Provost's Committee on Technology

Final Report

July 2, 2007

Committee Members:

Steven Chin (Chair)
College of Engineering

Steven Farney
College of Education

Vasil Hnatyshin
Computer Science Department

Anthony Mordosky
Information Resources

Richard Scott
Department of Geography

Mark Sedlock
Network & System Services (I.R.)

Jerome Spencer
Computer Science Department

Executive Summary

The Committee on Technology, comprised of Rowan faculty and staff, investigated the information technology infrastructure on campus with the goal of providing recommendations that will increase the reliability and availability of our campus IT systems and services. Staff members from key areas of Information Resources and the College of Professional and Continuing Education (CPCE) provided valuable consultation to the Committee.

After careful consideration, the committee recommends the following key actions be taken:

1. To meet the current needs of the Rowan community and in support of new initiatives, a funding level of $760K be provided to support an upgrade which will allow critical services to perform at normal levels in the event of a system failure. This will include a new Data Center on the northern side of the campus, a redundant Storage Array Network (SAN), and a number of redundant servers which are critical to system operations (e.g., Banner, Oracle, Exchange, and WebCT) to be installed.

2. Appropriate staffing is necessary to achieve increased system reliability and availability. Staffing must be added to support both operations and maintenance. The Committee estimates that 5 positions are necessary, and will help place Rowan on par with staffing at other comparable institutions.

3. The Support Desk function should be reviewed, including staffing levels, hours of operation, task coordination, and staff training. It is recommended that the Support Desk functions be more carefully reviewed with the goal of improving the customer experience.

The detailed findings which support the recommendations are described herein.

Overview

The Committee on Technology was charged by the Provost to review existing infrastructure, compare it with the best in class, and make recommendations that will increase the reliability and availability of our campus IT systems and services. The committee was asked to make recommendations with three options: Ideal, Realistic, and Minimal[1].

The committee met 7 times during the semester: March 22, March 30, April 5, April 13, April 20, April 26, and May 7. Key personnel from various units within the University were invited to speak to the committee, in order to obtain critical information needed for the report. Other reports from previous studies germane to this committee were used to help set the context for this investigation, and proved helpful in developing conclusions and subsequent recommendations. These materials appear as appendices in this report.

Bruce Klein (Director, Network & System Services) provided a status report on the campus information technology infrastructure, and associated facilities issues. Reference material which he provided is included as appendices.

Michael Ciocco (IT Design Specialist, College of Professional and Continuing Education) described the mission critical network systems for the CPCE online program, and their requirements to successfully deliver online courses.

Redmond English (Enterprise Information Systems) provided a summary of needs as it relates to the Committee's charge. As the Banner and Oracle servers are a lynchpin to many of the critical systems on campus, it was important to include them in the study.

Infrastructure and computer support is dependent on organizational structure and staffing levels. Anthony Mordosky (Associate Provost for Information Resources) led a discussion in these areas, and the findings and recommendations are included herein.

In order to increase the effectiveness of this report, the committee's findings and recommendations are concisely presented, and reference material provided as appendices. The committee is available to meet and amplify on specific topics as needed.

[1] The "Minimal" option contains those elements that should be done.

Information Technology Infrastructure

Primary goal:

To improve the reliability of the campus network and computing infrastructure

Reference material:

Appendix I: Proposed Procurement Items for Achieving Reliability

Appendix II: Reliability Improvements – Narrative Description for Appendix I

Appendix III: Status Report on Campus Information Technology Infrastructure[2]

Appendix IV: Mission Critical Network Systems for CPCE Online Programs

Recommendations:

- Three scenarios were developed to assist in future planning of upgrades; Minimal, Realistic, and Ideal (see Appendix I). The level of implementation strikes a balance across diverse functions within Information Resources.

  The Minimal upgrade will ensure that critical services are functional, but that users will see a performance loss. The Realistic upgrade will allow critical services to perform at normal levels. The Ideal upgrade will provide a configuration where virtually all services (and not just the critical services) will perform at normal levels.

  The following costs for hardware are associated with each performance level:

  Minimal: $454K Realistic: $760.5K Ideal: $1004K (~$1M)

  In addition, the University is likely to incur additional software licensing cost to implement the redundant servers associated with each performance level. Those costs are being investigated with the appropriate vendors. In Appendix I, the committee has also included staffing requirement for all performance levels.

[2] This report provided a starting point for the committee's investigations by providing a context for the present situation.

- CPCE requirements are embedded within these scenarios. CPCE will rely on the campus-wide network infrastructure for online course delivery (CMS & WebCT). As customer satisfaction is paramount to successful CPCE operations, future upgrades must ensure a high degree of system reliability and availability. See Appendix IV for a description of mission critical network systems[3]. Information Resources will work closely with CPCE to ensure that future growth will meet the online needs of the customer.

- Enterprise Information Systems (EIS) needs are embedded within these scenarios. The inclusion of a redundant Storage Array Network (SAN) and Server (Banner and Oracle) will help to improve the overall system reliability.

- A system analysis may be helpful in identifying areas where network capacity may be optimized, and in the planning of new technology which will validate planned configuration changes. Tools such as OPNET exist for facilitating such an investigation.

[3] The minimum uptime requirement in Appendix IV (Mission Critical Network Systems for CPCE Online Program – Michael Ciocco – March 30, 2007) for CPCE mission critical systems is specified at 98%. At the present time, a 99.97% uptime requirement is being imposed based on commitments with POST ASI, who are the external contractors marketing the online endeavor to students. Achieving a 99.97% uptime requires that there are only 157 minutes allowable for outages and maintenance during the year. This may require a rapid movement to the "Ideal" Scenario, as Verizon outages could potentially exceed 157 minutes a year.

Facilities Infrastructure

Primary goal:

To document the physical infrastructure, with the recognition that it has an effect on information technology planning and the cost of deployment

Reference material:

Excel Spreadsheet:
Facilities Infrastructure - Status Report Tables.xls (provided as supplement)

Recommendations:

- There are areas within the physical infrastructure that are in need of improvement. It was beyond the scope of this committee to address these issues. The committee, however, recommends that network infrastructure and computer system upgrades be performed in coordination with Facilities Management, and as early in the planning stages as possible. The impact of insufficient electrical, cooling, and other environmental considerations cannot be overstated on the overall stability of the Rowan Network.

Support and Staffing

Primary goal:

To investigate the organizational structure within I.R., and if the current number of employees meets current and future needs

Reference material:

Appendix V – Saxena Report (Peter Saxena – September, 2005)

Appendix VI - Educause Core Data
Comparison with Comparable Institutions – Number of Support Staff

Excel Spreadsheet
Central Staffing – Educause Core Data TR Public Rev3.xls (provided as supplement)

Recommendations:

- The committee compared Rowan with other comparable institutions with regard to I.R. (in essence, Information Technology) support staffing. The staffing levels suggest that we are below the norm for these institutions based upon two factors. One, the weighted data that normalizes the institutional differences due to size indicates Rowan is at least 4.6 full time staff below these peer institutions. Second, the category of "Other" that represents in Rowan's case the printing & duplicating center essentially results in Rowan providing similar IT support services with less full time employees. No other institution in the comparison group has more than 2 full time employees in the "Other" category and in fact the weighted average of all comparable institutions is a mere 0.6 staff. This is tantamount to Rowan providing similar IT services while having in reality 1.8 to 3.2 full time staff less than these comparable institutions actually providing IT support services. While more analysis must be performed in order to confirm these conclusions, it should be noted that TCNJ, a sister institution, has at least 11 more full time employees while providing similar support for 2347 less FTE students.

- It is the consensus of the committee that a significant contributing factor to any negative perceptions of service from Information Resources stem from user's expectations not being met when working with the Support Desk. There are a number of contributing factors, including staffing levels, hours of operation, task coordination, and staff training. It is recommended that the Support Desk functions be carefully reviewed with the goal of improving the customer experience.

- The College of Professional and Continuing Education (CPCE) will require after-hour support, which may be outsourced. The general issue of after-hour support is an area that requires further investigation, so that reliability and availability is adequate.

