



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



science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA



CSIR
Touching Lives through Innovation



HPC Ecosystems Project

Overview of the HPC landscape in Africa

South American-African Astronomy Coordination
Committee (SA3CC) Meeting 2026
20 May 2026

Bryan Johnston
Senior Technologist II
HPC Ecosystems Project Lead
CHPC, South Africa

bjohnston@ace-lab:[~]\$ whoami



SysAdmin

HPC Ranger Recipient

Principal Technician, UKZN
*Research & Advanced
Computing*
May 2013 - May 2016



Project
Lead

HPC Project Lead

Senior HPC Technologist, CHPC
(former) ACE Lab
(Advanced Computer
Engineering Lab)

June 2016 – present



HPC User

MS Computer Science

(Computing Systems)
GA Tech
OMSCS Programme



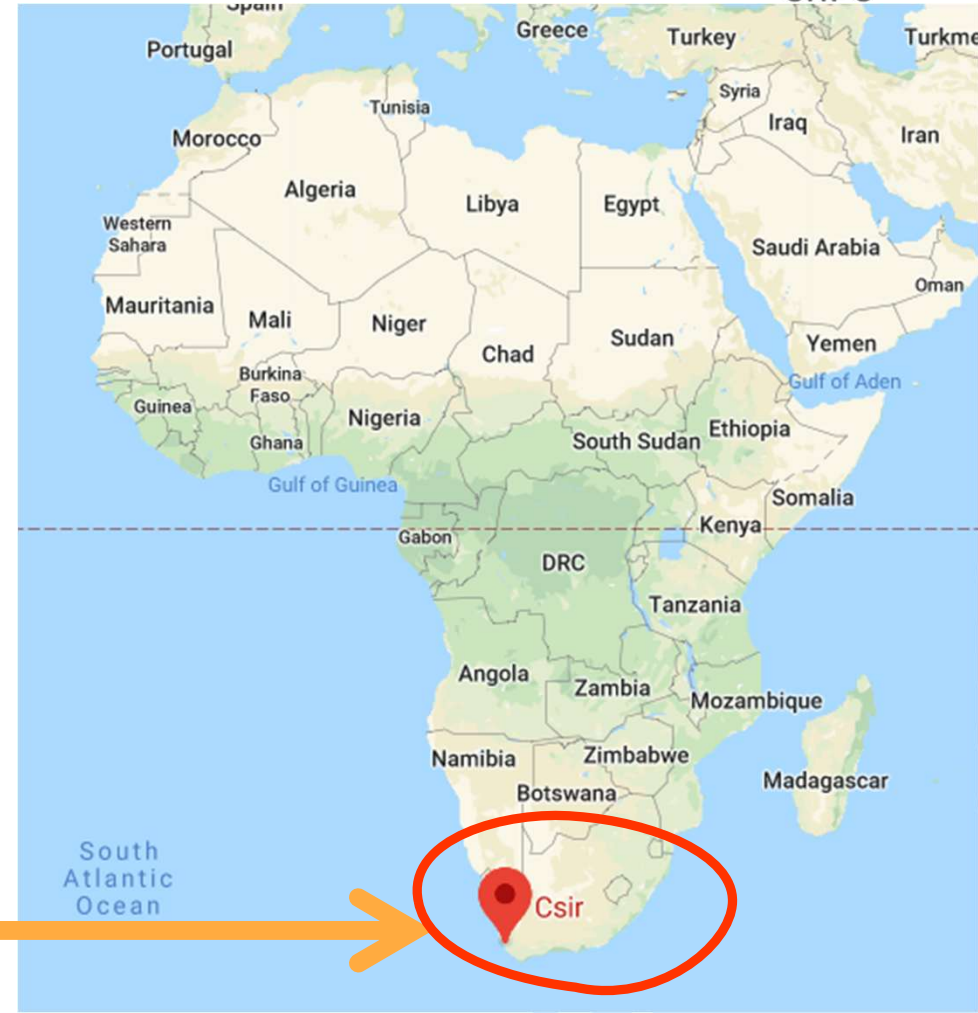
ALICE

“Dear
BrYan”

whereami



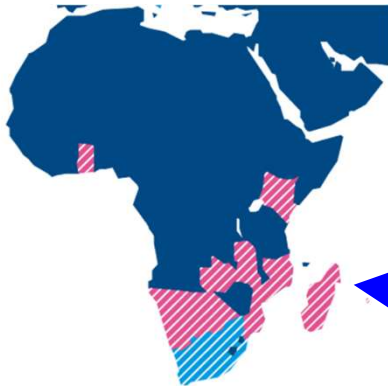
South Africa: the most descriptive country name!



CENTRE FOR HIGH PERFORMANCE COMPUTING

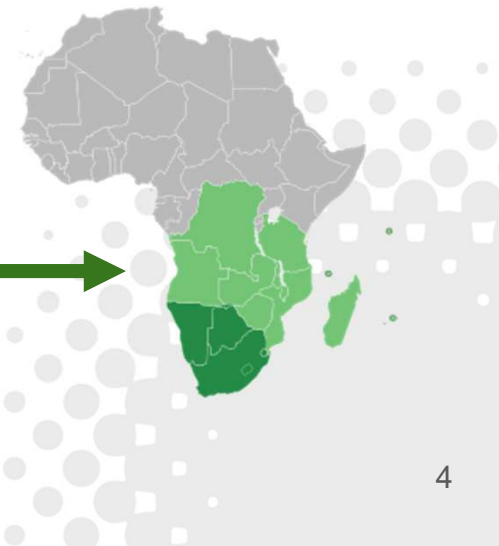
NATIONAL SUPERCOMPUTING FACILITY

- 1PF system
- Formerly Top500
- Largest HPC System in Africa (YMMV)



... FOR RESEARCH COMMUNITY

- South African Academic Institutions & Research Facilities
- Southern Africa Community partners
- SKA partner countries





HPC Ecosystems Project

[Ten Years of the HPC Ecosystems Project - Transforming HPC in Africa for the past decade | Practice and Experience in Advanced Research Computing 2024: Human Powered Computing \(acm.org\)](#)

<https://dl.acm.org/doi/10.1145/3626203.3670537>



**(one of the)
Key Strategic Initiative**

(to) “...**develop** and support necessary **HPC education** and advocacy in the country and the SADC region”

HPC Ecosystems Project (in one slide)

Support the **HPC community** in **ZA, SADC** and **SKA** partner countries...

Develop, engage and align an **African HPC community**.

Repurpose and distribute decommissioned tier-1 HPC systems into entry-level systems.

Provide **HPC technical training** to the HPC community.

Develop HPC solutions to enhance HCD + scientific computing.

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

HPC Ecosystems Project Deployment Framework

Readiness Phase

Infrastructure

Operations / Logistics
(Shipping etc.)

Personnel (tech, users,
steering committee)

Implementation Phase

Deployment

Development
(Projects, WGs)

Piloting (testing & refining)

Operation Phase

Operationalisation

Active Use

Personnel Development
(HCD, community, etc.)



In the beginning...



The Problem/s

1. SKA Partner Countries

- The antennae alone generate raw digitized data at a rate of more than **2.5 petabits per second**. As it is impractical to store this data for long astronomical observations, it must be **processed in real time**.

