El Camino Community College District
IT Assessment

ver. 1.1
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1.0 Executive Summary

1.1 Project Background

PlanNet Consulting was engaged by El Camino Community College District (ECCCD) in April 2014 to conduct an assessment of information technology services, systems, infrastructure and solutions; to analyze and make recommendations for service improvement and contribute key components and priorities for a District technology roadmap.

Over the past eight months (which included some planned idle periods during the summer), PlanNet has conducted extensive interviews with district and college administration, faculty, staff, students and key IT service personnel and have reviewed and assessed survey results as well as existing documentation on the district's IT services policies, processes, budgets and high-level architecture.

This document represents the findings and recommendations from our assessment.

1.2 Methodology

PlanNet developed and submitted requests for information (RFI) to the District and conducted formal and informal interviews with district and college administration, staff, faculty and student stakeholders. In addition, ITS managers were interviewed based on their roles within the ECCCD organizational structure. The general interview topics were:

1. Fundamental goals of program and role of technology to achieve them
2. General assessment of current IT services and performance and methods for reporting satisfaction
3. Method for submitting technology requests for projects
4. Tools (systems and applications) used in program delivery
5. Training for technology tools and platforms
6. Governance and reporting structures
7. What each department is looking for IT services to support in the future

In addition to interviews, a survey of current IT capabilities, performance and solution platforms was conducted. The survey areas of assessment included:

1. Relative importance of various technology domains
2. Performance and availability of college-issued technology equipment
3. Use of multimedia technology in the classrooms
4. Accessibility of technology training and support
5. Performance of key enterprise systems, including email and Web-based systems
6. Performance of the campus network (wired and wireless)
7. Perceived effectiveness of emergency notification system

1.3   Summary of Findings and Recommendations

Results of the IT Assessment are detailed in this document and roll up to the following:

1.3.1   Key Findings

Organizational and Advisory Structures
1. IT organization is not well aligned with technologies and services that faculty and staff regard as important
2. IT organization has better alignment with student priorities than with faculty and staff, though satisfaction scores could be improved
3. IT organization is understaffed by at least 6 FTE
4. ITS endures position vacancies for longer than demand for services can tolerate
5. ITS is underperforming in service delivery including service coverage
6. IT organization does not have mature processes for project initiation and project management
7. IT organization does not have an accountability mechanism for tracking and reporting on performance metrics

Enterprise Applications
1. Colleague: Current ECC hardware (HP9000) is end-of-life with Ellucian doing more of its product development on Microsoft SQL database platform
2. Colleague: Current implementation has many customizations and use of non-native interfaces for reporting and data exchange; routine patching of the system has become very complex
3. Colleague: Poor system performance at peak load is a predictable and concerning customer satisfaction issue
4. Email: Regarded as one of the top two most important systems by faculty and staff with 24x7 uptime expectations; ITS has no formal Service Level Agreements (SLAs) or staffing capability to maintain email at that service level
5. Email: Increasingly, organizations (including higher ed) are outsourcing enterprise email to cloud-based systems
6. Learning Management System: ECC is effectively operating two LMS platforms to overcome limitations in either system
7. Document imaging: Current application in use at ECC is no longer in active product development
8. Document imaging: Many departments are clamoring for electronic workflow and forms processing capabilities, which are part of most enterprise class document management platforms

Infrastructure
1. Wired network: ECC has approximately 40% of access switches that are in need of replacement due to lapsed or approaching end-of-support deadlines
2. Wireless network: ECC is operating two distinct and unintegrated wireless platforms
3. Wireless network: ECC constituents ranked wireless networking as a top technology in terms of performance expectations but a low technology in terms of satisfaction; feedback from nearly every constituent focus group put wireless access issue as a primary concern

4. Server/Storage: ITS is maintaining three separate SAN (storage array) platforms; only one is enterprise class fiber channel, which happens to be the legacy storage array most in need of upgrade due to the vintage of the platform.

1.3.2   **Recommendations and Roadmap**

Phase I (first 6 months)
1. Fill vacant ITS positions
2. Establish District CIO position
3. Restructure Distance Education and Media Services under the CIO
4. Move Web Development under ITS
5. Immediately arrange for Registration Health Check for the Colleague Student Information System through Ellucian professional services
6. Initiate project to complete the conversion of Colleague to the MS SQL platform
7. Reassess the IT Tactical Plan for alignment, cost and viability
8. Fully deploy the Footprints service desk software to enable better ticket tracking and escalation mechanisms
9. Create a project to identify cost-effective means to expand wireless deployment

Phase II (6-18 months)

1. Create 6 new ITS positions
2. Identify next 3 departments to receive document imaging; initiate a conversion project with Hyland to move to new OnBase product while including the electronic workflow module
3. Refresh the objectives of the Campus Technology Committee
4. Create IT Service Catalog
5. Replace EOL network access switches

Phase III (18-36 months)

1. Replace LSI and EqualLogic storage arrays with fiber channel SAN
2. Install blade chassis servers at appropriate server refresh interval
3. Initiate a project to create a more complete disaster recovery plan
4. Technology Committee should review the recommendations of this assessment to determine progress toward completion of any approved recommendations

[further details can be found in Section 7.0]

*** End of Executive Summary ***

2.0   Project Background

PlanNet Consulting was engaged by El Camino Community College District (ECCCD,ECC) in April 2014 to conduct an assessment of information technology services, systems, infrastructure and solutions; to analyze and make recommendations for service improvement and contribute key components and priorities for a District technology roadmap.

The project objectives included:

1. Investigation of existing technology master plans, standards, infrastructures, and enterprise services.
2. Evaluation of viability of existing technology organizational structures and staffing levels to support ECC's mission, vision, business objectives, and growth objectives.
3. Recommendations for platform and architecture enhancements for ECC's core enterprise applications including: Colleague SIS, Colleague Portal, Microsoft Exchange enterprise messaging and calendaring, learning management system(s), and document imaging.
4. Evaluation of the core enterprise applications with regard to service delivery models, support capabilities, scalability, secure access, data protection and backup.
5. Recommendations for methodologies to promote collaboration between faculty and staff, as well as resource scheduling, using administrative systems available on campus or remotely.
6. Recommendation of methodologies to provide measurable outcomes to aid in the reporting of program improvement and success metrics.
7. Assistance in methodology development of an effective change management process for introducing new technologies.

Over the past eight months (which included some planned idle periods during the summer), PlanNet has conducted extensive interviews with district and college administration, faculty, staff, students and key IT service personnel and have reviewed and assessed survey results as well as existing documentation on the district's IT services policies, processes, budgets and high-level architecture.

This document represents the findings and recommendations from our assessment. The recommendations and roadmap encompass technology purchases as well as sustainable design to ensure that the technology can be well supported going forward from an operational perspective. The assessment takes into account necessary advisory structures to support effective delivery of IT services, as well as recommendations for which services are best suited for sourcing through the district or outsourcing to service providers.

3.0   Methodology

PlanNet developed and submitted requests for information (RFI) to the District and conducted formal and informal interviews with district and college administration, staff, faculty and student stakeholders. In addition, ITS managers were interviewed based on their roles within the ECCCD organizational structure. The general interview topics were:

1. Fundamental goals of program and role of technology to achieve them
2. General assessment of current IT services and performance and methods for reporting satisfaction
3. Method for submitting technology requests for projects
4. Tools (systems and applications) used in program delivery
5. Training for technology tools and platforms
6. Governance and reporting structures
7. What each department is looking for IT services to support in the future

Interviews conducted with District committees/focus groups and individuals:

Senior Management	Interviewee
College President	Thomas Fallo
VP – Administrative Service	Jo Ann Higdon
VP – Academic Affairs	Francisco Arce
VP – Student Services	Jeanie Nishime
CEO – Compton District	Keith Curry
VP – Compton Center	Barbara Perez
Faculty Focus Group	**Interviewee**
Business	Patricia Vacca
Fine Arts	Kevin O'Brien
Health Sciences and Athletics	Nathan Fernley
Humanities	Bruce Peppard
Industry and Technology	Mark Fields
Learning Resources	Moon Ichinaga
Mathematics	Satish Singhal
Natural Sciences	Soshanna Potter
Business & Academic Technology Committee	Virginia Rapp
Staff/Administration	**Interviewee**
Director of Outreach & School Relations	Robin Dreizler
Institutional Research & Planning	Irene Graff
Exec. Director, ECC Foundation	Katie Gleason
Dean, Community Advancement	Jose Anaya
Director, Human Resources	Lynn Lindberg
HR Operations / Contracts	Maria Smith
Recruitment	Roxanne McCoy
Training & Development	Donna Manno
Director, Admissions & Records	Bill Mulrooney
Dean, Enrollment Services	William Garcia
Counseling	Sabro Sabio
First Year Experience	Cynthia Mosqueda
Outreach	Julieta Ortiz
Dean, Counseling & Student Success	Regina Smith
Student Success	Griselda Castro
Director, Special Resource Center	Dipte Patel
Curriculum	Quajuana Chapman
Dean, Health Sciences & Athletics	Rory Natividad
Dean, Natural Sciences	Jean Shankweiler
Chief, Campus Police	Michael Trevis

Campus Police	Josh Armstrong
Director, Bookstore	Julie Bourlier
Purchasing & Business Services	Rocky Bonura
Director, Facilities Planning & Services	Tom Brown
Accounting	Babs Atane
Business Manager	Janice Ely
Publications	Heather Parnock
Digital Media Communications	Amy Hoana
Web Development	Omar Brenes
CalWorks (CEC)	Iris Fernandez
Dean, Student Learning / Distance Ed (CEC)	Rodney Murray
Director, Admissions (CEC)	Richette Bell
EOPS (CEC)	Michael Odanaka
Director, Enrollment Services (CEC)	Elizabeth Martinez
Controller/CBO (CEC)	Felipe Lopez
Information Technology	**Interviewee**
IT Director	John Wagstaff
Asst Director	Will Warren
Network Supervisor	Claudio Vilchis
Network Technician	Edwin Brooks
Technical Services Supervisor	Don Treat
Special Services Professional – CEC	Rudy Ramos
Committees	**Interviewee**
Academic Technology Committee	Virginia Rapp
	Peter Marcoux
Associated Students Organization	Mike Thompson
	Jessica Siripat
	Sabrina Farah
	Avery Marshall
	Greg Sonnen
	Rafiq Kahn, ASO president

In addition to interviews, a survey of current IT capabilities, performance and solution platforms was conducted. Summary results of the survey can be found in Appendix A. The survey areas of assessment included:

1. Relative importance of various technology domains
2. Performance and availability of college-issued technology equipment
3. Use of multimedia technology in the classrooms
4. Accessibility of technology training and support
5. Performance of key enterprise systems, including email and Web-based systems
6. Performance of the campus network (wired and wireless)
7. Perceived effectiveness of emergency notification system

PlanNet also reviewed the output of a recent technical analysis performed by Cisco partner SigmaNet that produced an extensive report and inventory spreadsheet with 27 high-level findings. PlanNet commented on the findings and performed some additional gap analysis as part of this assessment. Some security items were redacted and discussed with management separate from this published report.

Findings and recommendations delivered in this summary report were made utilizing PlanNet's experience with higher education clients, Community College best practices, Educause data, State Chancellor Office (technology) Guidelines, and interviews and input of industry specialists.   The roadmap was developed based on the gaps between what is available and usable, and what is feasible based on the conditions at ECC, funding, and all the other constraints that typically come into play.

