Preserving Our Born-Digital Cultural Heritage - it's EAASI!

Phase Two of The Australian Emulation Network (AusEAASI)

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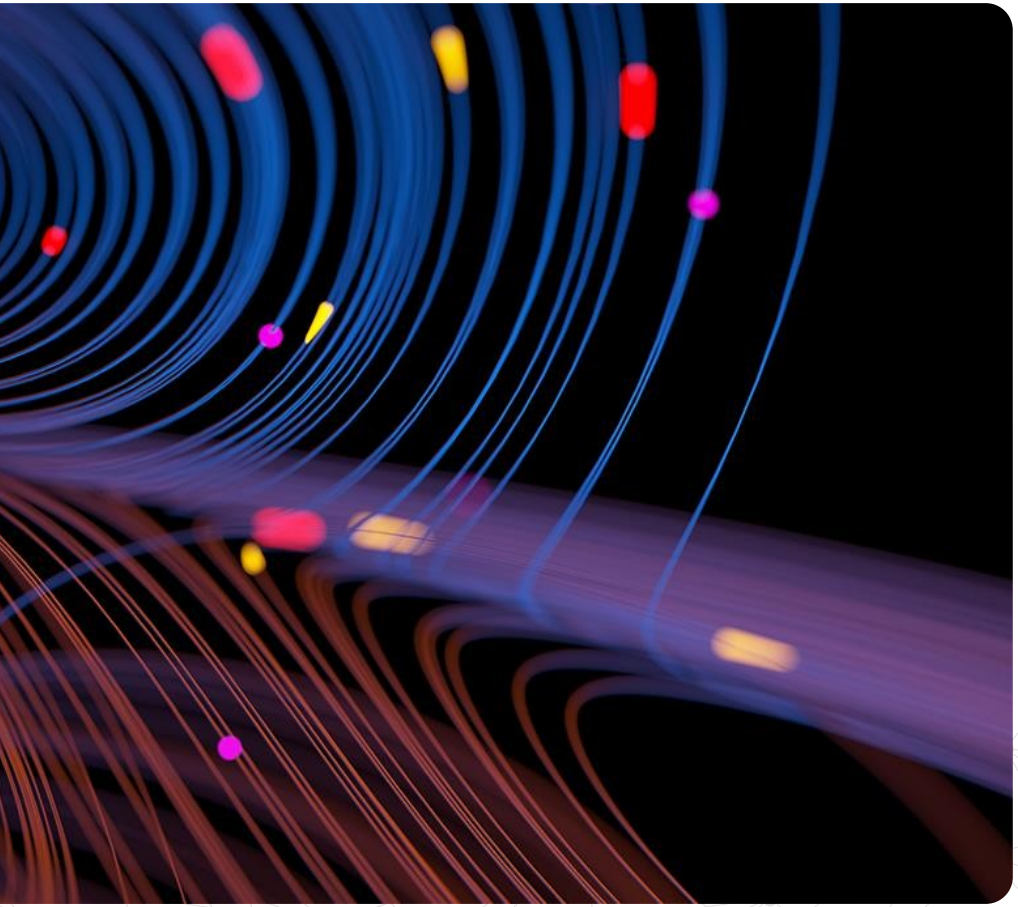
Acknowledgement of Country

AARNet acknowledges the Traditional Custodians of the lands we work upon and connect across, recognising the profound connection to lands, waters and communities where we operate.

We honour the enduring heritage and continuous thread of storytelling and communication of the world's most ancient living cultures.

We extend our respect to the Elders, those who have passed, those who are with us today, and those who will guide us into the future.



Agenda

- Who is AARNet?
- Born-Digital Cultural Heritage
- The Digital Heritage Problem
- The Solution: Emulation - it’s EaaSI!
- The Australian Emulation as a Service Infrastructure (AusEaaSI)
- Where Are We Now?
- Where To Now?

Who is AARNet and what do we do?

