

UCD EICT Architecture
2009 – 2013
Executive Summary

Prepared for
UCD

By

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EICT Architecture 2009-2013

Table of Contents

1	Introduction	3
2	Approach to Architecture Development 2009 - 2013	4
2.1	UCD Current Context.....	4
2.2	Current Architecture.....	5
2.3	Key Issues and Recommendations	6
2.4	Implementation Costs	9
3	Benefits of Approach.....	10
4	Appendix A: System Availability Target Levels	11
4.1	Availability Levels 2004 – 2008	11
4.2	Target Levels of Availability 2009-2103.....	12

1 Introduction

In 2003 University College Dublin adopted a five year strategy and implemented an EICT Architecture plan which set out key performance objectives and an associated program of work funded by a capital investment from the University. This Architecture (2004-2008) addressed IT infrastructure issues and provided a sound basis for future growth and development to meet the requirements of the University and its user community, congruent with the Universities overall strategy.

The key goals of the 2004-2008 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 University. Appendix A shows the impact of the Architecture on system availability levels.

A review of the Architecture was performed in 2006, which assessed the implementation and re-evaluated changes within UCD and external environments, which directly impacted the EICT architecture, and made recommendations on future work to be undertaken within the life of the EICT architecture (2004 -2008).

UCD IT Services have now published the IT Strategy 2009-2013, which supports the University Strategic Plan to 2014, and will deliver the related technology, systems and information management infrastructure, The IT Strategy details a number of prioritised requirements based on detailed information gathering exercises across the user community, combined with benchmarking against other equivalent Universities.

In drawing up the IT Strategy particular attention was given to:

- The characteristics of its user community, specifically in the areas of mobility and use of on-line access to University resources
- The capacity and scope of services required by the user community through 2013
- The expected changes in information technology on a global level

The IT Strategy has articulated this by setting high level goals and objectives across all areas of IT Services.

In order to facilitate the development of the ICT Architecture, UCD IT Services have commissioned Ward Solutions to document the current architecture and to design an architecture which will meet the requirements of the University 2009 – 2013. This entails:

- Documentation of current architecture
- Review and upgrade of services catalogue
- Development of an EICT architecture to meet the University's strategic goals

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Project Remit

Design a 5 year ICT Architecture as input to and congruent with overall ICT and University Strategies for 2009-2013, focusing on the following key elements:

- The adequacy of existing infrastructure and the requirements to replenish/refresh to meet and sustain existing and new service levels
- The requirement for new architecture/infrastructure to deliver new services and service requirements
- The ability of the infrastructure to continue to provide sufficient performance in the case of any major single outage of key architecture components

2 Approach to Architecture Development 2009 - 2013

The ICT Architecture is designed to deliver significant business and user benefits over the course of its implementation, specifically:

- Provide supporting infrastructure to meet the objectives of the IT strategy
- Maintain and enhance availability of the current architecture
- Meet the demands of users in respect of continuing growth, and seamless access and delivery of services.
- Deliver new and expanded services in line with technology advancements
- Ensure that the architecture protects against any major single failure

UCD IT Services have identified key IT priorities required to meet the demands for increased capacity and delivery of technologies appropriate to the UCD's mission and strategy:

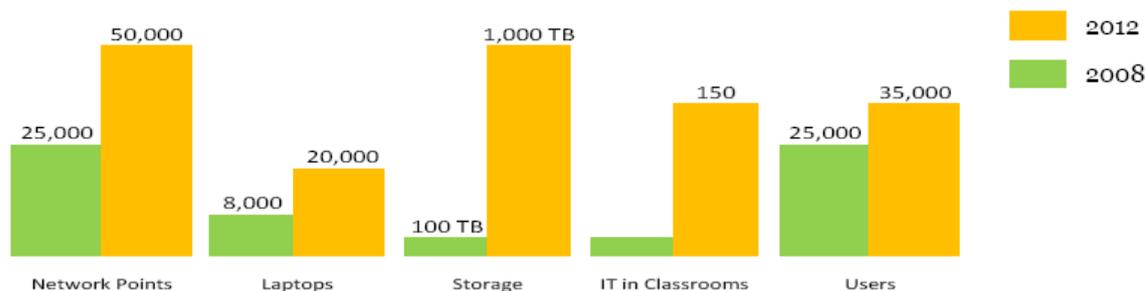
- Maintaining the performance and capability of the IT infrastructure and services through investment in the refresh of technology and networks
- Improving web access to systems and enhancing the availability of information for users across all areas including business systems, mobile and portal services, and UCD web
- Meeting increasing capacity requirements through the implementation of a collaborative UCD and National data centre on the Belfield campus
- Addressing deficits in classroom technology through continued implementation of ICT facilities in the classroom
- Developing skills and services around the management of eContent and data management capability

