

# ARROW Institutional Repositories: a report on the decisions and experiences of the ARROW Project

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The ARROW Project is funded by the Australian Commonwealth Department of Education, Science and Training, under the Research Information Infrastructure Framework for Australian Higher Education.

[arrow.edu.au](http://arrow.edu.au)

The ARROW Consortium comprises Monash University [lead institution], National Library of Australia, The University of New South Wales and Swinburne University of Technology.



**MONASH**  
University



**UNSW**



# ARROW Institutional Repositories

Presentation structure:

- Why Institutional repositories?
- ARROW and the other FRODO Projects
- ARROW Services
- ARROW Software Strategy
- ARROW Metadata Strategy
- ARROW Content and Advocacy



# What is an Institutional Repository?

A **managed** collection of digital objects

- institutional in scope
- with consistent data and metadata structures for similar objects
- enabling resource discovery by the “Communities of Practice” for whom the objects are of interest
- allowing read, input and export of objects to facilitate resource sharing
- respecting access constraints
- sustainable over time
- facilitating application of preservation strategies



# Why Institutional Repositories?

## – As Good Management of resources

- Need to safeguard digital resources generated already by institutions.
- Existing digital resources often:
  - are managed by grace and favour arrangements
  - rely on unsustainable hardware, software or individual support
  - need future-proofing migration strategies
- Yet are widely used and reflect substantial investment in generating their content



# Why Institutional Repositories?

## – As Research Enablers

- Need an enabling environment for other less technologically independent researchers
- Need to facilitate collaboration between researchers with similar interests but located in different faculties or institutions



# Why Institutional Repositories?

## - Research Exposure and Impact

- Greater exposure & impact of institutional research outputs
  - Readership is otherwise limited to subscribers to the journal in which research is published
  - Better return on investment of public funds in research through greater accessibility
  - Can publish online material for which printing is not financially viable
  - Opportunity to expose materials other than the print friendly
  - Opportunity to preserve and expose research data sets for further analysis by others



# Why Institutional Repositories?

## - Reforming Scholarly Publishing

- Potential to reform the scholarly publishing system
  - Facilitate publication of research for which the audience is too small to justify the costs traditional publication mechanisms
  - Provide alternatives to expensive journals
  - Regain intellectual property rights over research outputs
  - Achieve shorter times between output and access



# Different Types of Repository Content

An Institutional repository may be expected to store any mix of anything that can be represented digitally

- Print equivalents – Research papers, Theses, books, book chapters, archival records
- Audio
- Still and moving images
- Multimedia objects
- Learning Objects
- Research data sets



# Repositories - Technical Issues

- Interoperability
- Metadata
- Federated Searching
- Semantic web
- Authentication and Authorisation of users
- Rights Management
- Persistent Identifiers for digital objects



## Repositories – Technical Issues – Interoperability

- Few standards are available to assist in the exchange of digital objects between repositories
  - No widely accepted data models for complex objects – cf SCORM for learning objects
  - Few “archival” formats agreed for digital objects
  - Few Metadata standards, but lots of pragmatic Metadata schemata to meet the needs of specific communities of practice



# Repositories – Technical Issues – Metadata Exchange

- Dublin Core – insufficiently granular for many purposes
- Learning Object Metadata – not good for “bibliographic” metadata
- Need to preserve metadata relevant to categories of objects as decided by the “community of practice” that produced the object
- Open Archives Initiative Protocol for Metadata Harvesting (OIA-PMH) – can gather Dublin Core metadata to establish resource discovery services



# Repositories – Technical Issues – Federated Searching

- eXtensible Access Control Markup Language (XACML)
  - No profile defined as yet to tag repository content to signify who can access it
  - Hence no standard way to allow search software to determine who can access what across a federation of repositories
    - Eg All University staff can access ...
    - All enrolled students in “State” can access...
    - All members of “professional association” can access...



