Enabling Service Oriented Grids for Earth Sciences in Australia

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CSIRO Exploration and Mining

Predictive Mineral Discovery CRC

www.csiro.au

Outline

- **Are we on the right road?**
- **Are we there yet?**
- **What's next?**

Are we on the right road?
Letters of support for the Innovation Access Fora Grant – 1

The Geoscience Agencies recognise that significant potential of this technology to deliver strategic geoscience data to the to the minerals exploration industry

David Mason, Chair Chief Government Geologists Committee

BHP minerals is focussed on the utilisation and analysis of geospatial data to provide advice across our global operations in a timely and efficient manner. The ability to obtain these data more readily and in open exchange formats will increase our efficiency to do what we do best

Grant McLatchie, Co-ordinator Business Improvement, GIS, IT & Databases, BHP Billiton

Reasons from our letters of support for the Innovation Access Fora Grant – 2

io global utilises geochemical data sets from government and the private sector on a daily basis, and improved efficiencies through interoperability would greatly benefit our business

Stephen Winter, Managing Director io global

acQuire throughout the world the implementation personnel have continued to discover significant issues with the transfer of effective data between systems. Many issues have been identified including:

- Data is invalidated or lost in the transfer process
- Metadata … is often lost because it was not convenient to transfer
- Unsupportable data conversion tools are constructed to facilitate transfers of data that are part of a critical process

Bill Withers, Managing Director, Metech Pty ltd

Reasons from our letters of support for the Innovation Access Fora Grant – 3

The issue of poor data interoperability and interchange in the exploration and mining industry is widely recognised as a significant barrier to achieving better outcomes – both scientifically and economically within the industry.

As a software vendor, Fractal Technologies is acutely aware of the inefficiencies caused by having to support such a wide range of data formats, which requires us to spend a significant portion of our development resources writing file format translators rather than adding value through the creation of smarter data processing algorithms and data analysis tools

Mark Morrison, Technical Director, Fractal technologies Pty Ltd

Reasons from our letters of support for the Innovation Access Fora Grant – 4

The project will

- **Improve efficiencies in data access and quality assurance from public service providers regardless of geographical location or jurisdiction**
- **Increase the utilisation of technologies across and within sectors**
- **Assist the Australian Minerals Industry to improve their efficiencies for data access and management that support minerals exploration**

Mitch Hooke
Chief Executive
Minerals Council of Australia

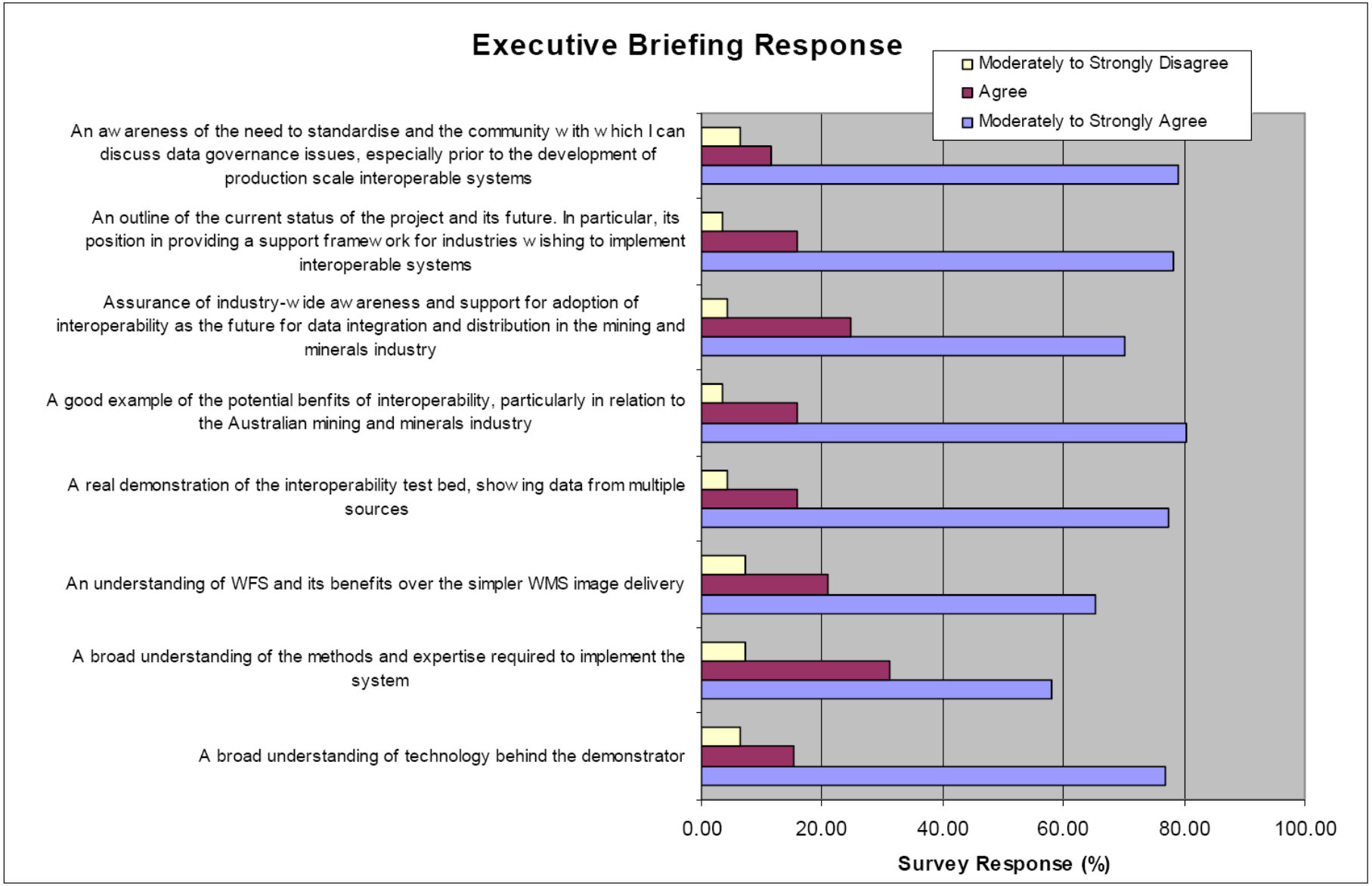
Key points from case studies and support letters