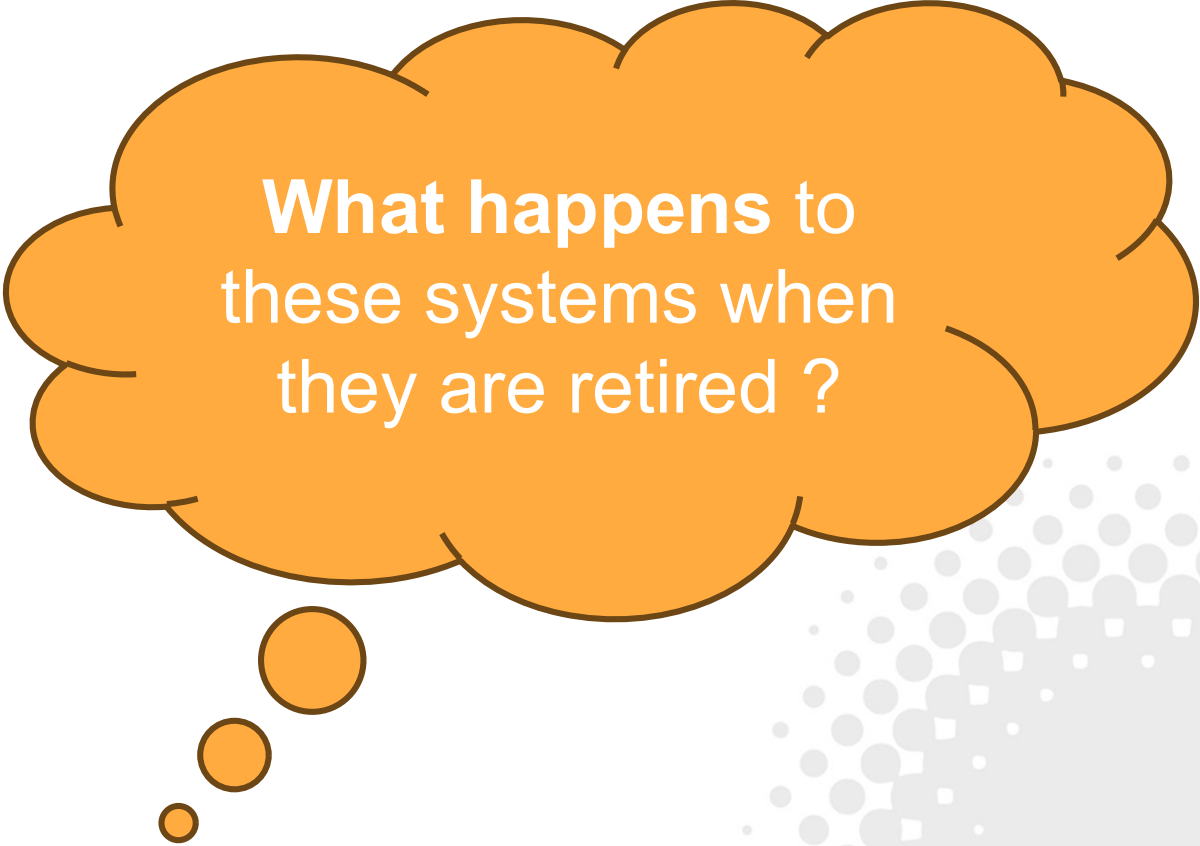


2. Developing HPC expertise in (South) Africa



The Solution

- **Supercomputers**
 - Live fast. Retire young.



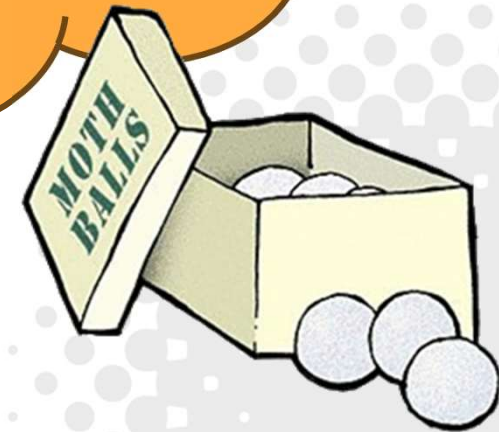
What happens to
these systems when
they are retired ?

The Solution

- **Supercomputers**
 - Live fast. Retire young.



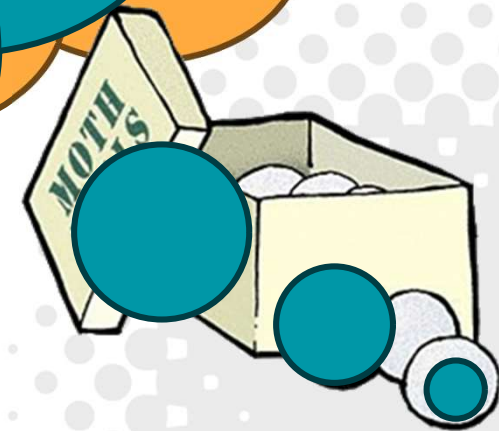
What happens to these systems when they are retired ?



The Solution

- Supercomputing
- Live for

ARE THEY
STILL USEFUL?