# Repositories – Technical Issues – Semantic Web

- Semantic Web
  - Relies on machine interpretable data to allow application of business rules
  - Hence Metadata standards need to be granular and follow consistent encodings of concepts
  - Example - Machine analysis of citations to link to full text often fails as citations are not consistently expressed



# Repositories – Technical Issues – Authentication, Authorisation, Rights Management

- MAMS Project is working in this area
  - Shibboleth as a model
  - XACML as a way of encoding fine grained access control
  - Digital Rights Expression Languages and Patents
- Repositories need access control to honour constraints imposed by copyright owners
  - eg to meet the ROME database expressions of publishers permissions policies for depositing previously published content to repositories



## Repositories – Technical Issues – Persistent Identifiers

- Repositories need to offer a preferred form of citation for their content
  - Which does not break as URLs do when files are moved or web sites restructured
  - Handles from CNRI seem to be becoming widely adopted
    - DOI (Digital Object Identifier is a Handle)
    - UK Stationery Office adopting Handles
    - DSpace uses Handles



# Repositories - Open Source Software and Sustainability

- The business case for open source software is not necessarily clear cut
  - Red Hat model - “manageable” open source software for fee
  - Complete self reliance
  - Reliance on a consortium of users of a particular product
  - Total cost of ownership is difficult to calculate



# ARROW Project

## ARROW Consortium Partners

- Monash University (Lead Institution)
  - University of New South Wales
  - Swinburne University of Technology
  - National Library of Australia
- 
- October 2003 funding granted
  - AU\$3.66 Million over three years to identify and test solutions to establish institutional repositories at the ARROW partners



## ARROW stages

- Demonstration (2004)
  - Developing architecture, selecting, testing and developing software
- Deployment (late 2004 – end 2005)
  - Populating the ARROW Partners' repositories
- Distribution (mid 2005 – end 2006)
  - Enabling others to participate
    - Under review for earlier participation by others



## The FRODO Projects

- Federated Repositories Of Digital Objects ([FRODO](#)) Projects funded by DEST under the Commonwealth Government's *Backing Australia's Ability* Initiative
  - Meta Access Management System
  - Towards an Australian Partnership for Sustainable Repositories
  - Australian Research Repositories Online to the World (ARROW)
  - Australian Digital Theses Program Expansion and Redevelopment



# ARROW FRODO Partnerships

- MAMS
  - Access control through eXtensible Access Control Markup Language (XACML) metadata
  - Needs development of a FRODO profile of XACML for access control interoperability
- APSR
  - Interoperability through consistent metadata for similar objects
  - Needs FRODO Metadata schemata for object exchange, export and ingest into new repository environments as part of sustainability and preservation initiatives
- ADT
  - Interoperability through harvestable Dublin Core metadata
  - Supporting e-theses online which are pointed to from ADT
- Web services strategy?



