
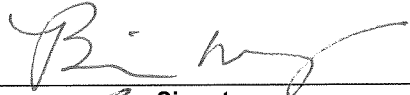



#1117

NDSU Technology Action Plan Request

I. Action Plan Introduction and Authorizations

NDSU ORGANIZATION OR UNIT			
Department of Computer Science			
Project Duration (3 years maximum)		From: (5/16/11) Start of Summer 2011	To: (8/17/12) End of Summer 2012
Type of Project (Check one)	New	Previously Submitted	Renewal
Total Technology Fee Request	\$66,847		
Project Director (Must be NDSU faculty or staff)	Campus Address: IACC 258 A19 Phone: 701-231-7786 Fax: 701-231-8255 E-mail: Adam.Helsene@ndsu.edu		
Name (Type or Print)	Signature	Date	
Project Director Adam Helsene		3-1-11	
Unit Head Brian Slator		3/1/11	
IT Division Consultant	Signature	Date	
Galen Mayfield		3/1/11	

Executive Summary (maximum of 175 words)

This project will be a pilot project for the use of virtual desktops and applications for student, staff, and faculty use on campus.

Successful deployment of virtualized desktops and applications is expected to reduce year-to-year maintenance costs of labs and workstations as well as improve availability of computing resources in buildings and classrooms that do not have the space for new computers and labs.

We will test and deploy multiple virtual desktop infrastructure solutions and determine the characteristics of those solutions in the context of in-class usage, out-of-class usage, and in the context of an academic institution (as opposed to a business environment).

The scalability, performance, and availability, and usability of these systems will be assessed and reports produced during and after the project. These technologies will be tested in both in-classroom and out-of-classroom settings to determine if it is viable to deploy across the entire campus for various departments and the general student body.

NDSU Technology Action Plan Request

II. Project Overview

1. How does this project meet student needs?

This project, once deployed, will allow students to use software required for coursework and other academic purposes from multiple locations across campus, including their personal devices (e.g. laptops, tablets, phones).

2. What audience does this project directly serve? What audience is indirectly served? How many students are affected?

This pilot project will directly affect many students enrolled in courses offered by Computer Science. Courses such as CSCI 122 and CSCI 159 are targeted as courses in which to use this technology specifically because they require specialized software and are taken by students from across the entire campus.

The entire student body is indirectly affected as we will be focusing on the viability of deployment for other departments and the entire campus as well as usability by students.

3. For projects that target a subset of NDSU's students, please describe the possibility for broader application in the future.

Staff in various ITS divisions have expressed interest in using this technology to improve their own operations and improve the student experience that those departments deliver. Should this project be a success, potential campus-wide or department-wide deployment can be considered and planned using this project as an example and guide.

4. Describe both the immediate and long term impact of this project.

This project, in the short term, will allow us to gather information on the usability and scalability of virtual desktop technologies in the context of our University.

The long term impact is in the results of the project, which may help ITS and other departments around campus to make decisions regarding the deployment and usage of this technology.

5. Who will pay for ongoing expenses following the technology fee funded portion of this project (e.g., who will replace hardware or software after it has reached its end of life)?

The Department of Computer Science will be responsible for the ongoing expenses related to the equipment and licenses provided for this pilot project as long as those equipment and licenses are for the use of students and classes related to the department.

6. Describe how this project will follow NDSU's best practices in information technology. (Please make sure the NDSU IT Division staff you consulted signs in Part I of this form.)

Each component of the project will be evaluated and implemented in ways that are consistent with NDSU and NDUS policy. Extra care will be taken to protect access to management functions of the infrastructure and the underlying storage.

For each major component, a ITS specialist will be consulted during implementation to ensure that best practices are being followed.

7. What service on campus is most similar to the one proposed here? How does this project differ?

This project is similar to services offered by Desktop Support and Classroom Technology, which provide desktops and software to students. This project does not intend to be dramatically different from those services, instead, it aims to discover if and how those services can be implemented and extended in a different way which can improve the operations of those departments and improve the student's usage of NDSU-provided software and computer systems

NDSU Technology Action Plan Request

III. Project Description

Computer virtualization is a recently-developed technology that allows for a single computer to run multiple instances of other operating systems or applications in 'virtual machines'. These virtual machines act much like a physical computer, allowing a small set of high-powered servers to present multiple, separate desktops or sessions to different users at the same time. Some of the motivations of using such technology include central management of virtual machines, more efficient updates, customized sets of applications for different users or departments, and added redundancy and performance when using older or less powerful computer hardware.

