

**Date:** 10 August 2006

## **Review of EICT Architecture for UCD**

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# UCD EICT Architecture Review

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### 1 Introduction

In 2003 University College Dublin undertook a five year (2004 through 2008) project to design and implement an IT Architecture, in support of its EICT strategy, which would address both current IT issues and establish a sound basis for future growth and development.

The key goals of the new architecture were to:

- Meet the user requirements and objectives of the EICT strategy
- Provide the essential availability and performance levels
- Accommodate growth and change – i.e. scalability
- Address the conflicting demands – balancing flexibility and reliability

This project was divided into three phases:

- Phase 1 – Achieve reliability & performance
- Phase 2 – Cater for growth & change
- Phase 3 – Provide redundancy & recovery facilities

This covered all the major Systems, service areas and supporting infrastructural platforms for the College.

Since the commencement of the EICT architecture project a number of changes have occurred within UCD and external environments which directly impact the EICT architecture and influence recommendations on future work to be undertaken. These include:

- Ongoing Structural changes in UCD, including new schools, closure of WAN sites etc.
- Expansion in student residences, requiring cabling and services.
- Increased levels of Student PC & Laptop ownership
- Increased demands for full wireless penetration
- Full adoption of UCD Connect and Blackboard
- Expansion and changing scope of business systems
- Introduction of Modular Teaching Programs in UCD with semesterisation
- Ongoing development of MAN interconnectivity by HEAnet
- A raised research profile, targeting “Leading Research Status”
- Establishment of a distributed Operational/Support model in Computing Services and with expected extension of support windows
- Proposed upcoming developments including the Gateway project, Science and Technology expansion etc.

UCD Computing Services has commissioned a review of the implementation of the IT Architecture to provide a status update on the current work to date on the EICT Architecture programme, identify any changes required, taking into account changing environments and technologies, and to recommend how best to progress its implementation to maximise return on investment and provide an IT Architecture that meets business requirements. This report highlights the main areas of compliance, deviations from original plans, and makes recommendations on a prioritised basis for continuation of the IT Architecture plan implementation.

## 2 Key Findings & Recommendations

The ongoing implementation of the EICT architecture plan has proven to be successful to date in providing the sound IT Architecture required to meet UCD's requirements and provide a sound basis for future growth and expansion.

The defined targets for deliverables in respect of infrastructure, service delivery and budget have generally been met to date.

Delivery targets and priorities for delivery have changed the implementation of the plan going forward to encompass:

- Environmental changes
- Scope changes
- Altering requirements for systems and services
- Increased scaling requirements.

The following sections detail the recommended approach over the final 2 years of the architecture plan based on the findings from the review. Priorities are based on the relevant performance and availability measures, together with identified changes in the demand for services over the initial period.

### 2.1 Outstanding Work

Implement all major outstanding work on current EICT plan to include:

#### **Networks**

- Implement zoning for all buildings and major services
- Implement redundancy for WAN links and infrastructural services

#### **Business systems:**

- Migrate all outstanding systems to the new platform

#### **E-Learning**

- Review capacity for next 3 yrs and scale accordingly

#### **Access Services**

- Implement common authentication & authorisation service

#### **Operational Monitoring and Management**

- Implement a central Enterprise Data Centre approach to monitoring/management
- Extend UCD's proposed centralised monitoring to include Business Systems, Learning and Research
- Continue to enhance procedures to align them with recommended best practice

#### **File and Print**

- Review future plans for storage and file/print delivery

#### **Security**

- Develop full security framework to be extended to and implemented on all major systems and networks.
- Develop and implement authentication infrastructure plan

#### **Storage**

- Implement overall storage plan and infrastructure

## 2.2 Additional Works

Additional works recommended which were outside the original scope to include:

### Networks

- Implement Core Switched Backbone

### Business systems

- Revise the Business Systems Architecture to align the architecture with business plan accommodate new business systems
- Develop a medium-term Information Systems and Integration Plan to encompass new Business Systems Requirements in providing a more definitive/prescriptive architecture to requirements for the medium term

### Content Management

- Define an architecture for the implementation of a content management solution

### File and Print

- Implement alternative application delivery for laptop environment
- Implement alternative web file storage delivery environment

### Business Continuity Management

- In order to develop and implement a Disaster Recovery plan the University will need to consider formulating a BCM strategy and implementing a Business Continuity Management process for key Business systems and key infrastructure service elements.