2.1 UCD Current Context

Resulting from the successful implementation of the EICT Architecture 2004-2008 UCD now has a fully up to date network in place together with high availability platforms for systems and services. The network provides stability and open access to services for all users in UCD's Community. Services are provided in expanded windows of operation and are generally available 24x7.

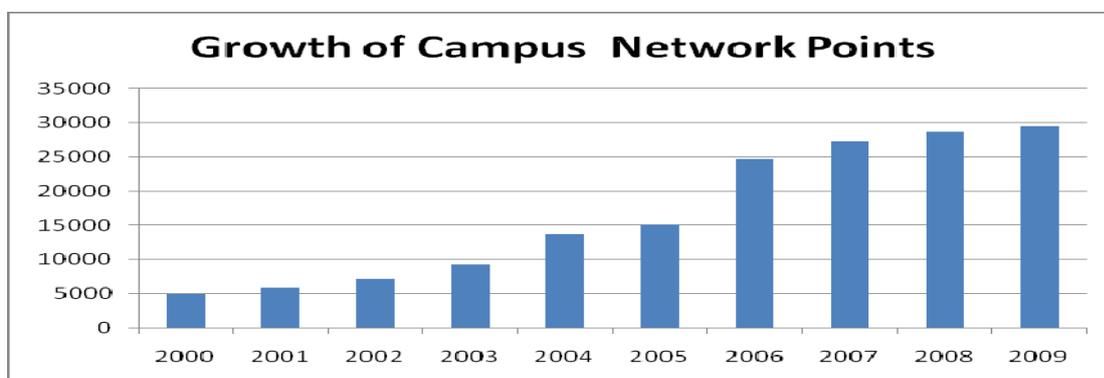
The current architecture is designed to cater for a user community of 25000 users. There has been a consistent level of growth in the UCD user base during the life of the current architecture, which is expected to continue over the next 5 years, and the architecture will require an ongoing programme of refurbishment and expansion in order to cater for this growth.

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Projected Growth of Infrastructure 2008 – 13 (above)

The campus continues to grow and the user community continues to evolve becoming more diverse, mature and sophisticated. Technologies are evolving with increased requirements for mobility and access to web delivered services. This is coupled with emergence of new commercial offerings in respect of web services, storage and collaboration facilities from large providers. The historic growth pattern is illustrated by network point expansion (below).



There are major strategic and organizational changes in UCD, including:

- Growth in research activity and increased demand for new and advanced services for research users
- Modularisation and semesterisation with consequent demands for IT enabled processes for users
- Development of 4th level with emerging new customer base of graduate students and innovation alliance
- Campus development encompassing new activities and expansion of existing activities e.g. residences, retail, commercial, research, conference etc.
- UCD Education Strategy and UCD Research Strategy

2.2 Current Architecture

The current architecture has proven very successful to date in ensuring stable and consistent delivery of services to users. It has achieved many of the objectives set at the start of its implementation.

Services are now provided over a network which has high levels of reliability, availability and redundancy. The fundamental principal of dividing the enterprise architecture into physical, logical and functional boundaries (zones) has for the most part been implemented.

Access capability has scaled to accommodate the large scale growth in user population through the increased number of wired access points and the increase in wireless coverage on the campus. Physical locations are segmented into building or location based zones with redundant connections to the network backbone and to the Internet.

