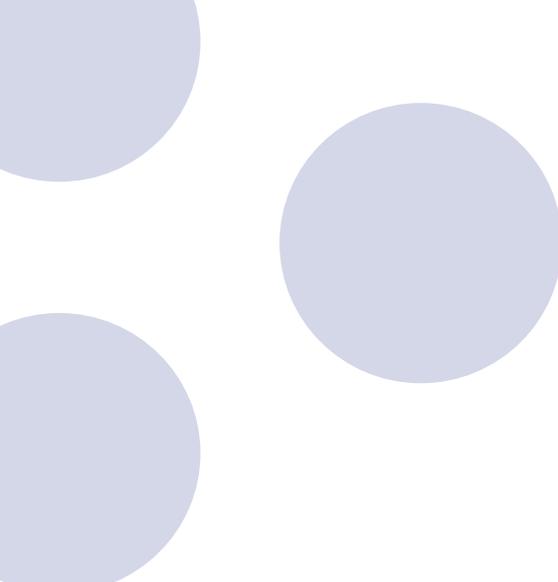


 **eResearch: an eRevolution**
Victorian Government eResearch Initiatives





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Minister's Message

Victoria's research community has earned a reputation for excellence. To build on this our researchers must work at the forefront of science and this, therefore, necessitates being armed with eResearch capabilities.

eResearch is a seismic shift in scientific practice. Advanced broadband is networking scientists on a global level, which is giving rise to dynamic collaborations, with knowledge, expertise and tools being shared within and across organisations from industry to government, across academic disciplines and across national and international borders. These collaborations are producing increasingly faster scientific outcomes. And faster science has ramifications for us all.

For example, precise radiotherapy treatment planning for cancer patients requires extensive computer facilities and is a time-consuming process restricted to a handful of centres with the requisite resources. How different would life be for patients to receive real-time treatment planning conducted remotely at a high-performance computing centre, with the results transferred directly to the patient's clinic, irrespective of geography?

The technology that will underpin our cancer patient's survival is the advanced broadband network that will link our universities and research institutes to the world.

Through our *ICT Industry Plan 2005-2010*, *Broadband Framework*, and the *Healthy Futures* initiatives, the Bracks Government is working closely with the State's research institutes, universities, other governments and grid services providers to take a comprehensive approach to developing the skills, services, infrastructural foundations and applications for eResearch. This collaborative approach is vital to accelerate the uptake, and place Victoria at the forefront, of eResearch.

The Bracks Government recognises the critical importance of innovation to economic performance. The Government has invested \$1.6 billion in building Victoria's innovation capability, the biggest investment ever made by a state government. By investing heavily in research infrastructure, the Government is ensuring that Victoria moves forward as Australia's leading information economy.

