# Cape to Cairo and Other African Journeys

Building Africa's digital future

August 2018

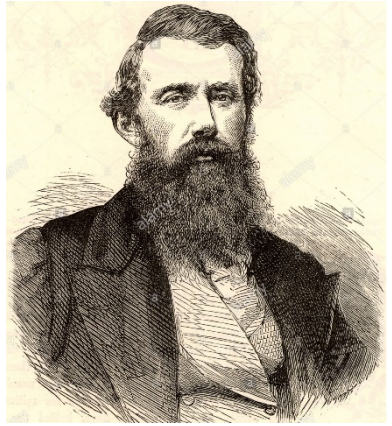
# A Little History (With a dash of Physics)

# Exploration of Africa by Europeans

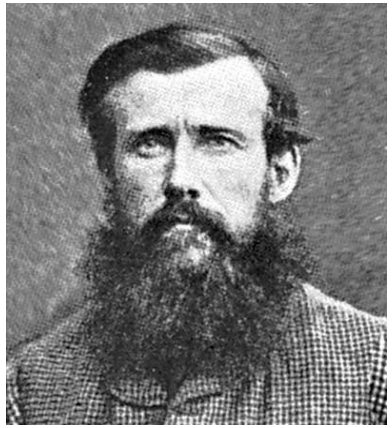
- Explorers travelled to new places to discover new things. The early explorers to Africa wanted to discover the source of River Nile which they had seen in Egypt. Explorers travelled by sea and landed in the coastal towns. They travelled on foot with porters carrying their luggage. Traders were the earliest visitors to Eastern Africa. Early traders who came to the African coast were mainly from *Arabia, India, Persia (Iran), China, Greece and Portugal.* They mainly practised barter trade. They brought manufactured cloth, carpets, spices, salt, gunpowder and guns in exchange for ivory, slaves, gold and rubber.

- James Bruce (1730-94) was a Scottish explorer who set off from Cairo in 1768 to find the source of the River Nile. He arrived at Lake Tana in 1770, confirming that this lake was the origin of the Blue Nile, one of the tributaries of the Nile.

- John Speke was travelling looking for the source of the Nile. In 1856 they reached Ujiji on the shores of Lake Tanganyika. Here they were told by local people that the lake was not the source of River Nile. He reached Lake Victoria and, seeing waterfalls leaving Lake Victoris, was convinced that it was the source of River Nile although he had no proof. Together with James Grant he travelled Northwards along the Nile. When he reached England, he published articles about his discoveries in Eastern Africa



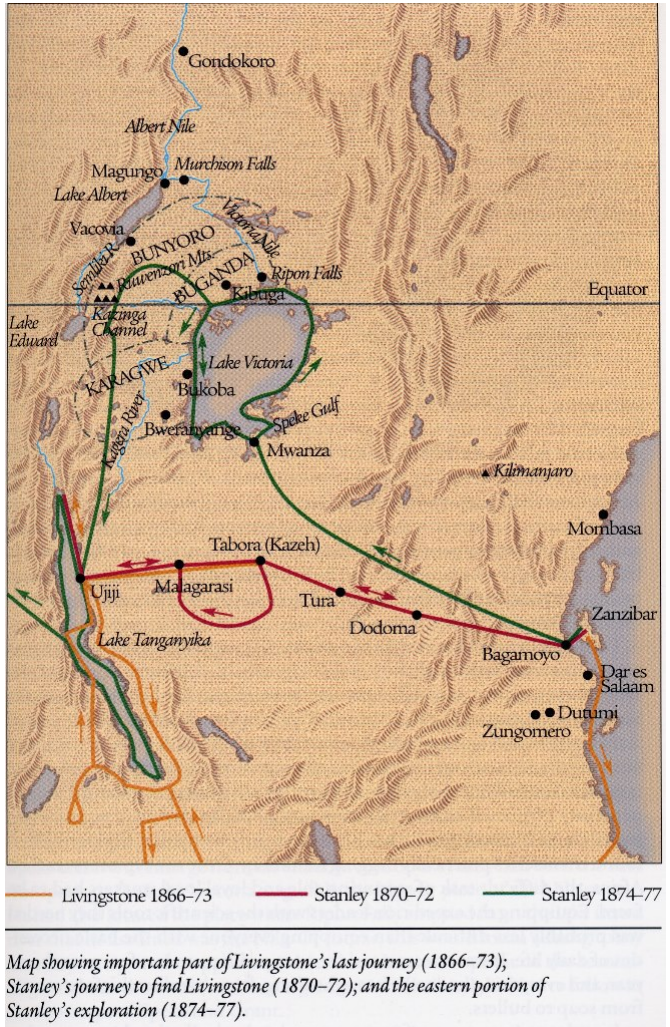
**Name:** John Speke
**Born**: 4 May 1827, Buckland Brewer, United Kingdom
**Died**: 15 September 1864, Neston Park, United Kingdom



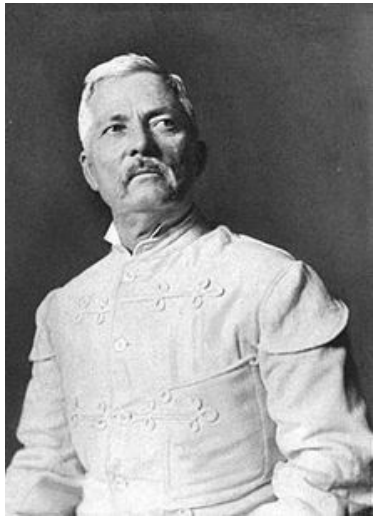
**Name:** James Bruce
**Born**: 14 December 1730, Stirlingshire, United Kingdom
**Died**: 27 April 1794, Scotland, United Kingdom

# Further Exploration of East & Central Africa

- Henry Morton Stanley was a British explorer. He came to East Africa to look for David Livingstone, a missionary who had come to Africa and not returned home.
- He travelled over 700 kilometres through the dense tropical forests. He hoped that the journey through Africa would bring him fame and wealth.
- In 1871, he found Livingstone in Ujiji.
- Stanley wrote a book when he returned home to describe his adventures in Central Africa.
- In 1873, Stanley decided to continue with his travels. He travelled along River Congo to see if he could discover more new things in Africa.
- In 1877, he reached the Atlantic Ocean. He then wrote a book entitled “Through the Dark Continent.”



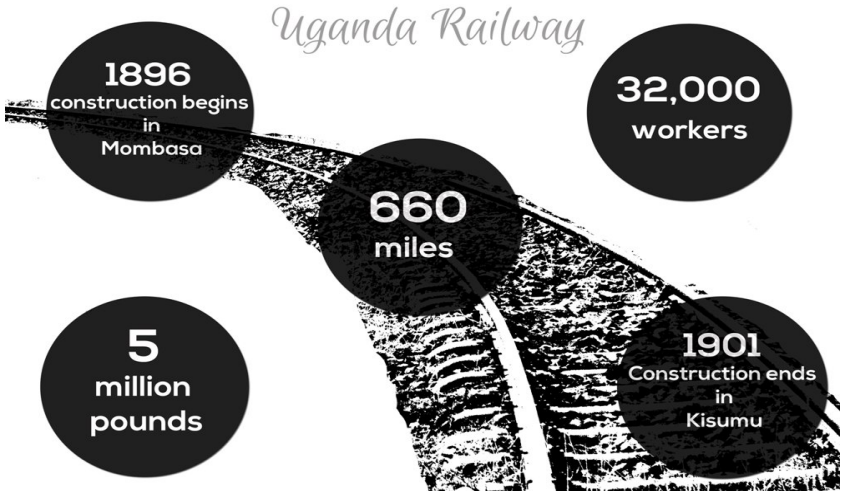

*Map showing important part of Livingstone’s last journey (1866–73); Stanley’s journey to find Livingstone (1870–72); and the eastern portion of Stanley’s exploration (1874–77).*



