

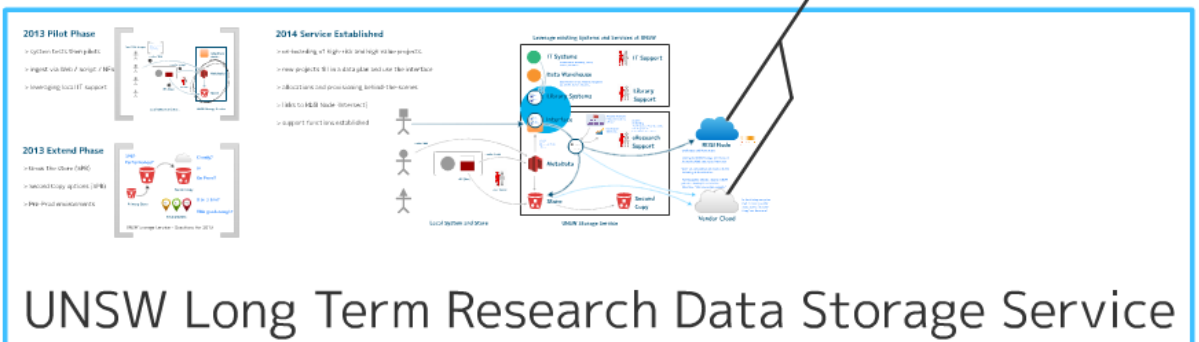
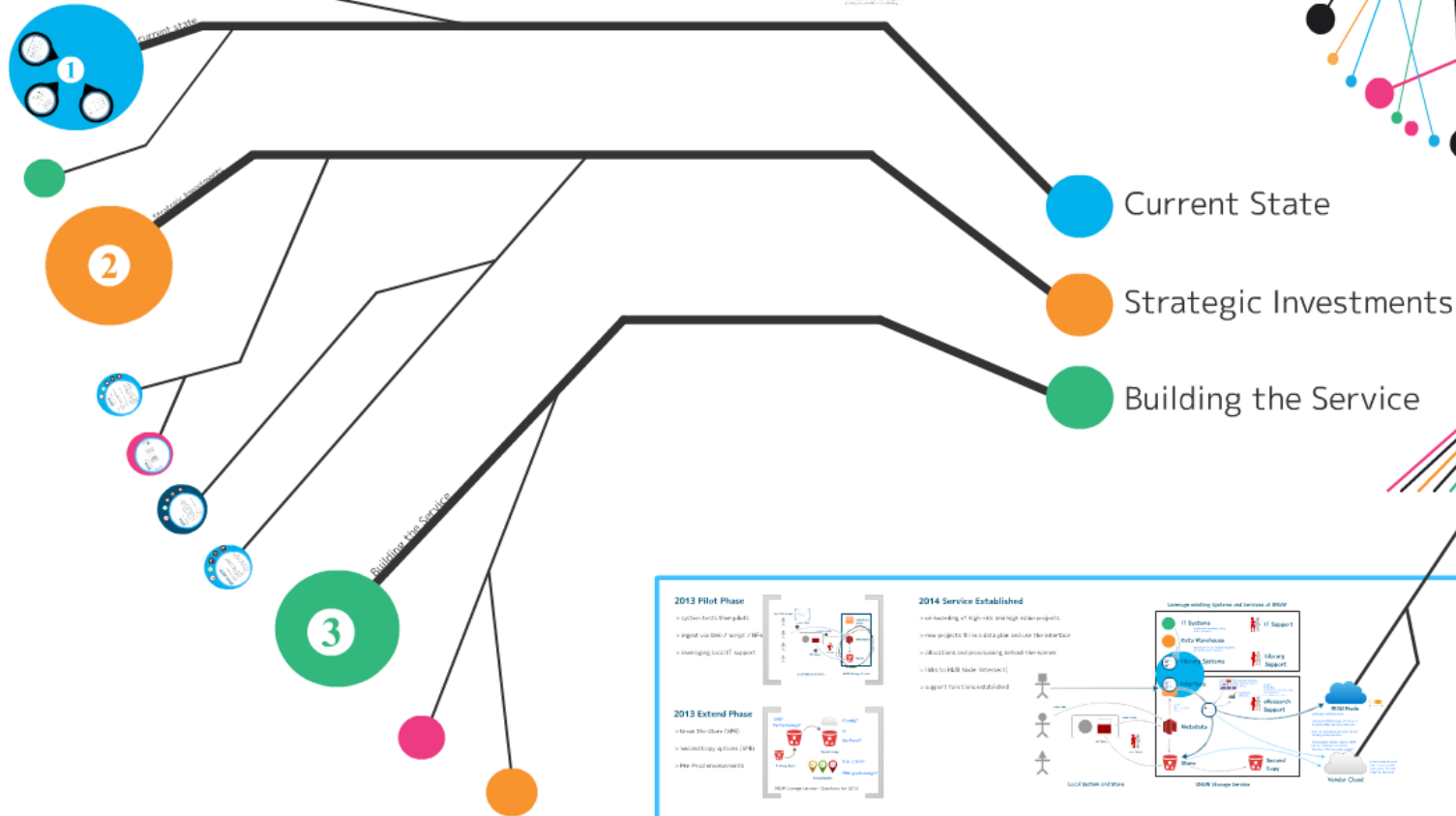
Building a long-term Research Data Storage Service for UNSW.



Luc Betbeder



speaking for the whole team...



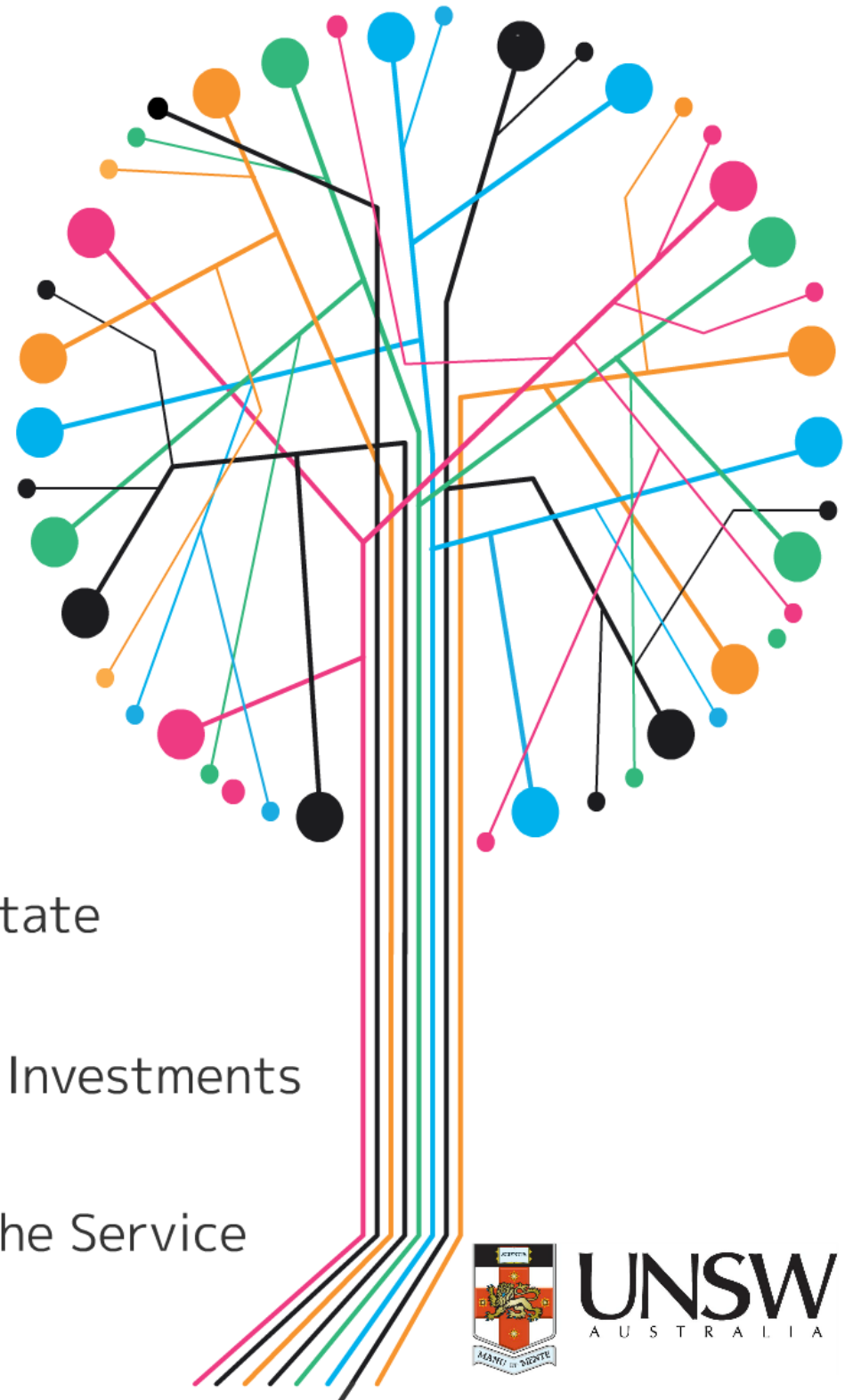
UNSW Long Term Research Data Storage Service

Building a long-term Research Data Storage Service for UNSW.



speaking for the whole team...

From Ft. Verde Del Rio, Wendy Nizkorik, Dora Bell, Teri Gray, Debbie, Jani Chacones, J. Brooke J. Simons, Susan Hernandez, Jo Luque, Carole Webb - and you cannot miss, Chag Simons and Susan, And Whiting Expressions (2024) Editors: Barbara Chacones, Mary Mae L. McPhee, Greg Lewis, Graham Jones, Claude Pines and all the wonderful participants in the Ad-libs Group and Pilot sites. Thank you



 Current State

 Strategic Investments

Building the Service

UNSW
AUSTRALIA

Building a long-term Research Data Storage Service for UNSW.



Luc Betbeder

luc@unsw.edu.au



speaking for the whole team...