There are a number of different restrictions around campus limiting the potential use of computing resources in the classroom and outside of the classroom. There is a shrinking amount of free space for more computer labs in various buildings, while the student population and computer usage continues to grow. Many students use different computing platforms, such as Windows, Mac OSX, Linux, Android and iOS. However, software packages are typically Windows-only, so students using other devices need to seek out an ITS-provided computer on campus, which are limited resources that are often in high need.

Given the lack of space for, and cost of, new computer labs, adding more computer labs is not a good solution to these problems. Virtualized applications and desktops will allow students to use their own devices, as well as campus-owned, cheaper 'thin-client' devices to access computing resources on campus. There are fewer limitations on deployment of new computer labs, as thin clients take up less space, and are cheaper than full desktop systems. Students could even use their own laptops or other mobile computing devices and have the same level of access to software and computing resources as other students.

This virtualization technology can allow us to provide applications and even entire desktop environments that are running on centrally managed servers, but accessed via a number of different platforms, including laptops, desktops, tablet computers, thin-client devices, existing on-campus labs, and even small mobile devices such as smartphones. Students will be able to access a consistent, NDSU-provided computing environment from practically anywhere on campus with an available network connection. This would allow NDSU to potentially scale back the number of high powered desktop computers needed across campus, leading to a cost savings to departments and the campus as a whole. The students could use their own devices or use thin-client devices that cost much less than full powered desktop computers to connect to the virtualized desktops and applications

As these virtualized desktops and applications will be running on centrally-managed, high power servers, the life span of computers across campus can be extended since only the central servers would need upgrading to handle software packages that would require more computing power.

This pilot project will cover the deployment and assessment of Virtual Desktop Infrastructure (VDI) technologies for student, staff, and faculty use. This project will include hardware and software to support up to 60 concurrent users. This number was chosen as it would include one and a half standard courses.

We will use this technology in courses such as CSCI 122 (Programming in BASIC) and CSCI 159 (Computer Science Problem Solving) as these courses contain a good variety of students majoring in different areas. The students enrolled in these courses represent a diverse group of degree programs and computer knowledge. CSCI 122 uses Visual Studio as a major software package in the course, CSCI 159 uses Alice as their core software package. In addition, CSCI 418/618 (Simulation Models) will use virtualized desktops and applications to provide a test

environment for more advanced users with an application that requires more resources. Other courses will be included as they are deemed to be good test environments for this technology.

This project has a number of major goals. These goals include:

- Determining the viability of using VDI technology in new and interesting ways across campus to improve efficiency and the student experience.
- Seeking out key infrastructure needs and other challenges that need to be addressed before attempting to use this technology on a larger scale.
- Using the results of the project to be able to develop accurate estimates of computing needs for departmental deployment or campus-wide deployment.
- Determining and quantifying the usability of VDI systems across a diverse group of students, computing devices, and software applications.

Reports detailing the results of surveys and studies will be produced during the project. These reports will contribute to a final report which will summarize these interim reports as well as make recommendations for deployment requirements and practices in both individual departments and across the campus.

Implementation details

Equipment details

The implementation and execution of this plan involves a number of different components. These components include the hosting servers, storage servers, authentication mechanisms, and networking. The breakdown of these components in the planned implementation is given below.

The metric used for licensing and resource usage is generally measured in terms of concurrent users and connections. The target number of concurrent users for this project is 60. This would allow a full class of 40 students as well as 20 other students to access the system at the same time.

The servers will be hosted in the Computer Science department server room, located at IACC 258 A27. This room is locked and access is granted only to the Computer Science staff. This room has a stand-alone cooling system and access to all three phases of power that come into the IACC.

Virtualization hosts

The virtualized applications and desktops will be running on two host servers. These servers will be running VMWare vSphere 4.1 for the virtualization layer. The number of servers (two) was determined by consulting with Nathan Olsen (Systems Administrator, ITS) and by a need for redundancy. In general, it is assumed that a single processor core can handle 5-8 full virtualized desktops. A server with 12 cores (such as a dual 6-core system) should be able to sustain at least 60 concurrent virtualized desktops. A single server by itself would be able to serve the target number of students, but would not allow for a secondary system in the event of hardware failure or hypervisor updates or changes.

The planned servers are dual Intel 6-core servers with 96 GB of RAM each. These servers will provide 12 cores overall. Considering 60 concurrent users with full desktops, given 2 GB of RAM each, an assumed 75% memory usage rate, and the effects of Transparent Page Sharing (in-memory de-duplication of data common to different virtual machines), 96 GB of RAM would be a reasonable amount for each server.

