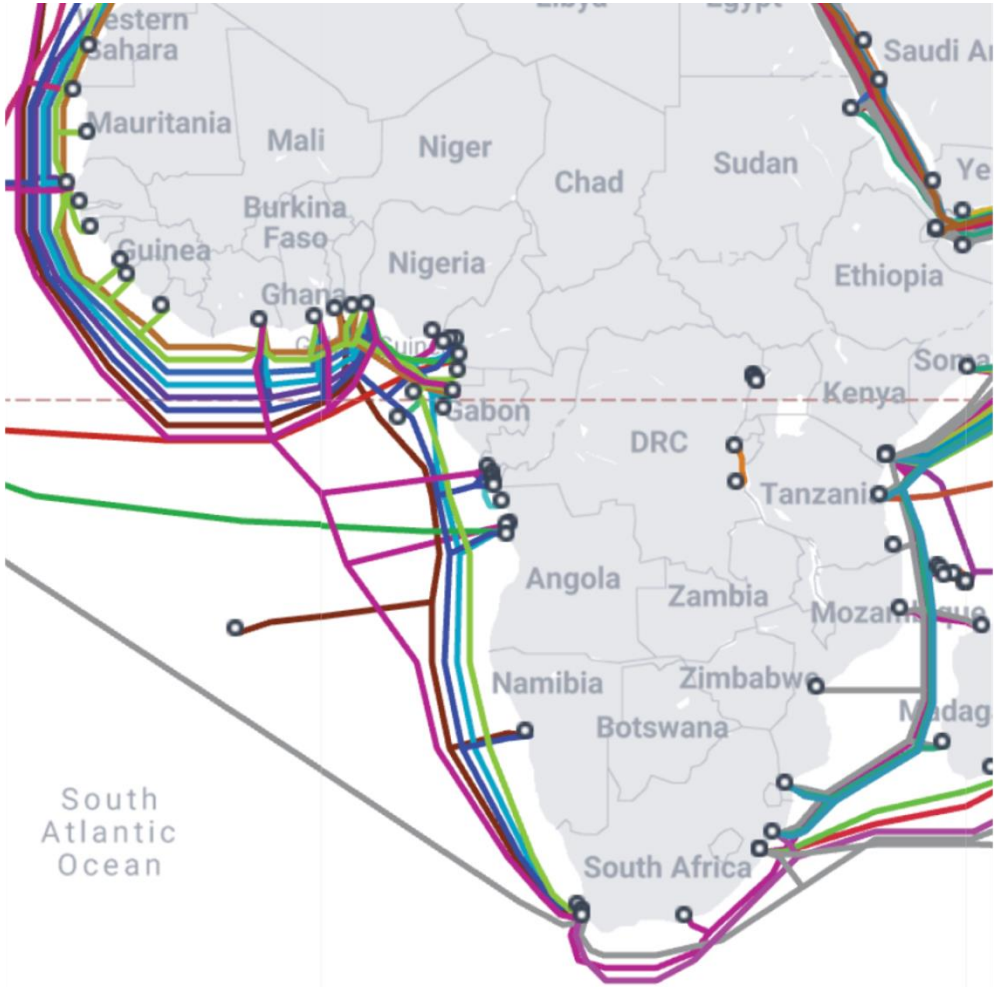
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- Anycast perspective
  - Former French colonies prefer PoP in Paris
  - Former British colonies prefer PoP in London



submarinecablemap.com

Colonial routing

- Limited peering between countries
- Reliance on submarine cables
  - Often follow colonial history
  - *E.g.,* former British colonies connect with a cable to London
- Anycast perspective
  - Former French colonies prefer PoP in Paris
  - Former British colonies prefer PoP in London
- Example: PoP in Nigeria (former British colony)
  - Neighboring French colonies may still prefer PoP in Paris



submarinecablemap.com

Preliminary results

- How do African networks route to our anycast testbed?

