



THE UNIVERSITY OF
MELBOURNE

The University of Melbourne

Enabler Strategy:

Information Technology Infrastructure

2011-2014



Table of Contents



Executive Summary.....	3
Introduction and Overview	5
Aims and Objectives.....	6
The Information Technology Portfolio.....	10
The IT Capital Plan 2011-2015	19
IT Capital Plan 2016-2020	30
Longer Term Priorities	32

Executive Summary

The University operates an extensive network of IT resources, including some 15,000 personal computers supporting about 40,000 students and 6000 staff. Information technology is pervasive in all aspects of study and work at the University, including the classrooms, of which 232 are equipped with modern IT resources.

Since 2006, much has changed in University IT. The University has renewed the wireless network, which now has nearly 1000 access points. The Unified Communications initiative has brought staff a modern email and calendaring system with closely-coupled IP-telephony and voice messaging. The physical data network has been largely renewed and brought under central management to the wall outlet. New, environmentally sustainable data centres have been commissioned at Parkville and Noble Park, the latter being a collaboration with other institutions. As part of Responsible Division Management, a project has commenced implementation, which will take several more years, to establish workspace computing support as a Common Service, after 20 years of a devolved model for IT support of this type. A Student Portal and a new Student Management System, ISIS, have been deployed. There are new Student Resource Centres, richly equipped with computers and IT support for students. Underway is transition of student email and online collaboration from an in-house facility to the cloud. The importance of IT in research has continued to grow -national eResearch investments committed to the Parkville precinct under University leadership amount to more than \$200 million.

Yet there is much more to be done. University IT systems and services work, and create opportunities. Where we lag is in exploiting those opportunities, not only to capture efficiencies and economies, but also to transform the way in which work is done in the University, to allow academic staff to focus on scholarship and research.

The IT landscape has changed since 2006. There are now pervasive and affordable wireless internet services using 3G: with 3.5 million active user accounts in Australia. That infrastructure has enabled transformation of the way people use the internet, not least with smartphones and other highly mobile access devices. Web 2.0, social media and social networking, the impact of the cloud and the consumerisation of IT are having a profound impact on student and staff expectations of IT on campus. The advent of successful commercial models for distribution of electronic books is likely to affect scholarly communications in just the same manner as MP3 transformed commercial music in the last decade. The

National Broadband Network will, in the foreseeable future, bring into the home the bandwidth hitherto available only on campus.

Our vision for the future of University IT is an integrated user-centric experience of IT systems, facilities and services - a distinctive and high quality 'Melbourne Experience' in a technologically advanced setting. A future in which IT does not merely create opportunities, but is proactive in seizing those opportunities. We seek standard, commodity IT services that 'just work', yet in a climate that enables and encourages innovation; a future in which we leverage the capabilities of others, in the cloud.

To ensure this is achieved we will put in place new governance structures so that the University community is involved and advised by experts to ensure that the benefits described are achieved.

Introduction and Overview

The University has an ambitious vision, encompassed in Growing Esteem, and a set of goals and strategies to achieve it, including and enabling one relating to IT infrastructure.

In 2010, the University was awarded the greatest amount of research funding nationally across both the ARC and NHMRC schemes, and retained national number one ranking for both research publications and research income. This performance was reflected in our ranking in the Shanghai Jiao Tong index of the world's universities. Now ranked 62, Melbourne is the fastest-moving university in the world's top 100. The 2010 Times Higher Education rankings place Melbourne as No 1 in Australia and 36th in the world.

At the same time, the University experiences very high demand for courses, enrolling high quality students in the new generation degrees of the Melbourne Model and from 2011 a full suite of graduate courses covering a range of professional disciplines as well as an increased number of other postgraduate coursework and research programs.

Information Technology has become pervasive in University work, be it in learning and teaching, research, engaging with the community or in enabling. Since our first computer was commissioned in 1956 (CSIRAC), computing has changed the ways in which University work is done, and it will continue to do so.

This enabling plan provides a vision for how IT will support the University in the future. It also takes stock of the current University IT position, and describes changes underway or planned over the next four years.

Aims and Objectives

GOAL

To support and enable the transformation of research, learning and teaching, and engagement through the provision of world class IT infrastructure and improved customer services, reduced IT costs and reduced environmental impact.

The University must continue to improve its information technology to world class standards so that by 2015 staff and students will have an employment and educational experience that is at least the equal in quality to that at other leading comprehensive research institutions. IT infrastructure and enterprise systems will also support evidence-based decision making in the University and contribute to efficiencies in the University's administrative operations. These systems will be commensurate with what can be expected at an internationally recognised research-intensive university.

The Parkville research precinct is a key partner for University IT. We aim to develop services that recognise the different needs of the research environment and the researchers.

The quality of the Melbourne Experience for students is now dependent on the success of the IT environment used in teaching and learning. The University must develop the agility required to seize innovation opportunities as they emerge and to deal with challenges in ways that make IT an strong enabler to the practice of teaching and learning.

Knowledge partnerships are the interactions between the University and external groups or individuals that enable the growth and utilisation of knowledge, consistent with the University's public spirited character. We need to develop systems and infrastructure required for sharing information with partners nationally and internationally.

As enablers, our University systems, sometimes known as 'enterprise systems', must support efficient business processes. Good enterprise systems enhance the staff experience. Equally importantly, well integrated user-centric University systems will exploit emerging technologies to allow people to focus on their academic endeavours and not on technical or administrative barriers.

STRATEGIES

1. Improving the Student Experience

The University will continue to invest in technologically enabled collaborative learning spaces. These will be supported by innovative ICT solutions which are reliable and available to students on an extended-hours basis. Development of a rich Personal Learning Environment - an online environment that transcends and integrates University-provided tools with those of the cloud, social networking, online collaboration, and the vast resources available through Google and others - is key to a distinctive and valued Melbourne Experience. Another challenge which we need to address but which has not yet been met is that of providing appropriate IT support on a 24x7 basis.

2. Supporting Research Aspirations

The University strives to hold top rank in all national indicators of research excellence and impact and to lead Australia in research higher degree recruitment and outcomes. Key to meeting these goals will be enabling cross disciplinary approaches to research through investment in technological solutions that foster interaction and collaboration. Key IT projects related to collaborative and e-Research solutions will be central to the achievement of the desired research outcomes.

Specifically, we aim to develop common research infrastructure, data stores and collaboration tools underpinned not only by network connectivity, but also by authentication, authorisation and accounting infrastructure to ensure that the right people have access to the right resources at the right time. We need to further develop services that can be used by researchers – those services will look different to the services we offer to other customers – because of the research context and its unique needs which include common research infrastructure, data stores, collaboration tools and connectivity.

3. Developing ICT infrastructure, campus core networks and enterprise systems to support current and future activity

The University will have research IT infrastructure that is amongst the best in Australia and globally and will contribute to the development of national collaborative research platforms. We will deliver personal learning environments to support a distinctive Melbourne experience for students and staff and our enterprise and local systems will enable increased administrative efficiency and effectiveness. Our ICT services will be responsive to the needs of our students and staff and will have the capability to respond to challenges with agility and an innovative approach to solving problems.

4. Pursuing environmental sustainability

We are aware of our responsibility to future generations to minimise our adverse impact on the environment. We will pursue technology solutions to reduce use of paper, and we will embrace online collaboration solutions to reduce travel. At the same time, we will exploit virtualisation and cloud solutions to reduce the environmental footprint of our use of IT. This is a key driver in our procurement and management of IT equipment and services.

5. Strategic IT Governance

University Information Technology supports and enables transformation of research, learning and teaching, and engagement. The student and staff experiences at the University are significantly shaped by the IT services delivered. In particular the continuing growth of the Parkville research precinct has seen an increased demand to provide research infrastructure services to these organisations. These services include storage and HPC (high performance computing) amongst others. This demand for ITS to be a service provider to external, as well as internal customers has introduced considerable complexity to the IT environment both in terms of technology and service models. The University environment is a dynamic one and there is continued demand for new and improved services. This demand comes from the many initiatives the University undertakes, as well as from a desire by users, including very senior ones, to rapidly adopt new technologies

Against this backdrop development and implementation of strategic IT plans is key to ensuring that IT services continue to meet expectations and maximise value as both internal and external environments change. To this end the University has decided to re-form its peak IT governance body. A new group, chaired by the CIO and with membership from the most senior levels at the University, is to be formed. This group, the IT Strategy Advisory Group will review and endorse strategic IT plans at a whole of University level. It is intended that this group will first meet in May 2011.

In parallel to this the role and composition of the University Systems Group (USG) has also been redefined. Aligning with overall IT Strategy USG will now govern all enterprise systems and the Enterprise Systems program of projects. USG will include representation from the business owners of key enterprise systems and will provide them the framework to plan, coordinate and monitor how IT activities are delivered to meet their business needs.

TARGETS

By 2015 the University will have improved IT infrastructure and services by:

- Completing enterprise systems upgrades for Students, Finance and Human Resources;
- Achieving the first stages of the Information Futures strategy;
- Successfully concluding the national collaborative research projects on time and within budget;
- Providing 24/7 support for students and staff for their IT needs; and
- Successfully completing the transition of all Faculties and Graduate Schools to the new workspace computing support arrangements.

2015 Target	Indicator
<i>Having effective management information and enabling enterprise systems to facilitate informed evidence based decision making and business activity</i>	<i>Successful implementation of meaningful management reporting and the Themis Improvement Project completed on time and within budget by end of 2012.</i>
<i>Playing a central role in advancing the national e-research collaboration tolls and networks</i>	<i>Completion of the NeCTAR and AURIN projects on time and in budget</i>
<i>Achieving round the clock support for students and staff in relation to IT</i>	<i>24/7 support provided</i>
<i>Successfully completing the Workspace Computing project to the specifications agreed in April 2010</i>	<ol style="list-style-type: none"> 1) <i>All Faculties and Graduate schools transitioned to new arrangements by 2014</i> 2) <i>Savings specified in 2010 achieved.</i>

The Information Technology Portfolio

University systems are the major IT-based business systems which support the business of the University.

Themis

As with any large organisation, two critical systems are those which are used to take care of financial management and human resources management. The present systems, Themis Financials and Themis HR, were implemented in the last decade. They were implemented using the off-the-shelf Oracle e-Business suite software applications (with customisation). Both systems use an underlying database management platform provided by Oracle, running on University-owned and operated servers in University data centres at Parkville and Noble Park.