Storage servers

Best practices for virtual machine storage dictate that a separate storage array be utilized to provide common storage for all host servers in a virtualization environment. This storage will be connected to the hosts via a high-speed network connection, using 4Gbps Fiber Channel.

Storage for virtualized desktops and applications is measured in Input/Output operations per second, or IOPS, possible by the storage array. An estimate from Citrix states that users with virtualized desktops may require approximately 10 IOPS for a light user up, 25 IOPS for a medium user, and up to 50 IOPS for very heavy users. Virtualized applications have been tested and have been shown to require between 1 and 8 IOPS depending on usage. The desktops and applications for Computer Science courses (the scope of this project) will likely fall into the medium and heavy usage categories. Given this workload, a server capable of at least 1500 IOPS would support 60 desktops at medium usage or 187 application instances with heavy usage.

For proper storage, there will be two distinct storage arrays. The first is virtual machine storage. This is required for the base virtual machines and should perform as described in the previous paragraph. The second array will be a lower-performance, high capacity array. This will store the student's documents, project files, and other files stored by that student.

It is possible to add on to the current Computer Science virtual machine storage system for this project. This storage array can be added to by adding on an external drive enclosure/chassis, additional drives, and Fiber Channel cards to the base system. Costs of these components are given in the budget justifications.

The main virtual machine storage array will require eighteen 15,000 RPM SAS disks, at 300GB each. An array similar to this configuration has already been tested and can deliver performance required by the virtual machines as described above. The secondary array will consist of six 2TB 7,200 RPM drives. Capacity, not performance, is the key number for the secondary array.

Backup for this storage will be provided by the Computer Science department utilizing the departmental backup server. The backup will be encrypted before being sent to the backup server, so only the client which contains the data can access it.

Networking

The host servers and storage server will form a private network, accessible only by those systems. This will be done utilizing Fiber Channel connections.

The virtualized desktops and applications will be accessible to students via the NDSU network over a 10 Gbps connection to the core network. The room in which these systems are to be hosted will have access to a 10Gbps connection to the core network installed in Spring 2011, well before the project start date. The hosting servers will use multiple 1Gb links to the switch with the 10Gb connection. Each user can only be given access to a single 1Gb link at a time, but the overall bandwidth of the server can be increased in 1 Gb increments as long as 1Gb ports are available.

The virtualized services will be available via IP addresses that are routeable only within the NDSU network. These addresses will be in the 10.x.x.x range. This ensures that only those individuals on NDSU networks can access the systems, partially improving security through restricting access to the systems. Valerie Nordsletten (Network Engineering and Operations) has been consulted regarding the ability to use these 'NDSU only' network addresses.

Devices

This proposal includes the testing of computing devices of varying kinds to test how the virtual desktops and applications are accessed via these devices. Devices that will be tested include an

iPad running the iOS operating system, and tablet computer using the Android operating system, and an assortment of thin-client devices. The tablet devices will be evaluated for their ability to efficiently access the systems in a classroom via the wireless network. This will hopefully be able to determine the potential for use by an entire classroom of students.

Thin-client devices will be tested to determine their potential for replacing desktop computers in labs and classrooms. This testing is of direct interest to Desktop Support, who may use the results of this project to determine if moving to thin-client platforms is a viable option for them.

Authentication and management

Authentication for the applications and desktops will be done through a Windows Active Directory, managed by the Computer Science department. This Active Directory system is to be implemented during the summer of 2011. The current expectation is that there will be a way to allow this system to utilize authentication provided by an already existing system, such as the NDSU Kerberos servers or NDUS Active Directory. Should this not be feasible, the Computer Science Active Directory will be a stand-alone authentication system operating using best practices for authentication systems.

Licensing

We will be testing multiple VDI systems, including those provided by Citrix and VMWare. In addition to licenses for the virtualization systems, licenses for Microsoft Windows Server and SQL Server are required for deployment and access. License costs and quantities are given in the budget justification portion of the proposal.

VMWare licensing

VMWare licenses are required for the back end virtualization on the hosting servers. These licenses are on a per-processor basis. Each hosting server is planned to have two 6-core servers, so this project will require 4 licenses. We plan on using VMWare vSphere 4 Standard for the hosting servers.

Also planned is a testing of VMWare View (virtualized desktops) and VMWare ThinApp (virtualized applications). These licenses are already owned by the Computer Science department and will be provided for the purposes of this project.

Citrix licensing

This proposal includes the purchase of 60 XenDesktop licenses, which provide for virtualized desktops. These XenDesktop licenses also include XenApp licenses, which provide for virtualized applications.