4.0   Organizational and Advisory Structures

El Camino College is not unique among enterprises with technology service departments that are increasingly challenged to do more with less. IT groups almost always experience more demand than resources. Managing expectations is more important than it has ever been when expectations of 24x7 service delivery and system uptime can seem to be more of an unspoken reality than an articulated mandate. It can be a losing battle with customer satisfaction if service catalogs and service level agreements are not defined.

To this end, PlanNet reviewed the way the organization is structured and functioning and taking guidance from the existing advisory structures.

4.1   Advisory and Committee Structure

ECC has two primary advisory bodies for information technology at the college: the College Technology Committee, and the Academic Technology Committee, a subcommittee of the Faculty Senate.

4.1.1   College Technology Committee

The College Technology Committee is co-chaired by the director of ITS (vacant) and a representative from the Academic Technology Committee to ensure representation from both the administrative and academic divisions of the college. The primary function of the College Technology Committee has, for better or worse, become the primary vehicle for maintaining annual updates to the ECC Technology Plan as well as reporting progress on various technology projects and initiatives established for the year. The purpose of the committee is no longer clearly aligned and attendance is inconsistent with some members reporting that contributions are perceived as ineffective. The committee is scheduled to meet monthly.

The Technology Plan is an imperative for the committee and should be recognized as its chief deliverable. The work product of the committee does indeed undergo annual updates and is structured like a true planning document with stated goals and objectives and recommendations for the upcoming year. However, the evolution of the document is largely staffed out to the director of ITS and not necessarily backed by a more collaborative approach. The document is published more for reporting purposes than as part of an informed budget planning process. Tactical plan projects are made through the Unit Plan and Plan Builder submission process where no preliminary mapping to strategic objectives is made or required prior to review by the VP of Administration, where such reconciliation finally occurs. There is no recognized mechanism for converting strategic goals into tactical projects that fulfill the objective from the strategic plan (top-down planning); rather, projects are submitted for funding based on triage of urgent needs (bottom-up planning).

The College Technology Committee needs to collaboratively develop updates to the Technology Plan (including feeding into CEC's separate technology plan process) and incorporate all technology-related requests that make their way to Plan Builder into a tactical plan that maps each request to a strategic objective, else it is subject to disqualification by the Vice Presidents, who effectively operate as final arbiters of the Planning & Budget Committee. The timing of the development and release of the Technology Plan should be adjusted to better coincide with the Plan Builder submission process such

that anything in Plan Builder has been vetted by the College Technology Committee in preparation for final review by the vice presidents.

4.1.2 Academic Technology Committee

The Academic Technology Committee is sponsored by the Faculty Senate and is co-chaired by the vice president of the Senate and another faculty representative. The committee, whose members are made up of volunteers from each of the academic divisions, meets two to three times per semester and has dotted line accountability to the College Technology Committee.

Practically speaking, the Academic Technology Committee is a forum for sharing ideas and issues among the faculty and then using the dotted-line accountability to the College Technology Committee to champion academic interests in the development of any recommendations that are made by the College committee. The Unit Plan process is still the principal mechanism for academic departments to on-board their technology requests and vie for funding. The work of the committee is largely consensus building and sometimes brokering priorities for certain departments who are not otherwise effective in articulating their technology needs.

4.2 ITS Department

The IT organization for ECC, known as Information Technology Services (ITS) is a 36-member staff in four departments: Application Support [7 positions], User Support Services [9 positions], Network Services [6 positions] and Technical Services [11 positions]. ITS is led by a director (currently vacant) and an assistant director [2 positions]. These two leadership positions are supported by an administrative assistant [1 position]. As of this writing, the Application Support department is fully staffed, the User Support Services department has 1 vacant position, the Network Services department has 3 vacant positions, and the Technical Services department has 2 vacant positions, including the supervisor position recently made vacant due to a retirement.

Compton Center has a Special Services Professional who reports to the ECC IT director and leads 3 technicians adding another 4 to the total above [36+4=40]. The Compton Education Center (CEC) tech staff report to their lead, but are physically situated at the CEC campus.

4.2.1 Staffing issues

The organizational structure of the ITS department has the following conditions that need attention:
- Too few technicians
- Too many vacant positions for too long
- Job descriptions do not reflect current technologies

The number of vacant positions within ITS is a notable and troublesome condition given the reputation that ITS has for being understaffed. An overwhelming observation cited in open-ended comments to the satisfaction survey was that poor performance from ITS was a direct result of not enough head count. Faculty said that access to technical support was the single most important aspect of technology services at ECC (4.82 rating out of 5), yet access to technical support scored no higher than "neutral" (3

out of 5) in actual satisfaction. Staff gave similar rankings for importance and corresponding satisfaction (only email outranked technical support as more important to staff). Some representative comments:

> *"Our IT department is doing the best they can with the resources they are given. They are understaffed and just do not have the manpower to complete the essential needs for all students and faculty. They work hard and do the best they can do."*

> *"Please hire more technicians - I believe if they had more help the quality of service and response time would greatly improve. With all the additional technology that is used at ECC now the ITS staff should have three times as many employees to keep all new classroom equipment in working order. It is nice to have all the bells and whistles but doesn't do much good if the computer doesn't work. Thanks for asking."*

> *"The staff needs to grow as fast as technology. There needs to be an increase in the number of staff as well as an increase in their technology ability and know how. I believe the current staff is working to the best of their ability. But it is not enough to meet the constant immediate needs of the campus."*

> *"With all they have to do with the minimal personnel they do a great job."*

Based on current metrics from the State Chancellor's Office as well as almanac data from the Educause Core Data Service survey of two-year colleges, ITS is indeed understaffed. Using an FTES target of 25,400 for ECCCD (19,400 for ECC and 6,000 for CEC, as provided by the VP of Administration), and 3,150 desktops/laptops in computer labs and at faculty/staff workstations (1,050 PCs for admin, 2,100 PCs for academic), ECC should have the following category headcounts:

Classification	State Chancellor's TTIP Guidelines*	Educause Survey Data of AA-degree Schools**	Current ECC Headcount***	Blended Delta
Application Development	1 per 12,000 FTES = 2+	0.25 per 1000 FTES = 6+	7	2+ over
Computer Ops/User Support****	1 per 12,000 FTES = 2+	0.25 per 1000 FTES = 6+	7	2+ over
Web Development	1 per 12,000 FTES = 2+		1	1+ under
Network Technician	1 per 300 PCs = 10+	0.4 per 1000 FTES = 10+	7	3+ under
PC support (Level 1)	1 per 150 PCs = 21	0.5 per 1000 FTES = 12+	13+	3 under
Technical Managers	1 per 500 PCs = 6+		4	2+ under
Central IT Support	45+	1.5 per 1000 FTES = 46+	40+	**5 under**

* 2009-10 TTIP Guidelines; ** 2013 Core Data Service Almanac, AA schools; *** includes vacancies and Compton Center
**** computer operations is linked to (split with) the metric for application development as it is not precisely defined in TTIP; help desk is included in Level 1 support)

Using the dated TTIP standard as a low-water mark and the more current Core Data Service survey as a high-water mark, the blended difference between quantity of IT staff that ECC currently has as compared to where ECC should be ranges from a low of 5 short to a high of 6 short. PlanNet's interpretation of these numbers, which includes national survey data, is that ECC should skew lower in keeping with California's impacted educational budgets. As such, a headcount of 5 is appropriate for ECC to address in its immediate staffing shortage and is reflected in subsequent recommendations, including a deferred option to add a CEC support technician.

4.2.2   **ITS Leadership**

From interviews with ITS staff and constituent groups, as well as survey response comments, it is evident that ITS is recognized as having performance issues and that those issues are largely attributable to resource constraints, both from a staffing and a budgeting perspective. So the genesis and accountability of those performance issues can be apologetically explained, but nonetheless must be handled as management problems.

From a leadership perspective, one must attempt to prosper as best as one can with the tools and resources provided. In resource-constrained environments, weaknesses in management disciplines become especially significant and failures to work smarter rather than harder are quickly compounded. Consequently, the outcome of running ragged for so long has exposed that ITS suffers from the following maladies:

A. Poor project management and prioritization
B. Poor communication with constituent groups
C. Inability to co-manage accountability with departments for the roll out of certain upgrades, such as document imaging and Colleague enhancements
D. Lack of focus on continuous improvement

Poor performance in these areas is indicated by the following outcomes:

A. Academic interests not sufficiently gauged
B. Delays in rolling out new computer labs
C. Reported delays in rolling out some updated laptops to faculty
D. Lack of emphasis on Learning Management System and Student Information System integration, including gradebook
E. Lack of professional training that extends beyond basic office suite of software
F. Administrative support suffering
G. Extensive Student Information System issues, such as constituency errors
H. Email and portal issues
I. Reliance on paper-based forms
J. Lack of enterprise-wide document imaging and electronic workflow

4.2.3   **IT Operations**

A key finding in PlanNet's review of the application portfolio is that most investments made in the current enterprise software and management tools are sufficient, but the applications are being used at a fraction of their full capabilities and feature sets. Some key examples are the enterprise messaging platform of Microsoft Exchange, which has not been exploited for its ability to serve as an effective campus-wide scheduling and calendaring platform. The document imaging platform has not been rolled out to other departments which are clamoring for it. Also, the primary network and system monitoring and alerting tool, Solar Winds ORION has fallen into disuse largely because its available features have not been deployed in a way that system admins can embrace the full range of functions.

The organizational issues already cited are all indications that ITS is only subsisting and not operating as a healthy, full-service, value-add department at ECC. Almost every system we were exposed to or that was discussed in stakeholder interviews are being used in a fairly primitive fashion or suffers from incomplete or haphazard deployment and configuration issues.

4.2.4   Customer Satisfaction

Consolidated findings from the satisfaction surveys have a lot to say about alignment between ITS and its customer service base. PlanNet asked for relative importance followed by relative satisfaction of key technologies as well as IT services from each constituent group. Optimally, we would see that ITS is delivering strongly in the areas that end users say matter to them the most, and that areas that matter to them the least are getting affordably lower marks given that high marks in unimportant areas can be reflective of wasted effort or misalignment.