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- Note:
  - Results are deployment specific
  - But gives some insights as to routing problems in underserved regions

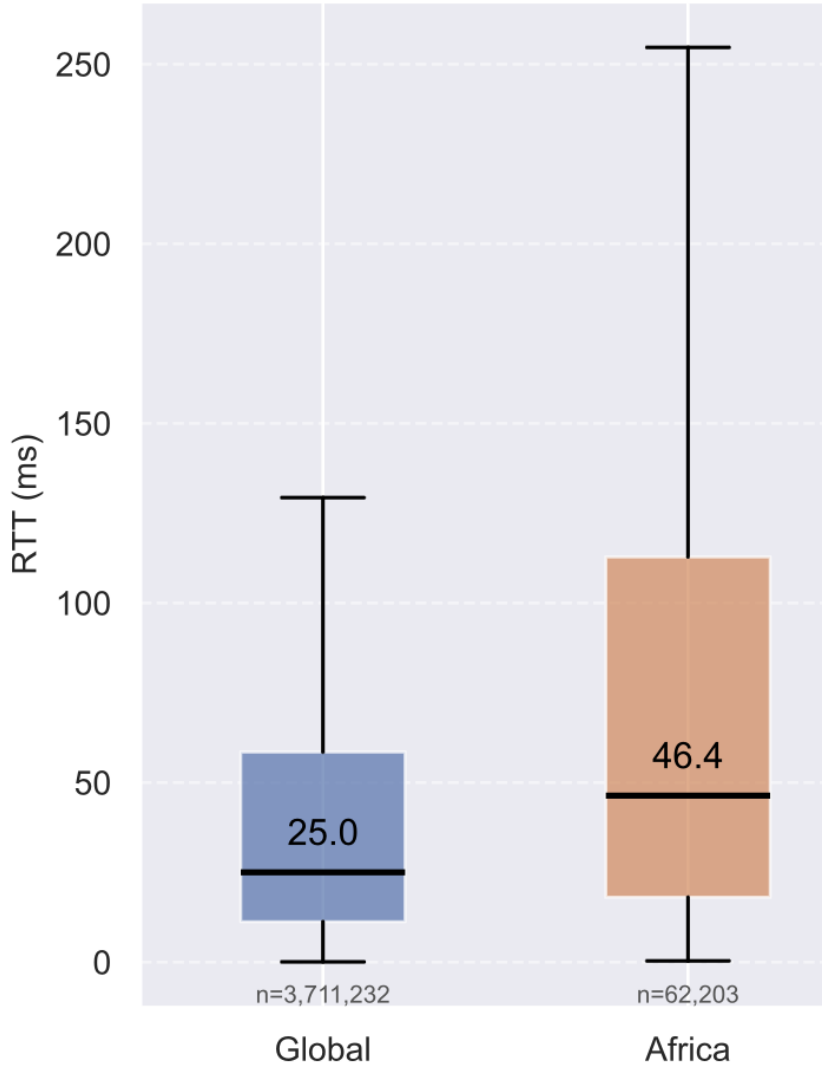
TANGLED

- Our anycast testbed
  - Lagos, Nigeria
