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REPUBLIC OF SOUTH AFRICA



**CSIR**  
Touching lives through innovation



# HPC Ecosystems Project

## Embracing Online Education for HPC System Administrator Training

SIGHPC Education Global Seminar Series  
March 2023

**Bryan Johnston**  
Senior Technologist  
ACE Lab  
CHPC, South Africa

## HPC Recipient

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



- 192 core Sun HPC (Ranger chassis)
  - SysAdmin Training
  - Student Cluster Competition
  - TACC & SC'15



## HPC Project Lead

- Senior HPC Technologist, CHPC
  - *Project Lead: HPC Ecosystems*
  - *ACE Lab*
  - *June 2016 – present*
- MS Computer Science (Computing Systems)  
*Georgia Tech, USA*  
*OMSCS Programme*



“Dear **BrYan**”

HPC Ecosystems Project Overview

# South Africa - most descriptive country name!



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

# CENTRE FOR HIGH PERFORMANCE COMPUTING

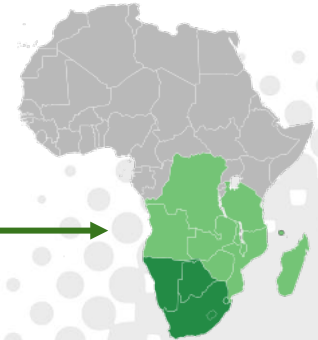
## NATIONAL SUPERCOMPUTING FACILITY

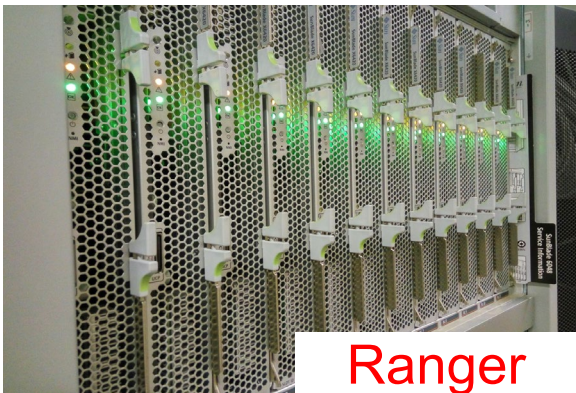
- 1PF system
- (just recently) formerly Top500
- Largest HPC System in Africa (YMMV)



## ... FOR RESEARCH COMMUNITY

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





Ranger

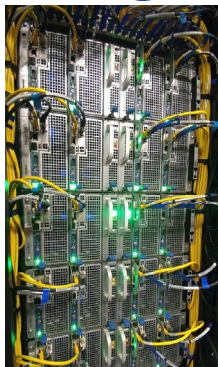


Cambridge



C6100

# HPC Ecosystems Project



Stampede

HPC Ecosystems Project Overview

# HPC Ecosystems Team @ CHPC (18+1)

## Advanced Computer Engineering (ACE) Lab

- David Macleod (Principal Engineer)
- Eugene de Beste (Senior Technologist)
- Lara Timm (Engineer)
- Mmabatho Hashatsi (Engineer)
- Nyameko Lisa (Senior K/A)
- Sean February (Senior Technologist)

[acelab@chpc.ac.za](mailto:acelab@chpc.ac.za)

## CHPC Technical Team

- Themba Hlatshwayo
- Zama Mtshali
- Zintle Sanda

## Research / Academic Support

- Dr. Charles Crosby
- Mr. Inus Scheepers
- Dr. Mthetho Sovara
- Mr. Samuel Mathekga
- Dr. Werner Janse van Rensburg

## CHPC Operations Support

- Funeka Mafani
- Lesley Fredericks
- Nox Moyake
- Dr. Ricardo Harry





HPC Ranger Sites

• All items

Stampede Sites

★ All items

HPC Cambridge Sites

★ All items

HPC C6100 sites

★ All items

Planned sites

📍 All items

Interested sites

🕒 All items

Other HPC System

• All items

Update of HPC Ecosystems sites as of 202205

	GLOBAL (17)	LOCAL (~17)
TACC Ranger	5	6
Cambridge M1000e	1	1
CHPC C6100	2	5
TACC Stampede	9	3 (+2)



