GCC Governing Board Meeting
October 17, 2011

SUBJECT: Response to Recommendation 8

Executive Summary

This report addresses Recommendation 8 in the Evaluation Report presented by the Accreditation Commission in May 2010*: "The team recommends that the college take the necessary steps to ensure the safety of the servers so that the system does not shut down due to overheating."*

The server room located on the first floor of the Library Building was built in 1997, fifteen years ago. Since then computer and network equipment, energy efficiency requirements, and data center best practices have changed significantly. Server rooms now require a more state-of-the-art temperature-controlled environment to maintain optimal performance of equipment and provide data protection. Server rooms also require reliable power provisioning, safe fire suppressions systems, and appropriate secure access controls.

This document summarizes the four critical components of a mission-critical campus data center as well as summarizes the obsolete systems currently in use on campus that directly affect the stability of the servers and threaten the continuity of computer access for students, faculty, and staff. This document also identifies the improvements required to increase the safety of the equipment located in the server room as well as satisfy the recommendation of the Accreditation Committee.

Current Risks

There are four critical components to protecting the college data center: cooling systems, power provisioning, fire suppression, and physical access. The first three components currently do not provide adequate protection against downtime and loss.

Cooling Systems: Cooling has been the primary source of the system outages. The server room requires an appropriate air-conditioning system that is controllable, reliable, and sufficient for the size and configuration of the server room. The current system is obsolete and no longer adequate. It is comprised of two, 15-year-old air-conditioning units that have become unreliable and have caused the servers and the network equipment to overheat. These cooling failures have led to serious equipment damage and extensive unplanned downtime. The air-conditioning units currently in use are:

Compu-Aire System 2100 40-ton chilled water downflow cooling system. The Computer Room Air Handler (CRAH) has fans, and central plant provides the chilled water to remove heat from the data center.

Compu-Aire System 2100 30-ton DS downflow cooling system. The Computer Room Air Conditioner (CRAC) has internal compressors using the direct expansion (DX) of refrigerant to remove heat from the data center. The CRAC unit provides precise temperature and humidity control for the mission critical environments and is designed for 24/7/365 operation.

Both units are down flow systems that work together and use the raised floor plenum space to distribute chilled air directly to the data center racks, also known as the server cabinets where the servers are stored.

The continued use of the current cooling system and ongoing air flow inefficiencies creates the following three risks:

1. The two Air Conditioning units are fifteen years old and are at the end of the useful life. There is a high risk of equipment failure, and replacement parts are costly and difficult to obtain.
2. The CREH, chilled water system, runs only when the entire building is being cooled; therefore, there is no failover during nights, weekends, and holidays. Consequently, if the CRAC unit fails during off hours, there is a high risk that the room will quickly overheat and cause the servers to shut down.
3. The airflow itself is as critical as the cooling process because the air movement through the server racks cools the servers to help keep them functioning properly.
    a. The internal walls are limiting space utilization by obstructing optimal aisle configuration as well as severely restricting return air flow to the back to the AC unit air handlers. These walls create significant cooling inefficiencies for the room.
    b. The airflow in the raised floor plenum is restricted causing a reduction in the amount of cool air flowing from the AC units to the computer equipment thereby impeding the cooling process. The restricted airflow under the floor causes a very high static pressure risking the stability of the AC units, and consequently, risking the proper function of the servers.
    c. The cool air is mixing with hot air when it is returning to the AC units. This makes the system work harder because the system must then re-cool the air. Additionally, the hot air is warming the newly cooled air diminishing the desired effect of the cooling system. The combination of cooling and re-cooling puts a strain on the aging system and threatens the performance of the servers.

Power Provisioning: Electrical power is also a critical component that directly impacts the availability of vital systems on the campus network. A centralized uninterrupted power supply (UPS) system, overhead power, power distribution units (PDU), and an emergency standby generator are necessary elements to achieve reliable protection for our servers. The current data center is not equipped with these vital elements causing an increased risk of extensive downtime should normal power be disrupted.

Fire Suppression: No doubt, a fire can create substantial damage to systems and equipment causing extended downtime and costing hundreds of thousands of dollars to replace. Currently, there is no fire suppression system in the server room leaving the equipment at risk of serious damage or destruction in the event of a fire.

