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The Preservation and Sustainability of Research Data

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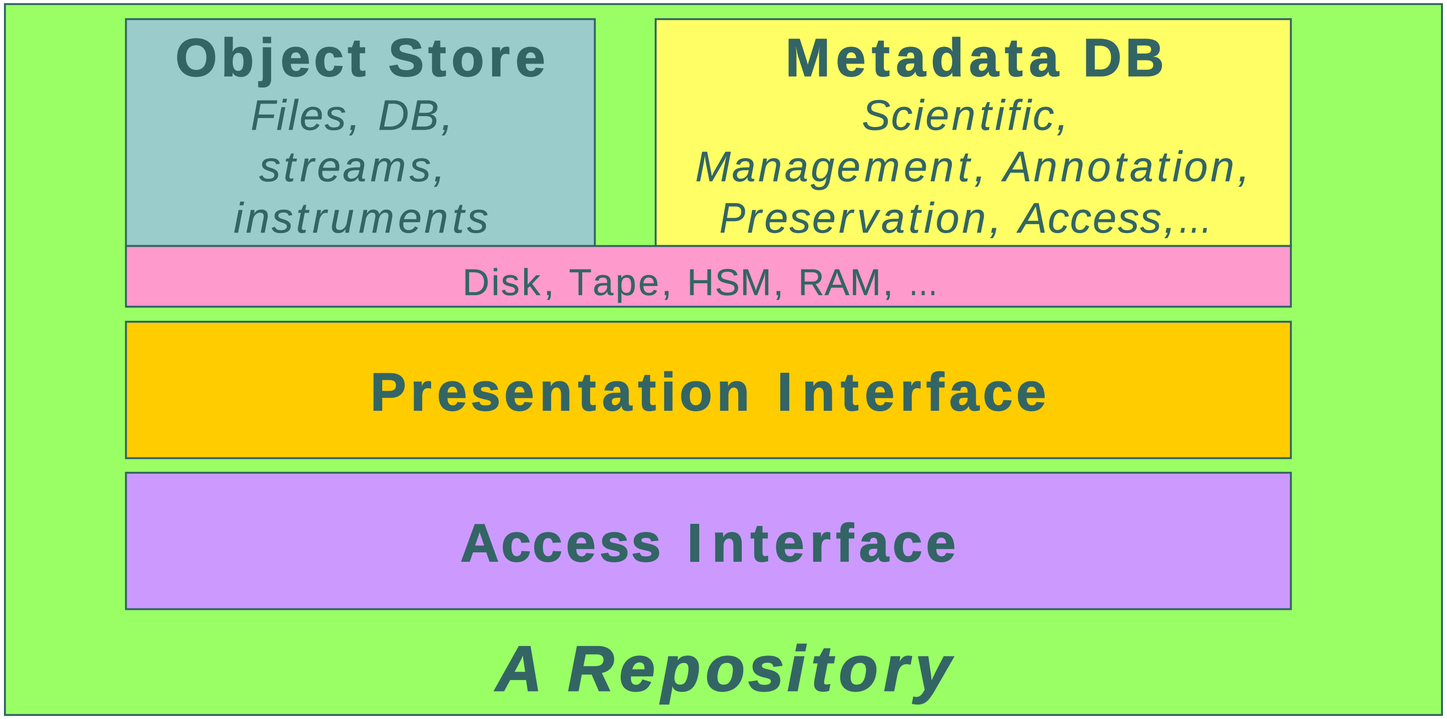
APSR
AUSTRALIAN PARTNERSHIP FOR SUSTAINABLE REPOSITORIES

This talk is based in parts on the “AERES” survey and report for APSR with Paul McNamara: www.apsr.edu.au

