GAVILAN COLLEGE

Information Technology

Infrastructure Assessment

Developed by:
Larry Angus
Angus-Hamer, Inc.
8/15/2015

Table of Contents

1.0 Introduction and Background

Angus-Hamer, Incorporated has been engaged by Gavilan Joint Community College District to perform a review of its Information Technology (IT) Infrastructure. This analysis is being done in concert with and in support of the enhancements to the college's main enterprise information systems known as Ellucian/Banner. Angus-Hamer has also been engaged to assist the college with evaluating and implementing additional modules for the enterprise information system. The Banner Enhancement Project Business Case prepared by Angus-Hamer is a companion document to this report.

The technology scope covered in this report is:

1. Data Center Core Computing
2. Disaster Recovery and Business Continuity Planning
3. Access-to-Computing-Systems
4. Infrastructure Support Staffing and Support Tools
5. Technology Refresh Planning

Over the past 20 years Gavilan College has made steady improvements to its information technology infrastructure in an effort to provide essential computing services to support its education mission. A key milestone in this effort was the passage and implementation of the Measure E Facilities bond in 2004. The technology aspects of Measure E have been reviewed and recommendations are made where additional improvements are needed. *Intelligent* buildings and their connections are essential to providing access-to-computing. In addition to the building foundational component, this report also reviews the resulting IT components and support structures that ride on the building communications systems and complete the college's Information Technology Infrastructure.

This report provides cost estimates for the recommended improvements to deficiencies found in Gavilan College's IT infrastructure

GAVILAN ✈ COLLEGE

2.0   Data Center Core Computing

The data center located in the multipurpose building houses the college's data center. This space includes network electronics, data security electronics, cabling terminations, data storage, application servers, and the Management Information Systems (MIS) support staff that make up the heart of the college's IT infrastructure. The data center also houses the network electronics and systems that connect the Morgan Hill and Hollister outreach centers and is also the secure portal to the internet.

2.1   Data Storage

Currently the college's data is stored on disc drives that are directly attached to various ageing application and systems servers. For each system, back-up and recovery is managed individually for each application system. The district should consider a centrally managed storage, back-up, and data recovery approach by implementing a Storage Area Network (SAN).

The purpose of a SAN is to securely house and deliver the data for the college in a resilient, central, and easy to manage platform. The storage array will allow a greater ability to recover from hardware failures and other disasters. It will help the college MIS department meet ever growing IT demands/expectations from the campus community. A SAN system will also help an already lean MIS workforce better manage the growing demands of data storage for existing systems, Ellucian/Banner enhancements, and future application storage needs. Another advantage of a comprehensive SAN solution is that it provides the capability to efficiently replicate data stores from site-to-site which will fit into a disaster recovery plan.

Estimated costs for SAN Components: $153,194 – one-time with $12,215 annual maintenance. This includes the storage components required for a primary data center and a secondary data center (see table 7-1 for details).

2.2   Core Servers and Server Virtualization

The college's applications and systems servers need to be refreshed to keep up with current and future data center computing demands. Server equipment refresh insures that the equipment is supported by original equipment manufacturer's support plans and increases computing power and reliability. Organizations are also using virtualization technology to reduce the number of physical servers in their data centers thereby reducing staff support effort, ongoing system maintenance costs, and power consumption. Virtualization provides a greater ability to centrally manage the computing needs of the college and more quickly recover from hardware failures or other disasters. A key advantage of virtualization is the ability to easily package and transport applications systems computing environments to alternate disaster recovery processing locations.

Estimated cost for Core Servers and Virtualization Software: $100,145 one-time, with $15,022 annual maintenance. These costs cover five application servers, and associated virtualization software licenses.

2.3   Core Data Network

The core data network is the network infrastructure contained in the data center which provides the high speed network backbone that connects the virtual server systems to the storage area network and the and associated support systems such as back-up and recovery. The core data network must be high speed to provide the performance and response times required by end system users. The existing core data network is only capable of one gigabit speeds. Gavilan should upgrade the core network to be capable of ten gigabit speeds and higher.

Estimated cost for Core Data Network: $68,553 one-time, with $10,283 annual maintenance. This replaces the aging core networks electronics in the data center.

