# Patterns for information infrastructure

**C3DIS**

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# Overview

- About patterns
- Context
- eResearch 2017 workshop
- Where to from here?

# Patterns for research infrastructure?

- Similar objectives challenges in disciplinary areas
  - Building technical infrastructure (store, compute + data)
  - Building community around the infrastructure



However...

- Lack of common language - hard to share experience practice etc
- Lightweight approaches to the social, institutional and economic dimensions of the challenge
- Solutions are context specific

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# A brief history of patterns

- Design patterns - generic reusable solutions to a recurrent problem

- Software pattern

  - *Design Patterns: Elements of Reusable Object-Oriented Software* was published in 1994 by the so-called "Gang of Four" (Gamma et al.)

- Architectural patterns

  - Alexander et al 1977 - Pattern language

    - ordered collection of patterns - Towns - Buildings - Construction

    - combined into an holistic set to be used together
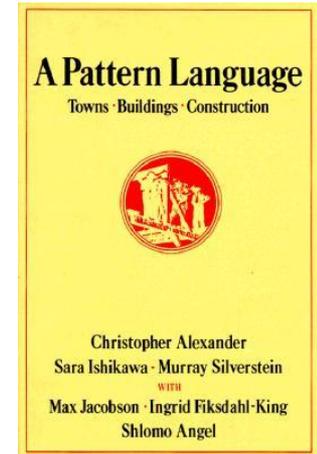
# Problem and solution pattern articulation

- Research infrastructure is socially constructed - embedded within and comprising existing practice, regulation, norms, community, technology

- Complex installed base responds to the (context) determines how problems patterns play out, as well as the nature of solutions

- One problem may have several related solution patterns
- Each solution pattern may have multiple different implementations

"Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice." *C. Alexander, The Timeless Way of Building, 1979*

- Data provisioning patterns  - centralised, federated, broker aggregator etc
- Facility governance patterns – networked, federated,  centralised
- Community building patterns – ANDS (staff as networkers) NeCTAR (facilitation and partnerships)

# Patterns for research infrastructure

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# Alexander's patterns

1 Independent regions

2 The distribution of towns

3 City country fingers

4 Agricultural valleys

5 Lace of country streets

6 Country towns

7 The countryside

8 Mosaic of sub-cultures

9 Scattered work

10 Magic of the city

11 Local transport areas

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# Research Infrastructure patterns

1 Independent regions

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1 Research domains

    2 Research facility

    3 Scale and density

    4 Data supply chains

    5 Connectivity between researchers around a facility

    6 Smaller collaborative spaces  (co)labs

    7 independent research in academies

    8 Mosaic of sub-cultures (disciplines, specialisations)

    9 scattered work – skunk works, x-domain opportunity

    10 Magic of seamless science collaboration through appropriate scale and accessibility of research infrastructure

    11   Frictionless data and people

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# For example….

## Scale and density

**Problem pattern**:

Research infrastructure fails to flourish because it doesn't get the right scale and density of technical infrastructure, data and community.

**Solution pattern**:

Design infrastructure to bring communities and data together to create scale and density of activity.

**Examples**:

Atlas of Living Australia

AURIN

# Summary of discussion

Four groups explored patterns and 25 minutes reporting back. Key insights about the process, and outcomes. Subsequent slides provide an overview of the group discussion and the resulting patterns

**Process insights**

- Stimulated lively discussion

- A range of interesting reflective conversations about eResearch community building objectives, problems and practice

- Describing context is hard - it has multiple dimensions

- The scale of the problem and pattern is sometimes hard to define - a hierarchy of problem patterns.

**Outcomes from the workshop**

- Participants exposed to a new approach to thinking about their practice - i.e. patterns
- Some initial elements of patterns were articulated (see following sections)
- There was support from participants to remain engaged in the process to determine next steps

**Group 1** – explored communication as a problem and through this, implicitly identified a set of nested sub patterns within a meta-problem of collaboration in competitive environments - **the frenemies pattern**

Group 2 - explored the problem of trying to sustain eResearch facilities that are typically funded through projects. They explicitly defined a nested set of problem and solution patterns - **beyond project based funding**

Group 3 – explored the '**glocalisation' pattern** through the lens of workflow design moving form abstract high level problem, definition into local adapted implementations

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# G1 Pattern - Working with frenemies

**Headline**

Difficult to navigate the various individual and organisational (dis)incentives for collaboration within a competitive environment that hamper eResearch adoption and growth

**Problem**

Researchers and organisations have drivers and constraints on collaboration (cost sharing, access to intellectual capital etc.) But…..organisational rules, governance and funding both enable and constrain collaboration.

Competition between collaborating researchers as well as between the organisations within which they work.

This makes them frenemies, friends (as collaborators) and enemies (as competitors) and can manifest at different scales.
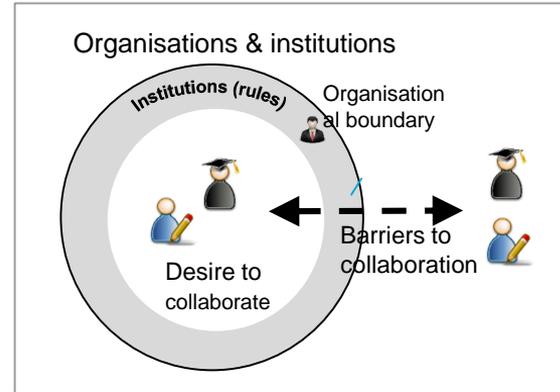


**Solution**

- With Frenemies, collaborate in the space where you are 'friends', and not where you are 'enemies'. For example:
    - focus collaboration in areas where there is less competitive tension between collaborators e.g. biodiversity and climate where there is less (science, reputational, business) competition
- change the frenemy equation - Flow funding through the system to drive collaboration' e.g. a community governed fund that increases incentives for collaboration
- Create 'watering holes' - places where there is a high value in participating, even though you have your enemies participating in there at the same time.

# G2 Pattern -eResearch facilities - beyond project based funding

**Headline**

Sustaining eResearch infrastructure is a challenges given the project based nature of the eResearch development and operation

**Problem**

eResearch facilities are needed to support data driven research. They are typically established and operated through projects with start and end dates. With a critical mass of projects, an economy of scale can be achieved to provide sufficient funding to sustain the facility.

Many facilities however are unlikely to achieve the required economies of scale to sustainably fund itself through project funds.

**Solution**

- Scaling through use of cloud and federation to reduce cost through economy of scale (cloud) and to allocate costs more effectively through the system (federation)

- Commercialisation of aspects of facility to create revenue stream for facility

  - Extend user base beyond publicly funded research and enable use for commercial research

  - Commercialisation of research outcomes - data and software products

- Outsource facility provision to industry

- Partner with other facilities to achieve economies of scale

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# Takeaways

- Patterns are potentially useful/powerful for creating shared view of problem and exploring solutions

- Patterns are hard to do – context, scale, multiple dimensions and relationship

- Madness?.. or useful pathway to designing the right watering holes?

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