  - Johannesburg, South Africa



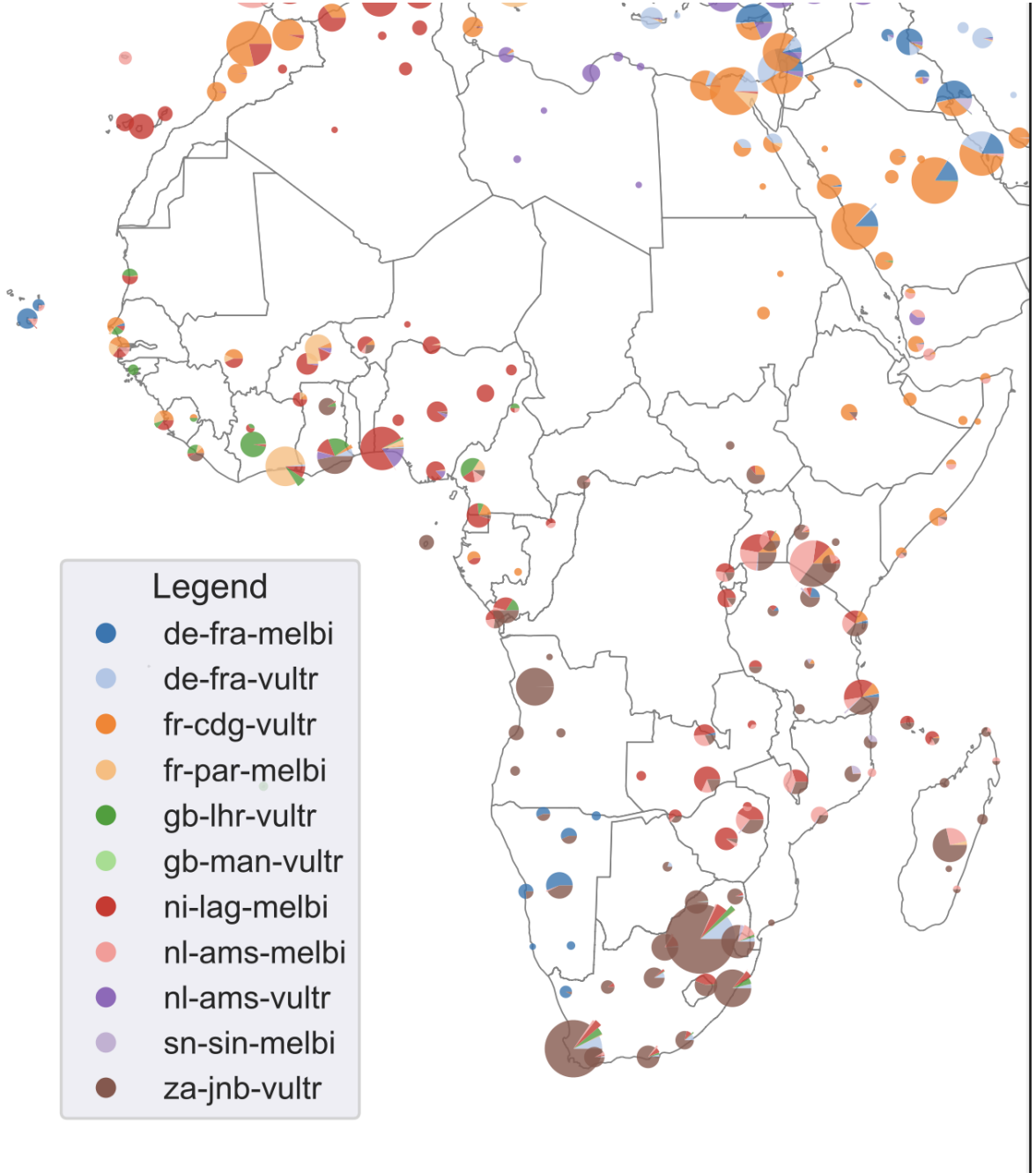
RTT statistics

- RTTs towards TANGLED
  - Global median RTT 25ms
  - Median RTT Africa 46ms (+54%)
- Not surprising
  - Low number of PoPs in Africa
  - But.. most operators don't either



