TCNJ THE COLLEGE OF NEW JERSEY

2017 – 2021 Information Technology Plan

Adopted July 2017

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1. EXECUTIVE SUMMARY

1.1 Introduction

It is critical that any information technology strategic plan be developed with a longer term view while retaining the ability to be agile and react to changing needs or opportunities during the course of implementation. This document provides a plan to coincide with and support the TCNJ College Plan, TCNJ 2012: Bolder, Better, Brighter. The plan will be revised annually to take advantage of strategic opportunities and to further detail the next 1 - 2 years but overall, the spirit of the 5 year plan should not change unless there are drastic changes to the College Plan.

1.2 The Plan

Many detailed plans have been developed to meet the growing needs of the TCNJ faculty, staff, and students. The unit plans in section 2 of this document have already been activated. These plans contain numerous no cost or low cost projects but the highest level, most strategic projects for the next several years are summarized in the following table. The costs are very high level estimates.

IT Plan Cost Estimates

	FY18	FY19	FY20	FY21	FY22	5 Year Total
Integrate systems to increase security and efficiency (IV)				$ 200,000		**$ 200,000**
Provide a robust identity management system to increase security and efficiency (IV)			$ 500,000			**$ 500,000**
Provide students with mobile access to lab software (I, IV)		$ 100,000				**$ 100,000**
Build Cyber Infrastructure capacity for Research Support (I, III, IV)		$ 417,000	$ 100,000	$ 100,000	$ 200,000	**$ 817,000**
Cloud Services/Telephony Migration (IV)		$ 200,000	$ 100,000	$ 100,000	$ 100,000	**$ 500,000**
Increase BYOD capabilities in instructional spaces (I, IV)	$ 50,000	$ 200,000	$ 100,000			**$ 350,000**
Provide a video content management and distribution system (I,IV)		$ 20,000	$ 60,000			**$ 80,000**

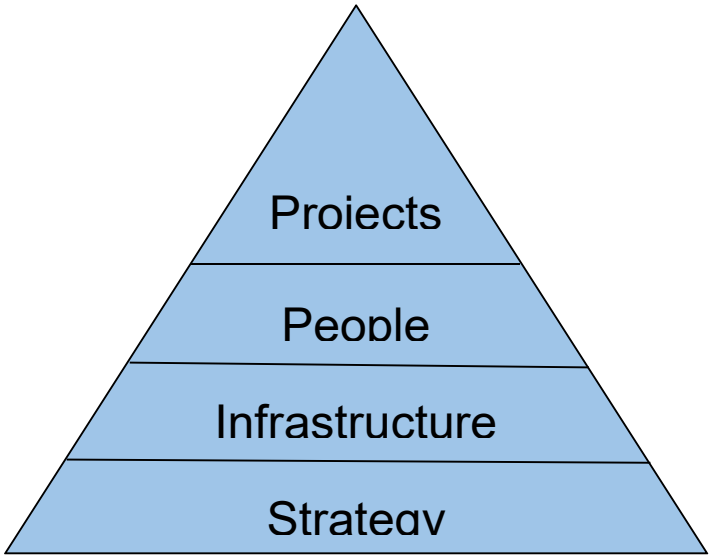
Technology Equipped Space Improvement (I, II, IV, V)	$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000	**$ 200,000**
Cloud CRM to provide critical work flow and message management tools for Recruitment and Enrollment Management. (I, III, IV, V)		$ 350,000				**$ 350,000**
Cloud SIS to increase security, user experience, and efficiency (I, III, IV, V)				$ 1,000,000	$ 700,000	**$ 1,700,000**
Document Management System to support enrollment management and records and registration (I, IV, V)		$ 500,000				**$ 500,000**
Contract Management Solution to increase efficiency (V)			$ 100,000			**$ 100,000**
Modernize HR system to add efficiency, security, and self service (I, IV, V)	$ 646,000	$ 400,000	$ 300,000			**$ 1,346,000**
Upgrade the PAWS (student information system) to increase security, user experience, and efficiency (I, IV, V)	$ 150,000					**$ 150,000**
Modernize Budget and Finance System to increase security, user experience, and efficiency (I, IV, V)	$ 318,912					**$ 318,912**
Provide appropriate technology to meet needs of events and conference services (I, II, III, IV, V)				$ 100,000		**$ 100,000**
Centralize mobile delivery of services to students (I, II, IV)		$ 20,000	$ 20,000	$ 20,000	$ 20,000	**$ 80,000**
Information Security Enhancements to protect college assets (IV)	$ 150,000	$ 100,000	$ 50,000	$ 75,000	$ 100,000	**$ 475,000**
Replace or modernize Business Analytics and Reporting Solution (I, II, IV, V)					$ 500,000	**$ 500,000**
Total	**$ 1,354,912**	**$ 2,347,000**	**$ 1,370,000**	**$ 1,635,000**	**$ 1,660,000**	**$ 8,366,912**

(College Plan Priority)

1.3 Process

The Information Technology Division built a plan that is predicated on four commitments.

1. Strategy - design an IT plan that will support the college strategic plan
2. Infrastructure - design and build core technology for future needs
3. People - have the right people with the right skills in the right roles
4. Projects - invest in the right projects at the right time



The team studied numerous articles, webinars, journals, and professional reports. Dozens of calls were completed with Gartner analysts. Meetings were held with IT staff and campus stakeholders. The IT Planning Council provided oversight of the plan development.

After considering the College Plan and the many resources, the IT Division embarked on a journey to define itself by understanding how it fits into the College Plan, documenting their values, and clearly articulating their Investment Principles. These documents provide the foundation for the resulting IT plan.

1.4 The College Plan Context

The Information and Technology Plan was developed in directly address Priority IV of the College Plan but, as noted above, the IT work supports the entire Plan.

Priority IV: Build, operate, and maintain a safe, sustainable, and accessible physical and technological infrastructure that supports high-caliber learning. An exceptional education requires more than excellent professors. Information technology and facilities undergird the primary educational mission of the College. Creating an optimized, secure technology infrastructure capable of supporting high caliber learning and developing an attainable plan to provide for our physical spaces will allow TCNJ to continue to provide an exceptional educational experience in and out of the classroom. This commitment to an exceptional educational experience requires that we not saddle our future colleagues with unmanageable deferred maintenance.

Goal 2: Anticipate, prioritize, coordinate, and address the instructional, administrative and residential technology needs of the college.

Action Steps:

1. Revise the Information Technology (IT) strategic plan to meet current needs and future directions for information technology.
2. Improve the communications and feedback loop between the campus community and the Information Technology division.
3. Assess and implement technological functionality of existing facilities (i.e. furniture, multimedia rooms).
4. Create a fully wireless, "bring-your-own-device"-ready campus.
5. Create instructional spaces that support flexibility in pedagogy, including technology-based pedagogies.
6. Increase interoperability of IT systems.

1.5 Information Technology Division Values

The Information Technology Division operates within the TCNJ set of values which include excellence, engagement, integrity, inclusiveness, and self-reflection. Additionally, the following IT Division values guide us in our daily work and interactions.

Teamwork - We consistently demonstrate our commitment to each other's success by being responsive, prepared, proactive, and genuine.

Communication - Authentic, consistent, reliable and open information sharing is

paramount to our culture of transparency. We recognize that constructive feedback is crucial to our continuous improvement.

Accountability - We are committed to making the best, most productive use of all resources. We provide a scale-able and agile infrastructure that supports evolving college needs.

Leadership - Our knowledge and commitment to our profession inspires confidence. We embrace creativity while seeking innovative and transformative solutions.

1.6 Investment Principles

Investment principles shall mean those underlying rules, guidelines, themes or assumptions that the College embraces and promotes when investing in Information Technology related resources. Those resources include the people, systems, solutions, training, education and support required to address the IT needs of the College.