Overall satisfaction rankings for technology and IT services in the District were given as follows (5-point scale, 5 being "very satisfied, 3 being "neutral" and 1 being "unsatisfied"):

- Students gave a **3.6** score (3% participation to the survey emailed to 9,974 students)
- Faculty gave a **3.0** score (18% participation to the survey emailed to 1,054 faculty)
- Staff gave a **3.3** score (30% participation to the survey emailed to 614 staff)

For students, the highest three areas of **importance** were (5-point scale, 22 items yielding 5.5 quartile):

TECHNOLOGY OR SERVICE AREA -- **STUDENTS**	IMPORTANCE RANK	IMPORTANCE SCORE	SATISFACTION RANK	SATISFACTION SCORE	ALIGNMENT*
Ability to access grades online	1	4.79	2	4.37	Good
Ability to register for classes online	2	4.76	3	4.33	Good
Ability to pay tuition and fees online	3	4.71	1	4.37	Good

The lowest three areas of **satisfaction** for students were:

TECHNOLOGY OR SERVICE AREA -- **STUDENTS**	SATISFACTION RANK	SATISFACTION SCORE	IMPORTANCE RANK	IMPORTANCE SCORE	ALIGNMENT*
Access to electronic textbooks	22	3.70	19	4.14	Good
Access to technical support for other computer application and/or network connectivity issues	21	3.75	14	4.41	OK
Access to notification system for class cancellations	20	3.76	7	4.51	Poor

For faculty, the highest three areas of **importance** were (5-point scale, 13 items yielding 3.25 quartile):

TECHNOLOGY OR SERVICE AREA -- **FACULTY**	IMPORTANCE RANK	IMPORTANCE SCORE	SATISFACTION RANK	SATISFACTION SCORE	ALIGNMENT*
Access to technical support	1	4.82	5	2.99	OK
District email system	2	4.76	2	3.13	Good
Access to wireless networking	3	4.62	13	2.40	Poor

The lowest three areas of **satisfaction** for faculty were:

TECHNOLOGY OR SERVICE AREA -- **FACULTY**	SATISFACTION RANK	SATISFACTION SCORE	IMPORTANCE RANK	IMPORTANCE SCORE	ALIGNMENT*
Access to wireless networking	13	2.40	3	4.62	Poor
Access to online help	12	2.73	6	4.41	Poor
Network bandwidth/responsiveness	11	2.79	7	4.41	Poor

For staff, the highest three areas of **importance** were (5-point scale, 13 items yielding 3.25 quartile):

TECHNOLOGY OR SERVICE AREA -- **STAFF**	IMPORTANCE RANK	IMPORTANCE SCORE	SATISFACTION RANK	SATISFACTION SCORE	ALIGNMENT*
District email system	1	4.88	1	4.01	Good
Access to technical support	2	4.82	10	2.98	Poor
Performance and specs of college-issued computers	3	4.79	2	3.58	Good

The lowest three areas of **satisfaction** for staff were:

TECHNOLOGY OR SERVICE AREA -- **STAFF**	SATISFACTION RANK	SATISFACTION SCORE	IMPORTANCE RANK	IMPORTANCE SCORE	ALIGNMENT*
Electronic workflow / forms processing	13	2.73	8	4.40	Poor
Access to online help	12	2.77	10	4.37	Good
Access to video conferencing	11	2.96	13	3.38	Good

* *alignment valuations were made based on quartile proximity; a value of Good lies within the same 25% rank of data, a value of OK is in the adjacent 25% band of results, a value of Poor is more than a whole quartile band away from the target rank*

These tables reflect good alignment in some key service delivery areas, particularly toward students, and reflect the importance for ITS to focus on and continue to strengthen core competencies around making services available online and the reliability and availability of those services. While rankings between importance and satisfaction were close, empirical satisfaction is still 20% lower than the desired importance.

A general misalignment in service delivery exists with respect to wireless networking and access to technical support and represents a significant gap for ITS to address in its technology and technology service delivery disciplines.

In a review of the open-ended comments provided by the various end-user groups, the most common themes were as follows:

Students	• Wireless coverage • MyECC portal issues • Need mobile portal
Faculty	• Tech staffing levels / Tech support issues • Need better support hours/coverage • Need better communication/training • Modernize/improve classroom/campus technology • Email problems
Staff	• Tech staffing levels • Tech support issues • Modernize campus technology

The high-level findings regarding the perception of safety on the campus, enrollment in the emergency notification system (a technology tool in addressing patron safety), as well as coverage of mobile phones (necessary for emergency notification to be effective) are that students, faculty and staff generally feel safe on the campus but are significantly unsubscribed (more than two-thirds for students) to the campus emergency notification system. Further feedback is that users rank mobile phone coverage as slightly above neutral in satisfaction.

Details of the survey results are provided in Appendix A.

4.3   Recommendations

To the extent that ECC wants to view itself as on a trajectory for being technologically sound and able to keep pace with the demands of technology in higher education, key actions must take place to change course, including overhauling the planning process, restructuring IT at the college, making investments to IT staffing resources and outsourcing for certain specialized services and functions to cover the gaps.

4.3.1   Refresh Objectives of the College Technology Committee

ECC should refresh the objectives of the College Technology Committee that clearly establishes the membership and accountability structure for the committee. Instead of acting as a tactical project reporting platform for ITS, the committee needs to function as the body where IT initiatives take shape and accountability for project priorities and potential funding are negotiated between the stakeholders and ITS who will produce the outcomes.

The business (academic and administrative departments) need to own the planning process through representation on the committee and, since they are driving it, they become advocates for creating momentum for their needs. There must be visibility to the committee on the effectiveness of ITS to deliver on its services, which requires ITS to have regular reporting on service metrics (discussed further in section 4.4). Lump sum complaints against ITS are not effective and specific resourcing issues need to be articulated by the committee to management for funding and sponsorship. A representative from CEC's technology committee should also serve on the College Technology Committee.

The goal is co-sponsorship for every IT initiative at ECC and CEC with alignment between the business and ITS. The process should be able to communicate needs, measure total cost of ownership, predict timetables, and bear joint accountability for ITS shortcomings if the projects have not been properly measured against the capabilities of an ITS department that regularly reports on its service metrics and performance.

4.3.2   Hire additional head count

ECC needs to keep pace with its peers and strive to be relevant with respect to technology in higher education; therefore, investments must be made to IT staffing resources. This should come in the form of increasing resources internally, providing for regular training and professional development for the staff to stay current on rapidly changing technologies, as well as outsourcing for certain specialized services and functions to cover the gaps.

1. ITS should immediately address the existing vacant positions in Network Services, as well as attend to the retirement of the Technical Services manager.
2. The college administration should address the staffing gaps identified in the comparison of ECC to its peers according to the benchmarks (see headcount table in Section 4.2.1).
   a. Network Services should add 2 additional network and system admin positions, off-loading technical duties from the department supervisor and adding capacity to keep up with system deployment project work and system maintenance, moving from an overwhelmed and purely reactive posture toward proactive and sustainable planning and problem resolution.

b. ITS should add an Information Security Specialist whose focus is specifically on the security, integrity and availability of District data. This technical resource would focus on identity management, external and internal firewalls, data access policies, active monitoring of security and remote access appliances, and evaluation of and reporting on dynamic security threats and vulnerabilities. This position should report directly to the Director/CIO but would have dotted line to the Network Services team.

c. Technical Services should add one (1) Level 1 Help Desk Consultant and one (1) Level 2 Computer Systems Support Technician. The help desk resource should be used to add capacity for lunchtime and extended (evening) hours support (including at CEC) as well as improve the ability of ITS to maintain its help desk database and an effective feedback loop for end users who are closing out their service requests and reporting on service satisfaction. The Level 2 tech is necessary to keep up with the expansion of deployed systems and software support.

d. ITS should also consider adding a network and system administrator for CEC to better support the growing infrastructure and modernization that has taken place on that campus over the past several years. With the advent of a renovated data center and all new server/storage infrastructure and the planned expansion of virtual desktop infrastructure (VDI), CEC can better attend to its service demands with this dedicated resource. The timing of this recommendation is less urgent than the other five (5) support staff identified above as CEC continues to draw from ITS shared services.

- With respect to system analyst / Colleague support functions for CEC, PlanNet recommends that ITS identify an existing key resource within the shared services Application Support team who is prioritized to Compton Center. This is not a new headcount, per se, but calls for a reassignment of perhaps 50-75% of an analyst position. Despite being under the operational umbrella of ECC, CEC has its own set of operating parameters and needs to continue to work toward autonomy on the student information system side for its distinct program offerings. As CEC continues to work toward autonomy in the coming years, additional dedicated resources will become necessary over time.

4.3.3   Reclassify the ITS leader as a CIO position

The IT support organization at ECC shows evidence of being demoralized from long-term resource constraints and suffers a severe reputation for underperforming. There is a saying that every problem is a management problem. To that end, it is essential that ECC make a strategic hire to help turn things around and lead ITS to the level of a high-performing, mature services organization equal to the challenges that will continue to test the mettle of a group likely to continue to be stretched for some time. This is no small task and requires an individual with a particular set of motivational, organizational and project management skills that go beyond technology domain expertise.

PlanNet recommends that ECC expand the scope of the ITS Director job description in order to classify the position as a Chief Information Officer (CIO) and better fit the profile of an executive who can manage across administrative and academic domains. And while higher education experience is typically "required," it is recommended that senior management consider relaxing this requirement to a "preference" and look to other IT professionals that can bring a new vision for how IT services can be delivered at El Camino, operating as a change agent. Qualifying industry sectors would involve those with direct customer support to large numbers of end users, such as hospitality, health care, retail; with

less priority given to sectors such as manufacturing, engineering, finance, etc. The reclassification would have the additional benefit of also supporting a higher salary range to attract from a broader talent pool.

Salary Guidance

Salary guidance for this restructured position is based on a combination of regionally adjusted national salary data along with a review of the peer institutions El Camino most closely compares to in the region. Following is table of IT leadership at these college districts and posted* salary ranges:

District	Job Title	Low Step	High Step**
Cerritos Comm College	Director, Information Technology	$130,392	$163,644
Citrus College	Chief Information Services Officer	$131,760	$173,390
El Camino Comm College	Director, Information Technology Services	$119,951	$135,005
Glendale Comm College	Assoc. VP, Information Technology & Services	$108,060	$137,904**
Long Beach City College	Chief Information Systems Officer	$130,668	$158,820**
Mt SAC Comm College	Chief Technology Officer	$168,018	$177,284
Pasadena City College	Director	$118,855	$168,293
Rio Hondo Comm College	Director of Information Technology	$127,645	$155,502
Santa Monica College	Director, Management Information Systems Director, Network Svcs & Telecommunications	$127,428 $112,848	$154,896** $137,160**

* Taken from published public documents available online; ** some districts have longevity steps that can add as much as 5% per 5 years but these maximums are not included here*

National salary range information for comparable positions including other industry sectors (not just limited to higher education) is also widely available*. A composite review of such information generally falls into the following ranges (Los Angeles employment would be expected to skew higher than national averages):

Job Title	Low	Mean	High
Chief Information Officer	$125,500	$192,000	$258,500
Vice President, Information Technology	$111,500	$147,500	$183,500
Director, Information Technology	$95,500	$129,000	$162,500

an example of such data is the RHT Annual Salary Report:
http://s3.amazonaws.com/DBM/M3/2011/Downloads/RHT_2015_salary-guide.pdf

Expanded Scope

By expanding the scope of the ITS organization (further described in Section 4.3.2), ECC will stand to benefit in the following ways:

1. Convert the mindset of ITS from a monopolistic IT services organization to a competitively advantaged service organization that must compete for the business of college departments and, ultimately, for student matriculation and retention
2. Create higher accountability for project delivery; no longer merely "best effort"

Reporting Structure

PlanNet recommends that ECC go a step further and not only reclassify the leadership position as a CIO, but also position the CIO as a cabinet-level position, reporting to the college President. By doing so, ECC will stand to benefit in the following ways:

1. Address the perceived lack of support for academic interests since ITS is seen as an administrative department
2. Position IT with a greater voice among the influencers of strategic direction for the college, which is appropriate given that Information Technology is both the product and the infrastructure of the institution; it has a function in both education and education delivery.
3. ECC would join the ranks of two-thirds of AA-degree schools nationally that have their highest ranking IT officer as a member of their president's cabinet, according to the 2013 Educause Core Data Service almanac, up from 58% the prior year.

