

# Providing the Advanced Computing and Grid Infrastructure for eScience

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*Workshop:*

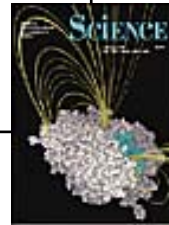
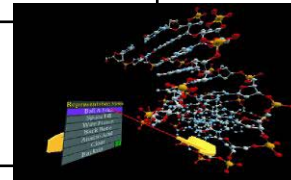
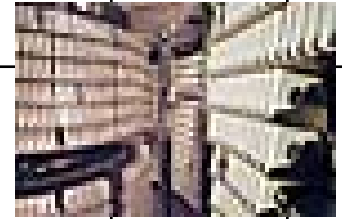
*Building an Australian Solid Earth and Environmental Sciences Grid  
July 29-30, Canberra*

# Topics

- **Grid Infrastructure for eScience**
- **Australian Partnership for Advanced Computing**
- **GrangeNet Grid Projects**
- **APAC Grid Initiatives**

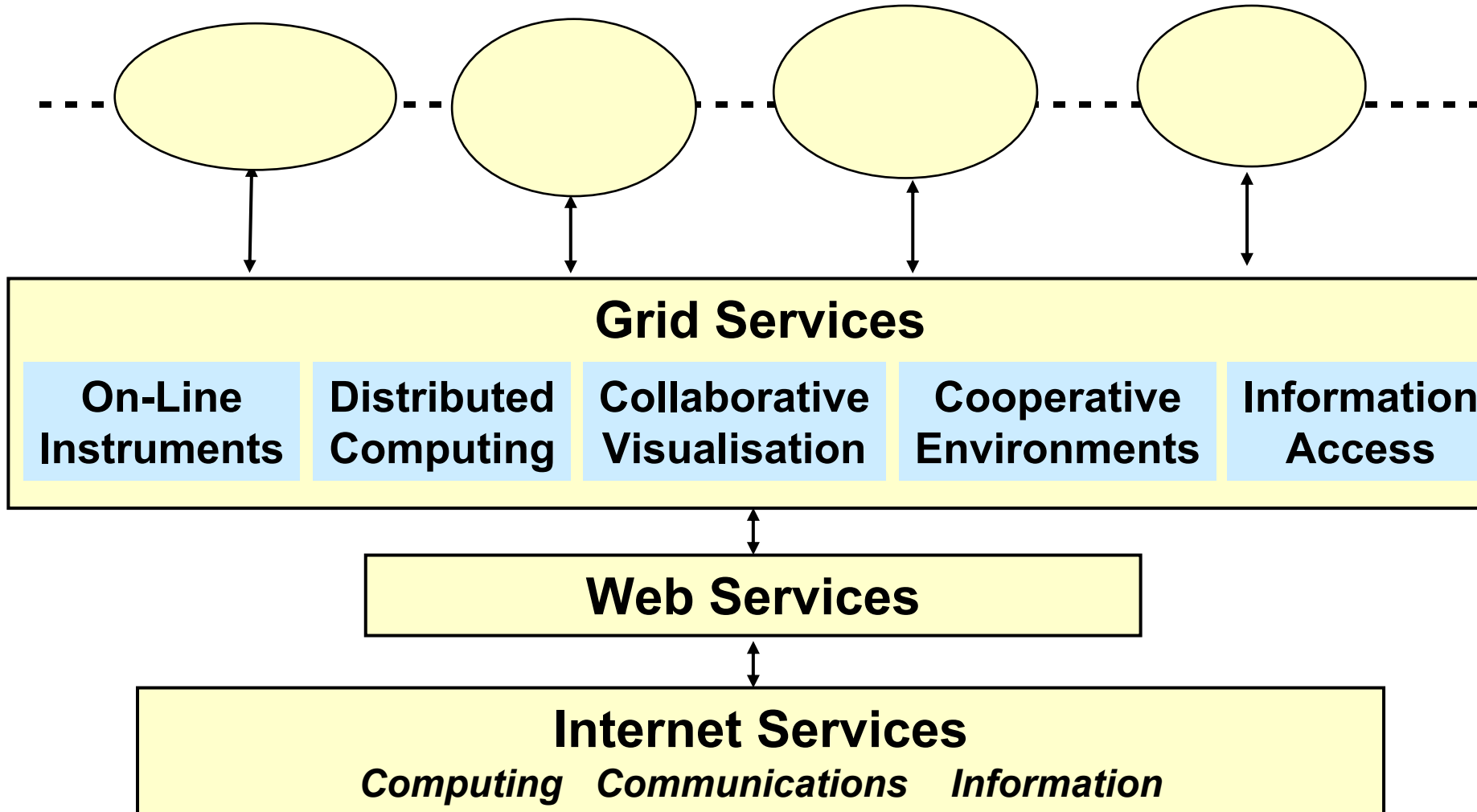
# Changing How Science is Done

- Collect data from **Internet** devices, libraries, sensors, instruments
- Analyze data with models run on the **Grid**
- Visualize and share data over the **Web**
- Publish results in a **Digital Library**



