



pawsey



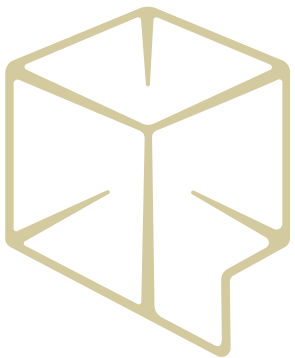
HPC User Forum: Pawsey Update

Presented by Mark Stickells, Executive Director

Introduction

An Australian National Tier-1 Facility

- Headquartered in Perth, Western Australia on Whadjuk country
- Launched as Pawsey in 2014, UJV foundations back to 2000
- Critical infrastructure for Square Kilometre Array (SKA) in WA on Wajarri Yamatji country, 800km north of Perth
- AU\$70m capital refresh by Australian Government
- 50+ Staff employed via CSIRO, national science agency



Pawsey Supercomputing Research Centre



Vision

Enable science and accelerate discovery

Purpose

To unlock impact scientific knowledge through research, critical infrastructure, expert staff, sector know-how and customer-centric problem solving

Values

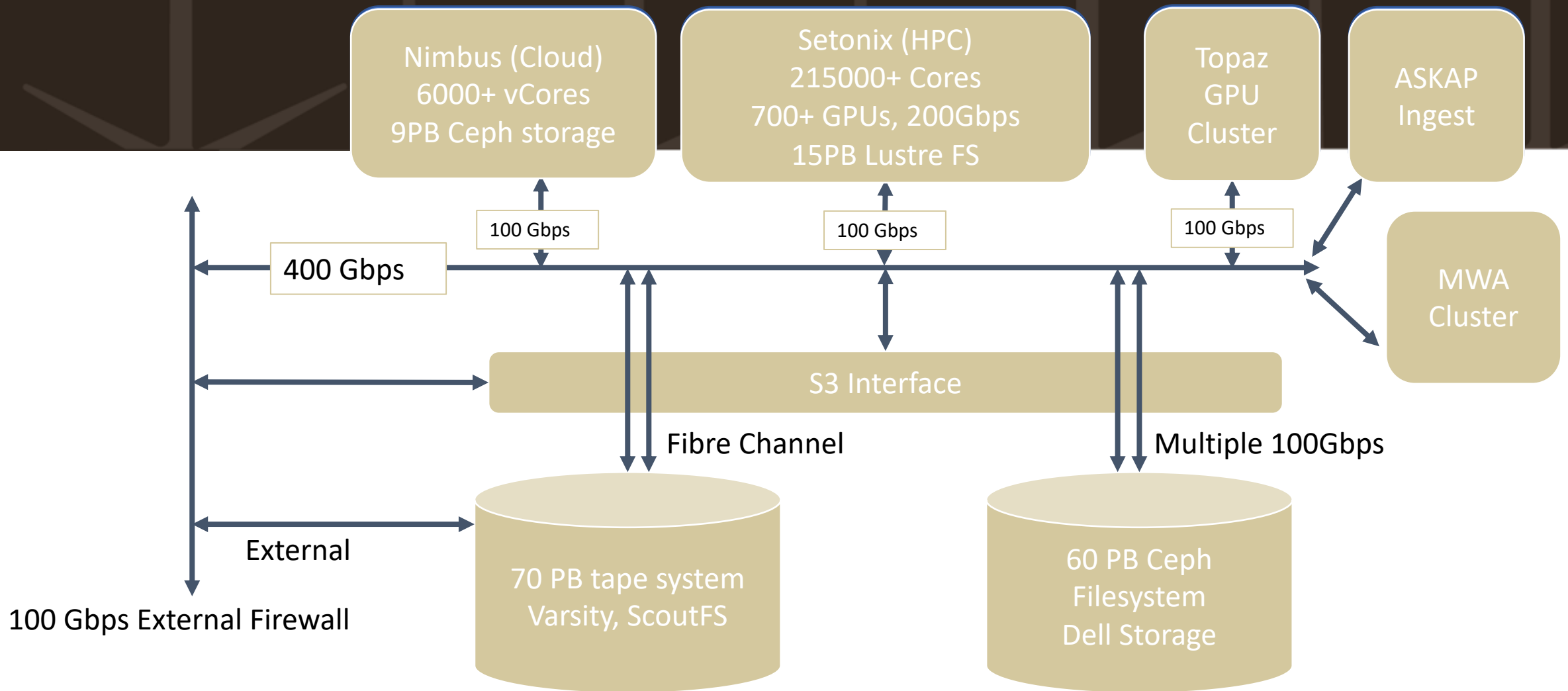
Positive, Collaborative, Innovative, Honest, Responsive