4.3.4   **Reorganize other technology departments under the CIO**

In keeping with the theme of bridging the gap between administrative and academic interests and broadening the scope of the proposed CIO's domain, PlanNet recommends that ECC reorganize two technology-based units under ITS as follows:

1. Move Distance Education and Media Services as a whole. These two functions are currently under the Learning Resources Unit and headed by one director who should instead report to the CIO position.
   a. This reintegrates and better aligns the accountability for all of classroom technology and allows for a unified service organization; faculty no longer need to distinguish between types of technology issues to know which service organization must be involved to address their request
   b. This creates a more direct relationship between the design and use of the learning management platform used for education delivery (distance education as well as hybrid courses); centralizes accountability for both the feature sets and the maintenance of the Learning Management System
2. All lab support personnel should be consolidated under ITS to optimize workload and expand coverage hours. Currently two full-time and one part-time lab support positions are structured as direct reports to academic departments and library. A specific service level agreement needs to be implemented for these (and all) departments to ensure that the level of attention to their specific needs does not diminish in the transition.
3. Move Web Development (currently under Public Relations & Marketing) to a department of ITS. The look and feel and design attributes of the ECC landing page (http://www.elcamino.edu) should remain the purview of the Marketing group, but the toolset and content management system and the personnel and skills needed to maintain those platforms should be under the jurisdiction of ITS.

a. This realignment further provides for better integration of portal and mobility technology that is not well served by having platform skillsets separated across major administrative divisions.

b. It is envisioned that the web developer position would report to the Application Support team of ITS. The digital media and graphic design functions would remain in PR&M but these teams would have consistent interaction.

4.4 Operating Attributes of a Mature IT Organization

In addition to the above recommendations for adding and restructuring IT support personnel to help address the capacity to do more things and be less reactive, it is important that ITS also take on the task of embracing a new set of operating principles so that any future growth or expansion of resources is not merely extending a certain amount of dysfunction. ITS should take the following steps to clearly define their operating parameters and produce measurable outcomes for their IT operations:

4.4.1 Define a service catalog

It is important for ITS to know what services they regard as core competencies and to have agreement with the IT advisory structure on what duties are expected to be fulfilled in house and which services or project types are candidates for third-party hosting. For example, ITS is currently outsourcing Learning Management System hosting and occasional use of professional services for very large and schedule-sensitive computer deployments. Consideration is being given to network monitoring and after-hours remote support. ECC ITS needs to know that it can fulfill its mission for the defined service catalog and to seek appropriate management support for challenges outside of that scope, either through staffing levels, professional development, or third-party hosting; and to secure the necessary operational budget to succeed in the defined services.

4.4.2 Establish Service Level Agreements (SLAs)

Once the service catalog has been defined, the service levels for delivering those services need to be established and agreed upon with the administrative and academic units. This would include defining system uptime targets for networks and servers, recovery objectives for lost data, break/fix response times for end user devices, and response times for various categories of help desk tickets.

4.4.3 Establish performance metrics

For each SLA, ITS needs to have a mechanism for reporting its success in meeting those targets. For example, system uptime per server should be tracked so that reports can be issued monthly that show the impact of various planned or unplanned outages. The help desk ticketing system (Footprints) should have a tracking mechanism enabled that reports time-to-resolution for various ticket types so that IT can track the types of issues that are weighing on resources and problem resolution can be invoked for categories that are repetitive or endemic. Further, it is important to have tracking enabled in order to create triggers and alerts when response time thresholds have been reached so that tickets can be escalated to maintain the SLA.

There should also be a closed-loop system to capture and measure customer satisfaction from the service event by allowing comments and feedback from the end user regarding their service experience. These metrics should also be reported to the advisory committees as an accountability mechanism.

4.4.4   Invoke change control practices

ITS should maintain a regular change control procedure that calls for reporting of any planned upgrades, discussion of impact to the business and potential impact to other systems. Typically this is done in a regular IT committee meeting structure that allows for interaction between administrative and academic units as well as ITS and helps establish appropriate schedules and maintenance windows. Too often, ITS is winging it with system maintenance, slamming in changes that impacts on the end-user experience. While this is done with the best of intentions in order to rapidly address incident resolution, it can often have a cascading effect and reflects a poor change control discipline.

4.4.5   Improve strategic planning

ECC does not have an effective strategic planning process, which is necessary to establish the initiatives and budgets that will support the overall mission of the College and the District. It is clear from stakeholder interviews that the current posture and track record of ITS does not allow for administrative and academic units to think about and feed into a process for how to use technology to enhance or advance their programs. A key example of this coming from the Human Resources division is the lack of a basic electronic forms processing tool and workflow engine that would modernize information flow around the campus. This is not unusual for resource-constrained environments, but it is still important to regularly calibrate the needs of the institution with the capabilities of the ITS group.

4.4.6   Improve tactical planning and status reporting

Once a strategic plan has been established and the needs of the institution have been articulated and mapped to a strategic plan for IT, then ITS management must break down the plan into achievable, tactical projects. The process should be to define the scope of each project, determine its total cost of ownership (TCO) to the District, determine whether the project is to be in-sourced or third-party-hosted, establish schedule and budget, and execute the plan with appropriate progress reporting to the advisory committees.

4.4.7   Perform security audits and IT health check

PlanNet recommends that an organization of the size of ECC without a dedicated IT security professional on staff should outsource an annual security audit that would include penetration testing of the edge network. Additionally, routine health checks of the IT environment at large would be recommended every two years, at least until such time as the stability and maturity of IT operations principles and practices is achieved.

5.0 Enterprise Applications

El Camino College has implemented dozens of network-based computer applications, taking advantage of the ability to use consolidated compute and storage resources and distribute their benefits through the ubiquitous campus network. A few of these systems stand out as being mission-critical. The essential functions of the college require that these applications be functional in order to teach classes and conduct business. PlanNet was scoped to evaluate the effectiveness of the existing infrastructures (network, server/storage, operations) supporting several core applications, which were identified as: Ellucian Colleague, Ellucian Portal, ETUDES and MyTeamSites, Microsoft Exchange, and Hyland Singularity.

The following sub-sections have been written to appeal to a more technical audience that would ultimately need to evaluate the merits of some of the specific technical recommendations.

5.1 Ellucian Colleague (Student Information System)

The Student Information System (SIS) is used for managing key elements of a student's relationship with the college including: Admissions, Financial Aid, Course Registration and Grades among others.   This SIS was originally acquired by the College under the name of Datatel. The merger of Datatel with SunGard Higher Education was rebranded as Ellucian.

Ellucian has continued to support and develop the Colleague (Student) product. There are many variations on how Colleague can be implemented. These variables include the breadth of modules that are used, the architecture of the implementation, and the back-end database selection. The College is using a standard suite of modules, with a modest server architecture, and the legacy Unidata database.

Current Deployment
- Server/Storage Infrastructure:
  1. Monolithic legacy HP-UX server, single-instance with 16 dual cores and 32 GB of RAM, serving application and database tiers
  2. Middleware (DMI) and web tiers are on Dell PowerEdge servers, combination of physical and virtual instances
  3. LSI SAN (fibre channel-based) storage
- Network Impact:
  1. Storage for application and database tiers are on isolated SAN-based fabric
  2. Backup cycles for other middle and web tiers are known to bog the network, although this is attributable to more than just the Colleague-related backup data
- Operations/Maintenance:
  1. Deployed with three environments: Development, Test and Production
  2. Weekend maintenance windows for routine backups and system patching
  3. Patches are deployed outside of established maintenance windows as needed
  4. Backups are disk-to-disk-to-tape
  5. Daily tape backups are kept in the data center until weekly pickup and delivery to offsite storage (Iron Mountain)

Representative Issues

1. The current version of Colleague Student is deployed on "legacy" hardware and Ellucian has indicated that customers will benefit from better integration if they move to its Microsoft SQL version.
   a. ECC has already invested in the hardware necessary to support this MS SQL platform. Virtual server instances for Dev and Test have been deployed and a new DotHill storage array has been positioned to handle the back-end storage specific to that application
2. Administrative end users say that the system was not initially deployed effectively and contains too many customizations and bolt-on product interfaces.
   a. This appears to have been the result of cost-saving measures by electing to use third-party and home-grown code to create certain application interfaces and reporting tools rather than purchasing native Datatel/Ellucian product modules.
   b. SIS applications are, by nature, routinely patched to account for not only product enhancements and bug fixes, but to implement the annual updates to financial aid packaging and other regulatory adjustments needed. ECC is confronted with an extra burden of patch management because of its extensive customizations that create a domino effect on other tools and interfaces that must be regression tested.
3. ITS does not have an effective way to analyze the nature of system performance issues.
   a. Anecdotally, the system frequently bogs and crashes under peak loads. End users have come to anticipate and expect that each registration period will be impacted by system crashes. Most recently, students were confronted during Fall registration with communication from ITS that up to a week's worth of transactions may have been lost.
   b. ITS performs certain file sizing and listener restart functions prior to peak use but these activities are not preventing system outages under load
4. ECC has been plagued by "constituency errors" for several years, marking a need to evaluate the relationship between ITS's technical team and the Ellucian support team. More must be done to demand outcomes from both teams rather than letting significant customer service issues languish for months.

Recommendations

1. ECC should promptly engage Ellucian professional services to perform a standard "Registration Health Check" to evaluate component configurations and gather recommendations for specific system tuning at the application and database layers.
   a. This service is readily available, off-the-shelf (no significant scoping issues to perform the engagement), and relatively inexpensive
2. ITS must immediately establish and prioritize a bona fide conversion project to move from the Unidata platform to the MS SQL platform.
   a. This must be treated as a full-blown conversion activity involving key individuals from every administrative department using Colleague
   b. ECC should contract with a third-party project manager to drive this project. If an Ellucian PM is used, the individual must be interviewed and contracted in light of true PM functions, not merely an administrative liaison to the technical team.
   c. The conversion should be run as a full business process reorganization event and not merely a data conversion. All customizations should be looked at and freshly

evaluated with an aggressive view toward removing as many non-native Colleague functions as possible.

3. ECC should consider purchasing additional DMI listener licenses to add capacity during peak registration periods.
    a. Ellucian's cost structure for its licensing can seem onerous given the expense that is required to license for periodic peak usage loads and they have not adjusted their business model to relax the financial impact to community colleges such as ECC. Nonetheless, this is the platform that ECC has made significant investments in and should therefore--until such time as a strategic decision is made to go away from the current platform--continue to make the necessary investments to run it successfully.
4. The database servers should be designed to use native Microsoft SQL clustering rather than VMWare secondary instances.
5. ITS should create a secondary warm-site node at Compton Center to help mitigate against local failure of the server room at ECC. Ultimately, a reciprocal agreement should be struck with an out-of-region college to expand a disaster recovery capability that eliminates regional risk.
6. PlanNet evaluated the hosting and managed services offerings for Colleague and recommends that ECC continue to operate the environment as a premise-based deployment using ECC-badged employees to maintain the systems.
    a. In lieu of using Ellucian AMS (application management services) as a regular operational outsource for maintaining the Colleague Student system, ECC should budget $3,000 annually to have the Registration Health Check performed by Ellucian at least 45 days prior to fall online registration and perform all necessary tuning and remediation items identified.
    b. A decision about using Ellucian AMS in the long-term should not be made until after the conversion to the MS SQL database version is complete and the success of the conversion has been measured. ECC can expect that the operational cost trade-off of outsourcing Colleague database administration and patch management may be between 1 and 2 FTEs, but PlanNet feels the value of this outsourcing is not as beneficial as applying resources at the application layer to continue to address program needs for the academic and student service functions, which are not addressed in the AMS offering.
    c. ECC does not stand to benefit from moving Colleague to a fully hosted (off-premise) deployment unless a strategic decision is made to begin outsourcing all other IT platform support since ITS will be retaining a certain amount of infrastructure capacity and system administration skill sets for other IT systems.

5.2   Ellucian Portal (Portal/WebAdvisor)

The Ellucian Portal is the application set that provides a single point from which the college community can gain access to authorized components of the Ellucian product suite. Access to Email and MyTeamSites is also facilitated through the Portal application. This system is tightly integrated to the Colleague Student system described above.