- **Show the diversity of use cases for the same data type throughout the mining value chain**
- **Show a strong business case for interoperability for management of your data in the external world**
- **Show an even stronger business case for interoperability for internal data management**
- **Show why standards need to be developed by groups working together as part of a community**
- **Highlight the emerging issue that responsibility of data quality becoming a legislative issue**

Conclusion

- **Demonstrable need for interoperability**

National Roadshow – Response to the demonstrator



National Roadshow – Response to the demonstrator

"the explorers agreed that the SEEGrid project for interoperability of precompetitive geoscience data was essential when it comes to long term benefits to aid future exploration effort in Victoria."

Chris Fraser, Executive Director, MCA Victoria – August 2005

"The Australian Geoscience Council therefore recommends:…

5. The development of new ways to store and access data and information (such as the SEEGrid) should be embraced…"

Mike Smith, President, Australian Geoscience Council Submission to Prime Minister's Science, Engineering and Innovation Council

Results of Roadshow

Technical solution appears successful

Business case is clearly identified and addressed

…Are we there yet?

Are we there yet?....No… Some recent feedback

Why interoperable Geoscience services?

"Pre-competitive geoscientific data is a critical responsibility of all Governments and a vital complement to private sector exploration…

The MCA identifies three key challenges:

> improving the accessibility and consistency of pre-competitive geoscience data through nation-wide protocols, standards and systems – harnessing into a single system all exploration related data, including that generated by the private sector and all governments' (Federal, State, Territory) pre-competitive geoscience data sets"