## 2.3 Phase III

The following are Phase III deliverables which are currently at early stages of implementation

### Operational Monitoring and Management

- Implement Enterprise data center, with associated monitoring and management

### Disaster Recovery

- Develop and implement a formal Disaster recovery plan, Select and implement initial recovery hardware for selected services

## 2.4 Future Developments

A number of changes in the Campus Environment will require further architecture planning to encompass:

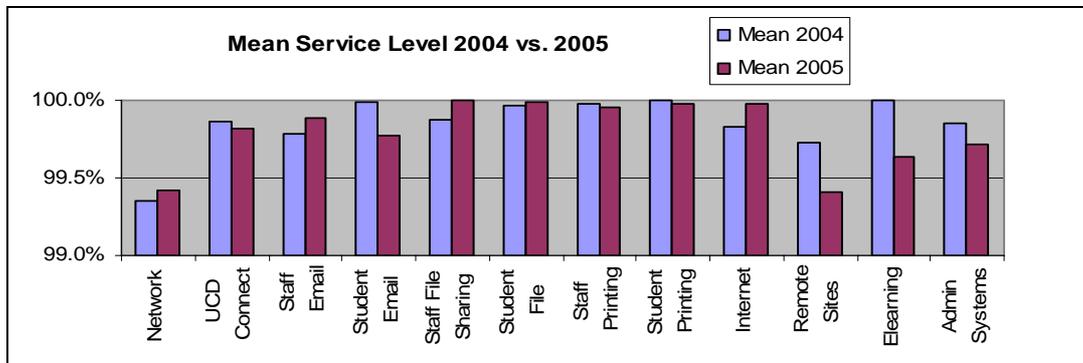
- Requirement for 100% wireless coverage on the campus
- Full laptop ownership/100% deployment University laptop programme.
- New campus developments e.g. the Gateway Project, new Science development etc.

## 2.5 Service Levels:

The EICT Architecture plan set targets for availability of services to be achieved over the period of investment, based on standard industry measures of IT services i.e. "uptime" of any given service within its operational window.

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All areas met the annual mean target for service delivery of 99.5% except:

- Network 99.4%
- Remote Sites 99.4%

The total number of weekly service breaches for 2005 was 22% lower than for 2004. However the total duration of service outage increased to 32% for the same period. Remote sites and Network accounted for close to 50% of the total outage time in 2005, causing these two particular areas to be in breach of overall service level requirements.

Target service levels are realistic for all areas and are achievable for the areas in breach with completion of outstanding work.

Incidents which have caused service or system outages have been remedied through:

- Reviewed procedures
- Ongoing architectural implementation in the case of network issues
- Increased levels of monitoring
- Application of software patches to remedy bug issues in software.

The impact of network related outages is being reduced through the ongoing process of implementing zoning and network modularisation. Remote site outages will be mitigated through the implementation of redundant links. Increased monitoring, centralised collection and processing of monitoring data, combined with more efficient procedures for operational maintenance and system maintenance should dramatically reduce outage figures.

More details on particular service outages can be found in Appendix A at the end of this document.

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### 3 Detailed Findings

#### 3.1 Networks & Infrastructure

The network aspect of the architecture is comprised of two distinct areas:

- (1) Re-cabling of existing older buildings from co-axial to new network standard
- (2) Zoning and structuring of the campus network to improve reliability

#### Network Re-Cabling

**EICT Objective:** Re-cable older campus buildings to the new network standard.

**Five Year Budget:** €5.5 million      **Cost to end 2006:** €4.6 million

**Status:** - All major buildings complete, 24,000 network points installed ahead of schedule. This is 5,000-6,000 beyond what was expected at this stage.

**Outstanding Work:** - A small number of campus buildings and residences to be completed (including Richview, Belfield House, older residences)

**Additional Work:** - A second Data in Centre the Daedalus Centre (outside original scope) was completed in 2006 at a cost of €1.4 million. This item has been accounted for under the Network Cabling line in the Architecture budget (it is excluded from the 4.6million above).

**Overall Status:** **GREEN** Ahead of schedule, on budget.

#### Network Zoning & Backbone

**EICT Objective:** To ensure the availability of a reliable, fast network with redundancy for each campus and Server Farm Pod.