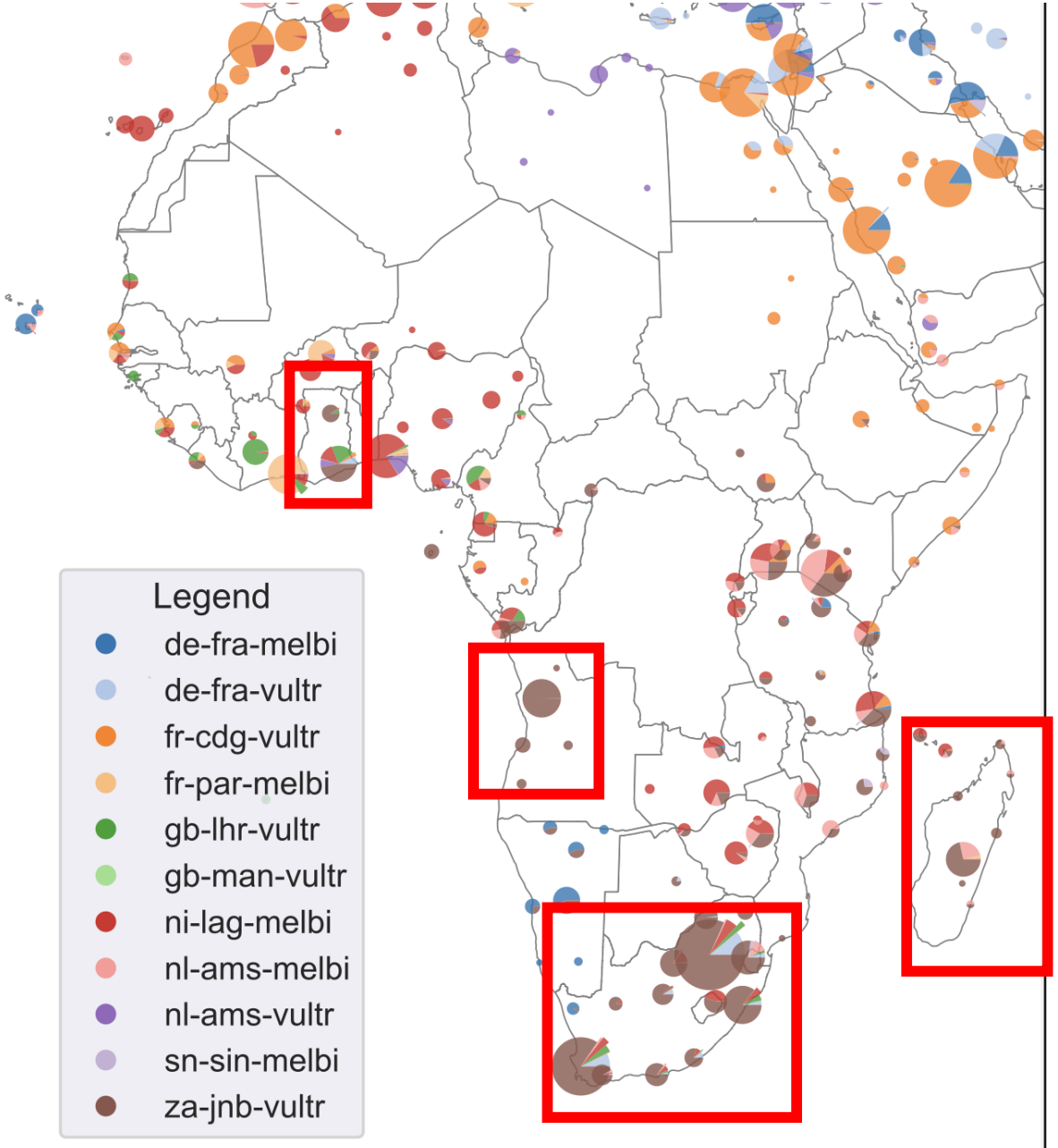
Colonial catchments

- Catchment
  - Set of addresses routing to a PoP



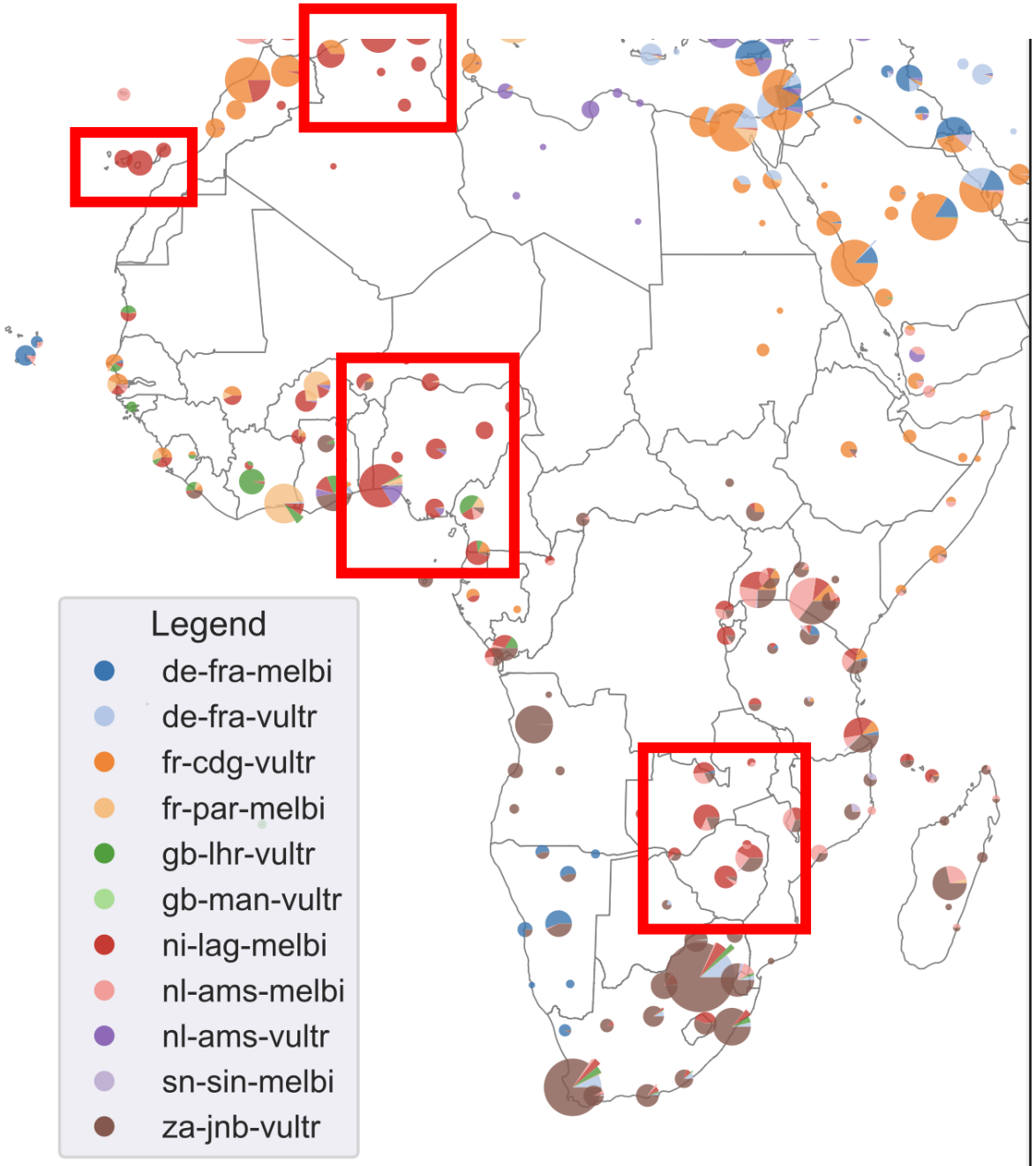