Microsoft licensing

Licenses for Windows Server and SQL Server will be required to support XenDesktop and VMWare View. Two Windows Server licenses and a single SQL Server license are requested.

Personnel and other resources

This project will require a significant amount of time to deploy, configure, manage, and assess results. Much of this will be done by Adam Helsene, the Computer Science systems administrator. This proposal also includes, in the budget, funding for an undergraduate student to assist with this project. This position will be budgeted to be a \$10/hour position at 20 hours/week for the duration of the project (15 months).

ITS resources

This project will utilize some ITS resources in the form of assistance with respect to the use of ITS managed systems, such as authentication and networking. Assistance in licensing compatibility and configuration for compatibility with NDSU/NDUS authentication systems will be required. Configuration of the ITS-managed switch in the CS Dept. server room will also be needed. The time requirement of ITS staff should be minimal and generally for configuration, testing different environments for compatibility with existing NDSU systems, and as advisers to assist with complying with NDSU security policy and NDSU best practices.

CS Dept. resources

The Computer Science department will be providing resources towards this project as well. They will provide the usage of their server room and related resources, the time of the systems administrator and other staff as required for purchasing, installation, configuration, maintenance, and other points involved with the execution of the project. They will also provide VMWare View, VMWare ThinApp, and other VDI-related VMWare licenses for use in testing and assessing VMWare desktop and application virtualization products.

Dr. Jun Kong, a specialist in the field of Human-Computer Interaction in the Computer Science department, has agreed to oversee a quantitative analysis of these virtualization systems as they relate to student usability in the context of NDSU. The Computer Science department will also be providing classes and students to test the various virtualization systems.

End results and reports

We intend to produce a final report in summer 2012 detailing many of the points of the systems as they are implemented and including results and analysis of usability testing and student surveys regarding the VDI systems. This report will also contain a set of best practices for deploying these systems across the NDSU campus as well as recommendations on potential deployment.

Interim reports on student surveys, device testing, usability, and deployment details and practices will be generated in line with the milestones given in the next section.

IV. Milestones

List the date for each project milestone. These milestones should represent the *significant* accomplishments that will be associated with the action plan. For each milestone, please indicate its expected outcome and the means for assessing that outcome. (The table may be extended as needed.)

	<u>Date</u>	<u>Milestone</u>	<u>Expected Outcomes</u>	<u>Means of Assessment</u>
1.	August, 2011	VDI systems implemented	Systems should be ready for use before Fall 2011.	Testing deployed systems to see if they are ready for student use.
2.	End of Fall, 2011	Device testing completed	There will be some devices which excel as platforms to access VDI systems and others that are not as useful.	Brief usability tests performed on each different style of device used for access
3.	End of Spring 2012	Student testing completed	Students will use VDI frequently in class and out of class	Survey about usage of VDI systems.
4.	Summer 2012	Usability reports completed	Students will find VDI convenient and easy to use on a variety of devices.	Usability study performed under the guidance of Dr. Jun Kong.
5.	Summer 2012	Full report completed	VDI will be a useful tool for students, staff, and faculty.	This is a product of previous reports, surveys, and testing.

NDSU Technology Action Plan Request

V. Supporting Documentation

Quotes and other references follow this page. This page will describe each attachment.

Attachment #1:

A Dell quote for virtualization host servers, this quote is provided by Nathan Olson and is used for a similar project.

Attachment #2:

A pricing quote from provantage.com for the storage expansion chassis.

Attachment #3:

A quote from CDWG for the following items

- ▲ Hard drives for storage
- ▲ Fibre channel cards for storage
- ▲ Citrix XenDesktop licenses

Attachment #4:

A quote from CDWG for VMWare vSphere 4 Standard

Attachment #5:

An SHI quote containing licenses for Windows Server and SQL Server, this is provided by Nathan Olson.

Attachment #6:

A quote from CDWG for thin client devices.