Research Data

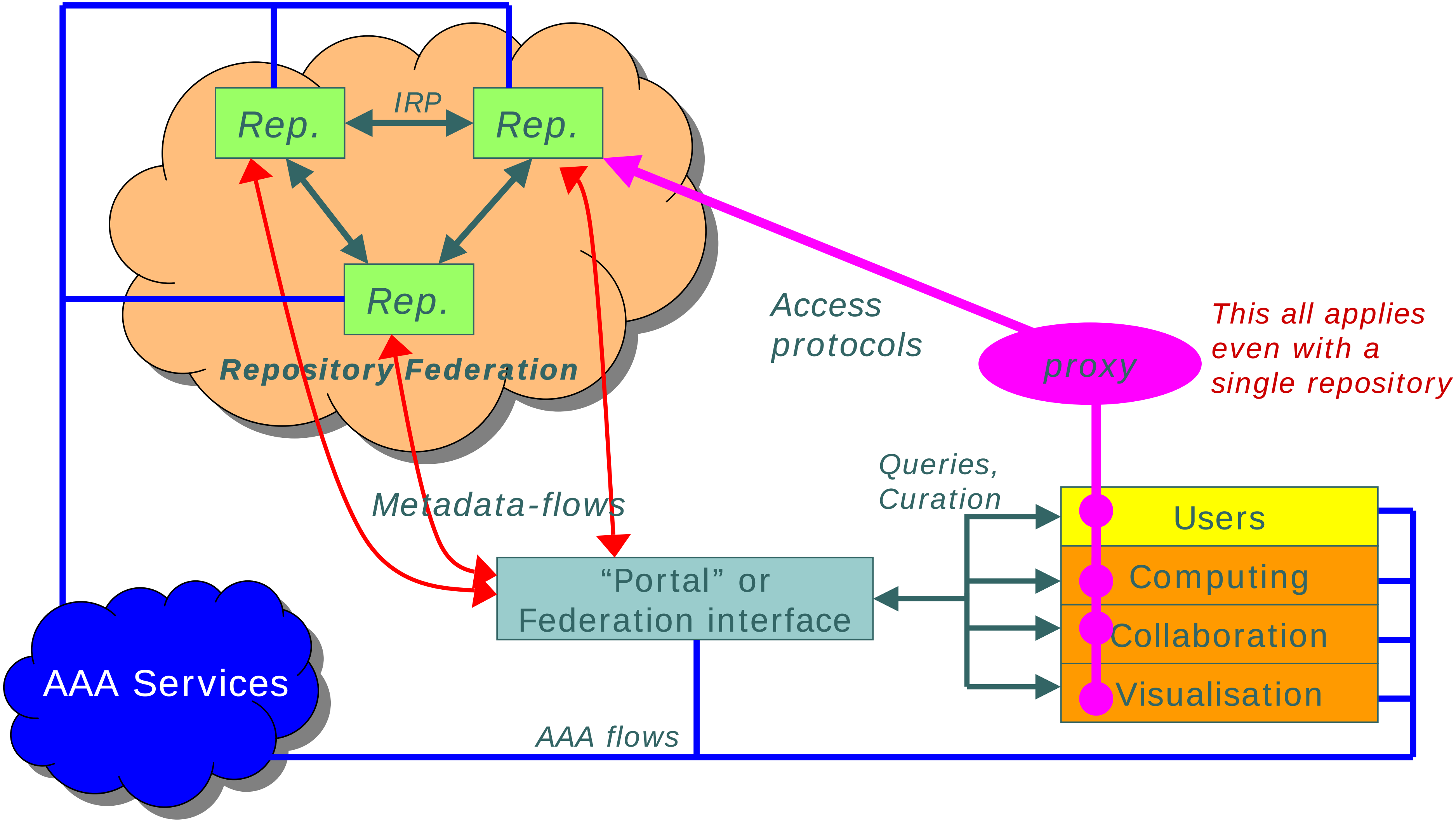
- This is not about publications but primary, derived or simulated data,
  - Which (may) lead to publication
  - Scholarly inputs and outputs
- Why is it different?
  - Data has a very different lifestyle
- Why is it hard?
  - Data has very different, and more complex, problems
- E-Research infrastructure?
  - Transparent and appropriate access to all resources,
  - to enhance research processes and build greater knowledge