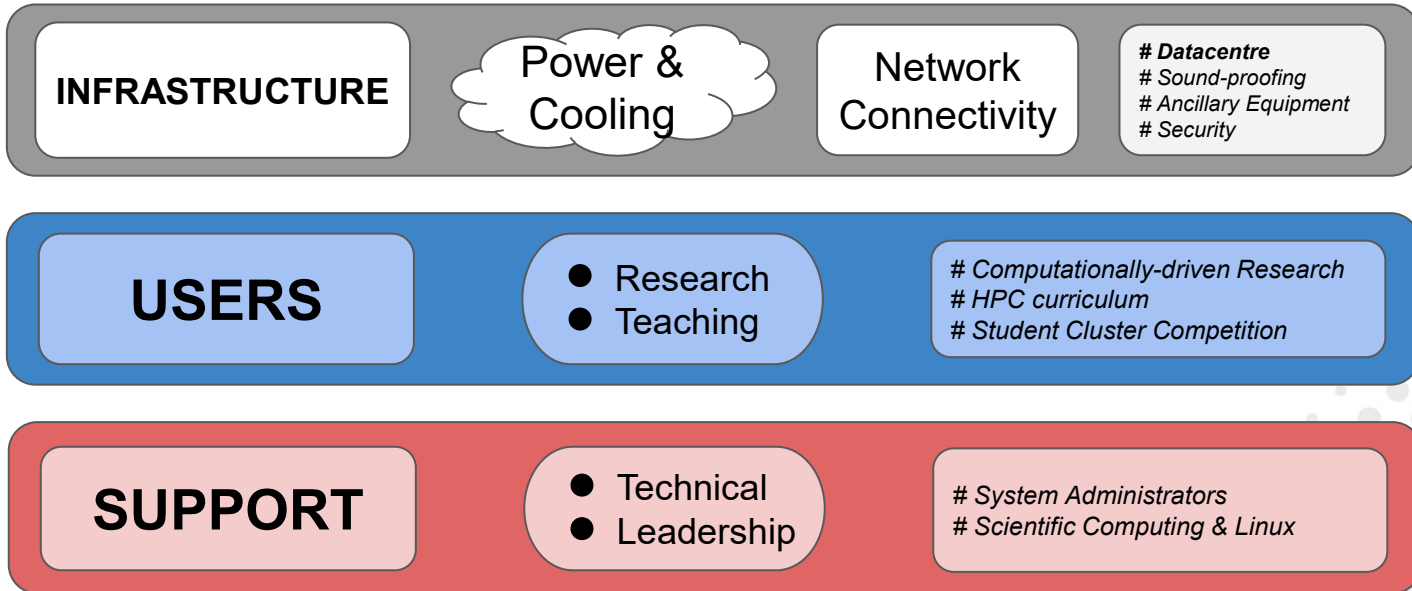
HPC Ecosystems Project Overview

# How it happens



# HPC Ecosystems Project - READINESS

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



# HPC Ecosystems Project – WHY WAIT?

## USERS

- Research
- Teaching

# Computationally-driven Research  
# HPC curriculum  
# Student Cluster Competition

**BUT WHY  
WAIT TO  
BEGIN THE  
TRAINING???**

**Research**  
\* Scientific Computing  
\* Computational Science

Scale of HPC use

**Teaching**

\* HPC curriculum  
\* Student Cluster Competition



# The Traditional HPC Ecosystems Model

Hardware  
Ready



Site  
Assessment



Site  
Deployment



HPC Ecosystems Project Overview

Site  
Training



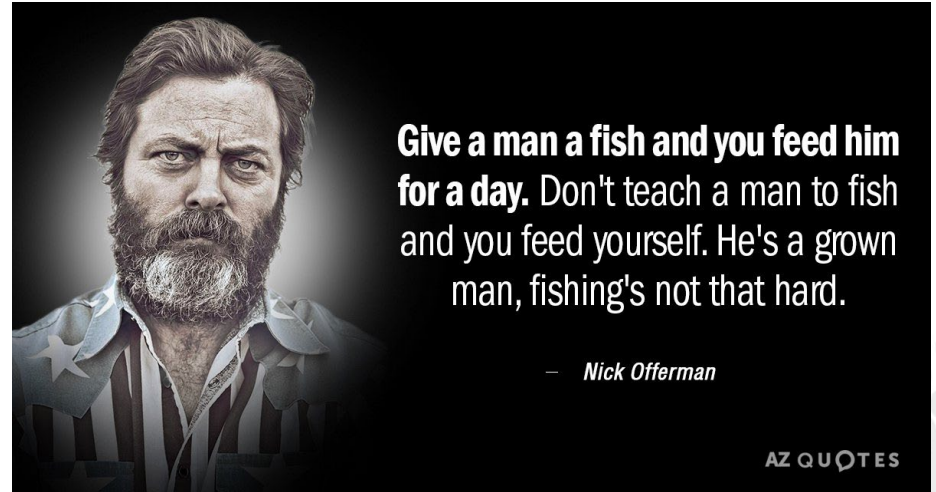