These systems work but since their implementation there has been greater than optimal customization: the systems have been described as 'massively customised' by external advisors. This brings increased complexity and higher support and maintenance costs, particularly as it becomes necessary to move to newer versions of the off-the-shelf applications and the underlying database platform. Vendor support for the versions in use will end in November 2013.

ISIS

The University has recently implemented a new system for managing its relationship with its students. Unlike financial and human resources systems, there are fewer off-the-shelf solutions available.

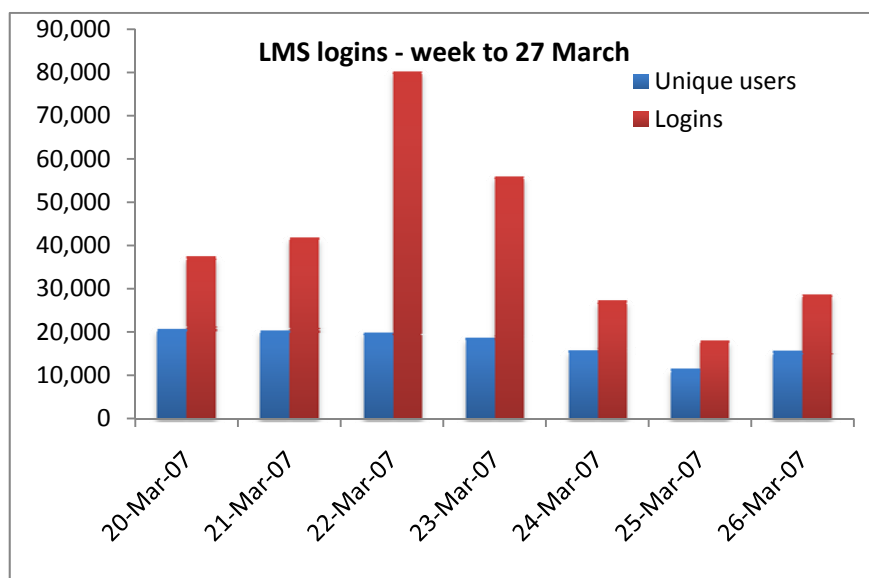
Based on the Student One system from Technology One, the Student System, ISIS, went live in June 2010. After overcoming difficult implementation challenges, the system works. We are selecting and enrolling students, reporting as required to government, recording student progress, collecting student fees and enrolment-related funding, and awarding degrees.

However there are issues with the usability and timeliness of the application process, particularly for scholarship applicants; extra work has been necessary in checking fees and invoicing; interactive response times are slow; and not all older student records have yet been migrated in a manner that allows provision of transcripts by the new system.

Online Learning

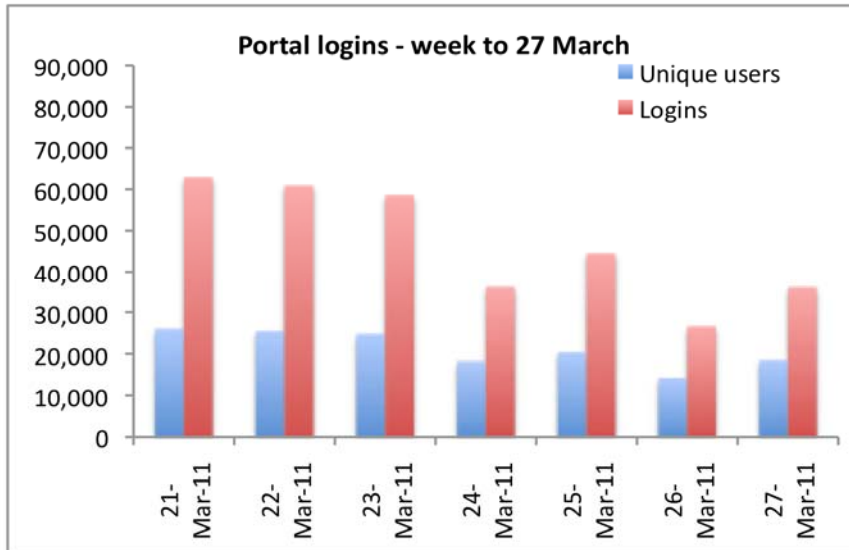
In learning and teaching, the University has determined that it will remain a University in which on-campus classes are a distinctive and vital part of the learning experience. That is not to say that there is no place for online learning and teaching as part of the experience. More than five years ago, the University implemented a Learning Management System (LMS), using the off-the-shelf Blackboard product, hosted on University-owned and operated servers at Parkville. The system is used to facilitate student access to content and learning resources, and the administration, documentation, tracking, and reporting of student progress in all undergraduate and most graduate coursework subjects. The system inter-operates with related facilities, including Lectopia (recorded lectures available online), Readings Online (central repository for properly-licensed online material) and Turnitin (a system for encouraging academic integrity by detecting plagiarism).

In the week to 27 March 2011, daily LMS logins were between 17,938 (Saturday) to 80,205 (Wednesday). The number of distinct users each day was between 11,301 (Saturday) to 20,625 (Monday).



Student Portal

In 2007, the University deployed a Student Portal, intended to provide integrated, consistent, single-point-of-delivery for all academic and administrative services to students. The portal is heavily used. In the week to 27 March 2011, there were 325,765 logins from 39,677 distinct users.



However the portal is not effective as a student communication mechanism - it suffers poor performance at times and is sometimes unreliable. There is limited customisability to the University's needs, and no capability for students to personalise the Portal for their needs and preferences. The current portal does not provide an embedded and seamless framework for student access to some of the most commonly used systems (e.g. LMS, Library Search/Catalogue). Further, there is no real integration with the new Student Mail and Calendar service. The portal provides no useful way for staff to 'walk in the student's shoes'. The system is in need of upgrading.

Library Systems

Part of the mission of any great University library is to facilitate access to scholarly information. In the 21st Century, that mission includes online access to readily searchable information on the physical collection, or to the information itself. The Library must also have systems to manage access to physical collections and particularly, a circulation (lending) system.

The University does have these systems which in most cases use off-the-shelf software running on University-owned and operated servers. Importantly, facilities operated for the Library provide students and staff of the University with the ability to access external material licensed through the library (i.e. online databases of journal articles and other scholarly material), no matter whether the student or staff member is on campus or not.

Identity and Access Management

IT systems are the systems the University operates in order to support the IT environment and its use. At the very heart of this are the system or systems that manage identity, and access to systems: Authentication, Authorisation and Accounting.

Identity and access management is fundamental to University IT. It is, arguably, the one thing that the University must do itself in some sense, rather than merely outsourcing it or leaving it to the market in an unmanaged way.

It is also fundamental in that proper provision and management of IT resources depends on identity and access management. There must be in place a robust system which :

- knows that students, staff and other authorised users are who they say they are;
- ensures that only people properly authorised are able to use University IT resources and University IT-based resources; and
- measures and records use, for accountability (which is a key element of IT security) and, where appropriate, for cost recovery.

The University's current de-facto identity management infrastructure (ARS) was developed many years ago and was not designed to act as an Identity Management system. It is nearing obsolescence and has significant resource and infrastructure single points of failure. A recent external review of the University's identity management infrastructure recommended the replacement of various existing legacy systems with an off the shelf solution from one of the major vendors in this area.

Remedy - IT Service Management

Remedy is an off-the-shelf system used as a tool to deliver a shared IT service management environment to support ITIL and related business processes across the University. It provides:

- A Service Desk application to support incident and problem management processes in the ITIL system
- A Change Management application to support ITIL change and release management processes
- An Asset Management application
- A Service Level Management application to underpin all delivered services that are supported via Remedy
- Standardised reporting across applications

Website Hosting

The University has diverse approaches to hosting websites. Parts of the University's web presence are hosted on servers managed by departments and faculties; other parts are probably hosted externally, and parts are hosted on centrally-managed webservers.

Centrally, there is a website hosting service which offers website administrators and owners hosting of 'static' websites which are usually developed and maintained using the Dreamweaver application. The service also provides hosting for wikis and blogs. An alternative, also provided centrally, is a Content Management (and hosting) Service which uses the open-source MySource Matrix system.

IT Security Services

IT security is a responsibility of every member of the University community, but it is especially a responsibility of IT staff. The University has a small central IT security unit, responsible for development and maintenance of the IT security framework and relevant policy and standards, information security and risk management, IT security incident management, IT security monitoring and vulnerability assessment.

Telephony

The University's telephony services are in three categories: the legacy PABX service, IP-telephony services, and mobile services.

The IP-telephony service is a work in progress. It is an enterprise class voice over internet protocol service, using the University's data network. Benefits include in-built internal telephone directory service, internal caller identification by name, decreased cabling costs, decreased moves and changes costs, and user mobility. The telephone extension number is associated with the logged-in-user, not the cable outlet. To date more than half of the University's fixed-line telephone services have been moved to IP-telephony.

The legacy PABX service uses its own dedicated cabling to connect telephones to the PABX (Private Automatic Branch Exchange) and thence to the public switched telephone network. PABX equipment is nearing the end of its reliable life, and cannot be replaced. Work continues to migrate all University telephone extensions to IP-telephony. The main constraint on progress is the need for IP-telephones to have a network connection of sufficient quality to ensure quality and reliability of service consistent with telephony expectations. In many cases, this requires upgrade or remediation of existing infrastructure.

Mobile telephone and mobile internet services are provided through Victorian Government arrangements, with carriage service provided by Optus.

IT Housing and Virtual Machine Service

For many years, decentralisation prevailed in much of IT at the University. It remains the case that servers, storage and associated infrastructure are housed in various locations. Some locations meet contemporary professional standards while some do not.

In an initiative associated with Responsible Division Management and IT as a Common Service, the University has established a central IT Housing service: housing of server, storage and associated infrastructure encompassing environmental and specified network services for customers within one of the University data centres. The service includes managed computer room equipment; power, cooling and environment management; controlled access to the data centre., connectivity to the University network and internet; equipment rack space; and network and physical security.

The objective is to ensure that all relevant IT servers and related assets are housed in appropriate conditions.