From IT: Vishal Sehgal, Amrany Nusebeh, Chris Will,
Sergey Tschin, Serj Chasomiro, Bernhard Sembrat,
Dusan Muntazic, Jim Keiper, Denise Black... (and yes
comes too... Greg Sawyer and team). And the very
business stakeholders: Barbara Chmielewski, Prof
Mark Hoffner, Greg Leslie, Graham Moran, Waude
Francis and all the wonderful participants in the
Advisory Groups and Pilot sites. Thank you.





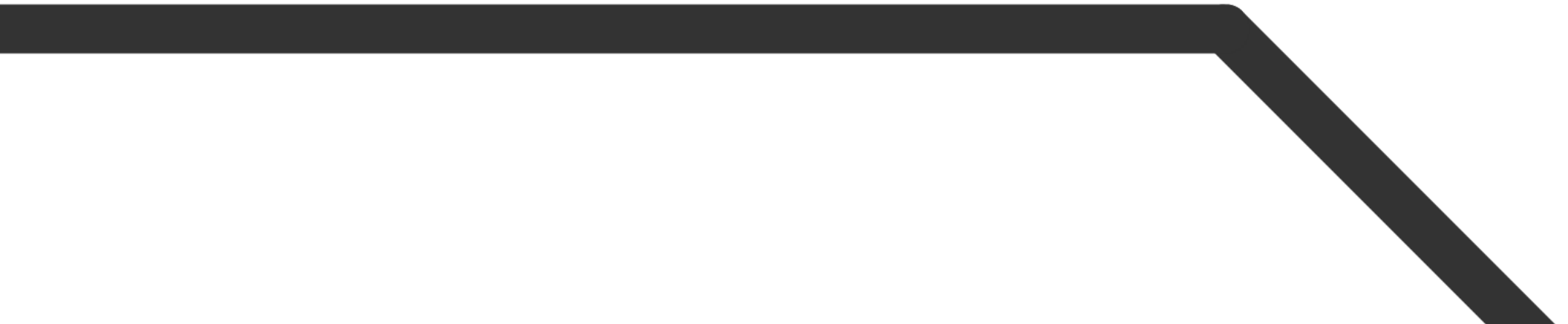
Luc Betbeder

luc@unsw.edu.au



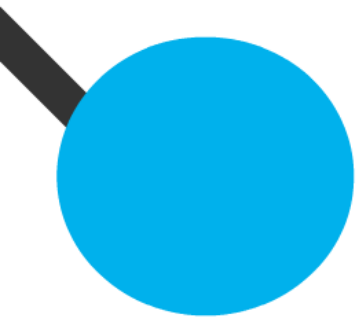
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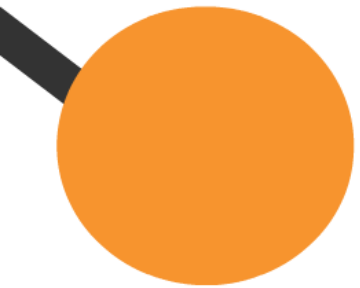


whole team

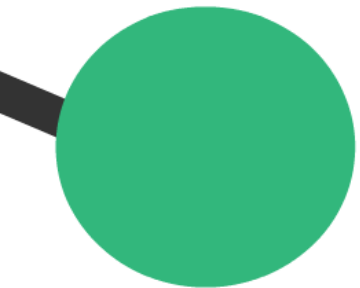
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Current State



Strategic Investments



Building the Service



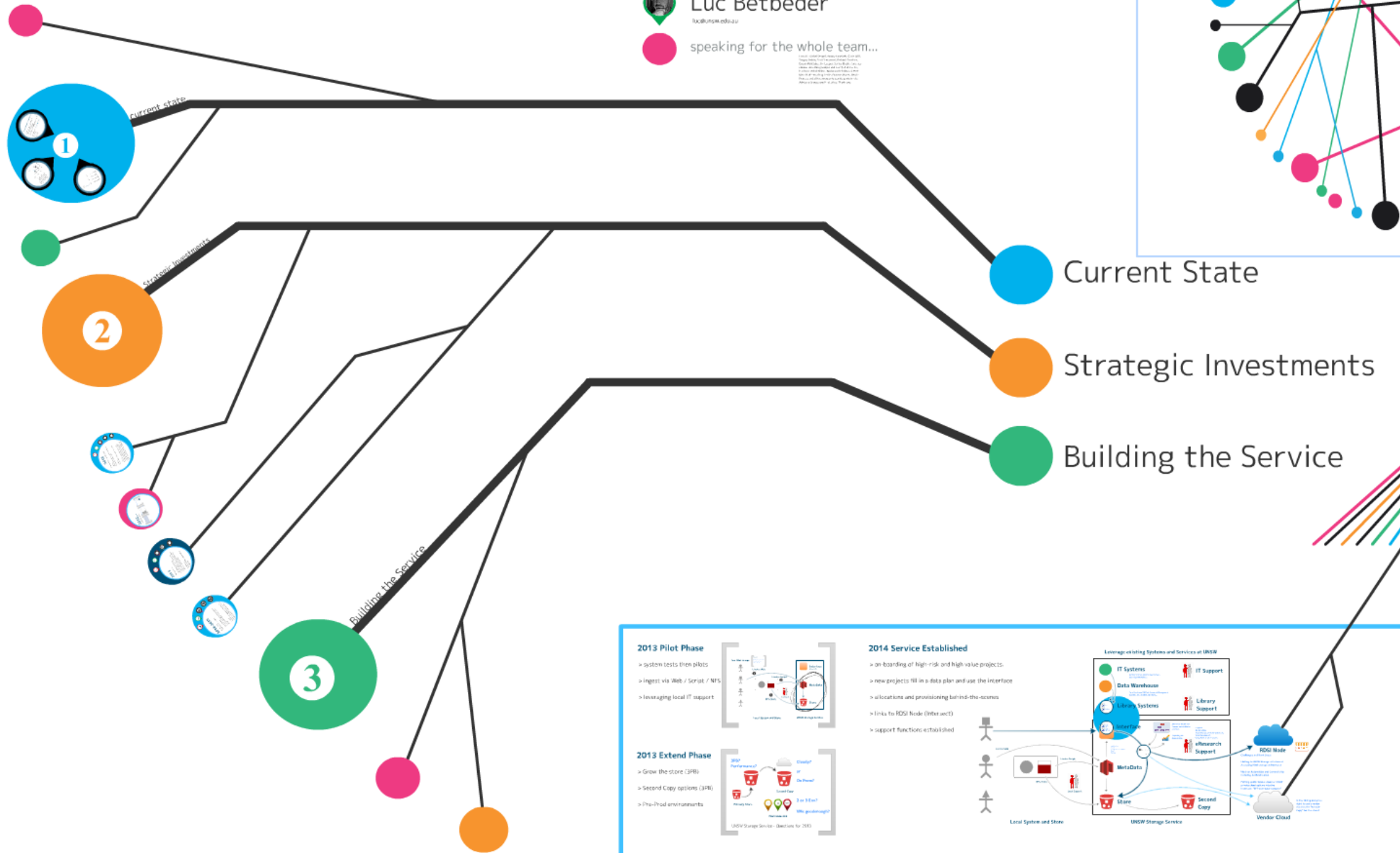


Luc Betbeder

luc@unsw.edu.au

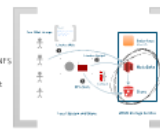


speaking for the whole team...



2013 Pilot Phase

- > system tests then pilots
- > ingest via Web / Script / NFS
- > leveraging local IT support



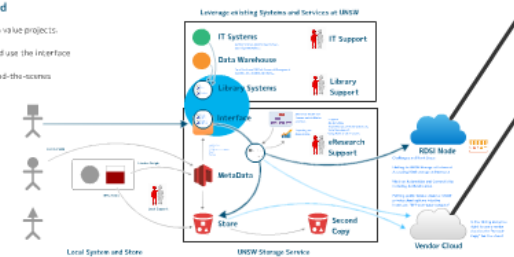
2013 Extend Phase

- > Grow the store (3PB)
- > Second Copy options (3PB)
- > Pre-Prod environments



2014 Service Established

- > on boarding of high-risk and high-value projects
- > new projects fill in a data plan and use the interface
- > allocation and provisioning behind-the-scenes
- > links to HDS Node (interact)
- > support functions established



UNSW Long Term Research Data Store

current state

1

Existing Research Storage Service

Under IT funded and Gov. IT sponsored
Data Management and Service Work
Costs are barrier for smaller @mapa = \$1K/7B
Add to existing needs:
Sci - 200 TB
Med - 1 TB 7B
Eng - 20 TB

Long Term Storage

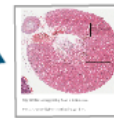
And many local specialist
systems are
being used for
computation...

