



# Network Infrastructure Services Strategic Plan 2008

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## Executive Summary

This document, lays out a strategic framework to guide the development of NIS services, plans, projects and other activities. Primarily the planning horizon for this document is the 3-5 year range however attempts have been made to look 'as far out as we can'.

The key trends that will drive the strategic direction of NIS during this period are,

- **Rapid growth in demanded network capacity** primarily due to eResearch initiatives and the increase in multi-megabit broadband services to consumers.
- **Convergence of technologies** driven by the ubiquitous use of IP for all aspects of communication and related technologies.
- **Ubiquitous access** to services driven by the *mobility framework* and other trends such as the focus on work-life balance.
- **Service focus** resulting from the an increase in providing vertical services as a result of industry trend that is increasingly pushing higher layer functions into the network fabric.

Taking into account these (and other) trends as well as the strategic directions identified in the *Excellence and Diversity* strategic plan and the ITS strategic plan this document outlines the strategic themes and directions for NIS during this planning horizon. Highlights of it are,

- Convergence of voice and data onto a single network
- Wire Speed Networking
- Reduction in complexity
- Adoption of a Service focus within NIS

Another key recommendation in this document is to continue to keep the the NIS budget along a service focus and not be translated into a cost-centre focused model.

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## Preamble

This document, lays out a strategic framework to guide the development of NIS services, plans, projects and other activities. It is also input into the University's and ITS divisions 2008 IT Strategic Planning processes; the development of the 2009 ITS Budget submission; and the development of the 2009 IT Project Portfolio.

Primarily the planning horizon for this document is the 3-5 year range however attempts have been made to look 'as far out as we can'. Due to the rapid changing nature of the IT industry it is difficult to predict beyond a 3-5 year horizon with any degree of certainty.

This document is a continuation and update of the 2007 NIS Strategic planning document. New inclusions in this iteration have been identified with the tag **New**.

## Monash Universities Strategic Objectives

The following are the objectives listed in the Monash Universities 2004-2008 strategic plan **Excellence and Diversity** that are applicable to the NIS strategic plan.

- Excellence in research and scholarship
- Excellence in education
- Excellence in Management
- Diversity
- Innovation and Creativity
- International Focus

## Trends

### **Macro Trends**

**Macro influences** are the trends that sweep across all areas of life such as a countries economic state, social and political trends.

#### **Work Life Balance**

Balancing work and life is becoming increasingly prominent. Employees as well as organisations are looking at ways that provide employees flexibility to successfully balance their work and personal life.

**Impact:** *Technology is looked at to facilitate this flexibility. Allowing employees to work from anywhere they choose and providing them the access to the information that they require to do their work from anywhere is becoming crucial. The network is an essential component in enabling this flexibility. Network solutions implemented will need to provide the ability for the applications and services to be accessed from anywhere.*

#### **Increased mobility**

Society is increasingly mobile and no longer confined to one geographical location. Reachability is now required regardless of location.

**Impact:** *Along with the work life balance this will drive the need to have applications and services accessible from anywhere that the user chooses. Network solutions implemented will need to provide the ability for the applications and services to be accessed from anywhere.*

### **Virtual tribes, digital worlds & social networking (New)**

A growing social trend is the increased use and popularity of virtual meeting places and virtual worlds such as Facebook and Second Life. These are redefining the usage patterns of IT and the Internet. There is a trend that the younger generations are adopting virtual social networks as a replacement for email for informal communications.

**Impact:** *As these virtual worlds meet the workplace needs there will be a need to control and moderate the use of such services. Change from email to virtual social networks for communications might require redefining some of the services and delivery mechanisms that are currently employed.*

### **Focus on global warming and reducing carbon emissions (New)**

Global warming is increasingly becoming a top priority for countries worldwide. Australia has ratified the Kiyoto protocol and has agreed to ambitious targets. There will be an increase in focus towards doing things in a more energy efficient and green manner.

**Impact:** *There will be a need to reduce the energy consumption of IT infrastructure while continuing to increase performance. Technologies that harness the power of computers more efficiently such as virtualisation, blade-computing will need to be adopted. Technologies such as video-conferencing will gain increasing focus to help reduce the environmental impact of travel.*

## **Micro Trends**

**Micro influences** are those that influence a particular industry. For Monash and NIS these are trends that influence the educational, IT and networking industries.

