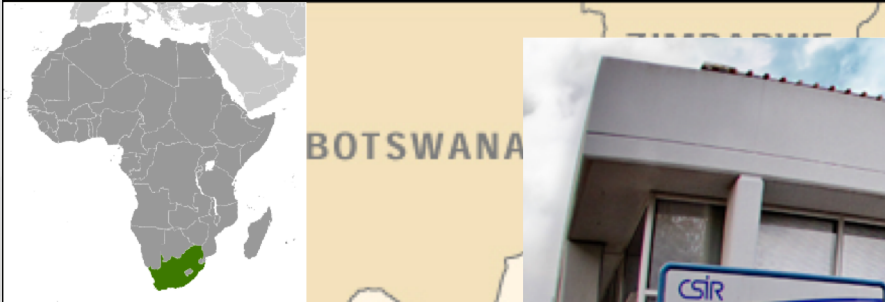


COLLABORATE
INNOVATE
ADVANCE

The Role of Cyber-Infrastructure in Development of Africa

Dr. Happy Marumo Sithole
Center Manager: NICIS

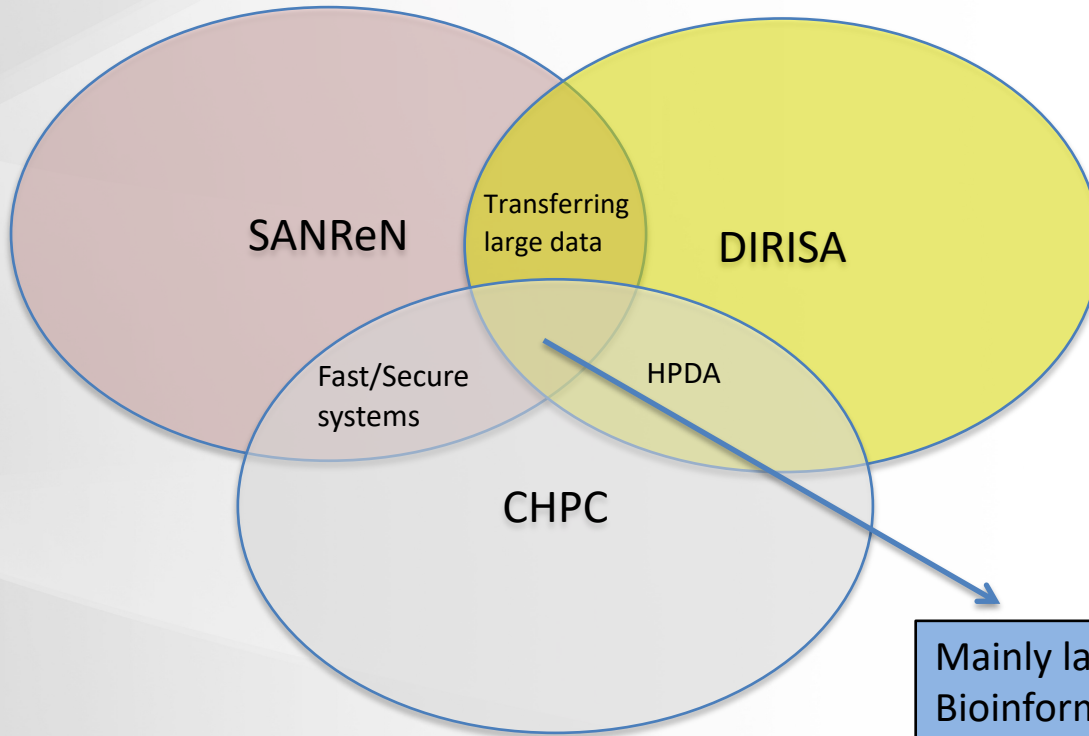
Email: hsithole@csir.co.za



BOTSWANA



NICIS Model



- Common services between any two entities of NICIS
- Joint planning is very important
- Intersection of the three entities most crucial, as defines the success of overall NICIS.
- Development of cross-cutting skills internally and within the community

Mainly large Scale Science projects SKA, CERN, Bioinformatics, 4IR, SADC C.I. Framework, Climate Change

Vision

The realisation of a vibrant and competitive knowledge based economy impacting socio-economic development by enabling education, research, and innovation through shared access to advanced cyberinfrastructure facilities and services

Mission

To *provide* a *world class* national integrated cyberinfrastructure system that *enables* research, innovation and learning comprising a national high performance computing facility, a national research and education network and a national data intensive research infrastructure *accessible* across the research and higher education sector through *integrated* eResearch *services* and the development of *relevant human capital*.