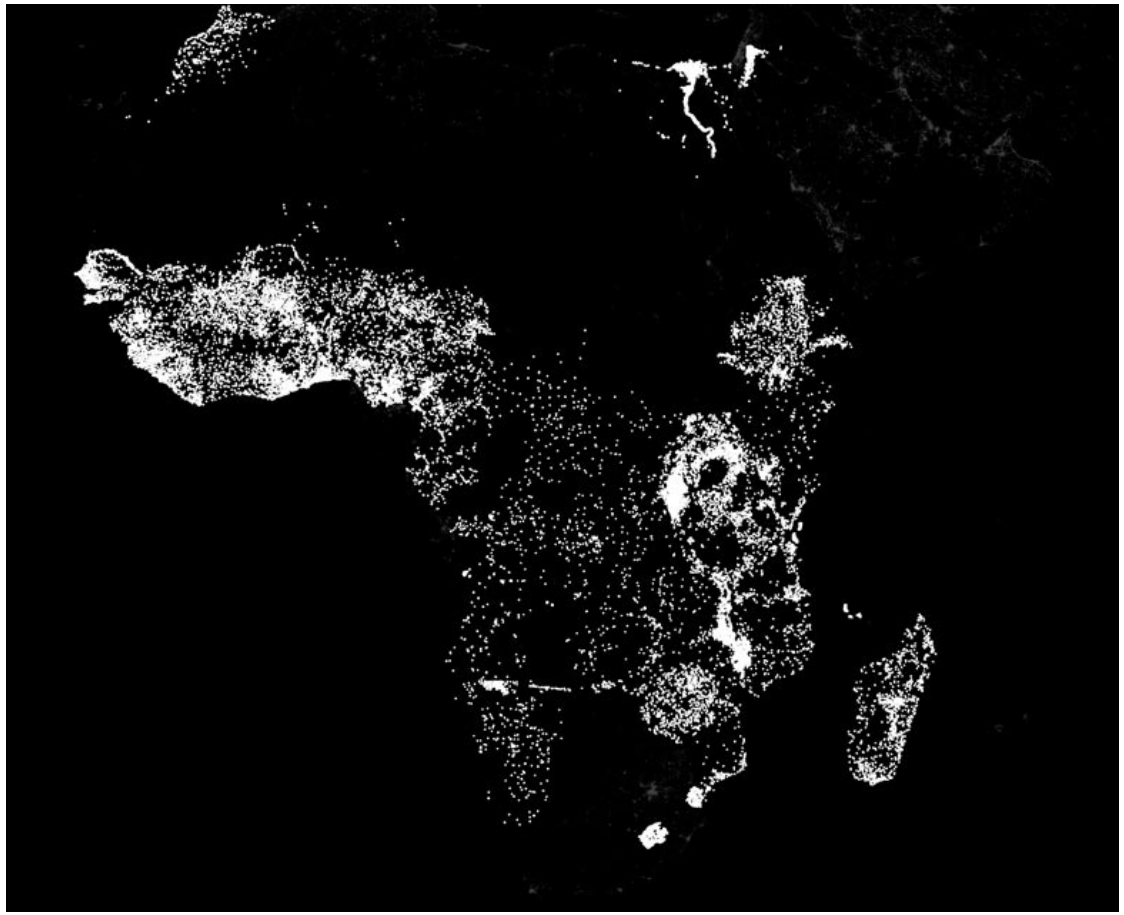
**Name:** Henry Morton Stanley
**Born**: 28 January 1841, Denbigh, United Kingdom
**Died**: 10 May 1904, London, United Kingdom

# The Lunatic Express: Mombasa to Port Bell

- The term Lunatic Express was coined by Charles Miller in his 1971 book The Lunatic Express: An Entertainment in Imperialism. Now, more than 3 decades since its conception , no other term could best describe The Uganda Railway and the adversities that befell its construction. The railway was a purely strategic endeavour having been built by the British to protect their interests in Uganda from the Germans. As is evident, it was named after its ultimate destination (Uganda) despite the fact that all 660 miles of it lay in what is today Kenya.
- Building of the railway commenced in 1896 at the port of Mombasa and two years later the first passenger train left Mombasa for Voi. Construction was finally completed at the port of Kisumu (Port Florence) on the 20th of December 1901.
- While the Uganda Railway cost the British government £5.3 million (about Shs21 billion) to construct, the evidence shows that this was, in reality an export subsidy, rather than a capital investment that wouldn't look out of place with some donor projects today.
- The extension of the railway dramatically changed the trade environment in the region. In Mombasa, where the railway had first been built, trade through the Kilindini Harbour grew from £1.6 million in 1908-9 to £3.7 million in 1911-12, according to traveller and historian Norman Maclean.



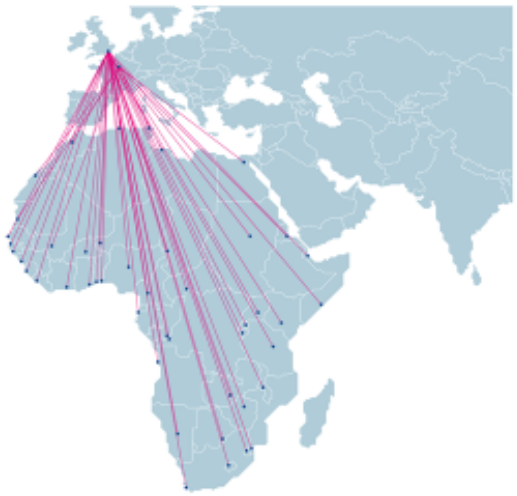
# No Longer a Dark Continent – but BIG



# AFPIF2012 TBT – Mike Silber, Liquid Telecom

## African Internet 2012

Artists Impression...



- Mostly sub sea Trunk Routes
- Multiple sub sea routes and competition leading to lower pricing
- Internet hubbing mostly in Europe
- IXP of choice for Africa is LINX
- Some cross border connections, mostly selling commercial transit to countries with no landing stations
- Nearly all countries have local IXP. Many of these have participation from local incumbent Telco
- Cheaper than before
- Latency to Europe about 50% less, inter Africa Latency still about the same as a direct satellite

## African Internet 2022?

- Fully meshed terrestrial Internet?
- Less direct connections to subsea cables?
- Cross border peering will be a reality
- But who will do the cross border peering?
- We don't expect to see a pan African IXP
- Will the African Internet backbone be 'owned' by African operators or traditional tier 1 USA based carriers?
- Will there be content and traffic to support this?