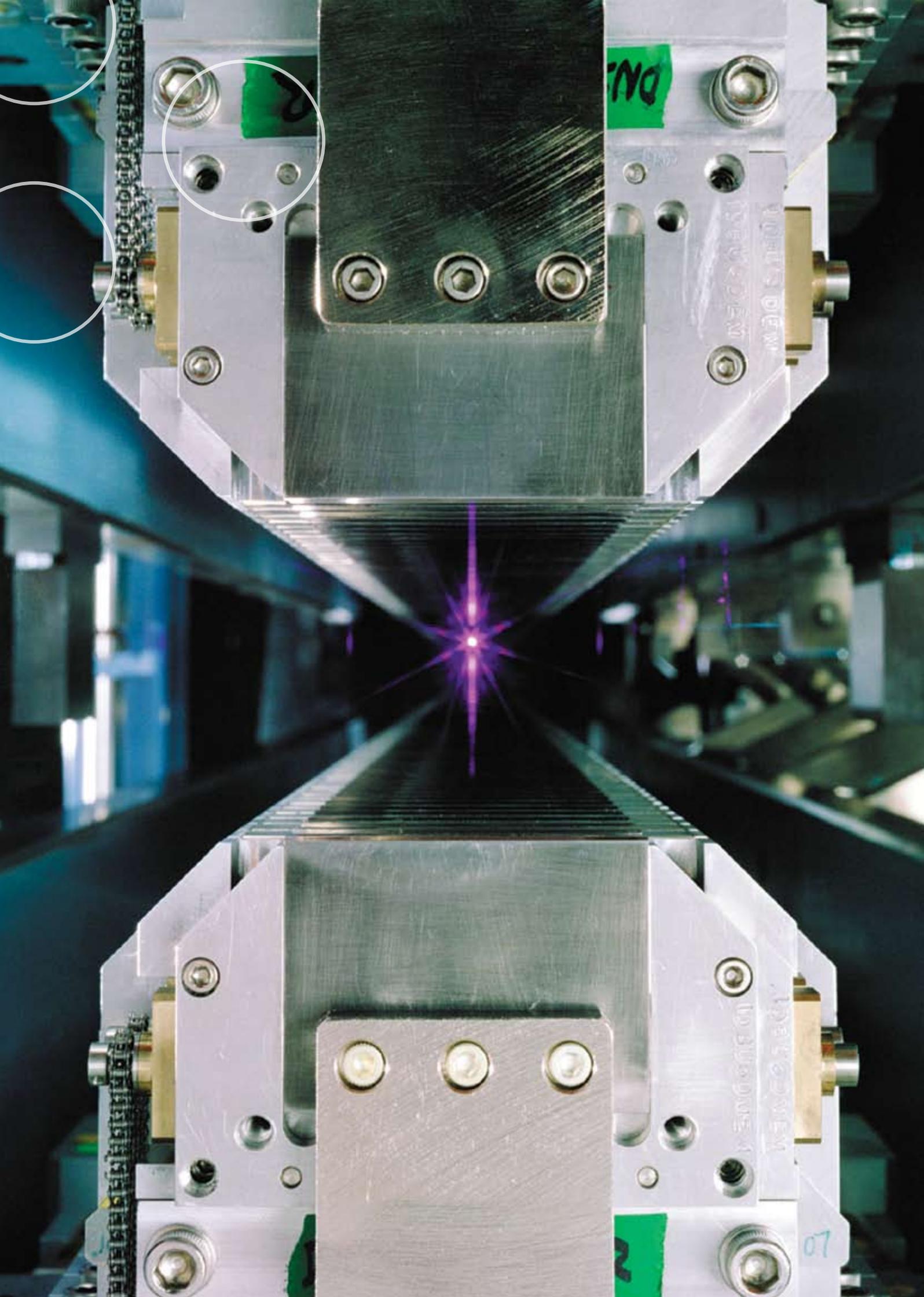
Pivotal to these economic developments is innovation, and for this reason our research community must join the global trend to eResearch practices in order to remain competitive and relevant.

With our world-class universities producing tomorrow's scientific leaders and cutting-edge technologies being developed within our state, Victoria must embed eResearch across our science sector in order to keep our bright minds at home and attract further investment. Victoria, as a hub of innovation, must be networked to the world.



