Visualizing and Simulating Africa's Internet Topology (visAIT)

Project Overview

With the continued growth of the internet comes the research challenge of recreating a topology of all the interconnected internet elements within a region. Such a topology would be useful to be able to conduct different types of further research on the internet such as analyzing different content distribution network placement strategies or the impact of inter ISP peering among local autonomous systems. Although several past researchers had embarked on recreating the topology, our task was to create a web platform that has a pipeline that continuously conducts internet measurements and present the results on an African map visualization, and also allows the user to perform simulations on the platform. Hence this platform will always reflect the current state of the autonomous system internet. The rest of this poster shows the outcomes of our project.

Aims and Objectives

Our research was guided by the following aims:

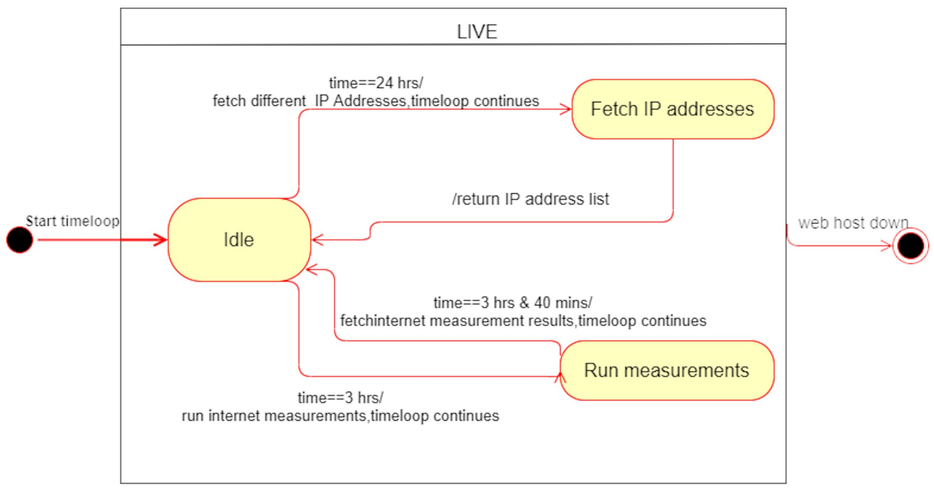
1) To develop an African internet topology visualization platform that continuously fetches internet measurement data and represents it on a map and thus reflecting the current topology state at any time.
2) To add simulation functionality to the platform that would allow researchers to simulate various inter ISP peering scenarios and their impact on internet performance.
3) To evaluate how the number of internet measuring vantage points affects the nature and the shape of the internet topology.

Project Results and Conclusions

The results and conclusions obtained from our research are as follows:

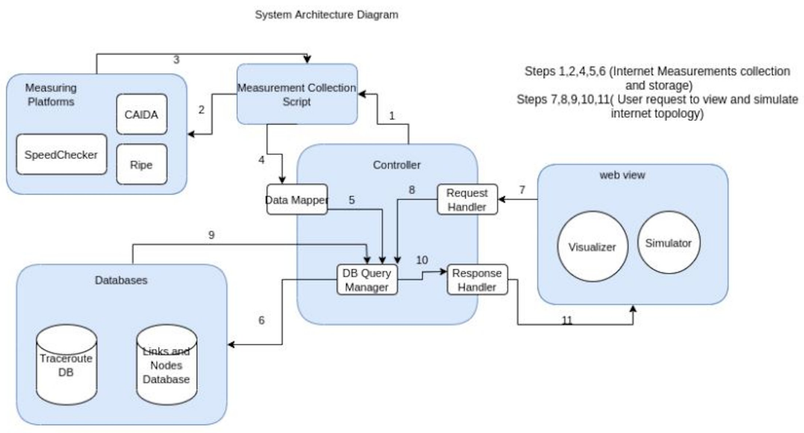
1) Our visualization accurately depicted the autonomous system topology in Africa when compared to the topologies produced by prior researchers
2) The amount of probe coverage an internet measurement platform has in Africa directly influences the quality of the topology discovered.
3) Using our platform's simulation, it was seen that the regional internet latency drops by **75%** and the interregional internet latency drops by **20%** when African ISPs were peered at regional IXPs.