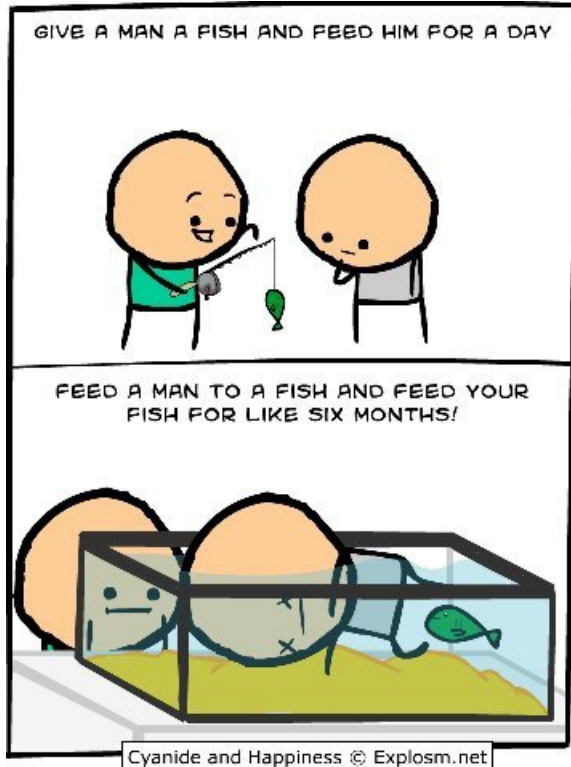
# On-site Training (pre-COVID19)



HPC Ecosystems Project Overview



# REPEAT train.site() UNTIL 1==2



# ONLINE TRAINING

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



HPC Ecosystems



## HPC Ecosystems Project (for SysAdmins)

- OpenHPC Virtual Labs
- HPC SysAdmin Workshops



# TAKING EDUCATION & TRAINING ONLINE

## LOWER OVERHEAD

- **Cost:** not funding participants
- **Logistics:** not hosting a F2F workshop
- **Workload:** long-term, can re-run online course relatively easily.

## SCALABILITY

- **Size:** can accommodate larger groups
- **Frequency:** can run programs in parallel / quick succession / on-demand etc.
- **Repeatable!**