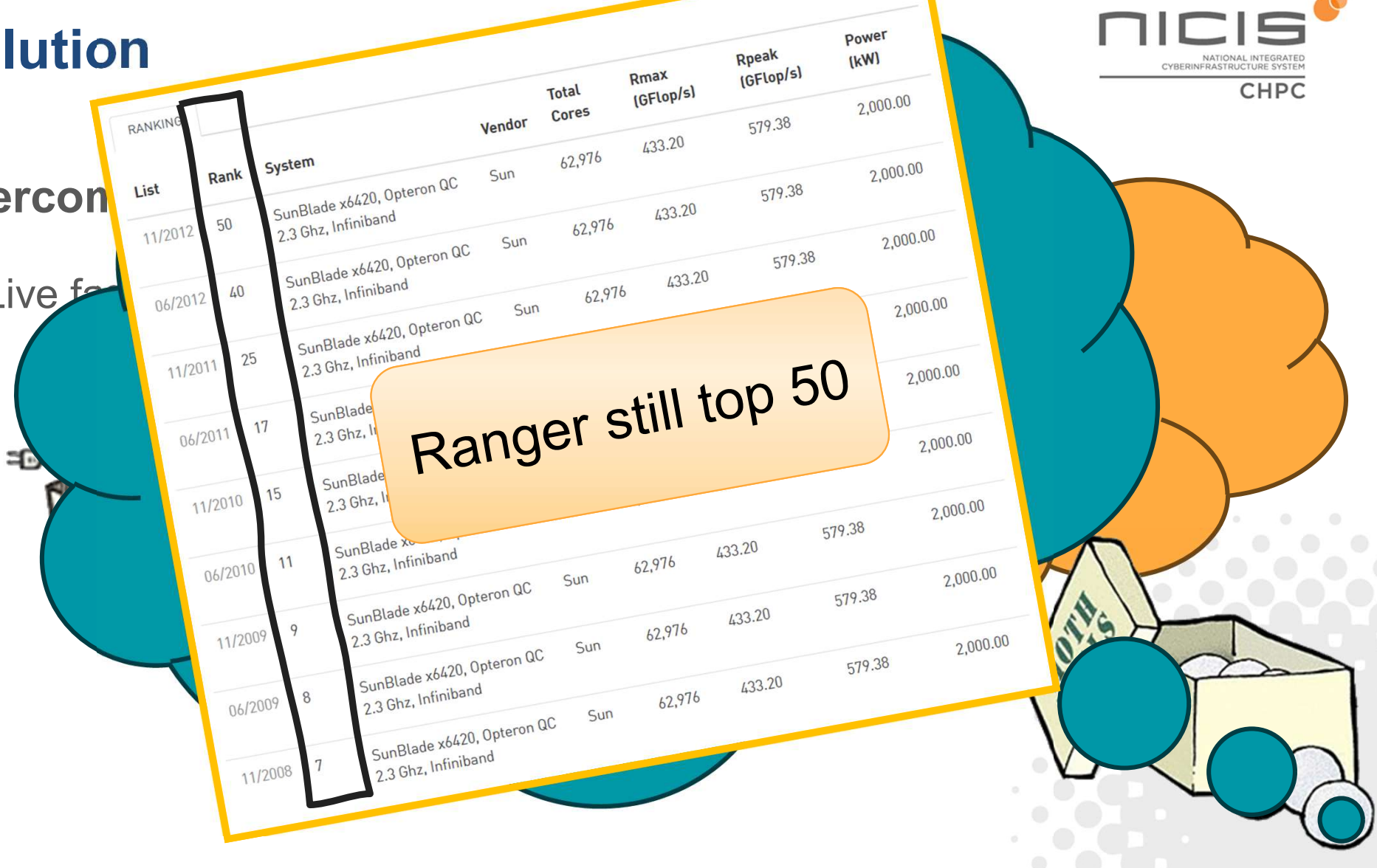
The Solution

- Supercom

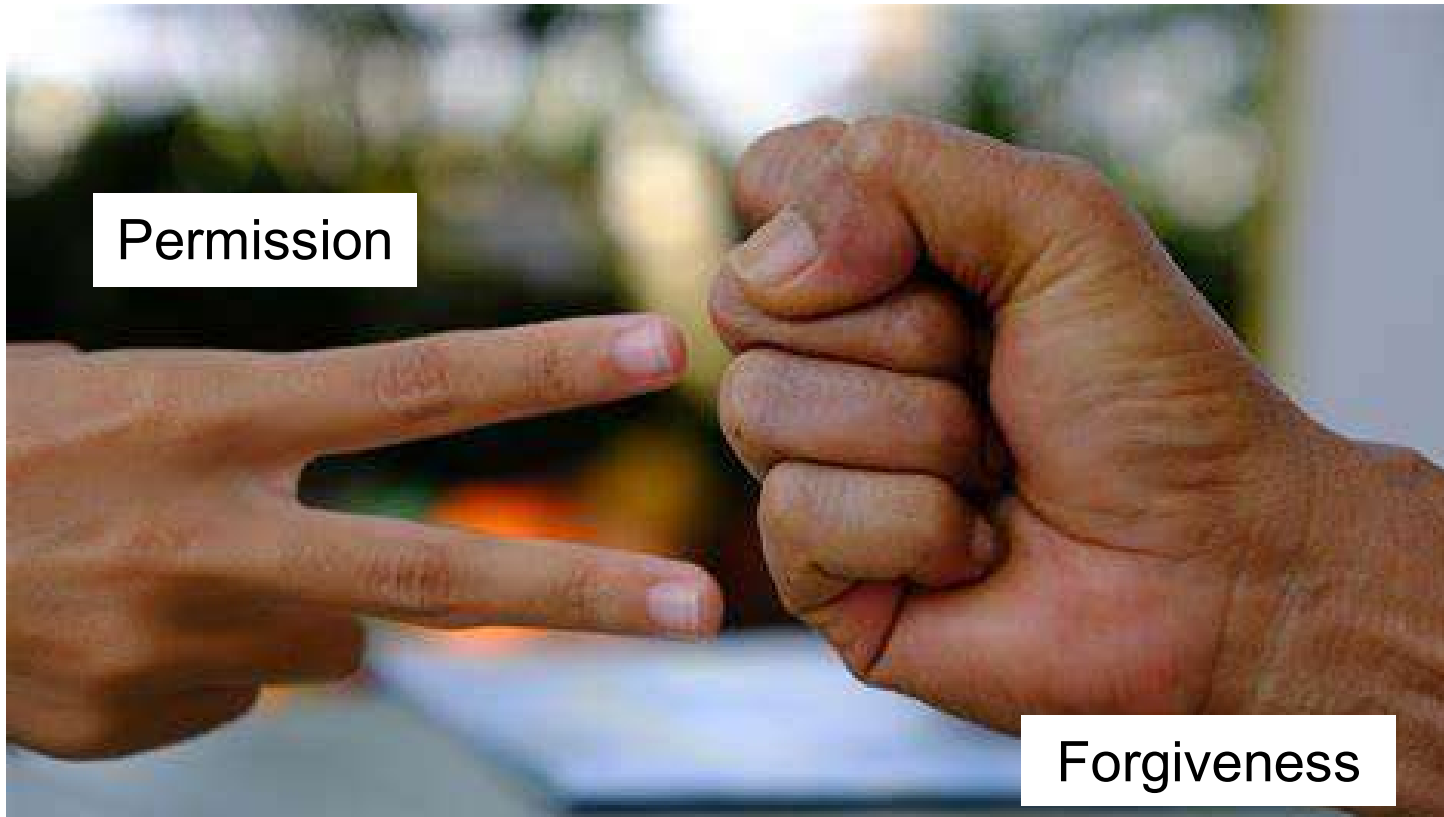
- Live for

| RANKING | Rank | System | Vendor | Total Cores | Rmax (GFlop/s) | Rpeak (GFlop/s) | Power (kW) |
|---------|------|--|--------|-------------|----------------|-----------------|------------|
| | 50 | SunBlade x6420, Opteron QC 2.3 Ghz, Infiniband | Sun | 62,976 | 433.20 | 579.38 | 2,000.00 |
| 11/2012 | 40 | SunBlade x6420, Opteron QC 2.3 Ghz, Infiniband | Sun | 62,976 | 433.20 | 579.38 | 2,000.00 |
| 06/2012 | 25 | SunBlade x6420, Opteron QC 2.3 Ghz, Infiniband | Sun | 62,976 | 433.20 | 579.38 | 2,000.00 |
| 11/2011 | 17 | SunBlade x6420, Opteron QC 2.3 Ghz, Infiniband | Sun | 62,976 | 433.20 | 579.38 | 2,000.00 |
| 06/2011 | 15 | SunBlade x6420, Opteron QC 2.3 Ghz, Infiniband | Sun | 62,976 | 433.20 | 579.38 | 2,000.00 |
| 11/2010 | 11 | SunBlade x6420, Opteron QC 2.3 Ghz, Infiniband | Sun | 62,976 | 433.20 | 579.38 | 2,000.00 |
| 06/2010 | 9 | SunBlade x6420, Opteron QC 2.3 Ghz, Infiniband | Sun | 62,976 | 433.20 | 579.38 | 2,000.00 |
| 11/2009 | 8 | SunBlade x6420, Opteron QC 2.3 Ghz, Infiniband | Sun | 62,976 | 433.20 | 579.38 | 2,000.00 |
| 06/2009 | 7 | SunBlade x6420, Opteron QC 2.3 Ghz, Infiniband | Sun | 62,976 | 433.20 | 579.38 | 2,000.00 |
| 11/2008 | | | | | | | |

Ranger still top 50



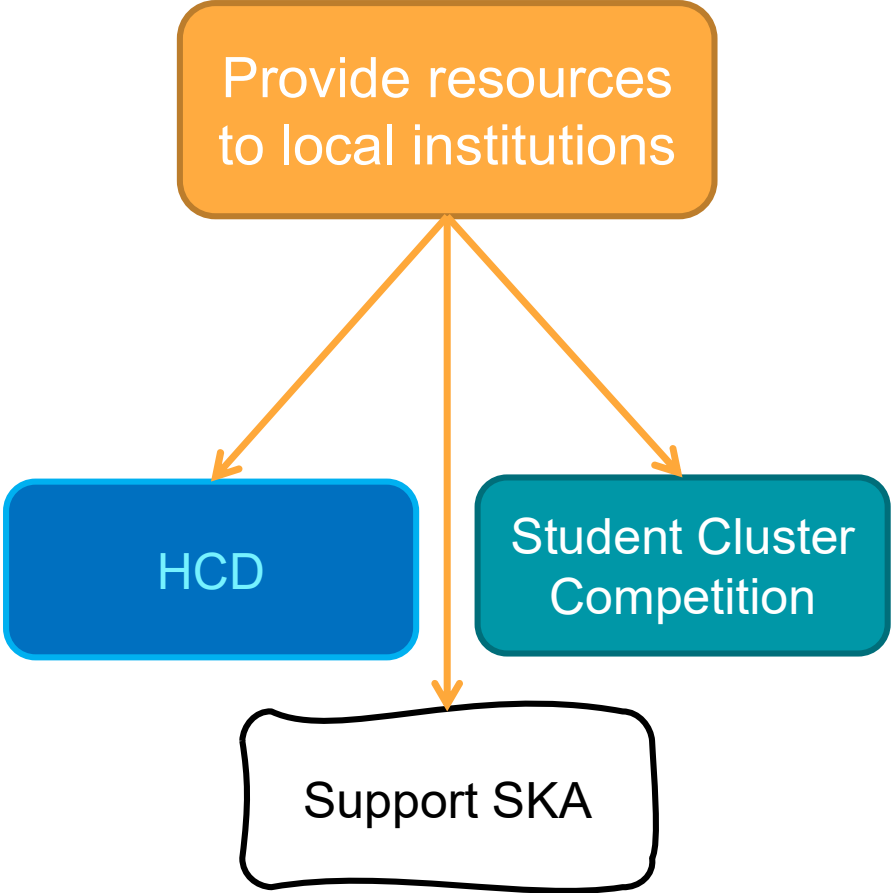
Happy + Dan vs. “Higher Powers”