Increasingly, it is possible to move beyond the notion of server housing, to the provision of virtual server hosting. A 'virtual server' is not a physical box housed in a data centre; instead, it is a service which provides the same functionality, using physical resources quite possibly used to provide other virtual servers and services at the same time.

The University Network

The University owns and operates a large high performance data network at Parkville and associated sites. The University Network comprises approximately 64,000 wired network interfaces under management, supported by 680 network infrastructure devices. The network supports 997 Uniwireless access points. The University Network extends to more than 140 buildings on campus and to 34 remote University and associated sites. In 2010, the network carried 1058 terabytes between the University and the wider internet, and this rate is increasing: in February 2011 alone, our internet traffic was 191 terabytes.

The University Network is in transition from a devolved model of responsibility to an endpoint model. In the devolved model, which is still in place in some parts of the University, central responsibility extended only so far as the 'front door' of each building. Beyond that point, cabling, infrastructure and management were a local responsibility.

In the endpoint model, central responsibility extends all the way to the physical wall access socket. Transition to the endpoint model is a key requirement for deployment of ip-telephony.

In either model, responsibility for the connection between the University network and the rest of the internet is central.

A network renewal program has been underway for some years, to bring all parts of the University under endpoint arrangements. Completion is expected in 2013.

Storage

Data is stored in many ways in the University - on desktop computers, on departmental file servers, on optical media. Storage for major University systems is provided by enterprise class professionally managed infrastructure housed in University data centres with robust backup.

Demand for enterprise class storage services is growing, particularly for storage of large research data sets which need to be shared, retained and preserved. A central Storage on Request service has been introduced to meet this need. The service offers high performance, high availability, robust frequent backup, and managed sharing permissions.

High Performance Computing

Research Computing Services offers a range of physical resources together with advice, training and consulting in the most effective means of using these resources to research objectives. They are for

compute-intensive tasks which cannot practically be run on the desktop. These are cluster systems, which consist of a collection of single or dual CPU computers which are managed as a single unit. They have a "head node" which users can log onto and prepare jobs, which are then submitted to a queuing system which allocates them to an available "worker node" which then runs the jobs.

The University is a member of the Victorian Partnership for Advanced Computing (VPAC), which provides University researchers access to peak computing resources. The University is a partner, with the Victorian Government and the IBM Research Collaboratory for Life Sciences, Melbourne in the Victorian Life Sciences Computation Initiative (VLSCI). The VLSCI exists for all Victorian researchers and aims to be one of the top 5 life science computation facilities by 2013.

Student IT Services

Students use University IT infrastructure and systems in many ways. There are extensive on-campus computer labs but now many students choose to bring their own computer, for access to University resources via Uniwireless or 3G. The Blackboard LMS and the student portal are used by most students at least once a week, from on campus or from students' homes and places of work, or anywhere that internet access is available. Similarly, services like access to online journals are available from almost anywhere.

Email, Calendaring and Collaboration

Since 1997, the University has provided all students with an email account, hosted by the University. In most ways, this was the same as the email service provided for staff. During 2011, student email is transitioning to a new, externally hosted service, which will provide an even better service without the University bearing hosting and related costs. Students retain an email address associated with the University, and access to a flexible and advanced email service. New benefits include an online calendaring system which works seamlessly with desktop and mobile calendaring clients, 1GB online file storage, a text-chat facility, and a facility for collaboration with other students in development of documents, spreadsheets and presentations.

The University provides all staff with an email service. For fixed-term and continuing staff, the system is based on Microsoft Exchange 2003 and also provides a calendaring system. Exchange is a modern system with seamless integration of email and calendaring on the desktop and on popular mobile devices.

Casual and honorary staff have not yet been migrated from an older Unix-based staff email system, which is at the end of its reliable life. Both Exchange and the legacy system are run on University owned and operated servers.

Personal Computers

The University operates a fleet of about 14,000 personal computers. About 8000 are allocated as staff workstations and the remainder are used at over the counter service points or for student computing.

Approximately 500 are available to all students in the libraries and Student Resource Centres. Many more are available to students in computer labs provided by faculties. Hours vary in these locations. During semester some facilities are closed only from 2am to 7am. Laptop computers are available for short-term student loans during opening hours at the Baillieu Library, the Law Library and the Eastern Resource Centre.

Support arrangements are in transition.

For much of the personal computer era, the University took a decentralised approach to staff IT support services. Some University-wide services were provided centrally: the major University systems, the University wide area network and internet access, bulk software licensing, purchasing of personal computers and related items, and hardware and software standards.

Local area networks, local printing facilities, file servers, personal computer deployment, acquisition and installation of desktop software and peripheral devices, and end-user support were left to faculties and departments.

Under the Responsible Division Management initiative, most IT services are becoming Common Services, leaving only specialist requirements to be met at a local level. The *Workspace Computing Service*, to which all divisions will transition by 2014, provides standard services to support workspace computing. The existing service includes procurement of new personal computers, computer management, hardware fault investigation and resolution, network connection, and investigation and resolution of errors in University standard operating environment software.

A related managed print service covers procurement, provisioning, break/fix, valet service, fleet management, service management, and rationalisation of the print environment located within each budget division.

Staff requiring help with IT have access to a central IT Service Desk, and IT staff will when necessary visit offices to provide assistance and to deploy new computers.

IT Help Desks for students are provided at Level 1 in the Eastern Resource Centre, and at the Percy Baxter Learning Centre. During semester, these are staffed every day, and in the evening Monday to Thursday. They provide help on student IT matters including the email service, the LMS, the Student Portal, and in general use of the student computing facilities. They also provide assistance to students in setting up Uniwireless access on their own laptop computers and mobile devices.

Teaching Spaces

Teaching spaces in the University are well-equipped with computing and presentation resources.

Type	Number	Facilities
e-learning studio	6	Data projector, networked dual-boot computer for presenter, dual boot computer per student table (shared for group work) linked for collaboration, laptop connectivity for presenter, wireless coverage.
learning suite	23	Data projector, networked PC for presenter, SmartBoard, wireless coverage.
e-seminar room	70	Data projector, networked PC (dual-boot in some cases), wireless coverage.
student workshop (byo laptop)	24	Data projector, laptop connectivity for presenter, wireless coverage.
student workshop	12	Wireless coverage
seminar room with wireless	26	Wireless coverage, television monitor
iMedia theatre	44	Data projector, networked dual-boot computer, laptop connectivity for presenter, lecture capture (system that automatically records audio and/or visual content from lectures), wireless coverage.
iMedia theatrette	27	Data projector, networked dual-boot computer, laptop connectivity for presenter, lecture capture (system that automatically records audio and/or visual content from lectures), wireless coverage.

The IT Capital Plan 2011-2015

SUPPORTING GROWING ESTEEM

The annual review of the ten year IT Infrastructure Plan provides the opportunity to ensure the overall progression of projects support the achievement of the University's strategic goals. The plan directly supports the vision for the University enunciated in Growing Esteem 2010 by successfully undertaking projects that support Research, Learning and Teaching, Engagement and the Enabling Stream.

Research

By 2015, the University aims to be the top ranked university in all national indicators of research excellence and impact. Melbourne will have formed closer links with the surrounding medical research institutes, building on existing collaboration and training opportunities and maximising the global impact of the entire precinct. Much of the University's research will be cross disciplinary on both national and international scales.

The University will continue to pursue improvements to government funding of research to achieve the goal of 'full funding' and greater infrastructure support.

Collaboration is a key driver for bringing together partners to deliver solutions to some of society's pressing health and social problems. By 2020 students and researchers will benefit from the University's engagement with a number of different partners which will be facilitated by the following IT infrastructure projects. Many are related to new property infrastructure projects. Information Technology Services will provide both network and workspace computing support for these projects, including for partners occupying these buildings.

- The Melbourne Brain Centre – Parkville and Austin nodes;
- The Peter Doherty Institute- collaboration with Victorian public health laboratories;
- Centre for Neural Engineering – collaboration between Engineering, ITS and the Faculty of MDHS;
- The Victorian Life Sciences Computation Initiative (the supercomputer initiative);
- The Victorian Comprehensive Cancer Centre;
- Network renewal to remediate and upgrade the physical network across the campus;
- eResearch infrastructure to build on existing investment to further enhance high speed computation, visualization and large scale data stores;

- Government funded Super Science projects – Built Environment research and the Collaborative Infrastructure project; and
- Carlton Connect - collaboration with partners IBM and the State Government.

Learning and Teaching and the Student Experience

By 2020 the University will have in place IT infrastructure that guarantees students have a ‘Melbourne Experience’ unmatched in quality by other Australian comprehensive research universities. Graduate programs need to address large variations in student circumstances and backgrounds such as culture, age, career, experience, family responsibilities, educational level, location of undergraduate study and reasons for study. This level of diversity, which will be a strength of the graduate cohort, requires flexibility in the University’s modes of teaching delivery.

To deliver a unique campus based Melbourne Experience, the University has aligned services with degree offerings through student centres, developed new purpose-designed study spaces, provided wireless connectivity and scheduled common shared time to enable students and staff to engage in activities without clashes. A continuing shift toward graduate programs will require modification to admissions policy, timetabling, capital infrastructure and online access to course materials.

The planned IT infrastructure projects which support these ambitions include :

- Upgrading of the Learning Management System of the University;
- An upgrade of the Student Portal;
- A customer relationship management system;
- A student advising system;
- A scholarly search system;
- Expanding the coverage of the University wireless network.

Engagement

The University will continue to expand the number and scope of its knowledge partnerships, and ensure effective metrics to promote excellence in these activities. To be a globally competitive institution, the University will continue to extend and develop its international character.

The University will develop and expand its advancement activities with a major campaign launch designed to treble the University’s annual income from donations and gifts within five years. A key IT project which will facilitate engagement with the broader community and provide contacts with the University is the CRM system and improvement of our alumni data base.