- The use of redundancy to increase system reliability and accessibility will clearly require an increase in staffing levels. Additional staff will be needed to manage and maintain these systems. An estimate of the additional staff needed for each upgrade (Minimal, Realistic, Ideal) is provided in Appendix I, and should be reviewed as detailed planning proceeds. It is important to note that the funding for additional equipment and the staff to support them are necessarily linked. The purchase of the equipment without the staff will not accomplish the specified level of reliability.

- The Technological Resources Committee has previously investigated computer laboratory support in the context of the Institutional Work Study (IWS) program. Their results may be useful for general discussion of I.R. support and operations.

Appendix I
Proposed Procurement Items for Achieving Reliability
(Source: Bruce Klein – May 9, 2007)

Description	Minimal	Realistic	Ideal	Cycle
Generator to Memorial Core Network equipment	$ 40,000.00	$ 40,000.00	$ 40,000.00	one-time
Generator to North Data Center	$ 45,000.00	$ 45,000.00	$ 45,000.00	one-time
Fiber to North Data Center	$ -	$ 40,000.00		one-time
Generator powered cooling in North Data Center				one-time
Racks in North Data Center (1 SAN, 2 empty)	$ 2,000.00	$ 2,000.00	$ 2,000.00	one-time
Dual Homed SAN connections for all servers	$ 22,500.00	$ 22,500.00	$ 22,500.00	one-time
Storage system (HP EVA8000)	$125,000.00	$200,000.00	$ 300,000.00	7 years
Core Network Equipment	$ 6,000.00	$ 20,000.00	$ 20,000.00	7 years
UPS	$ 15,000.00	$ 30,000.00	$ 30,000.00	6 years
Blade Servers	$ 70,000.00	$110,000.00	$ 150,000.00	4 years
Dedicated Linux LDAP servers	$6,000	$12,000	$18,000	4 years
Redundant DNS/DHCP server	VMWare	$ 6,000.00	$ 6,000.00	4 years
Exchange Servers	VMWare	$ 30,000.00	$ 30,000.00	4 years
Web Servers	$ 7,500.00	$ 15,000.00	$ 22,500.00	4 years
Network Load Balancer	$ 40,000.00	$ 40,000.00	$ 40,000.00	4 years
Oracle Clustering*	$ 40,000.00	$ 60,000.00	$ 95,000.00	4 years
CallXpress	$ 15,000.00	$ 15,000.00	$ 15,000.00	4 years
MySQL	VMWare	$ 8,000.00	$ 8,000.00	4 years
Redundant WebCT*	VMWare	$ 15,000.00	$ 50,000.00	4 years
Colocation Charges (annual)			$ 10,000.00	yearly
Redundant Internet connection (annual)	$ 20,000.00	$ 50,000.00	$ 100,000.00	yearly
Total	$454,000.00	$760,500.00	$1,004,000.00	
Additional Staff	2	3	5	

Definitions:
Minimal - critical services still function, users will see performance loss
Realistic - critical servces function at normal performance levels
Ideal - nearly all services function at normal performance levels

Items in orange would be housed at Verizon facility in Newark

* excludes any additional licensing costs

Appendix II
Reliability Improvements – Narrative Description for Appendix I
(Source: Bruce Klein – May 9, 2007, edited by the Committee)

The items in the priority list are broken into three categories: Minimal, Realistic and Ideal. The estimates in each category are based on the following definitions:

Minimal: In the event of a disaster or system failure, all critical services will continue running, but users will see a loss of performance.

Realistic: As above, but with no loss of performance

Ideal: Nearly all services (not just those from the 'critical' list) function without performance loss.

The following is the list of critical services:

- Exchange
- Banner (Campus ERP system)
- WebCT (Course Management System)
- The University Website
- DNS and DHCP
- Mail Relays
- Student E-mail
- Openarea
- MySQL
- VMWare
- Cisco CallManager Servers
- Backup Servers
- Touchnet (Payment gateway)
- LDAP
- BlackBoard transaction system

The core concept behind this plan is the creation of a second data center to house the redundant components. The existing computer room in the Library could be used with minimal changes. The 3rd floor server space in Rowan Hall could also used, but would require more substantial modifications. Costs for modifying the room in Rowan Hall have not been included.

In the Ideal scenario, items highlighted in orange would be housed at a Verizon co-location facility in Newark, New Jersey to provide a minimal set of services in the event of a complete loss of service at the Glassboro campus due to some type of disaster.

Items in light gray type are carried over from early columns for ease of calculating totals. Generally speaking, this indicates that there is no additional redundancy available for that item.

There is also a 'Cycle' column on the spreadsheet. This shows the life cycle of the purchase and how frequently this cost will recur.

Explanation of Line Items

Generator to Memorial Core Network equipment:

While Memorial Hall does have a generator, a decision was made during construction not to extend generator power to the room where the core network equipment is located due to cost concerns. The UPS on this equipment has approximately three hours of backup power. This generator must be installed in order to provide continuous telephone and network service to the campus during a power failure of more than three hours.

Generator to North Data Center:

Based on information acquired during conversations with Facilities, this is the approximate cost of providing a generator to the proposed location in the Campbell Library. If another location is decided upon for the North Data Center, this estimate will change.

Fiber to North Data Center:

In the Minimal scenario, the existing fiber-optic cable to the chosen location would be used. In the Realistic scenario, additional fiber back to the Student Center would be run. In the Ideal scenario (cost not provided), fiber to both the Student Center and Memorial Hall would be run.

Generator-powered Cooling in the North Data Center:

There is no estimate on this requirement, but a Data Center cannot operate without cooling in the event of a power failure.

Racks in North Data Center:

This represents the cost of four-rail server racks necessary to hold the new equipment in the North Data Center.

Dual-homed SAN (Storage Array Network) connections for all servers:

Most of the servers in the Memorial Data Center are currently single-homed to the SAN. The redundancy can be maximized to each of these servers by providing two connections to the SAN for each server.

Storage System (HP EVA8000)

This would be an entirely separate, redundant SAN. This second SAN would be located in the North Data Center to provide services in the event of failure of the Memorial Data Center. In the Minimal scenario, this would include enough storage

for most critical applications. The Realistic scenario would include enough storage for all critical applications. The Ideal Scenario would be a complete replication of all data in the primary SAN.

Core Network Equipment:

This represents the equipment necessary to connect the North Data Center. The Realistic Scenario would also include equipment that would be part of an overall upgrade to the Library (if the North Data Center were housed there).

UPS:

This UPS will be installed in the North Data Center to provide power during an outage while the generator is starting up.

Blade Servers:

This is a chassis with HP Blade Servers running VMWare. In the Minimal Scenario this would run Virtual Machines for DNS/DHCP, Exchange, MySQL and WebCT. In the Realistic Scenario, this would provide redundancy for servers that are currently hosted under VMWare. In the Ideal Scenario, it would perform the same function, but with more capacity for additional servers.

Dedicated Linux LDAP servers

Server(s) would be located in Memorial, the North Data Center, and the co-location facility in Newark, NJ.

Redundant DNS/DHCP

A DNS/DHCP server would be housed in the North Data Center.

Microsoft Exchange Servers

These servers would be housed in the North Data Center and would provide full redundancy to the servers in Memorial. This would provide the capability of running Exchange at either site.

Web Servers

Server(s) would be located in Memorial, the North Data Center, and the co-location facility in Newark, NJ.

Network Load Balancers

This is an expensive item that is a core requirement to providing redundancy for applications that are not natively clusterable. This would include web servers (http), directory servers (ldap) and many others.

Oracle Clustering

The listed prices are for hardware required to provide maximum redundancy for Oracle. This does not include any additional software licensing that may be necessary. Each tier provides an additional location (Memorial, North Data Center, Co-location).

CallXpress

CallXpress provides all of the menus and automated call handling for the campus. In the event of a system failure, an additional server would be needed to bring up in the North Data Center so that callers would still hear our menus and voicemail could be left.

MySQL

Most the campus web site and several other services rely on data from the MySQL server to operate. Without a secondary server, redundant web servers will only achieve minimally improved reliability.

Redundant WebCT

In order to begin to meet the stated CPCE requirements, a redundant WebCT server will be needed. In the Minimal Scenario this would be run under VMWare, In the Realistic Scenario, it would a physical server housed in the North Data Center. In the Ideal Scenario, a VM of WebCT at the co-location facility would be required.