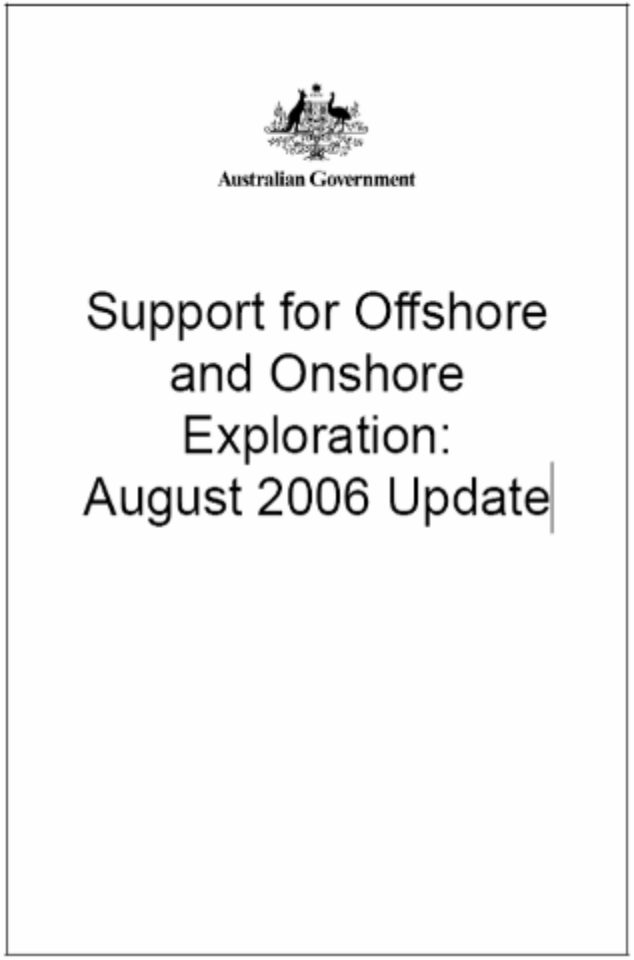
Mitchell H. Hooke,

Chief Executive

Minerals Council of Australia

Media Release 14th August 2006

Securing Australia's Energy Future



New Measure: Pioneer Innovative, Integrated Geoscientific Research

- $58.9 million will be provided to allow Geoscience Australia to pioneer innovative, integrated geoscientific research to better understand the geological potential of onshore Australia for both minerals and petroleum.

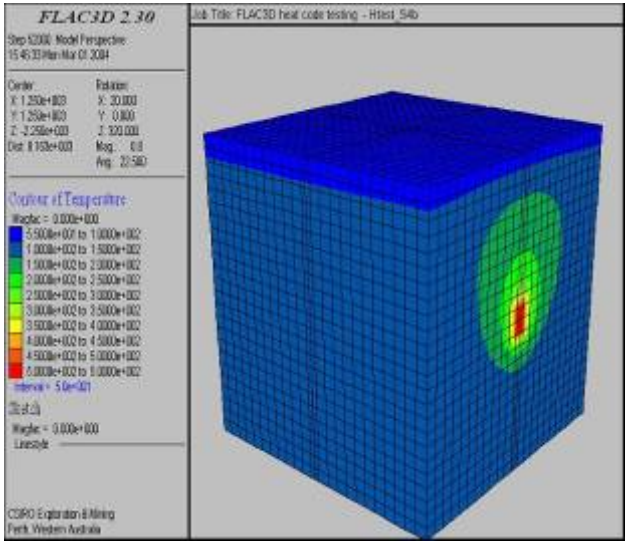
Current Government Support

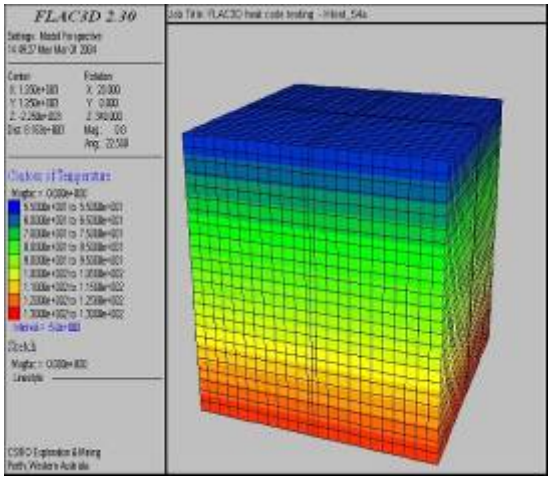
- The Minerals Exploration Action Agenda – the Road to Discovery (MEAA) contains four strategies which collectively aim to encourage greater investment in minerals exploration in Australia.
- These strategies address access to finance, access to land, the quality and availability of pre-competitive geoscience information and access to human and intellectual capital