Enablers – Supporting the Vision

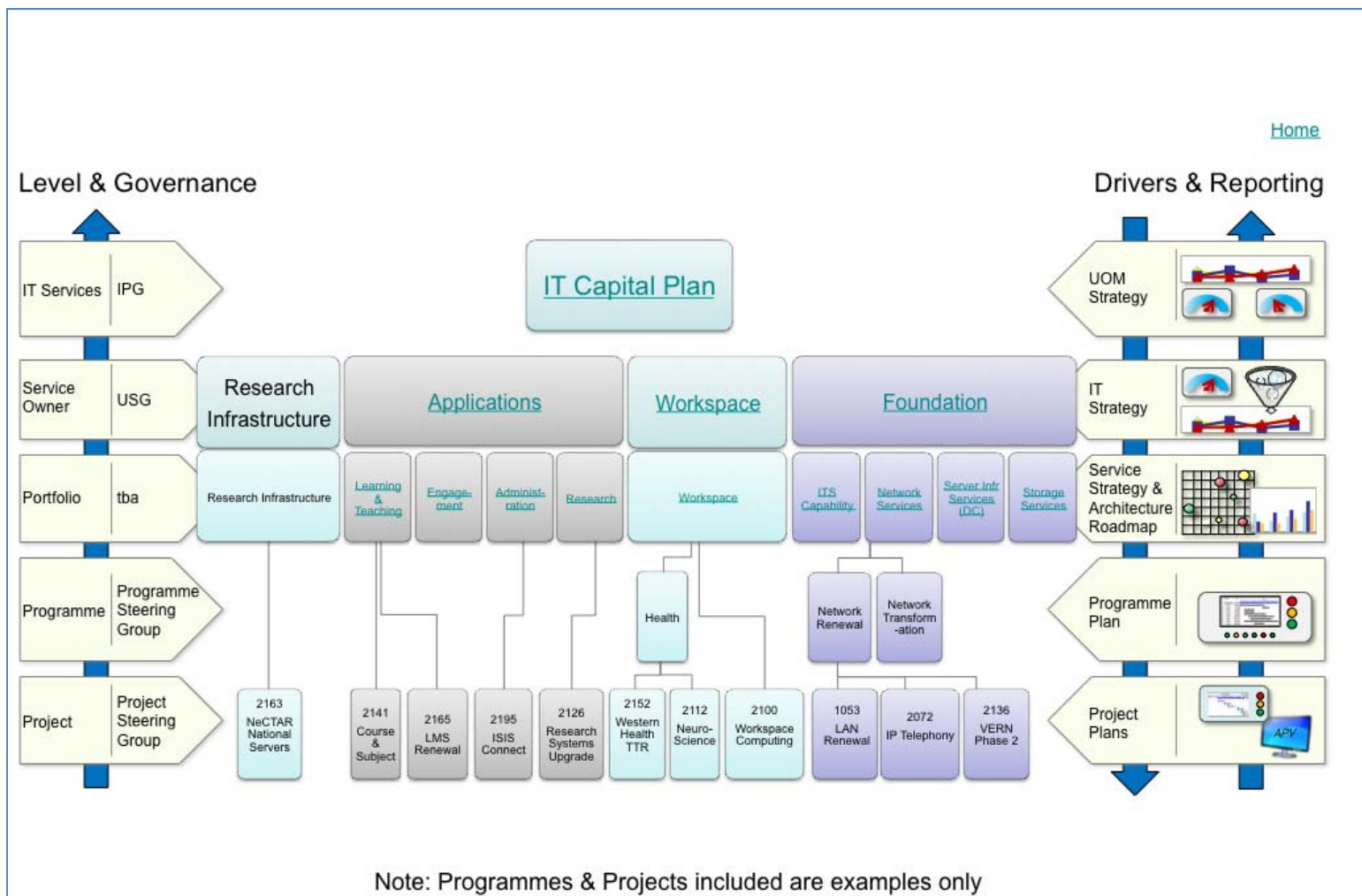
The relevant infrastructure projects which support the University’s operations by providing high quality administrative systems are as follows :

- Upgrade and partial renewal of the Themis Enterprise Systems;
- Improvement of the executive reporting and strategic analysis systems for the University to enable more informed decision making;

- Implementation of an application integration platform to enable integrating information from source enterprise systems;
- A master data management platform that will assist with single source of truth for key information assets;
- Enhancement of the web Content Management System of the University;
- Construction of a new Data Centre to support the VLSCI and Neural Engineering; and
- Completion of the Digitalisation Facility for the Library;

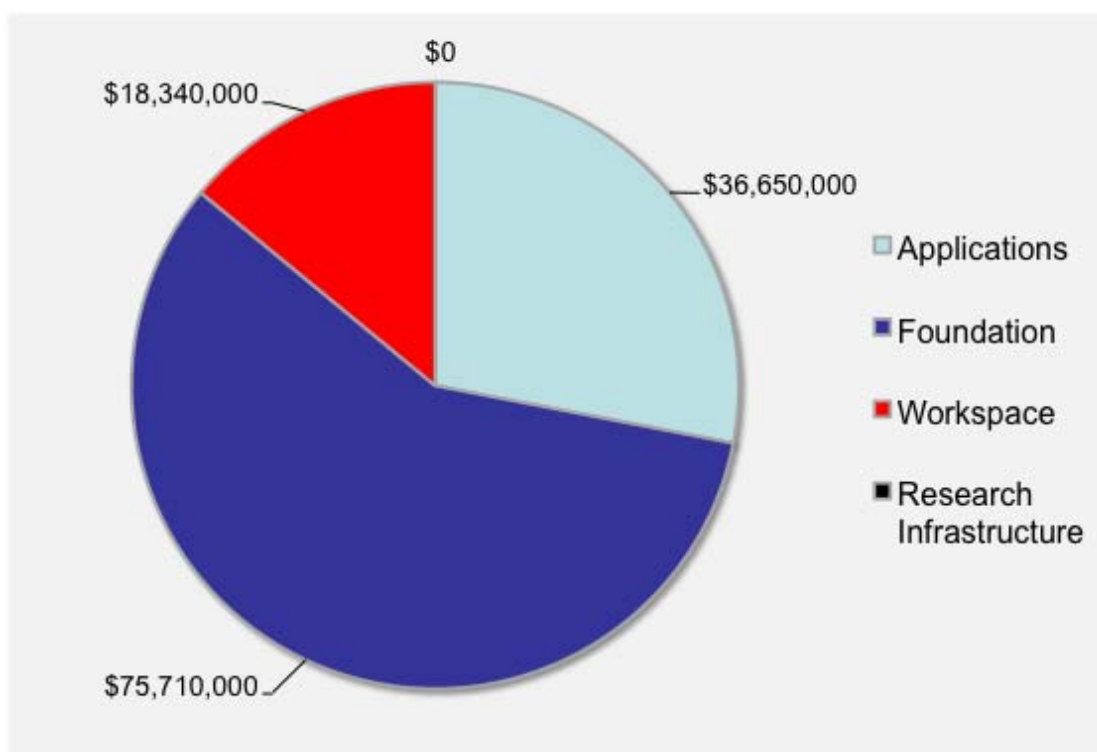
The projects listed under each of the Triple Helix strands above represent a very ambitious program of IT development. Difficult choices need to be made to contain the cost of these programs to the funds available so that the University has a viable IT infrastructure strategy in place.

The University's IT Capital Plan has a 2020 horizon. with detailed plans for 2011-2015. There are four principal development programs: Foundation, Applications, Workspace, and Research Infrastructure in which the above specific projects are grouped. The following chart shows how the plan is organised and its relationship to University strategy



Current Active Projects - Budgets by Service Owner

The following chart shows the distribution of the 2011-2015 IT infrastructure plan funds by these principal development programs.



Note: Research Infrastructure projects not included above include High Performance Computing Renewal (\$0.2 million), Nectar projects (\$6.7m) and VERSI (\$5.2 million).

Current active projects

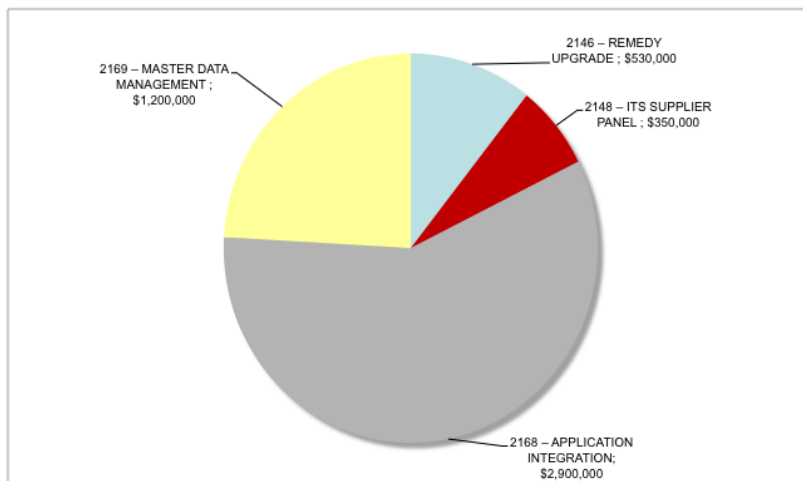
The following tables and charts show the extent of the funded projects in each of these areas.