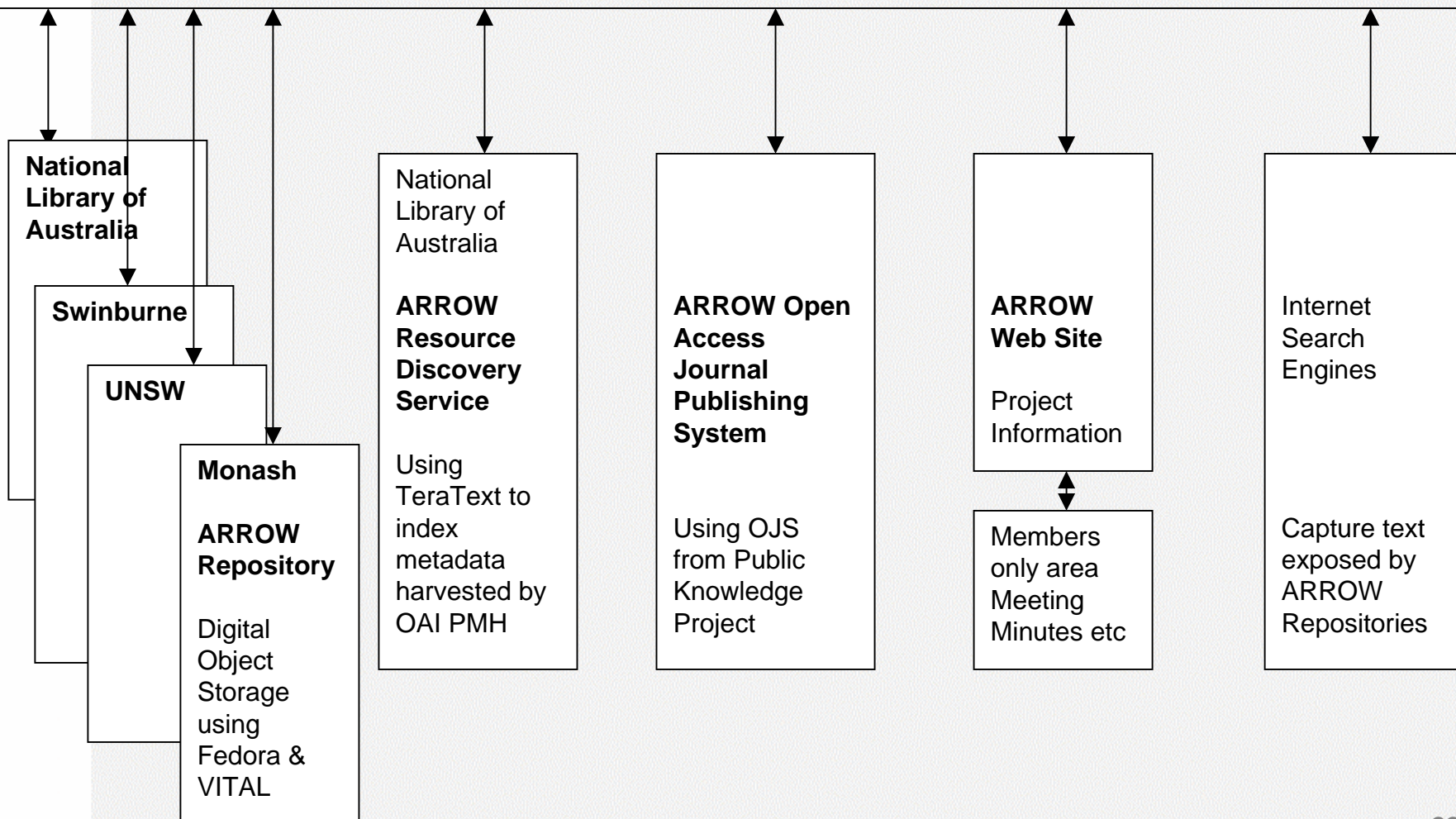
# ARROW Project Governance

- **ARROW Management Committee**, Advised by
  - **ARROW Technical Committee**
    - Developing a vehicle for content management
  - **ARROW Content Committee**
    - Content issues
    - Advocacy to achieve cultural changes to ensure content capture



# ARROW Branded Services Profile

Internet





## ARROW Technology – Software

Needed a repository system early in the project

- To learn what works and what does not work
- To manage content as a demonstration system
- But all repository software is immature at present

Commitment to open source software in the ARROW Funding Agreement

- Evaluation of DSpace, Fedora, other software



# ARROW commitment to Open Source Software

- [Open Society Institute “A Guide to Institutional Repository Software” 3<sup>d</sup> ed August 2004](#)
  - Software systems criteria for inclusion:
    - Freely available as open source software
    - Compliant with the latest version of the Open Archives Initiative Protocol for Metadata Harvesting
    - Currently released and publicly available
- ARROW Internal review of open source repository software



