NICIS
NATIONAL INTEGRATED CYBERINFRASTRUCTURE SYSTEM
SANReN

South African NREN Connectivity

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SANReN

South American – African Astronomy Coordination Committee (SA3CC) Meeting
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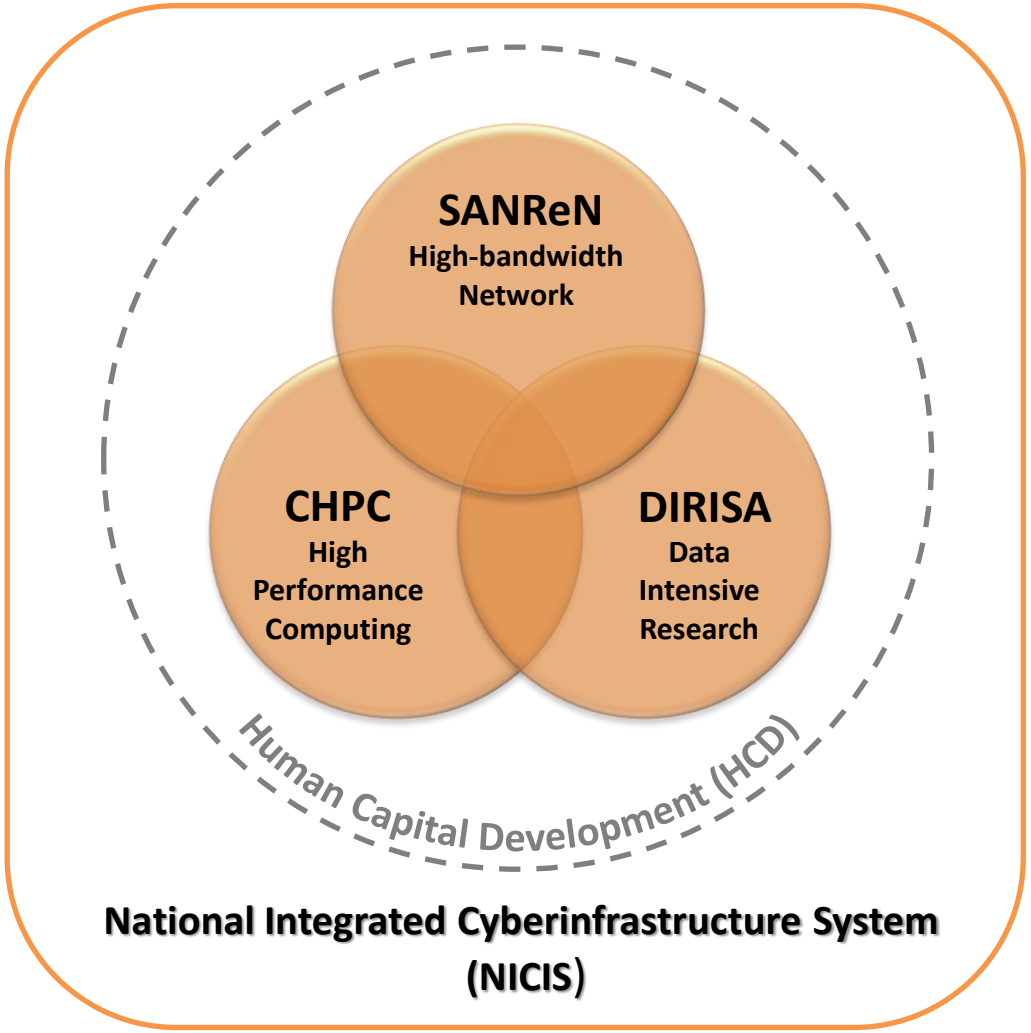
Outline

- South African NREN (SA NREN) Overview
- South African Connectivity (Local and International)
- Support to Astronomy
- SANReN Services

Background: NICIS

- National Integrated Cyberinfrastructure System (NICIS)
- Structure
  - South African Research Network (SANReN)
  - Centre for High Performance Computing (CHPC)
  - Data Intensive Research Initiative of South African (DIRISA)
  - HCD encompasses the 3 pillars
- NICIS is a hosted programme of the DSTI
- Hosted at the CSIR as a centre in NGEI Cluster, Smart Society Division



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SANReN, https://www.sanren.ac.za/ | CHPC, https://www.chpc.ac.za/ | DIRISA, https://www.dirisa.ac.za/ | https://www.dsti.gov.za/

The South African National Research and Education Network (SA NREN)

- Structure
  - Roles and responsibilities of the de facto South African NREN are distributed between SANReN and TENET
- Functions
  - SANReN
    - Builds the Network (network reach and capacity)
    - Develops Advanced Services
  - TENET
    - Operates the SANReN Network under terms of collaboration agreement with CSIR
    - Build onto the network
    - Host Services
    - Represents South African NREN at UbuntuNet Alliance (founding member) – Regional REN for South East Africa
    - SABEN – entity for the connection of TVET colleges