Source: http://www.dpmc.gov.au/initiatives/docs/exploration.pdf

What about Computational Services? Are we there yet?
Traditional Mechanical Modelling Workflow

- Models (mesh + data files) are individually and laboriously constructed
- The manual process is error prone





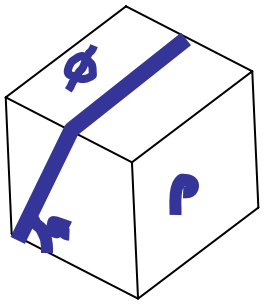
- "Powerful" desktop computes several models at a time
- Limitations are in the order of ~2 models per week

- Results are manually visualised one at a time
- Screenshots are manually taken and made into "movies"

- Very little, if any, standardised data archiving is done. This results in potential confusion or loss of the originating conditions of the experiments, making it unrepeatable in the long term

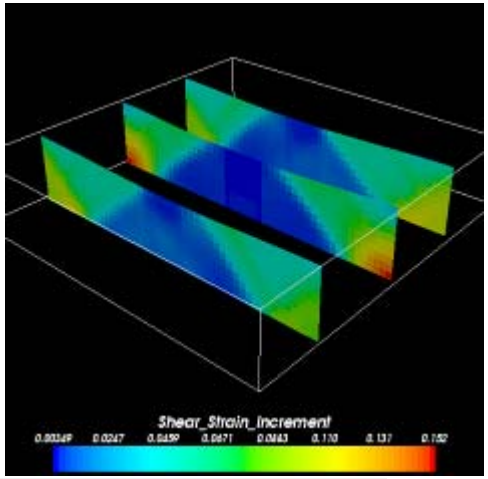
Slide courtesy of Robert Cheung and Warren Potma