### **Increase in tech-savvy users entering the university (New)**

The students entering university are increasingly technology savvy and have higher expectations of what technology can provide for them through their academic life.

**Impact:** *There will be a need to disseminate better information targeted towards an audience with a wider variation in their IT knowledge levels.*

### **Convergence of technologies**

Multiple technologies are converging together with the distinction between voice, video and data disappearing. Increasingly people are using multimedia to get their message across and technology is increasingly merging these seamlessly together.

**Impact:** *As this trend continues the user demand for converged solutions will increase. Future directions should take into account this trend and work towards gaining the advantages of this convergence of technologies.*

### **Continued Exponential Growth**

Both demand and the supply of technology will ensure that the exponential growth will continue into the future. The common trend in IT of doubling every 18 months translates to a 10 fold

increase every 5 years.

### **Terabit Network Infrastructure**

High capacity network infrastructure that transfer data at Terabit/s speeds are becoming available for R&E networking and will continue to increase during the planning horizon.

### **Broadband Internet access**

Megabit rate Internet access is increasing and is likely to become the dominant form of connectivity to the Internet for both domestic and businesses. The increase in access rates at both the consumer and the supplier ends will result in continued growth in traffic volumes.

### **Network Tipping Point**

As with supercomputers it is likely that there is a tipping point for network bandwidth. Until this point is reached there is limited demand for the service. Once it is reached the applications that never existed will want bandwidth. Once this point is reached there is no turning back. Increasing bandwidth creates more new applications wanting to utilise the higher bandwidth.

*Impact: The continued growth in traffic volumes requires continued capacity planning and pre-emptive bandwidth upgrades will need to be done to keep ahead of demand.*

### **Adoption of IPv6**

Asia (specially China, Japan & Korea) are adopting IPv6 as the default standard for their Internet services. As they are not encumbered with historic IPv4 implementation the adoption rate of it is very rapid within Asia. Economic drivers of having to integrate with Asia will drive the adoption of IPv6 in other countries such as Australia.

*Impact: Migration to native IPv6 will need to be introduced during the planning horizon in order to maintain the connectivity and accessibility to the growing Asian market.*

### **Rise of carrier provided ubiquitous wireless (New)**

Carriers will increasingly provide wireless data services through their network. The speed of these will become comparable to Enterprise wireless technologies. These will be bundled in with mobile phone services and become increasingly ubiquitous.

*Impact: The role of a traditional enterprise network as a means of connecting people to information will change. The economy and value of some in-house services such as wireless Ethernet will need to be evaluated against these new services.*

### **Mobile PC phones (New)**

Mobile devices are now much more capable devices incorporating a rich range of features that rival those on the desktop PC. Coupled with other trends such as Web 2.0 applications it is possible that mobile devices will be increasingly used as 'on-the-go' replacements for the desktop PC.

*Impact: As this occurs owners of such devices will want to integrate with our services.*

### **Consolidation of infrastructure (New)**

An increasing trend is the consolidation of applications and systems into lesser number of units. This is occurring at multiple levels through technologies such as blade-servers and virtualisation.

**Impact:** *Consolidation will result in different challenges in managing the environment.*

### **Power over Ethernet (New)**

Power over Ethernet (PoE) standards were introduced some years ago that provided power to devices through the network cabling. While this has not yet gained widespread use due to lack of deployed infrastructure but as infrastructure is refreshed and PoE becomes more widespread there will be an increasing number of devices that assume that power is available via the network. This can reach a point that most user devices get their power from the network instead of a GPO.

**Impact:** *The network will increasingly be relied upon to provide **power** to end user devices.*

### **Increased Government Funding for Higher Education Institutions (New)**

One of the main themes of the new Labour government has been to focus on improving the education system in Australia. This is likely to increase the funding available for universities and reverse the previous governments trend of reduced funding.

### **Emergence of Asian universities & falling student numbers**

The university sector is faced with declining student numbers and is expecting a depressed income stream for at least the next three years. This is partially due to the increased availability of tertiary educational institutions within Asia which is absorbing many of the students who previously would have gone overseas for their higher education.