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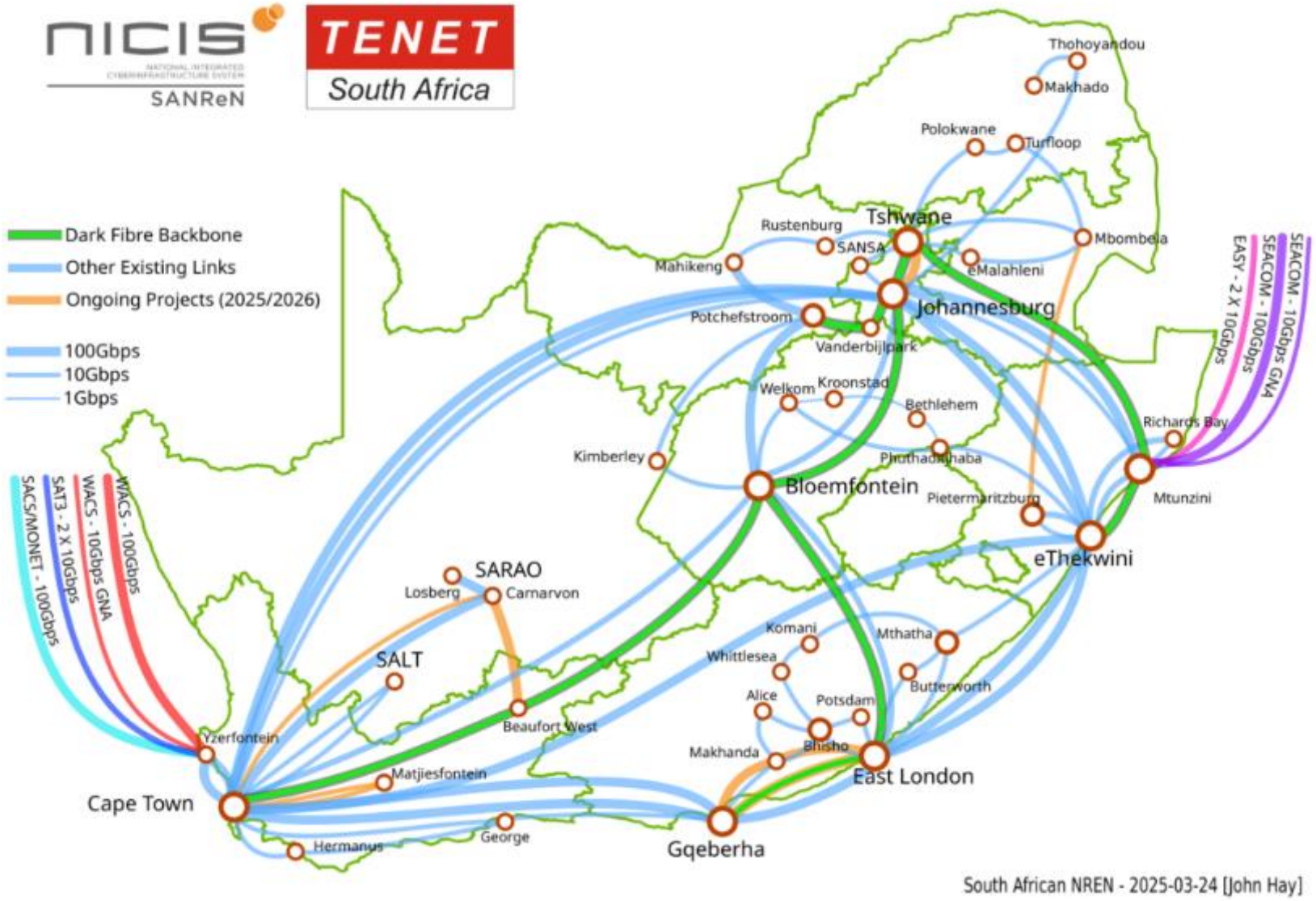
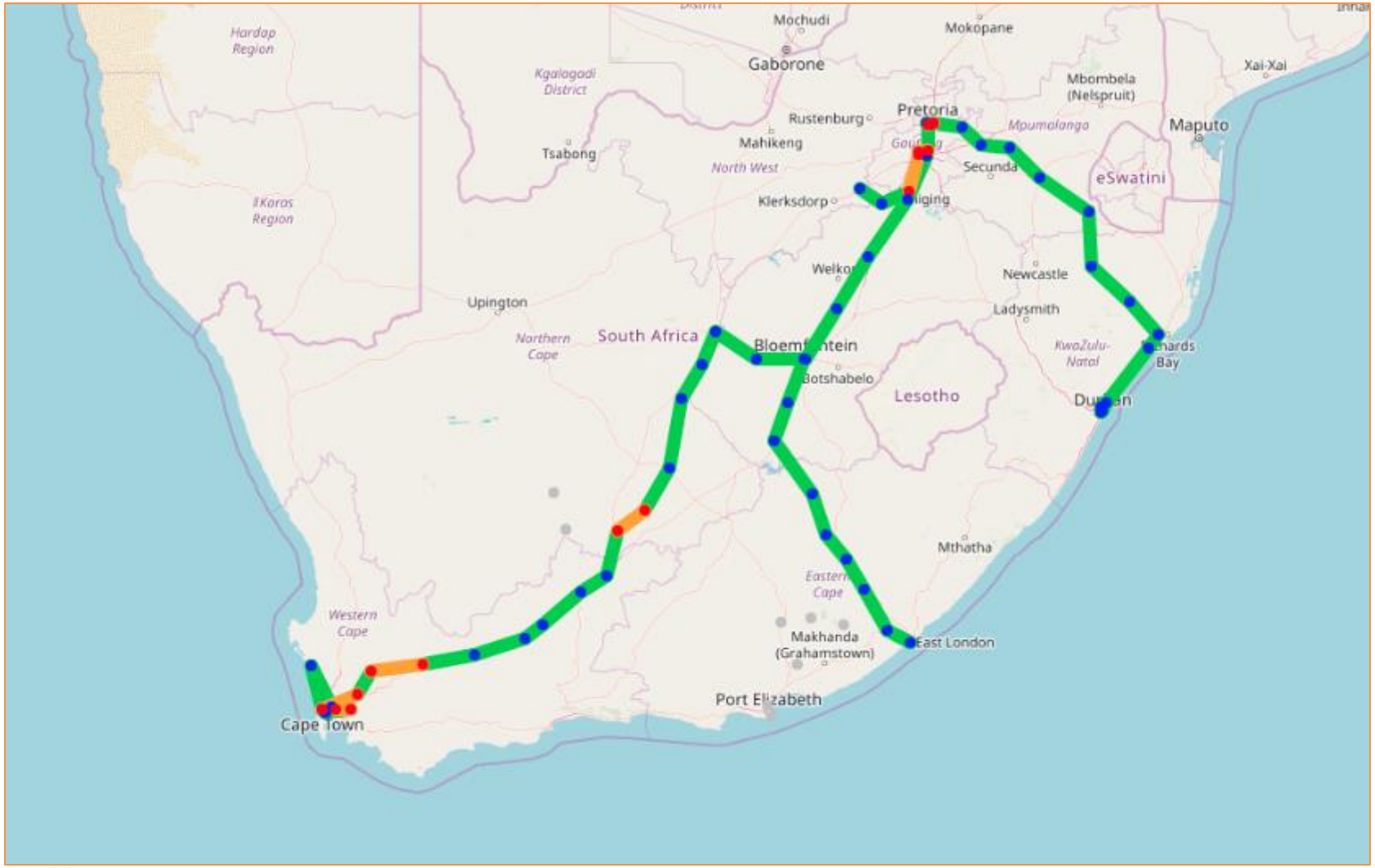
TENET, https://www.tenet.ac.za/ | SANReN, https://www.sanren.ac.za/