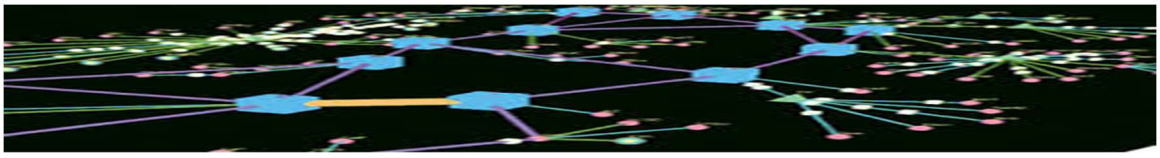
1. The College will always strive for the best value for the institution
    a. Purchases will not be based solely on lowest price
    b. Decisions will result in delivering the optimal mix of IT to create the best value for TCNJ
    c. Total cost of ownership will be understood prior to any resource commitment
    d. Portability, scalability, open standards, best practices, innovation and long term supportability will be included in value assessments
    e. Creative use of existing investments will be considered prior to making any new investments.
2. Impact Statement (including total cost-benefit) must be defined prior to investment
    a. Analysis of costs include:
        i. Lifecycle costs (Total Cost of Ownership) for implementing hardware and/or software
        ii. Costs to prepare existing systems and/or human resources for new investment
        iii. Project management and system implementation costs
        iv. Expectations, roles, and responsibilities
        v. Post implementation support costs
        vi. Exit strategy considerations (in case of system failure, product end of life, or migration to new system)
    b. Analysis of benefits should include
        i. Innovation value
        ii. Decreased operating costs

iii. Increased efficiencies
iv. Business process improvement
v. Increased customer satisfaction
vi. Better positioning for future demands and/or technology changes

3. Investments will align with college and department mission, strategic plans, goals, and objectives
    a. All projects/purchases will also be evaluated based on:
        i. Compliance/Critical Support/Upgrades
        ii. Security/Risk Aversion
        iii. Executive Initiative
        iv. IT Standards/Policies

2. IT DIVISION UNIT PLANS

2.1 TCNJ Academic Research Cyber Infrastructure Plan



Introduction

The TCNJ CyberInfrastructure Plan was developed to address the Board of Trustees strategic goals for the college and provide for the immediate needs of a growing faculty and student research agenda. Upon completion, TCNJ faculty and students will have a collaborative, sustainable, and reliable cyberinfrastructure environment that will allow them to more readily participate in the regional and national research community.

Cyber Infrastructure (CI) is a rapidly growing and expanding component of campus information technology. CI is focused on distributed computing, data, and communications technology. Hardware and software systems are being developed and implemented to build virtual research communities including the collaborative tools needed to knit these user communities together. This plan will support the anticipated significant growth in faculty and student research which is in alignment with the TCNJ strategic plan priority of creating a collaborative, sustainable, and reliable cyberinfrastructure environment.

The Cyber Infrastructure Plan is a segment of the overarching TCNJ Technology Plan. The CI Plan weaves together the resources within existing Information Technology departments of Enterprise Infrastructure, User Support Services and outside academic consortiums to advance the mission of research at TCNJ using the most up to date technology available.

Current Initiatives in Progress

TCNJ has a public class B IPv4 address and a /48 IPv6 address allocation and has configured its border routers with network ingress filtering anti-spoofing ACLs. Our ISP, NJEDge, employs anti-DDOS mechanisms. NJEdge acts as a regional network provider to its members for Internet1/Internet2 access, as well as providing various other services such as video conferencing, digital video repository and consortium cooperative purchasing. TCNJ has been a subscribing member since 1997 when the consortium was formed (see letter of support). Two 10GbE circuits and a bandwidth subscription 2.5Gbps provide TCNJ with redundant connectivity to the NJEDge network. NJEDge provides a gateway to Internet2 via their peering connection with the Mid-Atlantic GigaPOP in Philadelphia for Internet2 (MAGPI). The NJEDge connection

to MAGPI consists of a 10GbE circuit with 2Gbps of bandwidth available to its membership. TCNJ's HPC cluster is connected to the campus network with multiple 10GbE links and has access to both the commodity Internet as well as Internet2 through its regional provider NJEDge.NET.

The High Performance Computing (HPC) cluster is currently being used to host a variety of open source and commercial software across all the disciplines in the School of Science. The HPC cluster consists of a 400 sq. ft. datacenter housing more than 160 compute nodes providing in excess of 1,450 Intel CPU cores and 30 nVidia-based GPUs. It also provides approximately 0.5 petabytes of ZFS-backed storage with the ability to quickly and easily add another 0.5 petabytes. The cluster is connected to the campus network with multiple 10GbE links and has access to both the commodity Internet as well as Internet2 through its regional provider NJEDge.NET. The cluster can support multiple types of workloads including HPC, GPU-based calculations, Big Data, and virtualization. It is designed, with the aid of open source orchestration software, to be easily reconfigured to meet the evolving research and pedagogical needs of the faculty and students.

Faculty are using these programs to enhance the classroom experience as well as to further their individual research. Applications such as AMBER, MrBayes, Athena, R, and Matlab are being accessed on the cluster to run parallel jobs across multiple servers as well as long running, single server jobs.

In addition to traditional HPC, faculty in the Computer Science department are using virtualization to provide individual servers to their students as part of their coursework. These students are able to configure these servers as needed for their class projects.

Relevant College Plan Priorities and Action Steps

Priority IV: Build, operate, and maintain a safe, sustainable, and accessible physical and technological infrastructure that supports high-caliber learning.

Cyber Infrastructure Plan

The Cyberinfrastructure Plan was developed to directly support the college plan and will contribute to achieving this specific goal by:

- Deploying a dedicated decentralized high-speed research area network to support student and faculty research
- Expanding on-campus high performance computing clusters
- Providing scalable access from the research area network to Internet1/Internet2/XSEDE and other NSF-hosted services

- Leveraging campus access for ad hoc and ancillary access to research area network resources across all disciplines
- Improving campus abilities to process, store, and share Big Data

To achieve the goals and objectives of the CI Plan, the following six initiatives will be completed:

1. NJ Big Data Alliance

The New Jersey Big Data Alliance (NJBDA) was established by the Rutgers Office of Research and Economic Development and the Rutgers Discovery Informatics Institute to catalyze the collaboration among New Jersey government, academia and industry that will enable all parties to address the significant and immediate challenges posed by the proliferation of data sources and the resultant deluge of digital data in a strategic and coordinated manner. Founding members include Kean University, Montclair State University, N.J. Institute of Technology, Rowan University, Richard Stockton College, Rutgers University and Stevens Institute of Technology. The Alliance also works closely with the Office of Assemblyman Upendra Chivukula, the New Jersey Office of Information Technology - Enterprise Data Services, the New Jersey Economic Development Authority, and NJEdge.net, New Jersey's Higher Education and Research Network. TCNJ will seek membership in the NJBDA.

2. Federated Authentication Services

InCommon and Eduroam are complementary federations satisfying different needs in the academic communities. Both services permit visitors access to TCNJ-based resources and provide TCNJ community members reciprocal access while traveling to other colleges and universities. TCNJ is actively pursuing InCommon federation membership which would offer users access to shared Cyber Infrastructure resources using TCNJ credentials and also accept trusted credentials of collaborators and researchers from other institutions when there is a need to use TCNJ network resources. TCNJ is also pursuing membership in Eduroam, which is a secure, world-wide roaming access service developed for the international research and education community. Eduroam provides researchers, teachers and students easy and secure network access when visiting an institution other than their own. Integration between these two federations is planned but not yet completed, and it is necessary to join both federations to fully satisfy community needs.

