

# E-Research

# Disclaimer

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- A modified version of this set of slides was shown in capital city workshops, June 2004, by Professor Ah Chung Tsoi, Executive Director, Mathematics, Information and Communication Sciences, Australian Research Council.

# Big picture

- e-Research is to provide a vehicle through a technology infrastructure to allow researchers to ask the big (blue sky) or interesting questions pushing back the research frontiers in their own disciplines.

# A Few Examples...

## Visible cell

- This is a collaborative project from the Institute of Molecular Biology, University of Queensland
- Scientists want to bring together physical data, simulation data, biological data to create a visible, hypothesis-testing, cell environment.
- Requires:
  - resource discovery (resource = data, model, compute, etc..),
  - instrumentation of cell,
  - mathematical modelling & simulation,
  - visualisation,
  - data federation (bioinformatics data around the world)
- Team MUST include biologists, computer scientists, mathematicians, resource providers and support
- For further details, please see the project's web site:  
<http://www.imb.uq.edu.au/index.html?page=15550&ntemplate=235>

# Distributed aircraft maintenance environment (DAME)

- This is a collaborative project between the Universities of York, Leeds, Oxford, Sheffield, Rolls-Royce, and Data Systems and Solutions
- This is an e-Science pilot project demonstrating the use of the Grid to implement a distributed decision support system for deployment in maintenance applications and environments.
- For further details, please see the project's web site: <http://www.cs.york.ac.uk/dame/>

## eDiaMoND

- This is a collaborative project between IBM UK, University of Oxford, National Health Services, UK.
- This is to grid enable breast screening programmes in the UK, by using digital mammography and electronic patient records
- Even though patient records and mammography data are stored in distributed locations in the UK, from the radiologist's point of view these appear as though they are located in the same folder, enabling work on computer aided detection, and data mining
- Further details can be found at the project's web site: <http://www.ediamond.ox.ac.uk>

# Semantic Grids for Museums and Indigenous Communities

- This is a project sponsored by GrangeNet, and DSTC CRC
- Enable museums & indigenous communities in distributed locations to collaboratively:
  - discuss
  - define
  - annotatewhile respecting the access rights associated with objects in museums
- Further details can be obtained from the project's web site: <http://metadata.net/filmed/> (FilmEd project) and <http://metadata.net/TCM/> (Indigenous collection management project). A paper on this topic can be found at: [http://metadata.net/filmed/pub/GGF11\\_SemanticGrid.pdf](http://metadata.net/filmed/pub/GGF11_SemanticGrid.pdf)

## Enabling Research in Antarctica

- This is a collaborative project between Australian Antarctic Division and Equator a UK eScience programme at University of Nottingham.
- Developing and extending grid infrastructure for access in the field by supporting the study of carbon cycling in Antarctica lakes.
- Instead of having two scientists travelling daily for a few kilometers to set up and measure the depth of ice, they installed sensors and beam the information to satellite which then beam it back to the research station
- This is a paradigm for remote instrumentation.
- For further details please see the project's web site: <http://www.equator.ac.uk/Projects/E-Science/Antarctic.htm>

## What does it entail?

- Infrastructure support
- Personnel support
- Collaborative support
- Research support framework

# Infrastructure support

- Computing resources
- Network access
- Information storage
- Information access
- Large data sets
- Instruments and experimental facilities
- Specialist laboratory facilities
- Specialist platforms, e.g., telescope, high energy physics facility access.

## IT infrastructure to support research

- A generic requirement will be the information technology infrastructure required to support such research.
- Note that this does not imply research must use these IT resources. Rather such IT resources will facilitate research by allowing exploration of research questions hitherto cannot be solved because of the limitations in IT resources.

## Personnel support

- Big or interesting questions in research normally cannot be conducted alone.
- Usually it requires personnel support in terms of PhD students, post doctoral fellows, and research associates.
- It also requires technical support, e.g., programming support, data collection support, instrument operations, facility managers.

## Collaborative support

- To tackle big or interesting questions in their own disciplines, researchers normally cannot work in a vacuum and work alone.
- Requires collaborative effort among a group of researchers within their own discipline, or across a number of disciplines.
- Communicate and collaborate with some of the best in the world: personnel exchange, facility access, international forums, international standard organisations and support for such activities.

# Research Support framework

- Most of the framework to handle research questions are already in place.
- May need to widen scopes of some of our existing schemes, e.g., personnel support, collaborative support, standards involvement and associated support.

## Remote access paradigm

- A common characteristic is that these resources and researchers may be distributed geographically.
- Need to harness distributed resources so that they are transparent to and seamless to users.
- Need infrastructure to allow researchers to collaborate or visualise information together.
- This is commonly referred to as a grid or utility program.

# What is e-Research

- To generate, curate, and, analyse research data from experiments, observations and simulations providing quality management, preservation and reliable evidence
- To develop and explore models and simulations enabling computation and data at extreme scales providing trustworthy, economic, timely and relevant results
- To enable dynamic, distributed virtual organisations facilitating collaboration within the research sector and with industry, with information and resource sharing providing security, reliability, accountability, manageability and flexibility

Courtesy John Taylor, UK

## e-Research Benefits

- Better utilisation of existing infrastructure and prolonged life;
- Better utilisation of collected databases;
- Collaboration of researchers to solve new research problems in particular domains;
- Collaboration of researchers and computer scientists together to solve fundamental problems
- Creation of mechanisms for research training

# Importance of e-Research to Australia at this time

- Better utilisation of existing/future infrastructure (otherwise pressure in installing more and more resources, isolated national resources)
- New ways of conducting research -- multi-disciplinary collaboration, better utilisation of existing infrastructure, skill development (otherwise our researchers would not be globally competitive)
- Industry collaboration and technology transfer (otherwise industry would need to import skills)

# Incentives for e-Research in Australia

- To grid enable their existing programs.
- To develop further middleware components based on the core middleware.
- To encourage research collaboration between researchers within and across disciplines and computer scientists to better utilise existing compute/network/data resources.
- Enable leverage of international activities.

## Ways to proceed

- Please help us understand what incentives the government should put in place to encourage researchers to engage in e-Research
- Hence this series of capital city workshop to consult with the higher education sector on best way to provide such incentives
- Discuss now...
- Follow up on email – [ahchung.tsoi@arc.gov.au](mailto:ahchung.tsoi@arc.gov.au)