New Refined Workflow – making progress…

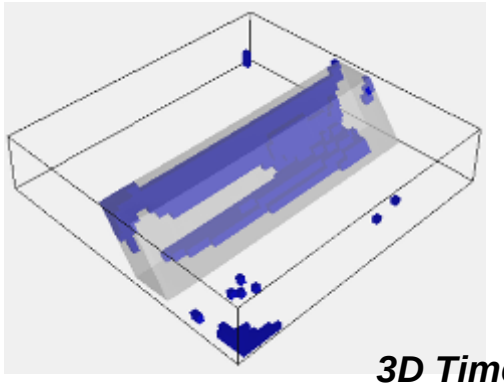


Parameterised Geometry Creation

Automated generation of visualisations

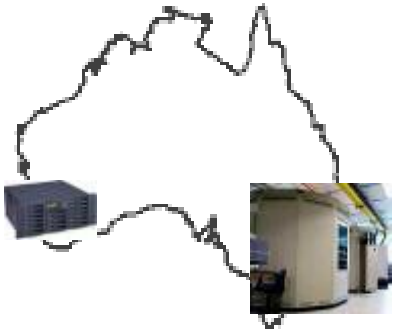


Automated movie generation



3D Time varying volume visualisation

Automated archiving



Multi-site data storage via Storage Resource Broker

- ***Parameterised template or wizard driven model geometry/mesh creation***
- Boundary condition & model properties ***parameter sweep utilities***
  - automatically creates a “family” of model, data files based on varying a set of parameters
- ***Inversion algorithms***
  - determine input parameters of future iterations automatically based on the user ranking of previous results

Slide courtesy of Robert Cheung and Warren Potma

Results to Date from pmd*CRC

For one Investigator, on one investigation:

- **500 Models in same period (100x more!) –** *human interpretation is rate limiting step*
- **Inversion/parameter sweep algorithms – semi-automated model creation; faster, less errors**
- **Automated post-processing/visualisation – all views X all timescale X all models await the investigator automatically**
- **Automated archiving – metadata searchable, more accurate store of experimental conditions, delivered to your store!**

What's next?

CSIRO will continue to support SEE Grid through the Minerals Down Under initiative

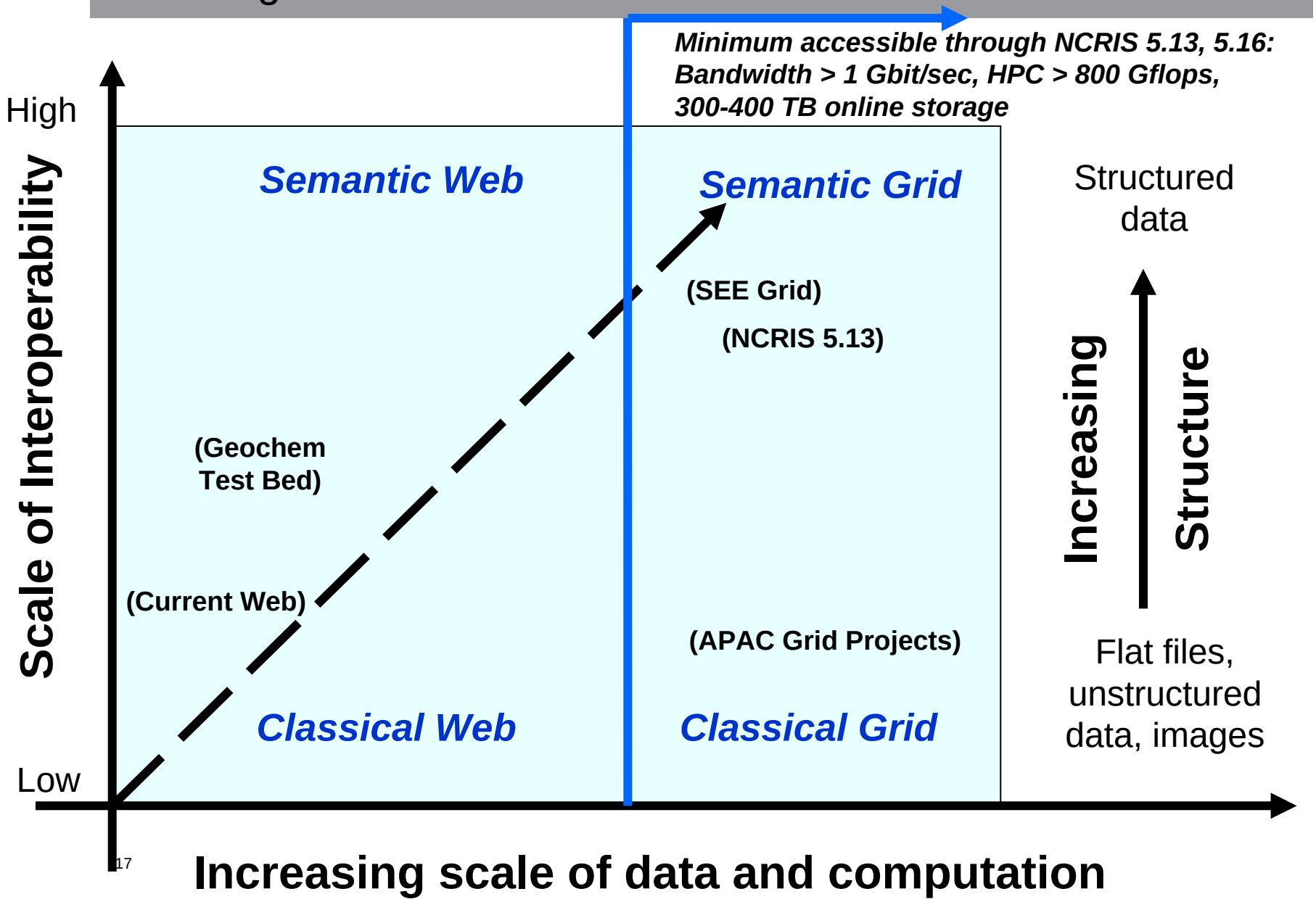
Minerals Industry Geospatial Consortium (MIGC) – Assay Data Exchange (ADX) initiative