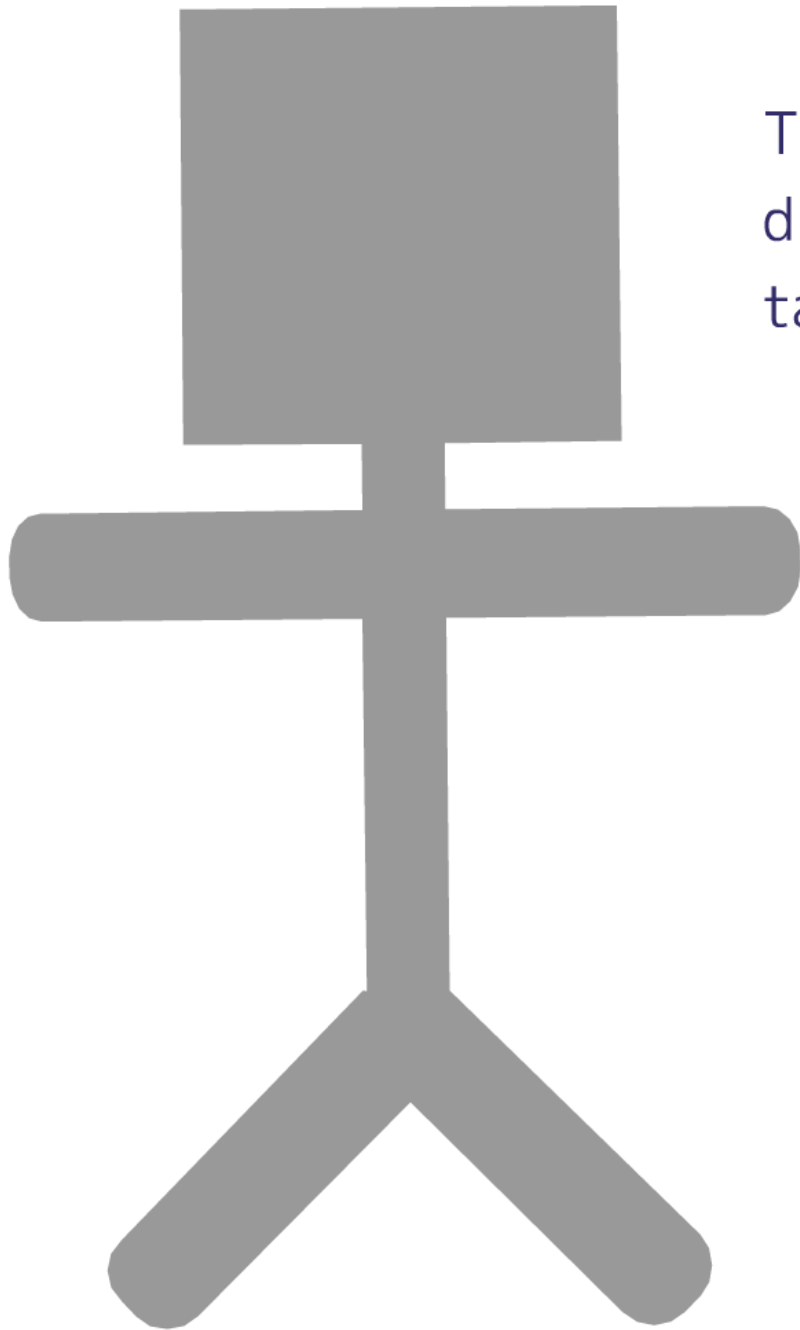
Large amounts
of different kinds
of research data
are being stored

Large amounts
of
different kinds
of
research data
are
being stored

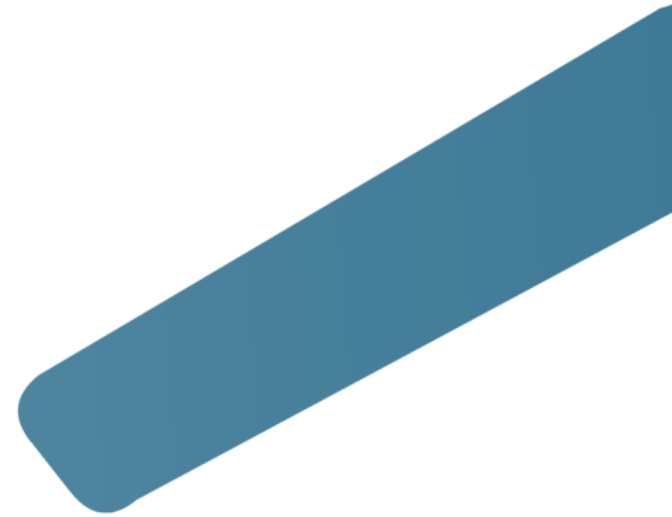


The grid pattern is a representation
of the distribution of research data by
category or source.



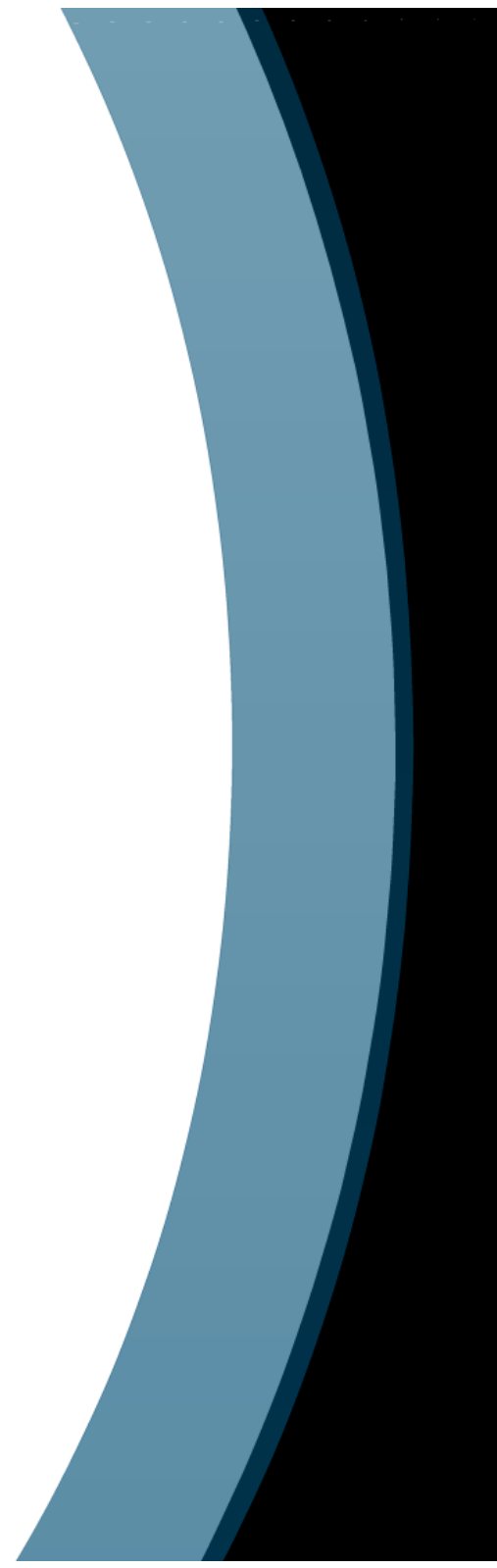
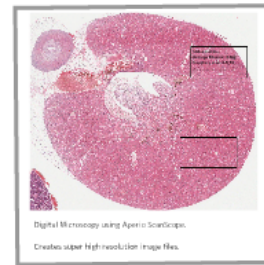


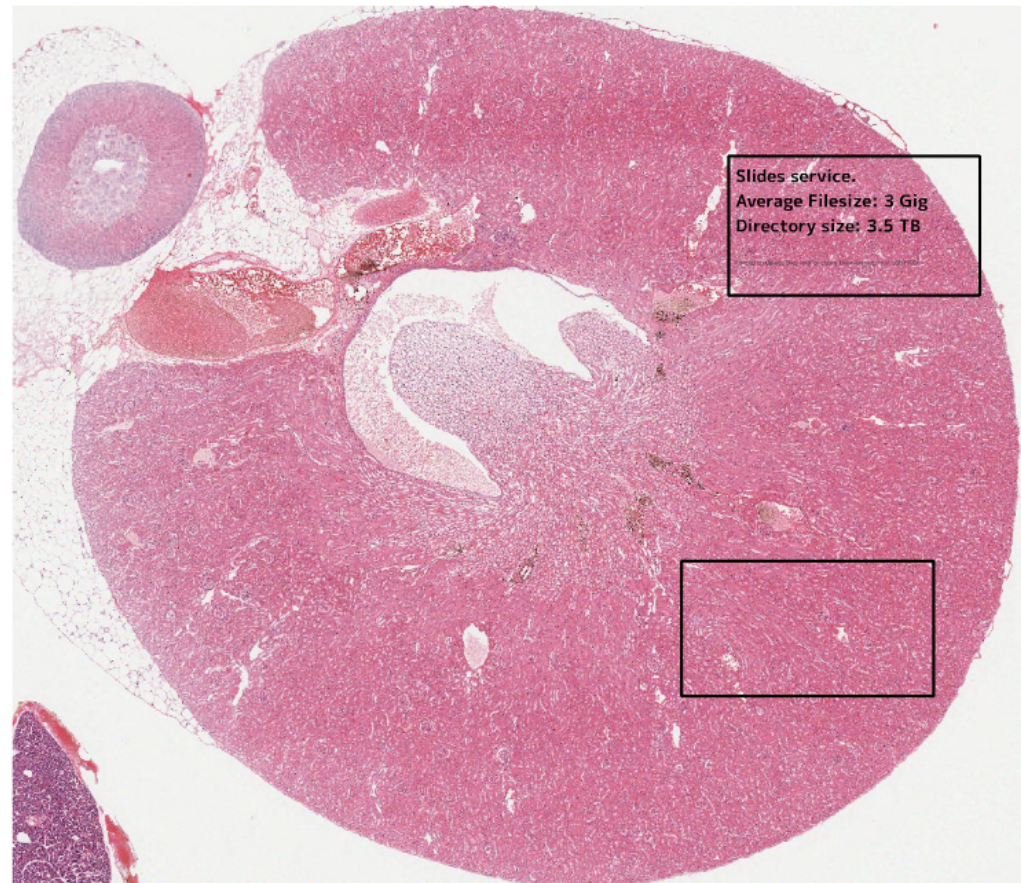
The grey person icons represent different kinds of research activity taking place on campus.





The grey person icons represent different kinds of research activity taking place on campus.





Digital Microscopy using Aperio ScanScope.

Creates super high resolution image files.

Slides service.

Average Filesize: 3 Gig

Directory size: 3.5 TB

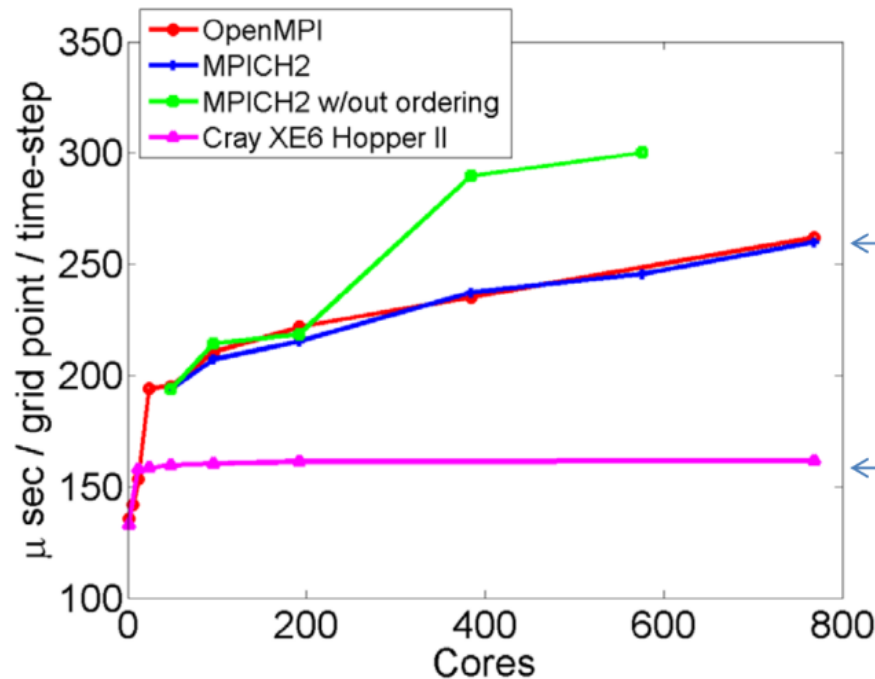
Forced to delete files and/or store them on external USB HDD.

and many
fit-for purpose
local specialist
systems are
being used for
analysis and
computation...