3.0   Disaster Recovery and Business Continuity Planning

Gavilan College should develop a formal Information Technology Disaster Recovery and Business Continuity Plan which provides both on and off site data replication and critical application processing capabilities. There are a number of options available to Gavilan College with varying levels of protection and costs. As stated earlier a SAN solution not only provides a safer modernized data storage solution for Gavilan but also is a key component of the disaster recovery plan. In addition to existing mission critical application systems, Gavilan intends to process its own payroll in the future, so it is highly recommended that a disaster recovery plan for payroll and all other mission critical systems be developed. There are three disaster recovery options discussed below each providing a higher level of protection. The district would not implement all three options, but would implement a single or blended solution to meet the business requirements and level of protection identified in the proposed requirements and design effort.

3.1   Disaster Recovery Business Requirements and Design

There are several levels of technical solutions that can insure that Gavilan College can continue providing data computing services for mission critical computer applications such as Payroll, Student Records, and Accounting. A prerequisite activity before selecting a solution will be to identify the business requirements for the college's mission critical business applications and to use those requirements to perform a detailed solution design and implementation plan. The following are three options that should be considered. One solution or a combination of the following solutions

could be implemented depending on the level of protection determined by the business requirements.

Estimated consulting fees for developing disaster recovery business requirements and a detail disaster recovery plan: $50,000 one-time.

3.2   On Campus Secondary Site

The Security/Facilities telecommunication closet is currently being used by MIS staff to provide a secondary online back-up of Banner data. A more appropriate telecommunications closet for this type of back-up is the Cosmetology telecommunications closet since it has more space and better HVAC capability. Obviously, this type of local back-up only protects the college from local system failures at the data center and would not protect the college from campus wide or regional outages.

Least protection - Estimated cost for on campus secondary disaster recovery site: $37,983 one-time with $3,004 annual recurring cost. This includes telecommunications room improvements, secondary application server and virtualization software.

3.3   Gavilan Outreach Center Secondary Site

Another option would be to use the Coyote Valley site as a secondary data storage and virtual server site. This newly planned facility could be designed to provide the space and environment for a small secondary data center. LAN-like speeds are now available from the telecommunications carriers that provide the wide area network (WAN) connections between the main campus and Coyote Valley. These high speed WAN connections are needed to replicate data between the disaster recovery site and the main campus. The California Teleconnect Fund offsets the carrier monthly charges making high speed data circuits affordable.

Mid-Level Protection - Estimated cost for outreach center secondary disaster recovery site: $34,533 one-time with $40,991 annual recurring cost. This includes secondary application server, virtualization software, and high speed data communications recurring charges for campus-to-campus communications and Internet.

3.4   Peer College Data Center

It is common practice among K-12 and higher education institutions to set up consortiums to provide back-up data center services for each other. San Joaquin Delta College has created such a back-up data center site for a number of peer community colleges. Delta College's data center provides redundant back-up generators, redundant uninterruptable power systems, redundant HVAC air handlers, and redundant network infrastructure designed for a multi-tenant computing environment.

Wide area network access to Delta College's data center is via the very affordable California Research and Education Network (CalREN), a high-capacity network designed to meet the unique requirements of over 20 million users, including the vast majority of K-20 students together with educators, researchers and other vital public-serving institutions.

Highest Level of Protection - Estimated cost for Peer College Data Center disaster recovery site: $96,951 one-time with $44,024 annual recurring cost. This includes cloud services fees, secondary application server, virtualization software, security appliances, and high speed data communications recurring charges for campus-to-campus communications and Internet.

4.0   Access-to-Computing Systems

4.1   Wireless Local Area Networking (WLAN)

In the educational environment widespread campus Internet and Intranet access has become a requirement for teaching, administration, and research. With the routine and pervasive use of cell phones, electronic notebooks, and other hand held devices, students and staff expect highly available and widespread campus access to computing systems. Access to instructional support systems, collaborative computing, distance learning, electronic mail, all require a high speed, reliable, highly available service.

The current Gavilan WLAN access points reached *End-of-Life* in April 2014. This means that replacement parts are no longer available from the original equipment manufacturer. Wireless access point equipment failures are supported by a very limited supply of spare parts and *grey market* sources such as EBay.

The Gavilan WLAN system must be replaced as soon as possible.

Estimated cost for wireless networking upgrades and replacement: $150,930 one-time, with $15,093 annual maintenance. This includes replacement of existing wireless LAN controller and wireless access points.

4.2   Edge Network Electronics

The edge network electronics are the devices that are located in each building's telecommunications closet. These devices provide the access to the Local Area Network for the WLAN access points and to desktop computing devices, scanners, and printers.