1. Foundation – IT infrastructure and services

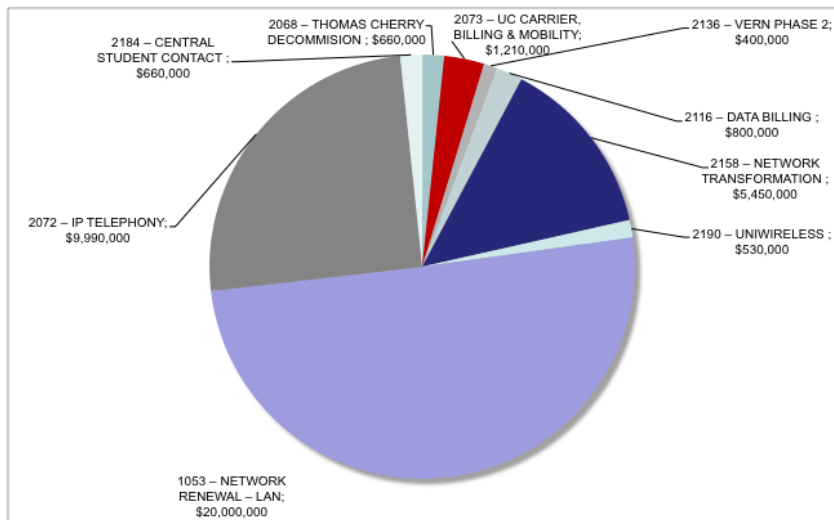
Portfolio/Project	Budget	Expected completion
<i>ITS Capability</i>	<i>\$4.98 million</i>	
Master Data Management	\$1.2 million	Not yet fixed
Remedy Upgrade	\$0.53 million	October 2011
ITS Supplier Panel	\$0.35 million	September 2011
Application Integration	\$2.90 million	December 2013

Portfolio/Project	Budget	Expected completion
<i>Network Services</i>	<i>\$39.07 million</i>	
Network Renewal - LAN	\$20 million	March 2012
IP Telephony	\$9.99 million	May 2012
Central Student Contact	\$0.66 million	May 2011
Thomas Cherry Data Centre Decommission	\$0.66 million	April 2011
Unified Communications Carrier, Billing & Mobility	\$1.21 million	May 2011
VERN Phase 2	\$0.4 million	August 2011
Data Billing	\$0.8 million	May 2011
Network Transformation	\$5.45 million	December 2011
Uniwireless	\$0.53 million	December 2011
<i>Server Infrastructure Services</i>	<i>\$29.03 million</i>	
Second Data Hall Build	\$23.1 million	November 2011
Unix Backup Consolidation	\$0.93 million	May 2011
Unix Infrastructure Management	\$0.05 million	not yet fixed
Identity and Access Management System Replacement	\$4.22 million	September 2011
Active Directory Remediation	\$0.73 million	May 2011
<i>Storage Services</i>	<i>\$2 million</i>	
Storage Services	\$42 million	May 2012

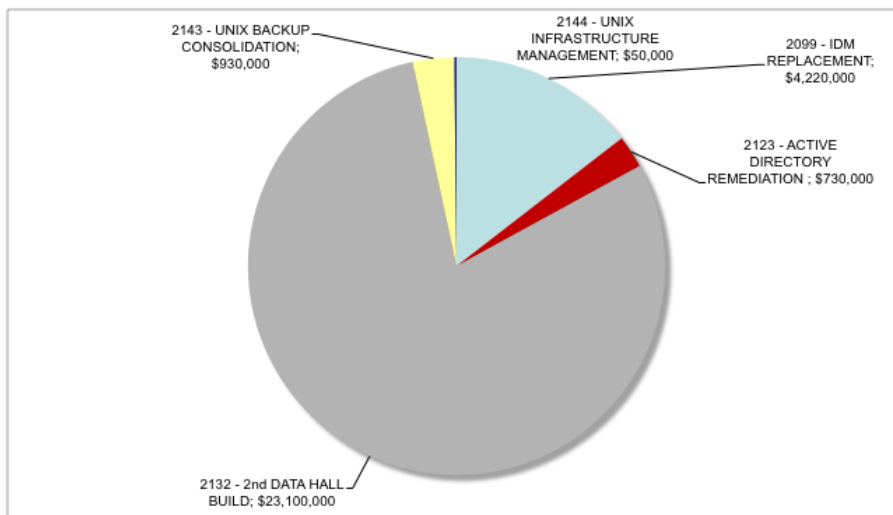
ITS Capability Portfolio



Network Services Portfolio



Server Infrastructure Services

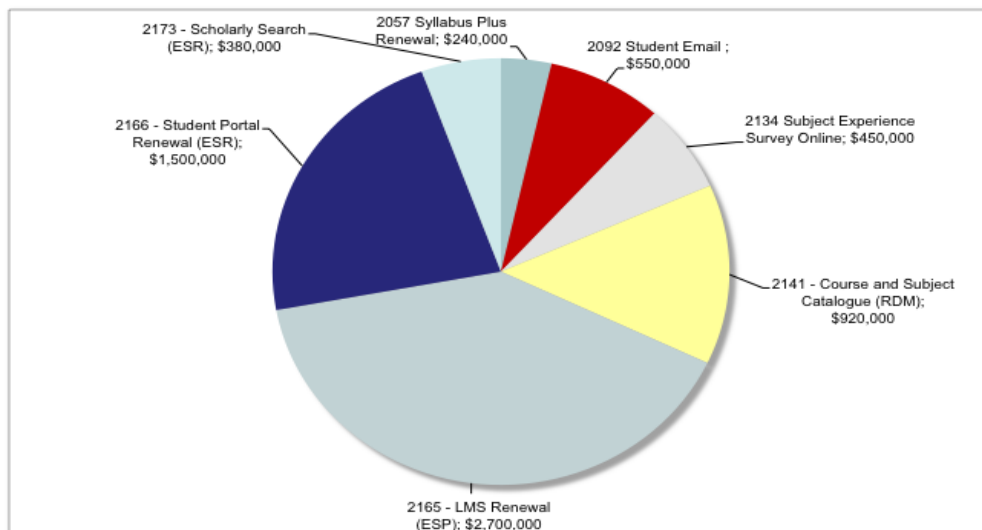


2. Applications

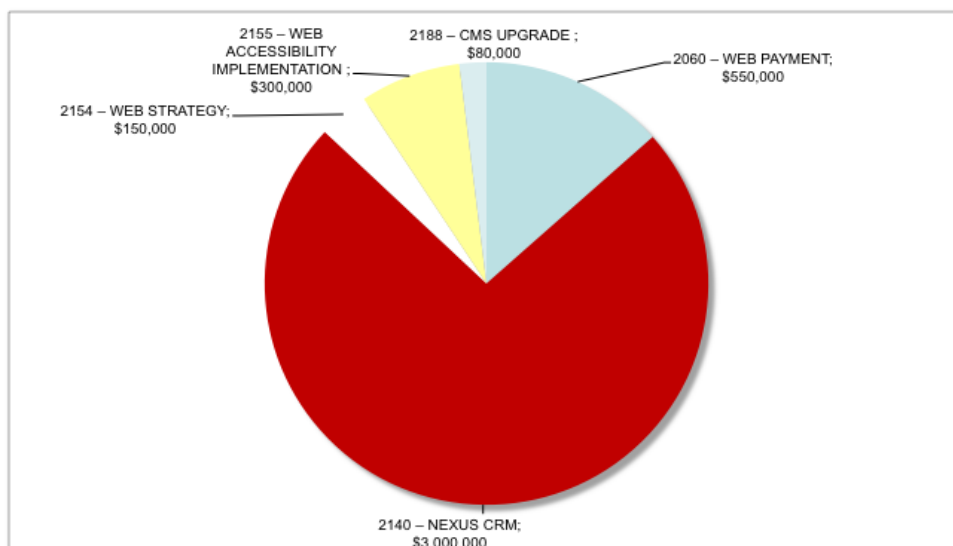
Portfolio/Project	Budget	Expected completion
<i>Learning and Teaching</i>	<i>\$6.74 million</i>	
Student Portal Renewal	\$1.5 million	March 2013
Scholarly Search	\$0.38 million	July 2011
Syllabus Plus Renewal	\$0.25 million	October 2011
Student Email Transition	\$0.55 million	April 2011
Subject Experience Survey Online	\$0.45 million	June 2011
Course and Subject Catalogue (RDMI)	\$0.92 million	August 2011
LMS Renewal	\$2.7 million	December 2013

Portfolio/Project	Budget	Expected completion
<i>Engagement</i>	<i>\$4.08 million</i>	
Web Strategy	\$0.15 million	April 2011
Web Accessibility Implementation	\$0.3 million	April 2011
CMS Upgrade	\$0.08 million	April 2011
Web Payment	\$0.55 million	April 2011
Nexus CRM	\$3 million	November 2011
<i>Administration</i>	<i>\$21.02 million</i>	
Enterprise Reporting	\$1.5 million	December 2015
ISIS Connect	\$5 million	June 2013
eProcurement	\$0.52 million	April 2011
Themis Improvement	\$14 million	December 2014
<i>Research</i>	<i>\$4.81 million</i>	
Research Systems Upgrade	\$4.81 million	June 2012

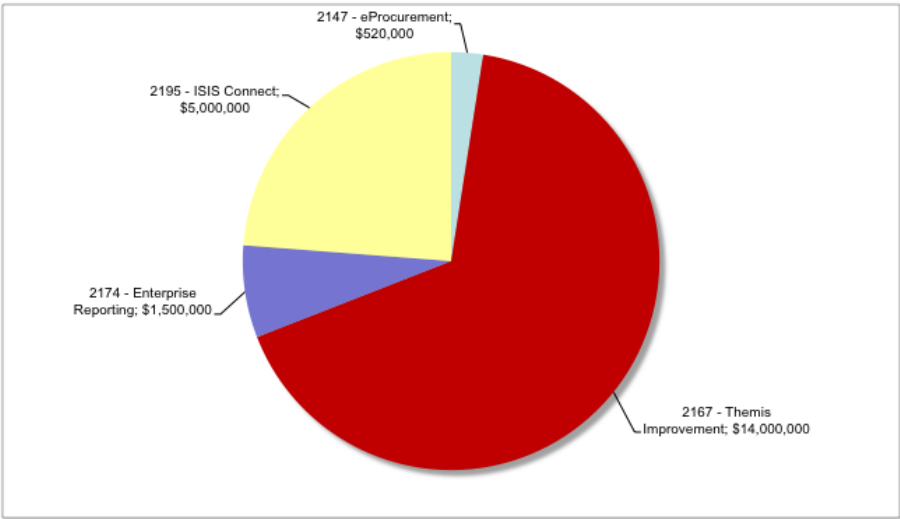
Applications- Learning & Teaching Portfolio