Local Stores and Systems

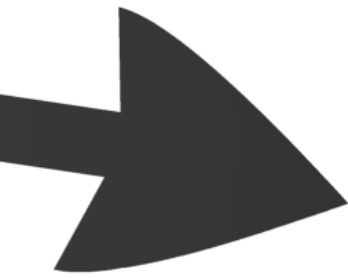
Computer cluster: Leonardi - 3000 nodes
eg: Models of diesel spray and combustion in engines



Perfect scaling would be a flat line.

← Our cluster

← #8 overall fastest machine in the world (with 3D torus interconnect)

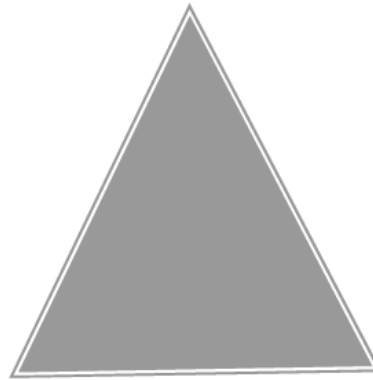
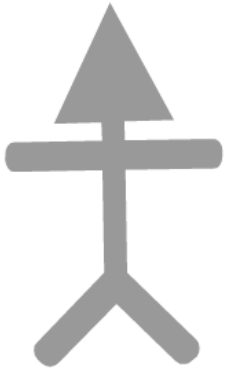


Computer cluster: Leonardi - 3000 nodes

Storage capacity: no-long term storage...

1 x RAID5 (3 x 2TB) + 1 HS (2TB) :
/home (3TB) + /share/apps (750GB)

1 x RAID50 (5 x 5 x 2TB) + 1 HS (2TB) :
/share/scratch (37TB)



Local Stores and Systems

How big is our data problem?



USB Drives in cupboard in Mech.ENG

Existing Research Storage Service

UNSW IT Hosted and Fac IT moderated

Disk - NetApp H/W used

Model and Service Work well

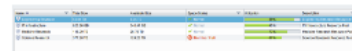
Cost is a barrier for smaller groups = \$1K/TB

But is being used:

Sci - 380 TB

Med - 116 TB

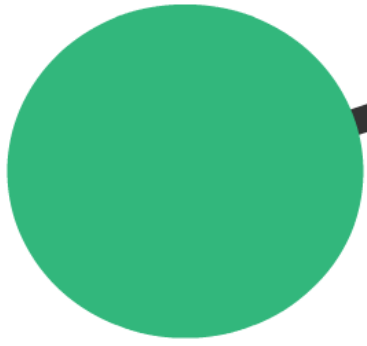
Eng - 58 TB



Category	Storage (TB)	Usage (%)	Free Space (TB)	Alerts
Sci	380	85%	65	1
Med	116	70%	36	0
Eng	58	60%	22	0

▼	Utilization	Description ▼	⌵
	89%	Engineering Research Resource P...	▲
	45%	IT Infrastructure Resource Pool	
	77%	Medicine Research Resource Pool	
	67%	Science Research Resource Pool	

▼



Strategic Investments



2012

Strategic Investment Planning (3 yr plan)

> process:

Align IT investment to UNSW "Business Domains"
(ie: Research, Academic, Other)

> method:

In-domain prioritising > estimating > voting

> outcome:

Multi-year / multi-stream investment for
research storage (To support "Research Practice",
meet Policy obligations, reduce Risk and
"Providing an excellent research environment,
with cutting-edge facilities and equipment.")



Long-Term Storage

A long-term "accessible archive" with metadata capability to support research practice at UNSW.

- > No direct charge to researchers or project.

- > Principles: large, functional, cheap, extensible, supportable, aligned, secure.

NOT a store for computation or analysis.

Interface / Portal

A portal for accessing and using the UNSW long-term store and other data storage services (e.g. RDSI node(s), vendor/cloud).

Linked to other UNSW systems (library, research projects, data warehouse, authentication etc.)

It is policy-driven. You create a data plan to use the store.

Devices and Bookings

We would like to link our research device booking system to the portal.

And eventually to provide tools to enable direct ingestion of research device data, device metadata and booking system metadata into store.

Smart Devices

Enhanced Metadata

Over time we want to provide the Store with additional metadata, integration, search and collaboration functionality.

This may include federated search (searching across stores) and improving the ingest metadata capabilities of the store.

Smarter Data

Active Storage

A self-service capability for researchers and research projects to access "active storage" (for compute) via the portal.

Active storage costs (unlike long-term storage) would be charged back to the projects.

Automation/Orchestration.

2012...

> procurement process.

Evaluation process based on these design principles.

Design Principle	Requirement
1. Redundant	Capacity must be able to handle 100% of the data in the event of a failure.
2. Availability	Any single component failure must not affect the availability of the data.
3. Scalability	Capacity must be able to handle 100% of the data in the event of a failure.
4. Flexibility	Capacity must be able to handle 100% of the data in the event of a failure.
5. Scalability	Capacity must be able to handle 100% of the data in the event of a failure.
6. Scalability	Capacity must be able to handle 100% of the data in the event of a failure.
7. Scalability	Capacity must be able to handle 100% of the data in the event of a failure.

Object-Based Storage Devices (OSDs)
Hierarchical Storage Management (HSM)
Cloud-based Storage Systems
Cloud

> Very strong vendor responses

HSM... Disk and Tape via SGI



DISK:
SGI ISS500 storage array. **0.5 PB**

TAPE:
Oracle SL3000 with
700 Slots / 4 Drives **1.0 PB**

SGI LiveArc = Arcitecta MediaFlux



Ingest with MetaData
Search
Version
Script / API
Web Client (Java)



Evaluation process based on these design principles.

	Design principles	
1	Resilient	Data must not be lost or corrupted. Data must be accessible for long time frames. Store outages should be minimal and planned.
2	Affordable	Long-term large-scale storage is expensive. The overall project must deliver large amounts of storage.
3	Supportable	Initial investment should be supportable within UNSW capabilities
4	Functional	Key functions must be available via initial investment. UNSW authentication, Drive mapping, Speed
5	Scalable	The capacity of the system is planned to grow from 1-5 Petabytes over 3 years. Initial system needs to be able to scale.
6	Extensible	The store will be extended with metadata, search, and collaboration features in 2014. Initial system needs to be able to be extended.
7	Aligned	The store should be aligned with national initiatives such as RDSI.

Object-Based Storage Devices (OSD)

Hierarchical Storage Management (HSM)

Expanding current Storage System

Cloud

> Very strong vendor responses.

HSM... Disk and Tape

via SGI



DISK:
SGI IS5500 storage array.

0.5 PB



TAPE:
Oracle SL3000 with
700 Slots / 4 Drives

1.0 PB

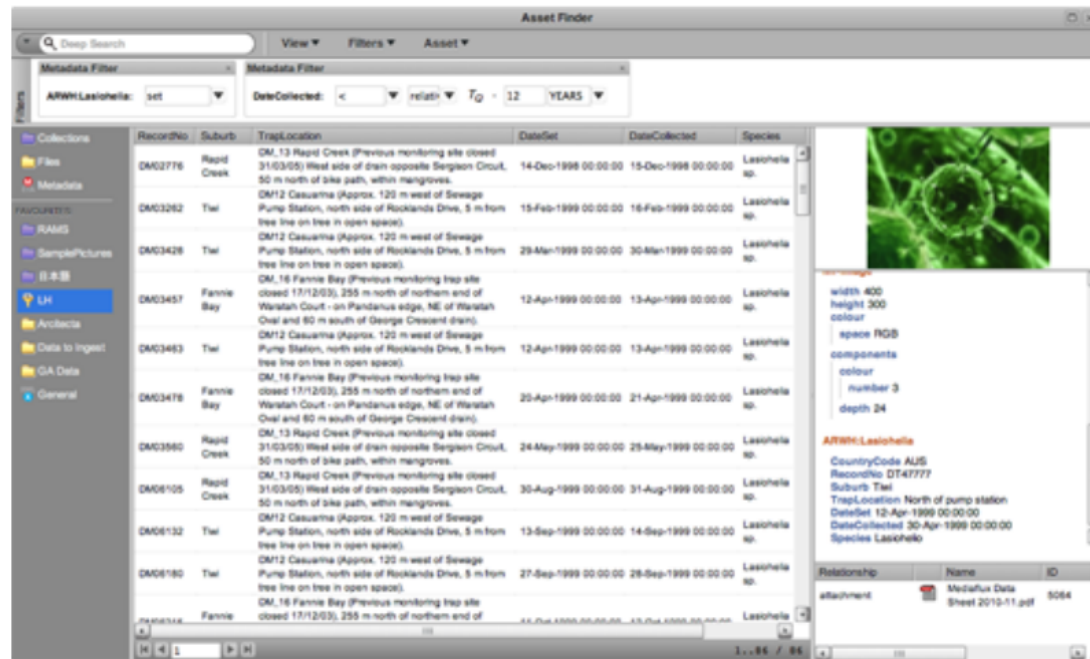
SGL LiveArc = Arcitecta MediaFlux



Ingest with MetaData
Search
Version
Script / API
Web Client (Java)