We sort of **know** this…

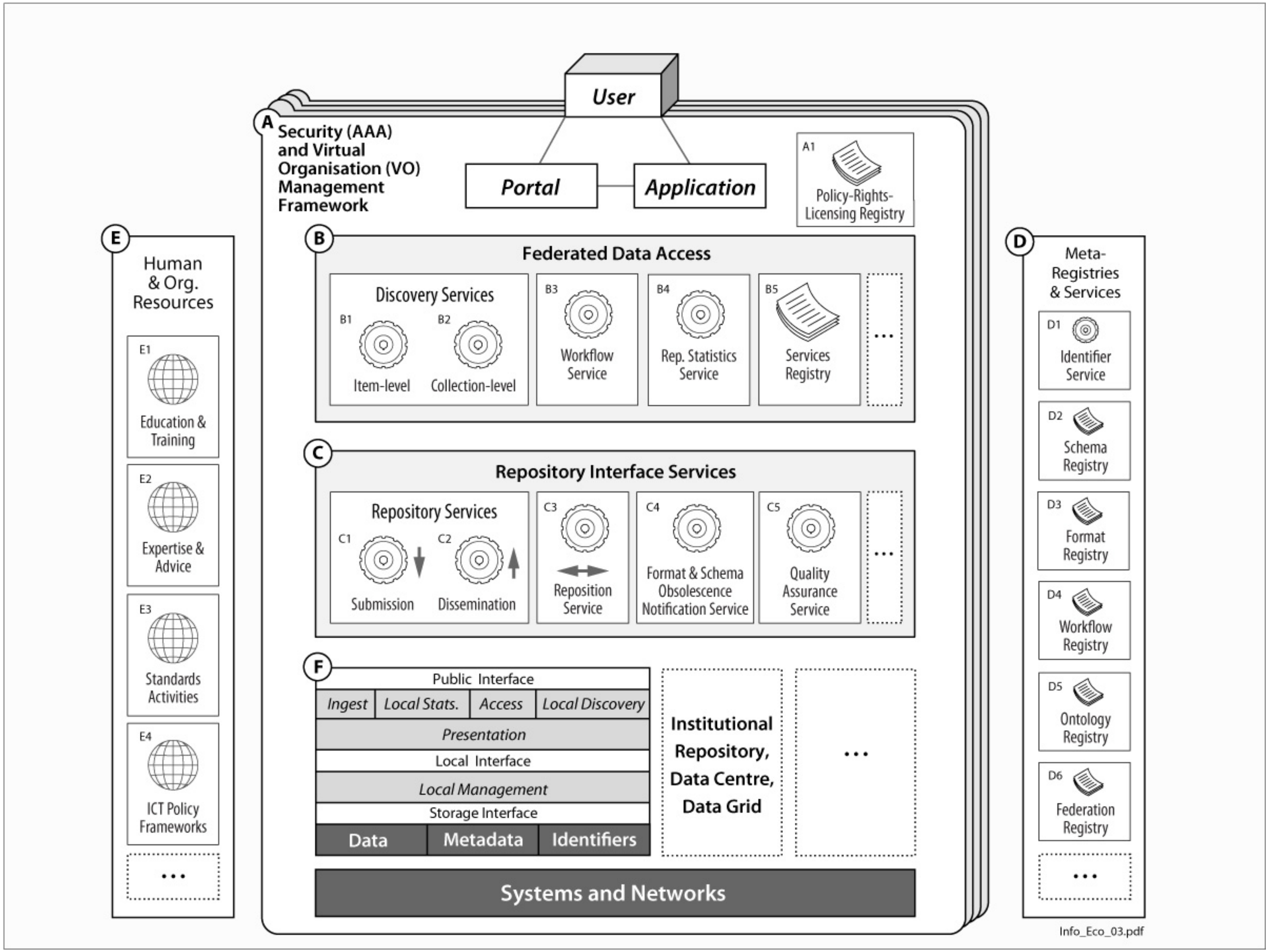


- **A (good) Repository**
  - is the sum of these things, and more…
    - Interfaces and services for management and curation, processes, security, standards, support, etc.