3. IPv6 Implementation

The central IT department acquired an IPv6 address allocation for the entire campus community. As a result, we have a well-developed and mature knowledge base of IPv6 and have taken the initial steps of deployment. While this is a long term project, the investment in the implementation will provide access to any network and all resources possible.

4. Software Defined Networking

TCNJ is deploying next generation software defined networking equipment. Software-defined networking separates the data plane where traffic flows between clients and the control plane and management of the device or management of the traffic flows occur. In contrast, older monolithic devices with application-specific integrated circuits perform a small series of functions with no separation in duties. The advantage of SDN is a modularity that results in flexibility and a maximization of up time. No longer do updates require disrupting traffic. Newer routing protocols are also embracing this idea to remove the logical network location of a device from its network address.

5. PerfSONAR

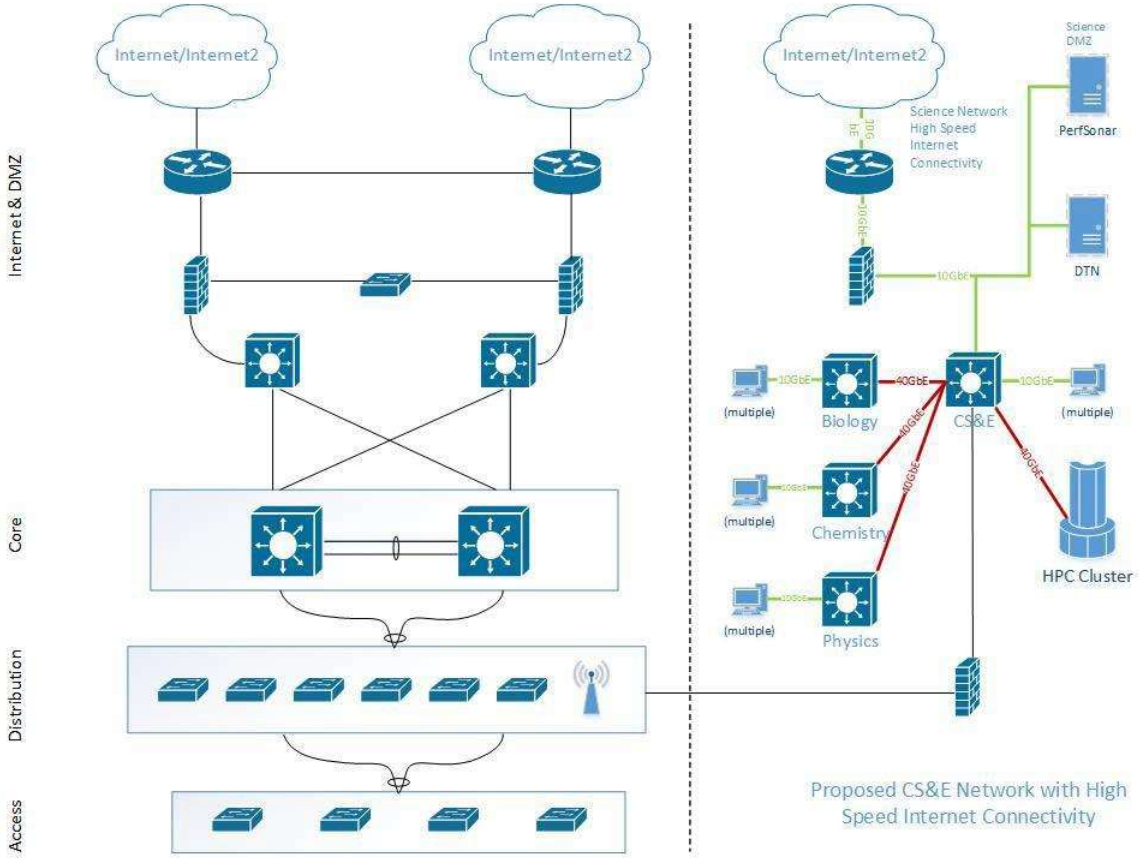
With the growing challenges in managing a high performance network infrastructure, there is an increased need to measure and monitor network performance to insure performance metrics are being met and the network is functioning at optimum speed and reliability. The PerfSONAR framework and toolkit provide end-to-end views of the network and visualization tools to assist in detecting and troubleshooting any issues.

6. Dedicated High Speed Science Network

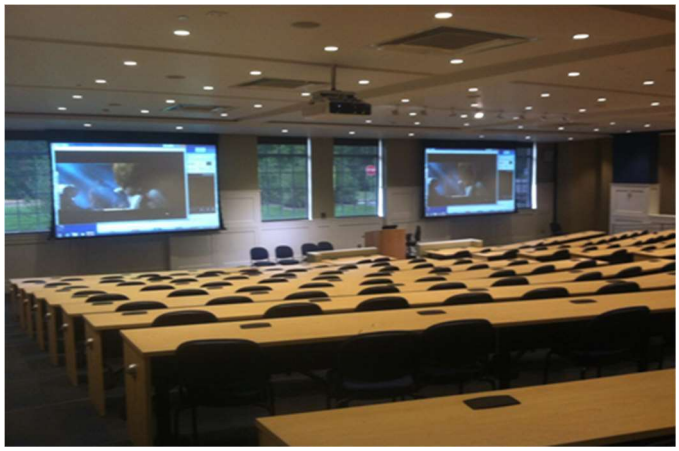
TCNJ is establishing a dedicated high-speed Science network infrastructure to support research on campus and between other institutions. Numerous research initiatives have future computational and data transfer needs that dramatically exceed existing infrastructure capacities. A Science DMZ will improve network performance, increase security, and create a local area high transfer environment that allows for high-volume transfers at up to 40Gbps. The infrastructure will also link this research area network to other NJ institutions via the NJEDge state consortium network and Internet 2 and provide better access to XSEDE and OSG.

Summary

Building on the broad IT goals of creating networks that are scalable, agile and nimble for the evolving needs of the College, TCNJ has deployed a collapsed backbone network consisting of access, distribution, and core layers and two active redundant Internet/Internet2 connections. This network provides wired and wireless access to over 40 buildings via a high-speed fiber infrastructure. The Science complex, comprised of Biology Building, Chemistry Building, and the Physics, Mathematics & Statistics Building are currently serviced via single 1GbE uplinks. The new Computer Science and Engineering (CS&E) Building, which is under construction (completed June 2017), will have 40GbE connectivity. The network architecture diagram below provides a visual reference of the planned HPC network setup:


Internet/Internet2
Internet/Internet2
Internet & DMZ
Core
Distribution
Access
Internet/Internet2
Science DMZ
Science Network High Speed Internet Connectivity
PerfSonar
DTN
10GbE
40GbE
(multiple)
Biology
CS&E
Chemistry
Physics
HPC Cluster
Proposed CS&E Network with High Speed Internet Connectivity

2.2 Media & Technology Support Services



Introduction

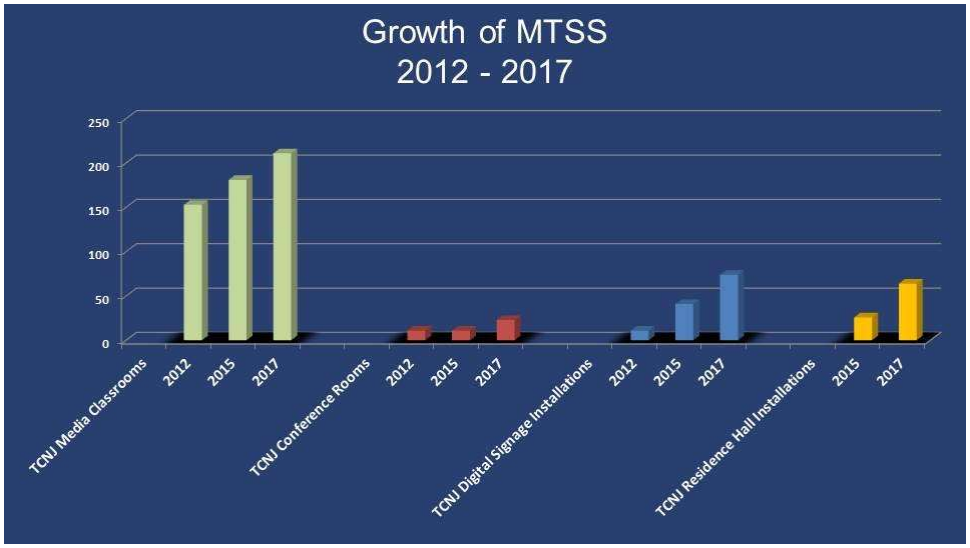
Media & Technology Support Services (MTSS) is active throughout the TCNJ community. Located in Forcina Hall, 1st floor, MTSS provides:

- Classroom & Instructional space, conference room technology management, service, real-time support
- Consultation, design, programming, installation, maintenance and support for display, conferencing and capture technology-related projects and initiatives
- Videoconferencing (VC) coordination and technical assistance, endpoint solutions
- Campus digital signage technology design, consultation, installation, and support
- Technical support and AV/computer equipment for event-related staging, rentals and loans, including academic, administrative and public events

Increase in technology equipped spaces:

- Since 2010, over 55 new technology enhanced spaces have been completed by TCNJ staff
- Since 2012, TCNJ has seen an increase of 35 class / huddle rooms
- Currently providing daily support for over 225 instructional, conference and group study spaces
- Over 2000 media equipment deliveries currently scheduled for the 2016-2017 academic year
- Since 2010, digital signage systems have begun to be installed throughout campus

- Over 40 of the digital signage systems have been completed by TCNJ staff



Room Types

- Conference Rooms - 15 seats or less (resident computer or laptop only solution, wall mounted LED display, Crestron control/monitoring, audio, web camera) **$6K**
- Seminar – Small, 20 seats (computer/monitor, HD projector, electric screen, or wall mounted LED display, Crestron control/monitoring, custom AV furniture or equipment rack, audio, web camera) **$19K**
- Baseline Instructional Space – Midsize, 24-48 (computer/monitor, HD projector/display, electronic screen, Crestron control/monitoring, custom AV furniture lectern, audio, document camera, blu-ray DVD, auxiliary inputs) **$29K**
- Dual Instructional Space – Large, >50 (computer/monitor, two HD projectors/two display, electric screens, Crestron control/monitoring, custom lectern, reinforced audio, wireless microphone, doc cam, UPS) **$45K**

*estimates also include the necessary Facilities and IT costs

Annual Media Equipment Lifecycle Replacement Plan:

- TCNJ follows a 5 year equipment replacement plan for most AV items with the exception of a few items that have a longer life span (document cameras, power amplifiers, etc). This plan allows the majority of the installed equipment to be covered under a warranty while in use, thus minimizing repair costs.

Relevant College Plan Action Steps

- Item 3 - Assess and implement technological functionality of existing facilities (i.e. furniture, multimedia rooms)
- Item 5 - Create instructional spaces that support flexibility in pedagogy, including technology-based pedagogies

The Plan

Educause Learning Space Rating System

The Learning Space Rating System (LSRS) will be used to assess the classroom design and implementation of technologies. This will allow us to benchmark our spaces against the best practices within the higher education environment.

BYOD in instructional & conference spaces

Media and Technology Support Services has been evaluating many different devices that support BYOD. This feature will allow for a more collaborative experience in our tech enabled spaces. We are working with other members of the IT team to help move this enhancement forward. Our goal is that by the 2017 Fall semester, the behind the scenes work has been completed and we are able to launch a pilot program with the final goal of outfitting every instructional space on campus.

Robust audio/video collaboration platform

With the availability and ease of use of software based video platforms, (Skype, Google Hangouts, Bluejeans, WebEx, etc) brings the need of implementing video collaboration tools in the instructional & conference rooms. Today's learning environment is a very fluid experience and the need to bring in an outside guest to your instructional space can develop very fast and needs to be easy. With a robust audio/video tool readily available in instructional spaces , the users can quickly navigate this ever changing world. The College would benefit from a standardized tool set that is permanently installed in meeting spaces and instructional spaces & labs.

Lecture capture

Lecture Capture currently has a small presence on our campus. However there are

spaces on campus that could benefit from a product being implemented. Spaces like Education 113, Education 115, Library Auditorium, Science P-101 along with other spaces see varying types of events that would benefit from this technology being implemented. It is our goal to outfit these spaces as budgets allow and follow the use and then base further decision making on the responses.

2.3 Enterprise Infrastructure

Introduction

Enterprise Infrastructure consists of three teams (Server/Storage, Network and Telephone) that converge to provide mission critical technology services which include:

- Campus wide internet access
- Email services and G Suite user and account management
- Network communication between all Academic, Administrative and Residential buildings on campus
- Telephone operations and management
- File shares and print services
- Identity Management (IDM) for single sign on of college applications and resources (ex. PAWS, YESS, wireless)
- Server and storage management, backup and disaster recovery planning
- The elevator pitch for Enterprise Infrastructure is 'we make things work on campus'

Enterprise Infrastructure works within the larger framework of the Information Technology Department to support the day to day operations of Enterprise Applications, User Support Services, and Media & Technology Support Services.

Server/Storage Team

- 6 FTE (Associate Director/Manager, 6 System Administrators) and 2 Student staff
- Manage over 400 servers/systems that support the academic, administrative and residential needs of the College.
- Main computer room is in Green Hall with a secondary site in Cromwell.
- Vast majority of servers are virtualized
- Identity Management is a large but often under-appreciated component of the server team's work (insert IDM visio)

Network and Telecommunications Team

- 6 FTE (Associate Director/Manager, 2 Network Administrators, 2 Technicians) 2 PTE (Technicians)
  7 Student staff
- Support for campus cabling infrastructure
- Infrastructure supports Voice (e.g. Telephone), Video (e.g. Cable television), and Data communications.
- Design and Engineering for cabling systems, for projects directed in-house (e.g. Facilities-lead renovations, wireless deployment), as well as Capital Projects (e.g. lead by Campus Planning and Campus Construction).
- Installation, support and maintenance for campus networking including wireless (currently 1100 access points across campus with many more to come)
- Approximately 40 campus facilities
- 100 Equipment rooms
- Approximately 28,800 ports across 800+ pieces of network equipment
- Telecommunications provides Campus telephone service (local and long-distance calling)
- Traditional telephones (approximately 3,000 stations)
- Mobile phone service (service managed for over 100 mobile devices

Current Trends and Initiatives in Progress

- Ubiquitous wireless access
  - 15 academic and housing buildings to be setup for wireless access over the next 6-8 months
  - Outdoor spaces will be included
- Server Virtualization and Consolidation

    - Any new server is virtual first
    - Since the Fall of 2016 we have consolidated servers and eliminated approximately 50 servers and storage units.
    - Electricity and maintenance costs have been eliminated on these servers taken out of service
- Virtual Desktops
    - Virtual Desktop initiative to provide anytime, anywhere access to resources for faculty, students and staff.
    - All kiosks are currently virtual
    - Computer labs will begin to rollout Summer 2017
- Network Infrastructure Upgrade
    - All switches on campus have been or will be refreshed by the end of 2017.
    - Internet capacity continues to grow with the needs of the college.
        - Currently 2 separate connections with a total bandwidth of 2.5 Gbps
- Security Access Control and Cameras
    - Enterprise Infrastructure has a large role in the campus safety and security plan including parking gate access, door access and point of sale systems.
- Construction and Renovation

Future Thinking for Enterprise Infrastructure

- Cloud-First Approach
    - Any new project or initiative is viewed from a ‘cloud-first’ perspective
    - Is there a cloud option and is that option viable and cost effective?
    - If not, then on premise solution must be virtual server compatible
- Scalable, Agile and Nimble
    - All projects moving forward will be viewed by three guiding questions:
        - Scalable - Can the solution/project scale up or down to serve the strategic goals of the College?
        - Agile - Do we have resources in place (human or technical) to pivot on short notice of a change in scope or direction?
        - Nimble - Can we move in a different direction as needed by ever evolving technology trends and innovations?