DELL**QUOTATION****QUOTE #: 572731067****Customer #: 23756933****Contract #: 90091****Quote Date: 1/28/11****Date: 1/28/11 10:36:18 AM****Customer Name: NORTH DAKOTA STATE /MICRO CTR**

TOTAL QUOTE AMOUNT:	\$32,103.75		
Product Subtotal:	\$32,103.75		
Tax:	\$0.00		
Shipping & Handling:	\$0.00		
Shipping Method:	Ground	Total Number of System Groups:	1

GROUP: 1	QUANTITY: 3	SYSTEM PRICE: \$10,701.25	GROUP TOTAL: \$32,103.75
Base Unit:	PE R710 with Chassis for Up to 6, 3.5-Inch Hard Drives (224-8462)		
Processor:	PowerEdge R710 Shipping (330-4124)		
Memory:	96GB Memory (12x8GB), 1333MHz 2R LV RDIMMs at Std Volt for 2 Proc,Optimized (317-6041)		
Monitor:	Embedded Broadcom, GB Ethernet NICS with TOE (430-1764)		
Monitor:	Embedded Broadcom, GB Ethernet NICS with TOE and iSCSI Offload Enabled (430-2970)		
Video Card:	Intel Xeon X5660, 2.8Ghz, 12M Cache,Turbo, HT, 1333MHz Max Mem (317-4108)		
Video Memory:	PowerEdge R710 Heat Sinks for 2 Processors (317-1213)		
Video Memory:	Intel Xeon X5660, 2.8Ghz, 12M Cache,Turbo, HT, 1333MHz Max Mem (317-4120)		
Hard Drive:	HD Multi-Select (341-4158)		
Hard Drive Controller:	PERC H700 Integrated RAID Controller, 512MB NV Cache, x6 (342-1147)		
Floppy Disk Drive:	Performance BIOS Setting (330-3492)		
Floppy Disk Drive:	Power Cord, NEMA 5-15P to C13, 15 amp, wall plug, 10 feet / 3 meter (310-8509)		
Floppy Disk Drive:	Power Cord, NEMA 5-15P to C13, 15 amp, wall plug, 10 feet / 3 meter (310-8509)		
Floppy Disk Drive:	Power Cord, NEMA 5-15P to C13, 15 amp, wall plug, 10 feet / 3 meter (310-8509)		
Operating System:	No Operating System (420-6320)		
Mouse:	Qlogic 2462 Dual Channel 4GB Optical Fiber Channel HBA PCI-E Card (341-9094)		
Mouse:	146GB 15K RPM Serial-Attach SCSI 3Gbps 3.5in Hotplug Hard Drive (341-8718) - Quantity 2		
NIC:	Broadcom 5709 Dual Port 1GbE NIC w/TOE iSCSI, PCIe-4 (430-3260)		
NIC:	Broadcom 5709 Dual Port 1GbE NIC w/TOE iSCSI, PCIe-4 (430-3260)		
NIC:	Broadcom 5709 Dual Port 1GbE NIC w/TOE iSCSI, PCIe-4 (430-3260)		
Modem:	iDRAC6 Express (467-8649)		
CD-ROM or DVD-ROM Drive:	DVD ROM, SATA, INTERNAL (313-9092)		
Sound Card:	Bezel (313-7517)		
Speakers:	Riser with 2 PCIe x8 + 2 PCIe x4 Slot (320-7886)		
Documentation Diskette:	Electronic System Documentation and OpenManage DVD Kit (330-3485)		
Documentation Diskette:	Dell Management Console (330-5280)		
Feature	RAID 1 for H700, PERC 6/i, H200 or SAS 6/iR Controllers (341-8699)		
Feature	Sliding Ready Rails With CableManagement Arm (330-3477)		
Service:	Pro Support : Next Business Day Onsite Service After Problem Diagnosis, 4 Year Extended (988-5084)		
Service:	ProSupport : 7x24 HW / SW Tech Support and Assistance , 5 Year (988-5124)		
Service:	Thank you choosing Dell ProSupport. For tech support, visit http://support.dell.com/ProSupport or call 1-800-9 (989-3439)		
	Pro Support : Next Business Day Onsite Service After Problem Diagnosis. Initial Year (993-		

Service:	2320)
Service:	Dell Hardware Limited Warranty Plus On Site Service Initial Year (993-8447)
Service:	Dell Hardware Limited Warranty Extended Year (993-8458)
Installation:	On-Site Installation Declined (900-9997)
Support:	Proactive Maintenance Service, PE, 1 Event per yr, 1yr (988-7407)
Misc:	High Output Power Supply Redundant, 870W (330-3475)
Misc:	No Power Cord (310-9057)

SALES REP:	Elizabeth McCann	PHONE:	512-513-9069
Email Address:	elizabeth_mccann@dell.com	Phone Ext:	

Please review this quote carefully. If complete and accurate, you may place your order online at www.dell.com/qto (use quote number above). POs and payments should be made to *Dell Marketing L.P.*