# Grid Services for eScience

## Research Communities



# APAC Partners



- Australian Centre for Advanced Computing and Communications (ac3) in **NSW**
- **CSIRO**
- **Queensland** Parallel Supercomputing Foundation (QPSF)
- Interactive Virtual Environments Centre (IVEC) in **WA**
- **South Australian** Partnership for Advanced Computing (SAPAC)
- The Australian National University (ANU)
- The University of **Tasmania** (TPAC)
- **Victorian** Partnership for Advanced Computing (VPAC)

*Approx. A\$100m investment over 4 years*

# APAC Achievements



- **APAC partnership formed June 2000**
- **APAC National Facility operational April 2001**
- **APAC and partner facilities serviced over 1,300 users**
- **Over 110 projects supporting users and developing expertise in 13 computational science and engineering themes**
- **Over 50 university courses prepared and delivered in computational science and engineering**
- **Consortium member of GrangeNet (March 2002)**

# APAC National Facility



- **Computing Systems**

- HP AlphaServer SC ES45 (127 nodes)
  - ranked number 80 in latest TOP500 list
- Dell Linux cluster (150 procs)
- HP GS1280 (16 procs)



- **Mass Data Storage System (MDSS)**

- Storagetek tape library (robotic silo)
  - Capable of a petabyte ( $10^{15}$  bytes) of storage



- **Visualisation**

- visualisation & virtual reality systems

- **Staff**

- staff at ANU Supercomputing Facility

<http://nf.apac.edu.au>

# GrangeNet:

## A GRid And Next GEneration Network

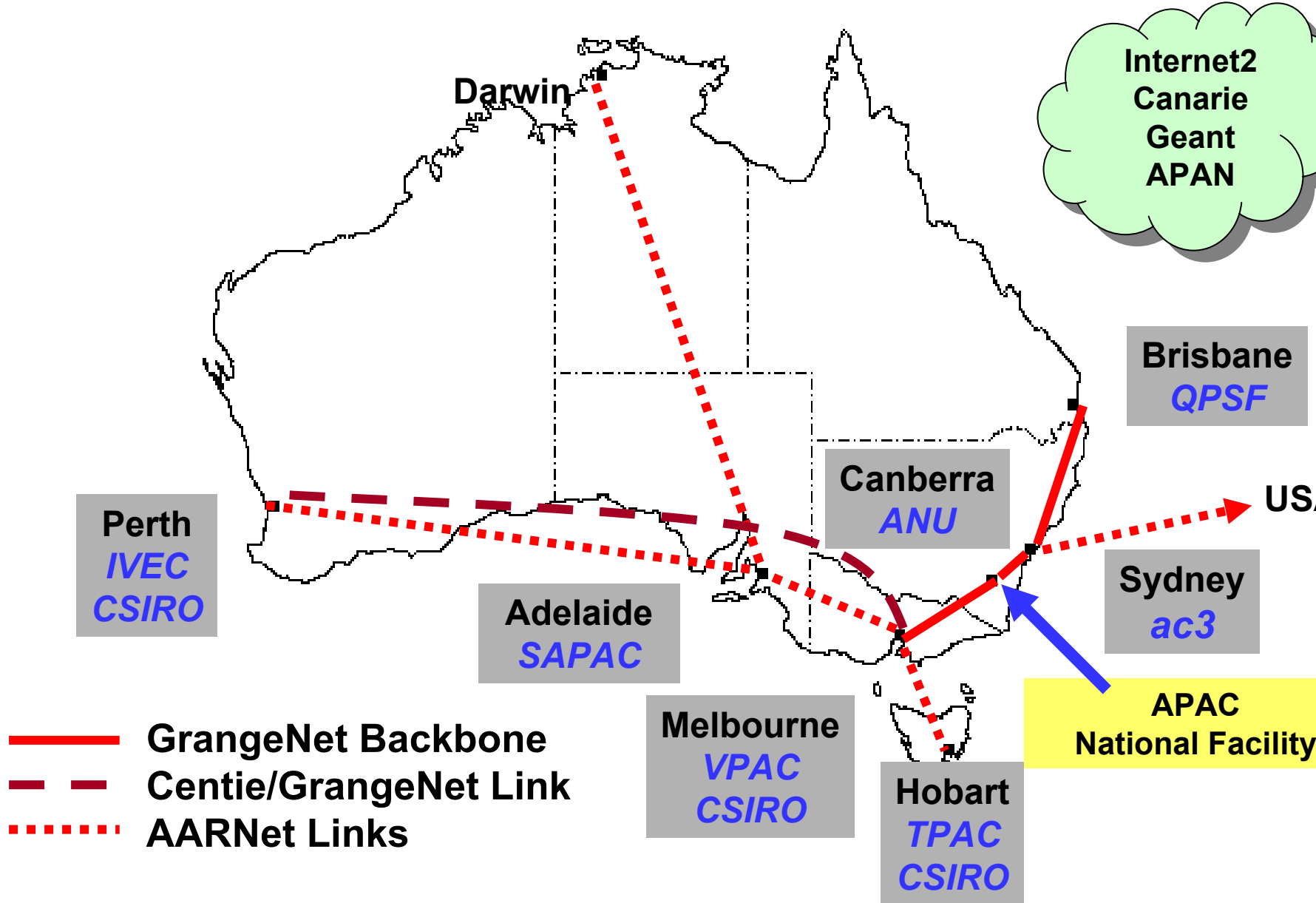
*[www.grangenet.net](http://www.grangenet.net)*

