The Future of Digital in Science

SC Asia 2019 SG-AU session

Angus Macoustra – Chief Technology Officer

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Outline

About CSIRO

Scientific Computing overview

CSIRO's digital+science opportunities and challenges

CSIRO's digital transformation

CSIRO

CSIRO – Australia's National Science Agency

5800 talented staff

$1billion + budget

Working with over **2800+** industry partners

55 sites across Australia

Top 1% of global research agencies

Each year **6 CSIRO technologies** contribute $5 billion to the economy

CSIRO

We solve the greatest challenges through innovative science and technology

POLYMER BANKNOTES

BARLEYmax™

RELENZA FLU TREATMENT

AEROGARD

EXTENDED WEAR CONTACTS

SOFTLY WASHING LIQUID

WiFi WLAN

TOTAL WELLBEING DIET

HENDRA VACCINE

SELF TWISTING YARN

RAFT POLYMERISATION

NOVACQ™ PRAWN FEED

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CSIRO Computing Overview

~400 talented staff

80+ collaborative eResearch projects every 6 months

Working with over 2600+ customers

~5 Million CPU hours per month

1500m^2 data centre floor space across Australia

~3 Petaflops aggregate performance

3700 published collections in data.csiro.au

~40PB primary data holdings

Australia's digital science opportunities and challenges

Domain + Digital initiatives

- **Our energy system - National Energy Analytics Research**
- **Clinical Research Data Network**
- **Provenance & supply chain**
- **AI for CyberSecurity**

Space

- **NovaSAR**

Facilities

- **C3 Centre**
- **Synchrotron**

EMERGING OPPORTUNITIES

PRECISION HEALTHCARE	$30-50b
DIGITAL AGRICULTURE	$10-25b
DATA-DRIVEN URBAN MANAGEMENT	$5-10b
CYBER-PHYSICAL SECURITY	$10-15b
SUPPLY CHAIN INTEGRITY	$10-15b
PROACTIVE GOVERNMENT	$5-10b
LEGAL INFORMATICS	$10-15b
SMART EXPLORATION & PRODUCTION	$5-15b

Data61 & Alpha Beta Digital Innovation Report:
https://data61.csiro.au/en/Our-Work/Future-Cities/Planning-sustainable-infrastructure/Digital-Innovation

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National Energy Analytics Research (NEAR)

The Challenge –
Energy security, outages, costs

The Opportunity –
Brings together energy data, research and reporting.
Digital twin of our energy network

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Clinical Research Data Network

The Challenge –
Post trial health data sets lay dormant, inaccessible and isolated with significant untapped latent value.

The Opportunity –
a National platform for Health Research Data

Opportunity to extend to a regional platform to support collaborations such as the CSIRO-NTU precision health collaboration

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Provenance and supply chain

The Challenge –

> product fraud, non-linear value chains and demands for authenticity and transparency

The Opportunity –

> A platform that provides trustworthy information on the history and properties of products

> Outcomes are biosecurity, food safety, market access.

> Digital twin of food production and trade system

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AI for Cybersecurity

The Challenge –
    Cyber attackers have an asymmetric advantage
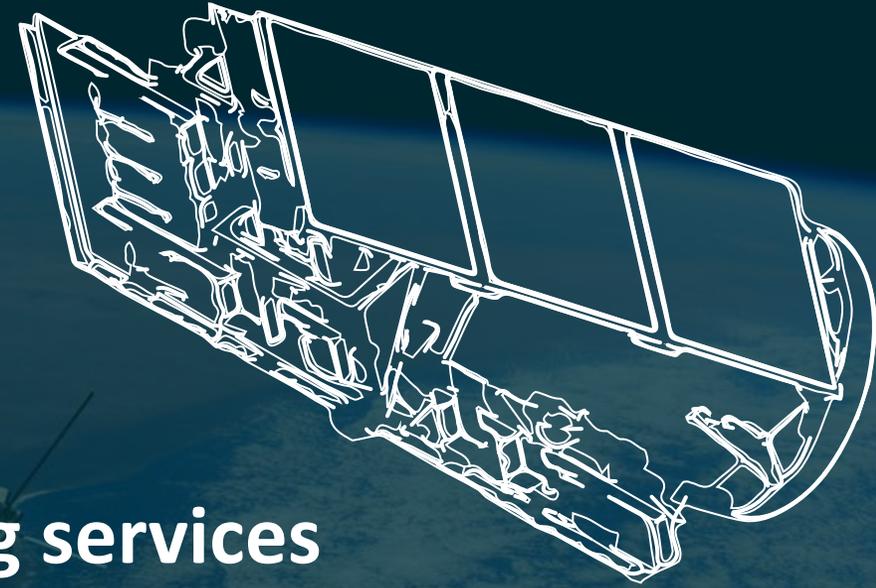
The Opportunity –
    Automated AI cyber counter measures to coordinate responses in real-time.