**Impact:** *The universities in Australia will have to distinguish themselves from the emerging universities in Asia in order to continue to attract students. Focus & funding is likely to be diverted towards programs that achieve this outcome. For Monash this is likely to be excellence in Research.*

### **eResearch Funding**

eResearch is a hot topic at the highest level within Australia with an eResearch coordinating committee being created to report to the Government on the formulation of a Australia wide eResearch framework. DEST funding priorities are shifting from infrastructure to content (applications, collaboration, research outcomes, educational content) and wider reach (broader R&E coverage). It is expected that there will be a significant amount of funding allocated to support eResearch in the coming years.

**Impact:** *This will offset some of the pressures caused by reduced funding and falling student numbers. There will be competing needs to provide high performance solutions to cater for eResearch needs, while at the same time implementing solutions that provide a very good return on investment. Solutions that think “outside the box” will need to be seriously explored in order to achieve a sensible balance between these two competing requirements.*

## Organisation Trends

**Organisational influences** are those that exist within an organisation. While there are many such trends within the organisation only the trends that could influence NIS are considered here.

### Triple Bottom Line Accounting

Monash is now doing triple-bottom-line accounting that takes into account not just financial aspects of its operations but social and environmental aspects of doing its business. As such there is increased focus on the environmental impact and goals to reduce this impact.

*Impact: Energy efficiency, product operational life-cycle and other such environmental considerations will become part of the decision making process.*

### New Data Center in Caulfield (**New**)

A new data center will be built in Caulfield with the construction commencing in 2008. When commissioned this will change the current design models used for systems.

*Impact: Current models and designs will need to be modified to accommodate the changes resulting from having the two data centers spread between two separate geographic sites..*

### ITS will be looked upon to be a Business Partner & Integrator for the University (**New**)

ITS is increasingly looked upon to become a partner in business solution design for the university and take a more active role in directing and guiding the building of university's business solutions.

*Impact: ITS and its groups will need to reorganise itself to become a business partner for the university and play an active role in shaping the business solutions.*

## Strategic Directions

### Strategic Themes

During this planning horizon all initiatives will be guided by the following strategic themes.

#### Reducing Complexity

As technologies get more sophisticated it tends towards increasing complexity. Complexity must be explicitly and consciously managed downwards. Doing so has benefits in supportability, reliability, usability and cost.

#### Increase Convergence & Open standards

Convergence of technologies will be a key focus during the planning horizon. The continued adoption of open standards to maximise flexibility and interoperability will remain a focus for the group.

#### Eliminate non-essential bottlenecks on the network

In order to cater for the high performance, high speed networks that is demanded for the future it is necessary that all components of the network operate at wire speed and does not have any bottlenecks. Historically devices used for features such as authentication, firewalling and caching

were not operating at wire speed and introduced bottlenecks into the network. Eliminating such bottlenecks will be a theme during this planning horizon.

### **Increase Network Availability**

With convergence of technologies onto one common network further increases the criticality of the network. The network has always been built with resilience and reliability in mind. This needs to continue with every opportunity taken to improve resilience and reliability of the network. Special attention needs to be paid to mission critical applications ensuring that they are provisioned with the maximum level of availability.

### **Improve Network Reach & Flexibility**

Monash's "Staff Mobility" initiative will see an increase in mobility of the workforce. Other trends such as work-life balance contribute also contribute towards the flexibility in where the workforce accesses the resources of the university. These contribute towards the need for being able to access the university network from any location. Building and configuring infrastructure to enable such access will be another theme.

### **Develop a Business Focus**

The University's demands of ITS is changing and ITS is increasingly required to become a business solutions partner and integrator for the university. To cater for this need the group should develop a business focus and be able to provide business solutions rather than just technical solutions.

### **Develop a Service Focus and adopt ITIL**

An ongoing theme within ITS is the gradual introduction and alignment with ITIL guidelines. With the increase in the number of Services that NIS is responsible for it needs to build a service focus based around the ITIL model and fit in with the ITS implementation of ITIL.

### **Identify Attractor Services**

Various opportunities exists to introduce applications and services that will act as attractors for staff and students to choose Monash university as their institution of choice. Exploring and introducing such applications where there is business benefit is to be another theme.

## ***Strategic Initiatives***

### **Network capacity**

This is a normal routine incremental expansion activity. This activity will come under some accelerating pressure over time from e-Research activities. Should expect progressively increasing budget impact over time as we move further away from the head-room provided by the last major expansion (NGN) project. The current network is Gigabit ethernet to the end-user wall-point , 10 gigabit ethernet within the core, 1 Gigabit ethernet or less within the WAN and to the internet. Wireless access is of course limited as it always will be to much lower (~Megabit) rates.