The current Gavilan edge network electronics have reached *End-of-Sale—End-of-Life*.   This means that although the equipment has a lifetime warranty, its operating system feature set—including any

flaws—will no longer be updated or enhanced by Hewlett-Packard. Again, this edge network equipment has a lifetime replacement warranty, but may not fit in with the data center core networking and computing environment that Gavilan will require in the future since it is limited to a one gigabit backbone network speed (a 10 gig backbone to key buildings will be required).

The Gavilan edge network electronics should be matched with any planned upgrades of the Data Center Core Computing environment to insure compatibility and ease of support. The replacement of the edge network electronics could occur over a span of time depending on the function and computing load of a particular building. Edge network switches are treated as a commodity and do not require annual maintenance, but should be replaced as needed as part of annual budgeting.

Estimated cost for edge network electronics: $168,997 one-time with no annual maintenance.

4.3 Campus Fiber Optics Backbone Upgrades

The campus fiber optics backbone is the high speed data communications freeway that connects the campus building's wired and wireless networks to the data center core computing environment, and the Internet. This makes the campus fiber optics backbone a critical foundation component to the overall IT infrastructure. Measure E made significant improvements in the campus fiber optics backbone, but did not upgrade connectivity to all buildings. As network payloads and applications increase, higher performance is required. Higher backbone speeds are the key to providing higher performance and response times demanded by multimedia applications, streaming video, and online interactive application systems.

Gavilan's network core currently supports one gigabit speeds. Ten gigabit speeds and higher will surely be required in the future, especially to key buildings. The following buildings need their fiber backbones enhanced or replaced:

1. Cosmetology
2. Gymnasium
3. Health Occupations Building (HOB)
4. Library
5. Portable Buildings [19-20]
6. Student Center/Administration
7. Theater

Estimated cost for campus fiber backbone upgrades: $168,278 one-time with no annual maintenance.

4.4   Building IT Closets and Inside Data Cabling Upgrades

As part of a result of original construction and/or Measure E, most building IT closets are in reasonable shape meaning that they are secure, environmentally functional, and have cabling systems capable of supporting gigabit Ethernet. Three exceptions are: the Library, Gym, and the Theater—which should have old data cabling replaced with modern cabling. One library cable end-point needs a secure enclosure since the data racks are located in office space not in a secure telecom room.

Estimated cost for building IT closet and inside data cabling upgrades: $162,000 one-time with no annual maintenance.

5.0   Infrastructure Support Staffing and Support Tools

The California Community College Chancellor's Office (CCCCO) has developed a Statewide Technology Plan commonly referred to as Technology II. The technology plan outlines the number of technical staff required to provide adequate information technology support to the Gavilan campus community. Gavilan currently supports the core IT network and system environment with two Senior Hardware/Software Technicians and two Computer Hardware/Software Technicians. As Gavilan adds functionality to its enterprise information systems additional demand will be placed on an already understaffed support organization.

The goal of every IT organization is to be proactive by anticipating problems and placing support structures in place to handle problems as they arise. When support staff is limited, as is the case with Gavilan College, the support tends to be reactive instead of proactive. There is simply not enough time in the day to develop the support structures that are required to provide proactive systems support. The following are key items needed to develop proactive support for the college's network, storage, and server environments.

5.1   MIS Organization Structure & Staffing

Technical support staffing is typically allocated by the number of desktop computing devices present in an organization. Recommended guidelines for ratios of support staff to computing devices are outlined in the Chancellor's Office Statewide Technology Plan. Gavilan currently has more than 1600 desktop computing devices with a current ratio of one support staff to 800 desktop computing devices respectively for the Desktop Technology Technician and the System Network Technician. The recommended reorganization would net the following technical support ratios:

Technical Staff	Computing Devices	Current FTE	State Guideline	Current Ratio	Proposed FTE	Proposed Ratio
Desktop Technology Technician	1600	2	1/125	1/800	3	1/533
Systems Network Technician	1600	2	1/500	1/800	4	1/400

In short the network and systems functions will need more support staff as the business/educational systems and associated computing devices grow. Ratios of support staff to the amount of computing devices affect the productivity of the entire enterprise and should be reviewed periodically to make sure staff support levels are adequate.