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Space – NovaSAR and beyond

Our latest national facility – NovaSAR-1 in service March 2019

Imagery will be open access

Establishing downlinks and mission planning services

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Collaborative Crystallisation Centre (C3)

Technology platform for crystallisation
- Novel AI/ML/visualisation/software
- 4,000,000 crystallisation experiments
- ISO 17025 certified
- Over 450 users
- 60,000,000 images

scientific discovery

crystallisation conditions

growth monitoring

machine learning
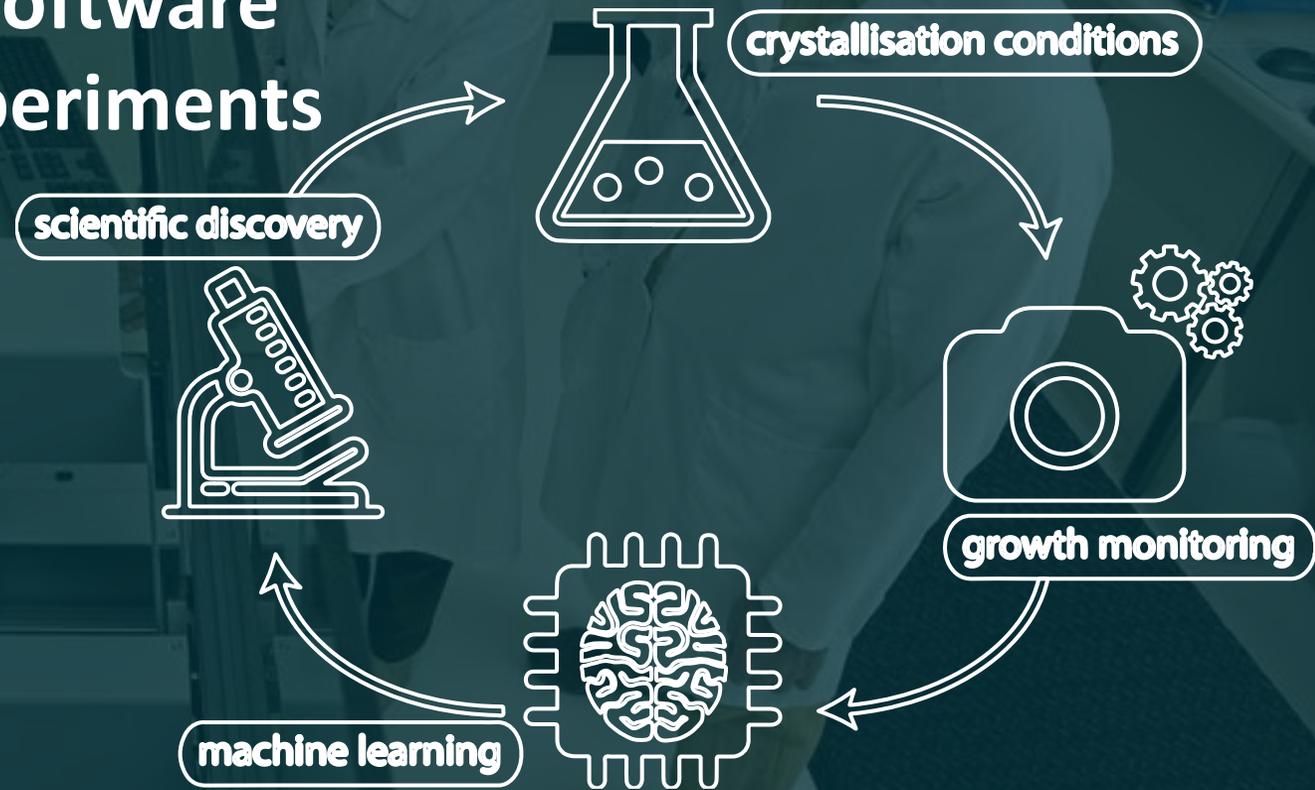
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World Synchrotrons – CSIRO X-TRACT

Canadian Light Source
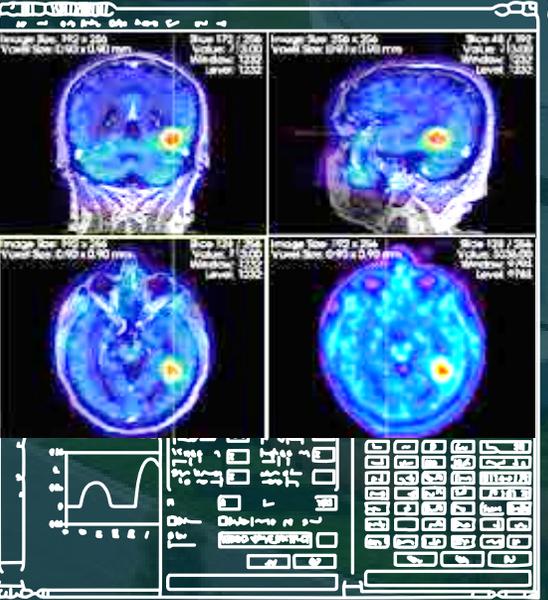
European Synchrotron