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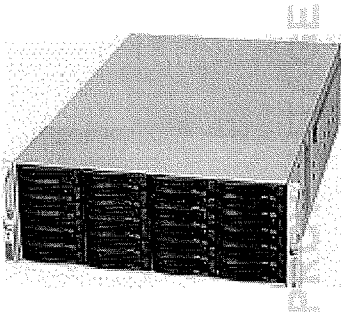
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Quote Date: 2/28/2011

Contact: ADAM HELSENE

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Brett Johnson

Phone: (866) 465-9917

Fax: (312) 705-6456

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230 N. Milwaukee Ave
Vernon Hills, IL 60061

(800) 594-4239

Billing Address

ADAM HELSENE
ATTN: NORTH DAKOTA STATE UNIVERSITY
1320 ALBRECHT BLVD N
258 IACC BLDG
FARGO, ND 58105-5769

(701) 231-7786

Shipping Address

NDSU COMPUTER SCIENCE
ATTN:ADAM HELSENE
258 IACC BLDG
1320 ALBRECHT BLVD
FARGO, ND 58102

Payment Method

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Shipping Method

FedEx Ground

Product	Contract	CDW	Mfg Part #	Qty	Price	Ext. Price
WD RE4 WD2003FYYS - hard drive - 2 TB - SATA-300	National Joint Powers Alliance	1933582	WD2003FYYS	3	\$284.46	\$853.38
QLogic SANblade QLE2462 - host bus adapter - 2 ports	National Joint Powers Alliance	871782	QLE2462-E-SP	2	\$1,315.89	\$2,631.78
ACAD CITRIX XENDT ENT CONC USER +SA	National Joint Powers Alliance	2288338	MW2E0000119	60	\$257.40	\$15,444.00
Hitachi Ultrastar A7K2000 HUA722020ALA330 - hard drive - 2 TB - SATA-300	National Joint Powers Alliance	1841364	0F10452	3	\$234.41	\$703.23

Sub-Total \$19,632.39

Shipping: \$0.00

Grand Total \$19,632.39

*Tax may change if this quote is amended by your account manager.

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Quote #: BZLQ399

Status: Open

Quote Date: 3/1/2011

Contact: ADAM HELSENE

Description: VMWARE VSPHERE QUOTE

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230 N. Milwaukee Ave
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258 IACC BLDG
FARGO, ND 58105-5769

(701) 231-7786

Payment Method

MasterCard/Misa Govt

Shipping Method

Drop Ship Ground

Shipping Address

NORTH DAKOTA STATE UNIVERSITY
ADAM HELSENE
1320 ALBRECHT BLVD N
258 IACC BLDG
FARGO, ND 58105-5769

Product	Contract	CDW	Mfg Part #	Qty	Price	Ext. Price
VMware vSphere Standard - (v. 4) - license	Market	1756439	VS4-STD-A	4	\$550.00	\$2,200.00
VMware Support and Subscription Basic - technical support - 1 year - for VM	Market	1756451	VS4-STD-G-SSS-A	4	\$170.00	\$680.00
Sub-Total						\$2,880.00
Shipping:						\$0.00
Grand Total						\$2,880.00

*Tax may change if this quote is amended by your account manager.

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3/1/2011

Fwd SHI Quote 4280394 VMWareMicros...

From: naolson.work@gmail.com on behalf of Nathan Olson <nate.olson@ndsu.edu>
Sent: Thursday, February 24, 2011 4:01 PM
To: Helsene, Adam
Subject: Fwd: SHI Quote 4280394, VMWare/Microsoft

----- Forwarded message -----

From: <Joe_Palmieri@shi.com>
Date: Fri, Feb 4, 2011 at 11:16 AM
Subject: SHI Quote 4280394, VMWare/Microsoft
To: nate.olson@ndsu.edu

Hi Nate,

Here is your revised quote. I included the XenDesktop with the new pricing. The 1 year add of SA is still included as well.

Joe



Pricing Proposal
 Quotation #: 4280394
 Created On: Feb-02-2011
 Valid Until: Feb-28-2011

North Dakota State University

Nathan Olson

Phone: 701-231-8579
 Fax:
 Email: nate.olson@ndsu.edu

Quote Prepared By

Joseph Palmieri

33 Knightsbridge Road
 Piscataway, NJ 08854
 Phone: 732-652-6638
 Fax: 732-652-6645
 Email: Joe_Palmieri@shi.com

Your Account Executive

Kevin Farrell

Phone: 888-289-6088
 Fax: 877-289-6088
 Email: kevin_farrell@shi.com

All Prices are in US Dollar (USD)

Product	Qty	Your Price	Total
1 VMw are vSphere Enterprise Plus - (v. 4) - license - 1 processor (up to 12 cores) - EDU VMw are - Part#: VS4-ENT-PL-A	6	\$1,793.00	\$10,758.00

3/1/2011

Fwd SHI Quote 4280394 VMWareMicros...