Co-location charges

This is the price of renting a rack from Verizon. The cost is $580 per month plus a charge for electricity. This is discounted through NJEdge.net from $2400 per month.

Redundant Internet Connection

These prices are for a second Internet connection to the campus that does not rely on our current provider. The three prices are for: 1) enough bandwidth to operate the website and send/receive e-mail, 2) enough bandwidth to run classes and the Library databases, and 3) enough bandwidth for all current services, albeit at a reduced level of performance.

Additional Staff

These are estimates based on the number of additional servers and equipment that would need to be operated to provide the requested level of redundancy.

Appendix III
Status Report on Campus Information Technology Infrastructure
(Source: Tony Mordosky)

Status Report on Campus Information Technology Infrastructure

Purpose of Document

The purpose of this document is to provide an overview of the technology infrastructure at Rowan University, including the principles followed in designing and implementing the infrastructure, the current status of each of the infrastructure components and plans for future enhancements and growth.

Review of Goals and Guiding Principles

The original design goal of the campus network was to provide network access to the entire campus. The primary focus at that time was to extend the reach of the network, not to make the network available as close to 100% of the time as possible. As the goal of reaching 100% of the campus was attained and the network came to be viewed as an essential service, the design goals of the network changed and new plans were made to attain these goals.

In November of 2000, the Network and System Services Systems Group had a series of meetings to identify known issues with the campus network and to plan for those changes that would need to be implemented to increase the availability of the network. The planning notes from those meetings are below:

NSS Planning Notes Fall '00

0. Facility Issues
    a. Electrical / UPS
        i. We need to make sure all circuits supplying power to our equipment meet the requirements of that equipment
        ii. A UPS needs to be installed for any critical equipment that doesn't already have one
    b. Environment
        i. Temperature
        ii. Humidity
        iii. Physical Integrity (that is, no ceilings falling down or leaking)
    c. Wiring Closets
        i. Obtaining sufficient space for closets
        ii. Documentation of closets
    d. Create a secondary Data Center on the north side of campus
    e. Security and Accessibility

i. Make sure that all wiring / equipment locations are physically secure
    1. Build enclosures around equipment in office or open spaces
    2. Eliminate shared spaces (no mop sinks in wiring closets)
ii. Make sure we have access to all wiring / equipment locations
    1. Get all keys necessary to get from exterior of building through all interior doors to our closet
    2. Make sure we have phone numbers and names of people in apartments that house closets

1. Physical Layer
    a. Add new lightning protection to phone lines
    b. Install proper grounding in wiring location
    c. Create redundant fiber links from each building
        i. Ensure we have 100% capacity for the building on each link
        ii. Ensure that each path to a given building is discrete
        iii. Redundant links should terminate in different location than the primary link (will require creation of new fiber hub locations)
    d. Re-terminate existing fiber plant
        i. Fully terminate all strands
        ii. Mount in proper enclosure
    e. Remove old wiring
        i. Take out all abandoned cable
        ii. Fire-stop all openings left behind
    f. Document inter-building cable plant
        i. Fiber
        ii. Copper
        iii. Conduit
        iv. Direct buried cable paths
    g. Provide dry manholes
        i. Sump pumps
        ii. Sealing
    h. Provide CATV distribution in each building
    i. Connectivity to water tower
    j. Rewiring Buildings
        i. Bole
        ii. Bole Annex
        iii. Hollybush
        iv. Memorial
        v. Carriage House
        vi. Linden
        vii. Hawthorn
        viii. Whitney
        ix. Westby
        x. Student Center
        xi. Bookstore
        xii. Herring Heating Plant

xiii. Cassaday
xiv. Team House
xv. Football Stadium
xvi. Esby / Rec Center
xvii. Wilson
xviii. Triad 1st Floor

2. Network Hardware
    a. Replace core switches
    b. Add aggregator switches to large buildings
    c. Add redundant routing
    d. Gradually move to 100Mbps to the desktop
    e. Build wireless infrastructure
3. Protocol
    a. Eliminate non-IP protocols (IPX, Appletalk, NetBEUI)
    b. Move to port-based VLANS
    c. Create a network management VLAN
4. Servers
    a. Storage Area Network (SAN)
        i. Redundancy (mirrored in south and north data centers)
        ii. Connect to Alphas, Proliants, Suns
            1. VMS, NT, Netware, Linux, Solaris
        iii. SAN Backup Solution
            1. All in one?
            2. Separate VMS, NT, Netware, Unix?
        iv. Must be able to provide partitioning between systems
        v. Must be modular
        vi. Must be able to support our needed capacity
            1. Current
            2. Future
            3. Backup capacity
    b. Training
    c. Servers
        i. Add divisional servers
            1. 2 node cluster for each division (1 node located in each data center)
        ii. Multi node cluster for openarea
        iii. Provide for specialty servers (applications, SQL, etc)
            1. cluster when reasonable
        iv. Create large cluster for student file / print / web services
            1. 8 4-processor boxes
        v. Dedicated Service Servers (DNS, DHCP, etc)
            1. 2 node cluster w/ smaller boxes
        vi. Mail Servers
            1. Should remain centrally budgeted
            2. new boxes / clustered
        vii. Elvis

1. Does it need replacement?

viii. Purchase Novell Premium Support

d. Voice Servers

i. New phone system

1. IP / Ethernet based?
2. Traditional ?
    a. Stay digital
    b. Analog
3. Distributed
4. Emergency Phones
    a. Stay analog?
    b. Go wireless?
5. Voice Mail
    a. Integrated messaging
    b. Fax support

5. Services

a. File and Print

i. Needs to be distributed over more servers
ii. Shared applications need to replicated to multiple servers
iii. Printing needs to be moved to all IP-based NDPS
iv. Need to configure support for WebDAV / Web Folders
v. Eliminate LAT-based printers
vi. Eliminate IPX-based Flash_PNW
vii. Need to configure FTP services
viii. Add support for AFP 3.0 (services for Macintoshes)

b. Mail

i. Distribute over multiple servers
ii. Groupwise 6.0 upgrade?
iii. Need to improve response time
iv. Cobain / forwarding issues
v. POP/IMAP Support ?
vi. Management Issues
vii. WebAccess

c. Directory Services

i. Leave student portion of tree alone
ii. Eliminate employees OU
iii. Create OU for each division and each department within
iv. Create Guest OU
v. Restructure directory replicas
vi. PKI / Digital Signatures
vii. Move printers to departmental OU
viii. Catalog services
ix. SLP (Server location protocol)
x. SIS / HRS Integration (XML ?)
xi. NT / Linux / Solaris NDS
xii. VMS Advanced Server <-> Domain <-> NDS

xiii. New version of RADIUS

d. DNS and DHCP
    i. Clustering ?
    ii. Redundancy ?
    iii. MX
    iv. Smtp
e. Web Servers
    i. Clustering ?
    ii. Cold Fusion
    iii. MySQL
    iv. Proxying and Caching
f. Oracle
    i. Clustered servers
    ii. SAN-based storage
g. ZenWorks
    i. Servers
    ii. Clients
        1. Automatically distribute printers
        2. Tighten up desktop management
        3. Customize Network Applications menu for departments and labs
        4. Inventory

6. Desktops
    a. PC
        i. Win 2K
            1. Lockdown lab computers
            2. Roaming profiles
                a. No desktops in profile
                b. "My" folders on H: drive
            3. Do we upgrade to Win 2K or only use on new PCs?
        ii. Power Management
    b. Macintoshes
        i. Get rid of Netware Client
        ii. AFP 3.0
        iii. OS X
        iv. IP-based printing
        v. Get Desktop Management tools
        vi. Mail Client
7. People
    a. Contract out generic work
    b. Add more technicians
    c. Add more students
    d. Receive training before rollouts
    e. Support Contracts
    f. No OJT
    g. Fill UNIX admin position

h. Tools
i. Books
j. Certifications / Continuing Ed.
k. Coverage for early mornings / nights /weekends

Since those planning sessions, all changes and upgrades to the network, servers and the services we run have been made with addressing this list in mind. In certain cases, the needs of the campus or the specific technologies mentioned in the list have changed over time. These changes are included in the on-going planning process.