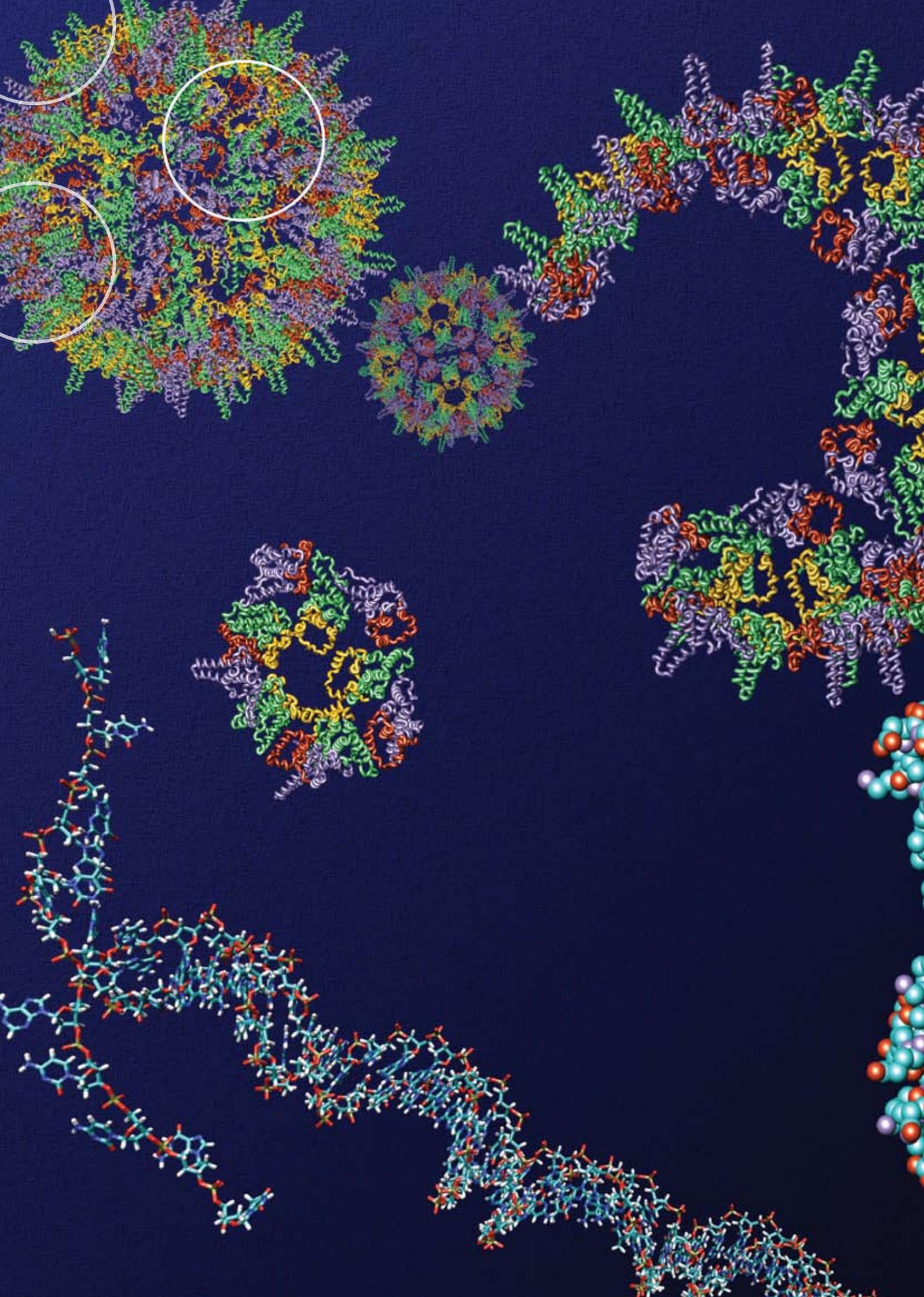
A handwritten signature in black ink that reads "Marsha Thomson". The signature is fluid and cursive, with a long, sweeping tail on the final letter.

Marsha Thomson
Minister for Information and
Communication Technology



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1. eResearch: an eRevolution

Just as the international research community pioneered the use of the Internet, researchers are again leading the way with the adaptation of the next generation of ICT innovations, which are transforming the way that the science community works.

eResearch is revolutionising every aspect of scientific practice. The National eResearch Coordinating Committee (eRCC) defines eResearch as: 'Those enabling information and communication technologies (ICT) which researchers increasingly use to support their research endeavours. The research environments emerging from the increasing use of distributed high-performance computing resources, data resources, scientific instruments and communications technologies are enabling researchers to perform their research independent of time and geographical location. Researchers have the potential to interact with colleagues, access remote instrumentation, share distributed research data and computational resources, and access information in digital libraries.'

Today, multi-disciplinary research teams are turning to collaborative tools such as multipoint video conferencing, data intensive resources such as genome databases, large scale scientific instruments such as synchrotrons, and the next generation of broadband networked supercomputers, as enabling infrastructures to help solve the really big issues – for example, finding new treatments for cancer, understanding and finding responses to global warming and investigating the mysteries of the human brain.