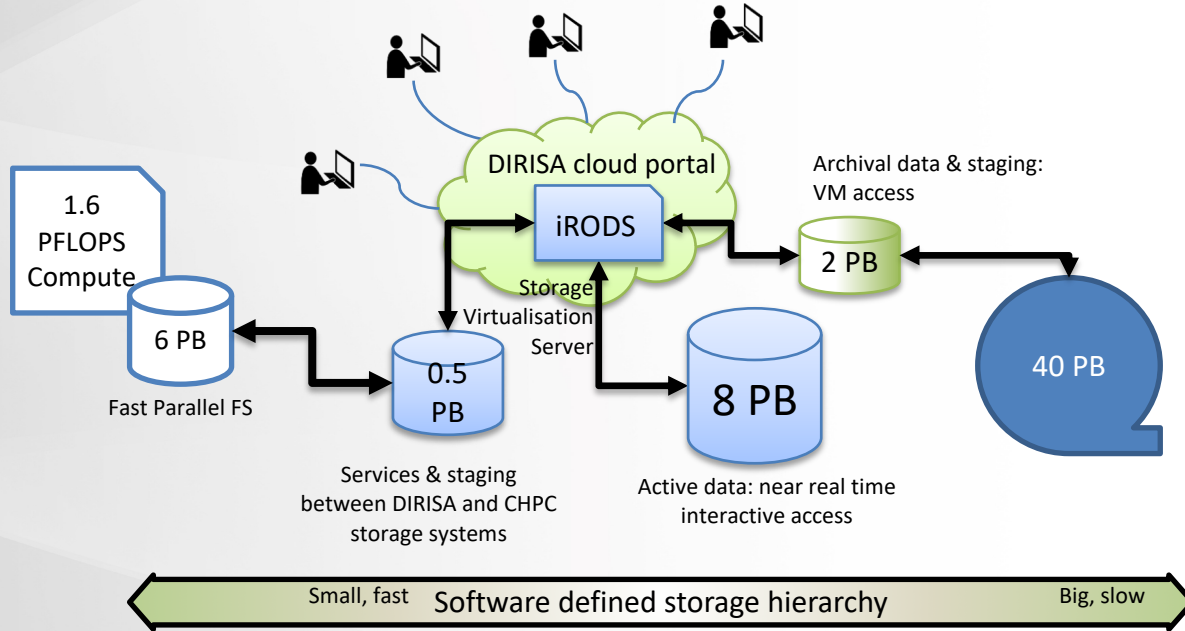
Strategic Objectives

- Sustain a **world class** and relevant **national integrated cyberinfrastructure system** for Science and Technology.
- Enable and promote **eScience** in South Africa.
- Position South Africa to take part in, host and **lead large scale global research and science projects** (e.g. SKA and CERN experiments).
- Provide **thought leadership** to South Africa's evolving cyberinfrastructure strategy and activities, and facilitate the uptake of advanced cyberinfrastructure.
- Foster the development of **human capacity in cyberinfrastructure and its application**, and contribute to the transformation of this sector.

Components of SADC CI Framework

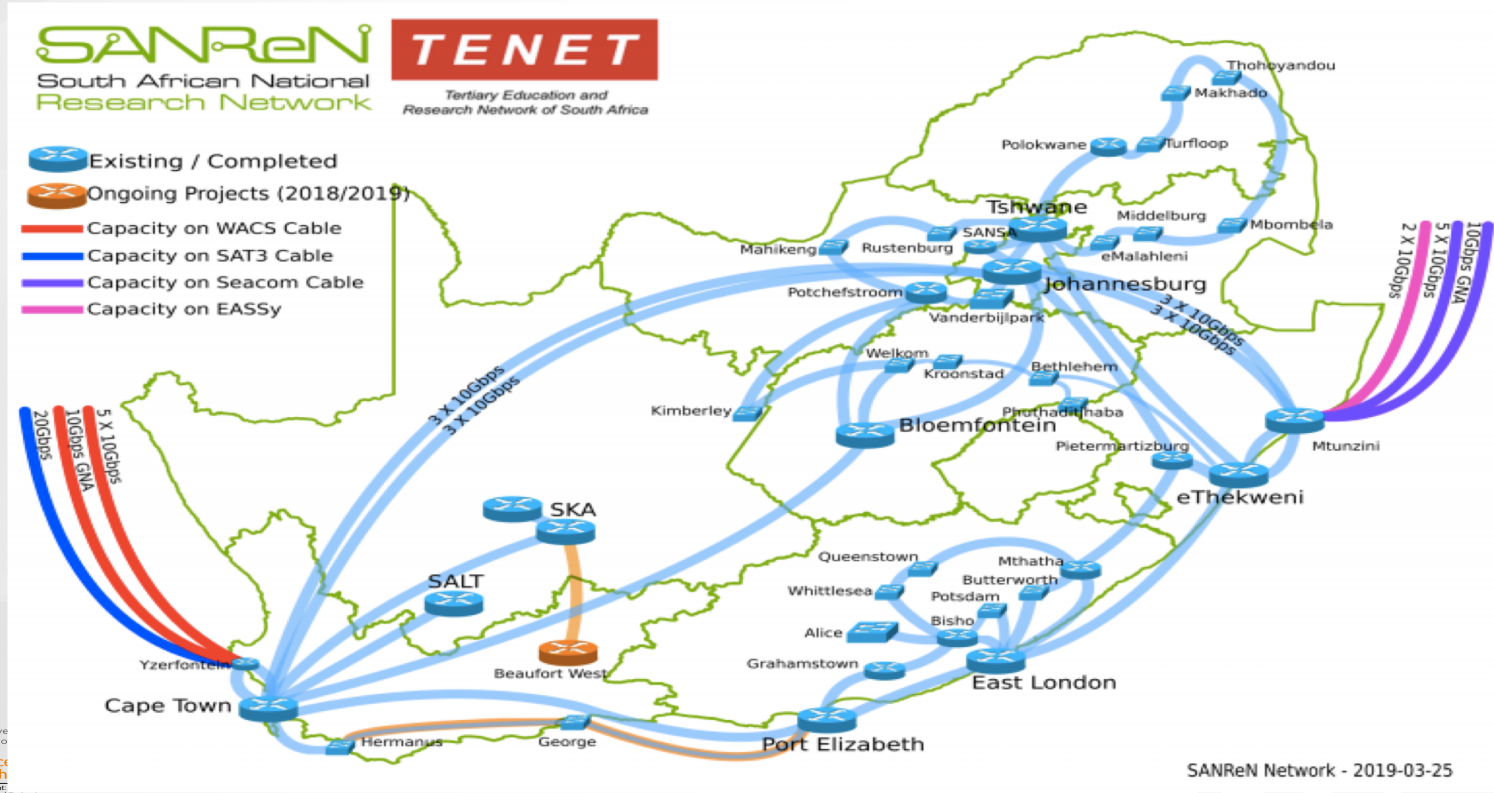
- **Policies** - To enable optimal establishment and utilization of cyber-infrastructure
- **Computational Resources** - Ranging from HPC to other computing capabilities (hardware and software),
- **Data** - tools and facilities (including repositories) to enable sharing and efficient data-driven discoveries, technologies and innovations,
- **National Research Networks** -broadband infrastructure networks and service providers for education, research and innovation,
- **Human Capital** - effective use of the CI.