# PRINCIPLES LEARNED FROM OMSCS

## Accessibility

- Data “lite”
- Offline availability
- Closed-Captions

## User Friendly

- Good UX
- FAQ / Support Resources

## Flexibility

- Accommodating

## Replayability

- Participants can repeat lessons

## Compatibility

- Multiple devices & OS support

# ONLINE EDUCATION STRATEGIES

## Drop-out / Disengagement

- Regular Office Hours
- Encourage Collaboration
- Incentivise Participation

## Confusion / Overwhelming

- Community chat
- Advice & Tips for online learning

## Life Happens

- Be understanding!
- Make it manageable!
- **BE HUMAN!!**

# Implementation

# Videos

## Accessible

- Downloadable
- Zero-rated
- Captions

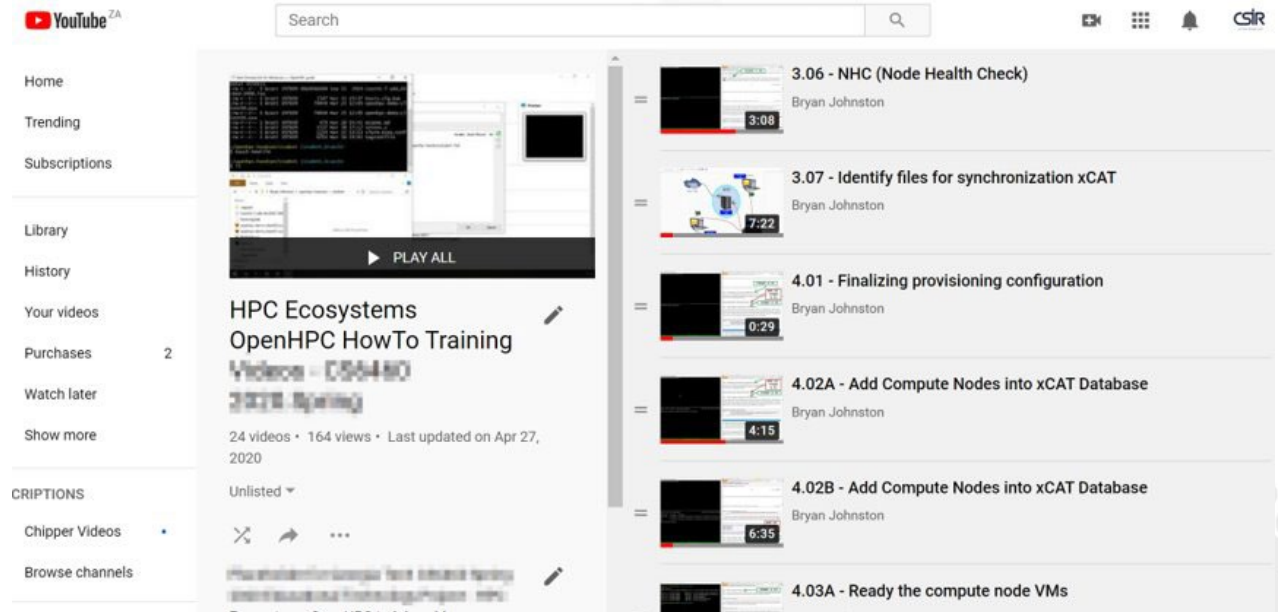
## Replayable

## Compatible

## User Friendly

## Flexible

- On Demand



# Virtual Labs

## Accessible

- Off-line