Applications - Engagement Portfolio

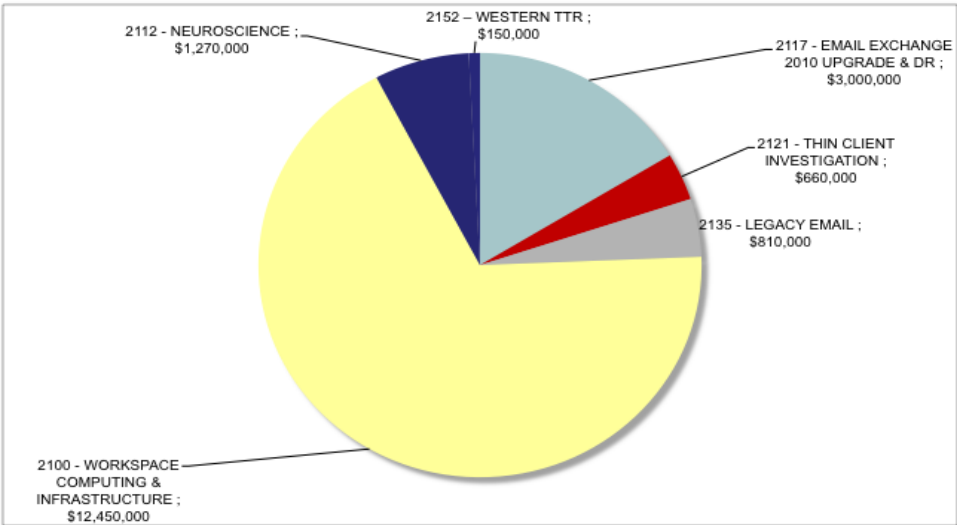


Applications - Administration Portfolio



3. Workspace Computing

Portfolio/Project	Budget	Expected completion
<i>Workspace</i>	<i>\$18.34 million</i>	
Workspace Computing & Infrastructure	\$12.45 million	November 2014
Neuroscience	\$1.27 million	December 2011
Western TTR	\$0.15 million	May 2011
Email Exchange 2010 Upgrade and Disaster Recovery	\$3 million	October 2011
Thin Client Investigation	\$0.66 million	July 2011
Legacy Email	\$0.81 million	November 2011



4. Research Infrastructure

Portfolio/Project	Budget	Expected completion
<i>Research Infrastructure</i>	<i>\$217 million (National eResearch Investments)</i>	
Victorian Life Sciences Computation Initiative	\$100 million	2013
National eResearch Tools and Resources (NeCTAR)	\$47 million	2015
Research Data Storage Infrastructure (RDSI)	\$50 million	2015
Australian Urban Research Infrastructure Network (AURIN)	\$20 million	2015

Details of projects

Each of these major IT projects listed in the above tables is described in this section.

Themis Development

The *Themis Improvement* project, planned for completion by late 2014, is a re-implementation of the Themis systems, based on next-release Oracle applications and database platform, with dramatically reduced customization, and consequent business process re-engineering. It is believed that no essential business functionality will be lost, but that alignment of business processes with standard system functionality could save up to \$10 million over 10 years.

An initiative within *Themis Improvement* is *Master Data Management*.

Master Data Management (MDM) is a foundational University capability; MDM supports improved reliability, availability and ongoing management of business information, particularly where the same information needs to be used by more than one business area. The key outcomes of MDM are data that can be re-used, that is clearly understood, and that has been allocated appropriate data governance (data custodians, responsible for policy, and data stewards, responsible for operational maintenance of master data). An objective of MDM is that Themis becomes a truly integrated system rather than a collection of related systems.

ISIS - the Student Management System

As noted, ISIS works, but not without significant pain points. The *ISIS Connect* initiative is intended to stabilise the system and to address the challenges noted and other matters, over the 2011-2013 period.

Online Learning

The Blackboard LMS and related systems have served the University well, but the times have changed, as have the available technologies and student expectations.

The purpose of the *LMS Renewal project* (2011-2013) is to move away from the isolated experience of a modular LMS to a model of a Personal Learning Environment (PLE). A PLE is primarily concerned with the practices of students in learning with contextual and diverse technologies, rather than a category of software. Rather than interacting with the tools supplied within the formal spaces of the University only, the PLE enables a wide range of contexts to be coordinated to support the goals of the student.

Student Portal

The *Student Portal Renewal* project (2012-2013), embryonic at this writing, is intended to overcome existing limitations: most likely this will include moving to a new software platform.

Library Systems

The main issue with the present scholarly search tools, which are largely in-house, is usability. In recent times 'cloud based' scholarly search and discovery tools have been developed by vendors. The 2011 *Scholarly Search* project will explore the possibility of moving some of our Library Systems functionality to such cloud based services.

Identity and Access Management

A project is underway to deliver an identity management solution with rich functionality, flexibility and usability; to meet University needs for a more advanced approach to identity management through initiatives such as federated access management to services and resources within and outside the University; to allow broader definitions of 'members' of the University community; and with greater levels of responsibility and control for security, privacy and compliance.

The University Network

The next step is 'network transformation'. Network renewal provides a faster, more reliable and more secure network, but not a manageable network. Network transformation makes the network manageable and automates processes associated with connection of end-user devices. It provides state of the art accounting, accountability, access control and user mobility.

Over the last decade, the University has built a wireless data network, now known as Uniwireless, with coverage across most University premises where students gather for scholarly purposes. Students, and staff, can connect to the network using a suitable device and their central University username and password. Functionality is limited to access to the University Network, and to external websites via a web proxy server. These limitations are significant, and reduce the value of the service, especially when it is used with mobile devices. It is imperative that any application available through a wired network at the desktop be available through the wireless network - and indeed in most cases, applications should be available via any internet connection.

Staff Email and Calendaring

A project is underway to implement a Microsoft Exchange 2010 service with sufficient capacity for all staff, including casual and honorary staff. As well as the benefits of bringing all staff onto one system, Exchange 2010 offers better support for Macintosh users.

Workspace Computing

In 2011, the scope of the Workspace Computing Service is increasing, to include server-side file storage and management, server management, and student lab management.

Expected benefits of workspace as a Common Service include lower costs through standardisation and economies of scale, better physical and network security, improved server management and economy

through virtualisation, and improved server availability, support and recovery. There is also a significant benefit in that IT staff who remain at the local level will be able to focus on requirements which are truly local.

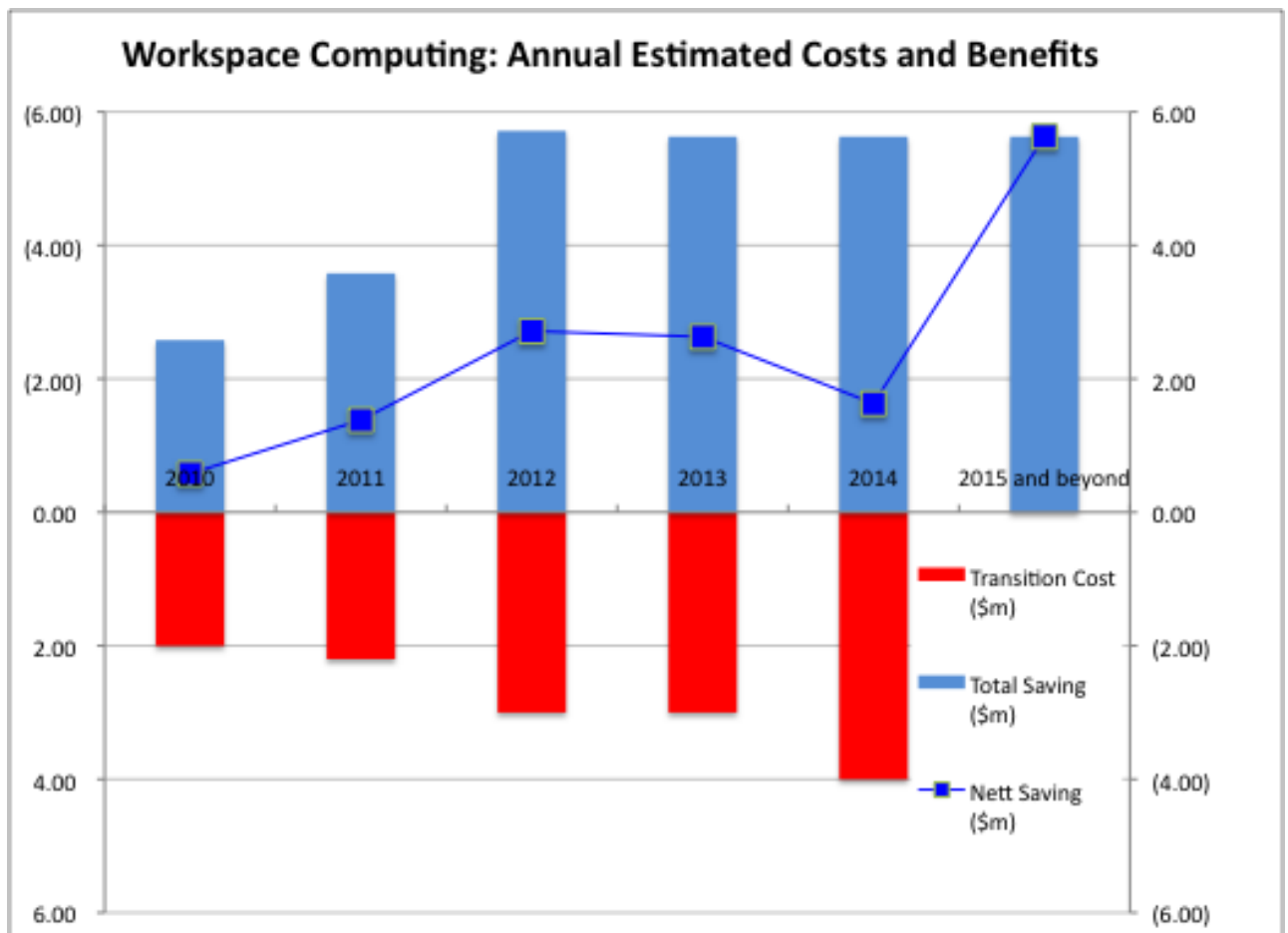
The initiative is not without risk. Change management will be key to success of this complex initiative, as will be finding ways in which to meet the diversity of needs in the University while gaining the economies of standardisation. Change is always difficult and experience with Phase 1 budget divisions shows that resistance is likely from affected IT staff and users, especially academic staff.

The challenge, which is significant but not insurmountable, is:

successful delivery of Workspace ICT services to meet the needs of academic and professional staff and students of the University. These core services provide and support the everyday technology environment that is used in the staff or student workspace.

Especially in the case of students, it is critical to recognise that the workspace includes computers and other devices which are owned by the user, not the University.

Whilst there are challenges the lowering of costs is a substantial benefit as shown below. Even in its first years, Workspace Computing is expected to provide savings exceeding the cost of the initiative; in the long term, we expect annual nett savings of nearly \$6 million.