# AFPIF 2017 TBT – Patrick Christian, Telegeography

LIQUID TELECOM

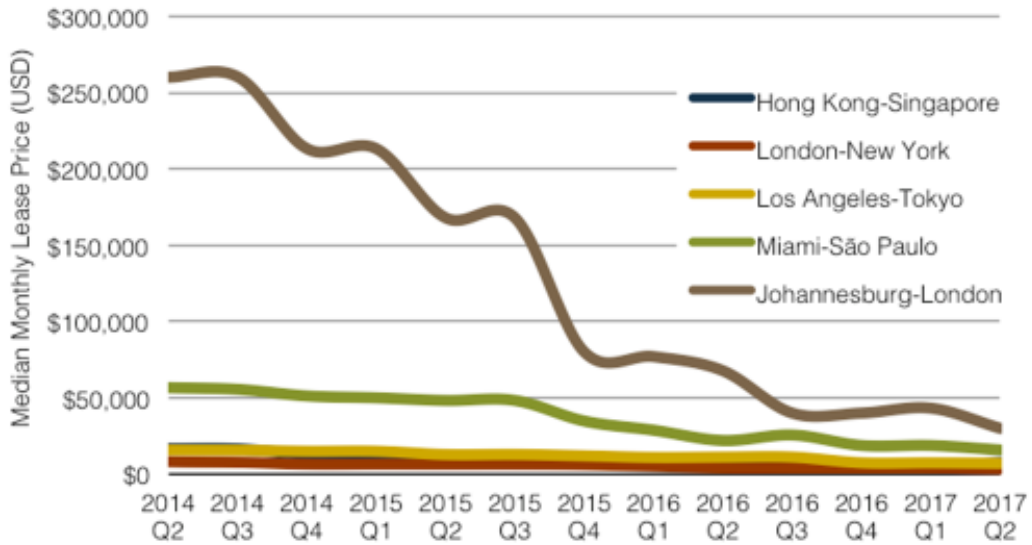
## Intra-African Routes

Major International Internet Routes within Africa, 2017

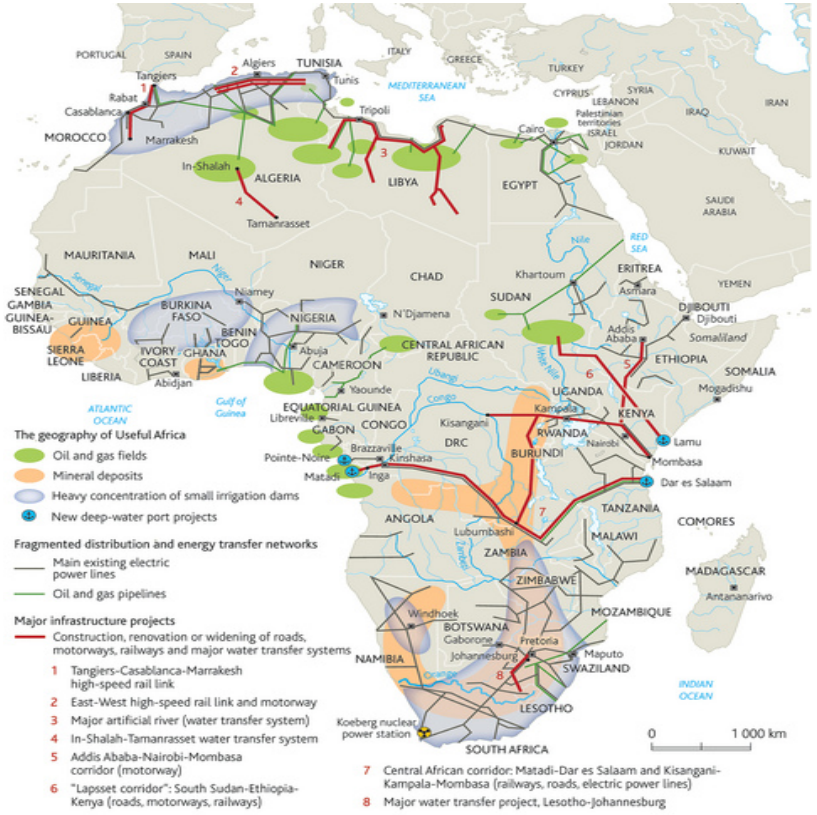


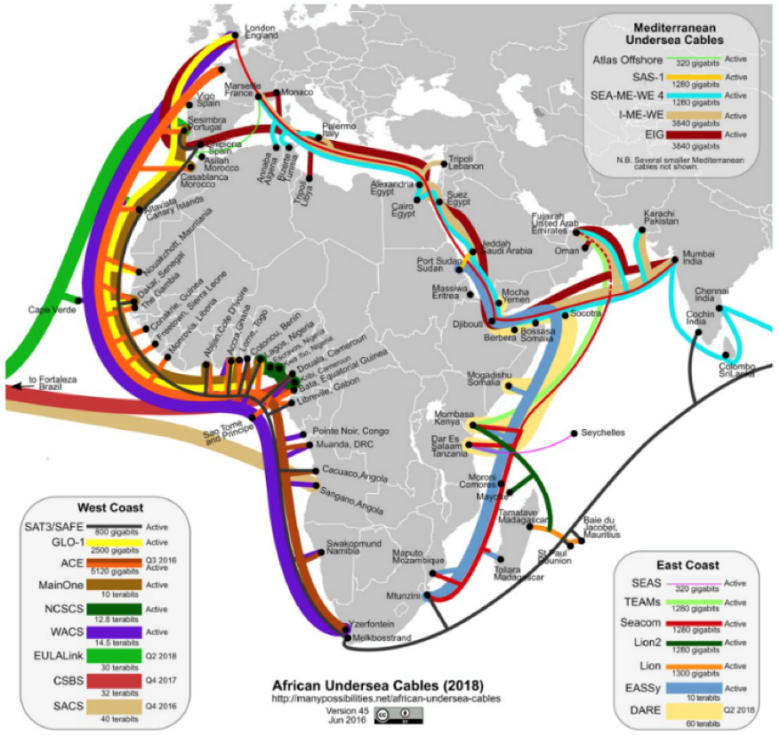

## 10G Wave Prices Dropping Fast

Median 10 Gbps Wavelength Price Trends on Major Intl Routes



# Broadband data networks follow road, rail & ports



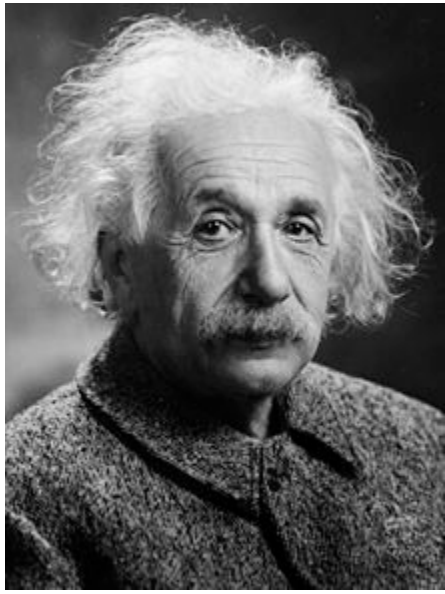
# The Laws of Physics

Theories
- Speed of light in a medium = c / refractive index
- Velocity= Distance/Time

UoM
- 1 ms = 1 second /1000
- RTT = Round trip delay – Time taken there and back
- 1 km = 1000 m