**Actions:**

- Implement network "Zones" for each campus and server group
- Implement wide area backbone for interconnectivity
- Implement redundant connections for sites & server groups
- Introduce 24x7 monitoring & management
- Provide separate & extended network facilities for Research
- Move experimental network use to "open zone"

**Five Year Budget:** €3.2 million      **Cost to end 2006:** €1.0 million

**Status:**

- Virtual LANs are in place for majority of campus.
- Zoning of buildings is ongoing with all WAN sites, and six campus buildings completed, and three ongoing. Three major systems have also been segmented using POD architecture s including:
  - E-Learning
  - Connect
  - Managed Business Systems
- Redundant wide area link implemented for Belfield campus to HEAnet for Internet Access

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- St Vincent's and Mater Hospitals are now connected to Belfield over HEAnet MAN, Crumlin will be connected shortly. Blackrock is still connected using ATM link.
- Infrastructure Services redundancy implemented utilising Campus services for WAN sites
- Wireless access coverage has been greatly increased with the current implementation of c.400 wireless access points
- Open network zone will not be implemented

- Outstanding Work:**
- Building zoning – implement POD segmentation for all major buildings on Belfield Campus
  - Implement server isolation and zoning of all major systems area.
  - Implement redundant wide area links need to be implemented for outlying campus sites including:
    - St Vincent Hospital
    - Crumlin Hospital
    - Mater Hospital
    - Blackrock
  - Implement redundant local infrastructural services in WAN sites

**Additional Work:** The core backbone is being transitioned to a Switched core backbone network.

- Service Availability:**
- Average yearly availability is 99.4%, for both Network and Remote Sites, below expected target of 99.5%
  - Breaches in service level availability resulted from a small number of incidents primarily a result of incompleteness of zoning and lack of redundancy for Wide area links
  - Target is achievable with completion of outstanding work.

**Overall Status:** ORANGE Behind schedule, below budget.

### Recommendations

- Implement outstanding work to include:
  - Building zoning – implement on Belfield Campus
  - Implement server isolation and zoning of each major system area.
  - Implement redundant wide area links for outlying campus sites.
  - Implement localised infrastructure services redundancy for outlying campus sites
- Implement Core Switched Backbone
- Develop a plan for the implementation of 100% wireless coverage on the campus
- Develop a plan to accommodate in the network architecture full laptop ownership/ 100% deployment University laptop programme
- Revise the architecture to accommodate future projects e.g. the Gateway Project.

### 3.2 Business Servers

**EICT Objective:** To provide a secure, high performance, redundant environment for business critical services (such as Finance, Payroll and Student Registration.)

#### Actions:

- Consolidate server environment to support current services and initial expansion
- Replace hardware with new environment to provide necessary scale, performance and redundancy to support ASPIRE project goals

**Five Year Budget:** €0.85 million

**Cost to end 2006:** €1.12 million

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- Status:**
- The Consolidation and resilience on Alpha platform complete
  - Implementation of Linux platform complete
  - Migration of e-Financials and Student systems to the new platform has been completed.
  - Implementation of disaster recovery elements for the data tier
- Outstanding Work:**
- Migration of Business Objects to the new platform
  - Migration of HR system to the new platform
  - Migration of CorePay to the new platform
- Additional Work:**
- Implementation of additional applications and/or modules.
  - Implementation of major upgrades to applications
    - Completed Banner 7 upgrade
    - Vista/SRC Budget and planning application re-architected
  - Accommodate new systems into architecture e.g. Research Management application
- Service Availability:**
- Average yearly availability is 99.6%, on target.
  - A small number of monthly breaches in service levels were a result of hardware failure and procedural, which have been addressed.
- Overall Status:** **ORANGE** Behind schedule, above budget.
- Notes:** Changes to requirements, expansion in scale of systems use and speed of upgrade required significant additional capacity. The implementation of best of breed, multi-vendor solutions have proven complex to implement on the new environment. Lower levels of consolidation were possible than initially predicted. In this context the original budget was too low and an additional allocation of € 400 K was provided to cater for these issues. (Revised budget is € 0.85 + € 0.425 = € 1.275 million)