Colonial catchments

- South Africa (brown)
  - South Africa (British)
  - Ghana (British)
  - Angola (Portuguese)
  - Madagascar (French)



Colonial catchments

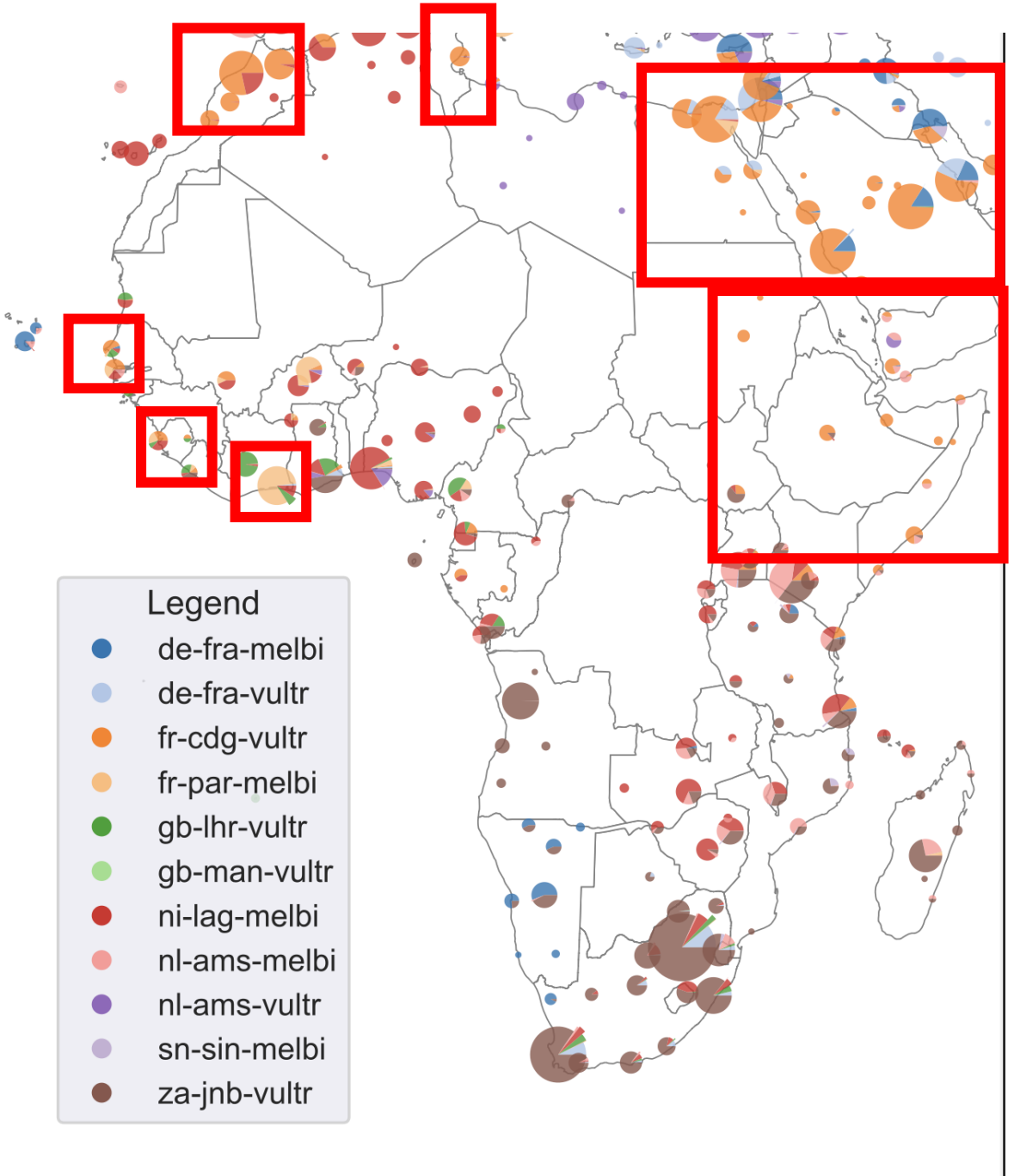
- Nigeria (red)
  - Canary islands (Spanish)
  - Algeria (French)
  - Nigeria (British)
  - Zambia (British)
  - Zimbabwe (British)