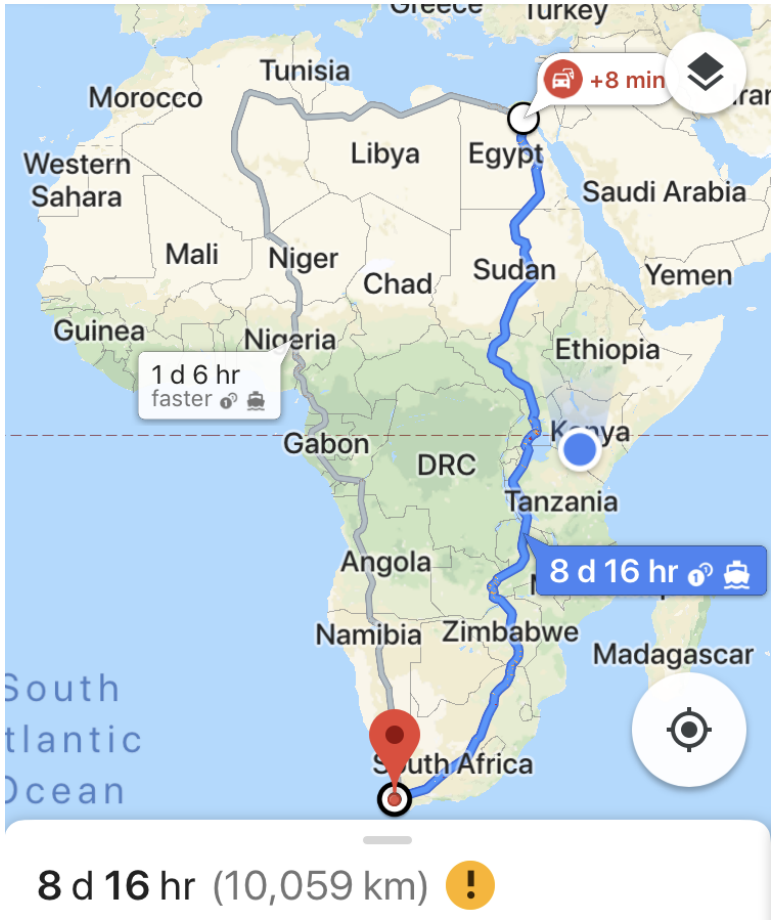
Universal Constants
- Speed of light in a vacuum (c) is 2.99 x $10^8$ m/s
- Refractive index of doped silica with an index around 1.4475
- Speed of light in fibre = 2.06 x $10^8$ m/s

RTT (ms) = 1000 x 2 x Distance(m) / 2.06 x $10^8$ m/s

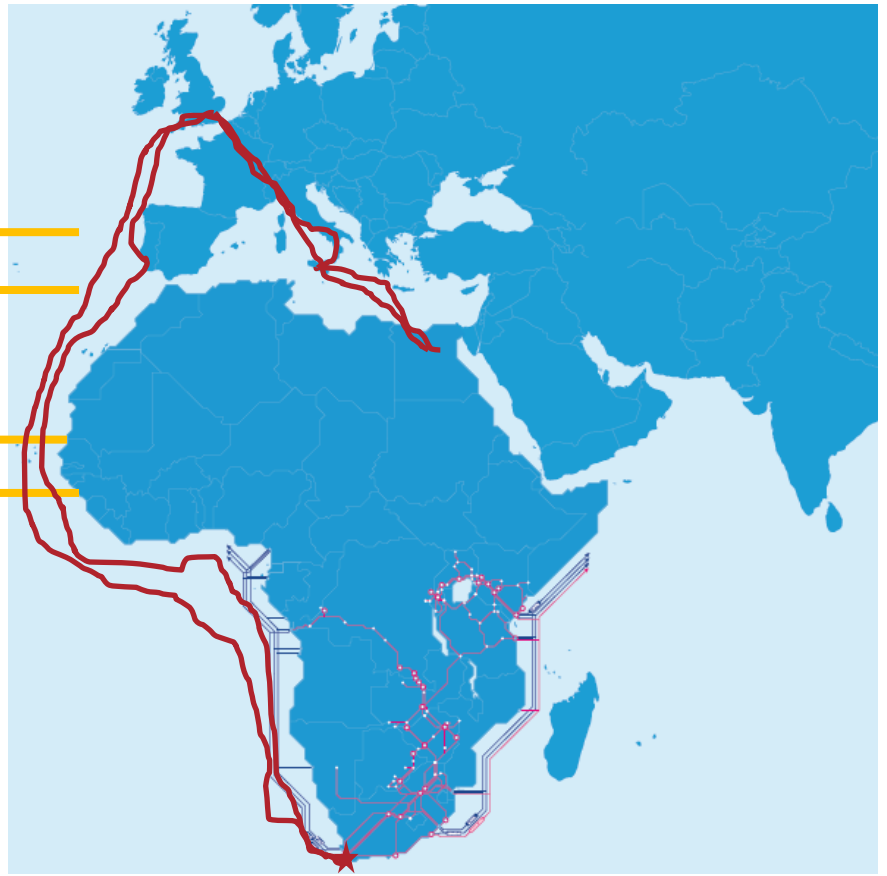
# Lets Take a few Journeys

# Cape to Cairo – 97 ms?

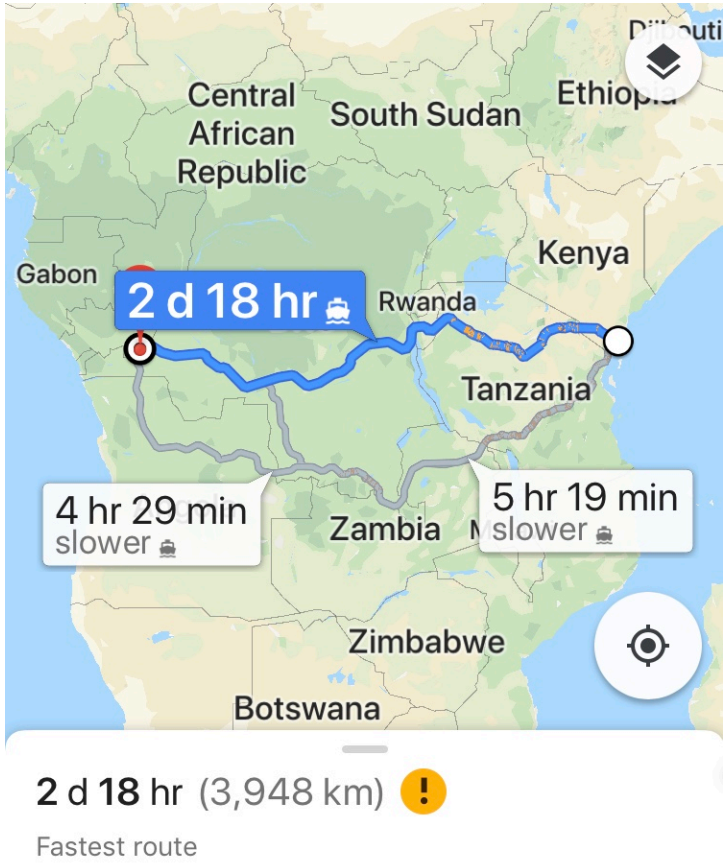



LZA-PE1-CPT#traceroute 41.209.193.1
1 teng0-1-0-1.luk-pe1-gsw.liquidtelecom.net
2 be5.luk-pe1-tho.liquidtelecom.net
3 xe2-1-6.londra32.lon.seabone.net
4 be3.palermo16.pal.seabone.net
5 telecom-egypt.palermo16.pal.seabone.net