### Recommendations

- Implement outstanding work to include:
  - Migration of Business Objects to new platform
  - Migration of HR system to new platform
- Develop a medium-term Information Systems and Integration Plan to encompass new Business Systems Requirements in providing a more definitive/prescriptive architecture to requirements for the medium term
- Revise the Business Systems Architecture to accommodate new business systems

### 3.3 E-Learning

**EICT Objective:** To provide the information technology infrastructure to support e-learning requirements.

**Actions:**

- Scale e-Learning environment (Blackboard) to support growth and to provide redundancy
- Phase out "On-line Classes" environment & migrate

**Five Year Budget:** € 0.65 million

**Cost to end 2006:** € 0.23 million

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- Status:**
- New e-Learning platform was deployed ahead of schedule catering for 5,000 users per day and a total population base of 25,000 users.
  - The non-strategic e-Learning platform AUC on-line class has been retired on schedule.
  - Trials of mobile computing and laptop carts are currently underway.
- Outstanding Work:**
- Removal of single points of failure in e-learning platform
  - Review capacity for next 3 yrs and scale accordingly
- Additional Work:**
- Implement a pilot infrastructure for next generation eLearning
  - Continue mobile computing infrastructure implementation
- Service Availability:**
- Average yearly availability is 99.6%, on target.
  - Increased outage is primarily a result of teething problems incurred during the migration to the new e-learning platform. Modifications to maintenance procedures and increased database capacity have resolved these issues.
- Overall Status:** **GREEN** On schedule, below budget.

### Recommendations

- Implement outstanding work
- Architect and deploy new e-Learning platform pilot environment.
- Continue mobile computing infrastructure implementation

### 3.4 Other Services & Web

**EICT Objective:** To provide the information technology infrastructure to support electronic content and document management requirements

**Actions:**

- Plan future platform for web and content management
- Identify and categorise document management solutions for individual business areas

**Five Year Budget:** €0.15 million      **Cost to end 2006:** €0.21 million

- Status:**
- Research (RIS) system migrated to Oracle & managed service
  - Web servers and architecture selected & implementation underway
  - Disaster recovery has been implemented between UCD and HEAnet for Web site.
  - A Document management application was procured as separate niche solution for Banner and e-Financials
- Outstanding Work:**
- Review requirements and implement a scaling program as required
- Additional Work:**
- A Content management system is currently under consideration (outside original budget)
- Service Availability:**
- Web average yearly availability is 100%, on target.
- Overall Status:** **GREEN** On schedule, above budget.
- Notes:** Savings under other headings cover the budget variance in this area.

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### Recommendations

- Identify a standard document management solution that interoperates with niche applications but becomes the UCD standard.
- Identify record management requirements (typically compliance driven – FOI – check auditor/financial requirements etc.). UCD should consider bottom up approach under the guise of overall data lifecycle management as distinct from top down enterprise records management solutions which have high cost and high failure rate
- Define an architecture for the implementation of a content management solution
- Review of ISP requirements for growing resident population

### 3.5 Research Services

**EICT Objective:** To provide the flexible IT infrastructure required to support research and to allow flexibility in deploying experimental and advanced technology projects.

**Actions:**

- Create shared location for deployment of research servers with dedicated bandwidth, power and support facilities
- Provide network services catering for research projects
- Provide “open” network area for experimental projects
- Provide access mechanism for electronic journals & content

**Five Year Budget:** € 1.14 million**Cost to end 2006:** € 0.34 million**Status:**

- A new Data Centre for research equipment hosting is in place
- A shared computing cluster implemented for use by research projects in the college
- A development cluster is deployed for use by IT Research
- A specialised team deployed for research computing
- High speed access to off-campus sites is over Gigabit MAN connections to HEAnet
- Monitoring of clusters and support are provided solely by IT Research
- Video conferencing facilities are available for real time collaboration.
- A program for provisioning of firewall protected research clusters has recently commenced.

**Outstanding Work:**

- Implement defined service levels and monitoring
- Review and implement storage requirements for research
- Review on-going network requirements & architecture for increased service provision to Research in respect of bandwidth/connectivity, security, data and compute facilities.

**Overall Status:****GREEN**

On schedule, under budget.

**Notes:**

A significant budget requirement for storage will impact the position of this area in the next two years. A shortfall in budget is anticipated.