Based on this list and the needs of the campus, the principles used for designing and managing the campus technology infrastructure are as follows:

1) The Rowan network infrastructure must be designed to maximize the availability and accessibility of the services it provides.
2) All servers that provide production services must be implemented with redundancy at both the hardware and software levels to whatever degree possible.
3) All equipment and services must be remotely manageable
4) All staff must be given the proper training and resources to effectively implement the technology for which they are responsible.

Appendix IV
Mission Critical Network Systems for CPCE Online Program
(Source: Michael Ciocco – March 30, 2007)

Mission Critical Network Systems for CPCE Online Program

Prepared by Michael D. Ciocco
Revision 1.2 3/30/2007

Introduction

The College of Professional and Continuing Education (CPCE) considers the following network related systems and services as *Mission Critical* to its Online Education Program. That is, if CPCE Online Education students and faculty were to experience an outage of any of the following services beyond the specified tolerances, it could negatively and permanently impact the future success of the CPCE endeavor.

For the purpose of this document, only the major critical services required by the CPCE for its Online Education program are listed and described. For each of these services, it is understood that intrinsic supporting services and systems exist as part of the Rowan University campus-wide network infrastructure. These supporting services must inherently match the required uptime figure presented. Supporting systems and services are listed as *dependencies*.

Uptime

All CPCE Online Education mission critical systems require a minimum uptime of 98%. That is, it is reasonable to expect no more than 2 total hours of outages over a 100 hour period of system operation. For the purpose of this document, the system uptime figure does not reflect planned outages. All systems are expected to have planned outages for maintenance, upgrades, etc. Said planned outages should be performed at a point in time with least impact to system users. System users should be amply informed well in advance to any planned system outage.

While some systems require maximum availability, the system uptime figure does not reflect 100% uptime. This is intentional as unexpected minor outages will occur due to unpredictable and unforeseen issues (i.e. temporary loss of power, system glitch or hang-up requiring a reboot, etc.).

Change Management

All servers and systems used to run the daily operating services for the CPCE Online Education Program are considered in *production*. Changes and maintenance of production systems should be managed under a change management protocol that involves any responsible CPCE staff members. The change management protocol should serve a dual purpose: (1) to dutifully inform the CPCE staff and management of planned production changes that will affect CPCE Online Education related systems and services and (2) provide a feedback channel from the CPCE to inform network and systems staff and management of any potentially adverse affects of planned changes on the CPCE's Online Education operation.

Major system changes including planned software upgrades or introduction of new software or hardware should be conducted in a development or *sandbox* environment prior to production environment release.

Recovery

Unpredictable system outages may occur that are beyond the specified uptime tolerance mentioned above. Although these types of outages are often severe and difficult to manage, the CPCE should be provided with a disaster recovery plan that the network support staff and administration will draft, maintain, and execute in the event of such an outage. Such a plan should include details of how the CPCE, or the University, will recover from a general system loss, including total system loss, and estimations of how long it will take to execute the recovery plan.

Mission Critical Systems & Services

This section highlights those systems that the CPCE has identified as Mission Critical to its Online Education program. The current core system or service is provided as well as its dependencies in the bulleted portions of this section.

Course Management System (CMS)

The CMS is the main channel by which online courses are delivered. The CPCE students and faculty access the CMS to obtain course content and interact with each other asynchronously. Online courses are not restricted by traditional course meeting times; therefore, the CMS, which for the CPCE replaces the traditional classroom, must be available to students and faculty 24 hours a day, 7 days a week while courses are offered.

- **System/Service:** WebCT/Blackboard CMS Server System
- **Dependencies:** LDAP System, Oracle Server System, SCT Banner

Email

Email is the prime means of communication for students and faculty participating in online courses. While telephone communication is available, email will be the preferred choice of immediate correspondence. It is critical that both the employee and student email systems have maximum uptime, reliability, and stability.

- **System/Service:** Microsoft Exchange (Employee) Email System, Student Email System
- **Dependencies:** LDAP System, SAN Storage System

Web Site

The CPCE Online Education web site will be the main entry point for all CPCE students and faculty for all related web services. Students enrolled in courses with the CPCE will generally work through the CPCE web site portal to access other campus web services, such as Banner, email, the CMS, etc. Also, the CPCE web site will serve as the primary face and presence of the college's Online Education Program (for Marketing purposes), making it absolutely critical that the core CPCE website itself has maximum uptime. The CPCE core Online Education site should have the availability and reliability of the core Rowan University web site.

- **System/Service:** Campus web server
- **Dependencies:** Related web services, LDAP System

SCT Banner

SCT Banner supports many related web services, including student management and registration. More importantly for the CPCE and its online course offerings, SCT Banner provides the student, faculty, and course management information backbone on which the CMS is driven. The main advantage to hosting the CMS in-house is that it is integrated with the SCT Banner system, thus greatly facilitating the setup of all courses, accounts, users, etc. within the CMS. Beyond this reason, SCT Banner is mission critical for the entire University, and therefore inherently mission critical for the CPCE.

- **System/Service:** SCT Banner servers and related systems

Glossary

Asynchronous - not occurring at the same time; of or pertaining to operation without the use of fixed time intervals.

Change Management – a policy designed to govern how and when changes are made to the network production environment. The goal of change management is for involved parties to act collaboratively to prevent downtime of day-to-day business due to network systems changes by accounting for all possible change effects.

CMS – Course Management System; relating to college courses/classes

CPCE – the College of Professional and Continuing Education at Rowan University

in-house – this term implies that the hardware/software infrastructure for the systems and services it refers to are located on the premises and run internally by Rowan University staff.

LDAP – an acronym for Lightweight Directory Access Protocol. Essentially, the LDAP system is the network directory service providing authentication information (username/password) for all network user accounts. Systems and services that need to be protected under account authentication are typically tied into the LDAP system such that users only need to work with a single user account for all services on campus.

Online course – a college course/class delivered entirely via online, or Internet-based, technology. Students and instructors meet virtually without traditional boundaries such as geography or location, classroom space, or time.

Production – a mode of operation that supports daily critical systems and services. Typically, this term relates to hardware and software used in daily operation on campus. Systems that are not in production are considered in testing or development.

Sandbox – the term refers to system hardware or software that is being developed or tested in an environment that has no effect or interaction with the production environment.

SCT Banner – this is an integrated enterprise management and administration system for the entire University. The Banner system encompasses many services including student registration, student and employee management, student grades, financial data, etc.

Traditional course – a college course delivered in the traditional sense where students meet with an instructor in a physical classroom as a specified time.

Uptime – the amount of time that a given computing system is available; that is, the system is powered on, accessible, and operating successfully. Uptime is typically measured in hours. For this document, uptime is given in percentages based on total possible uptime. For example, if a system has been operating for 100 hours and has a 98% uptime requirement, then it should be available for at least 98 of the 100 hours.

WebCT/Blackboard – the primary commercial course management system product licensed, hosted, and managed by Rowan University

Appendix V
Rowan University Technology Resources Assessment
(Source: Peter Saxena – September 2005)

Rowan University Technology Resources Assessment

Prepared for:

Anthony J. Mordosky
Associate Provost for Information Resources/CIO
Rowan University
856-256-4743
mordosky@rowan.edu

Prepared By:

Peter Saxena
Chief Information Officer
Roberts Wesleyan College and Northeastern Seminary
Rochester NY
(585) 594-6430
saxenap@roberts.edu

The scope of this report:

This report attempts to help Rowan University address the following issues surrounding their IT resources.

1. Does Rowan University have the right number of IT resources supporting the different IT needs across its campuses? If not, what should the support resource levels look like?

2. Are the resources being paid adequately within the geographical marketplace around Rowan University in order for the University to have a competitive advantage to retain its IT resources?

Rowan University:

- Rowan University has nearly 9,800 students, 8350 (FTE: 7230) in undergraduate studies and approximately 1450 (FTE:590) in graduate programs.
- The University has two campuses. The main campus is in Glassboro NJ and a much smaller shared campus is at Camden.
- It has 6 Colleges.
- Faculty count: approximately 415 full time faculty and 390 adjunct faculty per faculty.
- Staff Count: approximately 500 to 600 staff and administrators (estimate)
- Classrooms: 210
- Computer labs: 30 open + 20 specialized + 4 mobile.