Setonix – “World’s Happiest Animal”



- HPE Cray EX System announced October 2020, named February 2021
- 30x increase in compute power and more emphasis on accelerators with future-generation AMD EPYC™ CPUs and AMD Instinct™ GPUs
- Expanded data storage capabilities - Cray Clusterstor E1000.
- Phase 1 - Q3 2021 will deliver 45% increase in compute power to existing Magnus and Galaxy systems.
- Phase 2 - Q3 2022 will provide ~50 petaFLOPs compute power, 200,000+ AMD CPU cores, 750+ AMD GPUs, 548+ terabytes of memory
- 10 times more energy efficient than Magnus and Galaxy

Pawsey's Architecture 2021 +



Pawsey Systems



Nimbus HPC Cloud

Refreshed system - high throughput, flexible access

Additional object storage and Kubernetes container orchestrator

5X memory, 25x storage



Radio Astronomy

New MWA compute cluster **Garrawarla** 78-nodes dedicated to process 30 PB+ telescope data, enhanced GPU capabilities

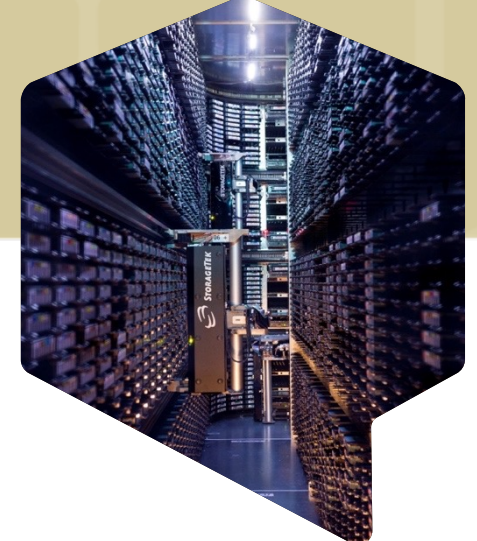
Refreshed 16 **ASKAP ingest nodes** - AMD processors designed for higher I/O performance - 2x bandwidth



Network

New **Spine-leaf architecture**, 400Gbps backbone, 100Gbps to host endpoints. Easily expandable to support Ceph-based object storage and Setonix integration

10x bandwidth increase to all network endpoint



Storage

New **open system software** for online storage. Re-using existing tape libraries + new 5PB cache to support new 100Gbps network infrastructure.