**Recommendations:**

- There are two Gigabit connections to HEAnet MAN from Belfield. While both are required to provide redundancy for UCD, the second link could be used exclusively for Research on a day to day basis and revert to normal Campus traffic only on failure or disruption of the primary link.
- Provision of Research related services and the ‘formalisation’ of these services based on proper Service Level Agreements to include:

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- Hosting services
- Visualisation Services including the implementation of a new visualisation cluster/CAVE in Daedalus

### 3.6 Access Services, UCD Connect & Email

**EICT Objective:** To provide a fast, reliable, secure environment for access to EICT services both on and off campus.

**Actions:**

- Implement and scale UCD Connect environment to provide access, email and basic services from any location
- Implement common authentication & authorisation service
- Provide physical access points at campus locations – wireless & wired to accommodate growth in user devices

**Five Year Budget:** € 1.35 million

**Cost to end 2006:** € 1.02 million

**Status:**

- A highly scalable resilient UCD Connect platform deployed catering for an average c.11,000 users per day, 1,600 concurrent and a total population base of 15,000 users of students and staff
- Old staff and student email systems phased out.
- Full capacity in place for all staff and 2 years incoming students.
- Increased physical access has been implemented with c. 24,000 fixed network points and c.400 wireless APs throughout the campus.
- Collaboration services established and delivered via portal, e-Learning platform.
- An Active Directory pilot has commenced – intended to enable provision of an enterprise directory and possible replacement for Novell e-Directory.
- An application delivery pilot using thin client technology project is about to commence (Q3/Q4 2006) to determine technical feasibility, sizing and suitability of a planned new application delivery infrastructure

**Outstanding Work:**

- Review capacity requirements for next 3 years and scale accordingly
- Common authentication and authorisation needs to be specified and incorporated into network design.
- Develop identity integration and directory services strategy and review architecture for solution implementation

**Service Availability:**

- Connect average yearly availability is 99.8%, on target.
- Staff e-Mail average yearly availability is 99.8%, on target.
- Student e-Mail average yearly availability is 99.8%, on target.
- Connect outages resulted from bug issues in software which were rectified through patching. The largest of these outages also affected Staff e-mail
- One major outage for student mail while running on the original PMDF platform

**Overall Status:**

**GREEN**

On schedule, on budget.

**Recommendations:**

- Implement outstanding work

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- Identify and implement appropriate applications to meet original Collaborative requirements e.g. peer to peer file sharing, file synchronisation and self-service backup
- Develop and implement a mobility strategy for UCD Connect and in particular staff and student email to cater for increased demand for laptop and remote access
- Address authentication and authorisation for connecting to the network and accessing services and applications
- Revise storage capacity and align with UCD's storage solution
- Review implications of the provision of 100% wireless coverage and increasing levels of PC and laptop ownership to the full campus population

### 3.7 File and Print

**EICT Objective:** To provide reliable and secure file, print and application services for teaching and personal use.

**Actions:**

- Review file / print / application technology environment
- Provide distribution facilities for software – ftp & CDROM, Terminal Services
- Plan application requirements with individual Faculties & deploy locally or centrally as appropriate
- Implement personal & group file access via UCD Connect

**Five Year Budget:** €0.45 million

**Cost to end 2006:** €0.11 million

**Status:**

- Existing architecture maintained and made more resilient
- Further SAN storage has been implemented to scale for demand

**Outstanding Work:**

- Review future plans for storage and file/print delivery
- Maintain environment for duration of architecture

**Additional Work:**

- Implement alternative application delivery for laptop environment
- Implement alternative web file storage delivery environment

**Service Availability:**

- Staff file average yearly availability is 100%, on target.
- Student file average yearly availability is 100%, on target.
- Staff print average yearly availability is 100%, on target.
- Student print average yearly availability is 100%, on target.

**Overall Status:** **GREEN** On schedule, below budget.

**Recommendations**

- Implement outstanding work.

### 3.8 Monitoring & Management

**EICT Objective:** To implement the operational processes necessary for the proposed IT Architecture, and reach the new target availability and reliability standards.