**209 msec**



# Mombasa to Kinshasa – 38 ms?




LKE-P1-MSA#traceroute 41.243.13.1
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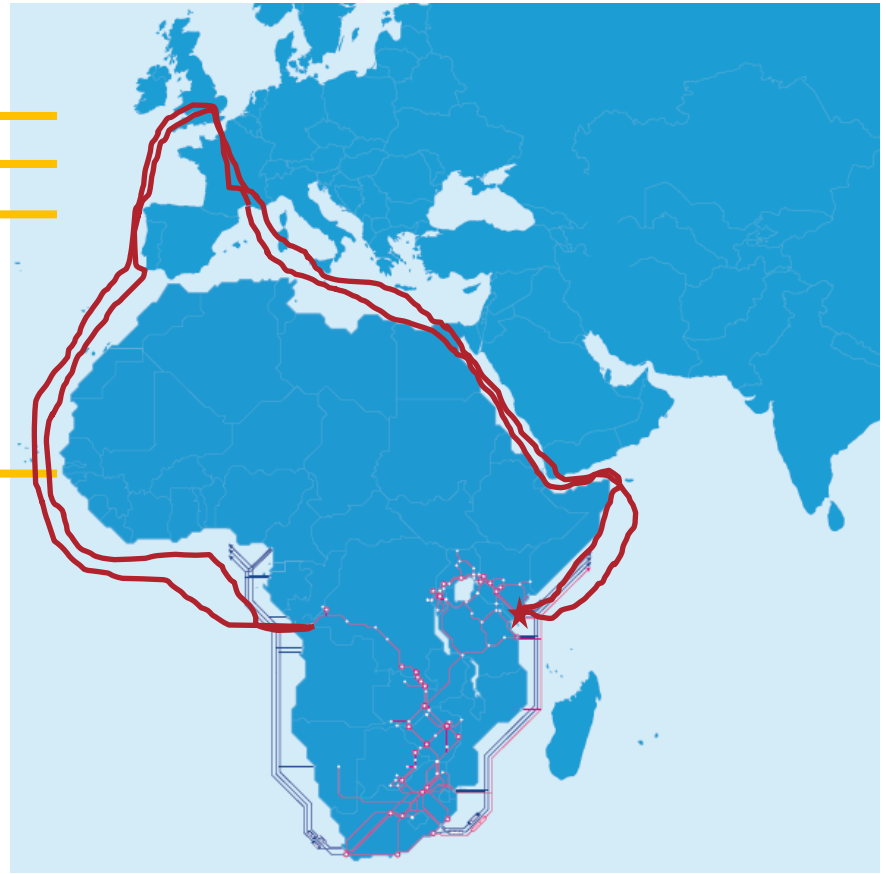
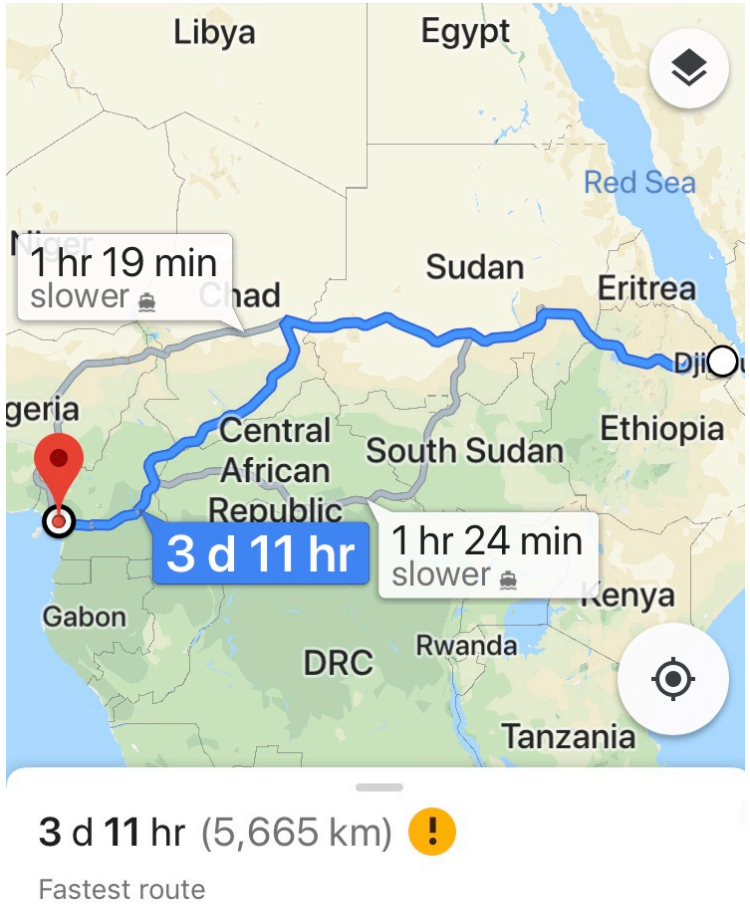
2 te0-0-0-0.luk-pe1-gsw.liquidtelecom.net
3 be5.luk-pe1-tho.liquidtelecom.net
4 5.11.10.95 145
5 195.66.226.204 131
6 182.79.222.165
7 125.62.187.189
8 dsl-del-static-078.45.246.61.airtelbroadband.in
9 41.243.13.1 302