AARNet, Australia's national research and education network

Pioneered the internet in Australia in 1989

Not-for profit company

Licensed telecommunications carrier

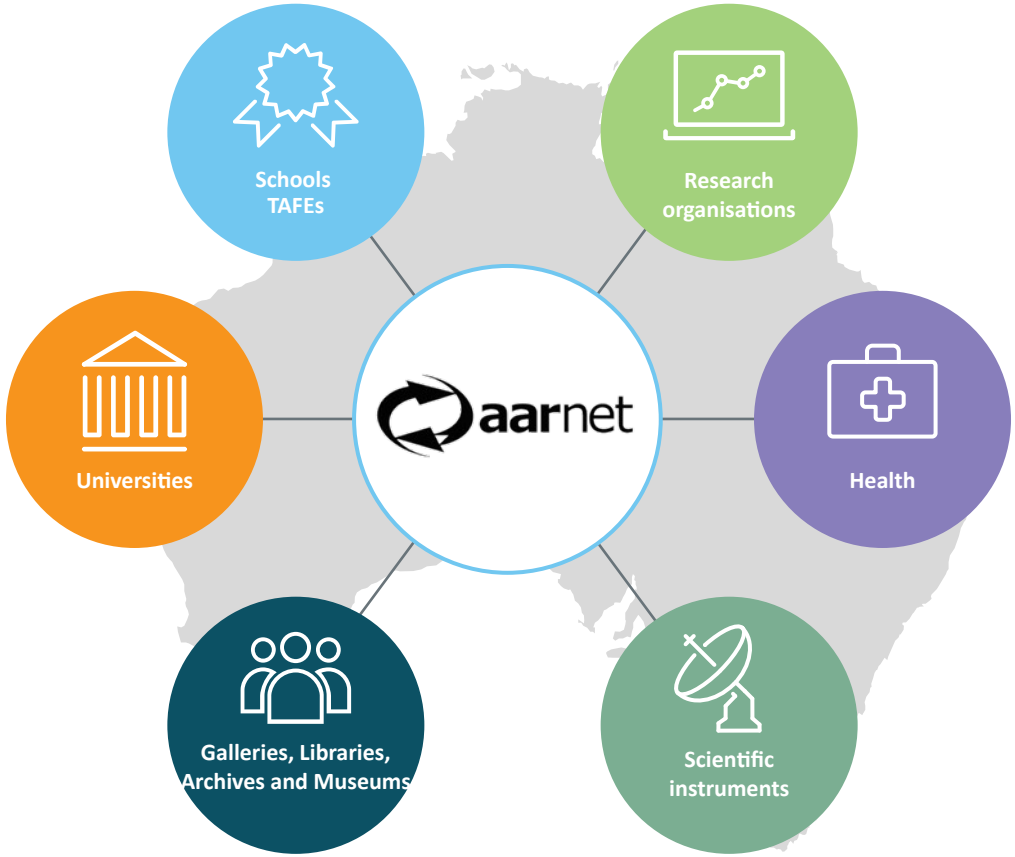
Owned by 38 universities and CSIRO

Serves more than 2 million people

Proudly Australian owned and operated

Learn more at aarnet.edu.au

The Australian Research & Education Community



Born-Digital Cultural Heritage

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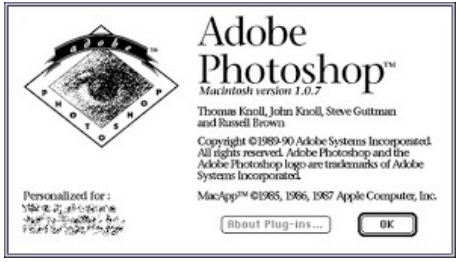
Born-Digital Cultural Heritage

Digital Cultural Heritage – Digital cultural items which were not derived from physical artefacts

- Australians were and are significant contributors to the development of digital media arts, design, and architecture internationally.
- Born-digital artefacts constitute the record of how we became digital, from earliest endeavours through to very recent history.
- Our digital and networked art and design history is fragile, inaccessible and underrepresented in our cultural institutions and archives.
- Born-digital artefacts produced in the last 30 years are:
    - some of the most significant records for understanding how we became digital
    - particularly vulnerable to obsolescence and obscurity

The Digital Heritage Problem

- Digital heritage material has typically not been collected in a timely fashion because of concerns about how it would be preserved and made accessible
- Born-digital cultural heritage is an emerging, cross-disciplinary area of research.
- Digital media face several forms of obsolescence which make it difficult for researchers to access content from 30-60 years old.
- Magnetic or optical physical media (e.g. floppy disks, magnetic tape CD-ROMs) deteriorate over time.
- Once computer hardware, operating systems and utility software become obsolete, software-dependent artefacts cannot be accessed without specialised digital preservation intervention.
- **Today, most content is born-digital, so both historic and contemporary born-digital content are at risk.**



Emulation as a Service Infrastructure

(EaaSI / AusEaaSI)

The Solution: Emulation - it's EaaSI!