<http://www.arcitecta.com/Products/Desktop>



Asset Finder

Deep Search

View Filters Asset

Metadata Filter

ARWH:Lasiohella: set

DateCollected: < relati TQ - 12 YEARS

Collections

Files

Metadata

FAVOURITES

RAMS

SamplePictures

日本酒

LH

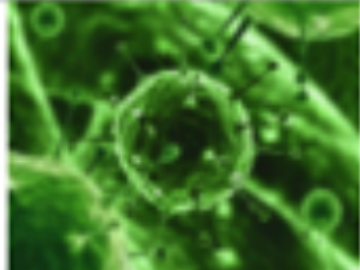
Arcticta

Data to Ingest

GA Data

General

RecordNo	Suburb	TrapLocation	DateSet	DateCollected	Species
DM02776	Rapid Creek	DM_13 Rapid Creek (Previous monitoring site closed 31/03/05) West side of drain opposite Serpison Circuit, 50 m north of bike path, within mangroves.	14-Dec-1999 00:00:00	15-Dec-1999 00:00:00	Lasiohella sp.
DM03262	Twai	DM12 Casuarina (Approx. 120 m west of Sewage Pump Station, north side of Rocklands Drive, 5 m from tree line on tree in open space).	15-Feb-1999 00:00:00	16-Feb-1999 00:00:00	Lasiohella sp.
DM03428	Twai	DM12 Casuarina (Approx. 120 m west of Sewage Pump Station, north side of Rocklands Drive, 5 m from tree line on tree in open space).	29-Mar-1999 00:00:00	30-Mar-1999 00:00:00	Lasiohella sp.
DM03457	Fannie Bay	DM_16 Fannie Bay (Previous monitoring trap site closed 17/12/03). 255 m north of northern end of Waratah Court - on Pandanus edge, NE of Waratah Oval and 80 m south of George Crescent drain).	12-Apr-1999 00:00:00	13-Apr-1999 00:00:00	Lasiohella sp.
DM03463	Twai	DM12 Casuarina (Approx. 120 m west of Sewage Pump Station, north side of Rocklands Drive, 5 m from tree line on tree in open space).	12-Apr-1999 00:00:00	13-Apr-1999 00:00:00	Lasiohella sp.
DM03478	Fannie Bay	DM_16 Fannie Bay (Previous monitoring trap site closed 17/12/03). 255 m north of northern end of Waratah Court - on Pandanus edge, NE of Waratah Oval and 80 m south of George Crescent drain).	20-Apr-1999 00:00:00	21-Apr-1999 00:00:00	Lasiohella sp.
DM03560	Rapid Creek	DM_13 Rapid Creek (Previous monitoring site closed 31/03/05) West side of drain opposite Serpison Circuit, 50 m north of bike path, within mangroves.	24-May-1999 00:00:00	25-May-1999 00:00:00	Lasiohella sp.
DM06105	Rapid Creek	DM_13 Rapid Creek (Previous monitoring site closed 31/03/05) West side of drain opposite Serpison Circuit, 50 m north of bike path, within mangroves.	30-Aug-1999 00:00:00	31-Aug-1999 00:00:00	Lasiohella sp.
DM06132	Twai	DM12 Casuarina (Approx. 120 m west of Sewage Pump Station, north side of Rocklands Drive, 5 m from tree line on tree in open space).	13-Sep-1999 00:00:00	14-Sep-1999 00:00:00	Lasiohella sp.
DM06180	Twai	DM12 Casuarina (Approx. 120 m west of Sewage Pump Station, north side of Rocklands Drive, 5 m from tree line on tree in open space).	27-Sep-1999 00:00:00	28-Sep-1999 00:00:00	Lasiohella sp.
DM06180	Fannie	DM_16 Fannie Bay (Previous monitoring trap site closed 17/12/03). 255 m north of northern end of	13-Oct-1999 00:00:00	13-Oct-1999 00:00:00	Lasiohella sp.



width 400

height 300

colour

space RGB

components

colour

number 3

depth 24

ARWH:Lasiohella

CountryCode AUS

RecordNo DT47777

Suburb Twai

TrapLocation North of pump station

DateSet 12-Apr-1999 00:00:00

DateCollected 30-Apr-1999 00:00:00

Species Lasiohella

Relationship	Name	ID
attachment	Mediaflux Data Sheet 2010-11.pdf	5084

1..86 / 86

2013

Starting the work.

> strategy and architecture:
Roadmap / vision document created and aligned with other streams of work taking place at UNSW and elsewhere. (Primarily Library and RDSI/Intersect)

> governance:
Boards and Business advisory Groups established.



Long-Term Storage

- Installation and configuration ✓
- Testing: July-Aug ⚙️
- Piloting: Sept-Dec

+Growing (to 3PB)
+Protecting (second copy)
+Staging (dev, UAT)

\$1M

Interface / Portal

- Analysis ✓
- Scope ✓
- Architecture and Solution Design ⚙️
- Build: Aug-Dec
- Release: 2014

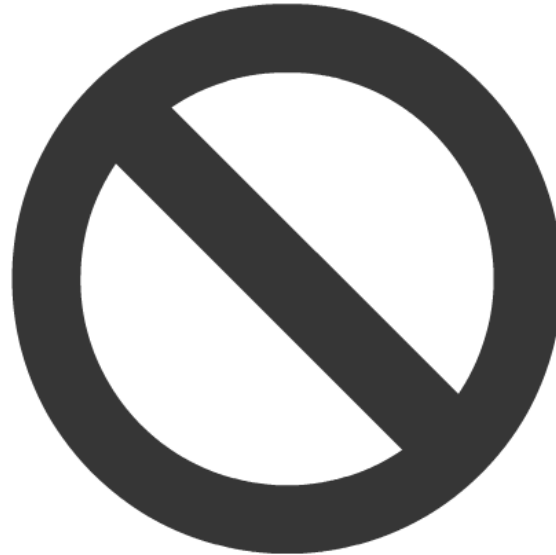
800K

Devices (Bookings)

- Analysis
- Scope
- Architecture and Solution Design

150K

Enhanced Metadata



Active Storage



ownCloud
experiments...

2014-2015

Run the service.
Expand capacity / capability.

> space allocation

Mix of existing targeted high risk and high value projects (100) and all new projects (1000).

> support

Mix of project-supported on-boarding for the messy existing projects and self-service data-plan-driven-through-the-portal.





4-2015

availability.

with risk and high
new projects



Building the Service



Strategic Investments

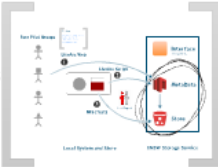
Building the Service



UNSW
AUSTRALIA

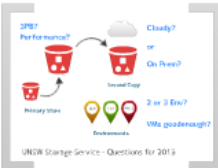
2013 Pilot Phase

- > system tests then pilots
- > ingest via Web / Script / NFS
- > leveraging local IT support



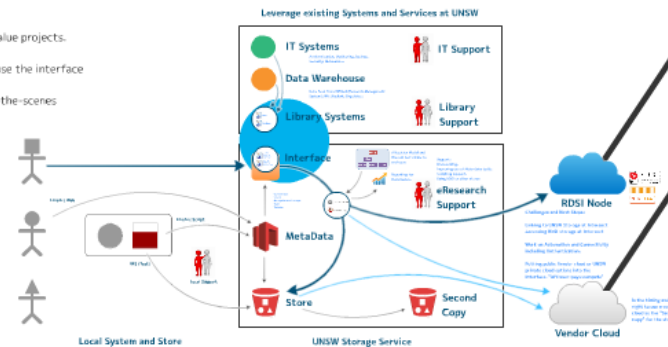
2013 Extend Phase

- > Grow the store (3PB)
- > Second Copy options (3PB)
- > Pre-Prod environments



2014 Service Established

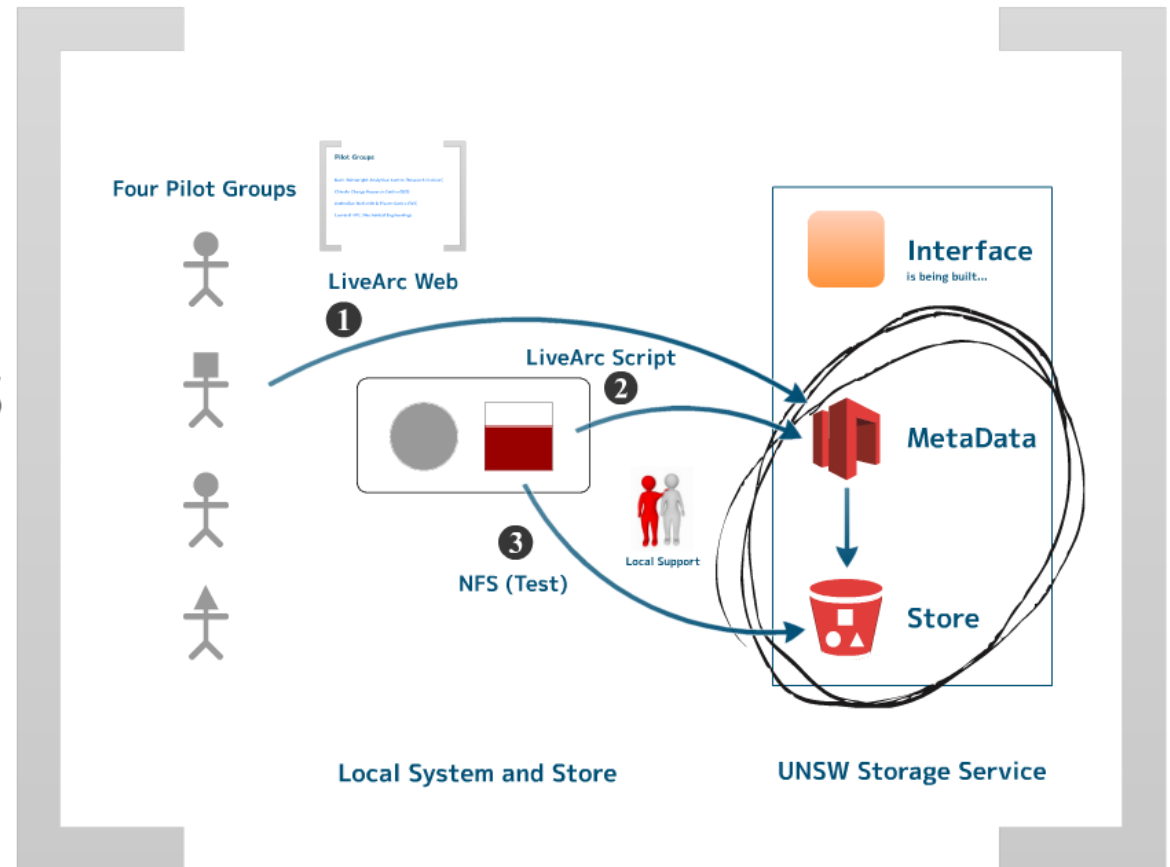
- > on-boarding of high-risk and high value projects.
- > new projects fill in a data plan and use the interface
- > allocations and provisioning behind-the-scenes
- > links to RDSI Node (Intersect)
- > support functions established