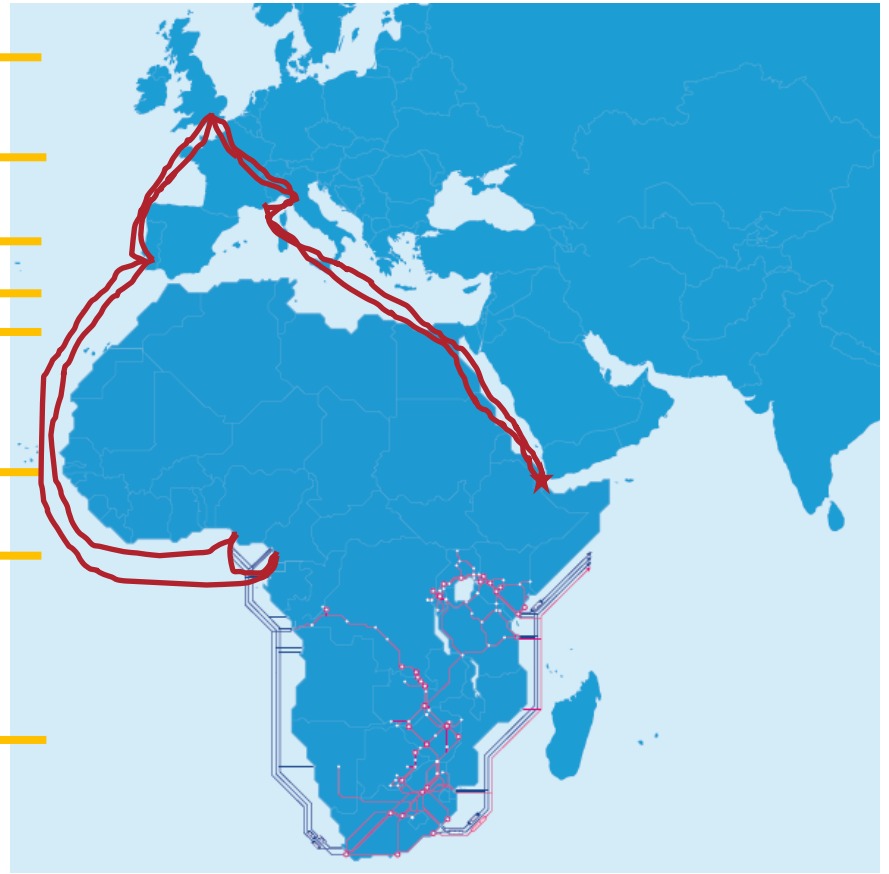
**296 ms**



# Djibouti to Douala – 55 ms?

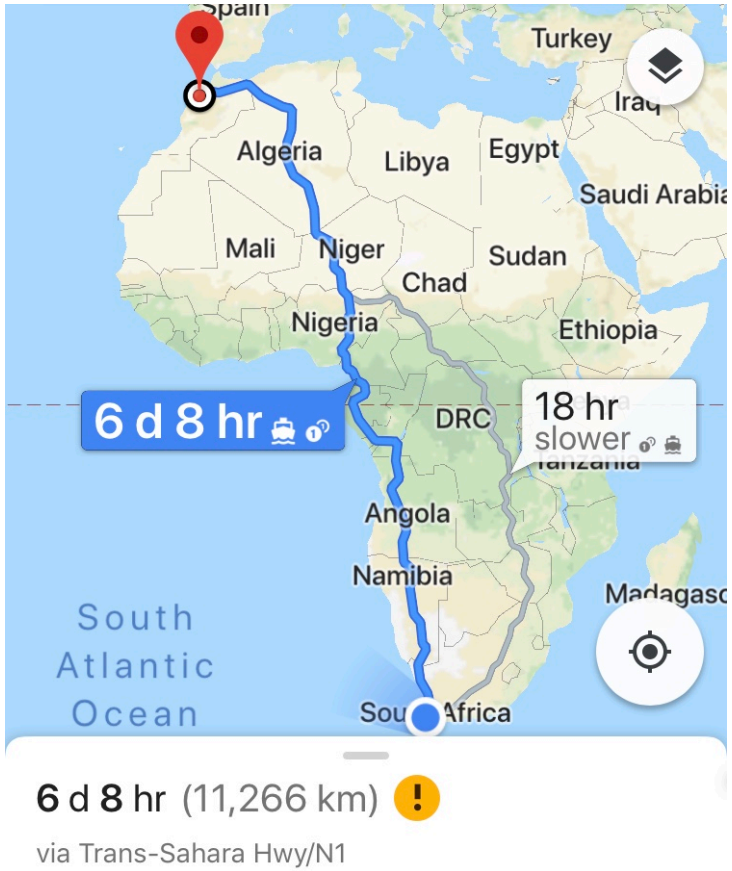



traceroute camix.cm
1 196.49.10.65
2 41.189.225.153
3 te0-7-0-27.ccr21.mrs01.atlas.cogentco.com
4 be2314.rcr21.mil01.atlas.cogentco.
5 ix-ae-12-0.thar1.wi3-milan.as6453.
6 if-ae-18-2.tcore1.pye-paris.as6453.net
7 if-ae-3-2.tcore1.l78-london.as6453.net
8 if-ae-2-2.tcore2.l78-london.as6453.net
9 if-ae-2-2.tcore1.sv8-highbridge.as6453.net
10 if-ge-6-0-0.core1.sz5-seixal.as6453.net
11 195.219.129.10
12 41.75.80.242 Lagos
13 41.75.81.46
14 154.72.175.205
15 197.159.9.6
16 197.159.1.158



202 ms

# Cape to Casablanca – 109 ms?




```
LZA-PE1-CPT#traceroute 197.230.43.17
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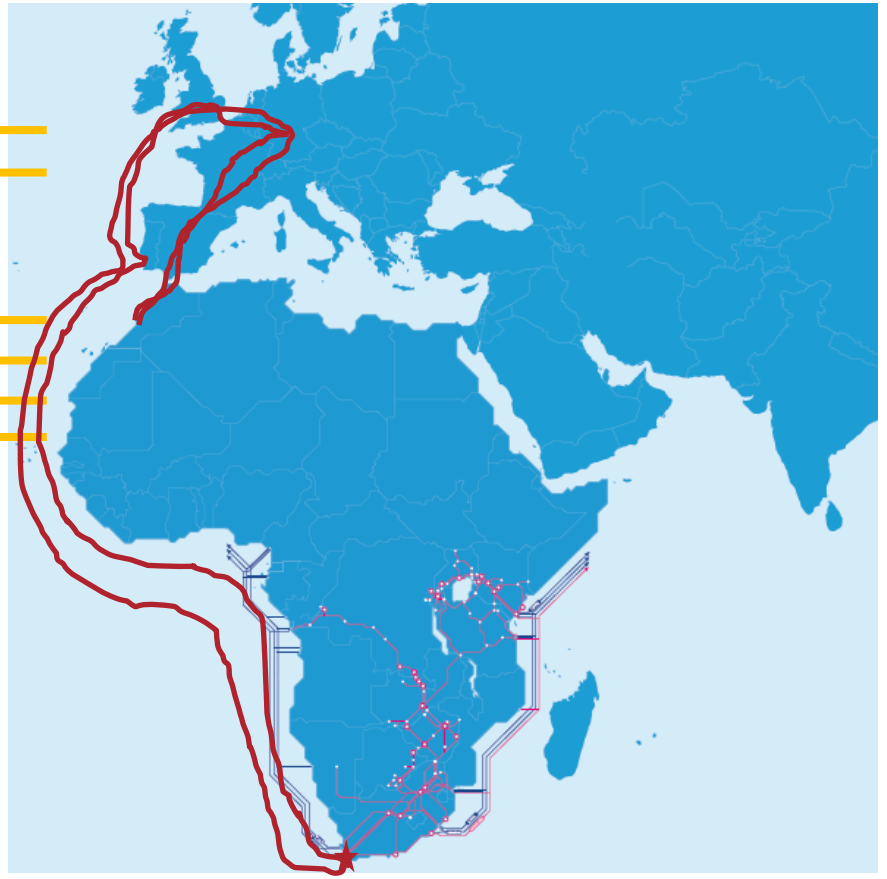
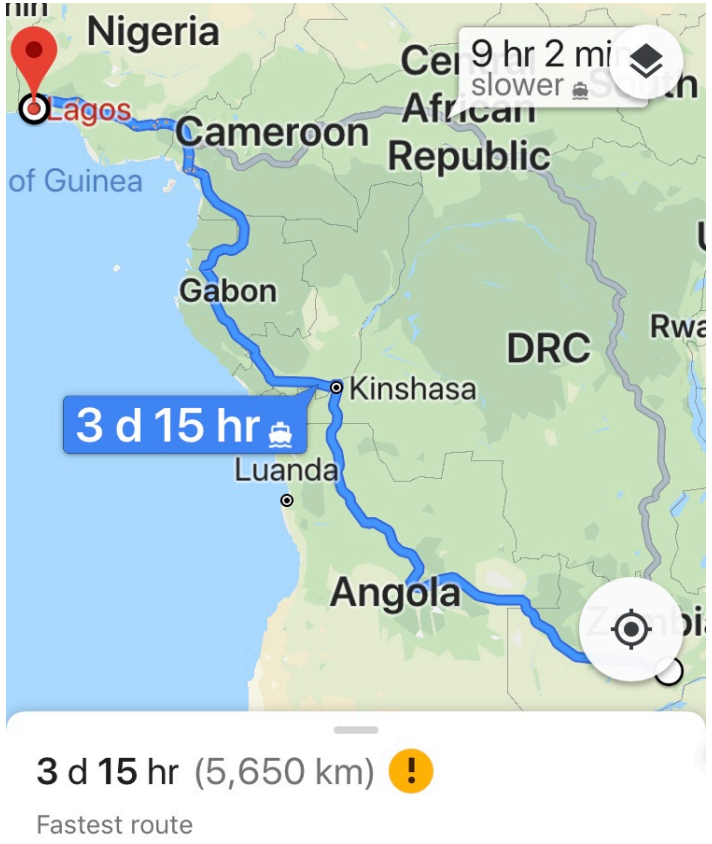
2  Bundle-Ether3.luk-pe1-tho.liquidtelecom.net
3  ix-xe-0-3-3-100.tcore2.ldn-london.as6453.net
4 195.219.83.86
5  et-2-0-2-0.ffttr6.frankfurt.opentransit.net
6  hundredgige2-5-0-2.auvtr4.aubervilliers.opentransit.net
7   hundredgige0-8-0-1.madtr3.madrid.opentransit.net
8   81.52.188.108
```