Current Deployment
- Server/Storage Infrastructure:
  1. The portal is made up of a combination of physical and virtual servers working in conjunction to present the "myECC" WebAdvisor and email gateways and provide the plug-in components for the other user-specific services available via the web.
     a. There are 5 virtual machines including 3 front-end SharePoint servers, a SharePoint indexing server and a database server running Microsoft SQL Server 2008
     b. WebAdvisor is running 1 physical server for the web front end and 1 physical server for the DMI "listener" that arbitrates connections to the back-end Colleague Student system
  2. The stock "www" landing page for elcamino.edu is managed by a separate content management system (CMS) known as OmniUpdate
- Network Impact:
  1. System is highly reliant on a robust network and Internet connection; user experience can be affected by the connection characteristics of the client computer

Representative Issues
1. Customer satisfaction weighs heavily on the regard for performance of this system.
2. The system is necessarily tied to the performance of the underlying databases of the Colleague SIS serving the WebAdvisor content; server performance of the back-end system can be responsible for slow performance of web client giving the appearance of network congestion when the network is not actually a factor in the end-to-end connection.
3. Constituency errors (discussed above) have been a key issue in user experience, effectively blocking access to the portal. ITS has worked extensively with Ellucian in recent months to create work-arounds to the issue, ultimately defining a better set of default conditions for student records being imported from external systems.
4. The top 5 most important technologies or technology services that students indicated in the survey responses were all about accessing online services (grades, registration, paying tuition, transcripts and course materials), punctuating the significance of ITS focusing on the interface and reliability of these student-facing services for which the portal is a principal gateway.
   a. Mobility versions of these services are increasingly valued. The following is a representative survey comment: *"I like the new layout of the MyECC site. I don't like that I can't access anything on my phone. I had a teacher last semester who posted what was needed for class or if class was cancelled on the team site, yet I had to be on a computer to see this. Before the changes, I could see everything on my phone. I liked that. The ability to check quickly without the hassle of finding a computer or finding a spot to set up to use my laptop. If that could be fixed, I would be so much happier."*

Recommendations
1. ITS should focus on enhancing the mobility version of the portal with all essential functions available not only in a standard PC browser but also accessible from smartphones and tablets.
2. ITS should continue its efforts to make single-sign-on to user accounts as seamless as possible through the portal experience so that multiple account names and passwords do not need to be managed at this level.

5.3   Microsoft Exchange (Enterprise Messaging/Email)

Exchange is used as the email application for faculty, staff and students. This is the official means by which college communications are handled with students, instructors and administrators. Forwarding of student email to personal third-party services is not supported. Enterprise calendaring is available for staff and faculty but is not in wide or consistent use such that the ability of meeting planners to see individual free/busy time is not effective.

Current Deployment
- Server/Storage Infrastructure:
  1. Application servers, data store servers and web interface servers are virtualized on Dell PowerEdge hypervisors
     - 4 database stores on VMs, 2 for staff, 2 for students
     - 1 combination CAS/HUB server on VM
     - 1 CAS only server on VM
     - 1 HUB only server on VM
  2. The 4 primary message stores are maintained on Dell EqualLogic iSCSI (network-based) storage
- Network Impact:
  1. The EqualLogic iSCSI storage is Ethernet-based using 10 Gb interfaces on a separate storage network
  2. Backup cycles are known to bog the network
- Operations/Maintenance:
  1. Weekend maintenance windows for routine backups and system patching
  2. Compton Center shares the same domain as El Camino College

Representative Issues
1. Faculty and staff regard email as one of the top two most important services that ITS delivers. Satisfaction from the survey feedback is that email is being served as well or better than almost all other ITS functions, but the empirical scores for success are lower by as much as 40% from the desired satisfaction target. Focus group feedback generated more negative anecdotes of this service than the survey feedback.
2. Email outages can take hours to resolve, both from the standpoint of time to recover the system as well as time to recognize and respond to an outage. Email is consumed as a 24x7 service but is not able to be maintained as a 24x7 service due to lack of staffing resources and a defined SLA, though ITS is applying a reasonable best-effort approach to attending to issues outside of standard workday hours given the circumstances.
3. Microsoft Exchange requires a specific skillset that is not effectively cross-trained within ITS.
4. Inability of departments to make good use of the visibility of individual free/busy times in the enterprise calendar is largely a training issue (not an ITS responsibility) or a deliberate choice by some departments to opt out. This significantly hampers the ability of campus schedulers and administrative assistants to effectively arrange coordinated meetings with other departments and to view and book room assignments.

Recommendations

1. ITS should fully host (off-premise) its email services
   a. With the popularity and increased stability of cloud-based email services, enterprise messaging has become commoditized and is no longer seen as a specialty service that requires unique deployment considerations.
   b. A significant number of application interfaces have been developed by all the major email cloud service providers that lowers the barrier for adoption into the enterprise space, particularly for education
   c. The ability to tie into local Active Directory deployments for identity management and single sign-on is well established
   d. Student email systems have been subscribed as a cloud service for years by even the largest colleges and universities with the likes of Google and Microsoft.
   e. The 2013 Educause CORE data service reports that 84% of AA-degree offering schools are already using some manner of cloud or vendor-hosted email systems
   f. Architectures for dealing with private segmented data stores are available as are provisions for dealing with e-discovery and litigation holds
   g. Moving this considerable mission-critical application to a third-party cloud service will instantly regain capacity within ITS to tackle other significant application support and deployment initiatives that lie before it; enabling ITS to move its most skilled resources away from doing highly commoditized work and position its core competencies around education-specific applications, advancing technology delivery and performance management.
2. Allow students to forward their ECC student address to a personal email account
   a. This promotes prompter receipt of official and urgent correspondence from the college and other entities using the student's address, such as prospective employers
   b. This removes the burden of students having to login separately to receive notification of email correspondence
   c. This facilitates the use of a preferred email client application instead of forcing all email views to be done using a web browser
3. Hosting can be done in two stages: move student email systems first, followed by faculty and staff
   a. ECC should comparison shop the two major cloud service providers currently supplying higher education: Google Apps for Education and Microsoft Office 365 for Education. This should be conducted as a full total-cost-of-ownership (TCO) study with contact made to Ellucian for any unique advantages for interfacing with its portal product
      i. ECC can use Microsoft Azure to federate the Active Directory services, putting one node at the premise and one node in the cloud.
      ii. This will further enable access to SharePoint, Exchange and DFS in the network
   b. PlanNet recommends that the transitions be made in separate calendar or academic years to minimize the global impact to the enterprise as well as to distribute the project load for ITS
   c. The college should require all departments to participate in the enterprise calendaring function as part of the transition to the cloud-based version of Exchange or Google Apps and train accordingly.

5.4   ETUDES and MyTeamSites (Learning Management System)

ETUDES (Easy to Use Distance Education Software) is the College's standardized Learning Management System (LMS) for any courses offered by Distance Education. It is also available to instructors who desire to incorporate its use into a hybrid- or classroom-based course.

It should be noted that many classroom-based course instructors take advantage of the "MyTeamSites" features accessible through the Portal in order to perform basic sharing of digital documents, announcements, discussions with the registered students in a course section.

Current Deployment (ETUDES)
- ETUDES is fully hosted. This means the College (ECC and CEC) has no servers, switches or data storage on campus that need be committed to the ETUDES system.
- Network Impact:
    1. No indication of network latency or response time issues preventing effective use of this platform in a hosted configuration
- Operations/Maintenance:
    1. Maintained by ETUDES at their hosted facility
    2. Course uploads are by ITS at appropriate intervals
    3. Use of ETUDES by faculty requires a two-week mandatory training enrollment

Current Deployment (MyTeamSites)
- MyTeamSites is part of the Ellucian Web Portal platform
- Network Impact:
    1. No identified network bandwidth issues, but subject to outages of the parent Colleague Portal (MyECC) system and hooks to single-sign-on mechanisms
- Operations/Maintenance:
    1. Maintained locally by ITS and patched as part of the regularly issued Ellucian updates

Representative Issues
1. Students scored responsiveness/performance of the ETUDES system slightly higher than MyTeamSites, approaching 4 out of 5 on the 5-scale, generally representing acceptable performance for an off-premise deployment subject to additional latency considerations when accessed from on campus.
2. Faculty largely panned the experience of using MyTeamSites as compared to ETUDES, giving most features a less-than-neutral score, an overall experience rating of 2.8 on the 5-scale (as compared to 3.65 for ETUDES), and low marks on responsiveness/performance of the system (2.73 as compared to 3.78 for ETUDES). Following are representative comments from the faculty survey as it relates to MyTeamSites:
    a. *"I have given up on using My Team sites in the beginning of the semester because it is not reliable. Often half of my class cannot access the material."*
    b. *"The interface is not user friendly. Students often get error messages when trying to open docs-must right click instead of left click. Seems quirky."*
    c. *"Consistent access. When the portal is down the students can't access or the instructors can't post and many times the portal has been down at critical periods during the semester."*
    d. *"The site is down too often and becomes a huge hassle for me."*

e. *"Access problems for both faculty and students in the middle of a term makes this extremely difficult to promote as THE place to go for course answers and documents. It may mean more stable hosting is required?"*

3. Faculty generally prefer the document handling features of the MyTeamSites platform because ETUDES has file size limitations.
4. ETUDES suffers from poor gradebook and discussion board features, according to faculty comments.

Recommendations
1. ECC should not operate at cross-purposes with multiple Learning Management System (LMS) platforms available and should focus on enhancing the user experience with the ETUDES platform as the primary LMS for both distance education and hybrid course instruction.
2. ITS and Distance Education should establish a local resource for rapid response to instructor calls for assistance with a published SLA; all other service issues are escalated to ETUDES beyond the parameters of the established SLA
   a. ITS and Distance Ed need to be seen as cooperatively increasing the value of the LMS that is currently invested by ECC
3. Since the features of MyTeamSites are already included with the Colleague Portal implementation, it should be viewed as an acceptable alternate platform for some instructors who have specific requirements that cannot be fulfilled in ETUDES, but should be subject to review and approval of the Office of Distance Education in order to minimize wider adoption of a system with lower service level agreements and performance issues.
4. Distance Education should develop several use case "white papers" that describe effective scenarios for using the respective platforms, illustrating when MyTeamSites is an appropriate use case.
   a. ECC should continue to lobby ETUDES to allow for waiver of their two-week training requirement for instructors who have demonstrated other LMS platform experience (such as Moodle or Blackboard) and are only planning to use the system for hybrid content delivery; all pure distance ed courses can retain the requirement that the instructor be certified on the ETUDES platform.
5. ECC should continue to submit enhancement requests to ETUDES to allow for larger file uploads or a way to link to third-party file sharing services to overcome the small file size limitation.

5.5   Hyland Singularity (Document Imaging)

Hyland (formerly Hershey) Singularity is a Document Management System (DMS). Singularity is being used by the Financial Aid office and by Admissions &Records for transcripts, but limited use elsewhere on the ECC campus (CEC Financial Aid and Admissions are Singularity users). The product is no longer being developed by Hyland. They have a different product, "OnBase" which is a more robust offering and referred to as an Enterprise Content Management (ECM) system.