## ARROW Technology – Software Selected

- **Flexible Extensible Digital Object Repository Architecture - Fedora™** <http://fedora.info>
  - Cornell and University of Virginia
  - ARROW a founding member of the Fedora Development Consortium
- **VITAL** from VTLS Inc <http://www.vtls.com>
  - ARROW / VTLS partnership to take the Fedora “engine” and construct a working repository to meet ARROW’s functional requirements using VITAL and open source web services
  - Sustainability through vendor support
- **Open Journal Systems (OJS)** from Public Knowledge Project (University of British Columbia) <http://www.pkp.ubc.ca/ojs/>
  - for open access journal publishing

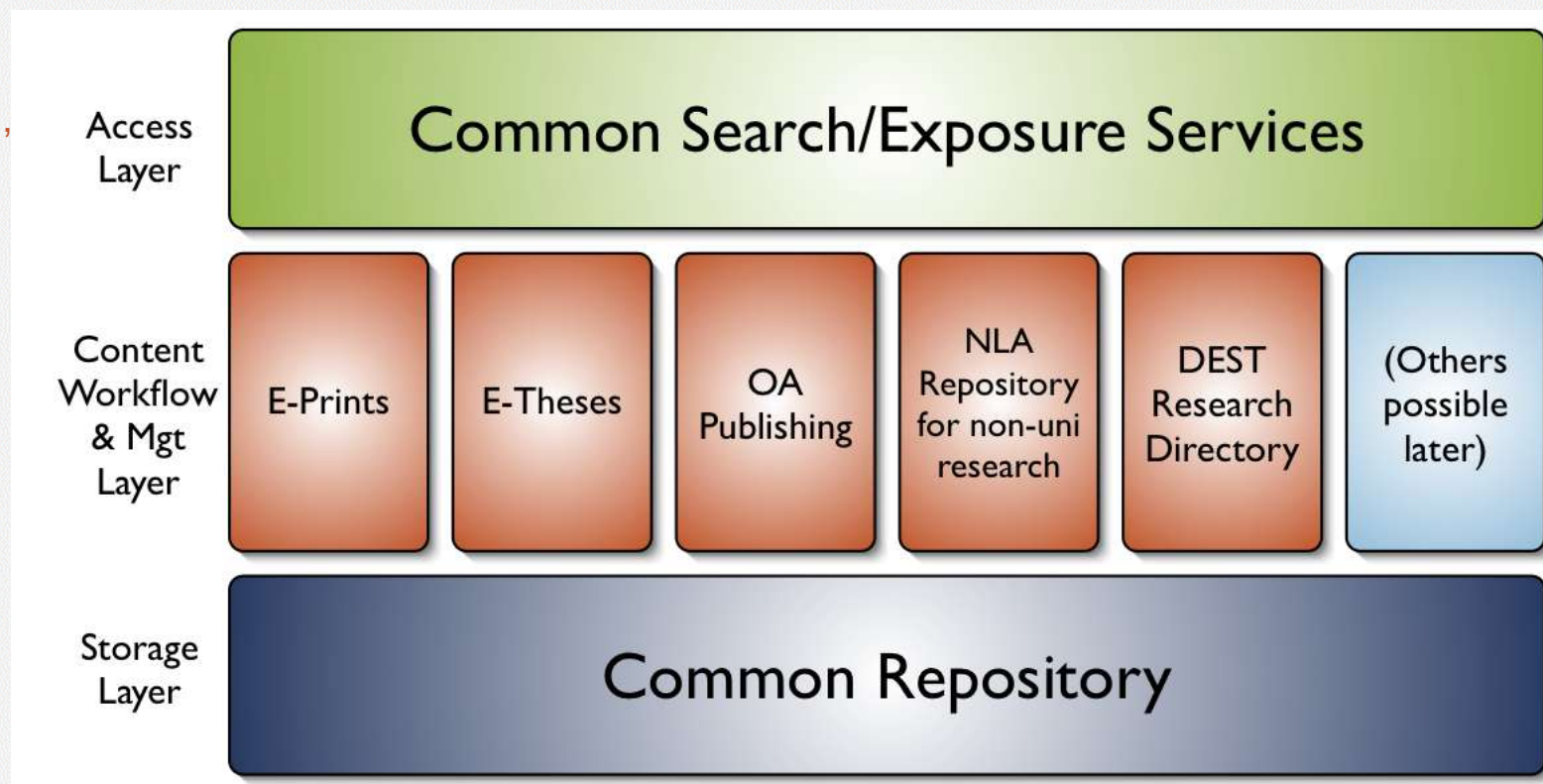