*Supported by the Federal Government's  
BITS Advanced Networks Program*





# GrangeNet Backbone



# Grid Services Demos

- **On-line Instruments**
  - Remote access to electron microscopes
    - *NANO facility, Uni. Sydney*
- **Distributed Computing**
  - Demonstrate distributed computing applications (Nimrod/G)
    - *install Globus on major computing facilities*
- **Collaborative Visualisation**
  - Connect virtual reality systems for collaboration
    - *engineering design of manufactured products*
    - *bio-molecular modelling and visualisation*
- **Cooperative Environments**
  - Install 5 Access Grid nodes in 4 cities
    - *first one at Sydney VisLab for SC Global 2001*
- **Information Access (Digital Repositories)**
  - Provide access to large-scale international datasets
    - *bio-informatics, astronomy, physics, cultural, environment*

# Gravitational Wave Astronomy

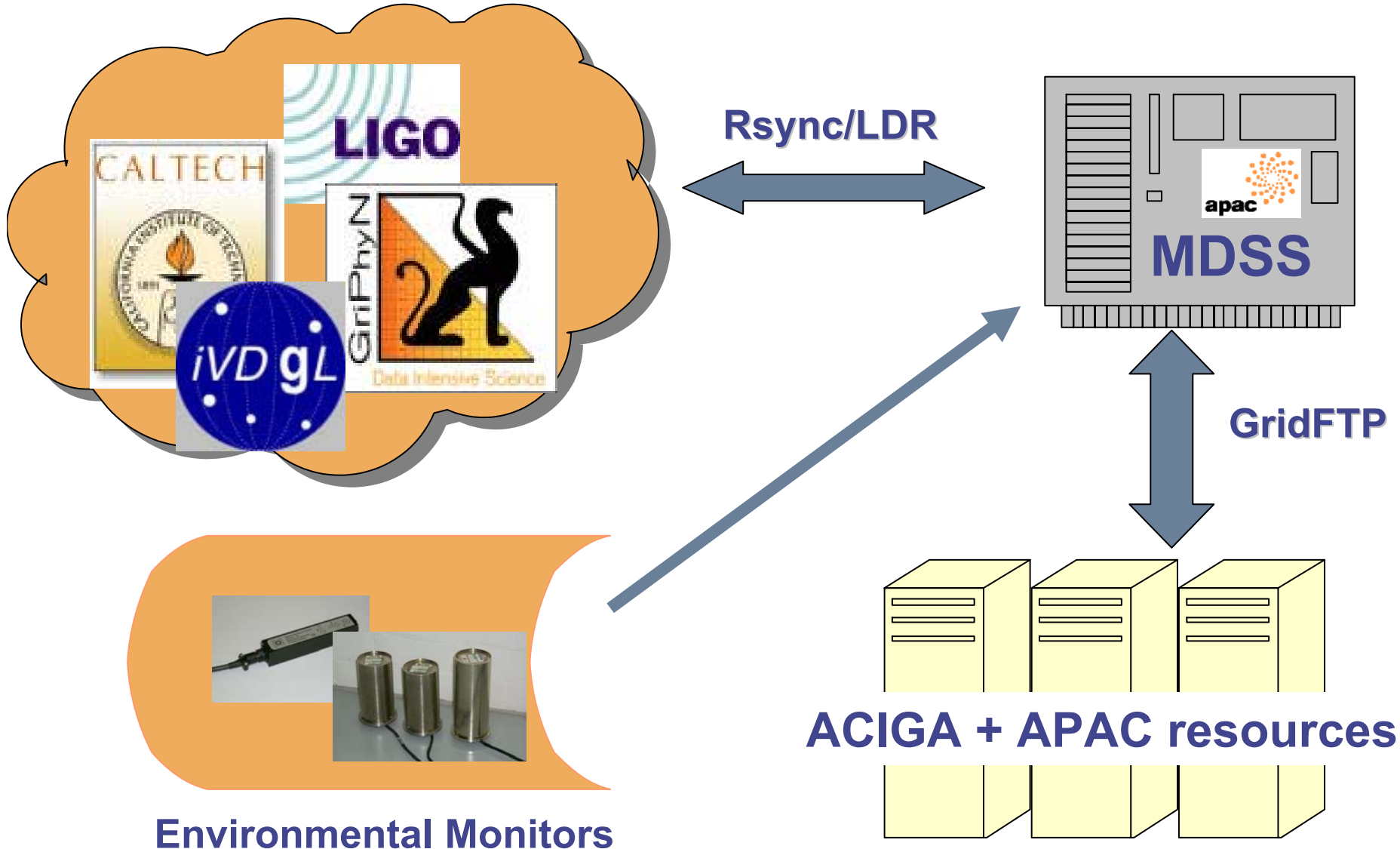
- **GWA involves exchange and simultaneous data processing between multiple detectors**
  - Gravity wave detectors + environmental sensors
  - ACIGA (Australia)
  - LIGO (USA)
  - VIRGO, GEO (Europe)
  - TAMA (Japan)
  - Technical collaboration with GriPhyN and iVDGL
- **ACIGA data pipeline centred on APAC MDSS**