Current IT Organization Structure:

I took the current org chart and categorized it into major service areas with resource allocations as shown below. My goal is to classify the resources within this format and then start looking for areas where resources are adequate or below adequate.

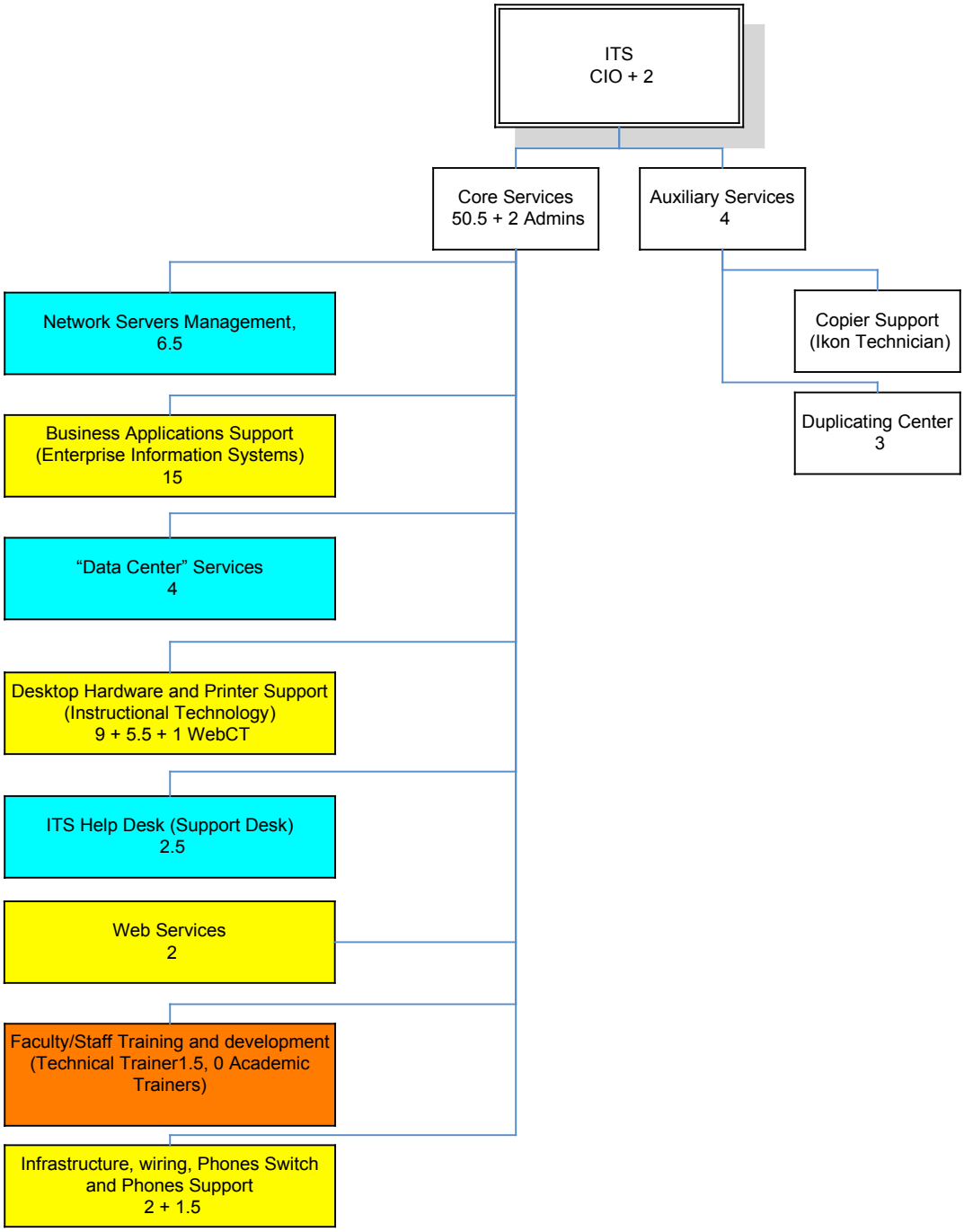

Figure 1 Current Resource Structure

Overall assumptions and observations for this chart:

- I noticed that almost all functions associated with technology are under the CIO which is a great. However, for a university of this size and one having an engineering school, it is quite possible that there are several resources within each school that are dedicated to technology support activities. These resources will be in addition to the IT resources and will not show any direct reporting structure to the CIO. For the purpose of this analysis, I am assuming that there are very few university resources that fall into this category.

- I also noticed that the CIO had responsibility of the Duplicating center. I am not opposed to this, however, if we start comparing resource allocations of Rowan University with other universities, we have to make sure that we are comparing the resources according to their function. Most universities do not include copying and duplicating resources under "Technology" funding. To be safe, I created an early classification; Core Technology services and Auxiliary Services. This is not to say that these services are not important to the functioning of the institution, but simply to say that most institutions would not consider them as "Technology".

- Audio Visual is again one of those functions that is ambiguous at this point as to its place within the institutional org chart. However with the advent of smart classrooms, many institutions are absorbing the AV resources within their budget and I have left it as is in my classification.

Resource Observations based on Current Allocations:

Initial comments:

- As I review each area below, I will be making comments about current resource allocations and desired resource allocations. If the workload of resources is fairly constant then desired resource allocations are easy to tabulate. You compare the amount of workload items that come in within a period of time with the amount of work that is completed within that same period of time. If the amount of work coming in is equal to (or less than) the amount of work being accomplished, then the resource allocations are adequate. If the resource levels are in-adequate, then there will be a gap between amount of work coming in and accomplished. Based on work load and resource ratios, it is not difficult to calculate how many additional resources will be necessary to close the gap.

  However, Higher education IT support is very cyclical as illustrated below. Traditionally, the support required is very high in September, high in October and January and moderately high in December and mid April to mid May. For the rest of the year, it is fairly constant. The IT projects load follows a

different cycle. The project activity rates are very high in the summer, moderately high during break weeks throughout the school year and relatively low at other times.

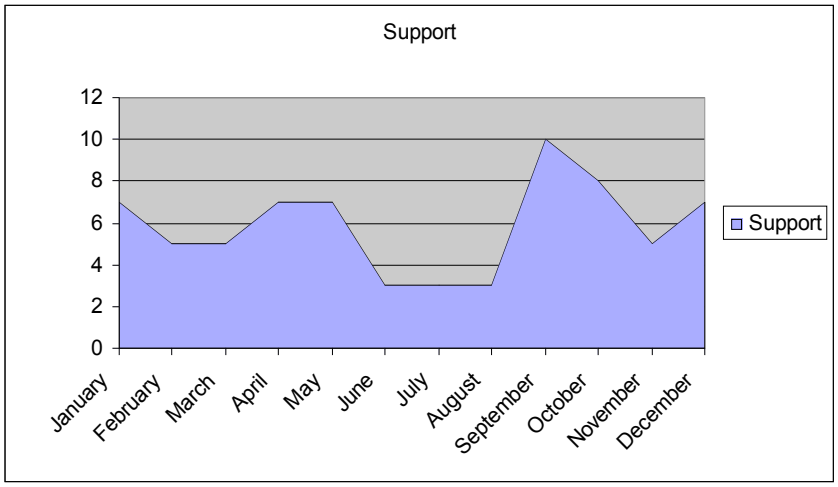

Figure 2: Support Variations in HE

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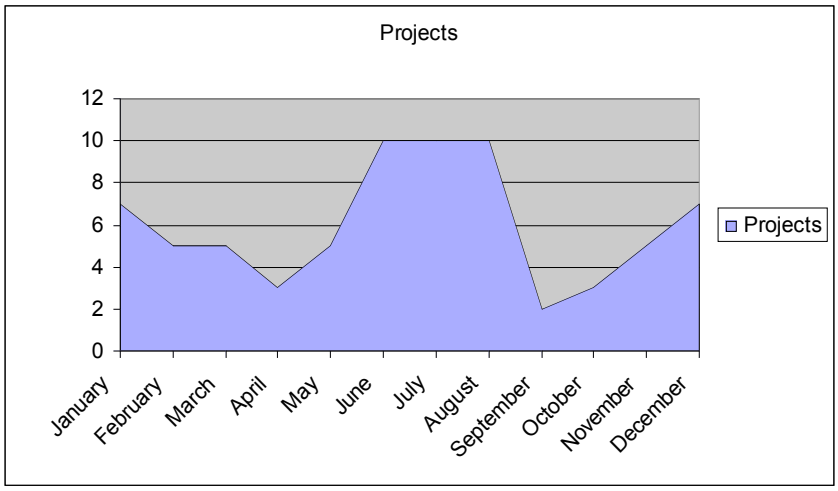