Estimated annual recurring costs for additional MIS support staff: $298,664

5.2   IT Infrastructure Support Tools

There are a number of IT Support Tools that Gavilan College can use to provide staff more visibility into their data network, storage environments, and server environments. Many of these tools are provided as part-of or as options for a Storage Area Network and for virtual server environments. The following are additional tools that aid technical staff in efficiently support IT infrastructure:

1. <u>Remote Desktop Support Tools</u> - There are a number of desktop support tools that allow support staff to "take over" a user's computer from a central support location which allows for fast repair of minor problems.
2. <u>Device Imaging Tools</u> – Gavilan's subscription to Symantec Ghost imaging software is out-of-date and inadequate for current desktop counts.
3. <u>Network Monitoring Systems</u> – As the core and edge network is modernized MIS should insure that an appropriate network element manager is purchased with the network electronics so that network staff has an automated tool to quickly identify network faults, manage network configurations, and monitor network performance from a centralized location.
4. <u>Multipoint Server Support</u> – Virtualization of academic program servers could allow for centralized management of servers and less complex thin client desktop computers. This would simplify the IT support for some academic programs.

Estimated cost for campus fiber backbone upgrades: $4,375 one-time with 5,400 annual software licenses and software maintenance.

5.3   Network and Systems Documentation

This is the area that is usually difficult for a smaller support organization to maintain at proper levels. The goal is for a technical support person to document key functions (usually disaster recovery) such that a peer or outside technical resource could perform the function from the documentation provided. Network diagrams, network electronics configurations, server system configurations, server images, and system recovery run books all make up Network and Systems Documentation. It is difficult for an organization that is in reactive mode to complete all of the documentation it would need to recover from a disaster or the loss of a key staff member. MIS has some of this documentation, but current documentation is incomplete and needs work. Gavilan is more in the reactive support mode that proactive support mode at this time. The risk of not having adequate documentation is that mean-time-to-repair systems and return them to normal function will be greater.

6.0   Equipment Refresh Planning

Gavilan currently does not have an IT equipment refresh plan for network, server, and desktop computing systems. A function of annual budgeting, an IT refresh plan provides the College with a systematic approach to upgrading equipment over time in a planned manner. Equipment refresh replaces older equipment that is unreliable, possibly unsupported, which cost staff time as the result of malfunctions. Planned refresh cycles allow the college to pay-as-you-go avoiding large unplanned expenditures as IT equipment reaches end-of-life.

7.0   Cost Estimates

Table 7-1 provides a summary of prioritized improvements to Gavilan Colleges IT infrastructure. Many of these improvements can be budgeted for and phased in over time; however, some initiatives must be completed to help Gavilan College stay competitive and to meet its education mission.

Table 7-1 – Infrastructure Improvements Cost Estimates

Technology Expenditure Category (matched to report categories)	One-time Cost	Annual Recurring Cost	Priority	Can Be Phased In?
2.0 Data Center Core Computing Upgrades				
2.1 Data Storage				
2.1.1 Primary Data Center	87,744	7,115	High	N
2.1.2 Secondary Data Center	65,450	5,100	High	Y
2.2 Core Servers and Virtualization	100,145	15,022	High	Y
2.3 Core Data Network - Switches	68,553	10,283	High	N
3.0 Disaster Recovery Infrastructure				N
3.1 Disaster Recovery Business Requirements and Detailed Design	50,000		High	N
3.2 On Campus Secondary Site	37,983	3,004	High	N
3.3 Gavilan Outreach Center Secondary Site	34,533	40,991	High	N
3.4 Peer College Cloud Computing	96,951	44,024	High	N
4.0 Access to Computing Systems				
4.1 Wireless Data Networking Replacement	150,930	15,093	Med	N
4.2 Edge Network Electronics Access - Switches	168,997		Med	Y
4.3 Campus Fiber Optics Backbone Upgrades	168,278		Med	Y
4.4 Building IT Closet and Inside Cabling Upgrades				
4.4.1 Library - 1	36,000		Low	Y
4.4.2 Library - 2	36,000		Low	Y
4.4.3 Library - 3	72,000		Low	Y
4.4.4 Theater	12,000		Low	Y
4.4.5 Gym	6,000		Low	N
5.0 Infrastructure Support Staffing and Support Tools				N
5.1 MIS Organization Structure and Staffing				
5.1.1 Desktop Technology Staffing (add 1 FTE)	82,377			
5.1.2 Systems Network Technician (add 1 FTE)	100,246			
5.1.3 Lead Systems Network Technician (add 1 FTE)	116,041			
5.2 IT Infrastructure Support Tools				
5.1 Remote Desktop Support		2,500.0	Med	Y
5.2 Device Imagiing		630	Med	Y
5.3 Multipoint Server Support	3,375	2,100	Med	Y
5.4 Network Element Manager	1,000	170	Med	N
Totals--->	$ 1,494,603	$ 146,031		