Elettra Synchrotron

Shanghai Synchrotron

Singapore Synchrotron

Australian Synchrotron

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CSIRO's digital transformation

AI/ML

Supercloud - openstack IB SDN baremetal

HPC parallel filesystem – BeeGFS

Digital Academy

Data Ecosystem

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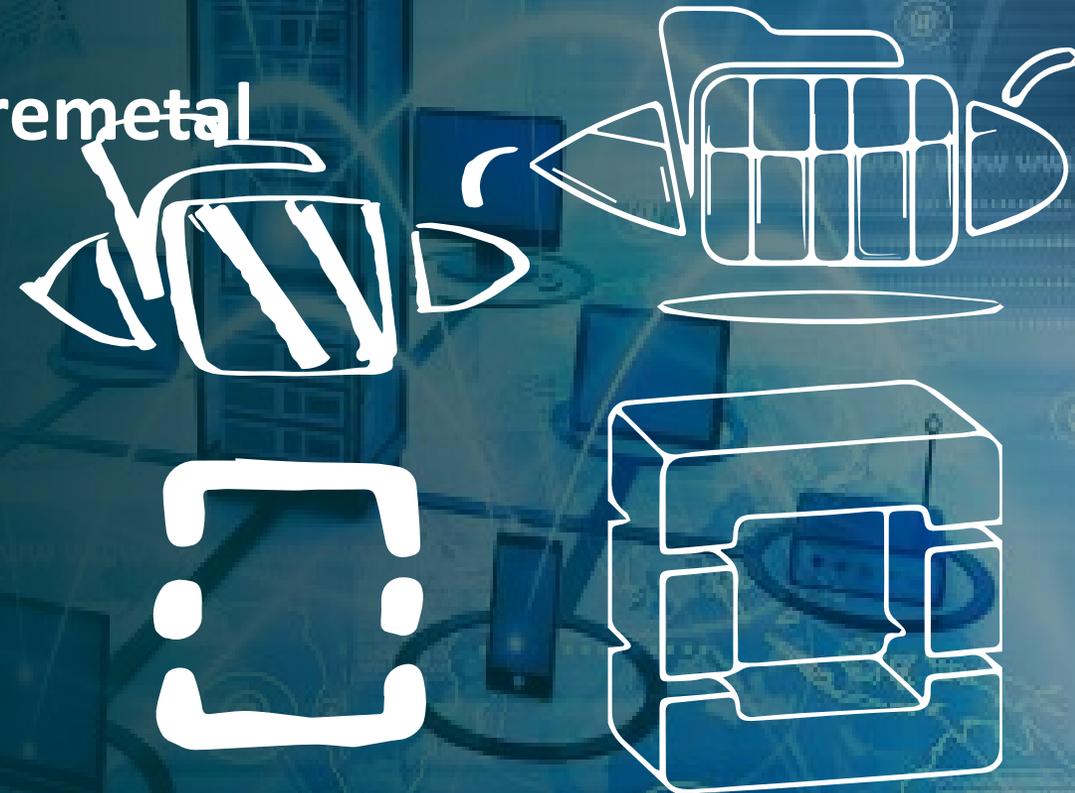
AI / ML

National AI Roadmap

National AI Ethics Framework

AI ML Future Science Platform

ML infrastructure – Bracewell and Deep Learning

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Supercloud

- API driven access to hardware

- workload isolation and flexibility to match changing user requirements,

- IaaS, SaaS, SDN and software-defined-storage converge

- Turning systems into applications,

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HPC parallel filesystem – BeeGFS

Data will drive our next generation applied industrial scientific applications

Flexible and performant storage design

2PB NVMe solution with BeeGFS parallel filesystem

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Digital Academy

To connect and build awareness, mindsets and digital capability

To empower people to operate effectively

To improve our speed and ability

Data Ecosystem

Exploring how CSIRO can best share, manage, and collaborate on data

- A way to make information visible

- Tools to enable collaboration
- Access to analytical tools, software and algorithms
- Data Management

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Summary

- **Science is being transformed**

- **Navigating the digital transformation of our organisation**

- **HPC, HPD, Data management and AI/ML are all key enablers that we are investing in**

Thankyou

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