Emulation as a Service Infrastructure (EaaSI)

- **Emulation simulates the function of obsolete systems and is a key digital preservation strategy for accessing legacy content.**
- EaaSI was the most developed emulation solution: first rolled out in North American universities, led by Yale University
- Disk images are created from original media, which can then be accessed under emulation on modern compute environments.
- EaaSI enables users to configure legacy computer environments, and to share them with others
- EaaSI has a rigorous approach to metadata and provenance, designed for long-term archival applications
- Development of the EaaSI system is championed by the **Software Preservation Network (SPN)**, an international consortium established to advance software preservation

Software Preservation Network

www.softwarepreservationnetwork.org

Systems Currently Emulated in EaaSI

- MS-DOS (3.x - 7.x)
- Windows (3.0 - 3.11)
- Windows 95
- Windows 98, 98SE
- WIndows ME
- WIndows 2000
- WIndows NT (3.1 - 4.0)
- WIndows XP (Standard, Pro 32-bit, Pro 64-bit)
- Mac OS (6.x - 9.x, X)
- Commodore 64
- Game Boy (Standard, Advance & Color)
- CP/M (x86)
- LInux (older versions)
- Android x86 (4.4 - 9.0)

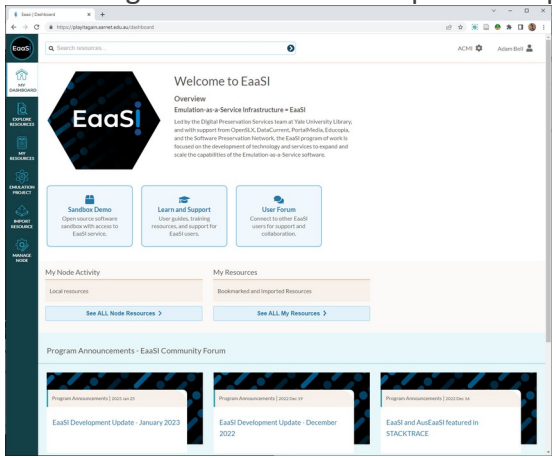
Mac OS

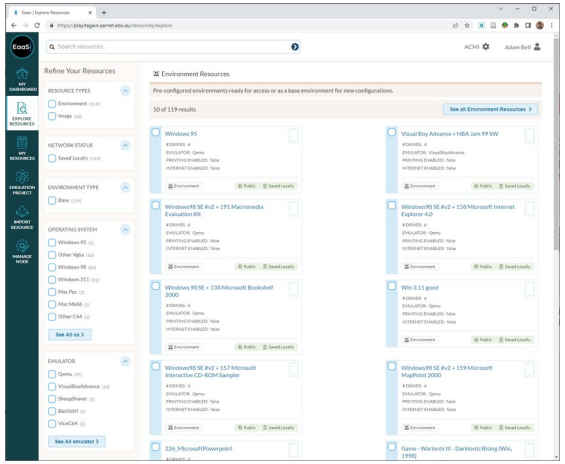
Microsoft Windows xp

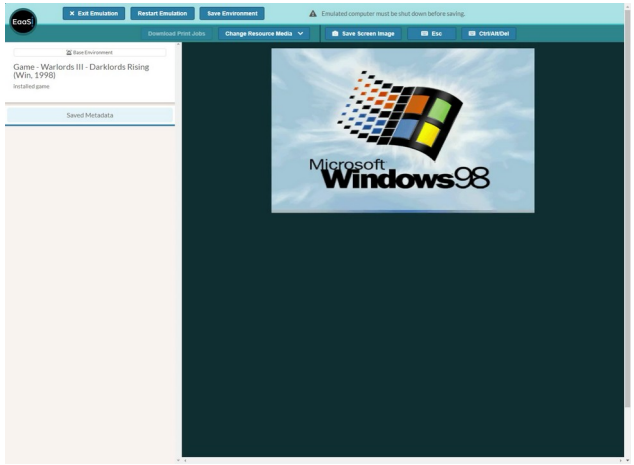
The Australian Emulation as a Service Infrastructure (AusEaaSI)

Leading the way in opening-up and building born-digital collections across Australia

- **Led by Professor Melanie Swalwell, Professor of Digital Media Heritage at the Centre for Transformative Media Technologies, Swinburne University**
- Provides a large number of universities and Galleries, Libraries, Archives and Museums (GLAM) organisations with access to the game-changing Emulation as a Service Infrastructure (EaaSI) network
- Leverages the millions of US philanthropic dollars previously invested in EaaSI's development (from the Sloan and Mellon Foundations)