One Geology – www.onegeology.org

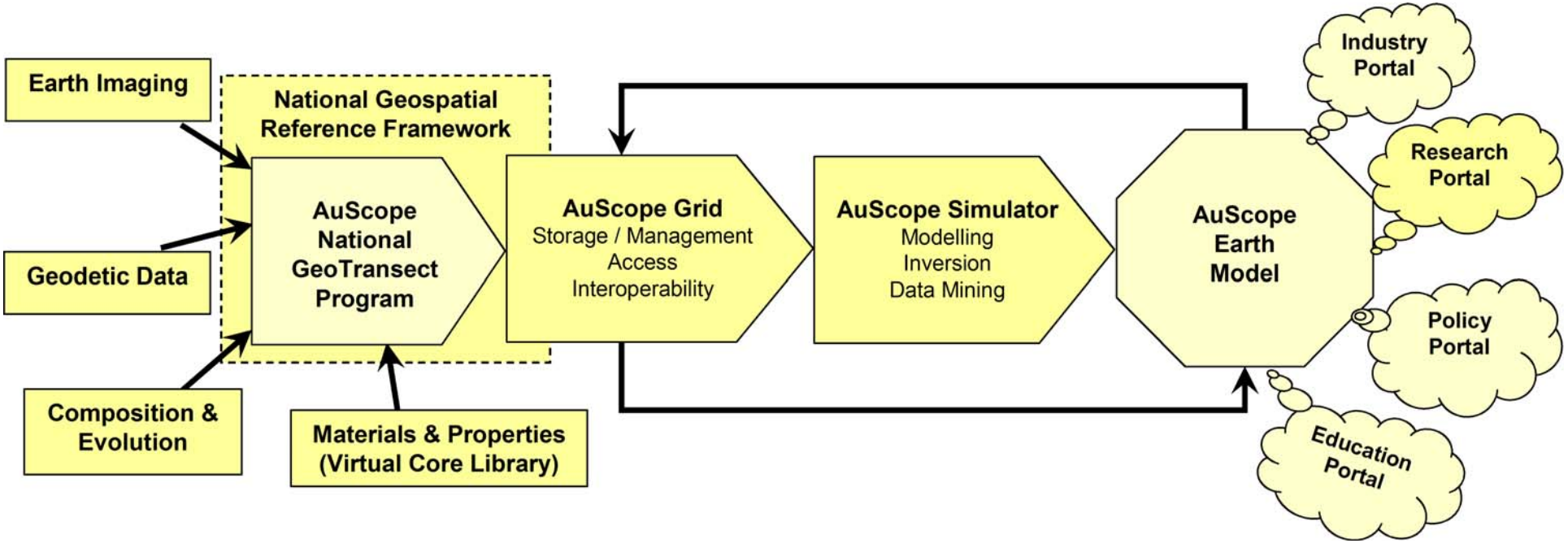
CGI IUGS - GeoSciML

NCRIS 5.13 - AuScope: Australian National Geoscience Research Infrastructure…

Pressing forward…



AuScope:
Earth Model for the Australian Continent



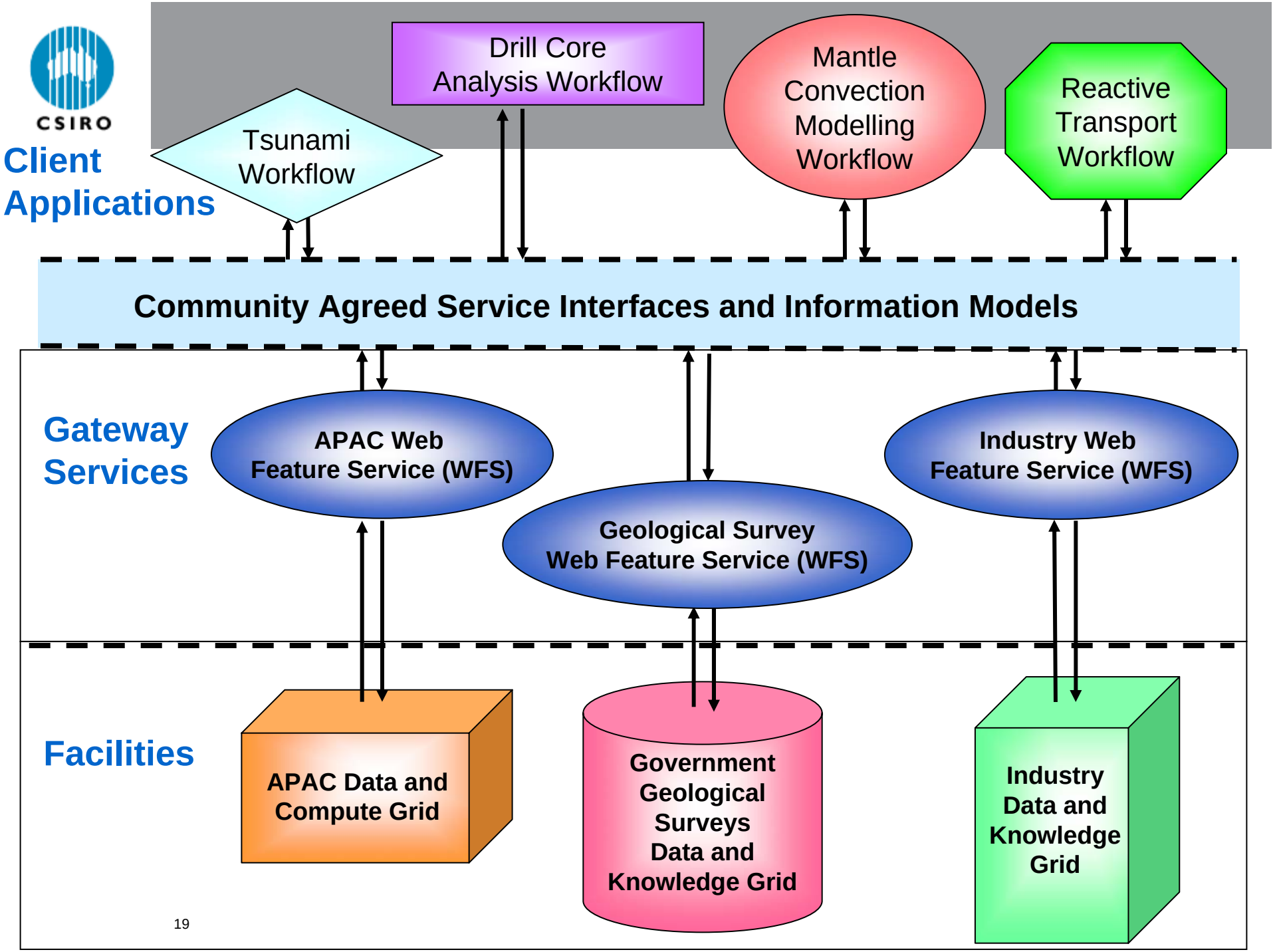