- Opensource (GitLab)
- Low Resource Requirement

## Replayable

## Compatible

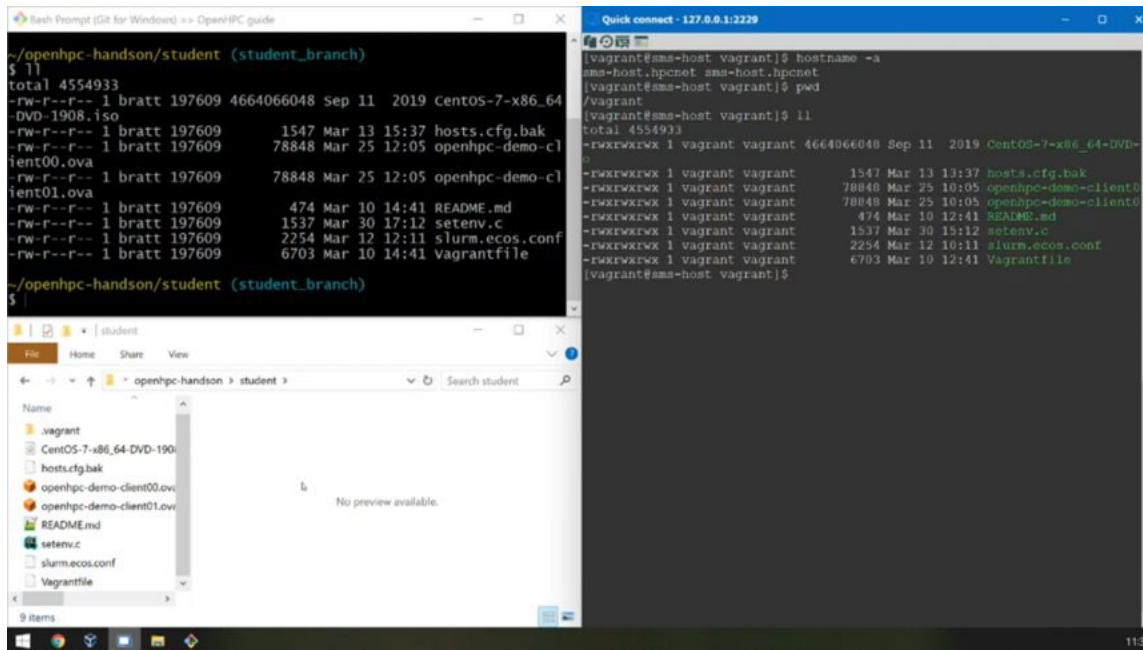
- VirtualBox

## User Friendly

- YMMV :-)

## Flexible

- On Demand
- Transferable to Production





# Formal Workshops

## Accessible

- FREE

## Replayable

- Quarterly :)

## Compatible

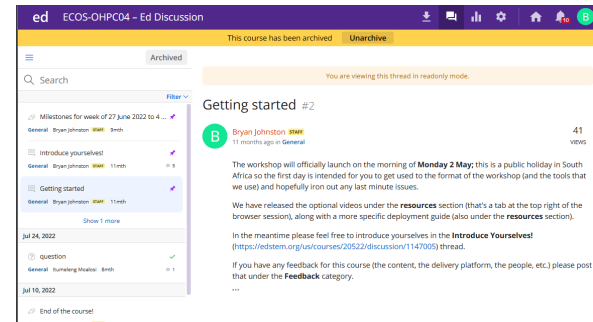
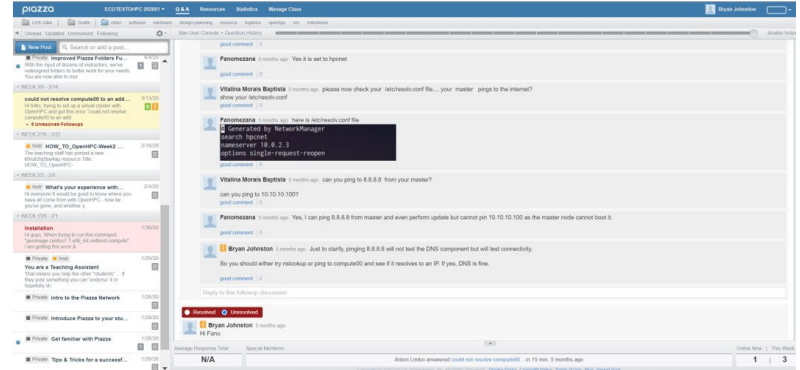
- Web-clients

## User Friendly

- YMMV :-)

## Flexible

- LMS and Slack
- 1-2 weeks for 15 hours of work



# FEEDBACK: YOU ARE NOT YOUR USER!

# HPC Ecosystems Project – DO IT!

[OpenHPC 101 \(hpc-ecosystems.gitlab.io\)](https://hpc-ecosystems.gitlab.io)

[YouTube: 'hpc ecosystems 101 openhpc'](https://www.youtube.com/watch?v=...)

HPC Ecosystems Slack:

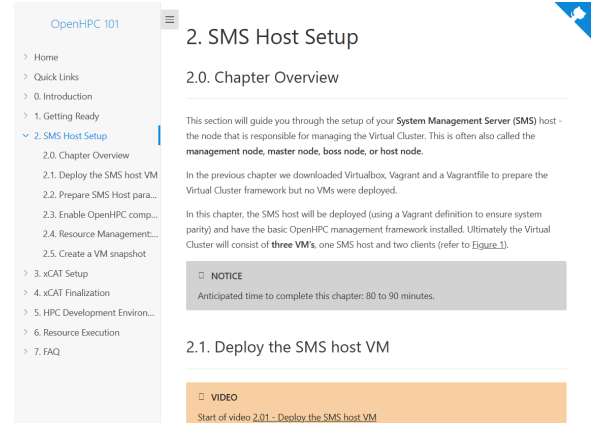
<https://tinyurl.com/sighpc-join-ecosystems-slack>