Permission

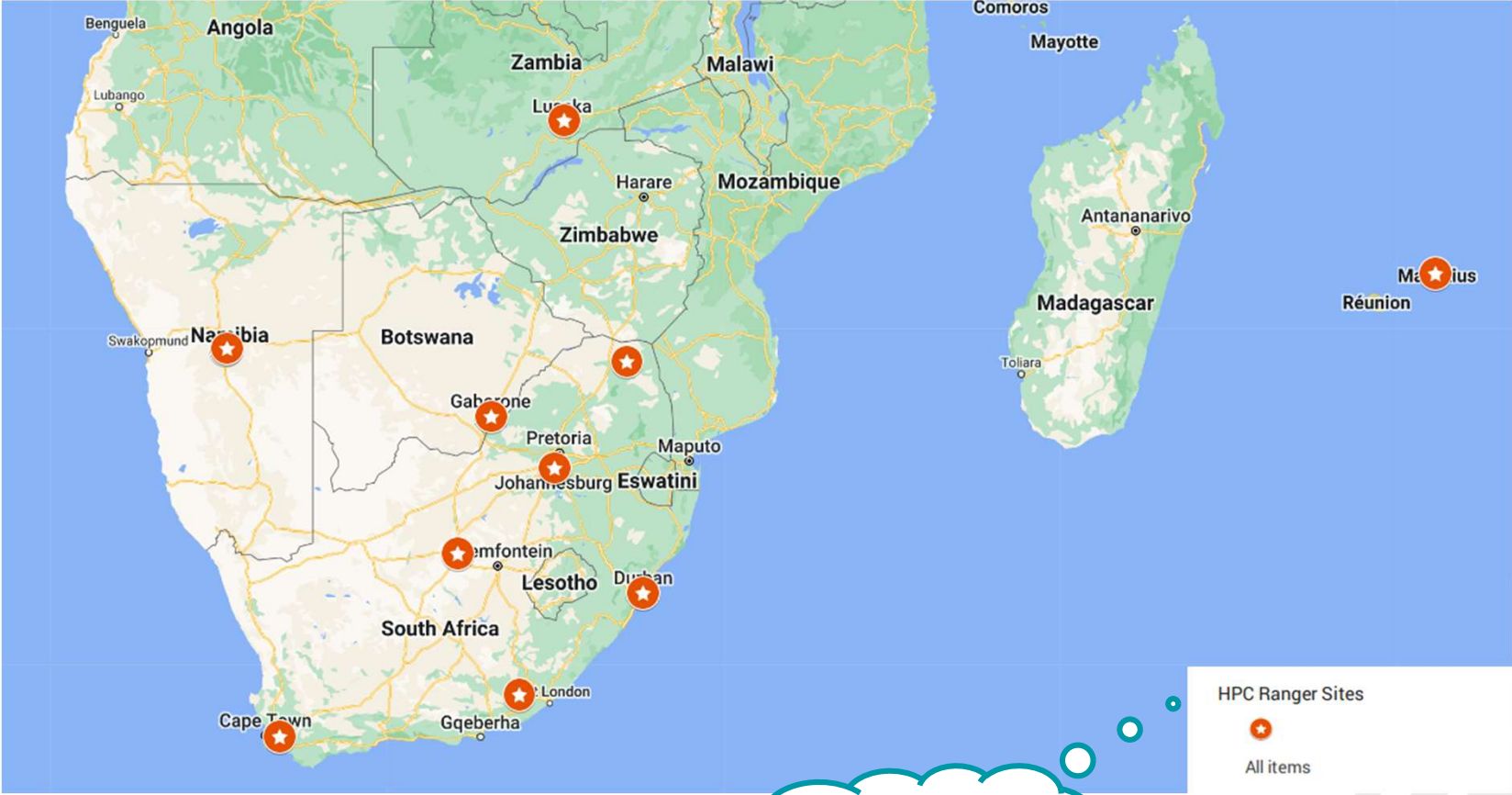
Forgiveness

Ranger Project (2014)



5 Sites

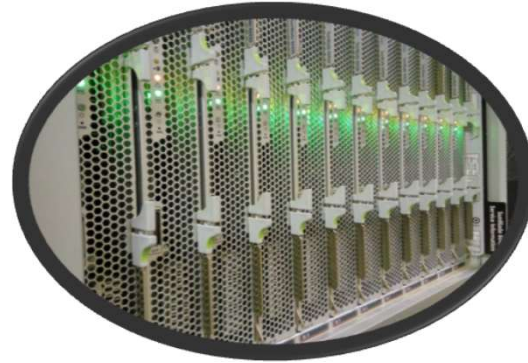
Ranger Project up to 2017



10 Sites



Stampede



Ranger



Cambridge



C6100

New Hardware:

HPC Ecosystems
~~Ranger~~ Project

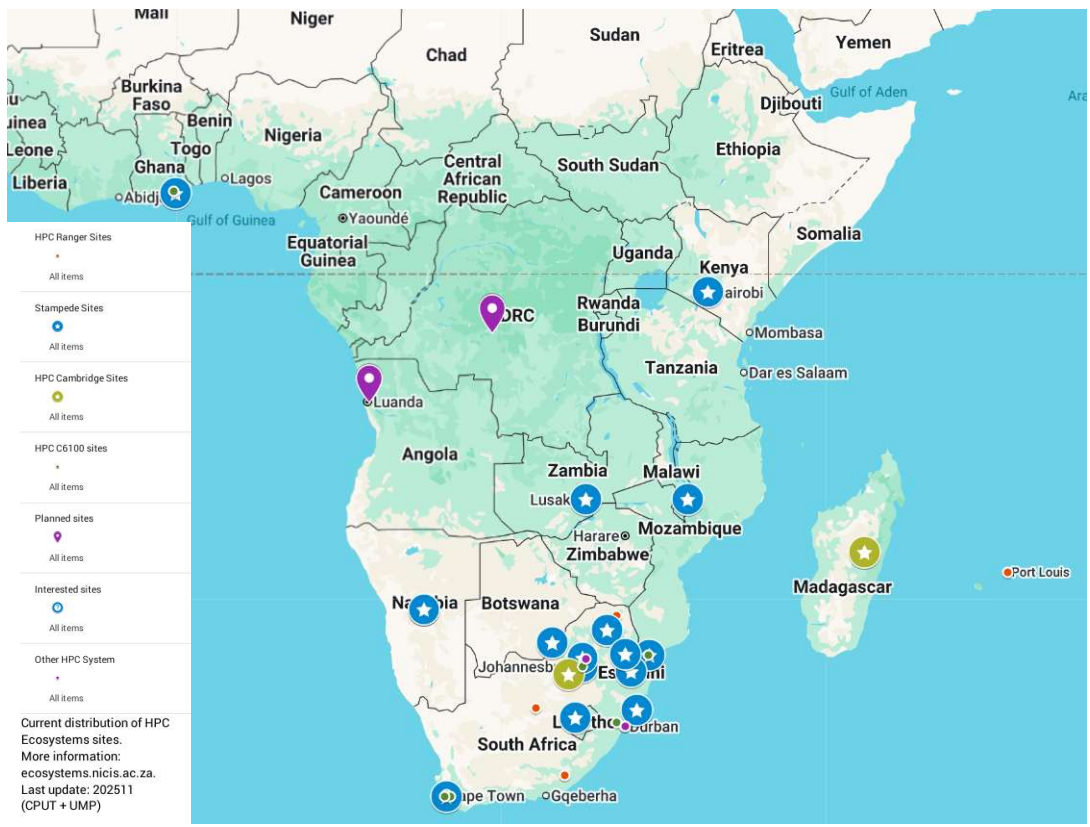


FOCUS ON GROWING THE COMMUNITY (2018 to 2020+)