- Gigabit ethernet to most individual end-user workstations should be more than adequate throughout the planning horizon.
- Special purpose workstations and servers will move to 10 GE.

- Core network capacity (on-campus and inter-campus) will move to 10 GE and above during the planning horizon. 10 GE services are outside current funded scope for VERN. Should expect increased costs for attached transmission equipment and VERN long-haul.
- Network capacity demands between components of data stores, in particular between components of geographically distributed hierarchical stores will rapidly outstrip 10 Gbit/s due to the restore from tape to disk-cache delay problem in the TB to PB range – N.B. for SAN demands:
  - $100 \text{ TByte} / 10 \text{ Gbit/s} = 1 \text{ day} = \text{not really "near-line storage"}$
  - Some data store doubling times currently appear to be around the 12 month range, i.e. 10 fold increase in around 3 years.

## **Logical work-spaces**

The “Grid” model is one of “a multiplicity of collaborative virtual workspaces which span geographic and/or organizational boundaries, near and/or far”. Different data sets have very different characteristics in terms of volume, timeliness, distribution, workflow and protection (encryption, privacy, isolation).

In this section there is deliberate avoidance of the terms ‘Private VLAN’, ‘VPN’, ‘GRE’, ‘extranet’ or similar to describe the requirement as such terms typically imply some particular technological implementation, geographic scope, architecture and/or security isolation level.

NIS will be called upon, in conjunction with the ITS-IS IMS, Security and other sections, to construct such logical workspaces as overlays over the internet.

## **Network security architecture**

This “Grid” architecture model is quite different to the “enterprise” (firewall) model and different again to the “VPN” (trombone/island) model. Adjustments to the approach to network “borders”, firewalls, access controls and security will be required. Some of the components logically sit outside the institutional boundary. NIS will need to work with the ITS-IS Security group to develop appropriate architectures and solutions.

## **Storage Area Networks (SAN)**

The coverage of SAN will expand to include off-campus, inter-institution and using iSCSI. There will be a focus on research provision. Apart from the inter-institutional dimension, these enhancements are within the NIS SAN roadmap.

## **Wireless Networks**

The coverage of Wireless will expand to include improve management, inter-institution and easier access. Wireless service will be gradually expanded to become ubiquitous within the campuses.

## **VERN**

VERN is an important component in achieving NIS and e-Research objectives. VERNet is deploying optical fibre infrastructure throughout Victoria for inter-campus and inter-institutional purposes in the R&E space. It will connect to most sites of most research and university institutions.

## **Experimental Network**

- There is ongoing benefit in Monash and the sector in retaining an experimental “network” or logical overlay separate from the production environment.

## **Next Monash Network**

The next phases of the Monash network are to incorporate the strategic themes into the network fabric. These include,

- Devolve functions to the edge to eliminate central bottlenecks, gateways & complexity
- User-based rights/access
- IPv6
- PoE
- MPLS style virtualisation of the network

## **Convergence of Voice & Data Networks**

A key strategic direction is the convergence of the voice network onto the data network using VoIP technology. The convergence of technologies and implementation of VoIP and video conferencing under the auspices of the ICE programme will change the way the services are used and perceived. This change has the potential to be an inspirational showcase, which will show Monash to the world as an innovator in the deployment of creative high end but high reliability and mature production solutions.

## **Develop capability for exploratory & pilot projects**

With the rapid changes in the IT field it is important to be able to conduct small scale exploratory work on how new and emerging technologies might fit within the Monash environment. A process of engaging the research students within the university for such activities will be established.

## **Service Focus**

Historically NIS has been an infrastructure group with its primary responsibility being backend infrastructure. Due to the changing nature of the industry it is increasingly becoming responsible for **Services**. While the primary function of NIS is in a Horizontal role of Infrastructure Management it now has Vertical roles in Service Management. The Vertical roles of service delivery and support need to be recognized and appropriate resourcing and skills provided to aid an overall service approach. To address this change in focus and in keeping with ITIL principles the structure within NIS will be modified.

Strategically this could be addressed by recognizing ‘network services’ a vertical function and fit NIS into the ITS structure to better address the service aspects rather than just the Infrastructure aspects.