The Plan

Anywhere, Anytime, Any Device Access (AAAA)

Enterprise Infrastructure will provide the foundation for anywhere, anytime and any device access to instructional and administrative resources. A robust wireless network throughout the campus will allow ease of use access for faculty, students, staff and guests. Collaboration with Media and Technology Support Services on BYOD in classroom and conference spaces will knock down barriers to entry for access to campus resources.

Virtualization Extends Beyond the Server Rooms

Over the past several years, TCNJ has been on a path towards the virtualization of servers, systems and storage. Moving forward, we will extend the capabilities of virtualization to the desktop. Virtual Desktops will allow users to access course applications, data, and files on any device, anytime and anywhere on or off campus. The Fall 2017 semester will see the deployment of virtual desktops to the computer labs. Extension of this technology will occur to individual users being able to access their TCNJ desktop experience on campus anywhere they have an internet connection.

Technology is Seen as a Utility

Like water and electricity, access to technology on campus should be a basic expectation for all. In order to meet this expectation, Enterprise Infrastructure will provide the underpinnings for unified interoperability of all IT systems. The TCNJ community will look towards Enterprise Infrastructure to provide not just servers and networking for their applications, but will look to us for a vision on where technology can take their research, applications or data to the next level.

Cloud First Approach

TCNJ has already begun the process of moving to the cloud with the migration of email from Zimbra to GMail. The G Suite is much more than an email service. It is a fully integrated productivity platform that allows users to communicate, collaborate and store data at an unprecedented rate. The Google migration has been a giant first step that all users have experienced in moving towards the cloud. Over the next 24 months, Enterprise Infrastructure will be exploring and implementing cloud resources for upgrades in

storage, disaster planning, telephone services, emergency notification systems and other needs that just may not exist right now. The goal is to take separate existing systems that are run independently and harness resources of the cloud to unify them and create a campus technology platform that is greater than the sum of its parts.

2.4 Information Security

The goal of the Information Security program is to protect TCNJ's informational assets. Higher education is a data rich environment with an increasing focus from cyber adversaries. *The Information Security program extends to each member of the TCNJ community.*

New technologies recently implemented

- Next Generation Firewalls that provide network antivirus and intrusion prevention
- New threat intelligence feeds that block malicious traffic identified by cyber security researchers and other higher education institutions
- Increased reporting and alerts from the security event log manager

New cyber threats are discovered all the time. TCNJ must be prepared to handle these challenges. The Information Security Office is a resource for all community members to ask questions and learn about digital safety. Over the next few years there will be continued improvement on the security posture of the campus with increased outreach and policy development, alongside new technologies.

<u>Policy development and community outreach</u>

Develop a more mature cyber security awareness training program

- Specific training requirements for specialized departments
- Security training as part of the new employee process
- Monthly in person meetings for open discussion with community members about security
- Live phishing exercises

New Policy Development

- Information Classification
- Information Security

- Service Lifecycle
- Software Update
- Logical Access Provisioning

Data Loss Prevention (DLP)

Prevent unauthorized access to TCNJ data and minimize the risk of data exposure. Sensitive data collected and stored must be kept to a minimum. Purge data that is no longer needed.

- Identify where sensitive data is stored
- Review the business practice and need for the data
- Confirm proper security controls are in place
- Make sure data is properly expunged when it is no longer needed

A DLP software solution will be deployed campus wide to help identify sensitive data on TCNJ desktops, laptops, network drives, and servers.

Multi-factor Authentication

A single password is no longer enough to protect sensitive resources.

- Common for most online banking and financial institutions
- Greatly reduce the risk of unauthorized access
- Must be easy to enroll and use

Network Traffic Analysis

With the explosion of IoT and BOYD it is more important than ever to have proper network visibility. There are a number of new products on the market that leverage network traffic data with machine learning to detect and take action on network anomalies. These tools can also be used for network forensic investigations in the event of a breach.

Data Breach Preparedness

Even with increased outreach and security controls their is always potential for a data security breach. Proper planning and preparing will reduce response time, and hopefully reduce the impact of a breach. The Computer Security Incident Response Plan has been recently updated and will continue to be developed. Additionally, an outside vendor will be on retainer to assist in the event of a serious cyber security incident. The scale and complexity of cyber attacks continue to grow. Having experts with experience available for assistance when needed is critical.

In the next few years more services and applications will live in the cloud. Availability is a major component of information security. A locked down system that no one can access fails the mission. BYOD and virtualization will change teaching and business practices. Virtual desktops and applications will allow secure access to data regardless of the end point. Embracing these new technologies with proper policies and authorization controls place will ensure minimal risk while providing easier access to to protected data.

2.5 Enterprise Applications

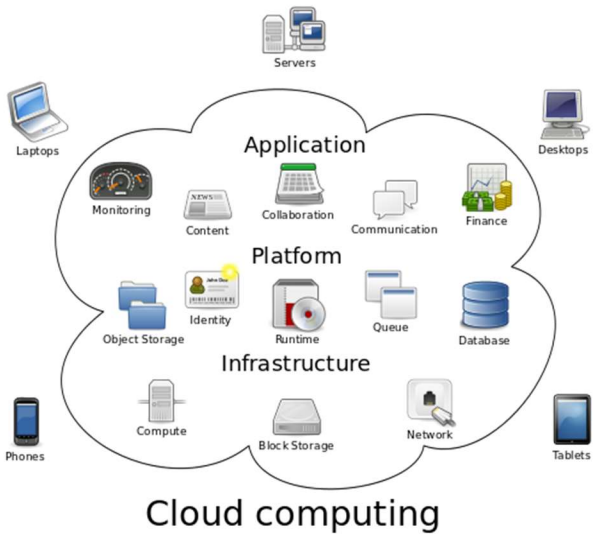


*Image By Sam Johnston - CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=6080417

Introduction

What We Do

* **We are responsible for The College's enterprise wide information systems.** The Office of Enterprise Applications maintains, supports and provides technical expertise to all our enterprise applications for The College. These systems currently include Oracle's PeopleSoft Campus Solutions, Oracle's PeopleSoft HR and Oracle's PeopleSoft Finance.

* **We maintain integrated enterprise systems that support the business of The College.** There are many systems that are used by individual departments at TCNJ. A large portion of our workload in EA is creating and maintaining interfaces to and from these applications. There are 26 of these system that integrate with PeopleSoft Campus Solutions (17) and Human Recourse (9). Some of the larger systems are StarRez (housing), MediCat (health services), Symplicity Conduct, Canvas, and BossCars.

* **We implement new systems and customize packaged software.** We maintain and support all TCNJ Web Applications. These are in house applications that were developed by TCNJ.

* **Design, Develop, and Maintain the TCNJ Data Warehouse.**

Enterprise Application Developers

- We currently have 1 Assistant Director and 5 Software Development Specialist 2s
- Responsible for our three major enterprise information systems; Student, HR, Finance.
- Apply the continuous updates provided by Oracle for these systems, 4-5 times per year for each system.
- Support the functional teams by troubleshooting issues, communicating with Oracle support, and implementing required fixes.
- Build and support custom modifications and bolt-ons that are requested and approved by the functional team. This includes supporting modifications that are currently in these systems.