**Actions:**

- Automate monitoring & escalation activities, with 24x7 response for key infrastructure
- Initiate project to improve operational procedures based on industry standards such as "ITIL"
- Create "Enterprise Data Centre"

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**Five Year Budget:** €0.5 million**Cost to end 2006:** €0.37 million

- Status:**
- A dedicated Operations Manager has been appointed to span the major areas of operations/monitoring.
  - Basic monitoring is in place for all major systems. This is being transitioned to a centralised view of all systems; however a full "Enterprise view" is not yet completed.
  - Two sets of services have been outsourced
    - HP monitoring & management for Business Systems
    - SUN monitoring for UCD Connect & email environment
  - In-house monitoring for network infrastructure, e-learning, file & print
  - Helpdesk operates from 08.30 through 18.30.
  - A trial basis on-call rota to provide out of hours support
  - Service level measurement windows (09.00 -21.00) do not align with support windows

- Outstanding Work:**
- Consolidated monitoring environment to be implemented.
  - Enhancement of system monitoring, to provide business services management view, real time performance collection and automated analysis.
  - On-going process improvement to align with best practice Industry standards and meet UCD's requirements

**Overall Status:** **GREEN** On schedule, on budget.

### Recommendations

- Implement outstanding work
- Review service support windows to ensure they are adequate. Consideration to frontloading the on call hours to provide this cover for a few hours prior to service windows to ensure any issues arising out of hours are rectified for the main business hours.
- Review impact of altering measurement windows to align with starting time for support windows e.g. change to 08.30 -20.30
- Extend UCD's Operational Monitoring/Management to incorporate
  - Business systems
  - E-learning
  - Research

### 3.9 Authentication & Security

**EICT Objective:** Provide a security framework which will accommodate the diverse needs of the various university enterprise services, providing maximum flexibility while at the same time catering for a complex set of university enterprise applications

#### Actions:

- Appoint a Security Officer
- Develop and implement a defined security framework with defined roles and responsibilities, policies and procedures
- Implement security on defined perimeters for the network using physical logical and management controls
- Implement an integrated authentication scheme authenticates all user access (wired and wireless) to the network and to core services based on common directory based identity.

**Five Year Budget:** €0.4 million**Cost to end 2006:** €0.14 million

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- Status:**
- A Security officer was appointed appointed mid 2006
  - Adopted the IS 17799 Security Management approach the Educause Risk Assessment framework.
  - Forming a strategic level an advisory group to define risk and security strategy for UCD admin systems
  - Currently conducting Wireless authentication trials.
  - Implemented a number of “common” security controls (firewalling, IDS, bandwidth management).
  - Implemented decentralised firewalling with centralised governance for initial research project.
  - Currently conducting a risk analysis and security policy development program for selected critical restricted data systems within Business Systems grouping.
  - Performing risk and security posture assessment of a number of business assets
  - Provides an automated vulnerability assessment service, as well as engaging in specific vulnerability assessment exercises across targeted systems.

- Outstanding Work:**
- Develop full security framework to be extended to and implemented on all major systems and associated implementation.
  - Develop and implement a client remediation strategy, including a network authentication system to authenticate real-users from wired and wireless networks.

**Overall Status:** **ORANGE** Behind schedule, on budget.

**Recommendations:**

- Implement outstanding work
- Roll out decentralised firewalling with centralised governance to all required systems.
- UCD should consider leveraging existing/current operational systems to facilitate specific security controls e.g.
  - Integrating vulnerability and configuration management
  - Integrating event and log management

### 3.10 Disaster Recovery Facility

**EICT Objective:** To provide the IT infrastructure required to ensure the necessary level of business continuity for the University.

**Actions:**

- Investigate options for recovery site (e.g. UCD campus, HEAnet, commercial)
- Select site & implement initial recovery hardware with network and access facilities (for selected services)

- Status:**
- UCD Web site has Disaster Recovery in HEAnet
  - Data tier in Business systems has Disaster Recovery implementation
  - The new data centre will provide Disaster recovery facilities for network services and possibly for other services such as critical business systems

- Outstanding Work:**
- Formalise Disaster recovery plan, select and implement initial recovery hardware for selected services

**Overall Status:** **GREEN** Phase 3 of original Plan.

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**Note:** The development of the new Data centre will provide a DR site capability on campus, even though it is geographically close to the current data centre as it is not co-located with separated services and facilities including power.