DIRISA Architecture

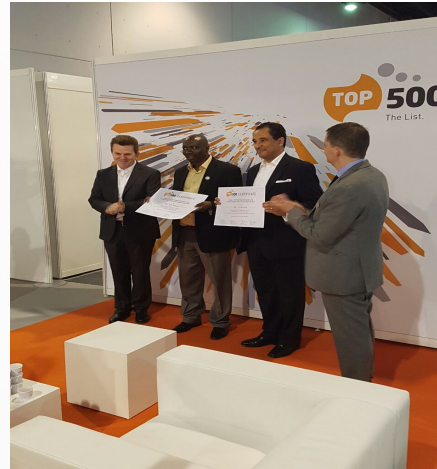


- Open (FAIR) Data & Open Science
- Federated locally and globally (“One-stop-shop” catalogue)
- Certified as Trusted Repository
- Linked to funder systems
- Suite of services for RDM and data intensive analytics

Current SANReN Backbone



Lengau HPC System



- **Been on TOP500 list for the past 4 years**
- **Awarded the fastest supercomputer in Continent**



- ❑ **Graphical Processor Unit (GPU) Cluster: 24 V100's**
 - ❑ 6 nodes (36 Intel Gold 6150 CPU's; 3 V100's; PCIe)
 - ❑ 3 nodes (40 Intel Gold 6150 CPU's; 4 V100's; NVLink)
- ❑ Since **September 2018**
- ❑ Immediate Demand from users:
 - ❑ **Transfer of Chemistry Users (MD)**
 - ❑ **Resources for Machine Learning (ML)**
- ❑ Machine Learning applications optimised – TensorFlow
- ❑ Big Data Analytics Focused

Users at the CHPC: Institutions

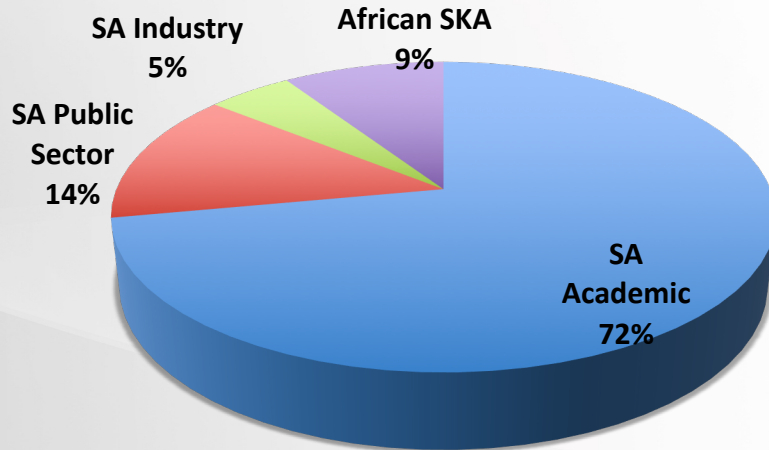
[Total Life Time Hours of Lengau: 537 million]

(Last 6 Months...)