Current Deployment
- Server/Storage Infrastructure:
  1. The deployment has two environments: production and test, both running on VMs on Dell hypervisors. All database functions are served from the shared Microsoft SQL server environment; no dedicated DB instance for Singularity

2. Storage is on the shared EqualLogic storage arrays
- Network Impact:
    1. No identified or anecdotal performance issues relating to document access
- Licensing:
    1. Based on concurrent users (up to 50)

Representative Issues
1. Hyland is no longer in product development for the Singularity document imaging product but will be maintaining bug fixes for some time.
2. ECC does not have an effective electronic workflow engine available for departments that want to use modern forms processing, digital archives and programmed document approval processes.
3. ECC has a significant number of processes that are paper-based, slowing processing time, creating multiple data entry cycles and expanding the sprawl of records that must be stored and retained.
    a. Specific examples of time and attendance record keeping, applicant processing, employee status requests, tracking flex hours for professional development, were cited in stakeholder interviews as representative of deficiencies in electronic workflow and forms processing
4. The current licensing entitlement for ECC includes electronic workflow, but the module/capability was never implemented
5. Currently, the Colleague system feeds Singularity with a simplistic flat-file data exchange for student index values
6. Hyland has license portability that allows for all features of the Singularity product that exist in the newer OnBase product set to be applied to existing customers who are willing and able to complete a migration to OnBase.
7. Microfilm transcripts were digitized by Viatron but there is no integration to Singularity. Transcripts cannot be accessed by A&R staff (technical issues have not been resolved). A call must be made to Viatron and they print out the transcript on behalf of ECC.
8. Architectural programming for several new planned facilities on campus had reduction of paper record storage as a consideration in the footprint available for various relocating departments.

Recommendations
1. Initiate a project to evaluate the timing of a conversion from Singularity to roll out to other Student Service and Finance departments
    a. Hyland will allow for user and module license portability from Singularity to OnBase, minimizing the cost impact of a conversion
    b. ECC should expect that a professional services engagement will be required to manage the conversion from Singularity to OnBase; these conversions are not typically done in-house. Further, a conversion project and a roll-out to additional departments should not be seen as strictly an ITS project, but a collaboration between the Hyland project manager, the department(s) deploying the software, and technical participation from ITS.
    c. Hyland recommends deploying their systems on dedicated hardware but they will support installation in a virtual machine environment as long as the customer is able to mitigate potential issues relating to the virtualization layer by temporarily installing

components on physical hardware to prove the virtualization layer is not a factor. This applies to both client virtualization as well as server virtualization.

d. Because the interface between Colleague and Singularity is non-complex, the timing of a conversion to OnBase is not a significant factor and could be performed as easily before or after a Colleague conversion to MS SQL

e. Once converted, OnBase will allow for "image enabling" the user interface in Colleague to allow for more interactive document reference without having to work between applications

2. Allow short-term solutions for departments who do not require integration with Colleague as long as image formats are not proprietary and integration to multi-function devices for scanning are tightly integrated

6.0   Infrastructure

ECC benefited from a special arrangement with Cisco to have an infrastructure assessment performed by an approved Cisco partner to evaluate network and server infrastructure components, including patch levels, potential configuration issues, and product lifecycle. Generally these assessments are geared toward finding sales opportunities for the manufacturer and integrator but useful and actionable information can be generated in these exercises as long as ECC recognizes that solution upgrades need to be viewed through the lens of a bona fide business requirement.

SigmaNet was the integrator selected for the assessment and they used a tool called MyITAssessment. The output was a 150-page report and inventory spreadsheet with 27 high-level findings. PlanNet's review of the assessment identified 11 findings that appeared to have some actionable value. Extracts of the assessment are included in Appendix B.

In addition, there were some areas that were not assessed by MyITAssessment, so PlanNet took on direct additional review of some infrastructure not captured in the SigmaNet effort and has included some additional findings/recommendations below.

The following sub-sections have been written to appeal to a more technical audience that would ultimately need to evaluate the merits of some of the specific technical recommendations.

6.1   Network

6.1.1   Wide-Area Network (WAN)

Current Deployment
   A. ECC has two Internet connections from CENIC, one at 1 Gbps and the backup circuit at 45 Mbps (DS-3 speed). Compton Center has a similar pair of connections.
   B. ECC connects to its branch locations using T1 service. Compton is connected by 3 bonded T1s (4.5 Mbps) carrying Colleague data and Voice-over-IP traffic to tie the phone systems together, and other applications. Student and Faculty traffic to MyECC from Compton routes over the CENIC connection.
   C. The Hawthorne Business Center is connected with a single T1 circuit.

Representative Issues / Key Findings
   1. The connection to Compton Center is unreliable. AT&T has been called to service outages on the circuits multiple times per year. Often any alarm condition has cleared by the time a technician becomes involved.
   2. Some of the WAN devices are on single power supplies and/or single power circuits, which presents risk of outage at the device or at the carrier circuit level if the power fails.
   3. The firewall and associated VPN client software are not running the latest stable release. Edge firewalls are very exposed to threat vectors and represent a key vulnerability when not updated with the manufacturer's latest protections against known threats and security vulnerabilities.
   4. The CENIC Internet routers are dated and should be upgraded or replaced with newer units, especially the one in the old campus MPOE.

5. Carrier services to the campus come into the Main Point of Entry (MPOE) in the basement of the Administration Building. That location is substandard for power and cooling and our understanding is that a new MPOE is being established in the renovated Industry & Technology building.

Recommendations
1. ECC should initiate a project to redesign the branch location connections, including replacing the problematic circuit(s) connecting Compton Center and Hawthorne Business Center.
   o Investigate the use of Metro-Area Network (MAN) circuits in lieu of bonded T1s. There are a wealth of Layer 2 Ethernet providers in LA County and often provide better cost-per-megabyte values.
   o Work with CENIC to provide site-to-site IP-VPN tunnel between El Camino and Compton campuses. This would amount to a set of configuration changes on the respective edge routers and would provide a better class of service for application traffic. The MAN circuit could be regarded as the primary link with the IP-VPN tunnel serving as a secondary path. Both links could be designed to be active-active for certain classes of target applications, such as restricting VoIP traffic to the MAN and sending all other traffic to the IP-VPN tunnel.
2. Some effort needs to be made to provide power diversity for all WAN devices to improve reliability and reduce risk of outage. ECC should explore the use of redundant electrical circuits, PDU's, and UPS's.
3. The Cisco ASA firewall and VPN client software should be updated to the latest stable release as per Cisco's current recommendations. This review of patch version level should be conducted quarterly and when specific security vulnerability bulletins are issued. ITS should also make sure that any available updates to the VPN client are offered as an auto-update to installed clients.
4. ITS should approach CENIC about a technology refresh for their non-District-owned Internet routers. This could be conducted as part of the redesign of the WAN connection architecture mentioned in the first recommendation.
5. The schedule for any equipment upgrades or lifecycle refresh to WAN equipment should coincide with the migration into the primary data center in the renovated Industry & Technology building. This creates an advantageous condition for simplifying the migration by just swinging the connection instead of relocating electronics.

6.1.2 Local-Area Network (LAN)

Current Deployment
A. Physical cable plant
   a) Fiber optic backbone has already been reworked as part of the data center relocation projects
   b) In-building copper infrastructure is sufficient in all new construction. Older buildings have already been outfitted with at least Cat 5E cabling which is sufficient for the current 1 gigabit to the desktop speeds that ECC is providing.

c) Cross connects in IDFs is disorderly and cable management practices need to be tightened up

B. Active LAN Electronics
    a) The campus core is relatively new hardware with Cisco's modern Nexus family of data center switch technology that has robust support for virtualization and mixed data/storage networks. It also has a lengthy support roadmap for many years to come.
    b) Access switches in the campus IDFs are largely current in the newer buildings but according to the SigmaNet MyITAssessment data, there 18 devices that are currently End of Life (EoL) and 119 devices that will become EoL by summer 2015.
    c) ECC uses a typical three-tiered campus network architecture with core at the MDF (data center), distribution at the building (BDF) and access at the IDF (floors or wings of buildings). Below is a typical topology showing redundant connections from a BDF to the redundant core switches in the data center:
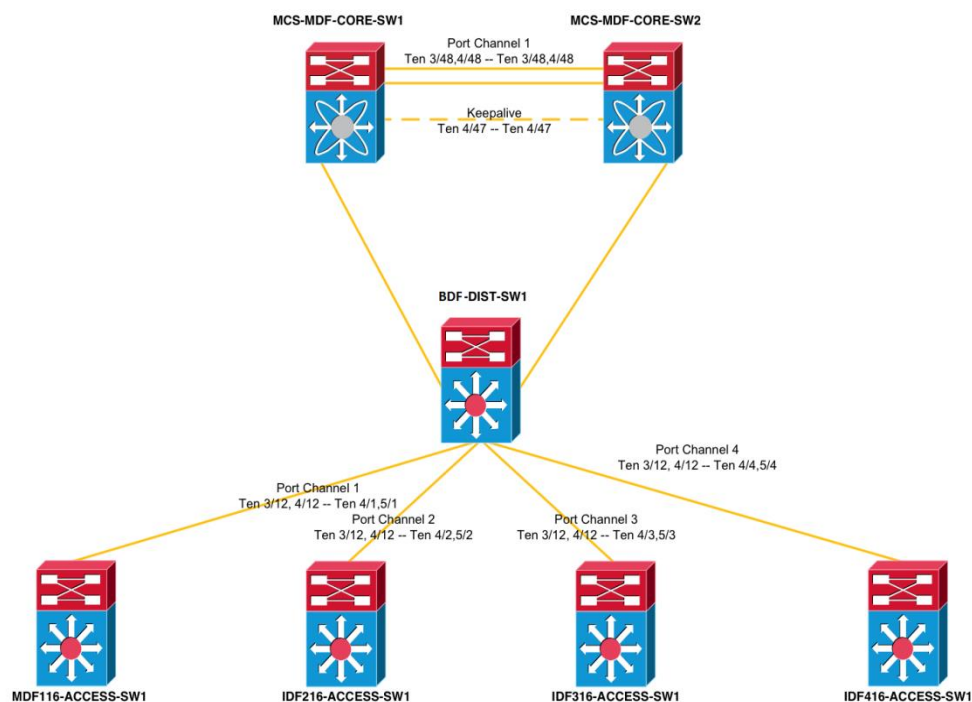
Representative Issues / Key Findings
1. ECC is at risk of having network switches unable to receive manufacturer support and updates. If there is a security vulnerability, a replacement may be required as the only means of addressing it. Older equipment is also at increased risk of hardware failure and unplanned outage.

2. In addition to the hardware issues cited, there are software patching issues that need to be attended to. Approximately 20% of the installed switch code base is at or approaching last day of support (LDoS).

Recommendations

1. ECC has been able to benefit from new construction projects to attend to much of the end-of-life equipment inventoried. ECC should initiate a project to evaluate the remaining EOL and soon-to-be-EOL devices where needed. This would appear to affect approximately 40% of the current installed base. This could be set up as part of a larger rolling technology refresh project that would seek to replace 20% of the infrastructure per year, given a typical 5-year lifecycle and depreciation for access switches, as well as continuing to seize upon opportunities to refresh inventory as part of new construction projects.

2. ECC should try to stay no more than 6 months behind the manufacturers recommended update schedule to minimize the risk of security vulnerabilities and potential breaches. Best practice is to do updates quarterly or as major security bulletins are issued.