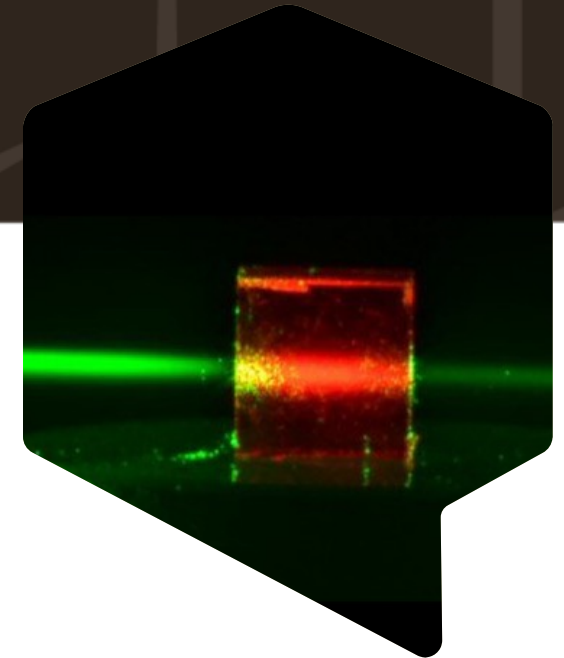
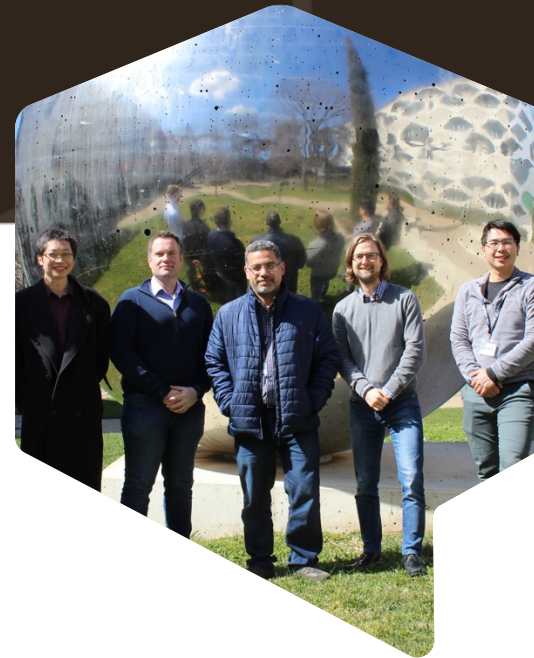
New 60PB online object storage for long term archiving of researcher data. Two zones - fast access vs energy efficient long-term storage



Australia's First Quantum Supercomputing Hub

Ugo Varetto, Chief Technology Officer, Pawsey

Pawsey and Quantum Computing



National Industry Roadmap

\$4B revenue

16,000 new jobs across computing, sensing and measurement, communications

Quantum Brilliance

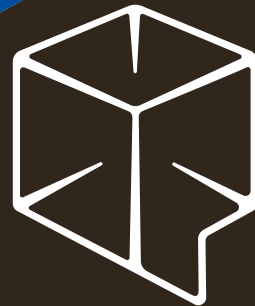
Australian startup using synthetic diamond technology

Room temperature quantum coherence (>1ms)

Pioneers & Benchmarking

2 University, 2 industry projects

dQDK fieldtrial @ Pawsey – room temp, hosted in HPC nodes for Open Science and Industry



PaCER: Pawsey's Centre for Extreme Scale Readiness

Dr Maciej Cytowski, Pawsey's Head of Scientific Services & co-Chair PaCER

PaCER - \$3m, 3yr Program



Strategy

Achieving sustainable scalability on the new HPE Cray EX supercomputer will create a direct pathway to achieve superior scale on next-generation supercomputers



Collaboration/Co-investment

3-year partnerships with Pawsey and HPC vendors, early access to supercomputing tools and infrastructure, training and exclusive hackathons focused on HPC performance at scale.



Projects

10 projects, 18 institutions
Collaboration with US National Laboratories (ANL, ORNL, Ames) and industry (GE)

PaCER Projects - Summary

Highlights

- 18 institutions – national and international
- Collaboration with US National Laboratories (ANL, ORNL, Ames) and industry (GE)
- 5 projects already have allocations on Magnus, their allocations in 2021 represent **21%** of total Magnus computational capacity
- 3 projects address SKA data processing & computational challenges
- 2 new projects – new users of Pawsey's facilities
- 8/10 projects focusing on developing and optimisation of in-house computational codes and workflows
- 6/10 projects are also using NCI's Gadi
- 4 projects WA, 3 projects QLD, 1 project SA, 1 project ACT and 1 shared between VIC and NSW

Topics

- CFD, Turbulence, Engineering
- Quantum Chemistry
- Cosmology
- CFD, Geoscience, Petroleum
- Radio astronomy
- Atomic and Molecular Physics
- Nuclear Physics
- Statistical Mechanics, Rheology
- Particle Physics