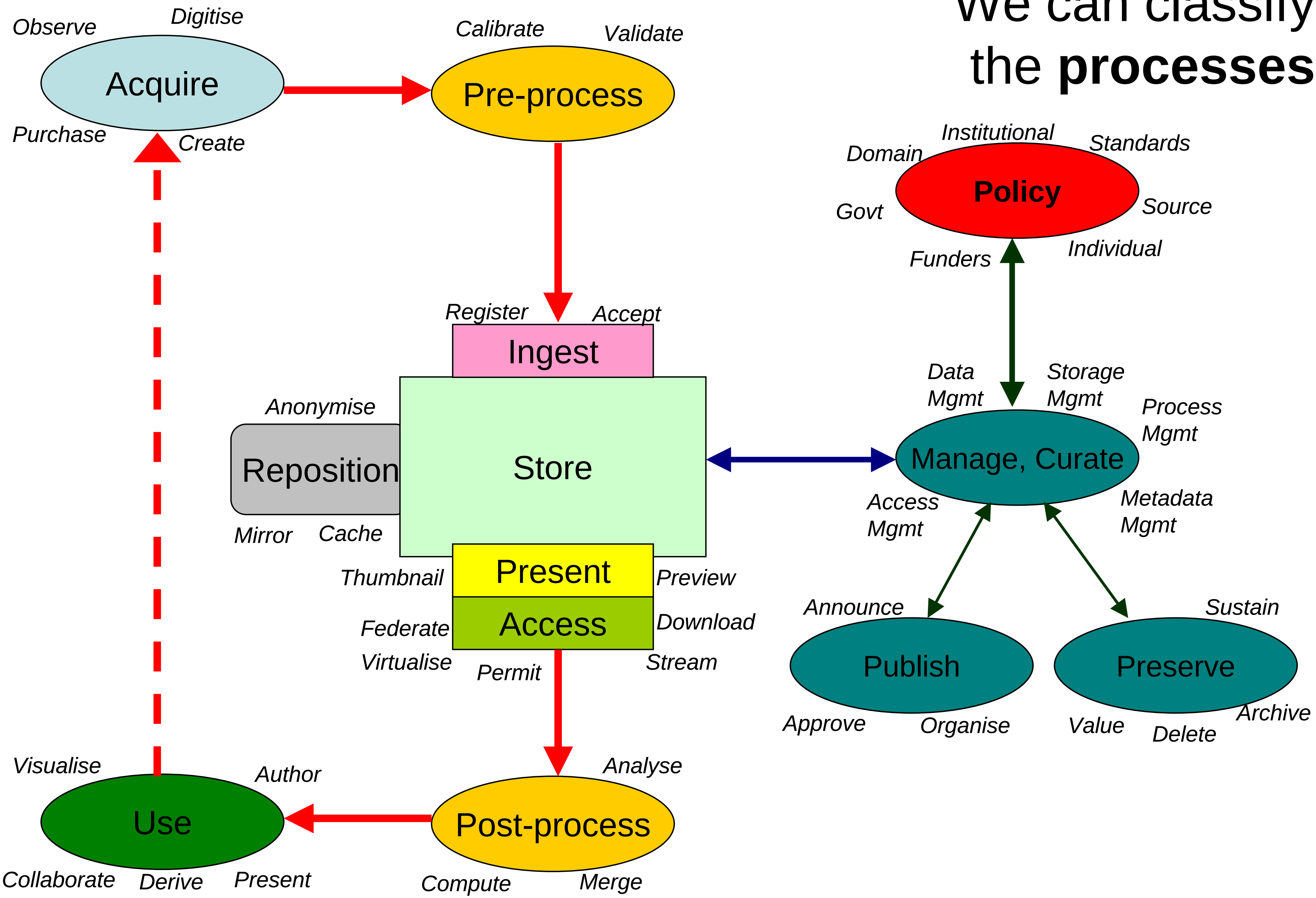
…and we can **architect** things around it…