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Services are delivered from secure redundant server pods. The implementation of a second centre in Daedalus and the strategy of splitting of key services and infrastructure across both data centres have provided an element of protection against major disasters/issues occurring in one data centre or on certain parts of the network.

UCD sets target service levels of 99.5% availability for all key services¹ which typically have been met or exceeded as the architecture has matured. The current enterprise architecture will require replenishment, additional capacity, optimisation and evolution in order to maintain existing services and service level requirements.

The future infrastructure must accommodate the expected growth in the campus and user population. It should meet demands and expectations for increased mobility, ease of access to University services, delivery of identified new services, and the changing business requirements of the University.

2.3 Key Issues and Recommendations

The following areas in the current architecture require to be addressed in order to sustain the current levels of stability and delivery and to improve these to cater for further growth in additional services to a larger community with higher levels of availability and performance.

- Network, servers and systems architectural platforms, and equipment will age and impede ability to deliver. A detailed replenishment and replacement program should be implemented to cater for sustaining and increasing delivery capabilities of current and future service requirements. Failure to keep equipment up to date will result in degradation of services and eventually will require reconstitution of all systems and servers.
- Improved target availability levels should be considered for 24x7 critical systems (e.g. Networks, UCD Connect, Student System). An increase to 99.9% from the current 99.5% will require greater monitoring and management services, ensuring that outages for these systems is kept to a minimum.
- The data centre utilisation is reaching capacity and the older computer centre has had intermittent issues with air-conditioning and availability. Migration to a new data centre is planned and should be implemented as a key element of the architecture. This will ensure a stable data centre environment and ensure that sufficient capacity is available to cater for fast growing Research and University requirements.
- The philosophy of anywhere/anytime access is sometimes compromised by network restrictions. This needs to be re-visited to ensure that all users are can access services regardless of location or network type.
- The ICT network infrastructure underpins all service delivery in the University. The common services infrastructure for DNS and DHCP (which is currently coupled with authenticating host access to the network) has become highly customised and difficult to support. A serious failure of the common services infrastructure would result in major network issues on the campus. It needs to be replaced with a less bespoke solution and decoupled from direct authentication.
- As data storage requirements continue to increase, there is a continual requirement to increase capacity and management of the data systems. While data for Business systems and IT Services are backed up, there is no backup of research data. As the volumes of data continue to grow, its management will become more complex and a Data Management Strategy will be required by the University.

¹ Performance figures are published on regular basis at <http://www.ucd.ie/itservices/itplanning/itperformance/>

(Appendix A provides a brief overview of the performance figures 2004-2008)

EICT Architecture 2009-2013

- The large variety of services being delivered, combined with the growing and diverse population of users, results in complex account management requirements. This should be addressed through more integrated account provisioning and management.
- Remaining single points of failure for key services need to be removed and key services need to be divided across data centres. UCD should ensure that, in the event of any major failure, failed over solutions will continue deliver a service within acceptable performance and availability levels to end users until full services are restored.
- The current proxy service is overloaded and has caused performance degradation, particularly on the wireless network. The service should be reviewed for its suitability and performance, as its main purpose is no longer web caching,
- The mail-hubs and email virus protection systems are not capable of supporting the volume of e-mail traffic on the network and have caused degradation in the email performance over the past year and should be reviewed. E-Mail is a critical communications tool across the whole community and any loss or reduction in performance of this service impacts the entire community of users.

2.3.1 Architectural Proposals

The current architecture infrastructure is fundamentally sound and the design implemented is well placed to meet the future demands for IT in the University. It will require a continuous program of replenishment and refurbishment to ensure that it continues to deliver services efficiently and continues to provide a solid foundation going forward.