The Internet Measuring Process

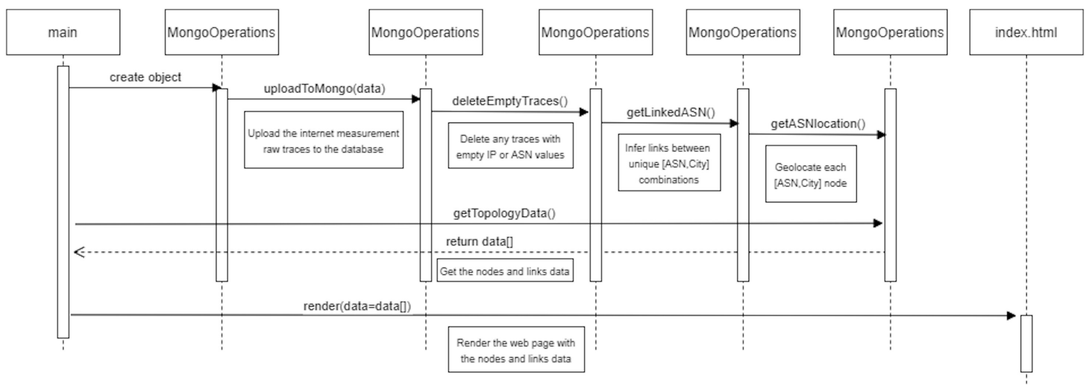


The main.py script first scrapes random IP addresses from African networks to use as destinations then runs internet measurements from Speedchecker, Ripe Atlas, and CAIDA every 3 hours as shown by the diagram

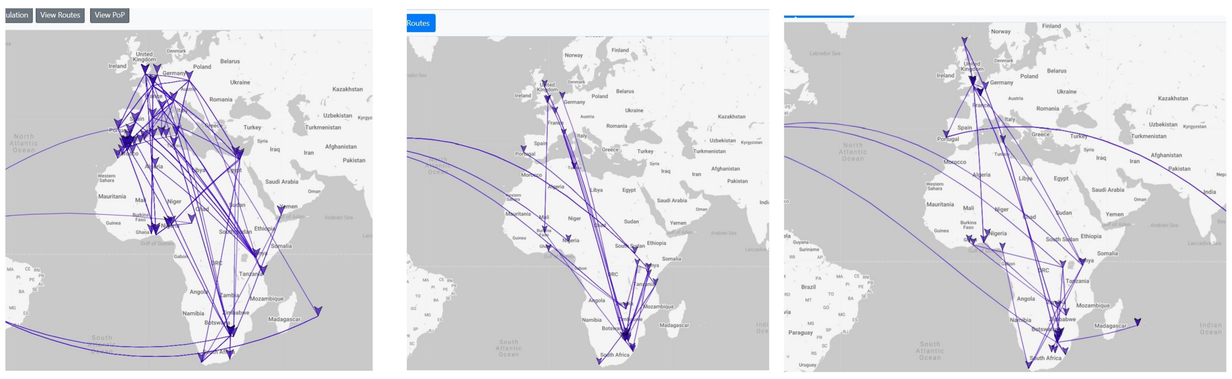
A system architecture diagram showing in more detail how measurement data is fetched by the appropriate module and stored in databases for the next processing stage



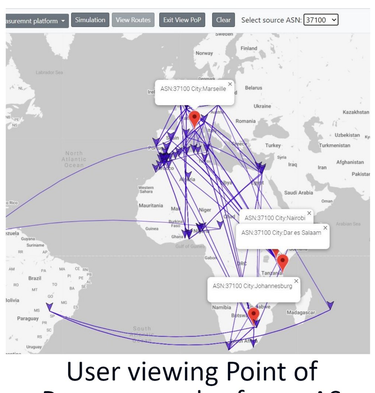
Data Processing and Topology Visualization



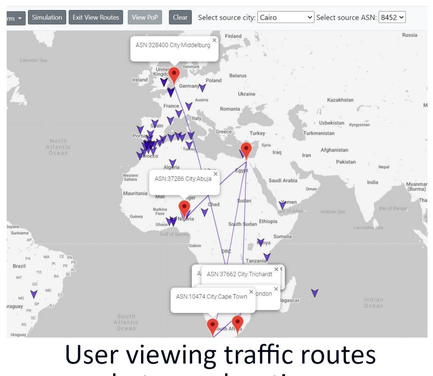
Sequence diagram showing the data processing pipeline from raw measured traces to a visualization