Colonial catchments

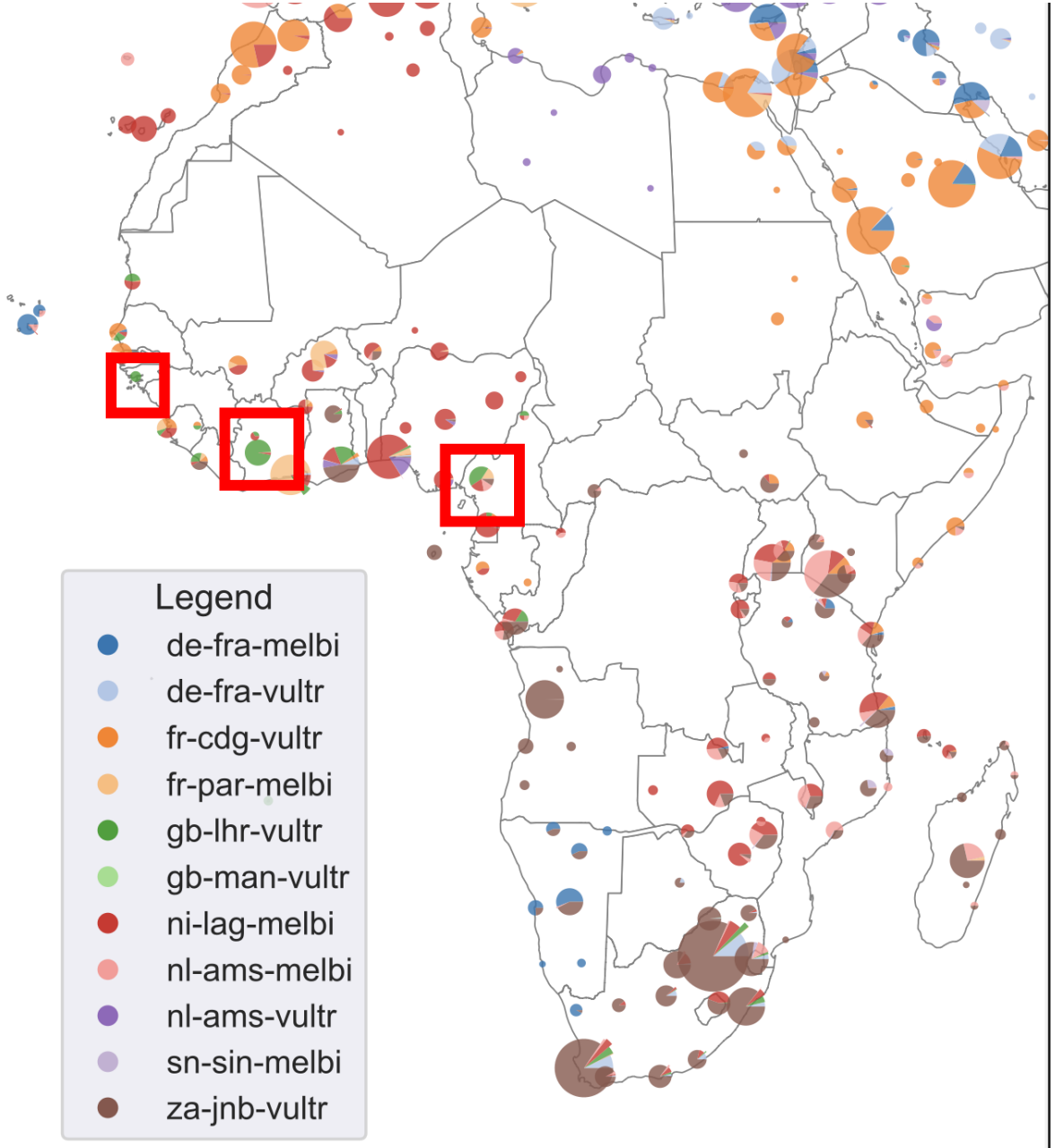
- France (orange)
  - Morocco (French)
  - Tunis (French)
  - Senegal (French)
  - Sierra Leone (French)
  - Cote d'Ivoire (French)
- No PoPs in former