3. ECC should remedy the focus items identified by PlanNet as actionable from the SigmaNet report. Those include the following:

   - Spanning tree block wrong [optimization impact]
   - PSIRT devices (Cisco-known and published vulnerabilities) in network [security impact]
   - Network software consistency [scalability and management impact]
   - Shared and critical uplinks (switches and routers) with errors and discards [performance impact]
   - Overutilization [performance impact]
   - Device buffer failures [performance impact]

6.1.3 Wireless

Current Deployment

A. Controllers
   a) ECC has two wireless platforms in operation. One third of the wireless access points (WAPs) are running on a legacy Cisco-compatible controller. The other two-thirds of the 116 WAPs (approx. 80) are running on a Dell-branded Aruba controller that supports more modern signaling standards. This latter platform is a very robust and tightly integrated solution that is appropriate for expansion at ECC.

B. Wireless Access Points (WAPs)
   a) Combination of G, AG, N, and AC; some use of ruggedized external WAPs
   b) Newer buildings on campus have the Aruba WAPs deployed that support the 802.11ac standard

Representative Issues / Key Findings

1. Operating two wireless systems presents ambiguity in the maintenance and management of the WLAN and presents inconsistent user experience, including

limited roaming between systems. Clients may have to re-associate when going between systems.
  a) Open areas and congregating areas are not well covered. Some patio spaces have been recently addressed with added WAPs.
2. End users cited poor wireless access as one of the top satisfaction issues in survey responses.
  a) The wireless system is not pervasive on the campus.
  b) Issues with roaming and hand-off from carrier 3G and 4G networks. Most smartphones will prefer an available WiFi signal but the WiFi actually performs worse than the carrier service that got handed off.
  c) Captive portal registration is cumbersome and does not retain credentials from day-to-day.
3. WiFi deployments do not need to be complicated by application portfolio analysis.

Recommendations
1. ECC should standardize on a single wireless platform going forward. The Dell/Aruba platform is the recommended manufacturer solution given the substantial investment already made and Aruba remaining as a top-tier manufacturer in the technology category.
  a) For as long as ECC decides to maintain both platforms (perhaps waiting out the construction schedule for various buildings slated for renovation or demolition), decisions will have to be made about the impact to clients who roam from one coverage area to another since they are not compatible. This may require communicating the limitations to campus users who will be expecting a different user experience.
2. ECC needs to make considerable investments in broadening the deployment and initiate a project to establish the approach for deploying a bulk of new WAPs.
  a) To increase reliability, ECC should deploy a second highly available controller. The controllers should be positioned in separate data centers to mitigate against local network or power outage.
  b) ITS can redeploy Aruba in legacy buildings and put brand new WAPs in buildings not slated for short-term renovation or demolition. This can be done creatively where available cabling is already in place in unused data outlets, such as for projectors or phone ports. Use a cost-effective wall-mount mechanism or above ceiling grid technique that minimizes the threshold to deployment.
    ▪ Or, ITS could deploy new WAPs in the old buildings and plan to recover them when the building is slated for demolition. This option needs to be evaluated in light of actual construction schedules and when the N radios are likely to sunset naturally anyway.
    ▪ The budgetary guidance provided in Section 7 for WLAN upgrades is not intended to be a wholesale rollout of additional wireless access points to bring the campus into complete coverage; rather it is suggested as a stop-gap measure to support the recommendation to attend to the most significant of the coverage issues weighing on customer satisfaction. PlanNet recognizes that ECC's construction plans dictate a measured rollout over time to achieve comprehensive coverage (indeed ITS has acted responsibly in leveraging new construction to address enhancements to

date), but additional investments should be made in the near term to enhance coverage where new construction is still too far out. The project described above should focus on repurposing WAPs for portions of future construction where the timing makes sense to do so.

    c) Use a mechanism for whitelisting known or registered devices to prevent repeated captive portal registrations

    d) As part of the construction impact, ECC should look for additional landscaping opportunities to install WAPs and power to locations that will support better exterior coverage to common and congregating areas. Low voltage cabling is not essential to these locations as suitable outdoor WAPs will have a wireless mesh feature that will use the secondary radio for backhaul to a nearby wired WAP to handoff the client connections to the network.

3. ECC should focus their deployment efforts on surveying for RF interference and generating heat maps for coverage and capacity to establish WAP locations. It is not necessary to spend for additional analysis on application profiles and security classes when ECC can direct all wireless traffic to the Internet and use the existing firewall and ACLs measures to protect the network.

6.2   Servers and Storage

6.2.1   Converged Server/Storage Platforms and Virtualization

Current Deployment

A. Currently using Dell PowerEdge rack-mount "pizza box" servers for VMWare hypervisors, providing the primary compute capacity for virtualization
- All hypervisors are uniform in their specifications
- Data network interfaces are 1 gigabit NICs
- Storage network interfaces for iSCSI are 10 gigabit NICs connected to a separate storage network switch architecture using Force10 switches

B. Primary storage for the virtualization environment is a set of Dell EqualLogic SANs using iSCSI as the networked storage protocol.
- There are two major EqualLogic SANs supporting administrative and academic applications. A third EqualLogic SAN is used for the physical security video surveillance storage.

Representative Issues / Key Findings

1. Current environment is a legacy architecture. It does not take advantage of power efficiencies to be gained by blade enclosures and tighter integration between storage and traditional networks. Maintaining separate storage networks adds to operational complexity.

2. iSCSI as a network protocol is not as efficient as fibre channel (FCP) for block data. This affects virtual machine performance, including impact to boot times and large block data transfers (such as during backups).
    a) Software iSCSI initiators cause additional CPU overhead on the VMware host.
    b) No Full Duplex traffic, since iSCSI I/O must wait until transmit is complete.

      c) Microsoft Clustering Services (MSCS) nodes are not supported in iSCSI storage.

      d) TCP introduces latency for iSCSI and encapsulation of the Ethernet frames around iSCSI frames and decapsulation creates extra overhead.

      e) iSCSI uses default ethernet MTU (1500) size which makes it slower and less efficient than fibre channel protocol, which uses a larger and consistent frame size (2158) and faster by design.

      f) iSCSI requires additional attentiveness by the networking administrators to ensure appropriate VLAN separation, QoS and prioritization is properly designed into the environment, particularly when traffic is routed and/or traversing multiple hops.

3. ECC has a number of servers that are nearing end of support or end of life.
4. ECC's use of NIC teaming is at the Windows Server operating system level, which is less effective.

Recommendations

1. ECC should move to 10 gigabit network interface cards for servers, particularly VMWare hypervisors managing large volumes of application data throughput. Alternatively, the servers could be equipped with converged network adapters (CNAs) to put both Ethernet and fibre channel (FCoE) on the same interface.

2. Storage arrays should be changed out for a fibre channel-based storage array, such as Dell Compellent or NetApp, at the appropriate lifecycle interval.

      a) Optimally, ECC would deploy a converged data and storage network switch (FCoE) platform, such as Nexus 5000-series, that can accommodate both Ethernet and fibre channel on the same switch.

      b) iSCSI protocol for enterprise storage is generally a value decision, not a performance decision. Since ECC has performance issues on some core applications, storage should be optimized for performance.

      c) Can do active-active with Compellent and fibre channel protocol (FCP) or network file system (NFS); important not to do active-passive for enterprise-class storage

      d) PlanNet recommends that ECC repurpose the DotHill SAN that was intended as the new Colleague application data store as a disk-to-disk backup target to maximize the current investment.

      e) These upgrades should be timed in the overall roadmap plan to make use of available operational refresh dollars to help underwrite the costs of moving to the new architecture. These changes could be moved into place over the next 24 months.

      f) Recognizing that iSCSI may be in the environment for some time, either due to the value proposition or waiting for an appropriate upgrade window, PlanNet recommends that ECC make the following in-place optimizations:

            1) Purchase TCP Offload Engine (TOE) iSCSI cards (such as QLogic 8300 series Convergent Network Adapter) with dual ports, since the CNA supports iSCSI and FCoE traffic. This will take care of the performance issue due to iSCSI software initiators, which have impact on a server's CPU.

            2) Increase the Ethernet frame to 9216 on the iSCSI network switch. This is necessary due to decapsulation of the Ethernet frame and MTU size.

3) Increase I/O block size from 8k to 64k or larger.
4) Authentication between storage initiator and iSCSI array must be set to CHAP authentication.
5) Establish a QoS policy for iSCSI if it is being routed across Layer 3 boundaries.

3. ECC should initiate a project to evaluate moving to blade chassis for its compute platform
   a) This will benefit ECC by providing:
      1) smaller footprint/rack space
      2) lower power consumption
      3) reduction of network and fibre channel cabling and adapters
      4) "single pane of glass" administration interface
   b) Compton Center has already made this type of upgrade during the recent data refresh project.
   c) Based on the quantity of servers that may be due to roll off of support over the next 12 to 18 months, ECC may want to hold off on conventional refresh and use any allocation for lifecycle refresh to put toward blade chassis.
   d) If ECC is able to hold off on upgrades until a single large procurement approach can be taken, a pre-integrated stack (servers, storage, network and virtualization) called FlexPod or vBlock should be considered in order to benefit from the tightly integrated platform design and maintenance. One entity licenses and supports the entire stack.
4. Virtual Port Channels (vPCs) should be used to connect the servers to the network. This will use active peer links in parallel to redundant switches (similar to multi-chassis Etherchannel) and won't present spanning tree issues, which also blocks throughput on one of the available links.

6.2.2   Virtualization

Current Deployment
A. ECC has 5 hypervisor nodes making up the VMWare version 5.0 environment
   o   Each hypervisor is built to common identical specifications, very uniform node deployment

Representative Issues / Key Findings
1. ECC is running version 5.0 of VMWare virtualization platform that presents the following issues:
   a) All system access for administration functions is not done with single-sign-on and Active Directory
   b) It is not possible to do native iSCSI or fiber channel over Ethernet (FCoE) at the hypervisor level using this version of VMWare. Consequently the OS-level storage drivers are in use and presents less integration and uniformity of support.
   c) End of general support for version 5.0 of VMWare is Q3 of 2016. An update project needs to be on the horizon.

2. Only one instance of vCenter control server and associated system databases which presents a single point of failure.
3. ECC is using VMWare-level virtual switches. This presents administrative inefficiencies and overhead where every hypervisor must be administered separately for changes to network configurations.
4. As is common in ever-sprawling virtual server environments, ECC has not been able to keep up with the on-going analysis of VM performance and tuning.
5. ECC has no automated DR capability (requires manual intervention) leveraged within the virtualization platform which is one of the key benefits available to virtualization customers

Recommendations
1. ECC should upgrade all VMWare vSphere hosts to version 5.5 update 2 for vCenter and ESX. The college should already be entitled to these upgrades without additional licensing. By upgrading, ECC will enjoy the following benefits:
   a) Single sign on using the existing Active Directory authentication mechanisms in place
   b) vSphere web client so that system administration can be conveniently accomplished from a web browser
   c) vCenter administration server can be operated as a pre-packaged virtual machine appliance; easier to update, patch and support
   d) Better support for virtual application high-availability (HA) architectures
   e) vSphere Storage Distributed Resource Scheduler (DRS) feature allows for more flexible movement of storage data along with survivable VMs in a vMotion event
   f) better support for solid-state flash drives
   g) better support for native Microsoft clustering (MSCS)
   h) VM virtual drives can grow to as large as 62 terabytes
   i) Many other improvements
2. ECC needs to establish a high availability (HA) design for vCenter, either as Link Mode or as a separately licensed HA pair.
3. ECC should use Cisco Nexus 1000v virtual distributed switch to make network administration of the virtualization platform less complex and more efficient. ECC is already licensed to use this product.
   o This will allow network configurations to follow the VMs as vMotion may move them from hypervisor to hypervisor
4. ECC should engage professional services to provide a comprehensive health check and capacity planning assessment
   o Recommend use of tools such as SysTrack from Lakeside and others
5. Site Recovery Manager is available to ECC to make its disaster recovery capability more robust than its current "best effort" approach to reinstall servers from backup.
   o SRM allows for VMs to dynamically migrate to an alternate hypervisor environment in an outage. ECC could use the CEC VMWare environment as a target for SRM (and vice versa).