AuScope Infrastructure *System*

A toolkit for Geoscience Research *and* Geoscience Applications

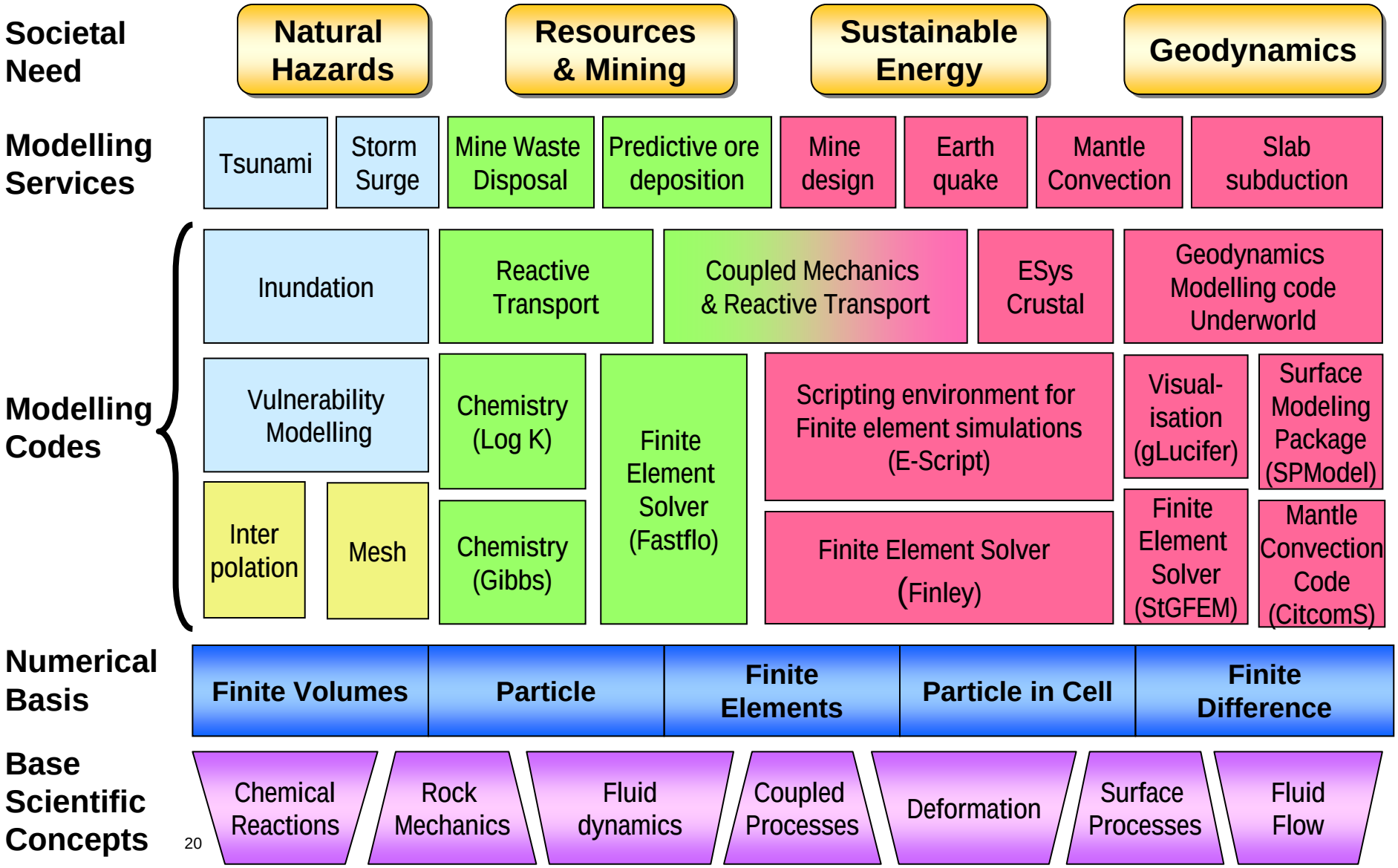
→minerals, energy, groundwater discovery and management; hazard prediction; environmental monitoring and management