Web Application Developer

- We have 1 Software Development Specialist 1 dedicated to our Web Applications. This developer is managed by one of our Applications Developer who splits their time between Web Applications and Enterprise Systems.

Oracle DBA (Database Administrators)

- 2 DBA's (1 DBA Position currently vacant)
- Our DBAs work with Oracle and the applications that use Oracle as their database.
- Troubleshoot and administer databases and core business applications which includes maintaining database security and integrity, backup and recovery, user maintenance and performance tuning, and developing new technologies.
- Provide technical expertise and assistance to project, developers and technical support personnel. Assist developers by providing technical information and guidance. Troubleshoot problems and resolve issues.

TCNJ Data Warehouse Developer

- We have an Assistant Director line which is dedicated to a full time Data Warehouse developer position. The Data Warehouse position is currently vacant.
- Design:
    - Work with TCNJ staff and others to assist them to create and document requirements and establish metrics
    - Work with area leads to design data structures to incorporate needed data

elements identified during based on collected requirements

- Development:
    - Develop data structures or enhance existing structures in the Blackboard Analytics data model for TCNJ review and approval, using T-SQL and Business Intelligence Development Studio in the SQL Server and Analysis Services environments
    - Implement designs in a non-production environment, test those designs, and work with TCNJ subject matter experts to validate the data and the embedded logic
    - Document development efforts and work with NTS staff to implement approved data structures and changes into the production environment
- Maintenance:
    - Assist in implementation of security and handle security requests related to the dimensions/objects in the data warehouse.
    - Participate in system upgrades. The BI Data Warehouse Manager can operate as a member of a team comprised of the BI Lead and NTS Lead to carry out necessary upgrades to the Reporting tools/Data Warehouse development tools/ETL/HEAdmin tool/Databases etc.

Current Projects and Initiatives in Progress

- Finance upgrade to Oracle ERP Cloud
    - Upgrade from PeopleSoft Finance 9.0 to Oracle Cloud ERP
    - Estimated completion October 2017
    - Implementing Concur - Travel and Expenses in coordination with this upgrade.
    - Wells Fargo will print checks and manage purchase cards.
- HR upgrade to Oracle HCM Cloud
    - Upgrade from PeopleSoft HR 9.2 to Oracle Cloud HCM
    - Upgrading Taleo Business Edition to Taleo Enterprise Edition
- PeopleSoft Campus Solutions Upgrade to 9.2
    - Upgrade our on premise hardware.
    - Upgrade from Oracle 11G to 12C
    - Upgrade PeopleTools version from 8:53 to 8:55
    - Upgrade PeopleSoft Application version 9.0 to 9.2
- Admissions CRM Implementation
    - As part of the 9.2 upgrade for PeopleSoft, we will be looking to upgrade

Admissions and Graduate Studies to the Oracle CRM for Recruiting and Admissions.

- SoftTime Implementation
    - Human Resources will be implementing a new system to handle absence management.
    - This new system will integrate with the current HR system and will replace the current monthly timesheets.
- TCNJ Mobile App - Dublabs
    - This past year, through our partnership with Dublabs, IT rolled out our first TCNJ Mobile App.
    - Future enhancements to this Mobile App will include
        - Course Registration
        - Bill payment
        - Course Feedback

Future Thinking for Enterprise Applications

- Cloud-First Approach
    - Any new project or initiative is first evaluated to determine if a cloud solution is available.
    - Is that option viable and cost effective?
    - If not, then a on premise solution can be considered.
- Scalable, Agile and Nimble
    - All projects moving forward will be viewed by three guiding questions:
        - Scalable - Can the solution/project scale up or down to serve the strategic goals of the College?
        - Agile - Do we have resources in place (human or technical) to pivot on short notice of a change in scope or direction?
        - Nimble - Can we move in a different direction as needed by ever evolving technology trends and innovations?

The Plan

Upgrade of our major Enterprise Wide Information Systems

- **Replace PeopleSoft Finance with Oracle Financial Cloud**

We are currently in an implementation to replace PeopleSoft Finance (Ver. 9.0, Tools 8.49.19). Our current system is out of date and needs new hardware, an upgrade to the tools version, and an upgrade to the application version. It was decided that it would be cost efficient to upgrade to the Oracle Finance Cloud version instead of upgrading. This implement is currently in process and is expected to be completed October 2017. Finance Cloud will replace our PeopleSoft Finance system as well as the following home grown Web Applications; Expenses and Travel.

- **Replace PeopleSoft HR with Oracle HCM Cloud**
  There is a lot of overlap between Oracle ERP and HCM. Although HR is currently on the latest application version, there would be cost and labor savings to upgrade to HR Cloud now rather than later. Starting in 2017, we will be purchasing the Oracle HCM Cloud licenses and selecting an implementation partner. The project should run August 2017 to January 2019.

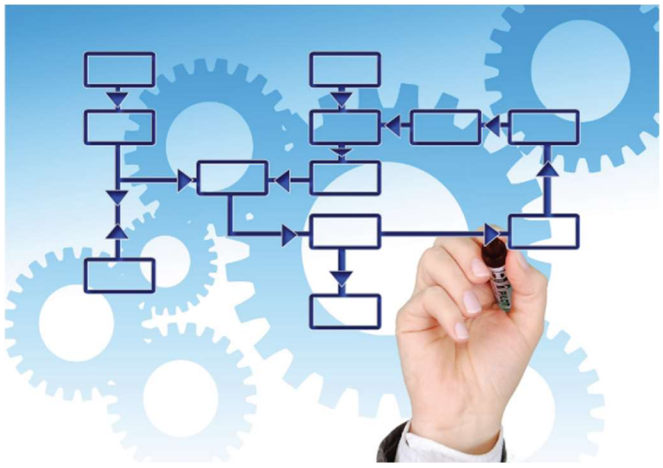
- **Upgrade PeopleSoft Campus Solutions (PAWS)**
  Campus Solution 9.0 went live with Admissions in 2007 and fully implemented in 2009. Since 2009 we have not seen a major upgrade to Campus Solutions. We are out of date with tools version, hardware, and application versions. The most recent update, 9.2, was released in December 2015. Oracle is only providing support for 9.0 until December 2019. Since the Oracle Student Cloud is not available 2020 we are looking at keeping Campus Solutions on premise and doing a Tools and Application upgrade to 9.2 tools 8.55. This will put us on the latest tools and application version and increase our Oracle support till 2027. This upgrade should start July 2017 and be completed by July 2018.

- **TCNJ Developed Web Applications**
  At one time TCNJ had a Web Application development team. This team was created to build and maintain specialized Web Applications to be used internally at TCNJ. Examples of these applications are: Travel System, Expenses, Directory, Transmittal, Tour Registration. At some point this Web Application development team was disbanded and the maintenance of the apps were inherited by Enterprise Application. It is our current plan to document each application, determine its usefulness, and evaluate any third party systems that could be purchased to replace the application completely.

We will also be looking at upgrading the servers and technology for any application which is determined critical to keep but has no third party replacement alternative. These new servers were brought online in May 2017 and applications will begin to be ported to the new servers over the next year.

- **Business Intelligence**
  Several years ago, the College adopted BlackBoard Analytics as the data warehouse solution and Pyramid as the reporting solution. In the next several years, many of our core systems will be replaced with cloud based systems that have their own sophisticated reporting and analytics tools built in. It will be necessary to evaluate how/if BBA fits into the overall data strategy. Developments in data warehousing and analytics change so rapidly, it is conceivable that an alternate tool set might more easily integrate with our new systems and better serve the College.

2.6 Business and Computer Operations



Introduction

The IT Business Office (ITBO) manages all business aspects of the IT department including computer operations, business continuity, budget development, purchasing, contract management, license management, receiving, inventory management, and project portfolio management, and project management. This office works closely with all IT sub divisions to manage the institutional inventory of computers as well as all software that is supported by IT.