192 msec

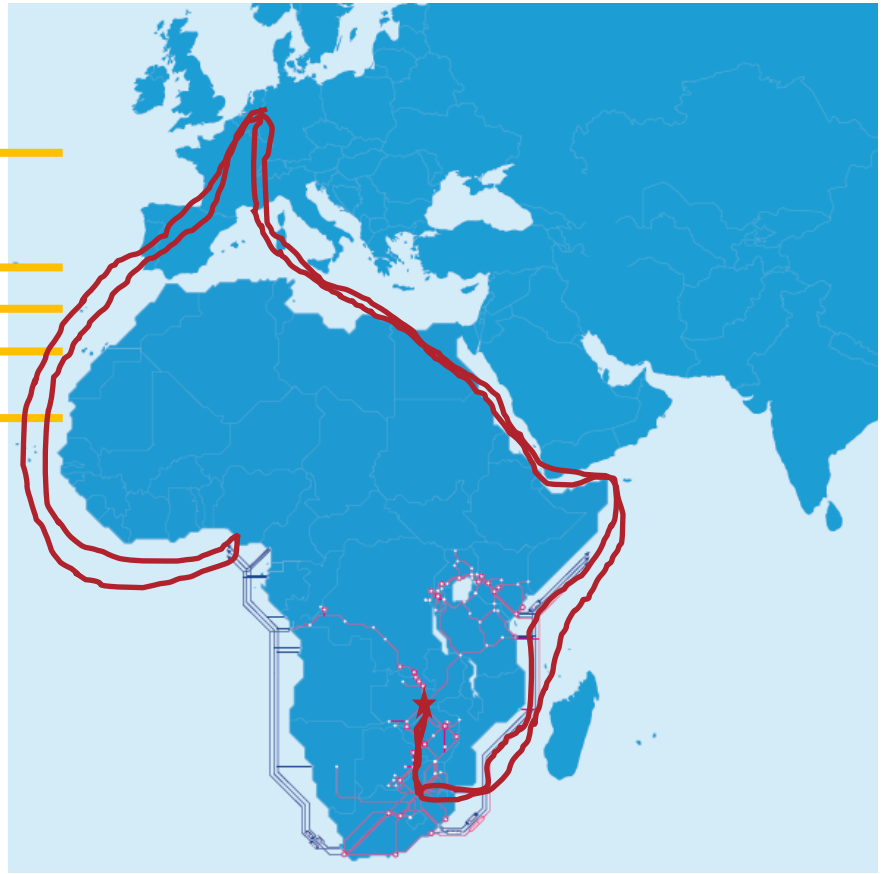


# Lusaka to Lagos – 54 ms?




```
LZM-PE1-LSK#traceroute 41.222.79.4
1  teng0-0-1-1.lzm-p1-rr-lsk.liquidtelecom.net
2  teng4-0-1-p1-byo.liquidtelecom.net
3  tengig0-2-0-4.lza-p3-jhb.liquidtelecom.net
4  tengig0-0-0-4.lfr-pe1-mrs.liquidtelecom.net
5  80.249.208.138 AMSIX
6  41.75.80.222
7  41.75.84.86 309
8  mail.nira.org.ng
```