19 Jan – 18 Jul 2019

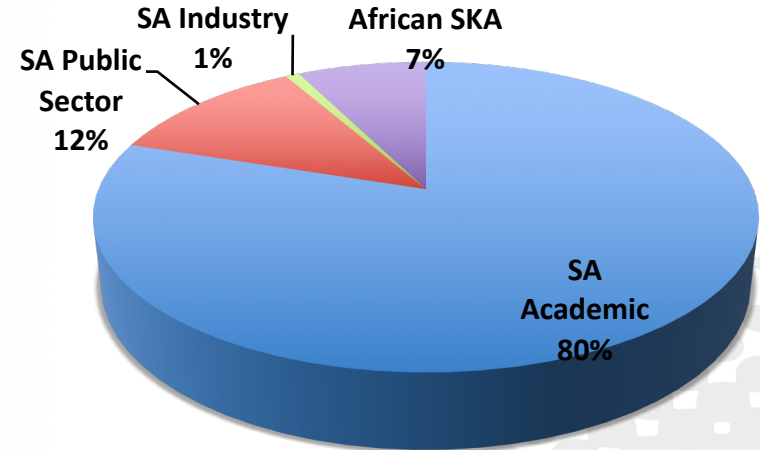
Research Programmes

210 Active Programmes



Core Hours

97 million hours

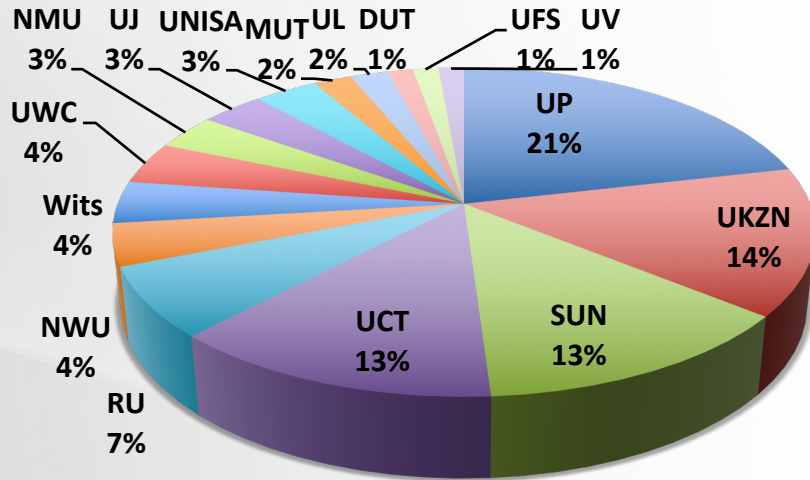


Users at the CHPC: Institutions

SOUTH AFRICAN ACADEMIC:

Research Programmes

151 Active Programmes

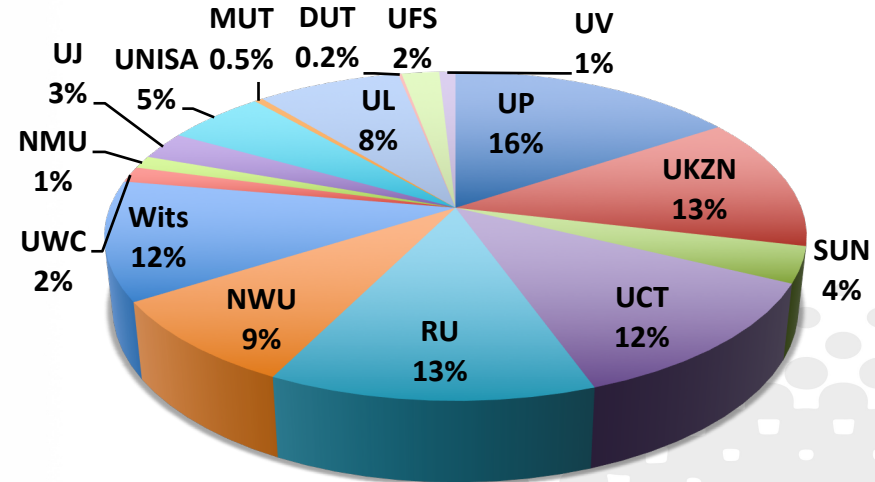


(Last 6 Months...)

19 Jan – 18 Jul 2019

Core Hours

78 million hours



Users at the CHPC: Institutions

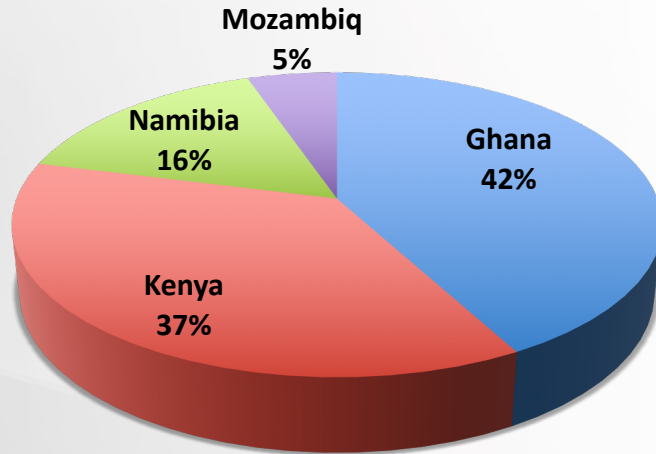
AFRICAN SKA PARTNERS:

(Last 6 Months...)