South African Connectivity



- Infrastructure:
  - a core national dark fibre backbone
  - Meshed with several managed bandwidth backbone links at 100Gbps
  - backbone extensions (regional links) – typically at 10Gbps
  - back-hauling from the submarine cable landing stations at Yzerfontein and Mtunzini
  - Capacity on undersea cables
  - several metropolitan area networks

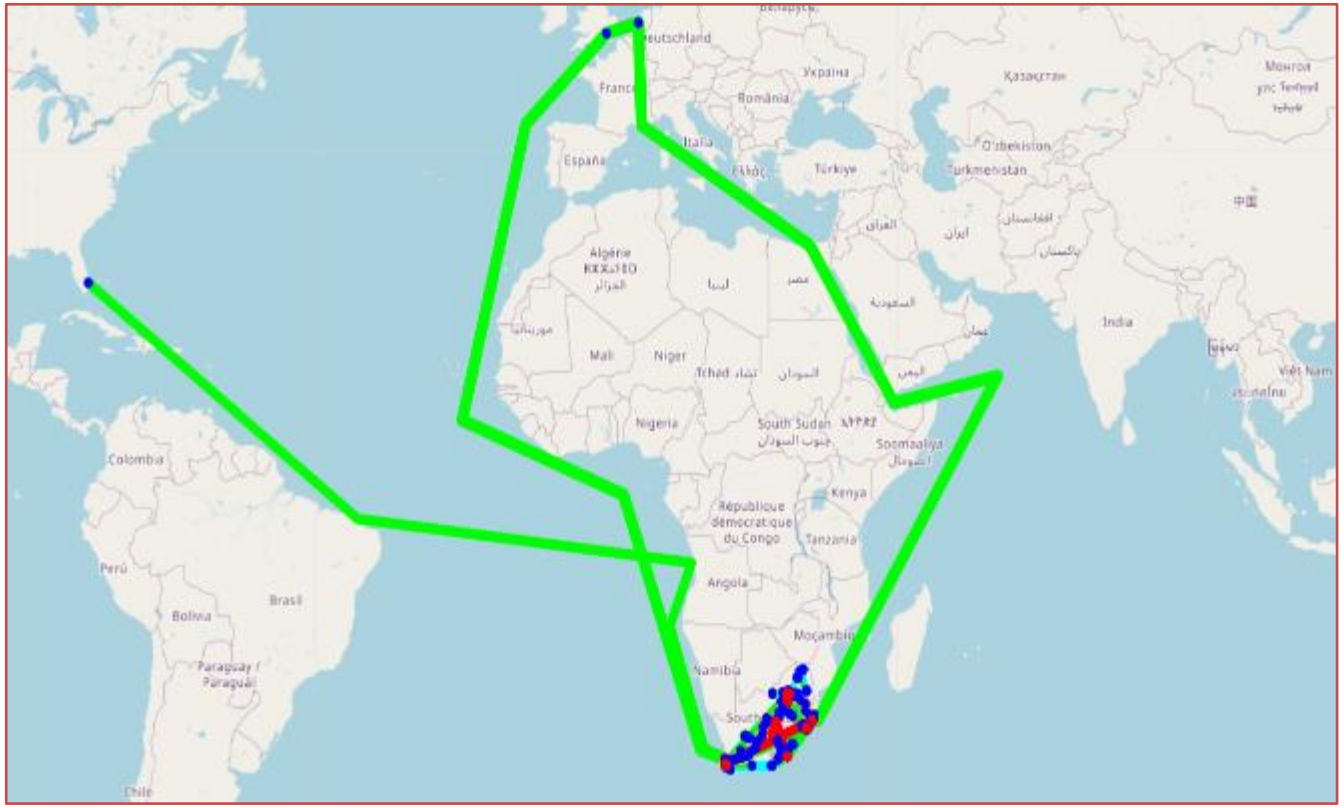
SANReN Dark Fibre Backbone



- 5 dark fibre links
- 96 Channel – Gridless
- and Directionless Optical Line System