…and we can identify the **services**



We can classify the **processes**



Version 5.1
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Let's look at Application Areas

- **Geosciences**
  - Minerals, oils and gases, tectonics, Govt, Surveys, Industry
  - Many data sources (spatial and physical) and simulations
- **Bioinformatics**
  - Genomics, proteomics, …
  - Public datasets, private queries, private annotations
- **Chemistry**
  - Simulation, need data *services* mainly
- **High Energy Physics**
  - Large expensive instruments, projects
  - Massive data, computation and simulation
- **Earth Systems Sciences**
  - Massive remote sensing data sets, large and complex simulations
- **Astronomy**
  - Big data, complex reduction process, big simulations, long-term research

Application Areas - 2

- **Financial**
  - Many sources, Stock/Financial exchanges, news, …
  - Timeliness and also long time scales are both important
- **Music, Arts, Sports**
  - Performance and creation, formal and practice
  - Education focus
- **Linguistics, Musicology**
  - Archives of digitised cultural material
  - Complex analyses
- **Social Science Data**
  - Census, health, surveys, …
  - Complex data structures, qualitative data
- **Archaeology**
  - Digitised physical materials, spatial and chronological data

Consider just *some* of the issues…

- **Sustainability of data**
  - Data formats, Simplex vs Complex (compound) objects
  - Software (Algorithms, implementations, OS)
  - Versioning (Recalculation, interpretation, validation, derivatives)
  - Underlying infrastructure (hard and soft)
- **Describing data: Metadata**
  - Varied research schemas (1 is nice, but most have zero or five…)
  - Scientific description can be itself contentious…
  - Many types: (Provenance and processing, Preservation, curation and valuation, Subjective metadata, annotations)
- **Rights around data:**
  - Needs Authentication and Authorisation to be working, and to scale
    - Requires *identities* and *roles* to be understood
  - Privacy, Security
  - Ownership - Not always (almost never!) with the researcher
  - Time-varying (Data sourced under old agreements, people die, agreements expire, …)

So why do this anyway?

- Create opportunities
  - For re-analysis, re-use; expected or otherwise

- Solve problems
  - Waste of $$, people and collection effort
  - Loss of irretrievable data
  - Inability to verify research

- Requirements (have to do it)
  - National good, cultural heritage, input to policy
  - Reference materials
    - Atlas, catalogues, …

- Value not just in collection but in accessibility

Is it happening already?

- Data re-use/re-analysis
  - Ever more examples, some very good, some horror stories…
  - Policy conflicts
    - Data must be kept
    - Data must be deleted (ethics; anything involving people)
- But…
  - New culture
    - This data has value outside of my domain, or after my project?
  - New capabilities, provided by the Internet
    - Discovery of who has useful data
    - Accessibility of useful data
  - New data is easier to cope with than old data
    - Introduce new workflows and processes starting now
    - Recover old data as/when needed
  - New (and old) fears by users (see later)

Some of the players: Government and funders

- Strengths: Control $$ and Policy,
  - and some data (ABS, BoM, GA, RTA, AADC. …)
- Weaknesses:
  - Policy politely suggests publicly-funded data should be well managed and appropriately accessible
    - No *teeth*, no *infrastructure*, no *recognition* if done
  - Funding is *project oriented*, infrastructure is *systemic?*
    - One-off grant for lifetime support?