HPC Ecosystems Google Group:

<http://tinyurl.com/SADC-HPC-Apply>

NICIS CHPC Events:

[events.chpc.ac.za](https://events.chpc.ac.za)



OpenHPC 101

- Home
- Quick Links
- 0. Introduction
- 1. Getting Ready
- 2. SMS Host Setup
  - 2.0. Chapter Overview
  - 2.1. Deploy the SMS host VM
  - 2.2. Prepare SMS Host para...
  - 2.3. Enable OpenHPC comp...
  - 2.4. Resource Management...
  - 2.5. Create a VM snapshot
- 3. xCAT Setup
- 4. xCAT Finalization
- 5. HPC Development Environ...
- 6. Resource Execution
- 7. FAQ

## 2. SMS Host Setup

### 2.0. Chapter Overview

This section will guide you through the setup of your **System Management Server (SMS)** host - the node that is responsible for managing the Virtual Cluster. This is often also called the **management node, master node, boss node, or host node.**

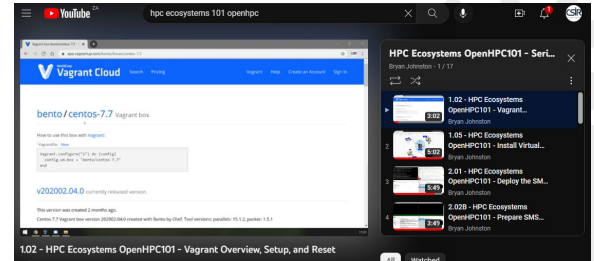
In the previous chapter we downloaded Virtualbox, Vagrant and a Vagrantfile to prepare the Virtual Cluster framework but no VMs were deployed.

In this chapter, the SMS host will be deployed (using a Vagrant definition to ensure system parity) and have the basic OpenHPC management framework installed. Ultimately the Virtual Cluster will consist of **three VMs**, one SMS host and two clients (refer to [Figure 1](#)).

**NOTICE**  
Anticipated time to complete this chapter: 80 to 90 minutes.

### 2.1. Deploy the SMS host VM

**VIDEO**  
Start of video 2.01 - Deploy the SMS host VM



YouTube

hpc-ecosystems-101-openhpc

Vagrant Cloud

bento/centos-7.7 Vagrant box

How to use this file with Vagrant:

```
Host: ubuntu  
vagrant config --provider 'virtualbox'  
vagrant up --provision --no-tty
```

v202002.04.0 Community released version

This version was created 2 months ago.  
Guest 7.7 requires host version 6.0.18 or later. Your host version is: 6.1.3 (update to 6.1.3)

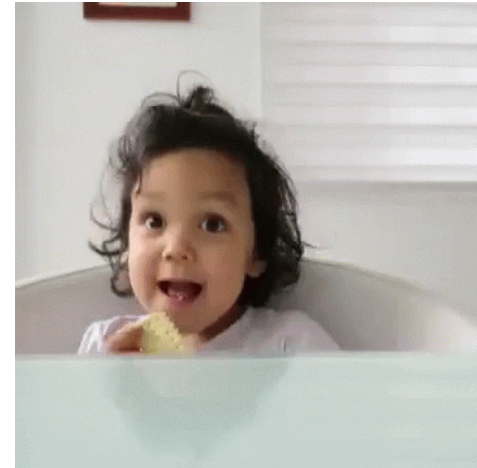
### HPC Ecosystems OpenHPC101 - Ser...

- 1.02 - HPC Ecosystems OpenHPC101 - Vagrant...
- 1.05 - HPC Ecosystems OpenHPC101 - Install Virtual...
- 2.01 - HPC Ecosystems OpenHPC101 - Deploy the SM...
- 2.02B - HPC Ecosystems OpenHPC101 - Prepare SMS...

1.02 - HPC Ecosystems OpenHPC101 - Vagrant Overview, Setup, and Reset

# 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





# THANK YOU! (and stay safe)



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HPC Ecosystems Project Overview