## **Attractor Services**

The following are identified as possible attractor applications that will support the universities strategic objective of attracting the best staff and students to become part of the Monash community,

- Extend network services to other residences (including to staff housing for visiting

academics/researchers)

- Major services accessible to native IPv6 users: e.g. so that people (e.g. in Asia) can see our web site in IPv6

## **Resourcing**

Many of the most strategically important production enhancements are currently listed in the “NIS Service Roadmap”. Strategic priority needs to be given to the activities listed in this Strategic Plan and the Roadmap.

It is important that we get more of our talented and highly experienced staff working on strategically important projects and enhancements so that we improve productivity towards enhancement outcomes.

Although it remains difficult to hire continuing staff, even where funding exists, the opportunity is always open to hire project-specific fixed term appointments to carry out funded activities. The way is therefore clear for us to immediately use this new Technology Refresh activity category to hire fixed term task-specific staff to progress these activities. We have the funding for this. All would be funded via existing NIS Production budget and recoveries.

The approval process for resourcing is a challenge and the ‘domino effect’ of internal applicants being appointed to roles can significantly delay appropriate & timely resourcing.

### **Operational Priority**

The strategy in service provision is to provide automated resilience of infrastructure where possible. A resilient infrastructure implies that there is added complexity. So that whilst a resilient infrastructure provides a service that is more immune to simple faults, it can add risk of a major service problem. This can be due to failure or confusion caused by resiliency mechanisms. There is continuing expansion of the services listed above. It is anticipated that this will continue<sup>1</sup>.

The priority focus within NIS is Operational. Over the last few years the data network service availability figures have improved. This is for a variety of reasons included improved standards, processes and adherence to both. There is a risk of complacency both within NIS, ITS and Monash:

- The better the Operations processes are the fewer operational failures and meet more of their service targets.
- As a result there is less perceived need for those processes and the temptation to remove focus, profile, resources and commitment.
- This often has devastating results for the organisation. Operational failures start to occur and Service targets are not met.

As a result Operations can move through peaks and troughs of success and failure if not addressed properly. Therefore it is essential that, even when things are going well, focus on Operations processes is maintained even though this may be hard to justify to senior ITS and Monash Management.

To help maintain operational focus, there are two main initiatives within NIS:

#### **1. Creation of a Network Operating Centre (NOC)**

The NIS network monitoring systems will be combined into a NOC (Network Operating

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<sup>1</sup> NIS responded to approximately 6000 service requests in 2006 - as distinct from incidents

Centre). This will include :

Webnet (Configuration Management)

Statseeker (Availability and capacity Management)

Wireless management

Alarms mechanisms

KPI production

Cacti (Availability Management)

Subnet address management

## **2. Application Aware Networking**

To enable applications to better utilise Monash network services there will be a focus on how to ensure any new applications, can effectively work and successfully operate on the Monash University network. By taking part in the service, this will provide ITS NIS first hand knowledge of the proposed "new application", to ensure that the application is supportable on the Monash network.

In collaboration with faculties and departments, this will provide an opportunity to investigate and highlight any possible impacts before proceeding from a test environment to production. This will help mitigate any risks of the "new application" will have on the Monash University network. The process will ensure that the proposed application has been adequately assessed and analysed for operability, risks and consequences.

## ***Budget & Financing***

The University's Strategic Cost Management (SCM) arrangements are to identify the real cost of different services. Any subsidies should be explicit and transparent. The direction specified within ITS is for self funded services.

Pursuant to SCM and in anticipation of the proposed restructure of the ITS budget, the NIS budget is internally structured along service lines. The ITS budget is grouped and viewed in terms of "Operational" (staff component of operational), "Production" (non-staff component of operational) and "Development" (centrally prioritized major projects). When the NIS budget is mapped back to the ITS budget structure this causes loss of clarity and detail giving rise to administrative error in transcribing, mapping, recording and analysing financial data.

There has been a move by ITS in 2006 towards 'cost analysis' of services across ITS by the introduction of Clearcost however this was not undertaken at the level of detail that exists within the NIS budget planning and so the lack of clarity has been compounded (rather than alleviated) by the introduction of the Clearcost application.

To eliminate these cross-subsidies, confusion, lack of detail and clarity, and to improve the ability to provide meaningful financial reporting, it is recommended that the NIS "cost recovery"-oriented budget be administered along service lines, and separately from the ITS "cost centre"-oriented budget.