It will underpin future expansion, integration of new and changing technologies, and the delivery of new services required to meet the needs of the University and its user community. It is intended to build on the stable architecture that is currently in place. In order to deliver on the objectives it is proposed to adopt a multi-stranded approach to the architecture over the coming years:

Strand 1 - Critical Measures

Consolidate and optimise current major key infrastructure elements through:

- A program of replenishment and replacement, specifically in the areas of:
 - Networking equipment and networking infrastructure
 - Server equipment for key application systems
- Implementation new data centre capacity and migration from existing older Computer Room
- Increasing availability levels for 24x7 critical systems and support with enhanced monitoring and management services
- Eliminating outstanding single points of failure

Strand 2 - Growth & Demand

Increase capacity, scalability and capabilities of the architecture to meet projected UCD demand through:

- Expanding networking infrastructure to cater for campus growth and PRTL developments
- Expanding mobile and wireless access, integrating cloud services to cater for new use patterns
- Scaling systems, storage and servers to meet the required levels of growth
- Streamlining access and authentication services to ensure ease of use for all customers.
- Implementing DR services in collaboration with other Universities and HEAnet

EICT Architecture 2009-2013

2.3.2 Key Projects

Key objectives relating to all areas of the architecture have been identified and a program of work is recommended for each in order to implement these objectives. These are aimed at consolidating the current environments through replacement and refurbishment, providing highly available environments for the key server blocks, and ensuring the necessary monitoring and management is in place to meet the required service levels.

Strand 1 - Critical Measures

These major projects refer to critical measures required to consolidate and optimise current major infrastructure elements:

- Implement a schedule to replace and replenish network equipment on a rolling basis.
- Develop a new data centre on campus and migrate the current Computer Centre
- Implement a server and storage replacement schedule for all current equipment
- Expand wireless and mobile coverage to meet growing user demand
- Implement additional redundancy for core and data centre switches
- Implement revised managed services to meet new target availability levels
- Review network monitoring, reporting & management to meet enhanced availability levels
- Implement a replacement programme for mail hubs, virus scanning and spam control
- Develop Connect as the major gateway for user services, integrating with external services

Strand 2 - Growth & Demand

These major projects will provide the core capability to increase capacity and scalability of the architecture meet future growth and demands of the user communities:

- Implement a programme to expand network in line with campus growth and PRTLII projects
- Upgrade common services infrastructure (DHCP, DNS etc)
- Implement a full Disaster Recovery plan
- Implement storage expansion plan and integrate with national storage infrastructure (eINIS)
- Scale digital content delivery environments to support growth in eLearning & eContent
- Develop cloud compute and storage services to complement UCD resources
- Implement identity management, access and account provisioning services
- Implement appropriate data-warehouse infrastructure to meet UCD demand
- Work with Building Services to implement classroom technology plan
- Review VLE hosting service to meet capacity and expansion requirements
- Review migration options for student email to external service
- Develop an information architecture for unstructured data for UCD Business users
- Develop data management architecture for research and other large scale data-sets

EICT Architecture 2009-2013

2.4 Implementation Costs

The projects have been costed over a 5 year period and broken down into 3 major areas:

Capital: Implementation of new elements of architecture

Replenishment & Replacement: Essential replenishment and replacement of current equipment and servers

Monitoring & Maintenance: Costs incurred by ongoing annual Management & Monitoring of 24x7 services

	Capital	Replacement / Refurbishment		Management & Monitoring	
		Annual	Total 5 Years	Annual	Total 5 Years
Infrastructure Replacement Cycle					
Network Equipment Replacement		€640,000	€3,200,000	€50,000	€250,000
Server Equipment Replacement		€350,000	€1,750,000		
Network Cabling & Wireless Refurbishment		€100,000	€500,000		
Storage Equipment Replacement		€150,000	€750,000		
Security Services				€100,000	€500,000
Service Growth & Developments					
Business Servers & Datawarehousing	€150,000			€200,000	€1,000,000
E-Learning & Digital content delivery	€250,000			€150,000	€750,000
UCD Connect	€200,000			€150,000	€750,000
Research Services	€250,000				
File and Print	€100,000				
Monitoring, Management & Authentication	€250,000				
New Storage Fabric	€1,500,000				
New Data Centre	€10,000,000			€50,000	€250,000
Annual sub-total:		€1,240,000		€700,000	
5 year Total	€12,700,000		€6,200,000		€3,500,000

3 Benefits of Approach

The architecture will provide the necessary infrastructure to support and deliver services in line with the University and IT strategies. It will provide a stable infrastructure that will scale sufficiently to support additional capacity, integrate with new and changing technologies, improve web access and enhance availability of information across all areas including business systems, mobile and portal services, and UCD web.