# ARROW Architecture & software components

VITAL Access  
Portal, OAI/PMH,  
SRU/SRW, Web  
Exposure

VITAL,  
Fedora, OJS

Fedora





Vital Proprietary Management Client,  
Access Portal

Open Source Web Services

Fedora Repository

Open  
Journal  
Systems  
Software

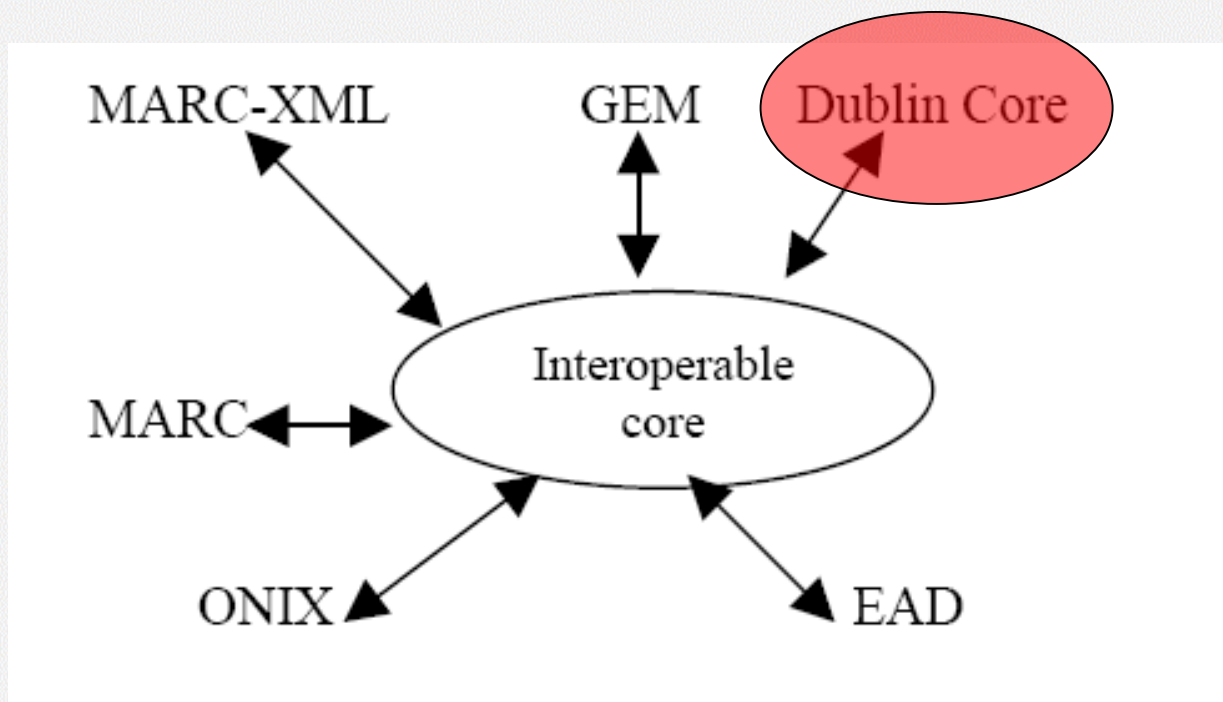


# ARROW Metadata Strategy

- Supports metadata schemata to suit individual data models
  - No requirement to shoehorn all metadata into one schema
  - Each stored object can retain metadata developed for it by the community of practice which generated the object
  - Maintains flexibility to store many types of digital objects in the repository
  - No need to anticipate every object type now