**299 ms**



# Maputo to Madagascar – Packets eventually find a way there even if Google and Lonely Planet Can Not


- No Direct Flights
- No passenger boats
- Lonely Planet advises that the only way is to ask around in Maputo harbour and hitchhike a freighter

```
LMZ-PE1-MPT#traceroute 41.204.120.154
1 41.60.134.226   pos8-2-2-lza-p2-
jhb.liquidtelecom.
2 bundle-eth10-p4-jhb.liquidtelecom.net
3 tengig0-3-0-7-pe1-cpt.liquidtelecom.net
4 ten0-0-0-7.luk-p1-tho.liquidtelecom.net
5 bundle-eth1.luk-pe1-tcy.liquidtelecom.net
6 10ge3-10.core1.lon2.he.net
7 100ge1-2.core1.par2.he.net
8 gulfsat.par.franceix.net
9 pe-th2-2-po2.malagasy.com
10 rtr-ixp-3-te4-0-0-3752.malagasy.com
 11 mainrouter-3-bond0.malagasy.com
 12 mainrouter-3-bond0.malagasy.com
 13 bwmgr-tc-3-eth9.malagasy.com
 14 pe-andranoabo-1-tengiga3-2.malagasy.com
 15  *  *  *
 16 corporate-portal.malagasy.com
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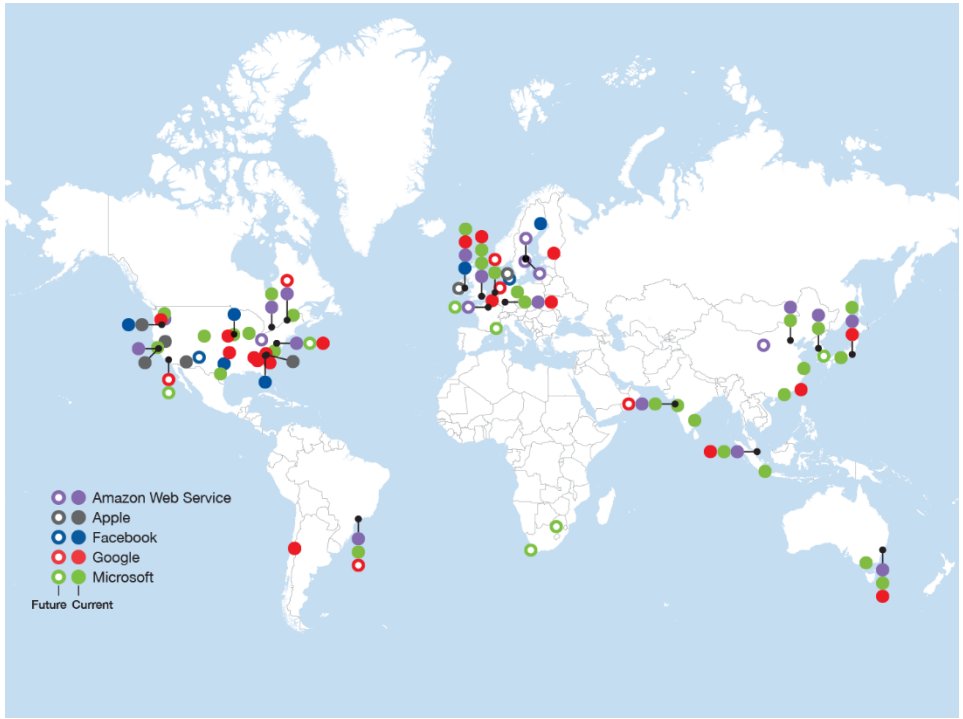
**589 msec**

# Content has been coming but Microsoft are the first of the ‘big 5’ to announce a Major Cloud Data Centre in Africa



# 2012-22 – Where are we?

- Terrestrial networks are there but Sub sea still carrying most of traffic between major hubs, JHB, Cape Town, Nairobi, Djibouti, Cairo
- Pricing of bandwidth driving lower, in line with South Africa, approaching LATAM pricing
- Internet hubbing mostly in Johannesburg, Nairobi… And Southern Europe
- IXP represented by most African Nations is NAP Africa
- Most countries have a fibre network - Many cross border connections – not all are active
- More countries have local IXP. We have multi site DCs in JHB, Durban, Cape Town
- Inter Africa Latency has reduced but often 2 to 4 times more than direct path
- Fully meshed terrestrial Internet has emerged in SADC and EAC regions only
- Cross border peering does not seem to be happening yet for peerings sake
- Regional IXPs have emerged where networks connect to via longlines ‘INX Anywhere’
- A number of African internet backbone companies - combination of terrestrial and Sub sea
- Content and traffic is here and more keeps coming

# What are the Future Drivers

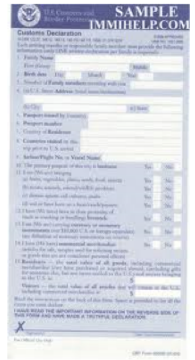
# To Travel Across a border…..

To Travel across a border You need

- A valid document to be present on both sides of the document (Passport + Visa)
- A means of travel (Plane, Train, car)
- Proof of payment of that means of travel (ticket, vehicle log book)
- To declare any goods you carry across and pay appropriate taxes
- Yellow fever certificate
- A reason to go  (holiday, business etc)

To build a network across a border you need

- A valid licence to operate appropriate telecoms services on both sides of the border
- A means of crossing the border (road route, rail route, overhead lines, undersea cable)
- Permission to cross the land on either side (often involves various different landowners and authorities)
- Respective companies either side charge for services and pay the appropriate taxes
- A reason to cross the border (consumer demand or business case)





# Infrastructure Mega Projects

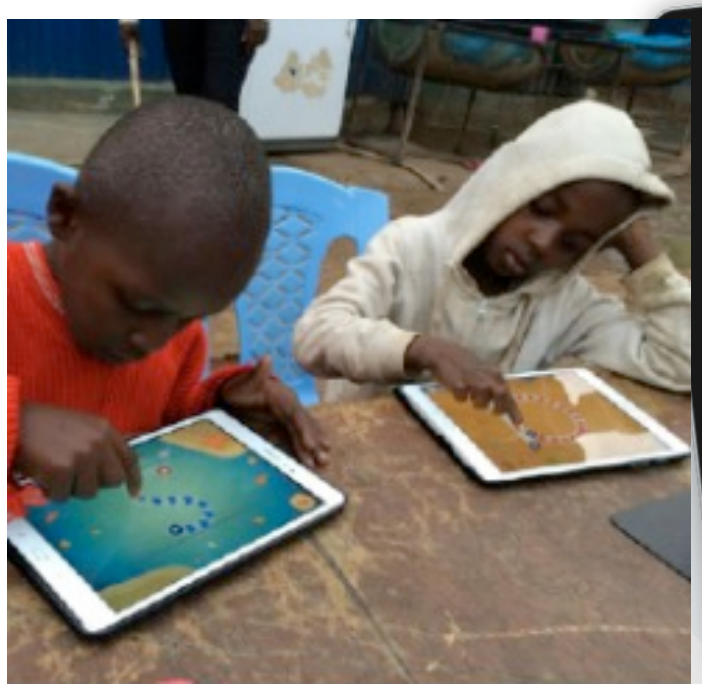
# Digital Transformation Starts Here

# 2018 Africa  Free Trade Agreement

Intra-African trade at the moment sits at approximately 10%, whereas intra-European and Intra-North American trade sits at 30% to 40% within those continents

The deal creates a continental market of 1.2 billion people, with a combined gross domestic product of more than $3.4 trillion

# Africa Rising Youth



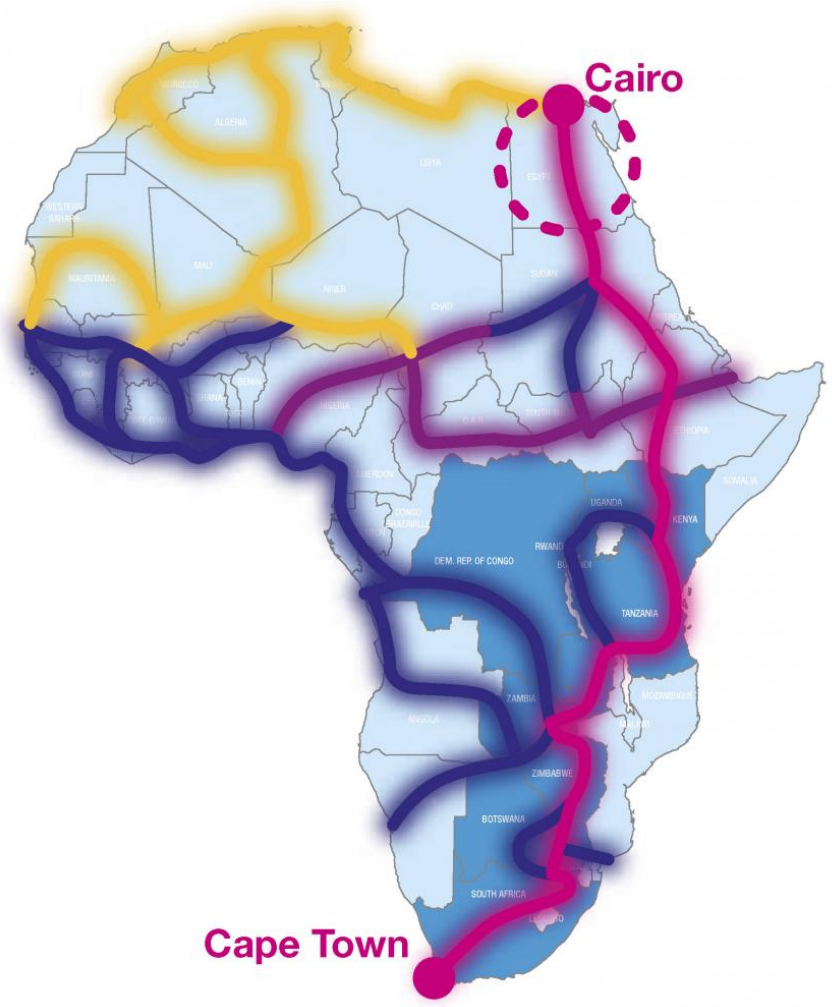

Last year's Nairobi Comic Convention attracted gamers from across three countries

https://www.liquidtelecom.com/information-centre/whitepapers/african-generation-z-report

# Things!

- Agriculture
- Health
- Utilities – water, sewage, electricity
- Smart cities – service delivery, Intelligent Transport Systems
- Transportation & Logistics
- Financial services
- Security
- Environment & Wildlife

# Our Vision of the Future




Infrastructure Growth

- Cape to Cairo North South in 2018
- Multiple Routes will cross East to west by 2020
- Continued combination of private and public sector investments in fibre
- Liquid Telecom will continue to build and also partner with other established fixed line fibre networks
- A West African Hub will emerge – but where?

Outcomes

- Digital Transformation of Africa's businesses and public sector driving shift to the cloud
- Africa's exploding youth population producing a billon 'digital natives'
- 1 Billon Things connected
- Africa trade agreement driving intra African trade

https://www.youtube.com/watch?v=kAxD9qy9rPM

Africa's Cloud
is Liquid.™

# Thank you

ben.roberts@liquidtelecom.com