Project up to 202511

36 Sites



| | GLOBAL (18) | LOCAL (18) |
|------------------|-------------|------------|
| TACC Ranger | 5 | 6 |
| Cambridge M1000e | 1 | 1 |
| CHPC C6100 | 2 | 5 |
| TACC Stampede | 10 | 6 |





DO IT THE RIGHT WAY

**(AKA: NOT DOING IT THE
WRONG WAY)**

WISDOM FROM LEARNING THE HARD WAY

FOMO. Free isn't a reason.

HPC is fast. But don't rush.

Training isn't a silver bullet.

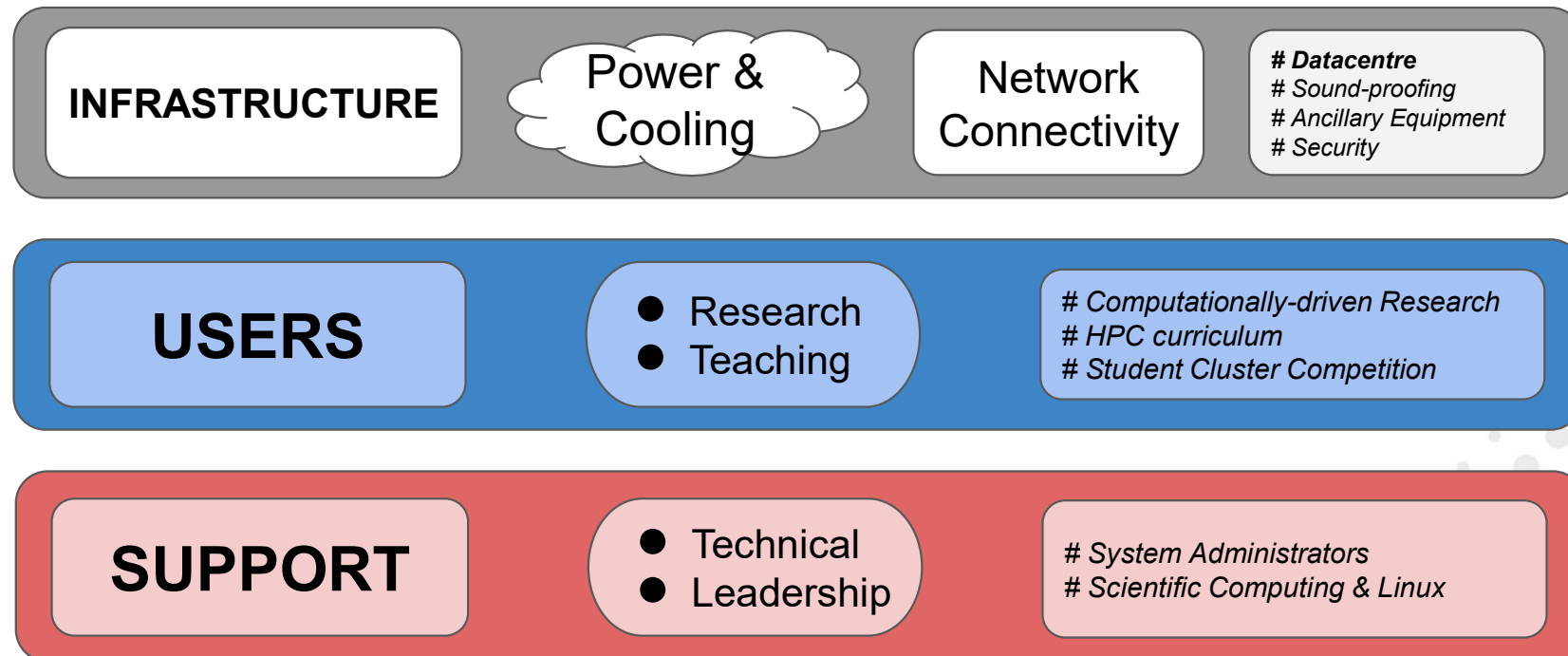
HPC without users is an expensive door stop.

Niche technical skills

HPC onsite is not a panacea

RECIPES FOR SUCCESS

To implement a **successful deployment** of HPC Ecosystems Resource/s, a site requires:



(FISH) RECIPES FOR DISASTER

GIVE A MAN A FISH
AND YOU FEED HIM
FOR A DAY,
TEACH A MAN TO FISH
AND YOU FEED HIM
FOR A LIFETIME



(FISH) RECIPES FOR DISASTER

GIVE A MAN A FISH
AND YOU FEED HIM
FOR A DAY,
TEACH A MAN TO FISH
AND YOU FEED HIM
FOR A LIFETIME



RECIPES FOR DISASTER

GIVE A MAN A FISH
AND YOU

UNSUSTAINABLE

EVERYBODY GETS A NEW JOB



ENABLING THE COMMUNITY

(2020 to 2023)

The Traditional HPC Ecosystems Model

Hardware
Ready



Site
Assessment &
Engagement



Site
Deployment



Site Training



ONLINE TRAINING

Moved Training Online in 2020
(influenced by ...)

Georgia Tech College of Computing
**ONLINE MASTER
OF SCIENCE IN
COMPUTER SCIENCE**

Offered in collaboration with Udacity and AT&T



HPC Ecosystems Project (for SysAdmins)

- OpenHPC Virtual Labs
- HPC SysAdmin Workshops

Summary up to 2025

36 HPC
systems

1000+
participants

24,000+ total
participation
hours.