Over the last five years the architecture has grown and evolved to provide a modern high performance network which supports the delivery of a comprehensive range of services with high levels of service availability to the University user community. Key services are provided from secure redundant server pods, UCD has seen a large growth in the adoption of Teaching & Learning technologies and extensive round the clock use of the Connect portal and e-Learning services. A new data centre has been implemented which provides hosted data centre services, compute clusters, and storage.

The proposed architecture will have the following benefits to the University:

- Ensure that key elements of the architecture are maintained and refreshed to guarantee that current service levels and performance can be sustained and enhanced in line with expectations, future growth and technology changes
- Provide a blueprint for growing the architecture to accommodate delivery of additional services and integrating new technologies across all areas of the IT environment
- Provide a blueprint for improving user experience through a program of improving web access to systems and enhancing the availability of information for users across all areas including business systems, mobile and portal services, and UCD web.
- Provide a resilient IT environment capable of providing adequate levels of performance and availability even in cases of failure of any major components
- Provide a flexible framework which can be tailored to the University's changing demands over the lifetime of the architecture project

The implementation of the architecture will ensure that the University can adopt a flexible approach to planning for future growth and development of IT Services within a technical environment, which is capable of expansion, and which will meet the changing demands and service requirements of its users.

4 Appendix A: System Availability Target Levels

4.1 Availability Levels 2004 – 2008

The current levels of availability have improved consistently over the life of the current architecture. The following figures provide a graphical representation of the trends for the years 2004 to 2008.