19 Jan – 18 Jul 2019

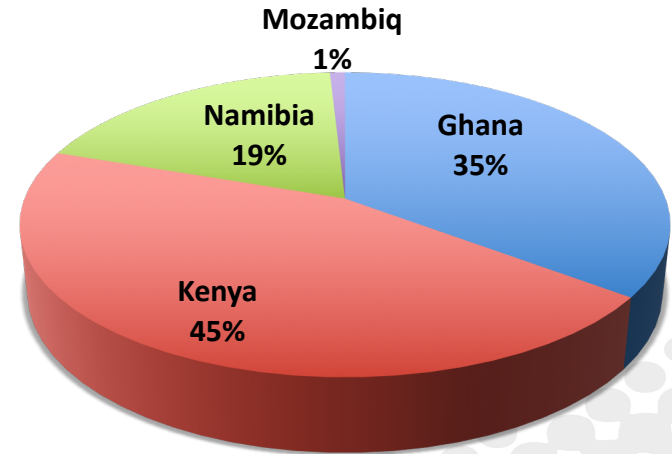
Research Programmes

19 Active Programmes



Core Hours

7 million hours



Users at the CHPC: Institutions

SOUTH AFRICAN INDUSTRY SECTOR:

(Last 6 Months...)

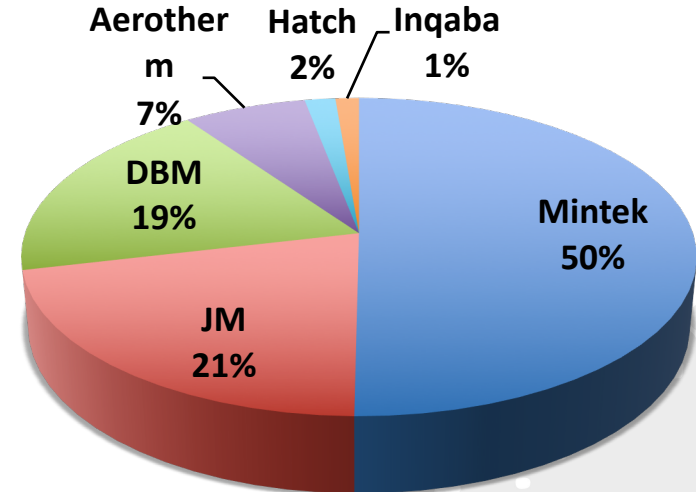
19 Jan – 18 Jul 2019

Research Programmes

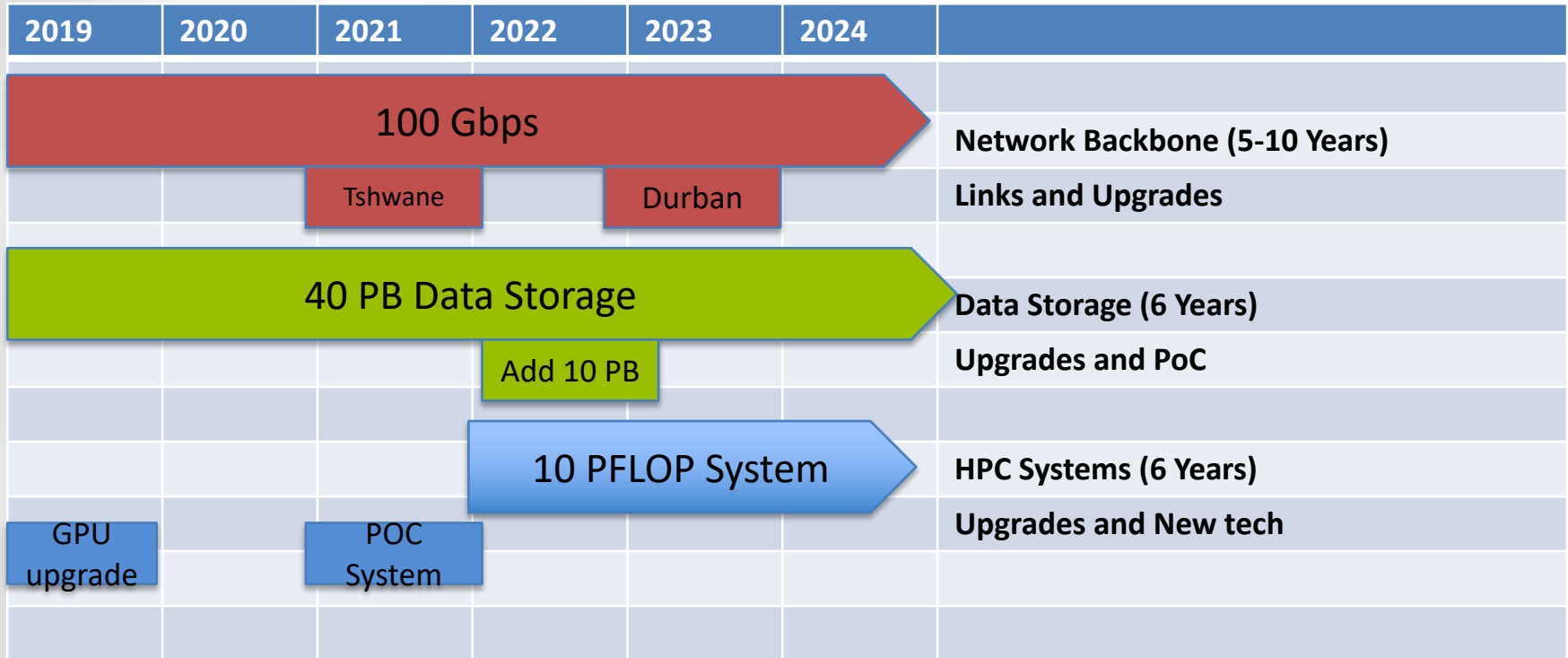
Core Hours

10 Active Programmes

1 million hours



Infrastructure Roadmap



A national initiative of the Department of Science and Technology and implemented by the CSIR.