Government and funders

- Opportunities:
  - Effective **and coordinated** policy, with $$ to back it up
  - Build coordinated, sustainable infrastructure; skills, expertise
  - Increase research effectiveness and leverage of $$ investment
- Threats:
  - Loss of irretrievable data
  - Waste of $$ and effort in collecting the same data
  - Insufficient data for policy input
    - Environment, healthcare, education, security, …
  - Loss of research effectiveness; other countries are doing this
    - UK, US, Asia (Taiwan, Korea, …)

Another key player: Organisations, Institutions

- Not just Universities
- Employ the staff that collect the data
- Manage the funds acquired by staff
- May have obligations,
  - Probably “own” the data
  - Long-term support (beyond staff tenure)
  - Moral and legal (is research data a ‘record’?)
- But have pressures to leverage their work…

And Users, who are *human*…

- Fear of missed “nuggets” in their data
  - Milk it for everything, for ever and ever
- Fear of missed errors
  - Probably varies by domain and career-stage
- Fear inappropriate leaks
  - Privacy/ethics,
  - first-to-market,
  - relationship to data providers (drug users, fishermen, …)
- Fear the cost of effort
  - Takes time (and money) away from what they’re good at
- Fear lack of recognition
  - I’ve done it for the national good, how about some accolades?
- Fear of trusting somebody else’s data
  - That person, or their repository may have done something wrong
- Fear unknown custodians/stewards
  - Can’t do as good a job as my PhD students

Recognition

- “We” require data to be effectively deposited
  - But don’t have anything to back up this requirement

- Implies an effective *place to* deposit
  - Recognition (certification) of repositories
    - How good, and how sustainable? What are the metrics?
- Implies an effective *process of* deposit
  - Recognition of the deposit effort
    - How well is it deposited? 1 star deposit into a 5 star repository?
  - Recognition of the deposit content
    - Depositor gets recognition, somewhat like a paper
      - Which requires a sufficiently good effort, and a citable repository
      - Interesting question of who “owns” the data, and hence accrues recognition

- Who carries out recognition, certification?
  - Domain-specific skills, technology-specific skills
  - Curation, preservation skills

Skills – and the lack of them

- In Australia, and globally
  - Skills around discipline-specific data management
    - Need to learn from researchers what their issues are
  - Skills around generic data management
    - Need to learn library/archive skills for non-publication materials

- Need more “translators”
  - Who seem to come from disciplines and not from IT or IM
    - And more from Humanities/Social Sciences than Physical Sciences
  - Who seem to have given up academic careers
  - How can we create more of them?
    - And the generic research data curators?

Valuation – what to keep?

- Ideal model keeps everything, for ever

- Pragmatism dictates some data deletion
  - Who has, or wants, that responsibility?

- Cost is going down
  - Storage (physical media) is getting cheaper
  - Processes for management are starting to scale
  - Keeping everything is becoming reasonable
  - Keeping it for ever is becoming manageable

- *BUT: May not be able to manufacture fast enough…*
  - *Peak Storage Capability, like Peak Oil?*

Sustainability

- Follow the $$$
- Govt top-slice, or top-up to institution/user
  - Fund fewer people to do more things?
  - Fund the same number to do more with less?
  - Create a whole new funding stream?
- Institutional top-slice, or top-up
  - Same questions.
- Leave it to users/communities
  - Where there’s a will, …
    - But we need to support areas where there isn’t a will yet

Implementation?

- Get users out of data management at some level
  - Scale costs on infrastructures, services and skills that are sufficiently common
- Deal with user fears
  - Some of it needs education, some of it needs trust to be established
- Users provide domain specific skills and domain policies
  - Coordination role within a domain – required!
  - But need technical backing when it crosses some boundary

Who is *thinking* about this?

- Institutions and partnerships: APSR and other groups
- Govt: DEST, PMSEIC, NCRIS (SII), eResearch-CC, Productivity Commission, …
- Funders and managers: ARC, NHMRC, AVCC/UA, …

- NCRIS:
  - Emerging Australian National Data Service (ANDS)
    - Programs around: Policies, key services, repository management, and research practices
    - Foundation set of key services enabling the creation of a national data commons
- Here's hoping…