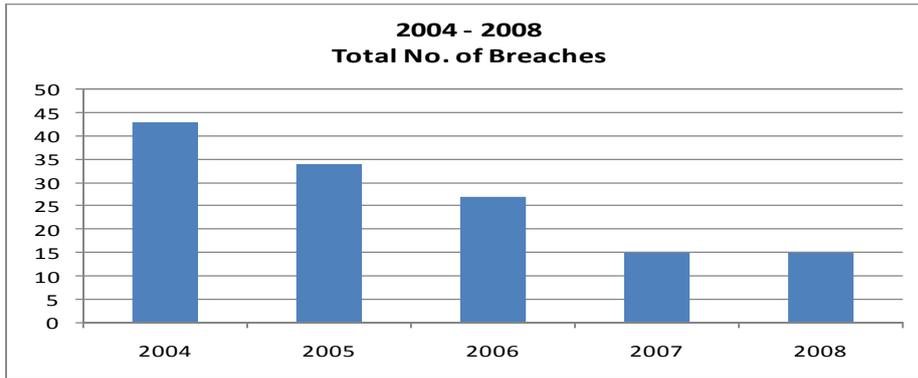


Fig 1.a. No. of Breaches of Service Availability

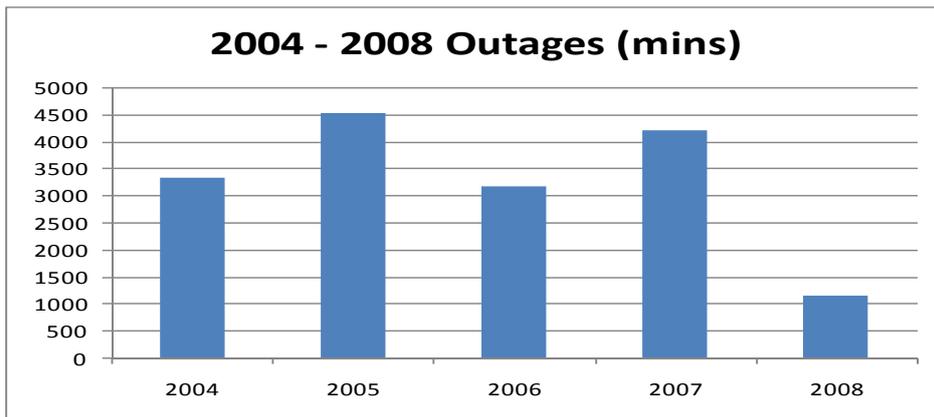


Fig 1.b. Total outages per annum

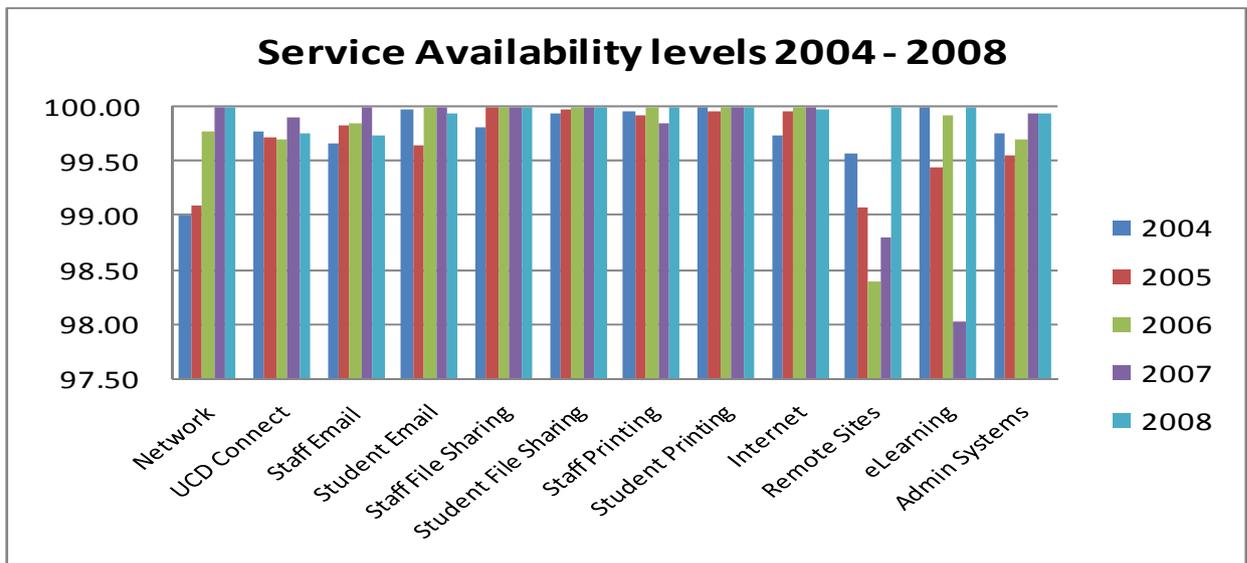


Fig 1.c. Comparative Service Availability per annum

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4.2 Target Levels of Availability 2009-2103

The following are the recommended Levels of Availability for new Architecture (2009 – 2013) for Critical systems

Service	Window of Operation	Window of Support	% Availability (Measured for Window of Support)
Internet Access (HEAnet)	24x7x52	12x5x52	99.9
WAN Infrastructure	24x7x52	12x5x52	99.9
LAN Infrastructure	24x7x52	12x5x52	99.9
WLAN Infrastructure	24x7x52	12x5x52	99.9
Networking Services	24x7x52	12x5x52	99.9
Remote sites	24x7x52	12x5x52	99.5
Connect Portal	24x7x52	12x5x52	99.9
Staff E-Mail	24x7x52	12x5x52	99.5
Student E-Mail	24x7x52	12x5x52	99.5
Blackboard	24x7x52	12x7x52	99.9
Banner	24x7x52	12x7x52	99.9
HR	24x7x52	12x7x52	99.5
Finance	24x7x52	12x7x52	99.5
Staff File Sharing	24x7x52	12x5x52	99.5
Student File Sharing	24x7x52	12x5x52	99.5
Staff Printing	24x7x52	12x5x52	99.5
Student Printing	24x7x52	12x5x52	99.5

Note: Detailed levels of availability and for all systems are given in the main Architecture document and include level of criticality and recovery point objective (RPO) and the recovery time objective (RTO) for all IT Services.