## OCLC Metadata Interoperability Core

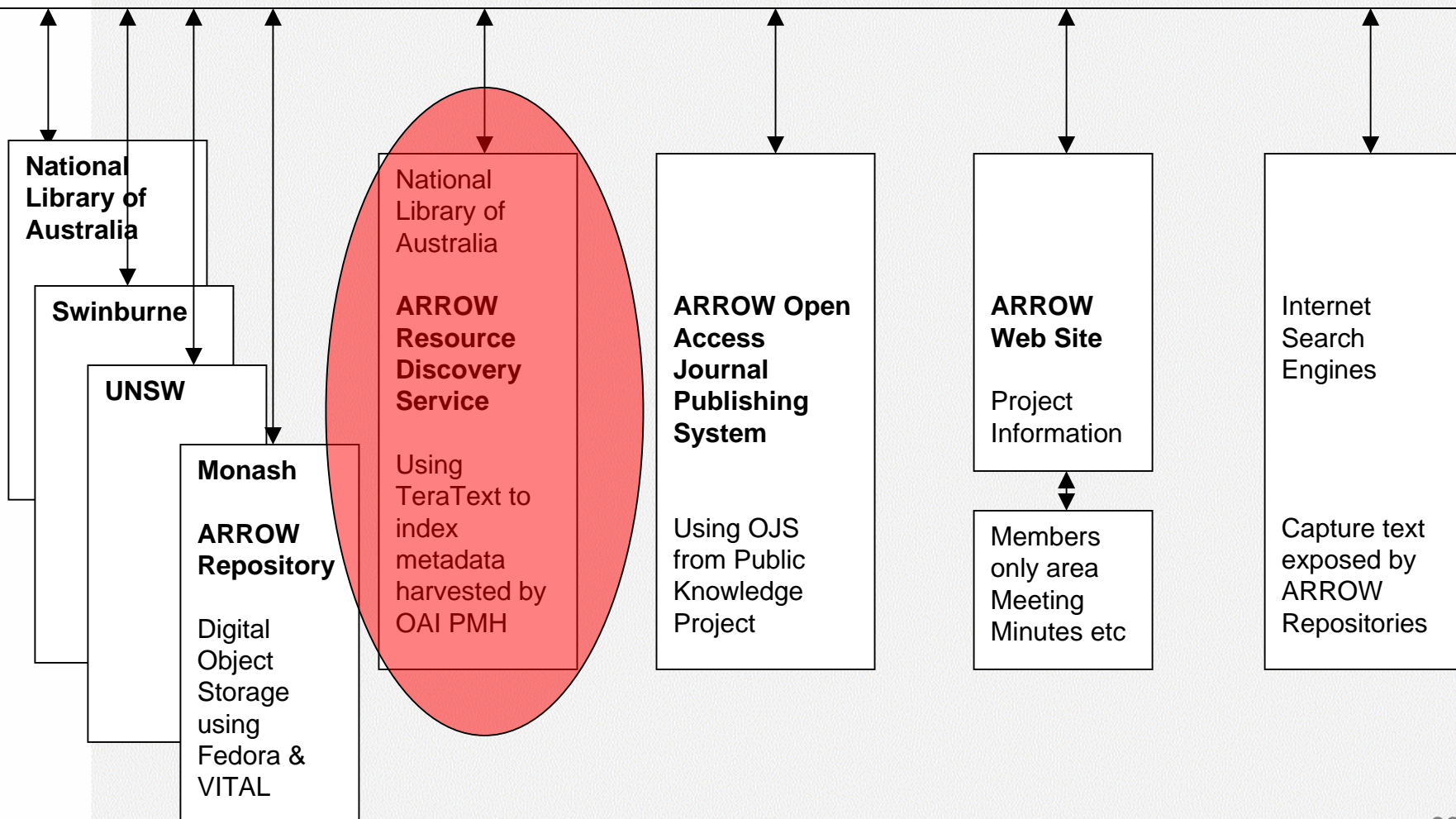


From: Godby, Smith and Childress. 2003. "Two paths to interoperable metadata" p. 3 at <http://www.oclc.org/research/publications/archive/2003/godby-dc2003.pdf>