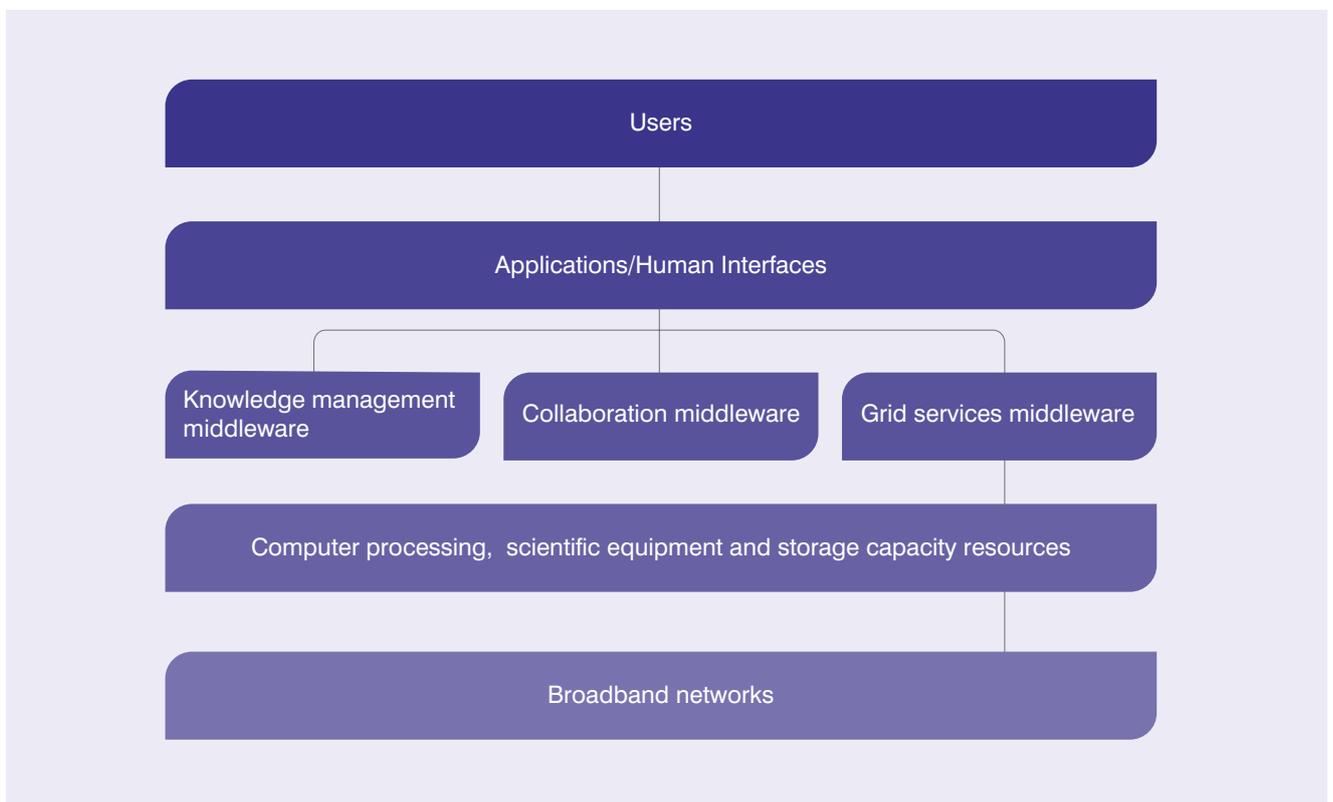
The underlying ICT infrastructure that provides these facilities is commonly referred to as the 'grid.'

The Grid: Powering Change

Put simply, the grid enables eResearch. The grid appears to the researcher as one virtual system with advanced broadband networks providing researchers with access to large quantities of research data, science instruments, super-computing power and analytical tools.

The grid enables the accessing of data from multiple sources and the sharing of ideas in real-time. By significantly reducing the time it takes for researchers to find solutions, the grid is powering the acceleration of scientific breakthroughs.

Key Components of eResearch Infrastructure



2. Victorian Government eResearch Initiatives

The Victorian Government recognises that in order for Victoria's research community to work at the frontiers of science it must be armed with the technological infrastructure to do so. This gives them the ability to collaborate and share the knowledge and tools in order to expedite new and innovative scientific activity.

To this end, the Victorian Government is investing in the Victorian Education and Research Network (VERN), the Victorian Partnership for Advanced Computing (VPAC), the National ICT Australia (NICTA) Victorian Research Laboratory (VRL), the Grid Infrastructure Initiative and the Australian Cancer Grid (ACG).

Victorian Education and Research Network

VERN is one of the fundamental building blocks of Victoria's research grid. It will be the physical link between researchers and scientific instruments, such as the Australian Synchrotron, other researchers, and the next generation of grid infrastructure and applications, such as telescopes, large data stores and advanced analytical tools.

VERN is a collaborative project supported by Victoria's nine universities, the CSIRO, and the Victorian and Federal Governments. The Victorian Government's contribution consists of an arrangement with the State rail authority, VicTrack, to provide access to its \$21.5 million, 517km fibre optic network, which is also used to provide signalling for the Regional Fast Rail project.