- 100Gbps DWDM Transport
- Commissioning of Blaney to Gqeberha (PE) segment in process

International capacity

- West African Cable System (WACS)
  - 110 Gbps
- South Atlantic 3 (SAT-3)
  - 20 Gbps
- South Atlantic Cable System (SACS)
  - 100Gbps
- Eastern Africa Submarine System (EASSy)
  - 20 Gbps
- SEACOM
  - 110 Gbps
- Equiano [TENET]
  - Capacity not yet activated



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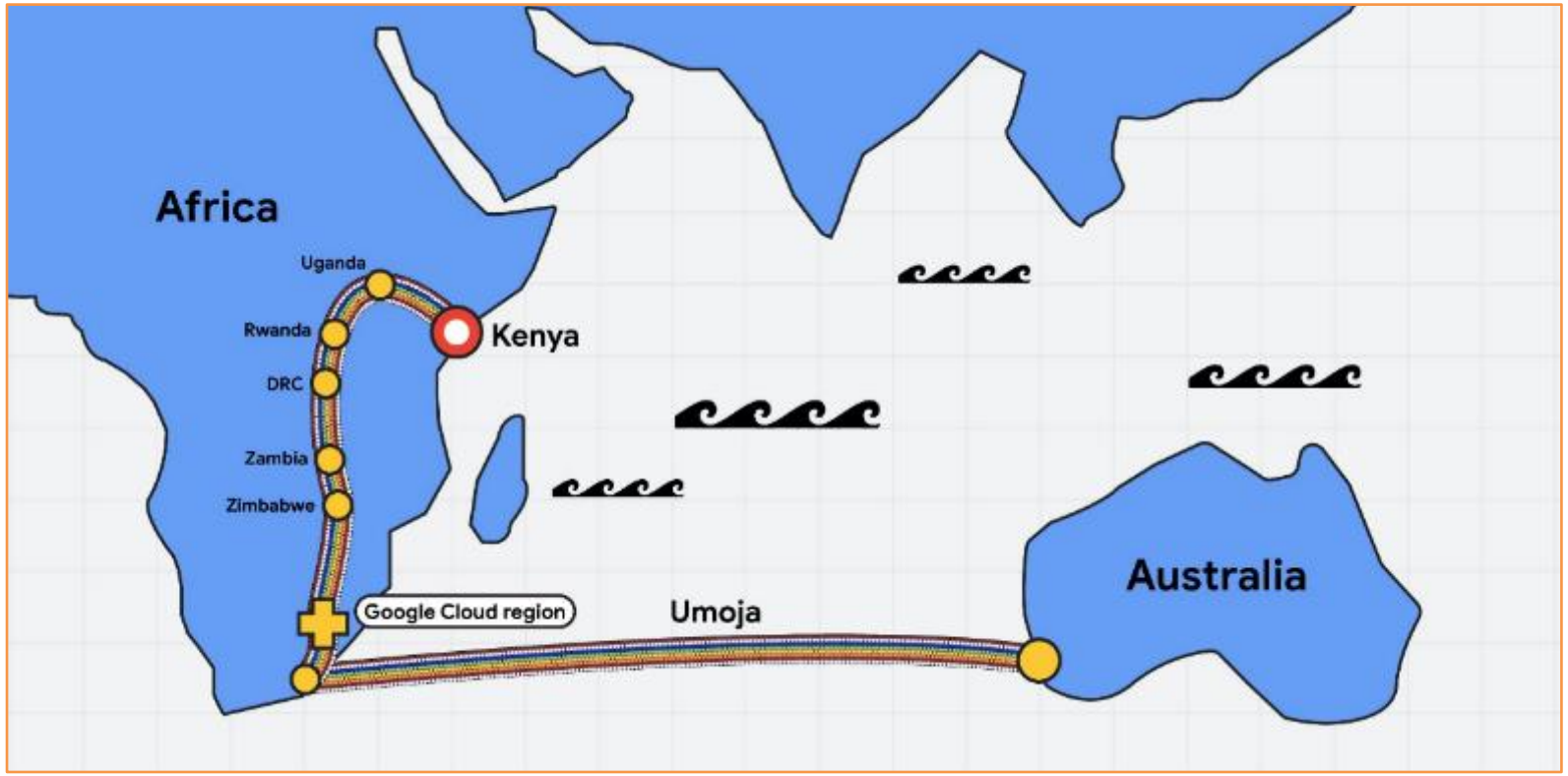
South African NREN link status: https://linkmon.sanren.ac.za/nrenmap/