AusEaaSI Project Participants

- Swinburne University
- Australian Academic & Research Network (AARNet)
- Royal Melbourne Institute of Technology (RMIT)
- University of Melbourne (UoM)
- University of South Australia (UniSA)
- Western Sydney University
- the University of New South Wales
- the University of Western Australia
- Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS)
- Australian Centre for the Moving Image (ACMI)
- Australian Computer Museum Society (ACMS)
- Art Gallery of NSW,
- the Museum of Applied Arts and Sciences
- the National Film and Sound Archive (NFSA)
- the National Archives of Australia (NAA)
- the National Museum of Australia (NMA)

- a consortium of NSLA Libraries
  - the State Library of WA,
  - the State Library of NSW
  - the State Library of Queensland,
  - the National Library of Australia (NLA)
  - the State Library of South Australia (SLSA)
  - the State Library of Victoria (SLV)
  - Libraries ACT
- Queensland State Archives (QSA)
- Tweed Regional Museum (TRM),
- Charles Sturt University (CSU)
- Regional Archives and a consortium of ten small to medium organisations from the Australian Museums and Galleries Association Victoria (AMaGA Vic)
- The Museum of New Zealand Te Papa Tongarewa, the National Library of New Zealand, Archives New Zealand (Observer status)

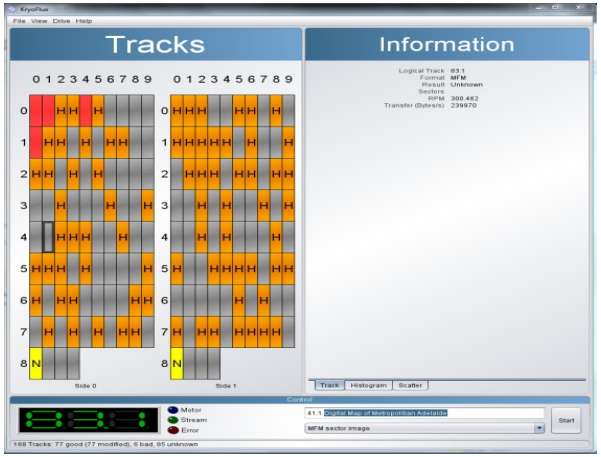
The Australian Emulation as a Service Infrastructure (AusEaaSI)

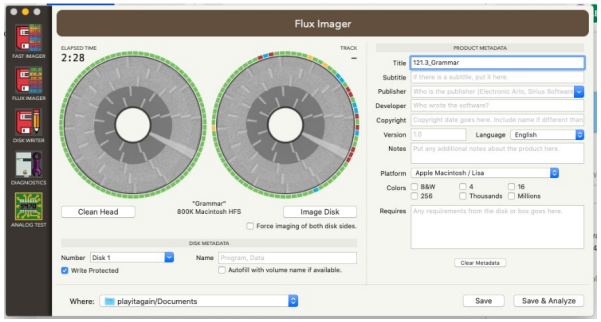
Lowering the barriers to digital preservation

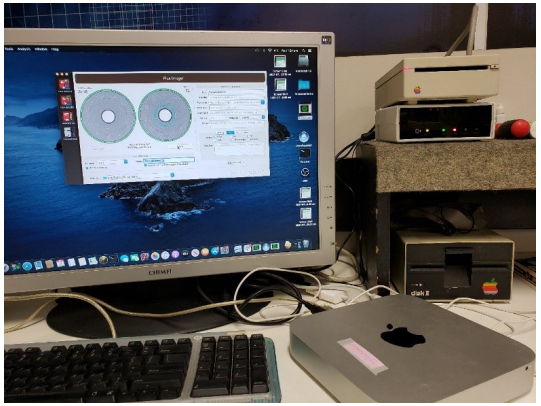
- Packages up open-source emulators and technical expertise with a single, centralised EaaSI service provider (AARNet), thereby providing:
    - Cost-efficient hardware utilisation
    - Lightened technical workload for institutions
    - Reduced institutional infrastructure requirements
    - Sustainable business model independent from grant funding
- Provides access to staff skilled in both preserving complex digital artefacts and configuring environments for rendering them.
- Provides user training in digital preservation and access to an active community of users

Training and Community Building

Disk imaging in the Swinburne Digital Heritage Lab, with Kryoflux & Applesauce







Where are we now?