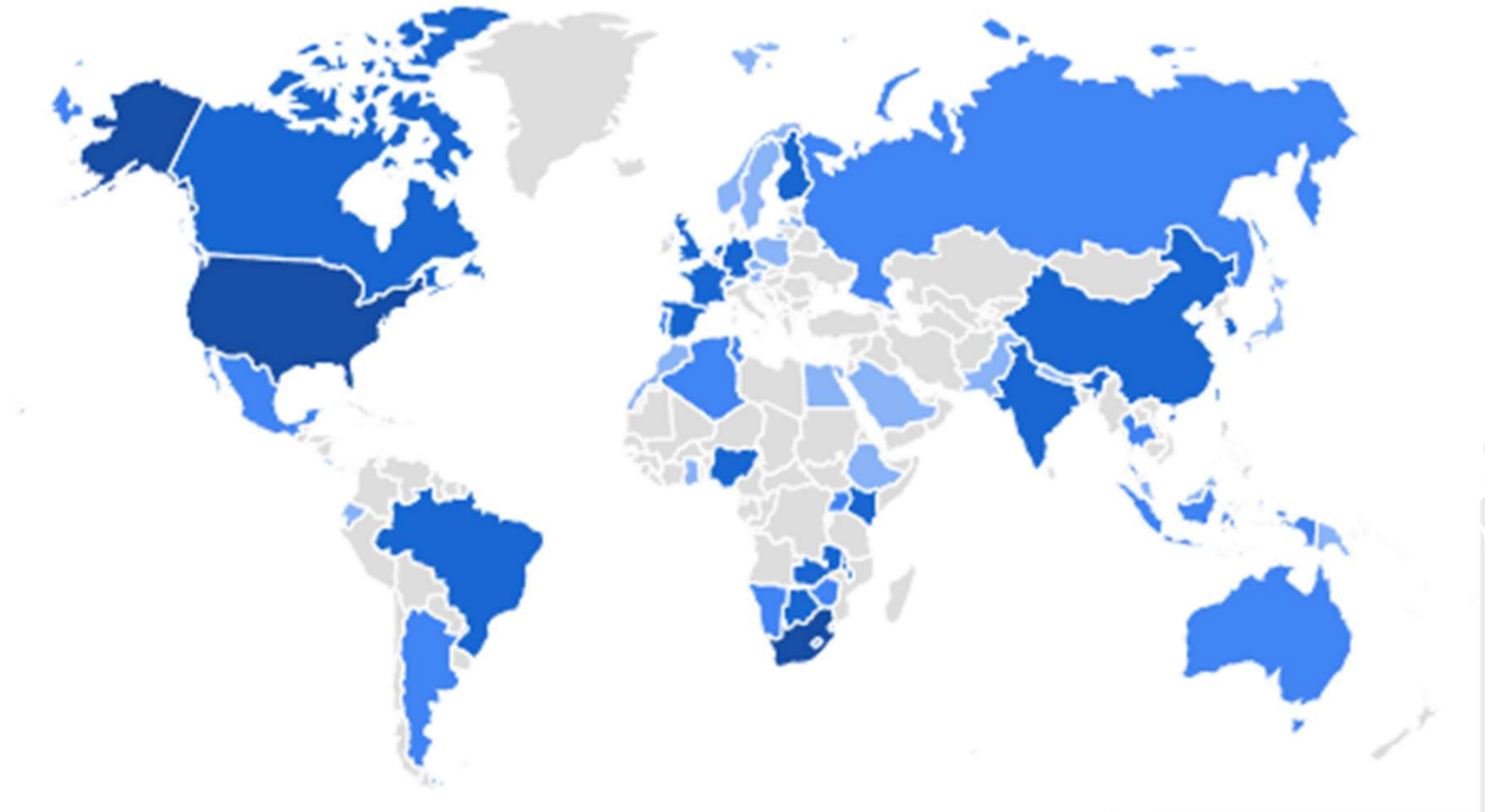
11
countries

35+ formal HPC
training workshops

Summary of OpenHPC2.x

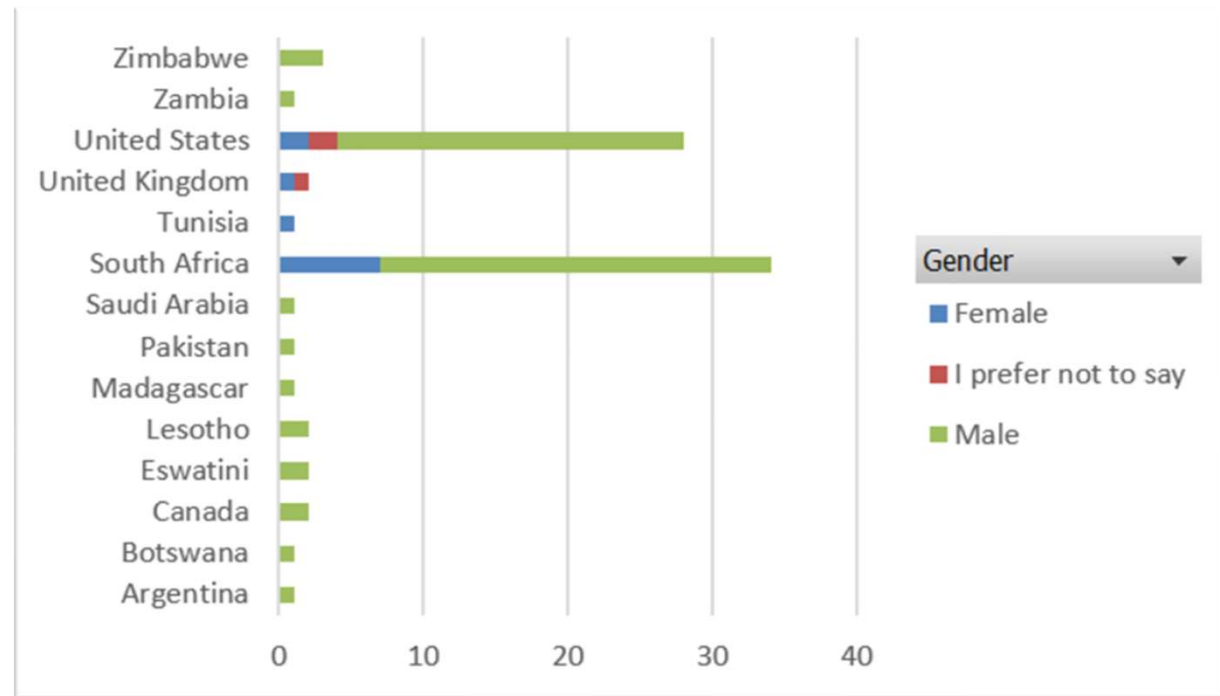
Over 12 months

| Total | 867 100% of total |
|------------------|----------------------|
| 1 South Africa | 433 |
| 2 United States | 181 |
| 3 Eswatini | 45 |
| 4 China | 29 |
| 5 United Kingdom | 18 |
| 6 Netherlands | 16 |
| 7 India | 12 |
| 8 Canada | 9 |
| 9 Germany | 8 |
| 10 Lesotho | 8 |



Sample of training (202409)

| | Grand Total |
|--------------------|-------------|
| Argentina | 1 |
| Botswana | 1 |
| Canada | 2 |
| Eswatini | 2 |
| Lesotho | 2 |
| Madagascar | 1 |
| Pakistan | 1 |
| Saudi Arabia | 1 |
| South Africa | 34 |
| Tunisia | 1 |
| United Kingdom | 2 |
| United States | 28 |
| Zambia | 1 |
| Zimbabwe | 3 |
| Grand Total | 80 |



11 Female

66 Male

3 Undeclared



Cloudless Cluster Virtual Lab

[Let's Get Our Heads Out of the Clouds: A scalable and sustainable approach to HPC Training Labs for Resource Constrained Environments and anyone else stuck in the Clouds](https://jocse.org/articles/15/1/13/)

<https://jocse.org/articles/15/1/13/>

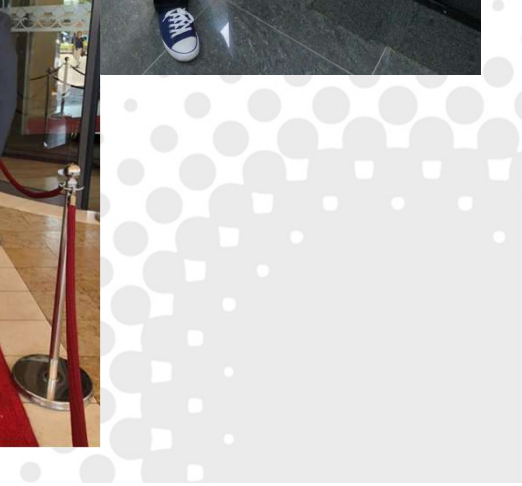




Special Highlights



Special Highlights



Special Highlights




Special Highlights



HPCwire Editor's Choice Award 2022
"changed the face of HPC in Africa"



Special Highlights

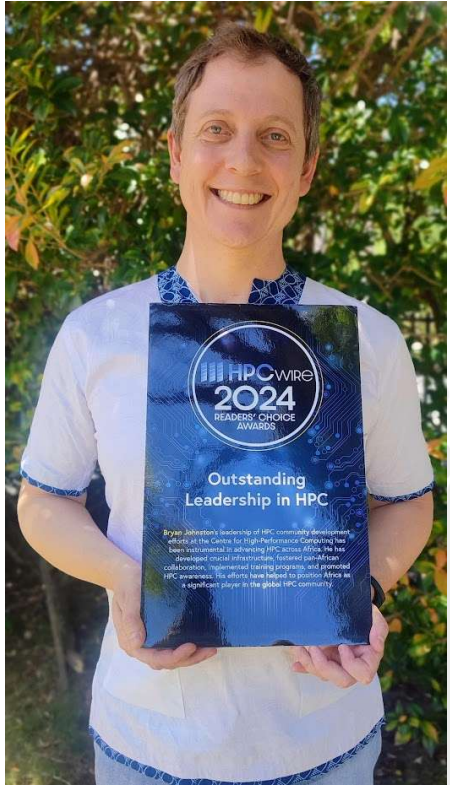


Outstanding Leadership in HPC

Bryan Johnston's leadership of HPC community development efforts at the Centre for High-Performance Computing has been instrumental in advancing HPC across Africa. He has developed crucial infrastructure, fostered pan-African collaboration, implemented training programs, and promoted HPC awareness. His efforts have helped to position Africa as a significant player in the global HPC community.