Future possibility: Umoja Cable



- Capacity on portion from South Africa to Australia
- Dependent on:
  - Business case for acquisition
  - Capacity requirements
  - Funding availability

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Image source: https://www.submarinenetworks.com/en/systems/africa-australia/umoja

Africa Continental Interconnects

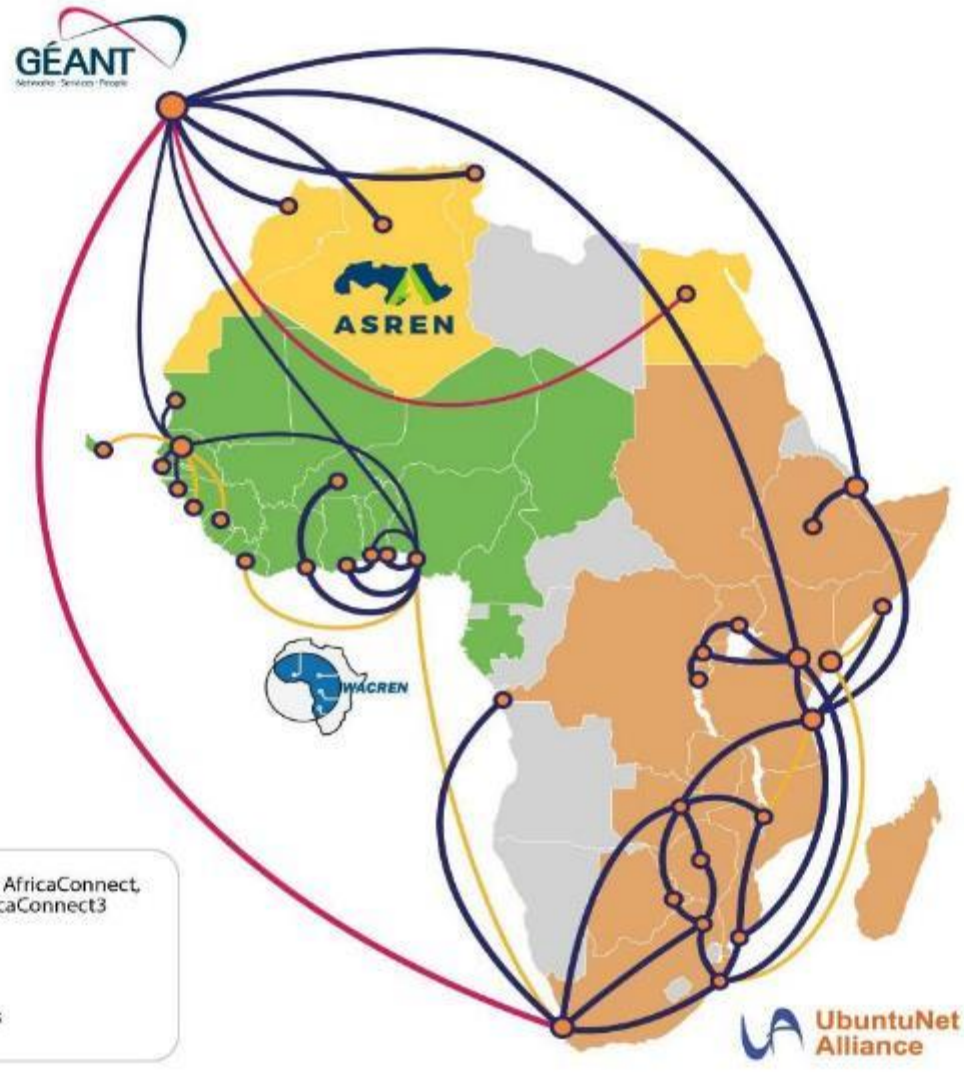
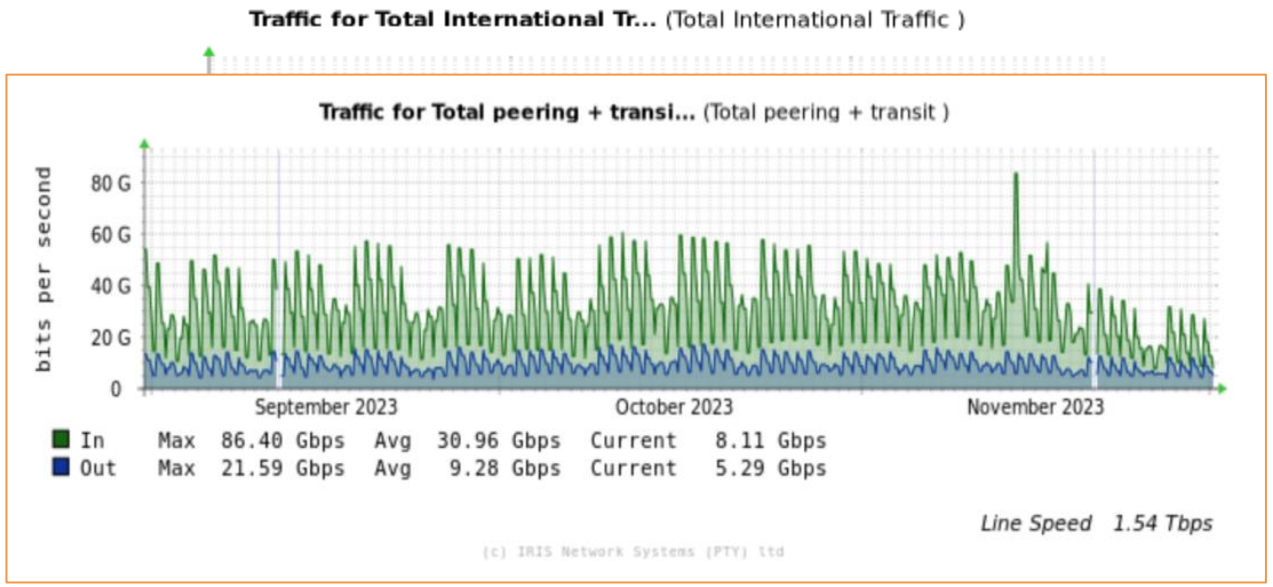