HPC Ecosystem Initiatives

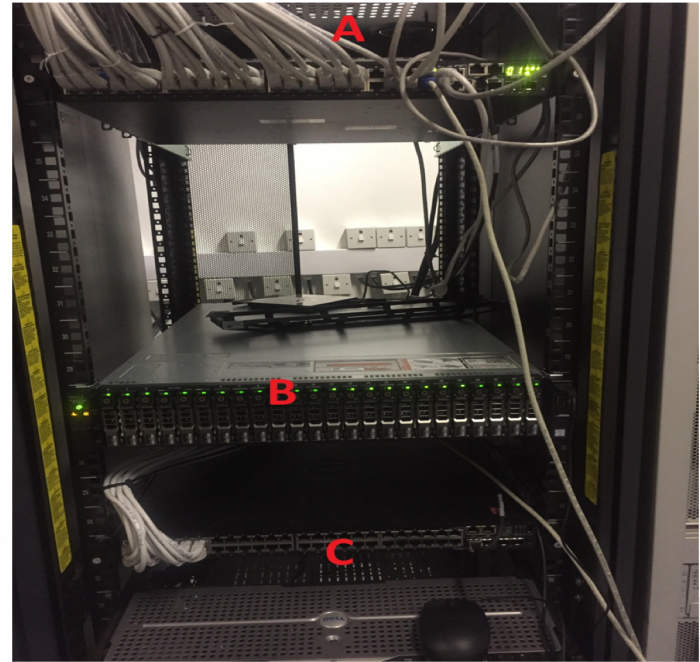
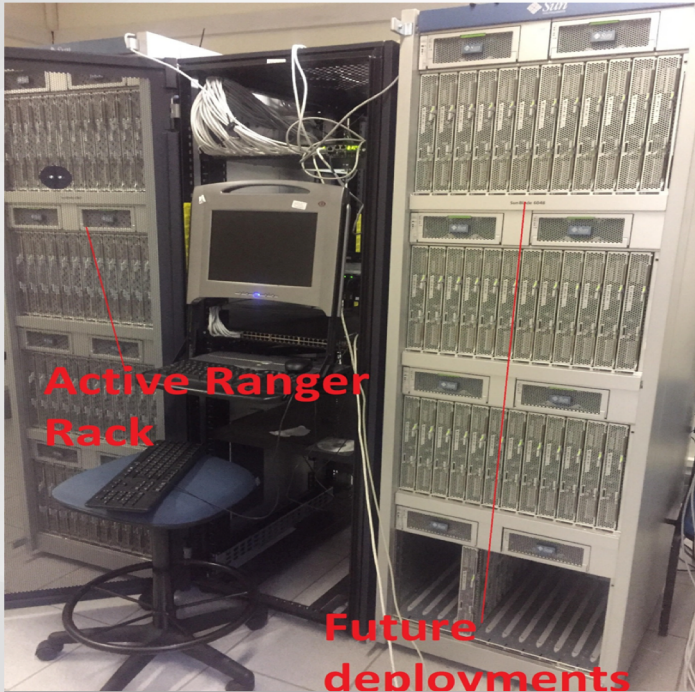
- Development of HPC capabilities in South Africa
 - Focus mainly on HDI “FEI”:
 - Providing Infrastructure
 - Development of skills and curriculum (research and ICT)
 - Development of Research Programs
- Development of HPC in SADC Countries
 - Infrastructure, skills and strategy
- Development of HPC and Big Data Initiatives in SKA Partner countries
 - Infrastructure, skills, strategy and demonstrate value to the Partner countries

	Infrastructure			Staff		
	Power & Cooling	Datacentre ID'ed	Equipment Shipped	SysAdmin / Linux	Dedicated time	SysAdmin Course
Mauritius : University of Mauritius (UoM)	✓	✓✓	✓✓	✓✓	✓✓	✓✓
Namibia : Namibia University of Science & Technology (NUST)	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Botswana : University of Botswana (UB)	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Namibia : University of Namibia (UNAM)	✓	✓✓	✓✓	✓✓	✓✓	✓✓
Zambia : ZAMREN	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Madagascar : University of Antananarivo (IOGA)		✓✓	✓✓	✓	✓	✓
Ghana : GSSTI	✓✓	✓✓	✓✓	✓	✓✓	✓
Mozambique : MoRENet	✓	✓✓	✓✓	✓✓	✓✓	✓✓
Kenya : NACOSTI	✓	✓✓			✓✓	

Countries with own HPC Initiatives

- Tanzania – DIT – facilitated the acquisition of HPC system from TACC and provided training.
- Zimbabwe – ZCHPC- assisted with strategy and operationalisation plan
- Eswatini – RSTP and Government DC – assistance with strategy and operational plan.
- Lesotho – UL – engagements on-going

Botswana



A national initiative of the Department of Science and Technology and implemented by the CSIR.

ZIMBABWE



A national initiative of the Department of Science and Technology and implemented by the CSIR.