Workforce Diversity & Inclusion Leadership Award



Second Life: Enabling a Student Special Interest Group through Decommissioned HPC Systems

Michael Beukman*
University of Oxford
Oxford, United Kingdom
mbeukman@robots.ox.ac.uk

Sayfullah Jumoorthy
University of the Witwatersrand
Johannesburg, South Africa
2430888@students.wits.ac.za

Jonathan Faller
University of the Witwatersrand
Johannesburg, South Africa
2432985@students.wits.ac.za

Eugene de Beste
Independent
Cape Town, South Africa
hed@debeste.co.za

Bryan Johnston
CSIR
Cape Town, South Africa
bjohnston@csir.co.za

ABSTRACT

The prevalence of High Performance Computing (HPC) in scientific research continues to grow, and with this growth, the importance of HPC education and training also increases. However, limited access to advanced research computing resources continues to impede workforce development in resource-constrained environments. In this poster, we describe our student-run HPC special interest group at the University of the Witwatersrand in South Africa, and provide an overview of the practical benefits it provides for students. Our group leverages repurposed decommissioned HPC systems to enable practical hands-on experience with HPC and computing clusters for undergraduate students at our university. We further discuss our group's approach to selecting and preparing teams for student cluster competitions, where historically we have enjoyed notable success.

KEYWORDS

Education, Workforce Development, Repurposing, Students in HPC, Student Cluster Competition, HPC Ecosystems Project, Africa

ACM Reference Format:

Michael Beukman, Sayfullah Jumoorthy, Jonathan Faller, Eugene de Beste, and Bryan Johnston. 2024. Second Life: Enabling a Student Special Interest Group through Decommissioned HPC Systems. In *Practice and Experience in Advanced Research Computing (PEARC '24)*, July 21–25, 2024, Providence, RI, USA. ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/3626203.3670753>

1 INTRODUCTION

With ongoing global digitalisation, specialist skills in software, hardware, and High-Performance Computing (HPC) carry an ever-increasing importance [1, 3]. This being the case, several HPC workforce training initiatives have been developed [4, 9, 11, 15, 16],

organised in a top-down fashion by a university or other institution [9, 16]. In this poster, we describe a *student-led* organisation that is dedicated to improving HPC education for undergraduate students. Our Special Interest Group (SIG) is based at the University of the Witwatersrand (colloquially referred to as Wits) in South Africa.¹ Our group serves three primary objectives:

- (1) Preparation and selection of the university's teams for the annual South African Student Cluster Competition (SCC) organised by the Centre for High Performance Computing (CHPC) [9].
- (2) Providing broad HPC training to the general undergraduate community at the university, focusing on practical skills not typically covered in the standard computer science curriculum.
- (3) Enhancement of teaching abilities, and a deepened understanding of HPC concepts for the student organisers, through the process of assuming teaching and mentoring roles for younger peers.

In this poster, we describe the inception of our student-run SIG, its organisational structure, our training processes, and how repurposed decommissioned HPC hardware enables us to successfully achieve our training objectives. We further describe some challenges we have faced through the journey of establishing and sustaining our group. Finally, we discuss the results we have obtained to date—including training the majority of the participating members of the South African SCC teams competing internationally over the past ten years.

2 BACKGROUND

2.1 Student Cluster Competition

Since 2013, the South African CHPC has hosted an annual SCC,²

From Student SIG to Success: *The Journey of a Student HPC Special Interest Group Towards Sustainable Training and Success in Student Cluster Competitions*

Bryan Johnston
CSIR
bjohnston@csir.co.za

Lara Timm
CSIR
ltimm@csir.co.za

David Macleod
CSIR
dmacleod@csir.co.za

John Poole
Center for Human Genetics, Clemson
University
jopoole@clemson.edu

Lily de Melo
University of the Witwatersrand
lily.demelo@outlook.com

Sayfullah Jumoorthy
University of the Witwatersrand
sayfullah.jumoorthy@live.com

Jonathan Faller
University of the Witwatersrand
jono.faller@gmail.com

Reinhard Jansen van Vuuren
University of the Witwatersrand
reinhardjvv@outlook.com

Michael Beukman
University of Oxford
mbeukman@robots.ox.ac.uk

ABSTRACT

Developing a sustainable High Performance Computing (HPC) workforce pipeline remains a global priority. As access to HPC resources continues to improve in Africa, the shortage of available skilled HPC personnel is a significant impediment to the adoption of advanced research computing infrastructure. South Africa has several workforce training initiatives aimed at developing career HPC system administrators, yet, apart from the annual national Student Cluster Competition (SCC) – an initiative of South Africa's Centre for High performance Computing (CHPC) – there are no other formal training programmes available for the undergraduate student community.

Each year since the inception of the CHPC-SCC the University of the Witwatersrand ("Wits") has entered at least one team. Through the implementation of an array of student-led training approaches using decommissioned HPC hardware, Wits has enjoyed continued success at these SCC events. Moreover, Wits students have been part of the national teams that have achieved six top-3 finishes in international Student Cluster Competitions.

This paper provides an overview of the student HPC Special Interest Group (SIG) formed at the University of the Witwatersrand that focuses on delivering HPC training to the undergraduate student community. The paper outlines the approach towards growing and maintaining the interest group, including teaching and learning strategies to prepare Wits students for Student Cluster Competitions. Insights into the challenges experienced and lessons learned are discussed particularly with respect to sustainable workforce

development. These insights could help develop a structured framework for creating effective and sustainable HPC special interest groups, centred around student involvement.

KEYWORDS

Student Cluster Competition, HPC Workforce Development, HPC Education, HPC Training, Africa

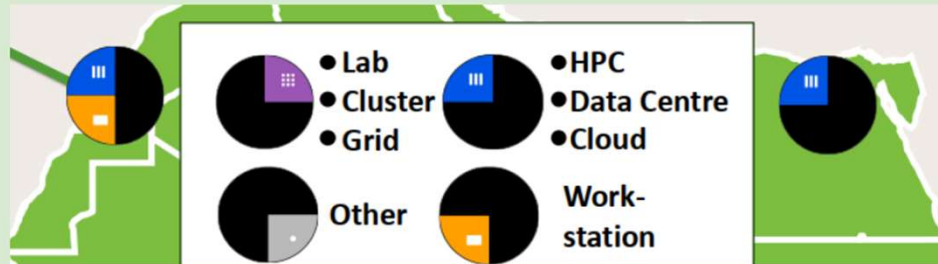
1 INTRODUCTION

Sustainable HPC workforce development is widely recognised as a critical component of effective advanced research computing [6, 11]. Until recently, South Africa did not possess a strong workforce pipeline for HPC. Following the inception of South Africa's first national HPC facility, the Centre for High Performance Computing (CHPC) in 2007, a concerted effort needed to be made towards HPC awareness and outreach initiatives.

