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| **[**Increased Access To IT Services and Enhancing the Student Learning Experience through Virtualization**]** |
| **Academic Institution:** University of Northampton  **Course of Study**: HND/BSc(Hons) Computing – Computer Networks Engineering |
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Project Proposal

Executive Summary

Network resource access and demand has drastically increased on the university’s IT resources over the past few years. With currently over 300 networked computers and more than three times as many students, the student experience has been affected and is approaching a critical state with the number of students on the up every year.

The purpose of this project is to research a best effective and sustainable network solution to address the lack of sufficient IT resources and access and enhance the overall student learning experience.

The first aim of the project is to design and implement a virtualised solution that implements parts of the relatively new computing phenomenon of “Cloud computing” and embraces the concept of a thin client. This solution involves a Server deploying virtual machines on demand that will provide access to at least 250 students simultaneously using remote access.

The second aim is to ensure that this solution is effective to the demands that are faced by the university today such as security, energy consumption costs, IT management and support costs including future scalability.

The results of this project will be a very modern, green and effective network solution that will see both students and staff enhance their learning and working effectiveness. There shall be huge financial savings experienced due to the reduced need for physical machines and lowered running overheads; which could see more investments from the savings going back into enhancing the student’s experience.

The design and prototype implementation of this project is anticipated to be complete within 5.5 months, but will involve further performance related analysis and tuning over several months and as demand is expected to grow. The project build cost would be a modest £3495.35 excl. VAT (an initial hardware and software licensing projection).

Introduction

University of Northampton’s Avenue campus is the main campus for the School of Science and Technology, located in the recently refurbished Newton Building. The campus also houses departments for Art, Design, Technology, Architecture and other facilities such as workshops, laboratories and computer aided design suites, spread over different buildings.

The current computer network at the campus is a reasonably large and ever expanding computer network which covers different buildings and is populated with over 300 networked computer workstations and other devices.

The campus has several open-access facilities at various locations. Demand for these facilities is always high, with lengthy queues forming at peak times, not helped by increasing student number and nature of students, i.e., full-time, part-time, distance learning, and their expectations.

This proposal will outline a networking solution that will adequately meet the current network’s demands shortfalls. We propose to bring into action a solution that is of high quality and reliable but also affordable for the university to implement. The result of our solution will have a two-fold effect of increased access to IT services for students therefore a more enhanced student learning experience and lowering the cost of IT administration in terms of both labour and energy consumption.

Project Description or Program

The current University of Northampton Avenue campus’ computer network is quite large and ever expanding; covering multiple buildings and populated with over 300 networked computer work stations and other peripheral devices. The campus offers several open access facilities to students across an array of location within the campus. The demand for these facilities and services is always high and failing to adequately meet the demands of students at peak times. With a surge in student numbers (full-time, part-time and distance learning) over the last couple of years the strain on the resource requirement has become visible.

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We believe that students who pay a tuition fee should be entitled to use the resources that are made available to them when they need to. For instance, from specialist software packages such as CAD/CAM software to the very familiar Microsoft Office software have to be purchased separately and installed on student’s personal computers if they need to use them out of campus. For students who have already paid a tuition fee to the University, we believe this is an unnecessary and sometimes unaffordable luxury. Therefore, a solution which enables students and staff alike to access such IT resources (software, access to servers etc.) from outside campus will be another step towards encouraging students to engage fully in their university academic experience.

We are proposing an innovative networking solution that will reduce the lengthy queues that form for network access, enhance the student learning experience by offering a more flexible always on round –the-clock network and resource access. The solution in proposition has the long term benefits of lowering IT support and administrative costs as well as lowering the energy consumption bill. To top it all the solution will be very scalable to future upgrades and transformation of the current network into a more modern efficient, flexible, secure and green network.

The proposed solution’s main objective is to create a network solution that will enable flexible stress free access to network resources (software, applications, files and folders) at any time of the day or night. The second objective being to tune the solution to be in line with the University of Northampton’s computing and access policy; including security, resource management and budget constraints.

With the core objectives having been set the project proposal see’s the following research, implementation and testing goals as fitting:

* An extensive evaluation of the existing network and its implementation, usage , security and management policy; enabling a seamless integration of any or all of the existing practices and features that are determined to be mission critical.
* A review of existing University intranet and both physical and logical security policy and the security policies utilised within comparable organisations.
* Implement, test and fine-tune a new server system based on a Microsoft Windows Server 2008 r2 operating system. This server will support all the current existing network requirements and include further enhanced features that would improve efficiency and performance of the old solution. Proposals on the cost of the server software and hardware shall be made available in project budget section for approval for funding.
* Implement Virtualization of the desktops on the server through Microsoft’s Remote Desktop (RD 7.0) protocol. As there is a huge demand for networked desktop and software applications we propose to create virtual machines running Microsoft Windows 7 operating system. The virtual machine shall have all the applications, software, and access to folders and directories that are approved to the user according to the security policy of the university (which may need to be modified to incorporate the new network features this project will bring about). The virtual machine is to exist as a remote desktop that’s part of a networked system and made accessible through a standard internet connection (including low bandwidth - dialup) to a minimum of 250 simultaneous users.
* To implement a well-structured Microsoft Windows server 2008 r2 Active Directory group policy that maximises security using the highest levels of encryption technologies including VPN(Virtual Private Network) and SSL 128bit (Secure Socket Layer). The group policy implementation will ensure users belonging to a particular group for example, computing; students to be served with only applications and software they need for their course including access to drives and folders they use with the necessary privilege restriction according to the university’s policy.
* Configure server remote access security policy by adding a Terminal Access Controller Access-Control System (TACACS) which is a remote [authentication](http://en.wikipedia.org/wiki/Authentication) [protocol](http://en.wikipedia.org/wiki/Protocol_(computing)) that is used to communicate with an authentication server and ensure that authorised users are given right of access.
* Configure the router with the necessary security access parameters according to the university’s access policies to ensure that users connecting to the Local Area Network are doing so securely and the data they are placing on the network is the approved safe data as per policy statement.