Three visualized topology maps from each of the 3 measurement sources (Speedchecker, Ripe, Caida respectively) showing links between Autonomous Systems

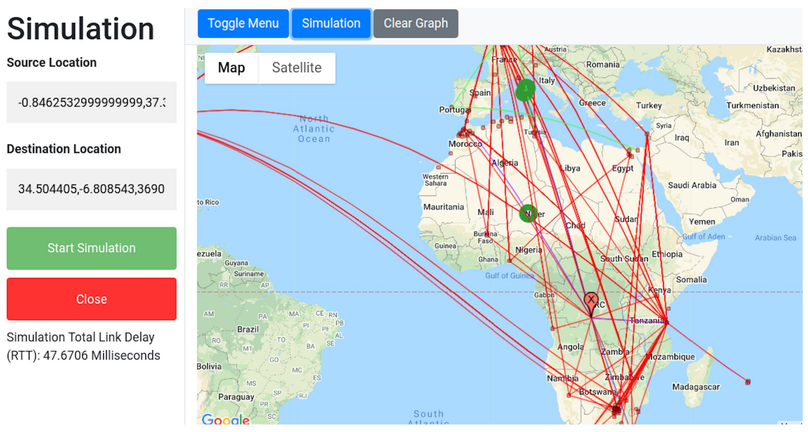


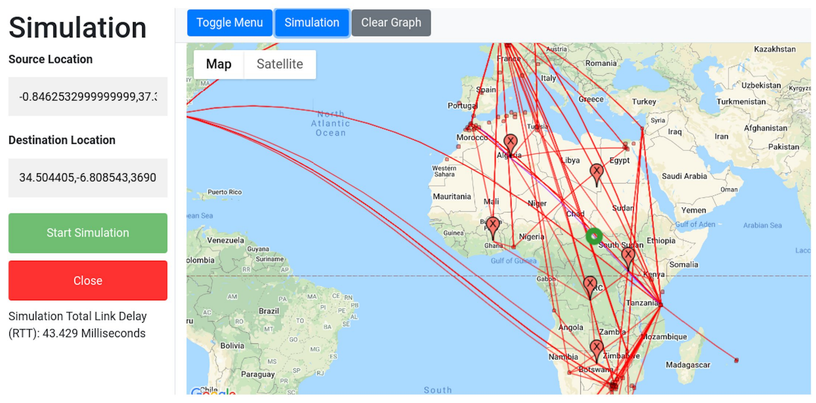
User viewing Point of Presence nodes for an AS



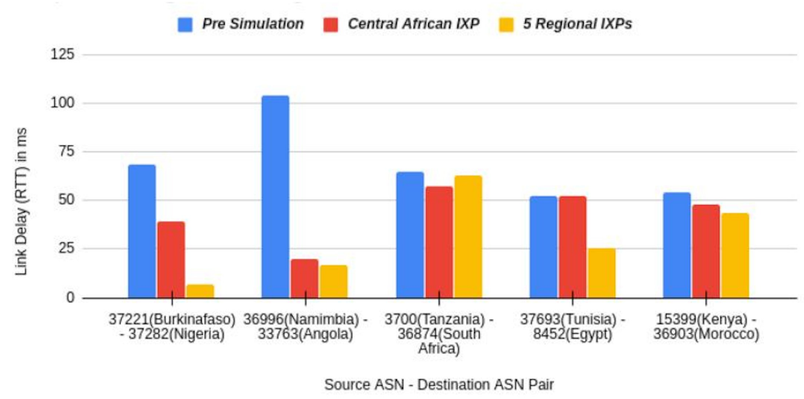
User viewing traffic routes between locations

Topology Simulation





Two different ISP peering scenarios being simulated by the addition of Internet Exchange Points (IXPs) at different locations on the African map. Notice the drop in total link delay when number of IXPs are increased from 1 to 5.



Graph showing how the simulation could be useful to study the intra traffic latency reduction that could be experienced as degree of inter ISP peering increases.

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