As a driver for HPC outreach aimed at undergraduate students at national universities in South Africa the CHPC's national Student Cluster Competition (CHPC-SCC) was launched in 2012. Through the SCC pipeline, South Africa has enjoyed notable success in the ISC Student Cluster Competition, co-organised by the HPC-AI Advisory Council and ISC Group (ISC-SCC).

This paper showcases the University of the Witwatersrand's student HPC Special Interest Group (SIG). The approaches taken towards sustainable student HPC training, the lessons learned the challenges encountered, and a brief overview of plans for expanding

<https://tinyurl.com/AfricaHPCdiscovery>

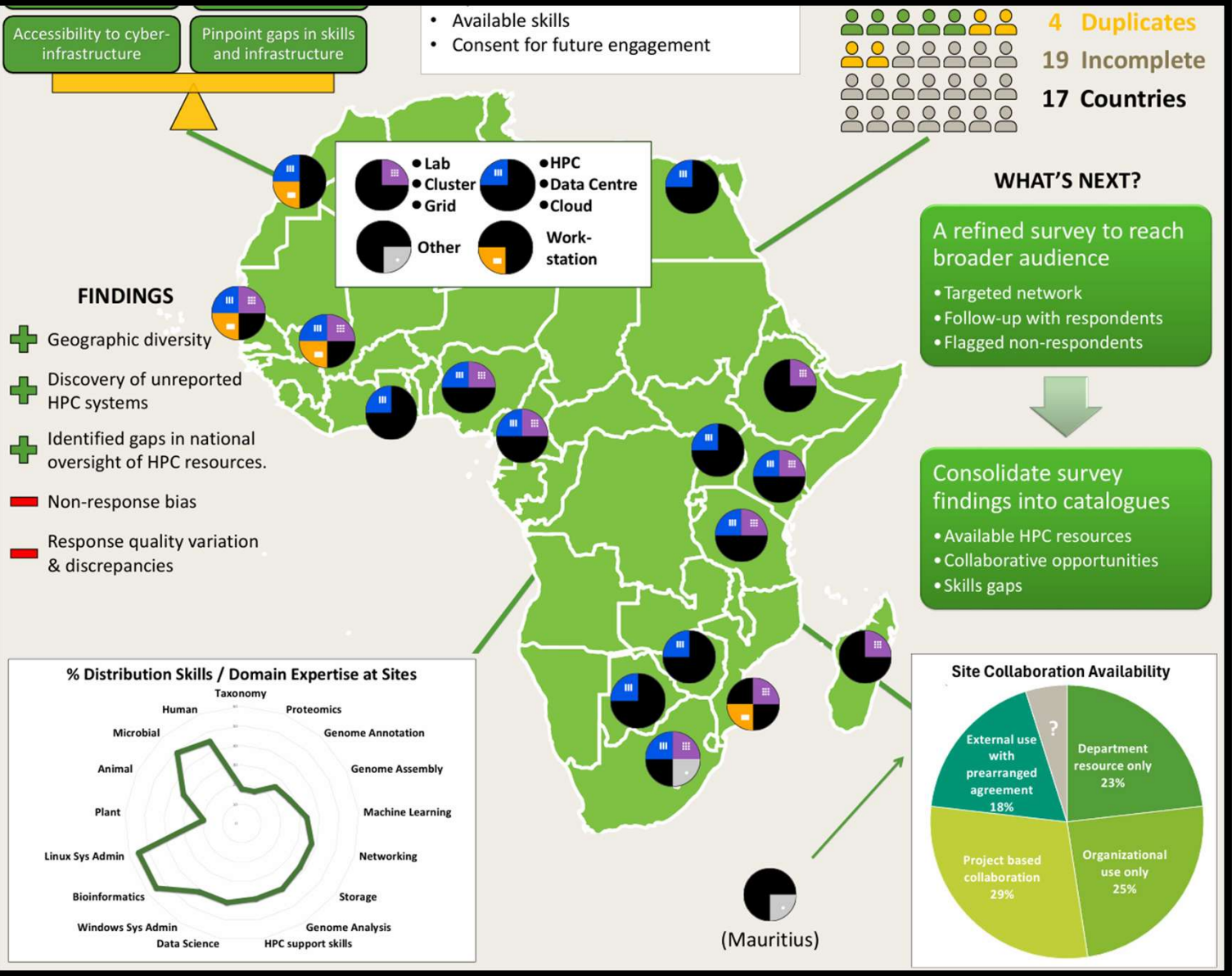


Discovering HPC Resources in Africa

Empowering Collaborative Research Opportunities

HPC Discovery in Africa: PEARC25
Supplementary information for the
PEARC25 Poster





WHAT'S NEXT?

A refined survey to reach broader audience

- Targeted network
- Follow-up with respondents
- Flagged non-respondents





WORKFORCE: Education, Training, Community



EMBRACE THE COMMUNITY

| Platform | 2025 | NOW | Notes |
|--------------------------|------|-----|--|
| Google Group | 168 | 168 | ~16 countries |
| HPC Educators Africa COP | 15 | 15 | A 'spin-off' Google Group community was established at the CHPC National Meeting to represent HPC Educators in HPC Ecosystems partner sites. |
| HPC Ecosystems Slack | 455 | 533 | North America, South America, Europe, Asia, Africa community members (no Antarctica ☹️ ... Australia 🇦🇺) |

TANGO@SC25



- Conference \$2000
- Hotel \$2500
- Pre-Workshop \$500
- **TOTAL: +/- \$5000pp**

- Aim: 12 with partial support.
- \$60k+ for Africa.

SC15

SC16

SC17

SC18

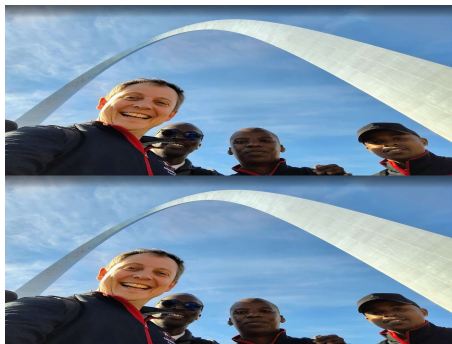
SC19

SC22

SC23

SC24

SC25



2026 Opportunities

The WLCG Tier-99 concept

- Designed a bolt-on for HPC sites to integrate into CERN grid workloads.
- ATLAS workloads map to the data-intensive requirements of the **SRCNet**

Stampede2 KNL hardware @ TACC

- Infrastructure is very workload-friendly and more power efficient than available alternatives.
- **Need funds to ship container!**

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

Focus Areas

Maintain & grow virtual
HPC community

Maintain active
communication

- Partner sites + HPC Ecosystems

Conduct online training

- Update curriculum
- Develop curriculum

Integrating User
Community

- To join the conversation with HPC systems administrators

Collaborate

- African / regional partnerships

Partnerships

- Do not underestimate the value of the global community
- Opportunities to engage at global events

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

HPC Ecosystems Project - Acknowledgements

- HPC Ecosystems Project Team
- HPC Ecosystems Project Community Partners
- Texas Advanced Computing Center (TACC)
- University of Cambridge
- STEM-Trek
- EPCC & PRACE
- OpenHPC
- Georgia Tech

HPC Ecosystems Project Overview



HPC Ecosystems Project - Acknowledgements

- HPC Ecosy
- HPC E
- Te
- Univers
- STEM
- E
- OpenHPC
- Georgia Tech

- <https://ecosystems.nicis.ac.za>

- [Join Slack Community](#)

- [HPC Virtual Lab](#)

HPC Ecosystems Project Overview





THANK YOU! (and stay safe)



Mr Bryan Johnston Senior Technologist: CHPC / Project Lead: HPC Ecosystems

E bjohnston@csir.co.za
ecosystems@chpc.ac.za

T +27 21 658 3975

CSIR, 15 Lower Hope Road,
Rosebank, Cape Town, 7700
www.chpc.ac.za

bjohnston@csir.co.za

HPC Ecosystems Project Overview