SADC-TACC Workshop@TACC



A national initiative of the Department of Science and Technology, Republic of South Africa

10 Southern African scholars attend workshop at TACC – Source Stem-Trek

science & technology
Department of Science and Technology
REPUBLIC OF SOUTH AFRICA

CSIR
our future through science

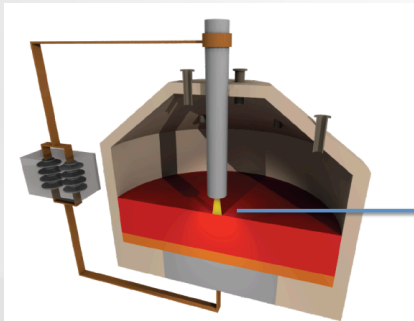
Understanding Risk in Shared CyberEcosystems (URISC@SC17) in Denver, Colorado-US.



CASE STUDY

Mintek: Pyrometallurgy

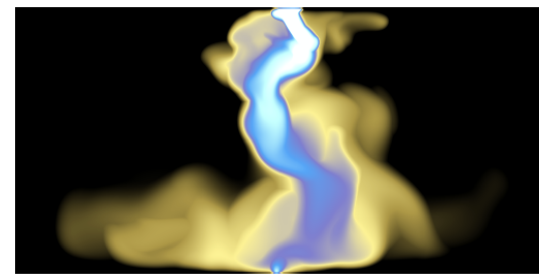
- ❑ DC Furnace **Plasma Arc electric smelting** simulations
- ❑ **CFD** and Magnetohydrodynamics (**MHD**) simulations
- ❑ Resulted in **patent** for Mintek on **arc detection technology**
- ❑ **Fully dependent** on **CHPC** for HPC resource requirements



Cross-section of DC Furnace
Showing Plasma Arc (photo)



Photographic Image



Simulated

CASE STUDY

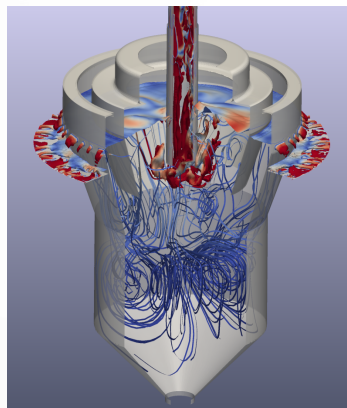
De Beers Marine: Diamond Mining

- ❑ Mining of **diamonds from seabed** west coast of SA and Namibia
- ❑ Advanced **technologies** required **for seperation** of diamonds by wet screening, grinding and deagglomeration
- ❑ Dependent on CHPC for **CFD** evaluations of **dewatering** sub-system **designs**
- ❑ Resulted in effective **decision making** for technology implementations

DE BEERS
GROUP OF COMPANIES

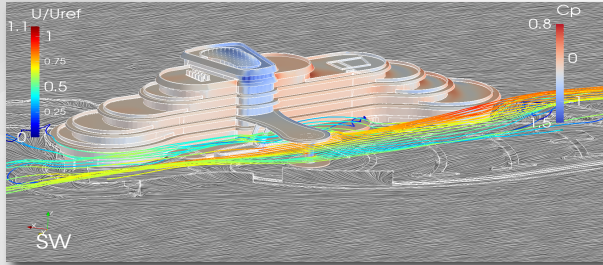


SS Nujoma- under construction

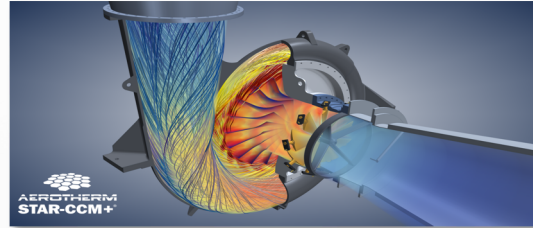


Courtesy: Mr Imraan Parker
(De Beers Marine)

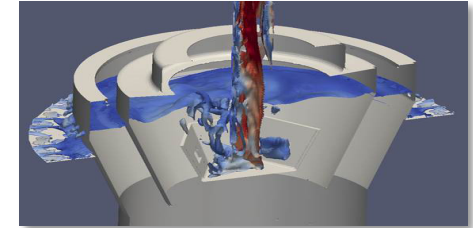
Engineering Applications



Building aerodynamics
(ECI-JV)

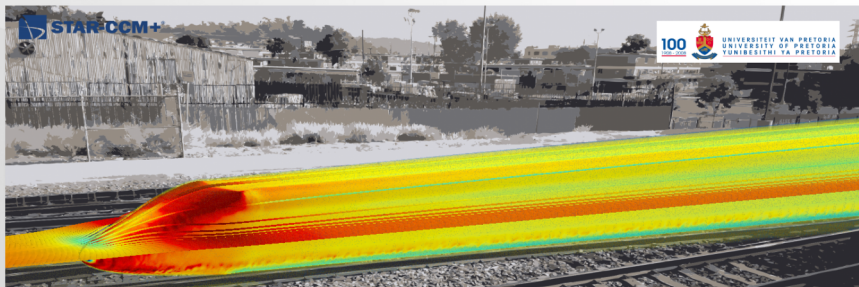


Centrifugal Steam Compressor
(Aerotherm)