Training and Education

Ann Backhaus, Pawsey's Education and Training Manager

Training and Education Highlights



Strategic Pillars

People, Research and Technology, Customers, Integrity, **Skills**

Attract, develop & retain staff



Upskilling Staff

Pawsey-wide commitment to increase data & supercomputing literacy through skills and knowledge frameworks



User Migration

Immediate priority – guided by Pawsey specialists, user and program analysis and HPC certified training



STEM outreach

Tertiary and Secondary engagement

Internship program - 25 this year, doubling previous numbers

Teacher PD & Masterclasses, student work experiences & targeted education

International
Women's Day
Women Using
Technology

8 March 2021

#ChooseToChallenge



PAWSEY



Diversity and Inclusion

D&I at Pawsey

Objective

- Through its events, activities, training and support, Pawsey seeks to strengthen, deepen, and widen an inclusive STEM pipeline

- 10 women trained in the SuperSTEM program
- More than 700 attendees of the National Data Science Week launch, a showcase of Women in Data Science
- More than 1300 views of case studies featuring women-led projects

Actions

- **For our users:** SuperSTEM Training, Skill Building, Team Building, Leadership Support locally, nationally and/or internationally for such initiatives as Women in HPC, Women in Technology, Women in STEMM, WiTWA, UN Women
- **For our staff:** National Dialogues and Collaborations in D&I and STEM / STEAM ResBaz's: Building HPC awareness and critical thinking skills
- **For educators:** Teacher Outreach, Making Data Accessible to Students, Carnival of Computing

Pawsey's Commitments include...

- **Women in HPC (WHPC)** - Pawsey supported the establishment of the Australasian chapter – WHPC is not a group just for women but also allies of inclusive diversity beyond gender.
- **Member of CEOs for Gender Equity** - CEOs for Gender Equity commit to boost women's workforce participation, lift productivity, and increase economic growth by sustainably improving gender equity in jobs and pay.
- **Actions** - advocacy, inclusive workplace practices, leadership development and training, mentoring, sponsorship and engagement

As we grow and diversify our research community, we're also growing and diversifying our own workforce. Through summer internships, Pawsey HPC Research Fellowships, and relentlessly promoting careers in data intensive sciences, we are steadily becoming more representative of the community we serve. When I first joined Pawsey two years ago, we had more men named Mark in our workforce than we had women and I'm very pleased to say that is no longer the case. Our commitment to diversity and inclusion is supported by the stories in this report of the performance and achievement of our staff and our community. Genuine improvements in diversity and inclusion ensure Pawsey is not just a better place for all to work, but a better performing business.

Pawsey has been responsive to the COVID-19 pandemic and worked with the NCI to provide accelerated access to supercomputing resources for eight Australian research groups working to understand and stop the spread of the SARS-CoV-2 virus. Their work is summarised alongside other examples of Pawsey-supported research later in this report. We are also continuing to work with the international research and supercomputing community to facilitate the sharing and analysis of information to block the action of SARS-CoV-2 and treat COVID-19.

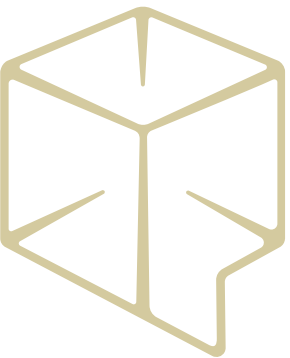
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Thank you ... Q&A



Pawsey and Radioastronomy

SKA-Low - Murchison Radio Observatory

- Compute needs and green energy
- GPUs and code optimization efforts – PaCER and international collaboration efforts (e.g CERN)
- Science Data Processors (SDP) vs Science Regional Centres (SRC)
- Data storage and movement challenges
- HPC and Quantum Accelerators?
- Multinational, intergovernmental collaboration, stakeholder and indigenous land use agreements – it's not all about the technology and science