**Recommendations:**

- Review requirements for disaster recovery and develop and implement a plan to achieve required level of DR.
- While not in scope for this plan, UCD should formulate a BCM strategy and Implement a Business Continuity Management process to:
  - Identify and prioritise critical business processes, systems and services
  - Ascertain ownership and responsibilities in all systems identified
  - Formulate and document BCM in line with BCM strategy
  - Disseminate BCM information to relevant personnel
  - Implement a schedule for testing/rehearsal to ensure that plans work and ensure that required changes to plans and procedures are documented and implemented.
- Responsibility for co-ordination of business continuity management processes should be incorporated into UCD's organisational structure.

### 3.11 Storage

**Five Year Budget:** €0.8 million                      **Cost to end 2006:** €0.22 million

**Status:**

- Dedicated SANs are currently in place for specific system areas: file / print, UCD Connect, Business Systems and Direct attached storage for Research.
- UCD is currently tendering for a University wide data storage solution

**Outstanding Work:** - Implement overall storage plan and infrastructure

**Additional Work:** - Substantial increase in the anticipated storage demand due to changing environment – which will include research, personal, business, teaching, application storage requirements and must cater for access, scalability, and redundancy.

**Overall Status:** **ORANGE** Altered requirements.

**Notes:** Significant budget requirement for storage will impact the position of this area in the next two years. Preliminary budget estimate: €2 million.

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### 4 Summary of Overall Position

This section provides a summary of the overall position of the EICT project.

**Five Year Budget:** € 15.445 million      **Spend to end 2006:** € 10.95 million

**Status:** Near completion of architecture in major project areas:

- Network Cabling
- UCD Connect
- eLearning
- File / Print
- Other services & Web
- Data Centre (outside original scope )

Substantial outstanding work in some core areas:

- Network zoning and backbone
- Storage for all areas

Focus required on procedures & operations (Phase III)

- Implement enhanced monitoring
- Implement security infrastructure
- Contingency and Disaster recovery planning

Changing scope requires re-assessment of requirements for

- Business systems – align architecture with business plan
- University laptop programme – architecture for delivery
- Content management – define architecture

**Budget Planning:** Estimated budget for the following 2 years across prioritised areas.

Investment required in storage:	€ 2.0 million
Outstanding Network zoning:	€ 1.5 million
Monitoring & Security	€ 0.3 million
Research computing:	€ 0.5 million
Revised business systems:	€ 0.6 million
Scaling of other architecture areas:	€ 1.0 million
<b>TOTAL:</b>	<b>€ 5.9million</b>

## Appendix A – Summary Status Table

This table summarises the status of the project to 2006.

	<i>5 Year Budget</i>	<i>Cost to end of 2006</i>	<i>Status</i>	<i>Service Level</i>	
<b>Network Cabling</b>	€5.5 million	€4.6 million	GREEN .	Ahead of schedule, on budget	
<b>Network Zoning and Backbone</b>	€3.2 million	€1.0 million	ORANGE	Behind schedule, below budget	99.4% - below target
<b>Business Servers</b>	€0.85 million	€1.12 million	ORANGE	Behind schedule, above budget	99.6% - on target
<b>E-Learning</b>	€0.65 million	€0.23 million	GREEN .	On schedule, below budget	99.6% - on target
<b>Other Services &amp; Web</b>	€0.15 million	€0.21 million	GREEN .	On schedule, above budget	100% - on target
<b>Research</b>	€1.14 million	€0.34 million	GREEN .	On schedule, below budget	
<b>Access, Connect, E-Mail</b>	€1.35 million	€1.02 million	GREEN .	On schedule, on budget	99.8% - on target
<b>File &amp; Print</b>	€0.45 million	€0.11 million	GREEN	On schedule, below budget	100% - on target
<b>Monitoring &amp; Management</b>	€0.5 million	€0.37 million	GREEN .	On schedule, on budget	
<b>Authentication &amp; Security</b>	€0.4 million	€0.14 million	GREEN .	Behind schedule, on budget	
<b>Disaster Recovery</b>			GREEN	Phase 3 of Original Plan	
<b>Storage</b>	€0.8 million	€0.22 million	ORANGE	Significantly altered requirements	

## Appendix B – Recommendations (Quick wins)

The following are recommendations which can be effected easily with high level of return in respect of impact.

**1. Recommendation:** On-call support is currently being piloted (This is not 24x7 rather an extended support window beyond normal working hours support). UCD should investigate the possibility of providing on-call out-of-hours support which will target specifically a window extending a couple of hours prior to the commencement of the working day.