UNSW Long Term Research Data Storage Service

2013 Pilot Phase

- > system tests then pilots
- > ingest via Web / Script / NFS
- > leveraging local IT support



2013 Extend Phase

- > Grow the store (3PB)



Four Pilot Groups

Pilot Groups

Mark Watmough Analytical Centre (Research Division)
Climate Change Research Centre (CCI)
Australian Wetlands & Rivers Centre (DCI)
Lowland HPC (Mechanical Engineering)

LiveArc Web

1

LiveArc Script

2

NFS (Test)

3

Local Support

Interface

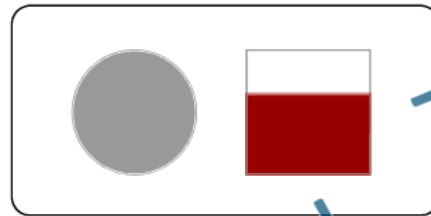
is being built...

MetaData

Store

Local System and Store

UNSW Storage Service



Pilot Groups

Mark Wainwright Analytical Centre (Research Division)

Climate Change Research Centre (SCI)

Australian Wetlands & Rivers Centre (SCI)

Leonardi HPC (Mechanical Engineering)

Four Pilot Groups

Pilot Groups

Mark Watmough Analytical Centre (Research Division)
Climate Change Research Centre (CCI)
Australian Wetlands & Rivers Centre (CIC)
Lowland HPC (Mechanical Engineering)

LiveArc Web

1

LiveArc Script

2

NFS (Test)

3

Local Support

Interface

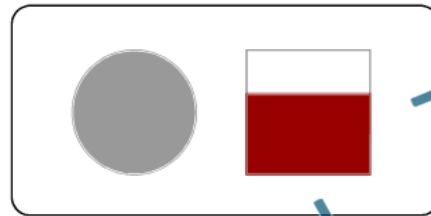
is being built...

MetaData

Store

Local System and Store

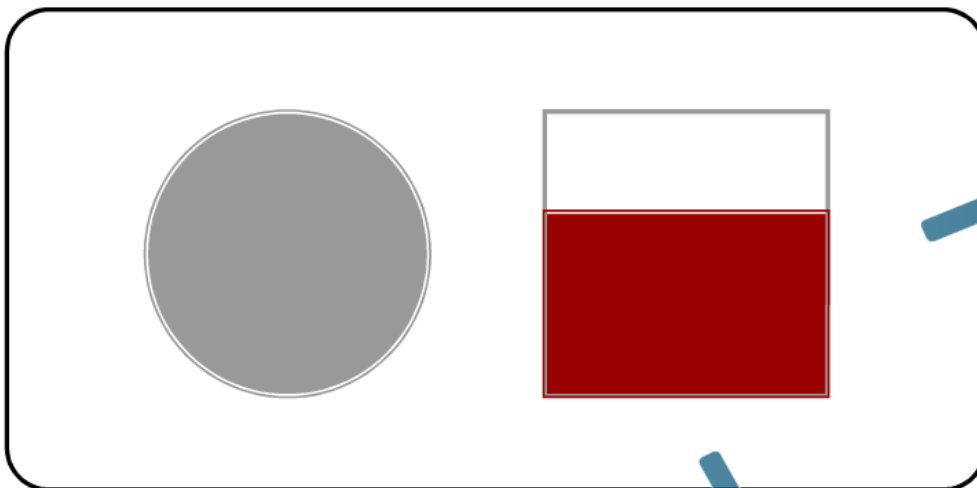
UNSW Storage Service



1

LiveArc Script

2



3

NFS (Test)

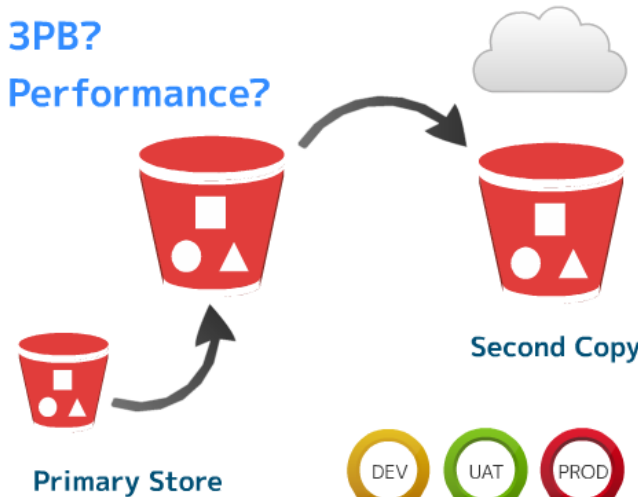


Local Support

2013 Extend Phase

- > Grow the store (3PB)
- > Second Copy options (3PB)
- > Pre-Prod environments

3PB?
Performance?



Cloudy?

or

On Prem?

Second Copy

Primary Store

2 or 3 Env?

VMs goodenough?

Environments

UNSW Storage Service - Questions for 2013

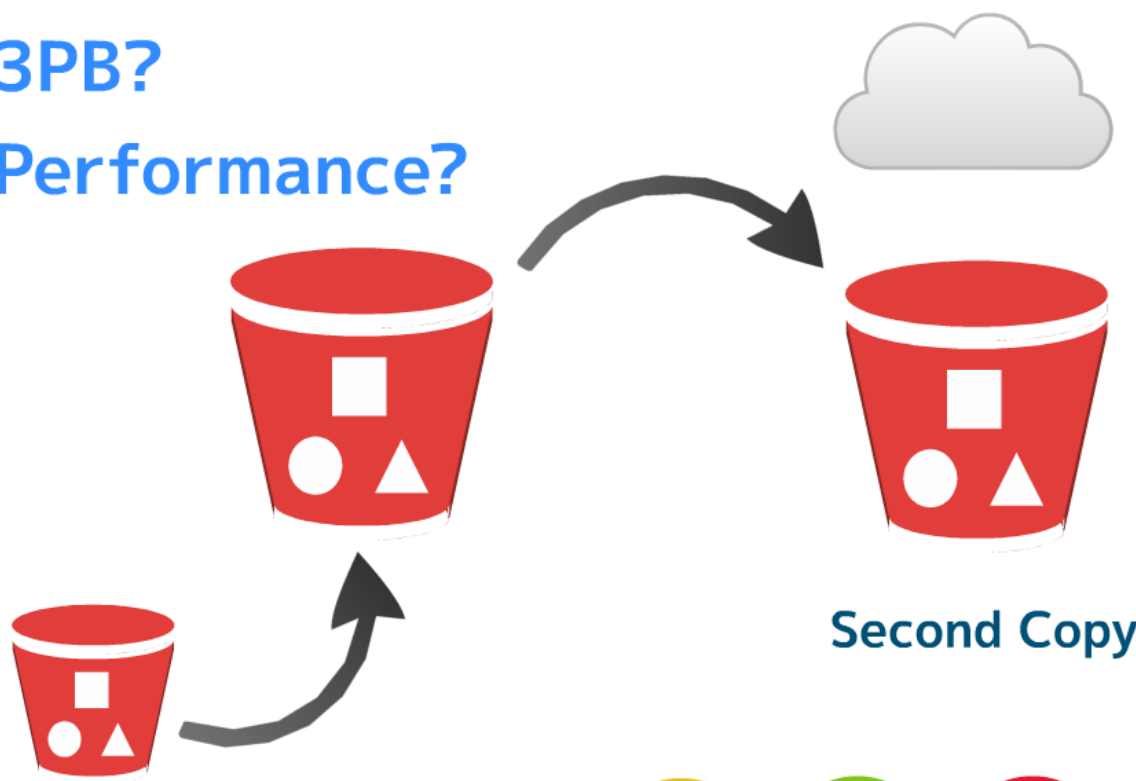
3PB?

Performance?

Cloudy?

or

On Prem?