The Good News

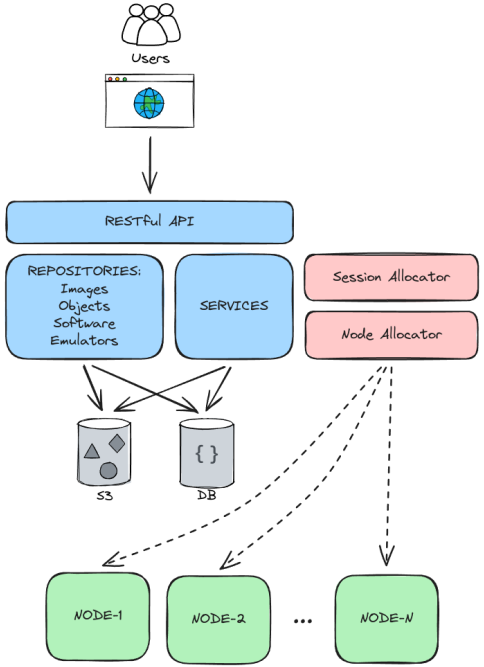
- **Building the existing software preservation and emulation infrastructure in Australia has been an unqualified success.**
- It has yielded far reaching benefits for researchers, their teams, and the broader research and archival communities which this project will extend.
- The large number of GLAMs participating speaks to the project's importance for collecting institutions in Australia and beyond
- An active Community of Practice (CoP) ensures that learning is shared, including with overseas observer organisations

Where are we now?

The Bad News

- **The original EaaSI architecture did not scale well, so AusEaaSI risked becoming a victim of its own success**
- Reliance on the OpenStack API limited the choice of potential deployment environments
- Lack of dynamic scaling led to a lack of flexibility with higher fixed costs
- Some software dependencies in the original architecture are no longer well supported

Legacy OpenStack Architecture

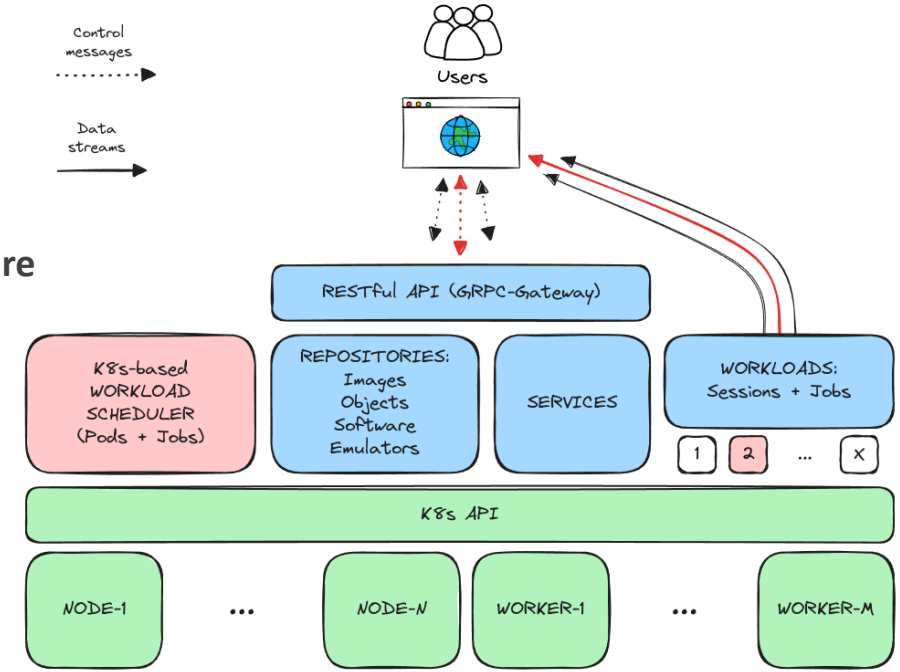


Where To Now?

The New, Improved EAASI – now expected early 2026

- **The Software Preservation Network (SPN) has been busy developing the successor to the original EaaSI system, EAASI.**
- The new EAASI is in development at Yale University and will be deployed for AusEAASI soon.
- The new, scalable architecture is based on Kubernetes orchestration, so it is far more portable than the original
- The new EAASI utilises object storage effectively, so storage volume should no longer be a limiting factor

New Kubernetes Architecture



Future Objectives

- Sustainability beyond original project timeline
- Security for use in sensitive data contexts (e.g. National Archives, AIATSIS)
- Establishment of a Centre of Excellence in Born Digital Cultural Heritage (Swinburne) to:
    - Collaborate with GLAM sector organisations
    - Transform the GLAM sector in the Digital Age
    - Lead research into the collection, preservation and use of culturally significant born digital artefacts

Do you need to preserve important but at-risk media?

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GAME OVER
INSERT COINS
TO CONTINUE