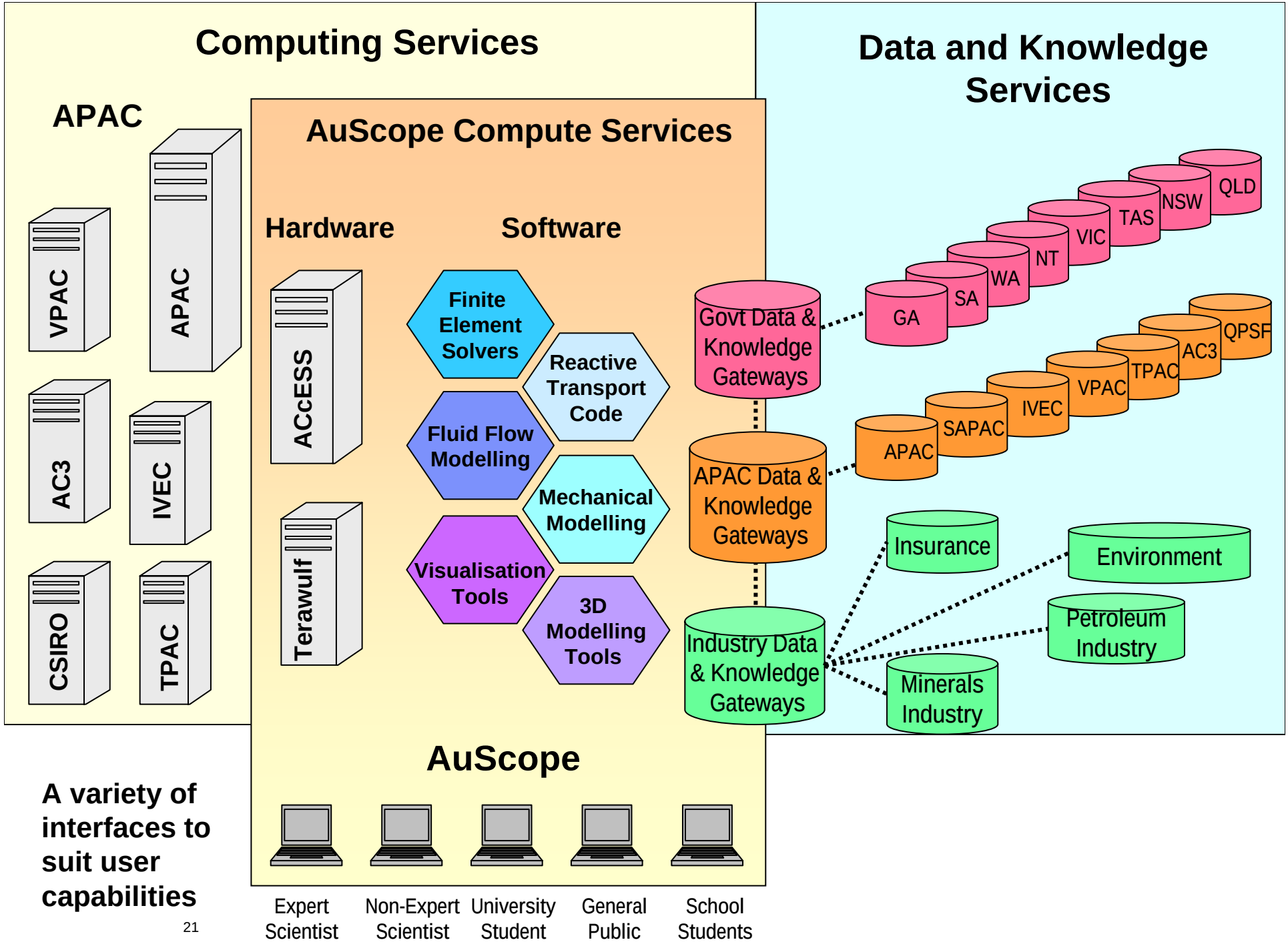
→Multiple workflows from observational data to user application

→Progressive refinement and enrichment by a community of practice


CSIRO
Client Applications
Drill Core Analysis Workflow
Tsunami Workflow
Mantle Convection Modelling Workflow
Reactive Transport Workflow
Community Agreed Service Interfaces and Information Models
Gateway Services
APAC Web Feature Service (WFS)
Geological Survey Web Feature Service (WFS)
Industry Web Feature Service (WFS)
Facilities
APAC Data and Compute Grid
Government Geological Surveys Data and Knowledge Grid
Industry Data and Knowledge Grid

AuScope Modelling Framework





A variety of interfaces to suit user capabilities

Summary

•Information Services

- Technical solution appears successful
- Business case is clearly identified and addressed by the technology
- *Next step to production services and lies with Industry and Government*
- *International standards and implementations are taking this forward*

•Data is not enough…

- pmd*CRC has demonstrated use of computational services applied to industry problems
- APAC Grid has established a Grid infrastructure to support Geosciences
- *Research community (including Government and Academia) taking this forward through:*
  - *NCRIS 5.13 – AuScope proposal*
  - *CSIRO Minerals Down Under, GeosciML,…….*

Outcomes from SEE Grid III

Some suggestions discussed relevant to AuScope:

- Be the guinea pig for the NCRIS 5.16 Trust Framework implementation – Rhys Francis
- Modellers let the Data collectors/custodians/interpreters know what they need – Malcolm Sambridge, Dion Weatherley, Paul Roberts, Louis Moresi
- Sort out the OGC-Grid linkage to big file issues – Andrew Woolf
- Link up with next GeosciML testbed involving interoperability with GoCad, GeoModeller, Patran and gmesh – Bruce Simons
- Continued linkage with GGIPAC

SEEGrid IV suggestion

Invitation to other NCRIS areas (IMOS) and groups (MIGC) to be involved and use this forum to advance our collective goals.

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Thank You

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