In brief, VERN:

- will link state-wide university campuses via an optic fibre next generation network (NGN) to deliver super-fast broadband services
- is a scalable dark-fibre network, which means that the universities can increase the speed or capacity of the fibre network to meet future requirements.

www.vernet.net.au

Victorian Partnership for Advanced Computing

The Victorian Partnership for Advanced Computing (VPAC) is a key component of Victoria's research grid. To support the advanced computing needs of Victorian researchers, VPAC operates a state-of-the-art, internationally-recognised High Performance Computing (HPC) facility linked by VERN.

The Victorian Government, through *Healthy Futures*, is providing \$1 million that will cover Victoria's membership in Round 3 of the Australian Partnership for Advanced Computing (APAC) program, giving Victorian researchers and industry ongoing priority access to the national supercomputer in Canberra and APAC's eResearch programs.

www.vpac.org

National ICT Australia Victorian Research Laboratory

The Victorian Government is supporting R&D in grid technologies through its funding of the NICTA Victorian Research Laboratory (VRL). The NICTA (VRL) was established in June 2004 by NICTA, the University of Melbourne and the Victorian Government as part of a tripartite agreement to establish a Victorian base for world-leading, commercially-focused ICT research. The Government has provided \$8 million in funding for NICTA (VRL) Phase 1 and \$20 million funding for NICTA (VRL) Phase 2.

NICTA (VRL) Phase 2 will undertake world leading research into ICT as an enabling technology, focused on end-use commercialisation in telecommunications, information technology and the life sciences sectors. The outputs from this ICT research will provide new advanced grid technologies in four research areas:

- neuro-engineering
- bio-signal processing
- bio-sensor networks
- computational analysis of complex biological systems.

www.nicta.com.au

The Grid Infrastructure Initiative

Since 1999, the Government has invested \$1.6 billion in building Victoria's science, technology and innovation capabilities – the largest investment ever made by a state government. This includes the recent, *Healthy Futures* initiative where the Government has invested \$230 million into medical research and the life sciences to develop both the economic and social well-being of Victorians.

The *Healthy Futures* initiative provides \$10 million for grid infrastructures, services and applications across the Parkville, Clayton, Bundoora and Werribee research precincts (including funding of \$1 million to VPAC to cover Victoria's membership in the Australian Partnership for Advanced Computing (APAC3) program).

The initial phase at Parkville and Clayton – valued at \$10 million (\$4.75 million funding from the Victorian Government) – has been agreed with the University of Melbourne and Monash University, the initial members of the Victorian eResearch Strategic Initiative (VeRSI) consortium.

The remaining funds for the \$10 million grid infrastructures initiative will be committed to complementary projects in the coming years.

VeRSI will deliver research leadership by harnessing enabling technology in a way that delivers a productive, collaborative research environment. VeRSI will deliver faster and more exhaustive research activities leading

•• Ambulatory motion studies

It is well-known that healthy older adults walk more slowly and take shorter steps than younger adults. These age-related gait changes make travelling – be it a stroll around a park, or grocery shopping – more difficult and dangerous.

Systems employed in the field such as stop watches and timing gaits have been unable to provide sophisticated information. New technology such as the GAITRite now allows the easy collection and examination of numerous gait parameters over many trials for large groups of people within a laboratory or field setting.

These systems also make it possible to extract new detailed data which are essential to understand population variability, to accurately

determine the point or range within which gait begins to change, and to better understand the underlying mechanisms of change.

For example, through Melbourne's Austin Hospital, Monash and Melbourne Universities are studying ambulatory motion, utilising world-class equipment such as GAITRite. Currently trading information is difficult and slow. VeRSI will transform this situation.

VeRSI will provide an equivalent improvement in the management, distribution and visualisation of gait motion study data, making it a dependable resource for analysis and integration with other studies over the long term.