2	VMware Support and Subscription Production - Technical support - emergency phone consulting - 1 year - 24x7 - 30 min - for VMware vSphere Enterprise Plus Edition (v. 4) - 1 processor (up to 12 cores) - EDU VMware - Part#: VS4-ENT-PL-P-SSS-A	6	\$841.00	\$5,046.00
3	VMware vCenter Server Standard for vSphere - (v. 4) - license - 1 processor - EDU VMware - Part#: VCS-STD-A	1	\$2,563.00	\$2,563.00
4	VMware Support and Subscription Production - Technical support - emergency phone consulting - 1 year - 24x7 - 30 min - for VMware vCenter Server Standard Edition (v. 4) - EDU VMware - Part#: VCS-STD-P-SSS-A	1	\$1,202.00	\$1,202.00
5	VMware vCenter Lab Manager - (v. 4.0) - license - 1 processor - EDU VMware - Part#: VC-VLM4-PF-A	6	\$767.00	\$4,602.00
6	VMware Support and Subscription Production - Technical support - emergency phone consulting - 1 year - 24x7 - 30 min - for VMware vCenter Lab Manager (v. 4.0) - 1 processor - EDU VMware - Part#: VC-VLM4-P-SSS-A	6	\$360.00	\$2,160.00
7	Acad Vcenter Capacityiq 25 Vmpk VMware - Part#: VC-CIQ-25VM-A	4	\$962.00	\$3,848.00
8	Acad Sub Sup Vcenter Capacityiq25 Vm Pk Prod VMware - Part#: VC-CIQ-25VM-P-SSS-A	4	\$452.00	\$1,808.00
9	Acad Citrix XenDesktop Plat Edx1 Conc User Lics W/ Sa Citrix Systems - Part#: MW2E0000120	103	\$350.00	\$36,050.00
10	Easy 1Yr XenDesktop Plat Ed Subadv Add On X1 Ccu Citrix Systems - Part#: EW2ZCXDPCECCUADD1	103	\$89.00	\$9,167.00
11	Microsoft Windows Server Standard Edition - License & software assurance - 1 user - EDU - Enterprise, Select, Select Plus - All Languages Microsoft - Part#: P73-00203	6	\$17.00	\$102.00
12	Microsoft SQL Server Enterprise Edition - License & software assurance - 1 processor - EDU - Enterprise, Select, SPLA, Select Plus - Win - All Languages Microsoft - Part#: 810-03312	1	\$1,007.00	\$1,007.00
13	Microsoft System Center Configuration Manager - License & software assurance - 1 server - EDU - Enterprise, Select, Select Plus - Win - All Languages Microsoft - Part#: J3A-00167	1	\$23.00	\$23.00
14	Microsoft System Center Configuration Manager Standard Server ML - License & software assurance - 1 operating system environment (OSE) - EDU - Enterprise, Select, Select Plus - Win - All Languages Microsoft - Part#: J6A-00089	6	\$6.00	\$36.00
15	MVL WINRMTDSKTPSRVCSAL ALNG LICAPK DVCCAL CAMPUS FACULTY A Microsoft - Part#: 6VC-01251	108	\$3.00	\$324.00
16	MVL WINRMTDSKTPSRVCSAL ALNG LICAPK DVCCAL CAMPUS STUDENT A	300	\$2.00	\$600.00

3/1/2011

Microsoft - Part#: 6VC-01251

Fwd SHI Quote 4280394 VMWareMicros...

Shipping	\$0.00
Total	\$79,296.00

The Products offered under this proposal are subject to the SHI Return Policy posted at www.shi.com/returnpolicy, unless there is an existing agreement between SHI and the Customer.



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Services

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Saved Carts Save This Cart E-mail This Cart

Quantity	Product	CDW-G	Availability	Price	Ext. Price
1	HP Thin Client T5740 - Atom N280 1.66 GHz Contract Name: National Joint Powers Alliance	1934041	In Stock	\$408.97	\$408.97
1	Wyse Xenith Zero Client 1 GHz Contract Name: National Joint Powers Alliance	2112692	1-3 days	\$315.42	\$315.42
1	Wyse R50L Thin Client - Sempron 1.5 GHz Contract Name: National Joint Powers Alliance	2093043	Call	\$429.59	\$429.59
Click ⊖ to remove an item from your cart				Sub-Total	\$1,153.98

Update Cart Clear Cart Create Standard Quote Use Standard Checkout Create Express Quote Use Express Checkout

Continue Shopping

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Enter a postal code to quickly estimate shipping cost.