**Benefit:** Outages which require human intervention and occur outside normal working hours, especially in the early hours of the morning may not be rectified in time to meet the main operational service windows

**2. Recommendation:** Utilise the 'original links to WAN sites as a backup to the HEAnet MAN connections.i.e. Radio links for Crumlin and St Vincent's be used as redundant links and investigate the possibility of implementing a similar solution for Mater Hospital.

**Benefit:** Remove redundancy on links to extended campus sites

**3. Recommendation:** Implement secondary infrastructure servers for DHCP, DNS and at the following remote sites:

- St Vincent's Hospital
- Crumlin Hospital
- Mater Hospital

**Benefits:** Removes the requirement to utilise Campus infrastructural servers for contingency.

**4. Recommendation:** Prioritise the ongoing program for isolating buildings through zoning.

**Benefit:** Reduces the impact on the network by isolating the impact of the failure to the zoned area if to a failure in a specific building or area on the network occurs.

**5. Recommendation:** In the eLearning environment use Hardware Load Balancers instead of round robin DNS. Enable SSL between clients and NLB, and then keep the eLearning servers in secure network only accessible through the NLB.

**Benefit:** Secures e-learning environment and removes potential single point of failure

**6. Recommendation:** Develop and implement a mobility strategy for UCD Connect and in particular staff and student email

**Benefit:** Addresses the growing demand for mobility in accessing what are perceived as essential day to day services such as e-mail

## Appendix C -Details of Service Availability

This appendix provides a more granular view of the major issues which caused outages or reduced service capability.

### Network

Mean up time 99.43%. Outage time 1075 minutes/8 incidents (resulting from 2 procedural, 6 Architectural issues).

Architecture related issues were the predominant causes of outages and have been mitigated through continuing segmentation of the network. When zoning is complete these incidents will only isolate the impact to local buildings or server pods. Procedural issues have been remedied through tighter monitoring of these procedures.

### UCD Connect

Mean up time 99.82%. Outage time 332 minutes/7 incidents (resulting from 1 Operating System, 6 Application related issues).

One outage resulted in down time of more than 50% (170 minutes) of total due to a software bug in attached storage which caused overrun of a scheduled outage for upgrade. Other outages were relatively minor and predominantly due to software bugs. Systems were patched resulting in no recurrences for this category of event since April 2005.

(2 outages in January 2006 totalling 95 minutes resulted from LDAP corruption requiring patch to fix and 3 incidents of degraded service in February due to bug in connection software for blackboard, patched and fixed)

### Staff Email

Mean up time 99.89%. Outage time 208 minutes. 3 incidents (resulting from 3 Operating System related issues)

One major outage was a result of Connect failure (170 minutes) to a software bug in attached storage which caused overrun of a scheduled outage for upgrade.

### Student Email

Mean up time 99.78%. Outage time 420 minutes. 1 incident (resulting from 1 Application related issue).

One major outage resulted from a failure of the old e-mail application early in 2005. This has since been retired and no outages have occurred since.

### Remote Sites

Mean up time 99.43%. Outage time 1104 minutes. 7 incidents (resulting from 2 Hardware, 1 Operating System, 2 Procedural and 2 Architecture related issues).

Two outages relating to the WAN links resulted in 590 minutes of the total. Migration to HEAnet MAN and implementation of redundancy for WAN links should ensure no

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recurrence of this form of outage. Two outages involving overruns of scheduled outages for upgrading systems accounted for 360 minutes of the total.

### E-Learning

Mean up time 99.64%. Outage time 674 minutes. 6 incidents (resulting from 6 Procedural related issues)

Two related outages involving a database corruption caused 515 minutes outage in July. This issue has been resolved through implementation of a new database maintenance plan. The remainder of the incidents related to space issues and have been resolved through extra capacity and modified database maintenance procedures.

### Admin Systems

Mean up time 99.72%. Outage time 521 minutes/5 incidents (resulting from 3 Hardware and 2 Procedural related issues).

Three outages due to Hardware failure resulted in 180 minutes outage. Components replaced by Vendor in two cases and in the third the result was a faulty patch panel. Procedural outages resulted in 285 minutes outage. The largest of these (165 minutes) was caused backup schedule conflict. Review of procedures and tighter monitoring has greatly reduced the likelihood of recurrence.