Figure 3: Projects Variations in HE

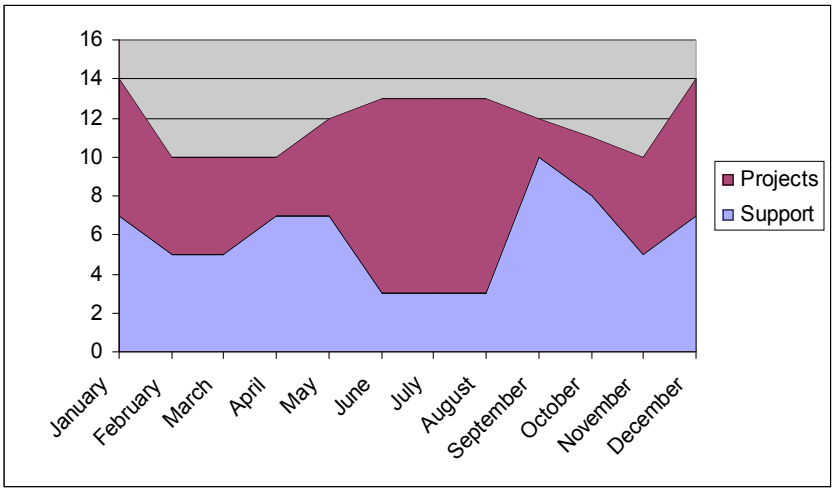

Figure 4: Total resource Variations in HE

The last chart represents the total utilization of IT resources within a typical higher education institution and represents the challenge of higher education technology management. It is very difficult to empirically quantify the workload associated with the peaks and valleys and therefore quantitatively assign resource allocations. The challenge is three fold:

1. Get resources that would be good to work on support issues and projects (most people are good at one or the other).
2. Balance work loads to ensure that you are not terribly understaffed during high periods or too over staffed in low periods.
3. Understand that due to the nature of the cyclical support and budget restrictions, the CIO will never have adequate resources in peak periods and therefore he/she has to balance and manage the expectations of the constituency during these periods, doing the critical to most important items and pushing the less important ones into lesser busy months where possible.

- Staffing IT within higher education is similar to making course adjustments to a moving ship. Most CIOs start with the resources that they have and use their experience as well as the experience of their colleagues to make adjustments that they feel are necessary.

  The next step is to carefully watch the progress and see if you are approaching the desired outcomes. You continue the process until you achieve the balance you are looking for. It is also very difficult to create pragmatic and empirical need justifications. Higher education does not produce a measurable output and therefore it is not always easy to measure success or failure. Many times the measurements are the collective objective opinions of the constituency

involved. I have several suggestions below that are designed to help the CIO in this process.

Rowan University Information Technology Resources:

I am outlining below my observations and suggestions for each area of technology support. From a benchmarking perspective, we are looking at 52.5 IT resources that report to the CIO. The 4 additional resources in the Copier and Duplicating center are labeled as Auxiliary services.

- **Network and Server Management**
  - **Responsibilities**:
    - Manage campus servers OS, email and user processing for all campus servers deployed in Solaris, Novell, Windows and Linux.
    - Network intrusion detection and security services.
    - Manage network electronics and infrastructure up to the wall.
    - Manage Internet connectivity.
    - Manage VOIP implementation.
    - Interface with the other IT teams to create a portfolio of Network services for Faculty/ Staff and Students through current and emerging technologies.
  - **Current Resource Levels**: 6.5
  - **Comments**: The current levels of staffing are low and my assumption is that these 6.5 resources are spread across the different areas identified above. To do justice to the area of coverage for this department, I am going to break down the resource needs based on area of responsibility and suggest adequate resource levels:
    1. Managing servers, OS, Email and User services on three environments for nearly 90+ servers on campus.
       If Rowan U. had a standard server operating system deployment along with a uniform email system e.g. all servers were Windows Server utilizing Active Directory services and SQL Exchange as their Email, they could manage all these server management pieces with 4 to 6 network administrator. However with the university having large portfolio of server operating systems, email and user management services, and with the high levels of specialized skill sets required for each of these areas from Network administrators, <u>Rowan University will probably need between 6 to 8 resources, just to manage these services.</u>
    2. Network Security and Intrusion detection services.
       The size of the Rowan University network prompts me to assume that the university maintains multiple connections to the Internet and probably has several areas of wireless connectivity on campus. All these factors combined with over

8000 students make me believe that the university could use specialized services in protecting their users and their data from viruses and unauthorized intrusions or hacking.

It is difficult to put a number on these resources. MIT e.g. had 15 resources dedicated to network security management in 2003 to protect themselves from 25,000 highly active students. For your size of the institution, I would certainly recommend dedicated security management resources versus a network admin who also managed other services. My suggestion would be to start with 1 dedicated resource and add more resources as the workload becomes evident.

3. Voice Over IP Implementation.
   For your sized institution, I would recommend 0.5 FTE dedicated resource for VOIP server and Voice Mail server management and another 0.5 FTE resource to manage the phones deployment and training for Faculty and Staff.

   Unfortunately it may be difficult for one resource to serve these two functions. The skill set required for the first part of the job are similar to those of a network administrator. The skill sets required for the second part of the job are more at a technician level.

   I am not sure if student dorm phones are VOIP or not. If students are also on this network then 1 additional resource should be considered to manage the additional support volume.

4. Managing infrastructure wiring and network electronic changes.
   The network administrator resources in service 1 above should be required to manage the network architecture and deployment of network switches e.g. creating the right level of subnets for the campus and configuring the centralized electronics to implement the desired structure.

   However, there should be at-least 2-4 technician resources who would support the wiring infrastructure and network electronics deployed across the campus.

- Total Current Resources: 6.5 + 0.5 management resource
- Total desired resources: 11-14 + 1 - 2 management resources.

- **Business Applications Support Services:**
  - **Assumed Responsibilities:**
    Responsible for managing all administrative business applications, systems and resources as well as be the liaison for the administrative

community within the ITS organization. This group will create relationships with direct administrative users and those within divisions and schools, determine their needs and champion the fulfillment of these needs within the ITS organization.

Internally they will closely interface with their own areas supporting various business applications and create seamless applications for Information exchange within the enterprise. They will also obtain funding, training and other resources to fulfill the needs of their constituency.

- **Current Resources: 17:**
  If we take out James Henderson and Irene Mathieson, there are 15 resources in this area; 1 project lead, 2 DBAs, 6 business analysts and 6 programmers. I am assuming that the Information system analysts are "business analysts" meaning that they are proficient in technology development but are dedicated to supporting the users and the ERP packages that are used by the institution. The Programmers on the other hand write and support the "bridges" between applications as well as the functionality that does not exist within the ERP applications.

- On the surface this staffing looks adequate if you are primarily using ERP packages and have very few custom built applications with one exception as detailed below.

- One project lead for 14 developers is difficult. You could probably add an additional project lead/senior business analyst and split the DBAs, analysts and developers in half. This would give each lead a staff of 7 and I think that would significantly increase the output of the entire area.

- I would suggest adding 1 additional project lead to the mix of current resource projections to handle the additional load of the current implementations.

- **Data Center Services:**
  - **No comments.**

- **Desktop Hardware and Printers Support (Instructional Technology)**
  - **Assumed Responsibilities:**
    This group will manage all client computers and printers for the institution in all offices, classrooms, labs and kiosks. They will be responsible for managing the delivery of all services "between the network jack and the user".

- I am assuming that all faculty and staff have an adequate computer. Your website puts the number of labs at 33. I am assuming that each has on average between 15 to 20 computers. I am also assuming that between 50% to 75% of your classrooms are “smart classrooms”.

- Current Allocations: 14.5 including AV. This area is heavily impacted by cyclical nature of support in higher education. At the start of school year, there are never enough technicians to support the needs and as the school progresses, the support needed declines over time.