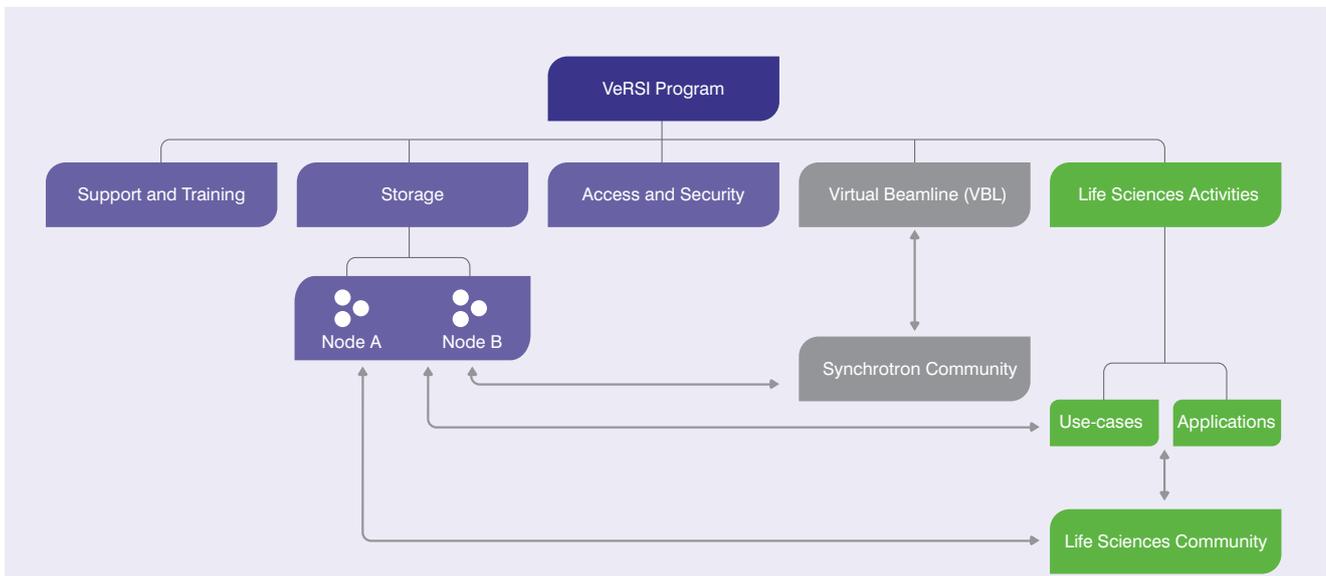
to improved commercialisation opportunities and an elevation in the status of the State's academic and research institutions.

It will increase the reach of the the Australian Synchrotron, improve collaboration in the life sciences and reinforce Victoria's position as a knowledge-based economy.

www.versi.edu.au



VeRSI Program Activities



The VeRSI Program

The VeRSI Program will consist of five complementary eResearch projects: three enabling projects, one demonstration project and one capability project (comprising eight Life Sciences use-cases and applications projects).

The enabling projects develop underlying infrastructure and services for eResearch. The demonstration project designs and builds production resources that can be used as templates and replicated by other research institutions. The capability project provides exemplars of production-level research methods and generic applications that enhance the researcher's capabilities and serve as tangible examples of the benefits of eResearch.

As other research precincts are established, further eResearch projects will be implemented.

The Australian Cancer Grid

Today's cancer researchers, whether they are combing through animal genomes or collecting medical histories from human patients, are in the midst of an information explosion. New techniques in biomedical research create huge amounts of data, greatly increasing the chance of scientific breakthroughs through the application of eResearch.

The Victorian Government is critically aware of the complexities and importance of cancer research, and to facilitate the State's leading role in this field, it has committed \$11 million for the development of the Australian Cancer Grid (ACG), a cutting-edge grid application.

Victoria will have a resource of patient and scientific data that will link Victoria's cancer researchers, health professionals, cancer institutes and health services into one of the world's largest cancer control networks.

The ACG will provide an integrated electronic repository of state, national and international research and clinical cancer data, providing vital new input into cancer research and accelerating new treatments.

Victoria will roll out the Bio21 Molecular Medicine Informatics Model (MMIM) across all metropolitan and regional cancer centres and expand the model to cover five cancer areas: breast, ovarian, prostate, lung and brain.

•• Distributed treatment planning database

Peter MacCallum Cancer Centre and our world-class scientists and research institutes are undertaking breakthrough research in understanding many cancers. Precise radiotherapy treatment planning requires extensive computer facilities. The capability to have

treatment planning executed in near real-time at a high performance computing centre, with the results immediately available for distribution to regional clinics where the treatment will be carried out will have an important positive impact for both patient and hospital.

•• Neurosciences and biomedical imaging

The Victorian Government is making a significant investment in mental health programs, and the University of Melbourne and Monash University have responded with major investments in bio-medical imaging. At Melbourne University, the imaging and computer facilities will focus on neuroscience, while Monash will focus on bio-medical imaging devices,

including computer tomography, magnetic resonance imaging, digital x-ray and digital ultrasound.

VeRSI will supply crucial integration and networking capabilities, in addition to multi-disciplinary and vertical integration for the different research groups.