Image source: https://africaconnect3.net/resources/

Some stats…



- Number of users: 1.3 million (estimated)
- Number of sites connected by SANReN and TENET: 400+
- Multiple 100Gbps backbone links between major cities
- International bandwidth: 360 Gbps
- Capacity on 5 undersea cables

Organisation	Number of links as at 24 April 2025
SANReN	312
TENET	387
SABEN	17
Other	18
Total	**734**

Organisation	Number of Devices as at 24 April 2025
SANReN	318
TENET	237
SABEN	339
Other	5
Total	**899**

Total Available Broadband Capacity (TABC) as at 31 March 2025
10 177.61 Gbps

Supporting Astronomy and Space activities in South Africa

Connectivity for the South African Astronomical Observatory (SAAO) in Sutherland for optical telescopes (South African Large Telescope (SALT))

Connectivity for the South African Radio Astronomy Observatory (SARAO) site at Losberg for radio telescopes (Karoo Array Telescope (KAT), MeerKAT, HERA and SKA telescopes). MeerKAT archive hosted at the CHPC

Connectivity for the South African Radio Astronomy Observatory (SARAO) at Hartebeesthoek

Connectivity for the South African National Space Agency (SANSA) Space Operations site at Hartebeesthoek

Connectivity for the South African National Space Agency (SANSA) Deep Space Network site at Matjiesfontein (in process)

Images: SAAO, https://www.saao.ac.za/ | SARAO, https://www.sarao.ac.za/ | HartRAO, http://www.hartrao.ac.za/ | SANSA, https://www.sansa.org.za/

NREN Connectivity: SARAO and SKA

Losberg

SARAO Fibre

Klerefontein

SARAO Fibre

SARAO Carnarvon PoP

10Gbps Link (in process)
N7, Springbok, Upington, Brandvlei, Williston, **Carnarvon**

SANReN (Cape Town PoPs)

100Gbps Link
N1, Victoria west, Loxton, Carnarvon

SANReN Backbone Fibre

SANReN (Beaufort West PoP)