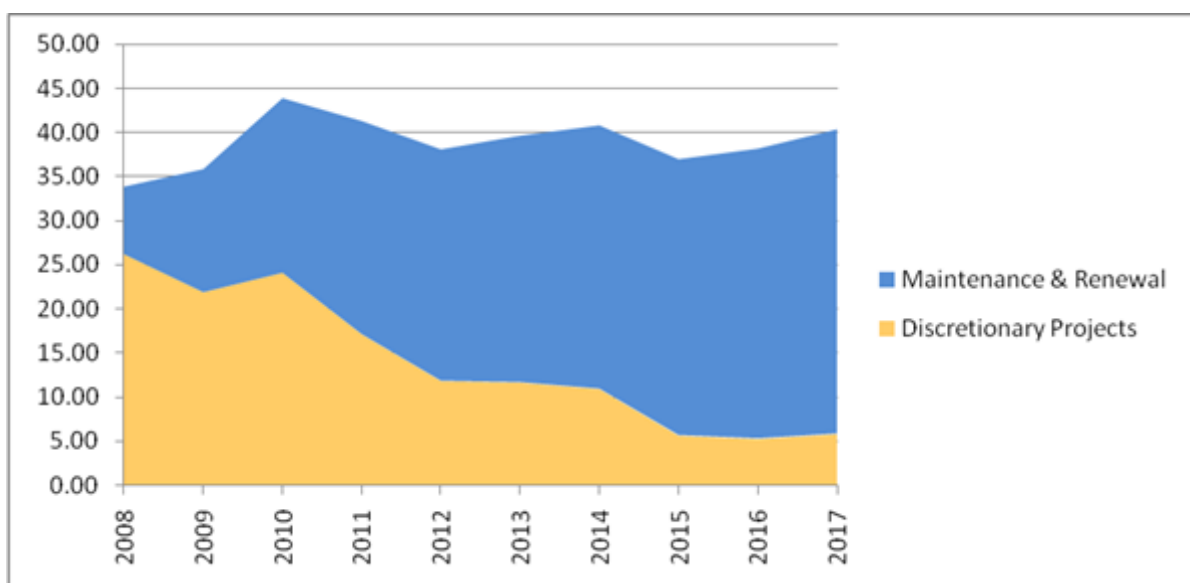
IT Capital Plan 2016-2020

The IT Capital Plan funds three types of broad expenditures:

1. New IT capital initiatives (innovation)
2. Renewal (cyclic replacement) of existing IT assets
3. Maintenance of existing software and hardware assets

Over recent years, the University has invested significantly in new initiatives, such as ISIS, the LMS, upgrades to Themis, network and Unified Communications. As a result, the renewal and maintenance components of the IT Capital Plan have increasingly consumed higher proportions of the IT Capital Plan, leaving little capacity for innovation and new initiatives. Some additional funding was approved in 2009 to implement outcomes of the Enterprise Systems Review.

The diagram below shows the composition of the IT Capital Plan for the past three years and into the future. The amount available for new initiatives continues to decline as available funding is used to maintain and renew existing infrastructure.



Such is the rate of change in IT that it is difficult to foresee the discretionary opportunities of 2016-2020; what is known is that a large proportion of available funds will be tied to renewal and maintenance.

Forward estimates (\$ million) for 2016-2020 include:

IT Maintenance - Operating	2016	2017	2018	2019	2020
Enterprise Software Licence Maintenance	12.60	13.20	13.84	14.50	15.50
IT Infrastructure Hardware Maintenance	7.22	7.53	7.86	8.20	8.56
IT Renewal Projects - Capital					
	2016	2017	2018	2019	2020
IT Renewal Programs	14.57	15.33	16.11	16.95	17.82
IPP - Strategic Projects - Capital					
	2016	2017	2018	2019	2020
Feasibility studies	0.69	0.73	0.77	0.80	0.84
Emerging Projects - unallocated	4.61	5.12	5.31	5.59	5.87

Longer Term Priorities

Towards and beyond 2015, the University will move away from the tradition that University systems are run in-house. In standardised and commoditised systems, so-called 'cloud' providers enjoy economies of scale and scope which the University cannot emulate. The markets may not evolve in ways which make cloud-sourced systems the best option for the University in all cases, but our first question will be: can someone else do this for us in a more cost effective manner than we can do ourselves.

From the end-user perspective, University systems must meet, or even exceed, the expectations that students and staff have from their experience as consumers. To the greatest extent possible given the nature of the transaction and the regulatory environment, enrolling online should be as easy and pleasant as making an airline booking online; working with the University finance system should be as easy as internet banking with the big four. The back-room experience (for example, the financial system as experienced by financial staff as distinct from those merely carrying out transactions) should be comparable with the experience of those in comparable back-room roles in relevant industries (for example, in the financial services industry).

Identity and access will be managed in such a manner that what people can do depends on who they are, not where they are or how they are connected to the internet.

All students and staff will share the one email/calendar/collaboration system, able to collaborate with each other, and with calendaring and collaboration facilitated by leveraging Themis/ISIS information (e.g. classroom commitments automatically appear in one's calendar, and with permission presets/defaults for opt-in sharing of online workspaces with classmates and colleagues (based on enrolment and organisation diagram information)).

Workspace Computing will mature to become a coveted service; a valued privilege associated with studying or working at the University.

The University Network will provide performance and reliability well beyond that of the consumer ISP experience, not only on the wired network as at present, but also on the campus wireless service. Network transformation will bring the managed flexibility and control of the best of the consumer services.

Technologies that are emerging but not yet mainstream and not yet embraced in University life are likely to change the way things are done in 2015 and beyond. Students and staff will use these technologies in their

University work and on other aspects of their lives; the challenge, and the opportunity, for University IT, is in not only accommodating this but also in exploiting the consequent opportunities to transform the way work is done. Some such technologies are discussed below.

3G data services have already become inexpensive, with coverage for 99% of the Australian population. According to the Australian Bureau of Statistics, there were 3.5 million active 3G internet access accounts in Australia in June 2010. 3G is just one aspect of mobility and portability, but it is an important aspect. It means people do things and use things everywhere, not just at home and on campus. It increases the 'anytime' aspect of the University experience too, because one is less often without internet connectivity.

Along with the sensors found in mobile devices but not laptops (GPS, compass, accelerometer, gyroscopic orientation sensing), 3G makes possible new applications. These new applications may not originate in higher education, but they will be used in higher education. An example is *Star Walk*, an iPad planetarium application that uses the position, time and orientation of the device to provide a chart of the stars, planets and other celestial objects. In everyday life, *TramTracker* for iPhone finds nearby tram stops and lists the next three trams approaching.

Mobile devices like the iPad and the emerging Android and Windows rivals; also smartphones, are more than just the same IT, but in a cafe or on the train, In this university, the evidence is there they matter, as may be seen just walking around and noticing these devices everywhere. Students and staff who have these devices reasonably expect the University to make it easy and pleasant to interact with the University using a mobile device. Banks, airlines, Amazon, Google, and others, set that expectation.

Going beyond merely meeting expectations, we aspire to *delight* students and staff who use mobile devices. Consumer-oriented organisations are doing so already.

Online collaboration, although easily over-stated especially in a campus-centred university, will be important, particularly as people try to cut down on travel for reasons of cost, safety and the environment. Students are likely to collaborate online in University-sponsored spaces, if, but only if, encouraged to do so. University-provided online collaboration spaces will compete with those readily available to the general public: the key strength the University will have is in identity and access management. If the University provides collaboration spaces in which students and staff can take it for granted that access control has been taken care of, leveraging Themis and ISIS information, those spaces will become preferred. Absent that leverage of the institutional context, are likely to just use ordinary Google apps accounts, or Dropbox or any of the many other commercial offerings.

The Cloud. Cloud storage for easy, cheap, secure, backed up data, available anytime, anywhere, beautifully meeting the needs of the nomadic student user. Cloud apps, especially for collaboration but also for University systems. Cloud CPUs for compute-intensive research.

ePub, along with PDF and a few other universal information formats is what makes device-agnosticism possible. It's what makes access to information everywhere possible. Academic publishing as likely to adopt ePub on a large scale in the near future. Licensing will be a difficult issue, and business models may sit uneasily with the traditional models for institutional access to scholarly publications.

Virtualisation means that in cases where we can't really expect students to use their own computers and software (because, for example, the required software for a subject is very expensive), we still don't really need to provide computer labs in the traditional manner. It might not always work (for example, when the

specialised work students need to do requires special and expensive hardware), but it will work in many cases. Advantage to the University - virtual servers in a rack (or in the cloud) cost less to buy and less to run than a computer lab. It takes less space, freeing space up for attractive and flexible social and learning environments for students. It also makes 24/7 access easy, and the student can be at home, at work, anywhere in the world, so long as they have the bandwidth. And with NBN, they usually will have the bandwidth.

Virtualisation also lets us shift physical resources between major University systems with the ebb and flow of load through the year. Better still, we can lease extra resources in the cloud at a moment's notice. The same goes for our labs-in-the-sky.