French colonies



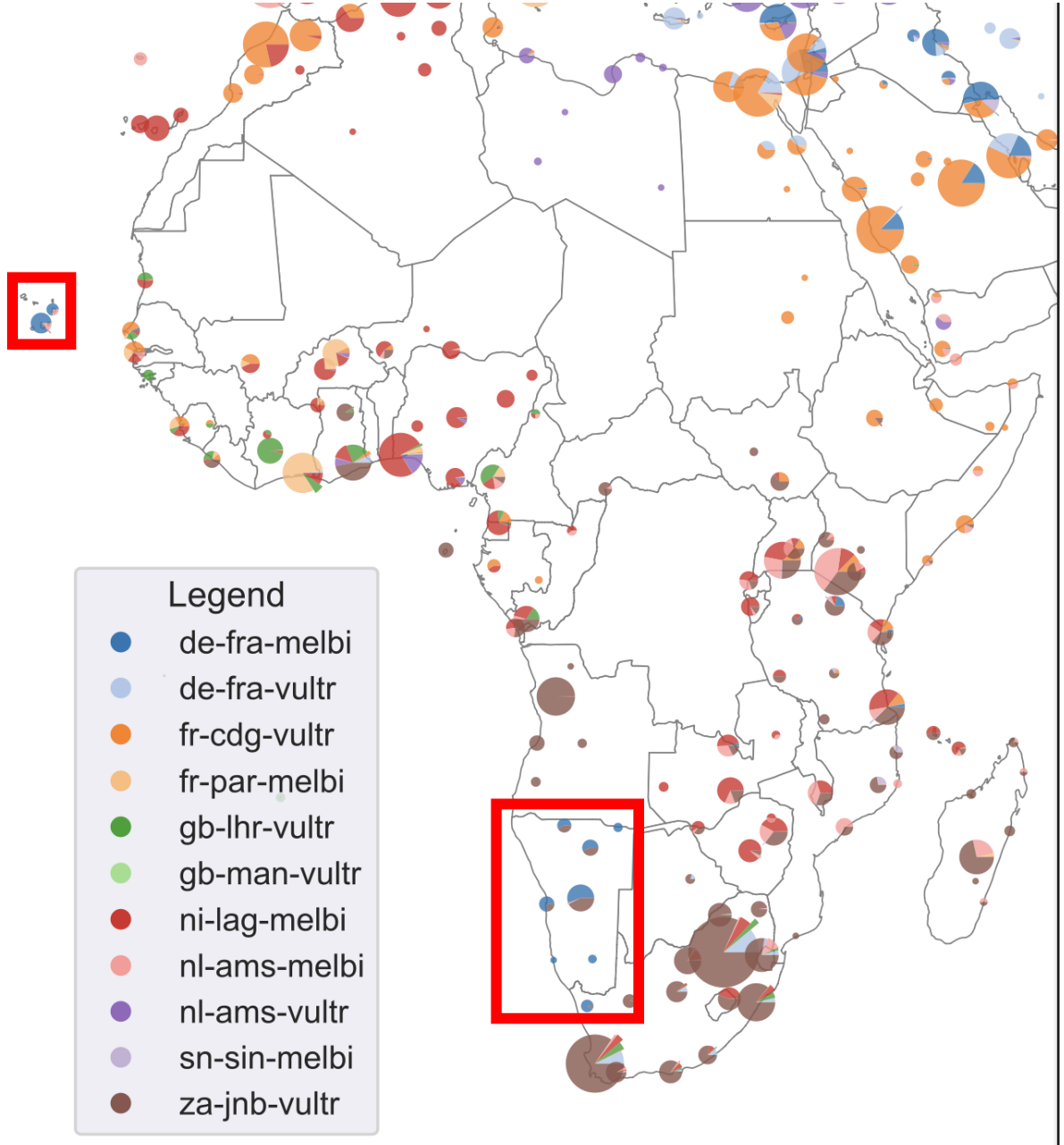
Colonial catchments

- UK (green)
  - Cote d'Ivoire (French)
  - Guinnea Bissau (French)
- Most former British colonies go to
  - Nigeria, South Africa



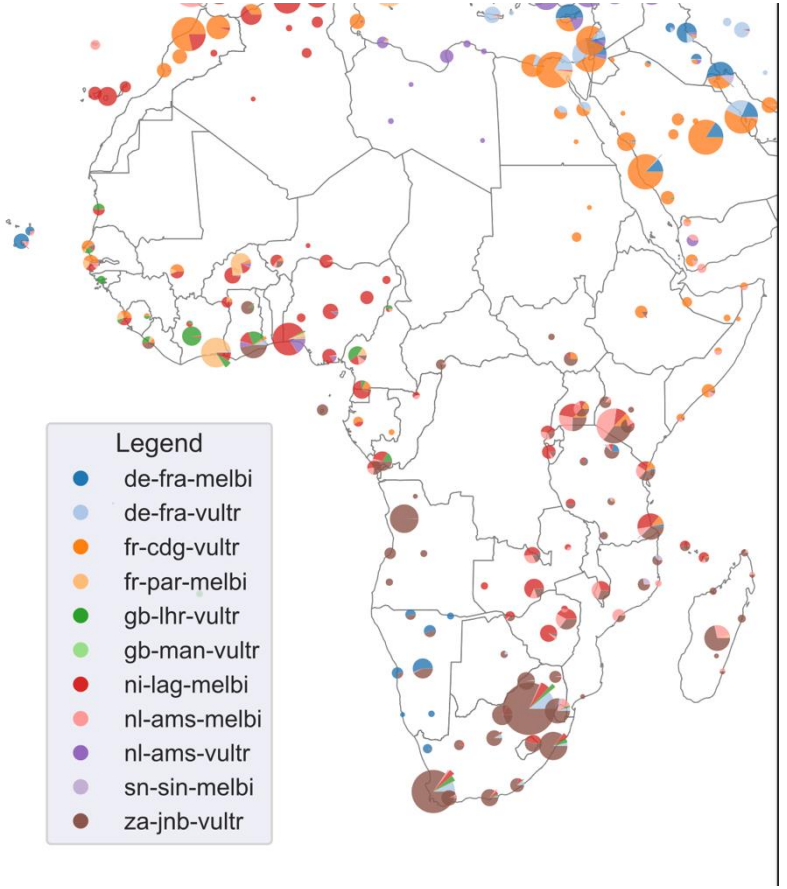
Colonial catchments

- Germany (blue)
  - Cabo Verde (Portugese)
  - Namibia (German)
- Limited colonial presence



Conclusion

- CDN deployment is sparse in underserved regions
- Also visible in anycast PoP placements
- Preliminary results show
  - Poor RTT for underserved regions
  - Further complicated by colonial routing
  - (problem: results are for our testbed only)



Q&A / Call for action

- Call for action
  - Looking for anycast operators (open to collaboration)
  - How do underserved regions route to your network?
  - How to strategize PoP placement in underserved regions?
  - Help us expand our anycast testbed in underserved regions
  - Contact: remi.hendriks@utwente.nl

- Acknowledgements
  - Catalyst (see vulgeo.com) for supporting this project
  - RIPE NCC public speaking course (Gerardo Viviers) for helping with this talk