Office Organization

The office consists of 3 teams:

1) IT Business Operations
2) Project Management Office (PMO)
3) Computer Operations

What we do

The Information Technology Business Office is responsible for:

Fiscal Budgets and Financial Reporting and Analysis

Business Case Development and Analysis
General, Project and Cost Accounting
Accounts Receivable Billings
Contract Negotiation, Review, Approval and Processing
Procurement of Goods and Services
Write RFP/RFQ/Bond applications
Training and Travel Authorization, Booking and Reimbursement
Records Management
Computer Operations including Data Center environmentals
Project Management for both internal IT projects as well as campus wide project management for all functional projects as requested or if related to IT.
Adhering to NJ state guidelines for all work performed within the office
Writing Board Waivers as needed based on submitted requests
Maintain accounting of all printer use campus wide

Current Projects

Campus Police Dispatch IT related renovation

Campus Police Dispatch purchase of a CAD application

Campus Police Dispatch -- Establishing a DR/BCP offsite Dispatch location -- (Green Hall Data Center

Green Hall Data Center footprint evaluation for potential space reclamation

Continued deployment of project management methodology and software system

Management of 12 in flight campus projects.

The Plan

Actively engage in a discovery process to identify a new software application to replace our 18 year old internal purchasing system.

- Possible solution could be using the current ITSM Team Dynamix application.

Review and address possible savings with the established 5 year plan for Asset Management

- Convert 1 year contracts to 3 year contracts (or up to 5 years per state guidelines)

With PMO at full capacity, work with the TCNJ campus and proactively manage all IT

related projects.

- Meet with Administration Department Heads as well as Deans to make them aware of our new Project Management Office

2.7 User Support Services

Introduction

User Support Services is committed to providing quality service through delivering innovative, secure and cost effective technology solutions in support of student, faculty and staff success.

USS
15 FTE - 1 Associate Director; 1 Technical Manager; 13 full-time staff; student staff

USS Divisions:

IT Help Desk
2 FTE - 2 Help Desk Analysts; student staff

- Tier 1 technical and troubleshooting assistance related to all TCNJ technologies
- ITSM system administration
- Develop and deliver IT training workshops
- Develop and maintain technical documentation and USS web presence
- Manage up to 700 monthly service requests

Computer Support Center (CSC)
3 FTE - 1 Manager; 2 Technical Specialists; student staff

- Centralized hardware life cycle support (acquisition, repair, deployment and disposal)
- Centralized standard software support and testing
- Develop/manage baseline computer images (Windows and Mac OS)
- Student technology support (ResNet)
- Mobile Device Management (MDM) administration
- Macintosh systems administration (JAMF Software Server administration)
- Patch management (WSUS - Windows Software Update Service)
- Annual computer replacement cycle project management

Academic Support Specialists
6 FTE - 6 Support Specialists; student staff

- Tier 2/3 technical and troubleshooting assistance related to all TCNJ academic technologies
- Act as IT Liaison for 7 Academic Schools + the Library
- Provide support for 32 Computer Labs and more than 100 research computers
- Specialized technology support including simulations, data acquisition, assistive technologies and mobile labs
- Technology consulting and acquisition

Administrative Support Specialists
3 FTE - 3 Support Specialists; student staff

- Tier 2/3 technical and troubleshooting assistance related to all TCNJ administrative technologies
- Act as IT Liaison for over 40 administrative depts
- Provide support for over 50 administrative applications/systems
- Technology consulting and acquisition
- Specialized lab support – EOF, Instructional Technology, Student Government and IT training

Current Initiatives

- IT Service Management (ITSM) Implementation
  - ITSM/PPO solution implemented Spring'17 (TeamDynamix)
  - Improved Incident, Project and Change Management processes
  - IT Knowledgebase
  - IT Service Catalog
  - Improved ITSM maturity level

User Support Services Plan

- Service Management Delivery Model
  - Develop additional ITSM processes including Problem and Asset Management
  - Introduce Service Management philosophy and processes to other TCNJ service providers
  - Align service delivery model with TCNJ Values and Strategic Goals
  - Develop relationship driven service and support models
  - Deliver quality service practices at every touchpoint for improved

customer experience
    - Publish service metrics in support of continual service improvement
    - Increased awareness of available IT Services (Service Catalog)
    - Expansion of user portal to increase information flow

- IT Asset Lifecycle Management
    - Seek efficiency through right-sourcing and remodeled lifecycle planning
    - Evaluate technologies to ensure product quality and performance reliability
    - Data driven forecasting for renewal, replacement and expansion
    - Consolidated endpoint management solutions for improved administration and reporting

- Professional Development
    - Increase awareness of existing TCNJ training resources including lynda.com Learning Paths and Google Learning Center
    - Faculty/staff focus groups to assess USS training offerings/catalog in cooperation with HR

- Knowledge Centered Support (KCS) Methodology
    - Capture new knowledge during service delivery and publish in an easily searchable and organized structure
    - Perform search analysis and asses the health of existing knowledge to improve the value of delivered content
    - Develop templates to ensure consistency in content capture and delivery
    - Expand Knowledge Base to include TCNJ Institutional content

3. STRATEGIC PLANNING RESOURCES

The Information Technology Division sought guidance numerous sources during the development of this plan. Inputs from several department, college, professional assessments, and reports were studied. Resources include:

- TCNJ IT Internal Assessment
- Gartner Assessment
- Education Advisory Board IT Functional Diagnostic
- IT Enterprise Risk Management Deep Dive
- Privacy and Security Deep Dive
- EDUCAUSE Core Data Reports
- EDUCAUSE Top Ten Issues

3.1 Information Technology Internal Assessment and ITPC Assessment

Over the last year, IT conducted an exercise to answer 4 basic questions:

1. What are we (IT) proud of?
2. What do our customers really appreciate?
3. What do customers want us to change?
4. What do we (IT) want to change?

This exercise was conducted through a series of meetings and distributed surveys. TCNJ's Information Technology Planning Council (ITPC) members were given a survey asking for responses and feedback from a "customer's" perspective. The ITCP members represent the faculty, staff and students, and are appointed by the Faculty Senate, Staff Senate, and Student Government.

IT Staff took a similar survey and held a half day retreat to answer these questions. At this retreat, IT broke into smaller distributed groups where they were asked to formulate a response to the questions from an IT perspective.

The survey results and discussion notes were compiled into a matrix and then presented at a second IT Division wide retreat. Again smaller groups were formed and charged with the task of assigning projects that could address the ideas expressed about how IT could change. Projects were supposed to be feasible, realistic, and address one or more change topics. Many of the projects met more than one or had a similar theme. We were able to group these project ideas into four main categories; Implementations/Upgrades, Security,

Mobile, User Experience/communications. Below is a list of those categories and a sample of project topics that addressed each one.

IT Implementations/Upgrades

- Procurement System
- Adjunct System
- Overall System Improvements
- Focus on improvements and upgrades

Security

- Password policy
- Desktop/laptop backups

Mobile

- Home access
- Mobile friendly
- WiFi

User Experience/Communication

- Communicate new capabilities
- Accessibility
- Software Maintenance
- Licensing
- Training
- Response Time
- Network Speed
- Help Desk/Support
- Transparency
- Internal Communication

These themes can be found woven throughout the IT department plans.