Physical Access: Entry to the server room should be limited to those whose responsibilities require such access. The risks of unwanted access have recently been addressed by the installation of door access controls. ITS and Facilities installed a new card-access system to the ITS office area and the server room. Access has been set up to allow entry based on job duties. All entries are now electronically logged and monitored on the system allowing for tighter security and control. Malicious or accidental acts of destruction or theft have now been minimized.

Proposed Resolutions

In order to fully protect the safety of the data center and servers from heat, power outages, and fire the following improvements to the server room should be implemented. These improvements will increase performance of the campus computers systems, decrease downtime, and reduce the risk of equipment damage due to malfunction or fire.

Cooling System

- Recalculate the current data center cooling requirements based on total watts used by all equipment located in the server room now and in the future.
- Replace both cooling systems as they are worn out and no longer reliable. Install two new Computer Room Air Conditioning N+1 redundant refrigerant-based (DX) down flow units that operate as a single system for maximum efficiency and reliability for supporting 24/7/365 operations.
- Remove the internal walls to maximize airflow efficiency and space utilization.
- Rearrange server cabinet rows creating hot aisle/cold aisle layout to separate inlet cold air and exhaust hot air to lower cooling costs by better managing airflow*.
- Anchor racks to the concrete floor to improve physical stability and safety.
- Install overhead ladder racks to relocate the data cable and electrical power from under the raised plenum floor; this will reduce air flow restrictions as well as protect the cabling from damage due to possible flooding.
- Replace existing raised floor perforated panels with new high output air grates to provide 55 to 70% open area to reduce the static pressure and increase the air flow from the AC units in front of every rack.
- Use ducted or plenum ceiling return air to decrease the mixing of hot and cold air; this will help reduce short cycling (bypass air) when cold air is pulled directly into the air handlers without cooling the equipment in the racks.

**servers intake air in the front and exhaust air in the rear. The cabinets should be laid out so that the front of racks face each other (cold isle) and the back of the racks create a hot aisle where the exhaust air is routed back to the AC unit return air handler on the top of the units.*

Power Supply

- Install a standby generator to power emergency circuits to the AC units, UPS system, and the Fire Suppression System in the server room to ensure instantaneous switchover in the event of a power failure.
- Replace the distributed rack-mounted UPS systems with a centralized, fault tolerant (N+1) American Power Conversion (APC) Uninterruptible Power Supply (UPS) system with a 15 to 20 minute runtime.
- Install two vertical metered PDUs connected to a separate circuit in the UPS system for redundant server power in every rack.

Fire Suppression

- Protect the server room by implementing a FM-200 clean agent fire suppression system which will interrupt the chemical chain reaction in fires and absorbs the heat to protect the computing hardware and data.
- Adequately seal the server room to prevent agent leakage.
- Install a post-extinguishment purge ventilation system to remove the agent using exhaust fans.

Summary

Based on the information in this report, it is clear that the critical systems necessary to provide proper data protection are in need of an upgrade. Addendum A specifies the materials, equipment, and costs necessary in order to raise the level of protection of the data center that is appropriate for the needs of GCC. The $950,000 investment detailed in the Addendum protects the computer equipment in the server room from serious damage and downtime by ensuring that appropriate cooling, power, and fire protection will be available 24/7/365. The proposed resolutions in this report should be the minimum standards of protection for the data center on campus. As highlighted in this report, the need for improvement is immediate. By approving this project, the college is safeguarding its data and systems; increasing computer reliability; meeting the access needs of students, faculty, and staff; and raising data protection up to best practices and industry-accepted standards. Finally, this investment will also sufficiently address the concerns raised in the Accreditation Commission Evaluation Report.

Recommendation

Staff recommends the approval of the server room upgrade project.

Addendum A

Two Compu-Aire, Liebert, or similar Refrigerant-based (DX), down flow computer room air conditioners; preferably one with dual cooling option connected to the central chiller plant and DX in a single unit	$176,000
Construction; Internal wall removal and return air modifications	$45,000
Overhead ladder racks, cabinets, floor panels, cabling, cable management, etc.	$92,000
Centralized APC Smart-UPS with Battery Modules and rack-mounted APC vertical PDUs	$165,000
Generac or similar Commercial Standby Generator	$240,000
Fike FM-200 Clean Air Fire Suppression System with exhaust purge system	$95,000
Electrical, consulting, other services	$60,000
Tax and Permits	$77,000
Contingency Reserve	$50,000
TOTAL	$1,000,000