3. eResearch in Victoria: Future Outlook

As Australia's research community adopts more eResearch practices, new issues and challenges will inevitably emerge. It is important that state governments are committed and informed participants in national debates about eResearch and its enabling grid infrastructures.

Recently, the Victorian Government completed a research project examining the issue of the grid and its potential impact on national research instruments such as the Australian Synchrotron, the Research Reactor, telescopes and sensor networks.

Consultation was undertaken with users of synchrotrons and other science instruments, grid researchers, university research leaders and ICT directors, and grid service providers.

The research process culminated in the preparation of the report A National Data Architecture for Australian Research – a Victorian Perspective, which details information architecture to connect national research data sources. The report was provided to the Commonwealth Government, in July 2005, for its consideration by the National eResearch Coordinating Committee.

There is a window of opportunity for leadership in thinking around eResearch and its application to national research facilities. By offering the report to the Commonwealth as a project of national importance for consideration and implementation, Victoria has positioned itself as a leader in eResearch.

Virtual Beamline design

Science - particularly that based on large instruments - increasingly involves global collaborations enabled by the Internet, very large scale data collections, high performance computing resources, tele-science and collaborative visualisation.

Virtual Beamlines (VBLs) will provide:

- a focal point for synchrotron activities remote from the synchrotron
- a tele-presence/access grid environment for collaboration, remote-control of data collection, training and pre-visit preparation

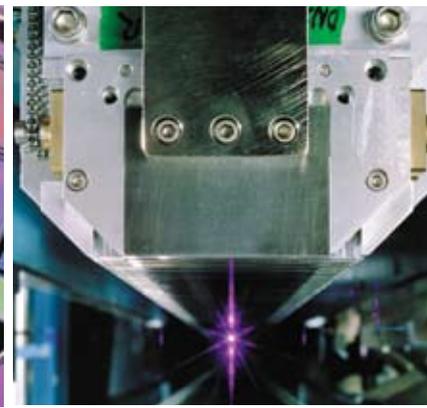
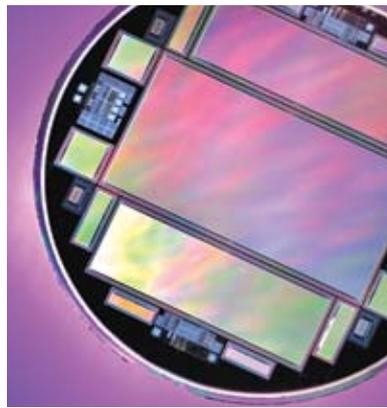
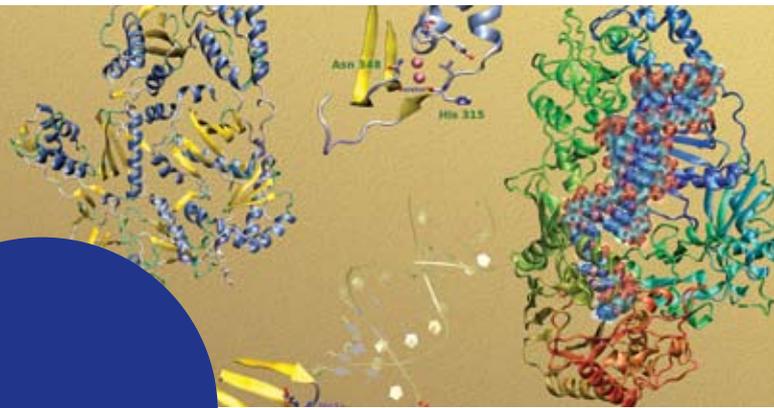
- a site where advanced visualisation and computing resources can be shared
- the connection point for managed storage resources
- data transcription where scientists can make copies of critical data on removable media
- dedicated (ICT) staff to manage facility and provide user support.

VeRSI will support the development of VBLs at the Australian Synchrotron, which will allow users to mentor the data collection taking place on site and to interact with collaborators during data collection without having to travel.

The successful creation of the Victorian eResearch program is largely due to a high degree of cooperation between the researchers/scientists, universities, research organisations, government and eResearch service providers.

All parties have worked together over a long period to make the initiatives a reality. This unified approach is critical for positioning Victoria's eResearch programs and interests within national and international eResearch frameworks.

Victoria's eResearch programs will accelerate the uptake of eResearch and place Victoria at the forefront of the grid and eResearch in Australia.



www.mmv.vic.gov.au