# ARROW Branded Services Profile

Internet





## **Fedora™ - Flexibility at the expense of implementation design effort**

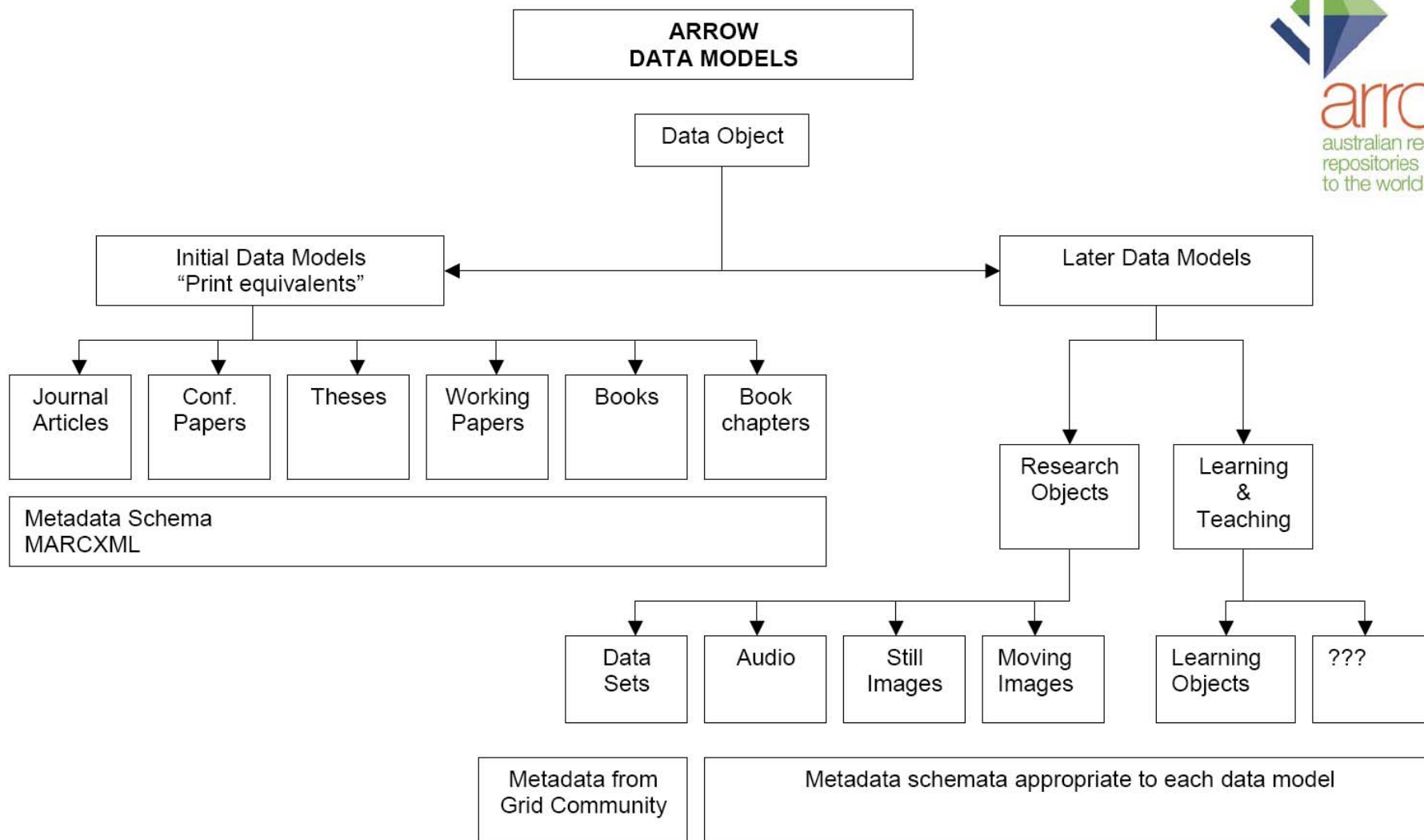
- Allows storage of any number of different types of digital objects
- But extra effort required
  - Data Modelling
    - How any given type of digital object will be stored can be tailored to suit
  - Metadata schemata for each data model (or even every object!) are allowed
  - Persistent Identifiers – Multiple identifiers from different schemes can be used