  I would suggest that the management set some targets for support levels for the start of school and ongoing and then keep a close watch on the time it takes to close work requests. E.g. you may say that your desired level of service during September is that most of the critical work items are resolved within a day and major work items resolved within a week. If this is achieved in 95% of the cases, then the resource allocations are acceptable for the start of school. If it is taking longer than that then additional support resources are needed during this time.

  In the same manner you could define LOS during the school year as; critical support needs in classrooms are resolved within 30 minutes and more than 90% of other items resolved within 2 days. Again if you hit this target 95% of the time then the support resources are adequate.

  I would suggest that once you define these targets, you review these with some IT committee that has faculty and administrator participation. This will authenticate the process and provide credibility to your desired LOS. Faculty usually would like 5 minute turnaround to all problems but in most campuses this is just not possible. However, by presenting some level of desired service levels to them builds trust and appreciation of these resources.

- I also like the combination of centralized technicians and de-centralized technicians to support larger campus deployments. The de-centralized technicians physically reside in major buildings or geographical locations to provide just in time support. I would suggest adding additional de-centralized technicians to the 4 other schools, plus at least 1 more to Camden. If the locations would permit, you could provide 3 technicians to cover two schools thus getting 1.5 technicians each versus 2 per school.

- These technicians cost the least in salaries but have a large impact on the usage of technology across the campus. Technology on a campus is <u>always</u> required to work whenever faculty, staff and students need it and if there is a problem, it needs to be fixed very quickly or else it

becomes a “reliability” issue and they stop using it.

- **ITS Help Desk**
  - This function is currently under Bruce Klein. I am hoping that this “Support Desk” handles all calls for all areas versus just the Network area. If it does then this area is providing 120 hours of manned coverage to the help desk and should be adequate.
  - I am also hoping that there is a roll over option where if the call volume is high, the calls would roll over to available technicians in the Network or the Instructional technology area.

- **Web Services:**
  - **Assumed Responsibilities:**
    Responsible for all institutional websites, both on the Internet and the Intranet.
    This group will also coordinate activities and responsibilities for all web based application services in conjunction with the Administrative Application Support units as well.

  - **This area appears to be highly inadequate to support the web needs of the institution. There are several possibilities:**
    - A good part of the Internet development work is being outsourced
    - A good part of the Internet development work is being done within individual schools and therefore the resources are budgeted there.
    - Web services to business applications are being handled by the “Enterprise Information Services” area. In this case, they are under staffed to handle this load.

  - **If every service listed above is being handled by this department, this area could have 2 - 4 resources with strong web development skills and 2 - 3 resources with strong graphic skills for a total of 4 - 7.**

- **Faculty and Staff Training and Development:**

  Politically, this is a critical area within the ITS department.
  Assumed Responsibility: Faculty Development and liaison for the academic community within the ITS organization.

  Liaison: This department will create relationships with faculty and their divisions and schools, determine their needs and either directly help in meeting their needs or champion the fulfillment of these needs within the IT organization. Internally they will work closely with the other IT areas to obtain funding, training and other resources to fulfill the needs of their

constituency.

It is extremely important for faculty to feel comfortable that they have an inside voice within the ITS support infrastructure. It is equally important for ITS to have full view of what the needs and wants are within the academic world in order to plan on addressing them. This department will be a key player in fulfilling this very important need.

Faculty Development and Staff training: This department will also specialize in creating and delivering pertinent, on the job training and hand holding support for faculty. For staff, they will work closely with the other directors and the institution to determine training needs and meeting these needs. It is no longer possible to assume that the incoming students will be familiar with on campus technologies and therefore will be able to perform seamlessly. This department will mobilize ITS resources to focus on appropriate technology enabler-training programs for students.

Course Management Systems: A recent study by ECAR of the University of Wisconsin system found that more than 95% of CMS use occurs within traditional classroom settings and only 5% in true Online offerings. This would be true for Rowan as well either now or in the near future. In order for the Faculty and the Students to effectively use this resource, they will require dedicated training and support resources.

For the size of the University and its current and future dependence on technology, I would suggest 4-6 training and faculty development resources, with some levels of dedicated support for each school. I would also recommend moving the WebCT resources under this group. This would move the resource count from currently 0 faculty development WebCT resource to 5-7 faculty support and WebCT resources.

Another area of "instructional support" is Course Management Systems *administrative* support for Faculty and Students. Current allocation is 1 resource. For the size of Rowan University, this area could use additional resources if the use of the CMS on the campus ramps up.

- **Phones Support: + Wiring and Infrastructure support:**
  - I am not sure how much of the campus is VOIP and traditional phones. The VOIP resource count above under network resources support the VOIP infrastructure. The wiring and infrastructure would also supported by the resources identified above.
    The resources identified here are only for traditional phone switch and phone lines support and the current allocation of 2 + 1.5 resources for over 800 faculty and staff phones, 300 phones across the campus and

nearly 3000 to 4000 student phones appears to be low. Appropriate resources could possibly be nearly 4.

Suggested Rowan University Technology Support Structure:

Figure 5 below presents some of the suggested resource changes within the ITS organization.

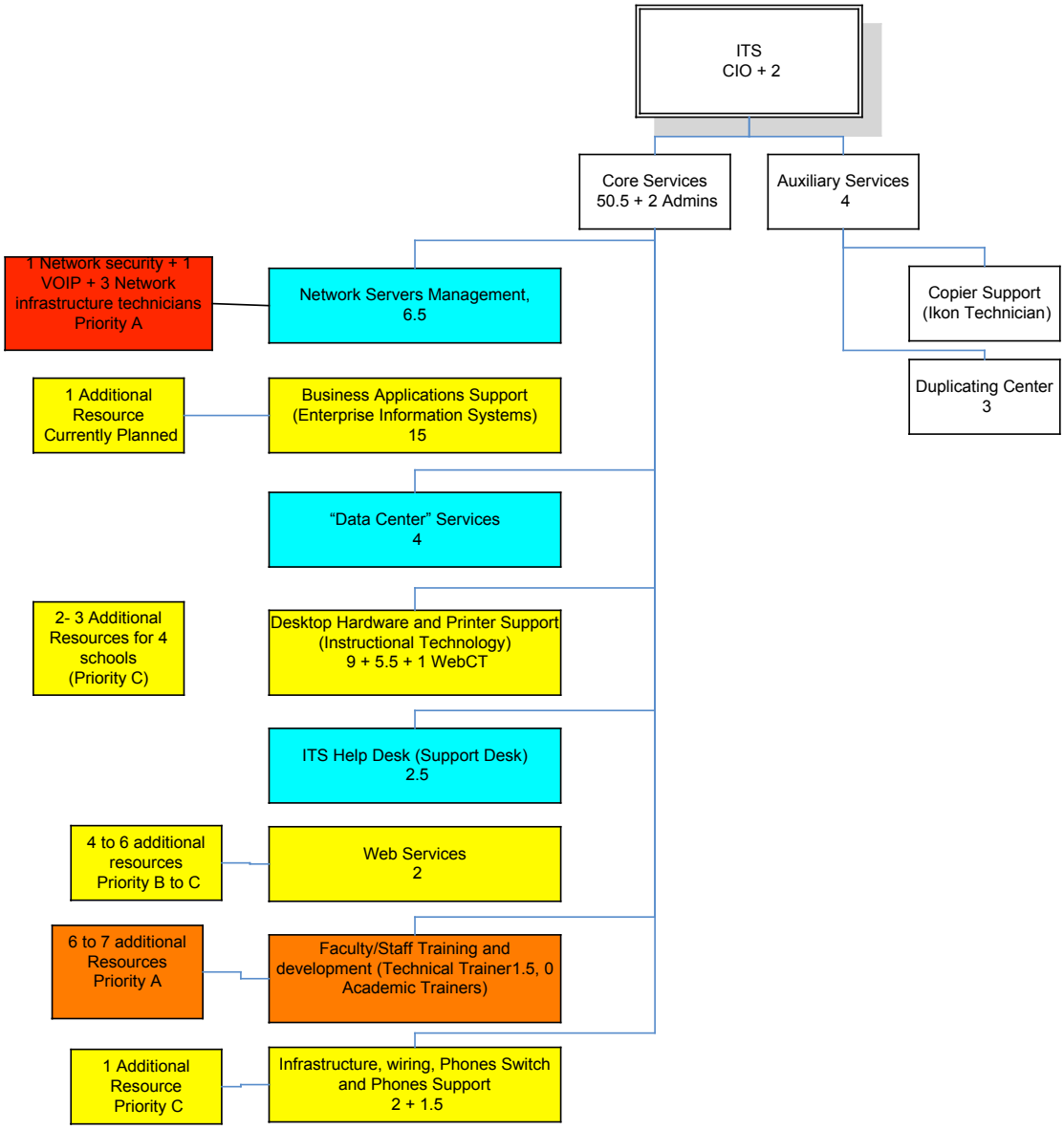

Figure 5: Suggested Minimum Additional Resources

Additional comments:

- **Validation:**
  Certainly the University should perform the due diligence necessary to

determine the validity of these suggestions and normalize the suggested needs based on their experience and judgment. There are also many indicators that would suggest that the above staffing levels are needed and many of these could be used as justification elements for additional resources.