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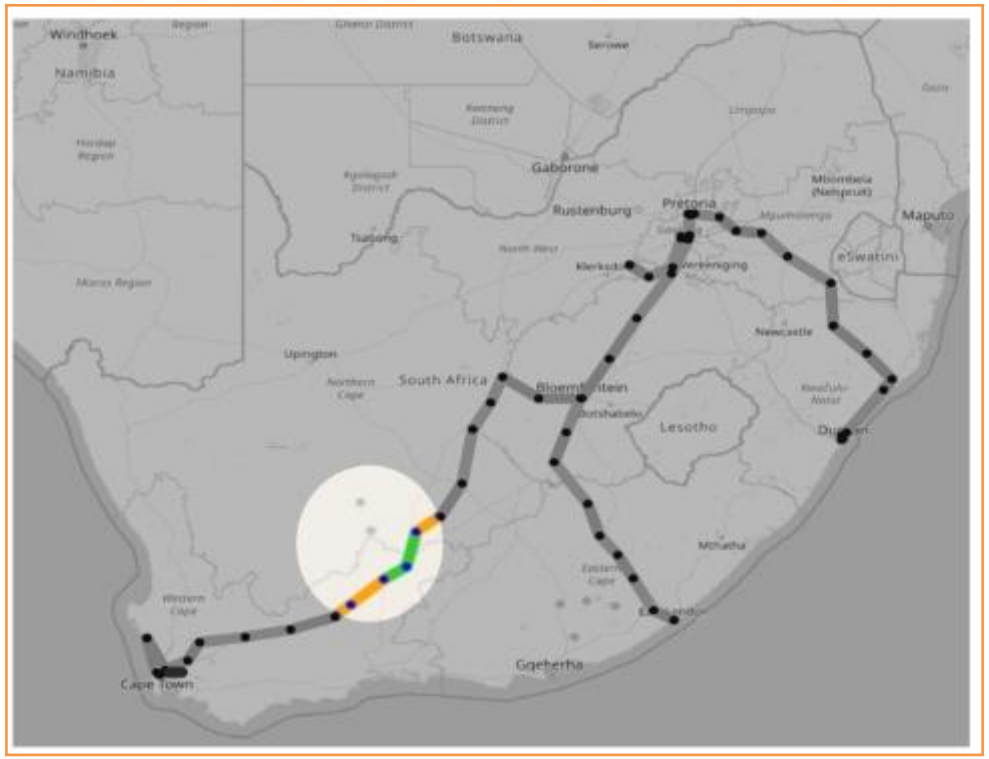
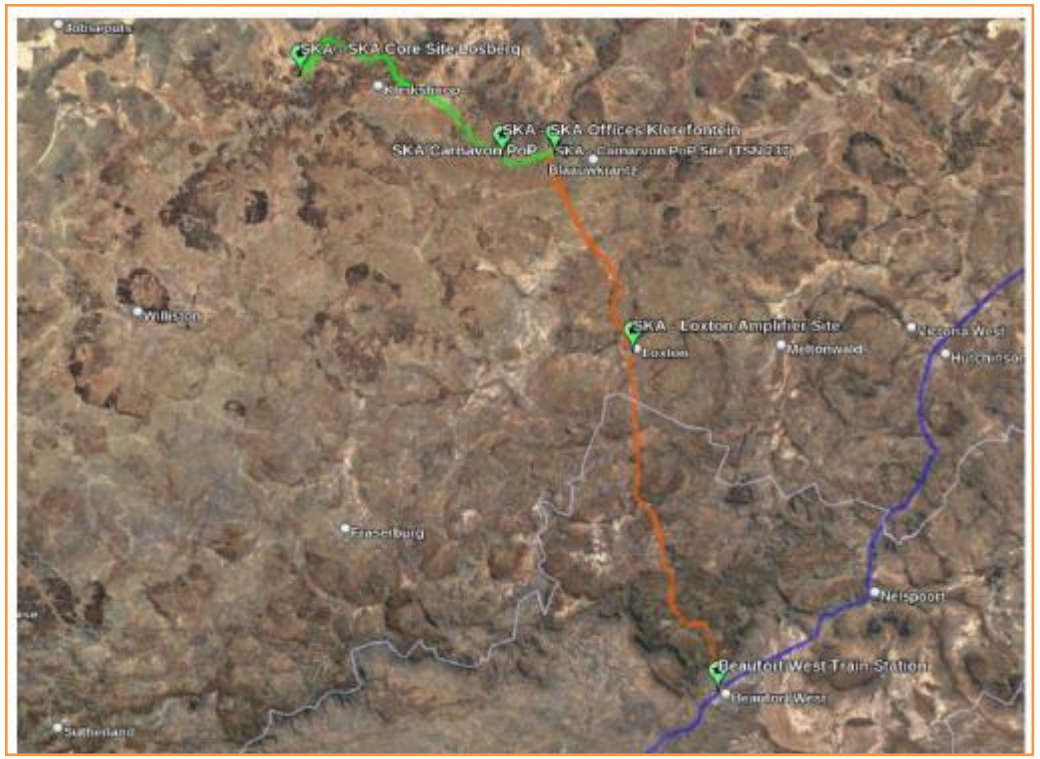
Dark fibre build





- Dark fibre build from Carnarvon to Beaufort West (orange)
- Approximately 180km build
- Project in process of being transferred to SKAO

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SARAO and SKA NREN Connectivity

Losberg

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Dark fibre build

SANReN metro Fibre

iThemba LABS

SANReN Backbone Fibre

SANReN (Beaufort West PoP)

SKAO fibre link

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SANReN Services

- PERT (Performance Enhancement Response Team)
  - A team at SANReN that assists with resolving network throughput issues e.g. slow data transfers
  - PERT team (pert@sanren.ac.za)
  - Primarily uses perfSONAR to interrogate network performance issues
- perfSONAR (Performance-oriented Service-Oriented Network Monitoring Architecture)
  - Network measurement and monitoring framework designed to provide detailed insights into the performance of network connections
  - One 100G node and twenty 10G nodes deployed in the network
  - Upgrade of the perfSONAR to 100G nodes in process