## ARROW - Data modelling

- Required to define how objects will be stored
  - How many parts are there in any given object that may be cited and repurposed separately
    - For example a diagram may be used in a lecture presentation
  - Do different access controls apply to different component pieces of an object
    - For example a chapter of a thesis with culturally sensitive materials
  - Need to establish use cases, then determine what metadata is required to manage each use case





Notes:

1. Each of the data objects may be simple or complex (ie have one or more data objects as components)
2. Where an Object is complex it may include a mix of bibliographic and/or non-bibliographic data objects
3. An object or components of complex objects correspond logically to a FRBR Expression of a work.



# Repository Persistent Identifiers - Recapping

- Repositories need to offer a preferred form of citation for their content
  - Which does not break as URLs do when files are moved or web sites are restructured
  - Handles from CNRI seem to be becoming widely adopted
    - DOI (Digital Object Identifier is a Handle)
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# ARROW Repository Persistent Identifiers

- ARROW Handles\* Format adopted:
  - <http://arrow.monash.edu.au/hdl/1959.1/nnnn>
  - 1959 = ARROW handles naming authority
    - 1959.n – one sub number for each ARROW repository
  - nnnn – running number
- ARROW will assign a handle to each datastream in a digital object to ensure that individual parts of the digital object can be cited and re-used independently

\*<http://www.handle.net/index.html>



## ARROW Content Committee

Unfortunately it is not as simple as build it and they will come...

**Publisher and Library/Learning Solutions (PALS) [Pathfinder research on web-based repositories](#), Final Report, January 2004**

“We find that IRs are currently rather small, with an average (median) of 290 records per institution (smaller but comparable to the median size of other OAI data providers). (Page 33)”



# Incentives are needed for academics to submit their materials to repositories

- Substantial advocacy is required to achieve participation
  - Mandatory deposit of e-Theses
  - Credits towards promotion
  - Funding linkages
  - Demonstrable additional exposure such as in Web Citation indexes and search engines



## ARROW Content (Advocacy)

- Advocacy tools prepared and circulated
  - Pro Forma Memorandum of Understanding with a university faculty of department
  - Copyright strategy paper drafted
  - ARROW Frequently Asked Questions
- Pursuing policy changes such as mandatory deposit of e-Theses
- Project champions recruited



## ARROW Content (Advocacy) (Continued)

- Design work proceeding on an interface between Research Master (RM) and ARROW for gathering DEST research evidence
  - Monash, Swinburne, UNSW all use RM v.4, but the solution will be generalised to accommodate other practices
- Migration of content from e-prints repositories planned



# ARROW Software Development – Current Status January 2004

- Functionality delivered
  - Image Management
  - Text Documents
  - Fedora native ingest for other digital objects
- Under development
  - Handles integration for automatic assignment of persistent identifiers
  - XML editor for metadata management
  - SRU/SRW interface
  - Audio, Moving Pictures and SMIL support
  - Support for Google spidering



## ARROW partnerships

- OCLC
  - To test the metadata interoperability core
- Google
  - To test indexing of research materials
- Open Journal System (OJS)
- Thomson ISI Web Citation Index
- VTLS and Fedora
- Research Master



## ARROW - Summary of design criteria

- A generalised institutional repository solution
- Initial focus on managing and exposing traditional bibliographic research outputs
- Expand to managing non-bibliographic research outputs
- Design decisions are being taken with the intention of not precluding management of other digital objects such as learning objects and large research data sets



## Questions?

## Further information?

Details of the ARROW project can be found at:

[arrow.edu.au](http://arrow.edu.au)