Primary Store

Second Copy



Environments

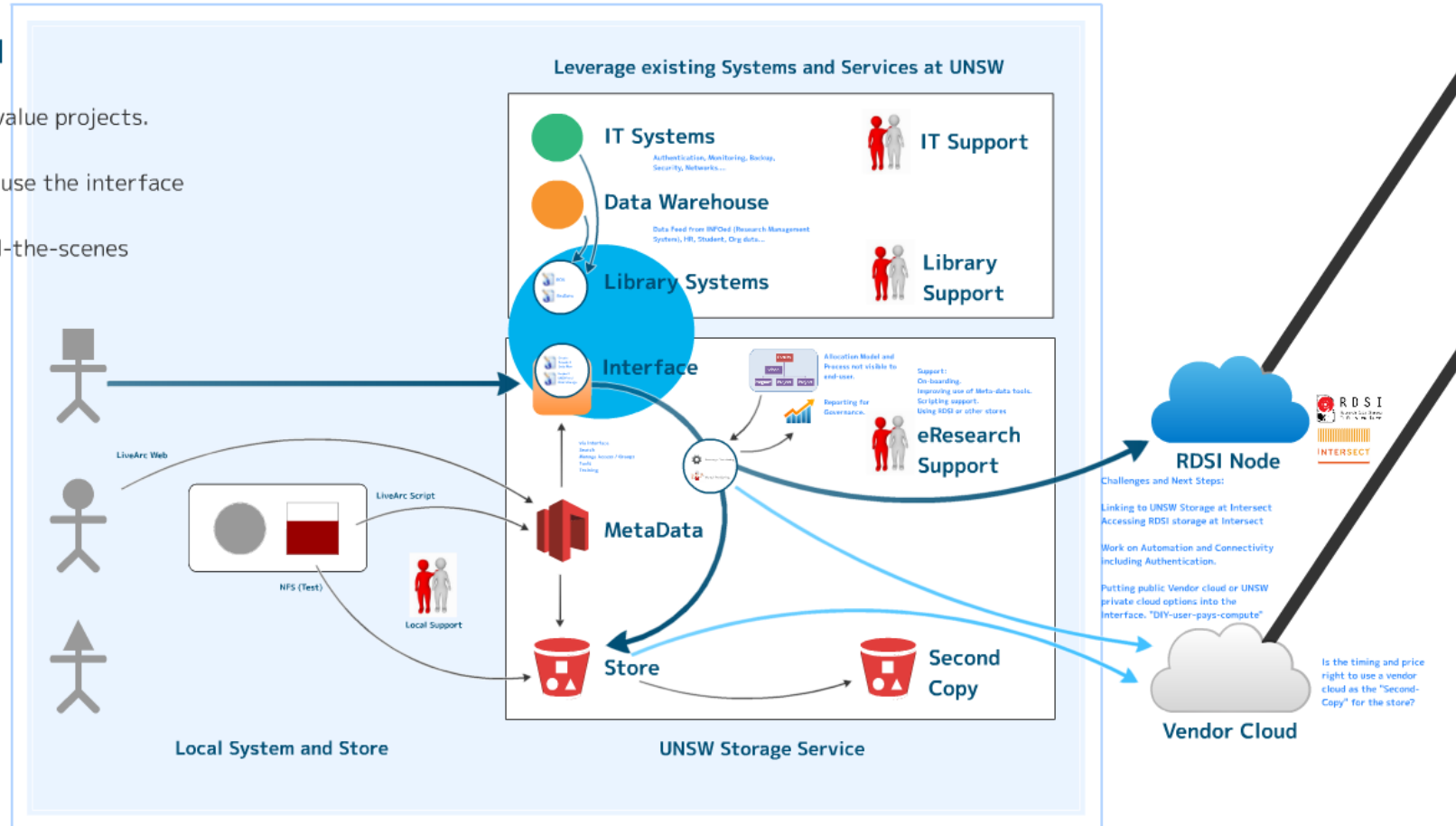
2 or 3 Env?

VMs goodenough?

UNSW Storage Service - Questions for 2013

2014 Service Established

- > on-boarding of high-risk and high value projects.
- > new projects fill in a data plan and use the interface
- > allocations and provisioning behind-the-scenes
- > links to RDSI Node (Intersect)
- > support functions established



Long Term Research Data

2014 Service Established

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- > new projects fill in a data plan and use the interface
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- > support functions established

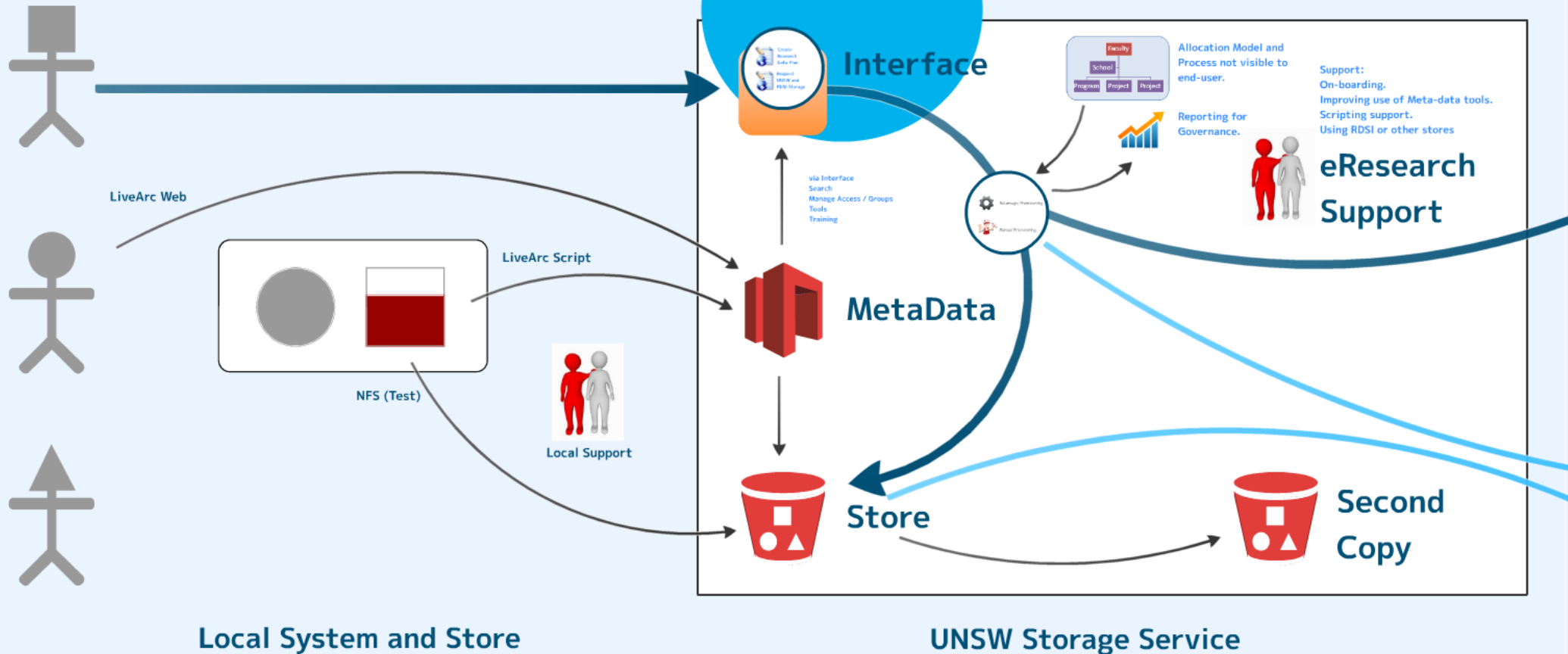


Leverage existing Systems and Services at UNSW

ue projects.

e the interface

he-scenes



Data Warehouse

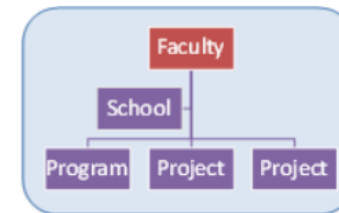
Data Feed from INFOed (Research Management System), HR, Student, Org data...

Library Systems



Interface

via Interface
Search
Manage Access / Groups
Tools
Training



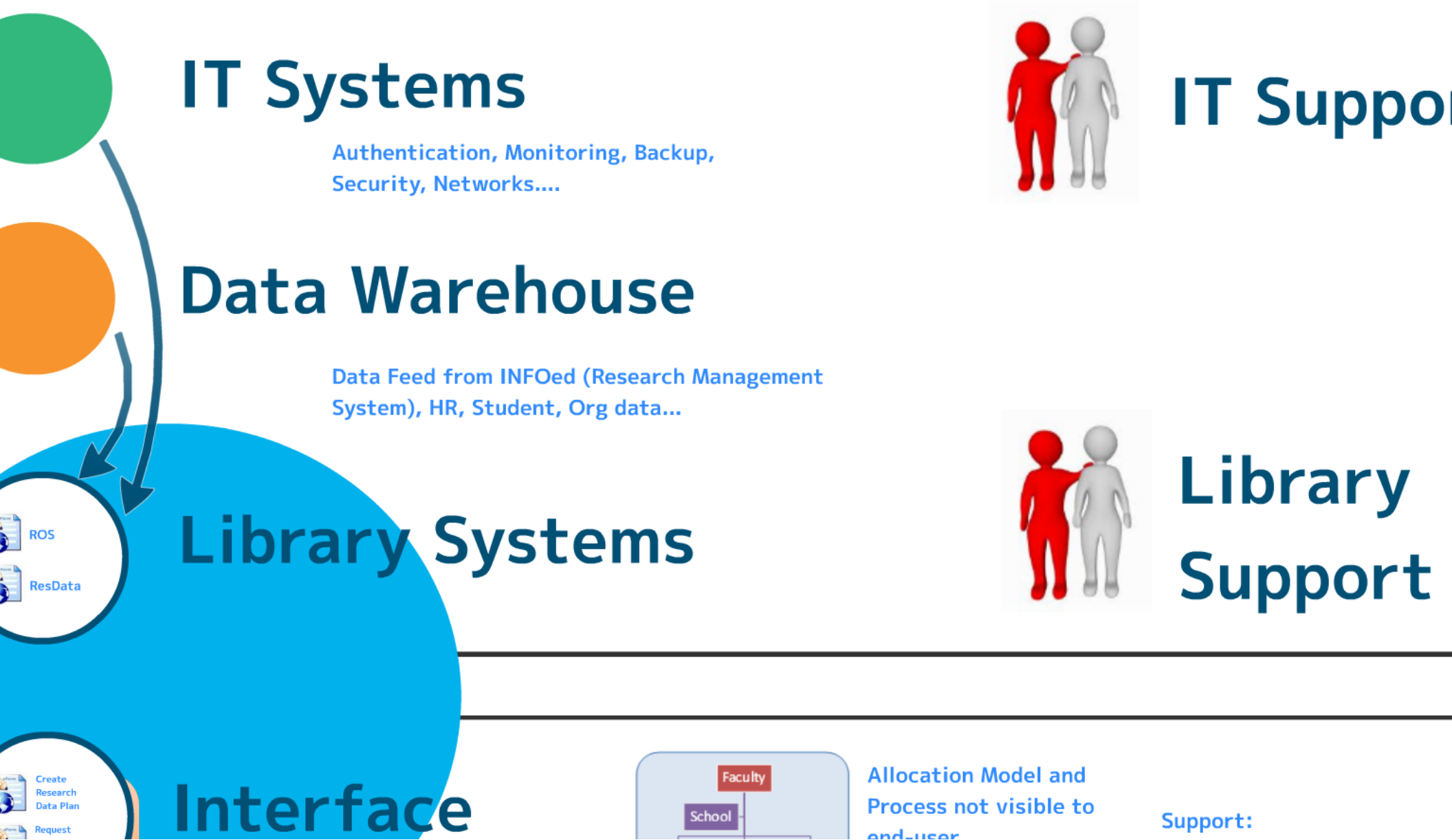
Allocation Model and Process not visible to end-user.