Quick Cart: [input] [icon]

Enter a CDW-G part number to quickly add it to your cart.

Product ID
CDW Part: XXXXXXXX
Mfg. Part: XXXXXXXXXX
UNSPSC: XXXXXXXX

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NDSU Technology Action Plan Request

VI. Budget

NDSU ORGANIZATION OR UNIT		
Department of Computer Science		
PROJECT DIRECTOR(S)		
(Must be NDSU faculty or staff)		
Adam Helsene		
A. Salaries and Wages (Number)	Number of Months	FUNDS REQUESTED
1. Staff ()	0	\$ 0.00
2. Graduate Students ()	0	\$ 0.00
3. Undergraduate Students ()	15	\$ 10125.00
B. Total Salary and Wages (Sum A.1., A.2., and A.3.)		\$ 10125.00
C. Fringe Benefits		\$ 621.00
D. Total Salaries (Sum B and C)		\$ 10746.00
E. Equipment (List each item; include installation and maintenance costs in your estimates)		
1. Host servers		\$22000
2. Storage server upgrade		\$7750
3. Network equipment		\$2750
F. Total Equipment (Sum items in E.)		\$ 32500
G. Materials and Supplies (List each item)		
1. Misc. cables and server accessories		\$500.00
2. VMWare licenses		\$2880
3. Citrix Licenses		\$15420
4. Microsoft Licenses		\$1051
5. Thin clients		\$1000
6. Mobile devices		\$2750
H. Total Materials and Supplies (Sum items in G)		\$ 23601
I. Total Salaries; Equipment; Materials and Supplies (Sum: Line D + Line F + Line H)		\$ 66847
J. Total Technology Fee Request		\$ 66847
K. Match (Describe in Match Section)		\$ 0.00
L. Total Project Expenditure (Sum: Line J + Line K)		\$ 66847

NDSU Technology Action Plan Request

VII. Budget Justification

Salaries/wages: The budget includes funds for a single undergraduate student at a rate of pay of \$10/hour with 15 hours/week for 15 months at 4.5 weeks/month (67 weeks). This total is \$10,125, the amount requested for a student worker in the budget.

Host Servers:

- Two Dell R710 Servers, \$10,701.25 each

Storage:

- Storage Chassis expansion: SuperMicro SC847E26-RJBOD1, \$1837.35
 - Pricing from provantage.com
- Eighteen 15,000 RPM SAS drives, 300GB each, which includes:
 - All quotes from NDSU Bookstore
 - Six - Seagate Cheetah 15K.7 300GB, \$259 per drive
 - Six - Hitachi Ultrastar 15K600 300GB, \$279 per drive
 - Six - Toshiba/Fujitsu MBA3300RC, \$280 per drive
- Six 7,200 RPM drives, 2TB each, which includes:
 - All pricing from CDWG
 - Three – Western Digital RE4 drives, \$284.46 per drive
 - Three – Hitachi Ultrastar A7K2000, \$234.42 per drive

Network:

- Two QLogic QLE2462 Fiber Channel cards, \$1315.89 each
 - Pricing from CDWG
- Mobile computing devices
 - iPad, WiFi-only, 16GB, \$499
 - Quote from NDSU Bookstore
 - Samsung Galaxy Tab (WiFi only) or similar Android device with 7" screen, estimated price \$500
 - Quotes unavailable, expected release in spring 2011
- Thin client devices
 - Pricing from CDWG
 - Wyse Xenith (XenDesktop 'zero-client'), \$315.42
 - Wyse R50-L (Linux-based thin client), \$429.59
 - HP T5740 (Windows-based thin client), \$408.97

Software Licenses:

- VMWare vSphere 4 Standard, academic pricing, 4 licenses, \$550 per license, \$2200 total
- VMWare vSphere 4 Standard basic support, 4 licenses, \$170 per license, \$680
 - Quotes from CDWG
- Citrix XenDesktop Enterprise, \$257 per concurrent user, 60 users, \$15,420 total
 - Pricing from CDWG
- Microsoft Windows Server Standard, 2 licenses, \$17 per license, \$34 total
 - Quote from SHI
- Microsoft SQL Server Enterprise Edition, 1 license, \$1007 total
 - Quote from SHI

NDSU Technology Action Plan Request

VIII. Budget Match