**Australian Consortium for Interferometric Gravitational Astronomy**  
**<http://www.anu.edu.au/Physics/ACIGA>**

# ACIGA Data Grid

Australian Consortium for Interferometric Gravitational Astronomy



# High-Energy Particle Physics

- **BELLE Physics Collaboration ([belle.kek.jp](http://belle.kek.jp))**
  - K.E.K. B-factory detector, Tsukuba, Japan
  - Matter/Anti-matter investigations
  - 45 Institutions, 400 users worldwide
    - 10 TB data currently
  - Universities of Sydney and Melbourne participating
  - Australian collaborators leading Grid adoption
  - Australian data grid centred on APAC MDSS
    - Exploiting Globus 2.x/3, GFarm
- **ATLAS Experiment ([atlas.web.cern.ch/Atlas](http://atlas.web.cern.ch/Atlas))**
  - Large Hadron Collider (LHC) at CERN
  - Collaboration 2000 people, 150 institutes, 34 countries
    - 3.5 PB data per year
    - operational in 2007



# Virtual Observatories

- **MACHO Project**
  - **M**Assive **C**ompact Halo Objects (Milky Way)
  - **L**argest online astrophysical data set in Australia
    - ~10TB Data collected over ~10 years
  - Hosted on APAC MDSS
  - Web interface at [www.macho.anu.edu.au](http://www.macho.anu.edu.au)
    - Currently using Z39.50 metadata standard
  - Mapping metadata to VOTable 1.0 standard
    - Emerging IVO metadata standard
- **International Virtual Observatory**
  - MACHO data being incorporated into SDSC SRB system
  - [www.ivoa.net](http://www.ivoa.net)
- **Australian Virtual Observatory**
  - IAU demo of Data Grid and Visualisation testbed
    - Distributed data-sets, Tomcat rendering software
    - [www.aus-vo.org](http://www.aus-vo.org)



# **Grid Middleware at APAC National Facility and ANU**

- **APGrid Data Farm (Gfarm)**
- **UNICORE (Fujitsu)**
- **iVDGL WorldGrid**
- **SDSC Storage Resource Broker**
- **Internet Backplane Protocol**
- **Lightweight Data Replicator**
- **Globus 2.x/3.0**

# APAC Grid Initiatives



- **Provide more support for ‘data-intensive’ computing**
  - access large-scale data sets across APAC partners
  - mirror sites (bioinformatics)
  - information infrastructure plans
    - video, animations
    - digital repositories
- **Install and operate an APAC Grid (2004-6)**
  - handle users’ jobs more efficiently across systems
  - provide portals to access computing/data facilities
  - allow access the most appropriate computing/data system
  - provide grid services to support virtual user organisations
- **Support national and international eScience initiatives**
  - demonstrations at APAC’03, SC2003
  - support ARC research networks