Some Indicators that would suggest that the areas identified above do need additional resources:

- These areas consistently score lower in customer satisfaction surveys.
- These areas consistently have a high number of issues, many of which remain un-resolved for a long period of time.
- Faculty, staff and students have often expresses dissatisfaction with the level of service provided and there is a lot of discontent associated with that area.
- Faculty, staff and students have consistently expressed a need for more support or support towards a specific area (e.g. faculty needing someone who can work with them to help learn available technology and provide hand holding support as they implement them within their classroom processes).
- Current resources appear to be very thin on providing traditionally accepted "Academic Support" activities. Faculty may appear to be more dissatisfied with technology. Another indicator would be that the academic use of technology on the campus would be lower than other similar campuses and faculty may express a lack of "trust" within the technology support infrastructure.
- Departments are creating internal resources to support areas that ITS is supposed to be supporting.
- Other ITS areas are finding it difficult to get proper support and resolution from these IT areas.

- **Salary Adjustments strategy.**

    - Adequacy of salary levels of various positions within the organization could become an important resource retention strategy for the department in the near future.

    - There are several industry reports available that could provide salary ranges for IT positions within the general geographic regions of Rowan University for both, for-profit employers and higher education. Rowan probably has a general standard where they plan to keep the pay of their resources within a certain percentage within their geography. E.g. Rowan could be paying an accounting position 80% of what they could make working for industry and 5% more than the next major university campus near

by.

- **A similar due diligence would provide you with the approximate ranges of the salaries for different positions within IT.**

- The CIO along with his key managers and HR should then normalize this data, compare it to current salary levels and determine the desired salary levels of different people within the organization.

- **Phased resource and salary infusion strategy.**

  - The additional resources address two needs. One is the immediate need where the support needs are clearly inadequate, for example in the Phones support and the Desktop support area. The second need is more strategic where support needs grow as it is provided. This would be true in the area of Faculty development and training. As you provide the support, you encourage and support evolutionary thinking within faculty members and over time, the support needs grow significantly.

  - Due to the budgetary processes with higher education, I would recommend that the university create a 2 or 3 year plan of gradually increasing salary levels and resource levels to desired levels. Both should be addressed each year however, communicate the planning of salary increases as early as possible and certainly create positive infusion as a priority over hires each year for existing staff. This would add to the morale and enable you to retain resources. The hope is that many would wait for their raise, versus taking a different job (the ones who leave, will leave anyway and there is no point creating a retention strategy for them).

- **Participation of the Associate Provost of Technology at the President's Cabinet.**
  - Rowan CIO is the highest level technology administrator on the campus and my assumption is that the campus recognizes and respects the responsibilities of Mr. Mordosky. A key strategic suggestion would be that the campus considers including Mr. Mordosky within the president's cabinet.
  - The President's Cabinet is composed of key individuals who provide oversight and management to several strategically critical areas of the campus. 10 years ago, the number of CIOs who sat on a President's cabinet were limited to those from highly technical schools. Currently, over 50% of CIOs (out of a sampling of 800

campuses within the Educause Core Data Survey) function as Cabinet members. The main impetus for this has been the transition of technology from a role of primarily supporting administrative applications 10 years ago to now where it enables the deployment of a major portion of education and education related services to faculty, staff and students. Many decisions within a President's cabinet today impact technology or are dependant on technology process integration and they require the expertise and insights of the senior technology administrator to be successful.

- In cases where the senior technology administrator is represented by another senior administrator on the cabinet, several issues can arise which could be detrimental to the institution.
    - Technology by nature is highly specialized and in most cases decisions regarding technology and its resources should be made with the help of senior IT professionals versus without them.
    - Technology is expensive and deployment and resource needs must be carefully managed at the institutional level. Allowing the CIO to participate at that level enables him/her to bring that focus to the cabinet as well as take it back to the IT resources. There may be cases where the institutional priority to fund a technology related service would take precedence over another item due to the impact of the technology on several different initiatives. There may be other cases, where technology may have to wait. In both cases, decisions will be made by fully understanding the values of all initiatives at the institutional level.

Suggested short term strategies:

1) Push to retain the Budget for the 3 additional Banner resources after the project is complete. The current resources are planned to be let go but the budget can be used to create a new IR department dedicated to Faculty Training and Development. You could hire 3 faculty development resources (with faculty leadership input in the hiring process) and move the WebCT person into this department.

   I would suggest creating authentication and support for this need through the Academic "system" of the institution by leveraging academic technology committees, faculty development committees, schools and departments that are looking for renewing accreditations, committees and faculty groups that you think would appreciate that you would want to do this for them and would be willing to talk to the Deans of their schools and other campus leaders to help you in this effort.

2) Use the current dissatisfaction level indicators (visible to the VPs) for the network reliability to create a case for the additional Network support resources and replacement electronics equipment.

It would be beneficial if you could create a direct value link between a good network and academic success within the classrooms and then create a case that the institution is really being negatively impacted due to lack of good network services to support the academic goals of its faculty, staff and students.

3) I do think that you need a 3 year computer replacement cycle for classrooms, labs, high end faculty users and staff/administrators and a 4 year cycle for everyone else. A three year cycle for all your critical servers and a 5 year cycle for most of your network electronics. This is not a short term battle but the longer you retain equipment, the more support it needs and the more un-reliable it becomes. Both factors are not good for higher education technology use where equipment is expected to work when it is needed and users cannot wait. It is difficult to be in a class and tell the students that they will have to wait to see the class presentation since the network is slow at the moment!

Appendix VI

Educause Core Data
Comparison with Comparable Institutions – Number of Support Staff

Institution	FTE Students	Weight	Total Staff	Total Staff Weighted	Comments
					1. FTE Students is used to normalize the data for comparison purposes. 2. The Weight for each institution is calculated as: 2.0 - (FTE Students)/MAX(FTE Students of all institutions) This provides a normalized comparison which relates the number of support staff to the number of student FTEs in each institution. 3. Illustrative Example: Millersville has 6972 FTEs. Rowan has 8247 FTEs. 6972*1.155 (the "weight" assigned to Millersville) = 8052 *equivalent* FTEs. By adjusting the staffing levels using this normalized value, Millersville can be compared to Rowan as if it were the same size, and not ~15% smaller. 4. The Weighted Average is the statistical average of each institution's FTEs multiplied by its weight. 5. The calculated Difference of 4.6 staff members is the Weighted Average staffing (60.6) subtracted from Rowan's overall staffing (56.0).
Bridgewater State College	7,722	1.064	55.5	59.1	
Humboldt State University	6,773	1.179	50.0	59.0	
Millersville University of Pennsylvania	6,972	1.155	46.0	53.0	
Rowan University	8,247	**1.000**	**56.0**	**56.0**	
Sonoma State University	6,781	1.178	47.0	55.4	
University of Tennessee at Chattanooga	7,373	1.106	40.0	44.2	
University of West Florida	7,307	1.114	53.0	59.0	
Western Carolina University	7,246	1.121	60.8	68.2	
The College of New Jersey*	5,900	1.285	67.7	87.0	
Weighted Average				60.6	
Rowan University				**56.0**	
Difference				(4.6)	