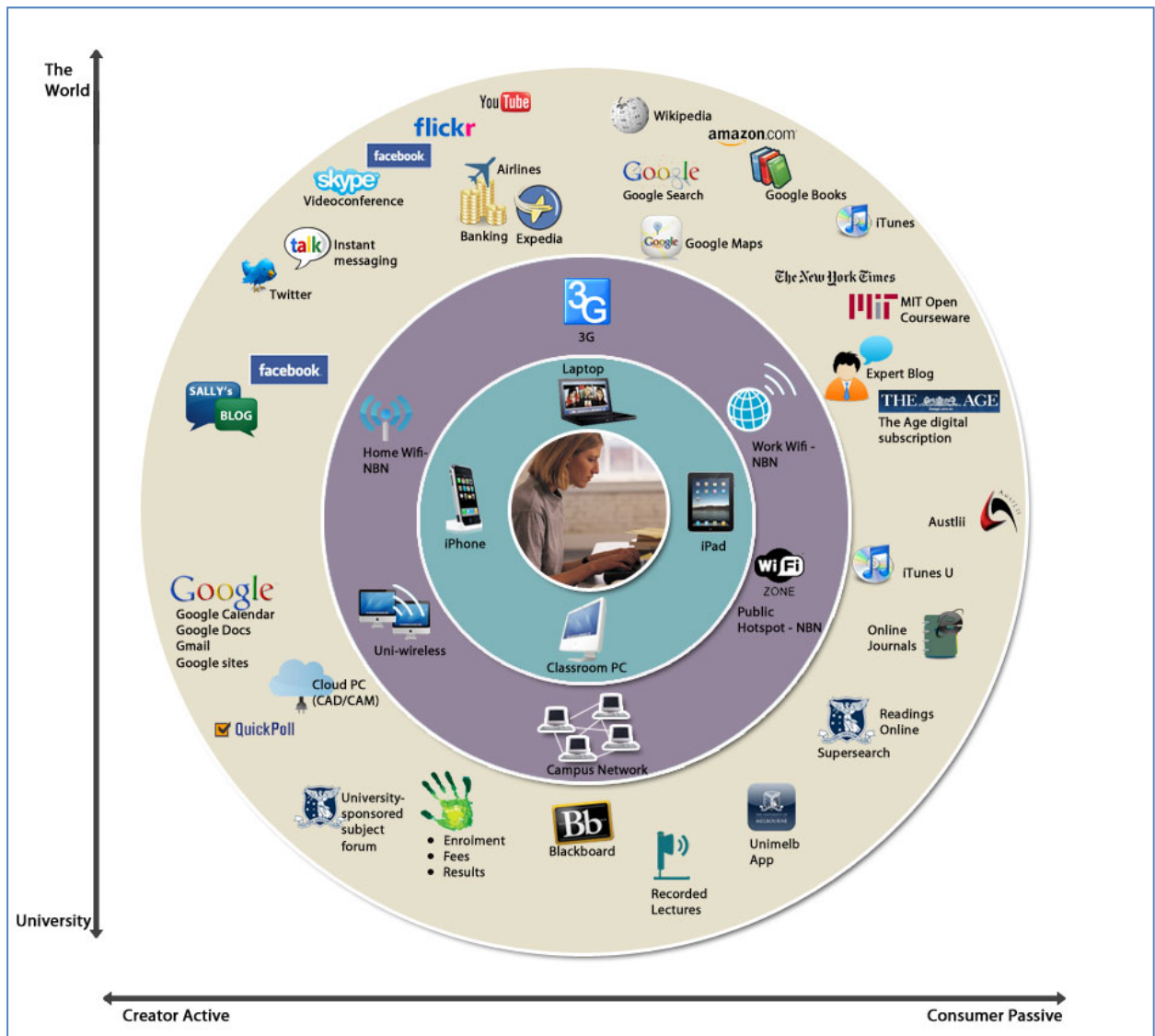
Consumerisation as in Amazon and iTunes, means several things. It means students and staff will often bypass traditional University channels like the bookshop and the library when they seek material. It means they will expect discovery and delivery through University channels to provide the same functionality and ease of use that they have with Amazon, iTunes, and Google Books. It means a conflict, which will not be resolved quickly, between the University tradition of all-you-can-eat (buy a book once and lend it out as often as you like; pay a fixed annual fee for all staff and all students to have access to online journals), and the consumer content model - pay-per-item. Will an institutional subscription model evolve for online ebook vendors?

There's an app for that! Imagine subject reading lists that include free or inexpensive apps for personal computers and other devices; apps which facilitate learning, illustrate key concepts, allow the student to explore. These complement the apps-in-the-sky. We are unlikely to develop these apps but we could curate them: the University as the student's guide on the side. There's nothing really new here: the University has for decades produced lists of required or recommended texts for students; this is merely about extending the same idea to subject-specific apps. For that matter, it's no different to providing a list of calculators suitable for use in a particular discipline. A key trend in software, especially for mobile devices, is towards people using many apps, each of which does just one or two things very well, in contrast to the trend of the last decade or so, in which people have tended to use just a few software packages to do nearly everything.

The Student IT Experience post-2015: A Day in the Life of Sally

Sally is a coursework student, studying towards a Masters in Acoustic Finance. In some senses, Sally lives on the internet, connected most of the day whether using her laptop, iPhone or iPad. She uses the net constantly in her life as a student, as a professional and in personal life. The University online presence is but one, important, part of her online interaction with content, with family and friends, and with colleagues within and beyond the University.

Sally's Personal Learning Environment



The day begins checking the Calendar on her iPhone, which is synced to the University's calendaring system, amongst others. Each semester when Sally enrolls, ISIS automatically populates her calendar with classroom commitments and key assessment and administrative dates. (Sally doesn't know it, but neither the ISIS people nor those who implemented the student calendaring system thought of that: it was an opportunity identified by the IT Strategy Advisory Group during its integrated review of IT systems and services.)

Today, along with two seminars to attend and an essay to submit, Sally's calendar reminds her that tuition is due. Her syndicate is due to present a seminar this morning, and they worked long into the evening finalising the presentation in GoogleDocs while discussing it in GoogleTalk. It's a good thing that between them, ISIS and Blackboard take care of making sure that these collaborative spaces automatically know who is working with who and therefore maintains the sharing settings - otherwise she'd spend more time messing about with sharing settings and less time getting on with learning. Over breakfast, she makes a

final review of the GoogleDocs presentation using her iPad, and saw that her colleague John had picked up and fixed a small but awkward mistake.

On the train into Parkville, Sally's still using the iPad. She checks her email; nothing there. She logs into the student portal to download the tuition invoice, and then logs into her bank to make the payment. Then some time out on Facebook before the train pulls into the Grattan Street underground station.

Seminar time. Sally's syndicate use the classroom lectern PC to login to their Google Docs space, and also to a shared Dropbox space where they've prepared some other resources. She gets an SMS from John - he's fallen off his bike and won't be there. OK, at least they know. The group presents, and Sally moderates the ensuing discussion, using Quickpoll to put contentious questions to the vote - fellow students vote using their smartphones, with realtime results displayed on the big screen, along with the twitter feed for the seminar. At the end of the class, the professor gives her perspective on the presentation and the discussion, and refers the class two recent and relevant papers.

Downtime, some coffee and a chat, and no IT! Then it's off to the Eastern Resource Centre to download those papers. One is an ePub on iTunes U and Sally downloads it straight to the iPad. The other paper is in an external research database behind a paywall; for that, it's Supersearch on the laptop, all through Uniwireless. That done, an IM from John pops up on Skype - is the syndicate up for lunch at PA's? Yes they all are, in 45 minutes. Sally leans back to read through today's Age, iPad edition, before lunch.

After lunch, Sally's next class is in a special location, a building she's not been to before. The Raymond Thomas Berry Barry Cherry Redmond Building. On her iPhone, she uses the Unimelb app which detects her position using GPS and guides her from PA's to that building.

After the class, it's time for a final review of the essay due for submission today. Sally then logs in to the LMS and submits the essay via Turnitin. Whilst at the LMS, she notices some lecturer's notes for a class next week, and also that the Lecture Capture recording of her presentation this morning is now available for download.

On the train home, Sally gets started reading the ePub paper on her iPad, making notes and placing bookmarks. She checks into an online forum associated with the morning seminar; a fairly animated discussion is still underway and Sally adds a few comments of her own before reaching home.

After dinner, before turning to her studies, Sally pays a few bills on Bpay and then turns to the more cheerful business of using Qantas and Expedia to book a trip to watch her favoured football team play in Sydney next weekend. No classes tomorrow, so it's a good evening to get some work done in the CAD/CAM lab. There are only 20 CAD/CAM cloud PCs licensed (the software costs \$4000, so she's not about to run it on her own laptop), and they are all in use so she registers in the queue. Time for some Wikipedia browsing and some silly Youtube videos. Half an hour later the SMS comes in - a CAD/CAM cloud PC is now available and she has five minutes to grab it. On her laptop, she launches the thin client application and logs straight in to the cloud PC. She's not sure whether it is on campus or in Australia for that matter - and she doesn't care. She's at home, effectively using a 'virtual' computer lab running software she can't afford to have at home. Sure beats the days of hanging around on campus all night.

Throughout the day, Sally used many kinds of online resource and applications. Some of it was via 3G, some was via her home wireless network and the NBN, some was via the campus wired and wireless networks. That was all seamless - her computer and other devices switch automatically between available

services. It all just worked. She moved seamlessly between University-oriented activity and other things, barely perceiving a difference in terms of the technology. Student IT post-2015 is all about Sally, not the University or the technology.

The Research IT Experience post-2015: A Day in the Life of James

Professor James Smith is with Neuroscience Victoria. Although not a University employee, the identity and access management system, along with national and international federated arrangements with the same purpose, ensure that James has access to all the University IT resources he needs, along with resources at ANU, in the United States and in Europe.

The day starts early with a videoconference from home with project team members in the Australia, the US and France. One thing IT can't do is eliminate time zones. Still at home, James uses VLSCI resources in collaboration with an ANU colleague to visualise their model of how a newly-engineered molecule might work to stop the advance of dementia in the aged. They write up their notes together in GoogleDocs - more federated identity magic.

During James' walk into Parkville, an urgent message on his phone from a teaching colleague - might the teacher please have a copy of a slide James presented at last week's seminar, to use in class later this morning. James travels light - he walks to work - but he is carrying an Android tablet which he uses to make a remote connection over 3G to his office desktop, from which he emails the requested slide,

In the lab, it's electron microscopy, capturing gigabytes per minute, all of which is transferred forthwith to a distributed international research datastore supported by the Go8 with funding from the Commonwealth, the Bill and Melinda Gates Foundation and the European Union. At the same time, VLSCI facilities preprocess the raw data for visualisation and analysis. This international research resource grows at terabytes per day, with complementary analyses underway constantly by team members on three continents.

In the afternoon, it is a Parkville Precinct Strategic Advisory Group meeting. During lunch time, the group's Executive Officer puts a late paper into the committee Dropbox. It's a short paper which James reads on his Android over coffee before making his way to the meeting. On the way, he uses the UniMeeting app on his iPhone to 'star' the paper for discussion.

It's a short evening, because there's yet another early morning international teleconference, but James (an expatriate Englishman) takes the time to enjoy the high definition pay-per-view UK match of the day netcast, delivered live via the NBN.

The information in this publication was correct at the time of printing. The University reserves the right to make changes as deemed appropriate.

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