Timeline and Milestones

The solution we propose to you will take up to 5.5 months from the date the project proposal being submitted and approved. Below we have a break-down of the project and the allotted time scales for each function.

**Please see Appendix 1 for Gantt chart**

The project has a multitude of befits to the university, the students and staff. Below is a list of some of the benefits that shall have their impact experienced with an almost immediate effect of the project being rolled out:

* Increased access to resources as the virtual machine is on 24 hours a day.
* Increased staff productivity and student learning as it’s no longer restricted to the hours the university is open and the computers are available (for students). The physical networked computers in the university’s open access areas will have less traffic as people just need to use their laptops or home computers and connect to the virtual machine, giving nearly the same effect of being connected to the Local Area Network physically.
* The enhanced learning experience results in students taking a fuller and more positive approach to experiencing university academics which could results in better grades as the learning process can revolve around a 24 hour timeline suiting students differing study patterns and ultimately improve student satisfaction.
* Lowered network management and administrative bills as the total number of physical computers required in the open areas could be reduced as well the amount of computers in use at any given time is lowered therefore the amount of system crashes lowers in turn pc support call outs are lowered.
* With a minimum of 250 simultaneous connections to the remote desktop (virtual machine) on a standard Windows Server 2008 r2; the university could in turn reduce the number of switched on networked computers and lower the electric bill and reduce its carbon footprint.
* The solution is scalable and has the scope of virtualizing the university’s entire data centre lowering the total number of physical servers, cooling systems, uninterruptable power supply systems (UPS) hence a lower power bill and IT management cost.
* A further spin off benefit of this virtualized solution would be the future implementation of online assignment submission.

Budget

The following is a short list of the main components required for the completion of the project. We have factored in a reasonable budget constraint on the hardware and software required for the project to materialise.

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| Component | | Cost | Min. Requirements & inclusive packages |
| Microsoft Windows Server 2008 r2 Enterprise Edition | | £1777.35 excl. VAT | |  |  | | --- | --- | | Minimum Processor Requirements | 1.4GHz Processor | | Recommended Processor Requirements | 2 GHz Pentium Processor or Higher | | Minimum Memory Requirements | 512MB | | Recommended Memory Requirements | 2048MB | | Media Requirement | DVD ROM Drive | | Minimum Storage Requirements | 10240MB | | Recommended Display Requirements | Super VGA (800x600) or higher res. | |
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| IBM System x 3650 M3 | £1718excl. VAT | | |  | | --- | | 2U dual-Socket Server featuring up to 2 Intel \*Xeon\* processor 5600 series | | 18 DIMM sockets, 1333MHz DDR-3(18 RDIMMs, 144GB max) | | IBM ServicePac -3 year onsite limited warranty on parts and labour | | Upgrades to 3 years 24x7 Onsite Repair with a 4hour response £490 excl. VAT | |
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\*\*Budget is subject to change should extra hardware be required, for example, a new router and a new switch.

***\*\** Hardware and software evaluations see appendix2 (Windows Server) and 3 (IBM x3650 M3)**

Evaluation

The project will be prototyped under lab conditions and thoroughly tested to ensure that it can withstand the strain and resource demands of multiple users at the same time.

The project like any hardware related network project may be susceptible to failure or malfunction. The biggest threat to the project not performing as required according to our research is down to hardware mainly with issues such as the following factoring in:

* Bandwidth demand. The university may have to upgrade their internet or wide area link according to user access demands. If the connection is low speed and there is a large number of users requesting resources of the Local network via the internet there might be a reduced quality of speed and visual representation of data onto their screens as a result of the bottleneck effect that might arise.
* The type of server hardware. The server processors and memory modules might not be up to the standard required to meet the demand that might arise once the project is live and therefore result in reduced speed and quality of service for the student and other end users.
* The routers and switches in the current network might need upgrading if they are not responsive enough to the user data demands.

To ensure that it’s performing as required we shall enlist some software to help us benchmark optimum performance and the least desired performance levels. There are inbuilt software applications that give a graphical representation on the performance of particular operating system and hardware modules such as:

* Power Meter counters
* Windows Performance Tools (WPT) Kit
* Windows Performance Monitor

Other open source or commercial versions are available, and their recommendation is subject to review after researching into them.

Even after rolling out the network onto the Local Area Network for live access by the intended users, the network and server performance shall continue to have stress, access and security tests carried out with fine-tuning according to access trends that the network administration team picks up. Some performance enhancements might be limited to the budget in place for the necessary hardware and software purchases required, therefore a balance and compromise might have to be attained between performance and resource availability.

APPROVALS

**Prepared By** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: / /

Project Manager

**Approved By** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: / /

Project Supervisor