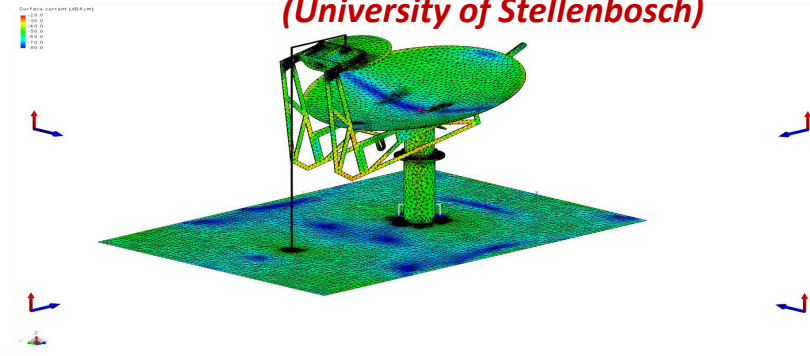
Elutriator Design
(De Beers Marine)

High-speed Train Design *(UP)*:

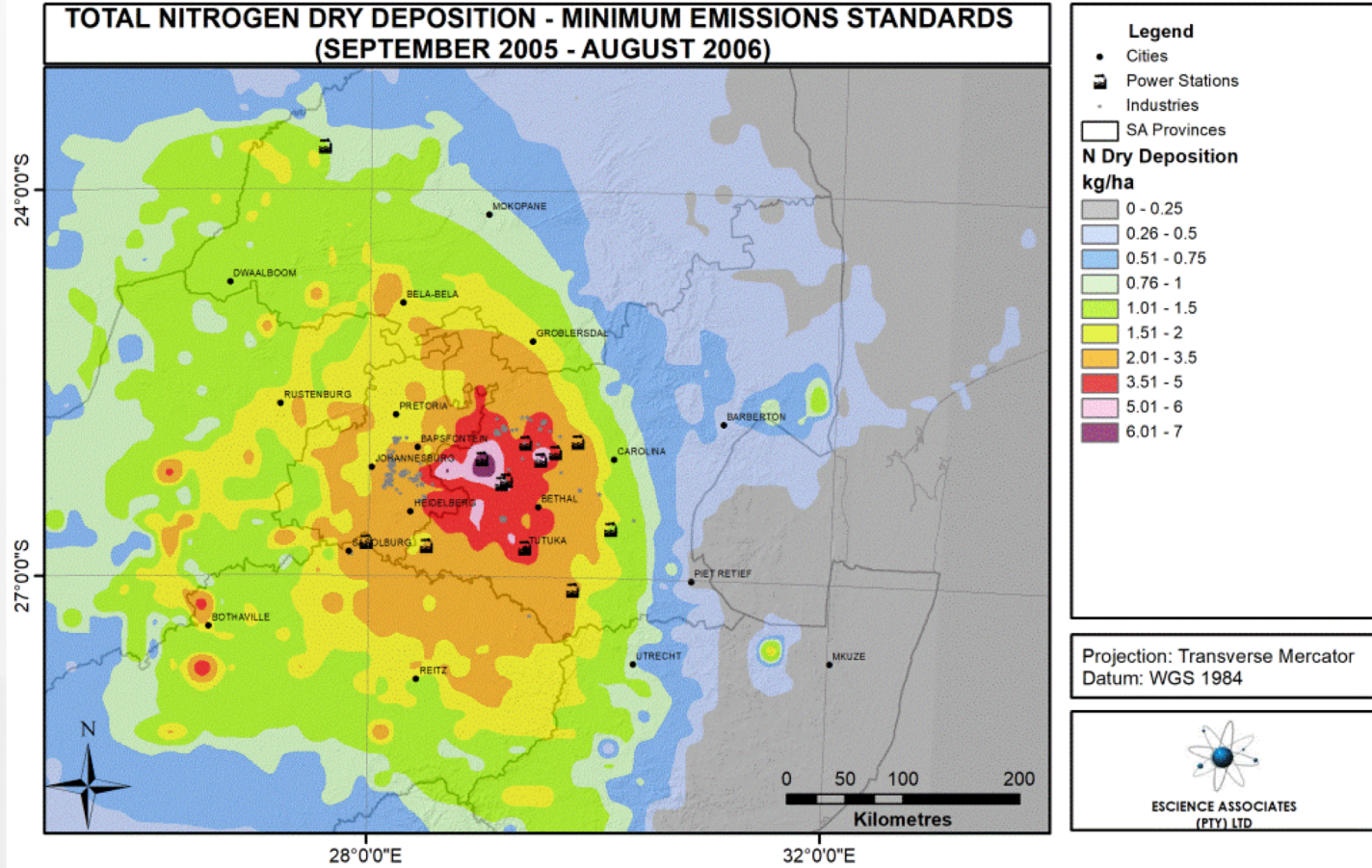


Radio-Astronomy Dish Design

(University of Stellenbosch)



eScience work for Water Research Commission (WRC)





2013 - 1st Place



2014 - 1st Place



2015 - 2nd Place



2016 - 1st Place



2017 - 2nd Place



2018 - 3rd Place



2019 - 1st Place

THANK YOU!