Reporting for Governance.



Leverage existing Systems and Services at UNSW



Interface



Create
Research
Data Plan



Request
UNSW and
RDSI Storage

via Interface
Search
Manage Access / Groups
Tools
Training

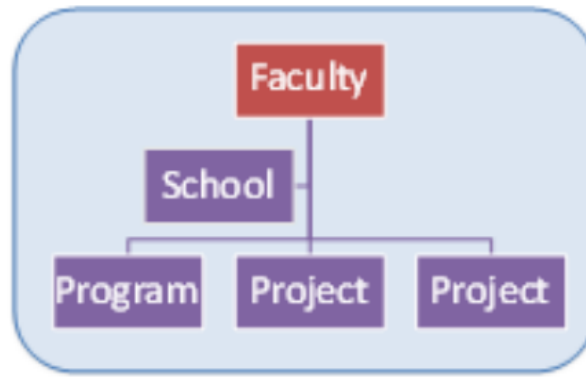


Automatic Provisioning



Manual Provisioning

face



Allocation Model and
Process not visible to
end-user.



Reporting for
Governance.



Allocation Model and
Process not visible to
end-user.

Reporting for
Governance.



Support:

On-boarding.

Improving use of Meta-data tools.

Scripting support.

Using RDSI or other stores

eResearch Support



RDSI Node



R D S I
Research Data Storage
Infrastructure



INTERSECT

Challenges and Next Steps:

Linking to UNSW Storage at Intersect
Accessing RDSI storage at Intersect

Work on Automation and Connectivity
including Authentication.

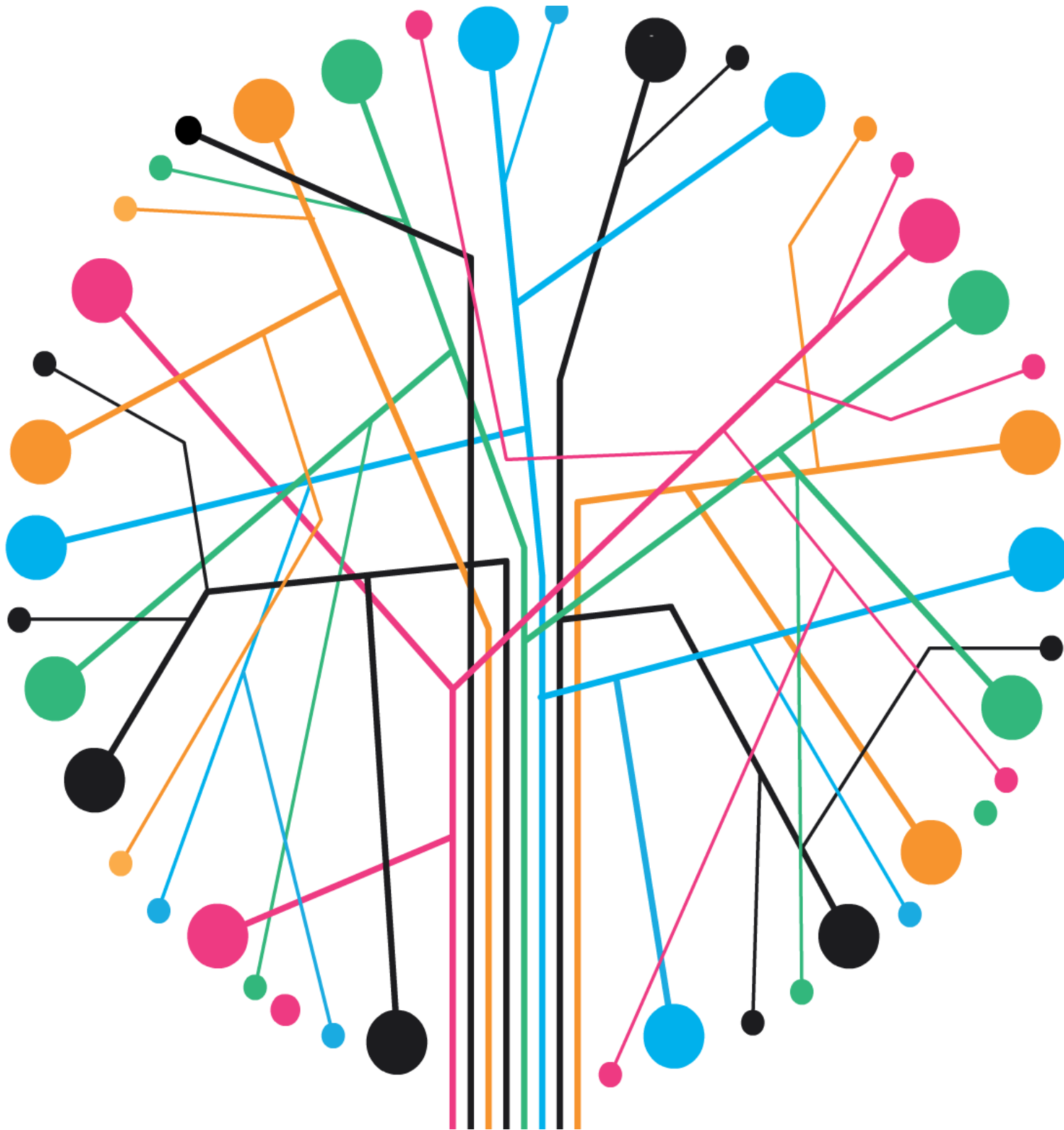
Putting public Vendor cloud or UNSW
private cloud options into the
Interface. "DIY-user-pays-compute"



Vendor Cloud

Is the timing and price
right to use a vendor
cloud as the "Second-
Copy" for the store?

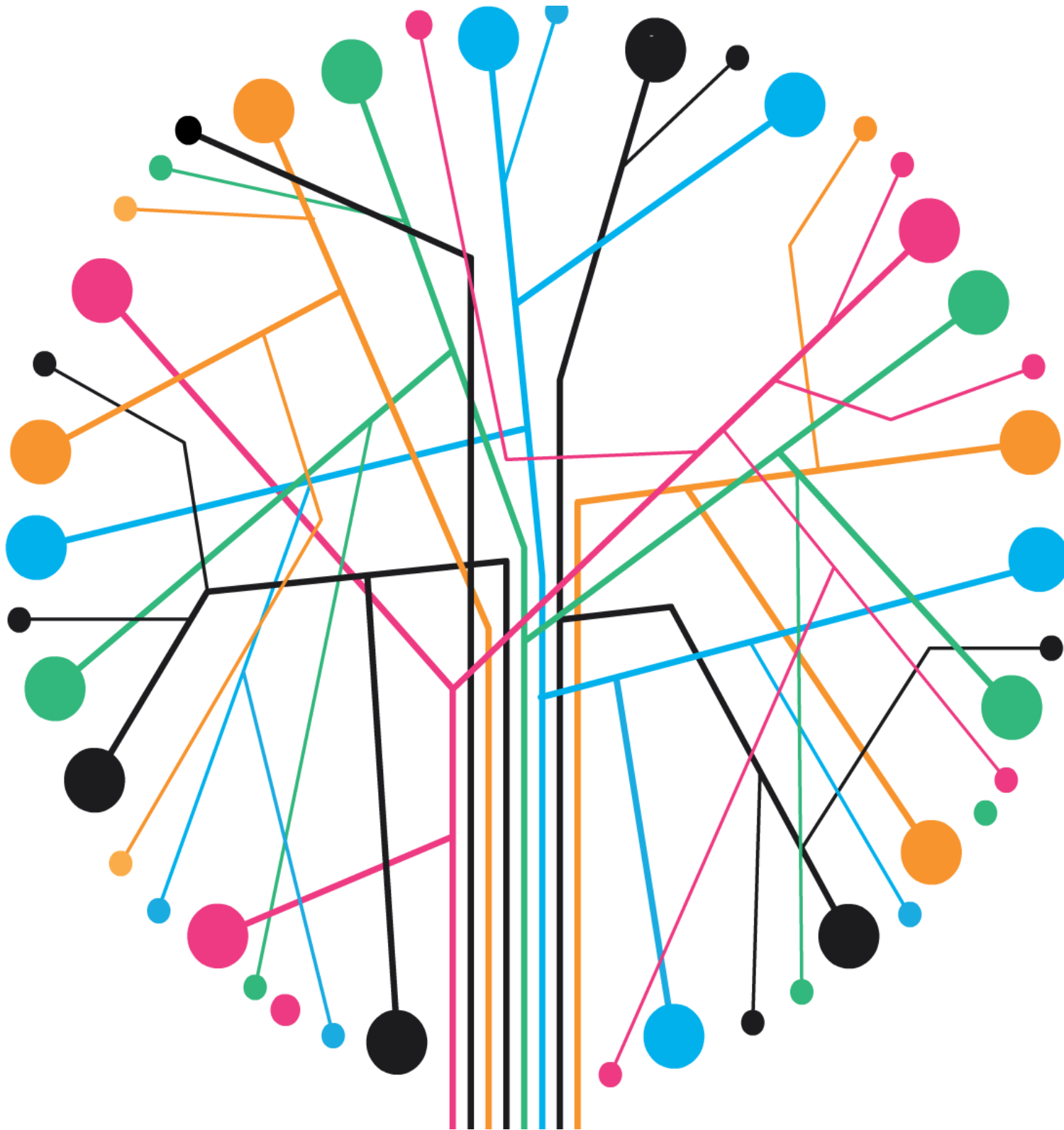
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UNSW
AUSTRALIA

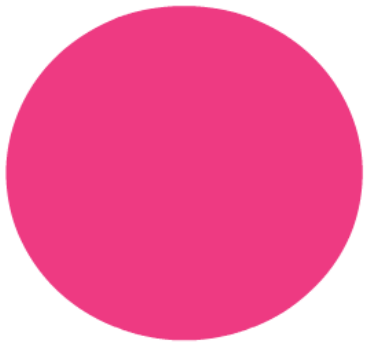
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speaking for the whole

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Dusan Munizaba, Jim Leeper,
comms too... Greg Sawyer and
business stakeholders: Barba
Mark Hoffman, Greg Leslie, G
Frances and all the wonderfu
Advisory Groups and Pilot sit