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SANReN Services: Data Transfer

- SANReN Data Transfer Service
  - FileSender
    - Allows users to share files of up to 100 GB
    - Used extensively by universities and students to share large volume of data
  - Specialized Data Transfer Nodes (DTNs)
    - Large File Transfer: 100s of Gigabytes or even many Terabytes of data
    - Using Globus File Transfer Software on specialized DTNs
    - 100G DTN nodes deployed at:
      - Teraco Isando, Johannesburg
      - Teraco Rondebosch, Cape Town
      - Teraco Riverhorse Valley, Durban
      - Losberg for SARAO (Not a full DTN, limited disk space, intending to upgrade once disks procured)
      - SANReN Lab, Building 43, CSIR Campus (Not a full DTN, limited disk space, for testing)

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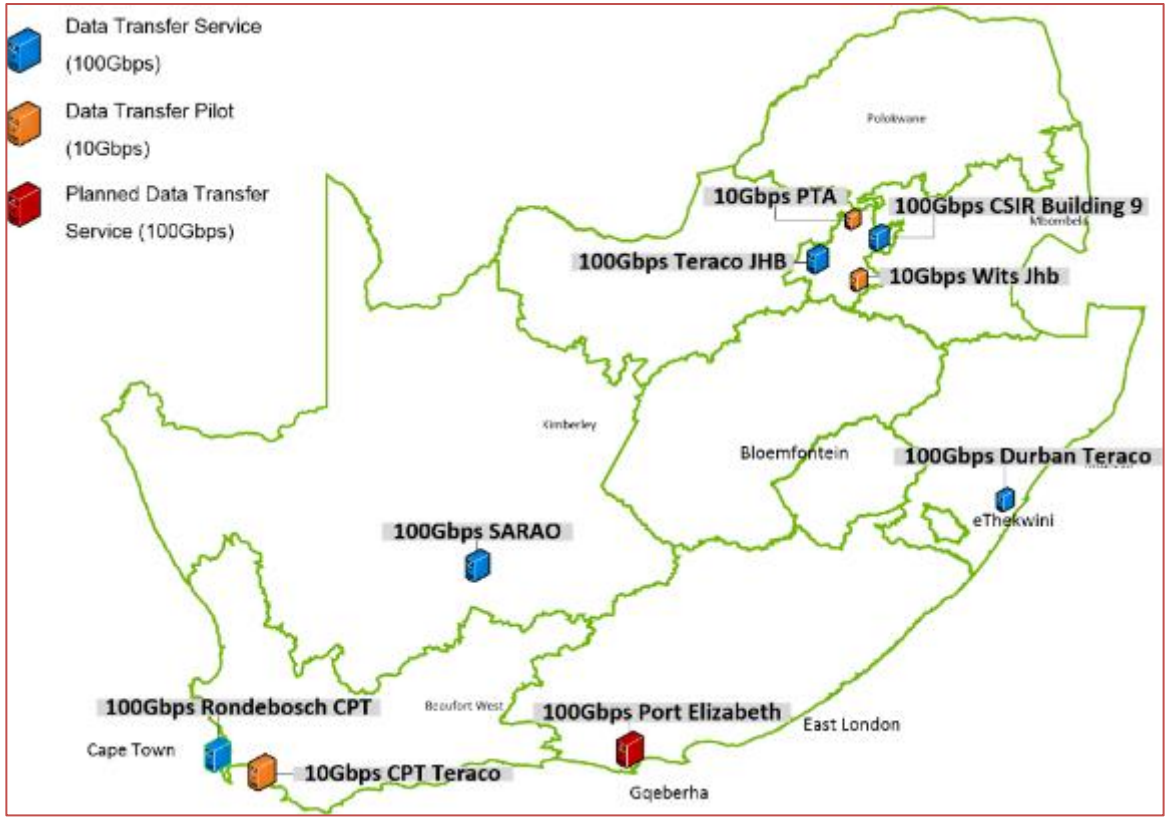
https://filesender.sanren.ac.za/filesender/

See https://www.globus.org/ and contact pert@sanren.ac.za to create account and allow your public key

SANReN Services: Data Transfer, cont.

- SANReN Data Transfer Service Activities
  - Implemented 100Gbps DTN and perfSONAR node on single hardware platform (Supermicro AS-1114S-WN10RT)
  - Benchmarking our 100G DTNs with EPOC team at Indiana University (top results)
    - 1TB data transfer from Washington to Cape Town: 8min, 45 seconds (1.90GB/s)
    - 1TB data transfer from Colorado (NCAR GLADE) to Johannesburg: 3mins, 2 seconds (5.48 GB/s)



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SANReN DTS
Data Transfer Service

SC 2024 paper: SANReN's 100 Gbps Data Transfer Service:Transferring data fast!

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SANReN

Thank You!

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