6.3   Performance Monitoring Tools

Current Deployment
A. ECC is currently using Solar Winds ORION for network monitoring
B. Virtual server monitoring and reporting is being done with a tool called Foglight

Representative Issues / Key Findings
1. The ORION deployment is limited to some network monitoring and alerting functions but a full implementation was never completed. ITS showed good vision in the product selection.
2. Foglight has limited flexibility

Recommendations
1. ECC should initiate a project to deploy the remaining feature sets of ORION, including modules that monitor server performance and up/down conditions
2. ECC should replace Foglight with VMWare vCOPS as the primary VM monitoring tool. ECC should already be entitled to vCOPS as part of vCloud licensing.
   a) vCOPS is regarded as a more sophisticated comprehensive analytical tool for VMWare, more operational in nature, able to spot bottlenecks, and identify myriad performance issues in the environment
   b) vCOPS can also be used for monitor policy compliance
   c) it is native to VMWare so contains tighter integration and remains patched along with the vSuite of updates
3. ECC should deploy Microsoft's System Center Operations Manager (SCOM), which is likely already entitled under ECC's Microsoft Campus Agreement
   o This monitoring tool offers similar functions as vCOPS for the Microsoft server instances

6.4   Backup and Archives

Current Deployment
A. Day-to-day backups are handled by one of two backup solutions in use at ECC, either Veeam for virtual machines or NetBackup for physical servers, which perform a disk-to-disk local backup (at the block level) each evening. Current practice is to use a legacy EqualLogic SAN for the initial back up pass before a secondary weekly process writes the data out to tape.
B. After data is backed up to tape, the tapes are kept on site in the data center until a weekly pickup interval at which time Iron Mountain removes the tapes to a secure offsite storage location.

Representative Issues / Key Findings
1. The server and storage infrastructure becomes impacted during nightly backups, often generating performance threshold alerts. Some rebalancing of the backup schedule has been done to mitigate some of these episodes.
2. ITS does not maintain a separate archive appliance and there is currently no deduplication technology in place to reduce the size of backup data at the target device.

Recommendations

1. Use of fibre channel storage devices with sufficient controller throughput will solve congestion issues on the storage network.
   o For as long as ECC elects to use iSCSI storage, the backup targets should also operate at 10 gigabit speeds for optimized throughput end-to-end.
2. ECC should implement a backup-to-disk appliance with deduplication and compression like Actifio CDS, Avamar or Data Domain; these types of appliances will allow extended retention, export to tape, as well as asyncronous replication between sites to allow for a more robust data recovery capability.
3. ECC should not keep daily backup tapes in the same location as the primary data store. Backup tapes must be moved off site on a daily interval, either by sending to Compton Center until the Iron Mountain weekly pickup or by increasing the pickup interval from Iron Mountain.

6.5   Disaster Recovery

ECC does not have a defined disaster recovery plan beyond best-effort system rebuilds from back up. Initial conceptualization has been done with respect to sharing infrastructure between ECC and CEC to support local campus-based or facility outage, but this does not adequately address regional risk that would affect both locations.

There are several key take-aways for ECC with respect to an appropriate disaster recovery and basic backup/restore capabilities.

1. ECC needs to define specific DR procedures down to the level of system rebuilds.
2. DR plans need to take into account the business continuity plans developed by the District's risk management principal. This contemplates the necessary network and circuit requirements to enable connectivity from faculty, students and staff who may need to reach the recovered compute environment from or at a far-flung location.
3. Each application needs to have a defined Recovery Point Objective (RPO), which describes how much data can be acceptably lost and re-entered or re-processed in a recovery scenario. With modern replication schemes, this target for many applications can be down to the minute; ECC is operating at an hours-long RPO for some systems based on the timing of certain system backups.
4. Each application needs to have a defined Recovery Time Objective (RTO), which describes the acceptable amount of time an application can be offline before users will once again require access. This time frame will vary greatly from application to application, but is often targeted to one business day for mission-critical applications at community colleges such as ECC. The current RTO for most applications is undefined and "best effort," which is likely to be many days or weeks without a defined recovery plan.
5. Defined RPOs and RTOs drive the necessary architectures that are needed to design a suitable DR posture and costs become exponentially higher as RPOs approach real-time high availability and RTOs shrink to a few hours.
6. The administration should have a well understood remote access pattern to core systems, in particular Colleague and Web Advisor, for faculty, students and staff. The primary learning

management system Etudes is already hosted, which involves remote access and removes the risk of a local equipment or network failure.

7. ECC should attempt to strike a reciprocal arrangement with a sister college out of region, preferably a Colleague site, who could help support access to student information systems and other state systems for financial and reporting functions, as well as over-subscribing to available virtual server resources with a sufficient allocation of storage space for replicating DR data.

7.0   Roadmap

7.1   Implementation Phases

PlanNet recommends the following actions and initiatives with phased timetable guidance:

Phase I (first 6 months)

1. Fill vacant ITS positions
   a. Begin recruitment for Technical Services Manager, position about to become vacant due to retirement
2. Establish District CIO position
   a. Recruit an outstanding candidate with demonstrated leadership style, coalition-builder
3. Restructure Distance Education and Media Services under the CIO
   a. Establish key success measures for customer satisfaction (time-to-response, time-to-resolution, customer satisfaction rating)
   b. Feedback mechanisms for gathering and publishing service levels
4. Move Web Development under ITS
5. Perform Registration Health Check
   a. Use Ellucian packaged service to complete this system tuning exercise
6. Initiate project to complete the conversion of Colleague to the MS SQL platform
   a. Hire a contract project manager to lead this 12-month engagement
   b. Involve all key departments with a view toward process re-engineering and reduction of customizations
7. Reassess the IT Tactical Plan for alignment, cost and viability
   a. Consider canceling all backlog projects not deemed deliverable within 1 year
8. Fully deploy the Footprints service desk software to enable better ticket tracking and escalation mechanisms
   a. Assess and revise current Help Desk SLAs and provide for better coverage during stated hours of operation
   b. Integrate the Media Services tech support team to the Footprints ticketing system and expand the Level 1 help desk response capability
9. Create a project to identify cost-effective means to expand wireless deployment
   a. Expand the use of the existing Aruba platform and sunset the use of the Cisco equipment, standardizing on a single control platform
   b. Deploy a redundant controller for high availability
   c. Rapidly deploy 802.11ac WAPs to buildings without coverage; identify creative use of existing cabling and ceiling/wall mount options. Use quantity 120 as guidance for immediately recognizable coverage improvements; precise quantity and pplacement to be refined in the study
   d. Remove any unnecessary captive portal registration mechanisms and position the wireless network as a hostile network direct to the DMZ

Phase II (6-18 months)

1. Create 6 new ITS positions
2. Identify next 3 departments to receive document imaging
    a. Focus on departments who have immediate need to reduce document storage due to new construction
3. Refresh the objectives of the Technology Committee
    a. Create clear membership assignments with appropriate balance of academic and administrative roles
    b. Establish the maintenance of the Strategic Plan as a key directive
    c. Establish the generation of annual Tactical Plans as a key directive
    d. Update the schedule of publication of the Technology Plan including the derived Tactical Plan to coincide with Unit Plan budgeting
4. Create IT Service Catalog
    a. Identify core competencies for ITS and opportunities for outsourcing
    b. Establish SLAs
5. Replace EOL network access switches
    a. Patch all switches to current code levels

Phase III (18-36 months)

1. Replace LSI and Equalogic storage arrays with fibre channel SAN
2. Install blade chassis servers at appropriate server refresh interval
3. Initiate a project to create a disaster recovery plan
4. Technology Committee should review the recommendations of this assessment to determine progress toward completion of any approved recommendations

7.2   Rough Order Magnitude (ROM) budget

For the recommendations made in this assessment, PlanNet offers the following high-level budgetary estimates for ECC's guidance on capital (one-time) and operational (recurring, such as maintenance) costs. Each entry has been indexed back to a report section where the details of the recommendation are expounded:

Action/Initiative	Report Section	Phase	Duration	CapEx (one-time costs)	OpEx (recurring costs)	Recommended Sourcing Option
1. Fill vacant ITS positions	4.3.2	I	6 mos.	none	Same cost	ECC HR
2. Establish District CIO position	4.3.3	I	6 mos.	none	$48K addtl.	ECC HR
3. Restructure Distance Ed and Media Svcs under CIO	4.3.4	I	9 mos.	none	Same cost	N/A

Action/Initiative	Report Section	Phase	Duration	CapEx (one-time costs)	OpEx (recurring costs)	Recommended Sourcing Option
4. Move Web Development under ITS	4.3.4	I	6 mos.	None	Same cost	N/A
5. Perform Registration Health Check for Colleague	5.1	I	3 mos.		$3,000/year	Ellucian Pro Svcs
6. Initiate project to complete Colleague conversion to MS SQL edition (technical lead at $165/hr, PM at $125/hr)	5.1	I	12 mos.	$600,000		Ellucian Pro Svcs
7. Re-assess IT Tactical Plan for alignment and viability	4.4.6	I	30 days	None	None	Coll Tech Cmte & ITS (internal)
8. Fully deploy Footprints service desk software	4.4.3	I	60 days	$20K	None	ITS (internal) with consultant PM
9. Fully deploy Solar Winds network management software	6.3	I	60 days	$20K	None	ITS (internal) with consultant PM
10. Initiate project to expand wireless coverage (spot coverage enhancements only: 120 WAPs; 25% estimate requiring cabling and special treatments)	6.1.3	I	12 mos.	$50K controller $145K WAPs & licensing $15K cabling, etc	$30K	Dell/Aruba for equipment; ITS/Facilities for deployment and cabling
PHASE I Totals				**$850,000**	**$81,000**	
11. Create 6 new ITS positions	4.3.2	II	12 mos.	None	$450K plus benefits	ECC HR
12. Convert document imaging to new Hyland product and expand use to addtl depts (2 weeks of technical lead and PM at $150/hr)	5.5	II	3 mos.	$24K pro svcs; $30K scanners (or integration to existing MFDs)	None	Hyland Pro Svcs & ITS
13. Redefine mission of College Technology Committee	4.3.1	II	60 days	None	None	Coll Tech Cmte
14. Create IT service catalog and SLAs	4.4.1&2	II	60 days	None	None	ITS

Action/Initiative	Report Section	Phase	Duration	CapEx (one-time costs)	OpEx (recurring costs)	Recommended Sourcing Option
15. Build out ITS procedures documentation	4.4	II	12 mos.	None	None	ITS
16. Replace EOL network switches and update patches (132 @ $10K)	6.1.2	II	4 mos.	$1.3M	Same cost	AT&T (or bid alternative) & ITS
PHASE II Totals				**$1,354,000**	**$450,000**	
17. Replace LSI and EqualLogic storage with fibre channel SAN	6.2.1	III	6 mos.	$170K	Near same cost	TBD
18. Install blade chassis servers	6.2.1	III	6 mos.	$220K	Near same cost	TBD
19. Initiate a project to create a DR Plan	6.5	III	6 mos.	$40K	None	outsourced consultant
20. Review IT assessment recommendations	7.0	III	30 days	None	None	CTC & ITS
PHASE III Totals				**$430,000**	**$ -**	