3.2 Gartner Assessment

Gartner provides dozens of opportunities for self assessment via numerous surveys and toolkits. Although these tools are helpful in identifying areas that need further exploration, the greatest value from Gartner has been from directly applying knowledge

gained from research documents and one on one assessment from Gartner analysts. They have been able to dig much deeper into the topics and provide significant input on IT planning. Topics included:

- IT Culture
- Governance
- Strategic Planning
- Professional Development Planning
- Cloud Computing
- Digital Workplace
- Data and Analytics
- Managing Cost Optimization
- Infrastructure Modernization
- Network Infrastructure Management
- Digital Strategy in Education
- Administrative Systems in Education
- Innovation and Change
- CRM and Customer Experience
- Technology Procurement Transformation

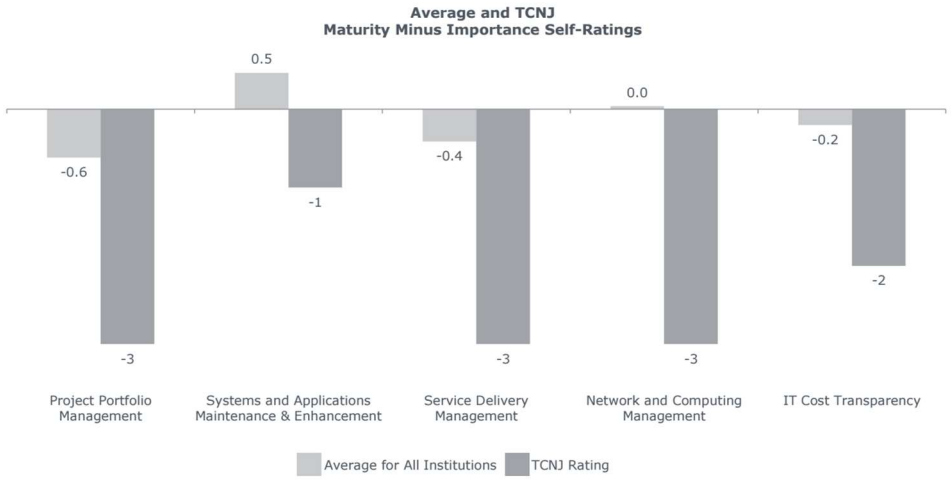
3.3 Education Advisory Board It Functional Diagnostic

The education Advisory Board (EAB) conducted an IT Functional Diagnostic study of TCNJ IT in Fall 2016. The results were then benchmarked against peer institutions. This work yielded numerous opportunities for TCNJ IT improvement including Project Portfolio Management, Systems and Applications Maintenance and Enhancement, Service Delivery Management, Network and Computing Management, IT Cost Transparency, Mobility Support, IT Enabled Collaboration, Data Access, Asset and Risk Management, Incident Response Planning, Disaster Recovery, and User Level Security Awareness Training.

Core IT Functions – Gap Between Maturity and Importance

Comparing Self-Rating to All Institutions

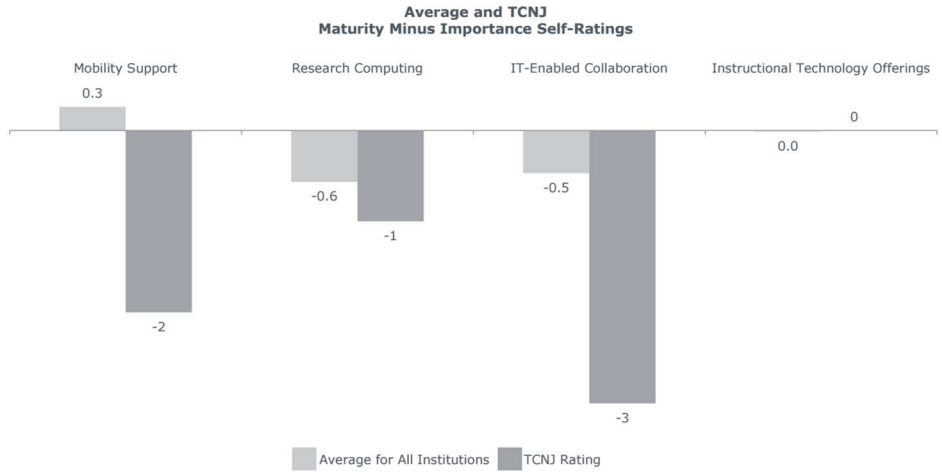
The graph below shows the average gap between average maturity minus average importance (lighter bar) and institution maturity minus institutional importance (darker bar). Here, a negative value can be understood as a gap between current performance and goals, and a positive value indicates that performance is at or above importance rating.

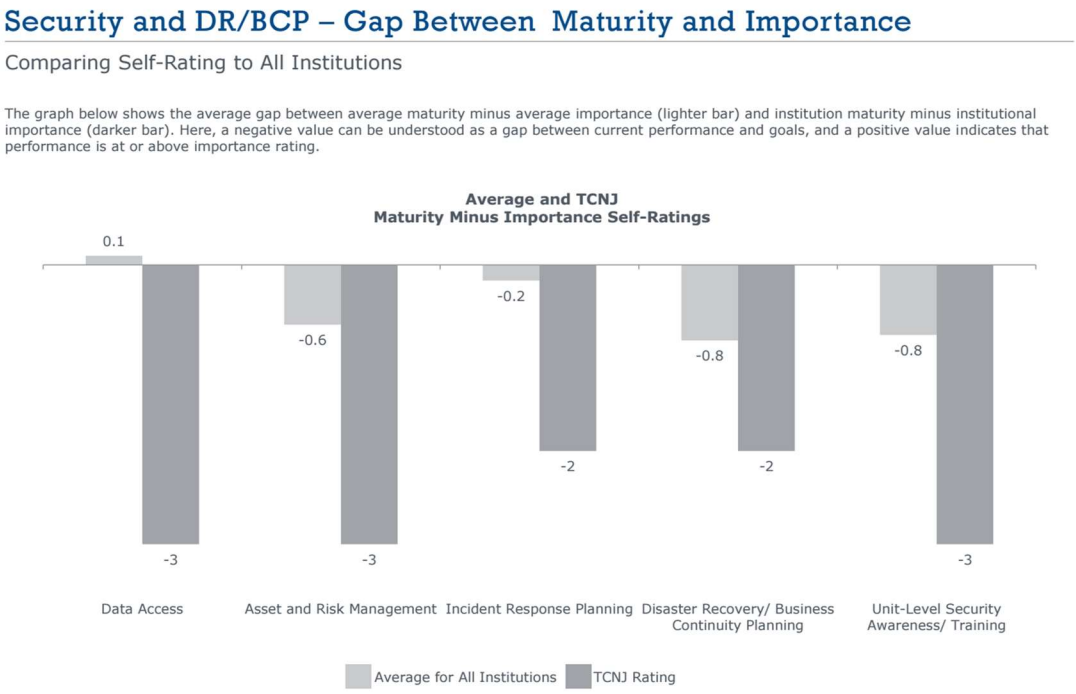


Campus Enablement – Gap Between Maturity and Importance

Comparing Self-Rating to All Institutions

The graph below shows the average gap between average maturity minus average importance (lighter bar) and institution maturity minus institutional importance (darker bar). Here, a negative value can be understood as a gap between current performance and goals, and a positive value indicates that performance is at or above importance rating.





3.4 It Infrastructure Risk Management Deep Dive

This report is not included in the public document due to the sensitive nature of the content. It should be noted though that opportunities for improvement were evident in the areas of strategic investments, procurement strategy, clarification of ownership and responsibilities, decision support systems, and reliance on homegrown systems.

3.5 Privacy And Security Deep Dive

This report is not included in the public document due to the sensitive nature of the content. However, opportunities for improvement have been considered in the the areas of training, management of data security incidents, management of Personally Identifiable Information, and account lifecycle management.

3.6 TCNJ Information Technology Internal Audit

In the fall of 2016, an audit was conducted of the IT change management and network security business process. The full findings are not included in this public document due

to the sensitive nature of the content however, as a result of this important work, TCNJ IT uncovered some opportunities to formalize the change management process and increase ability to monitor and act on security threats.

3.7 Educause 2017 Top Ten It Issues

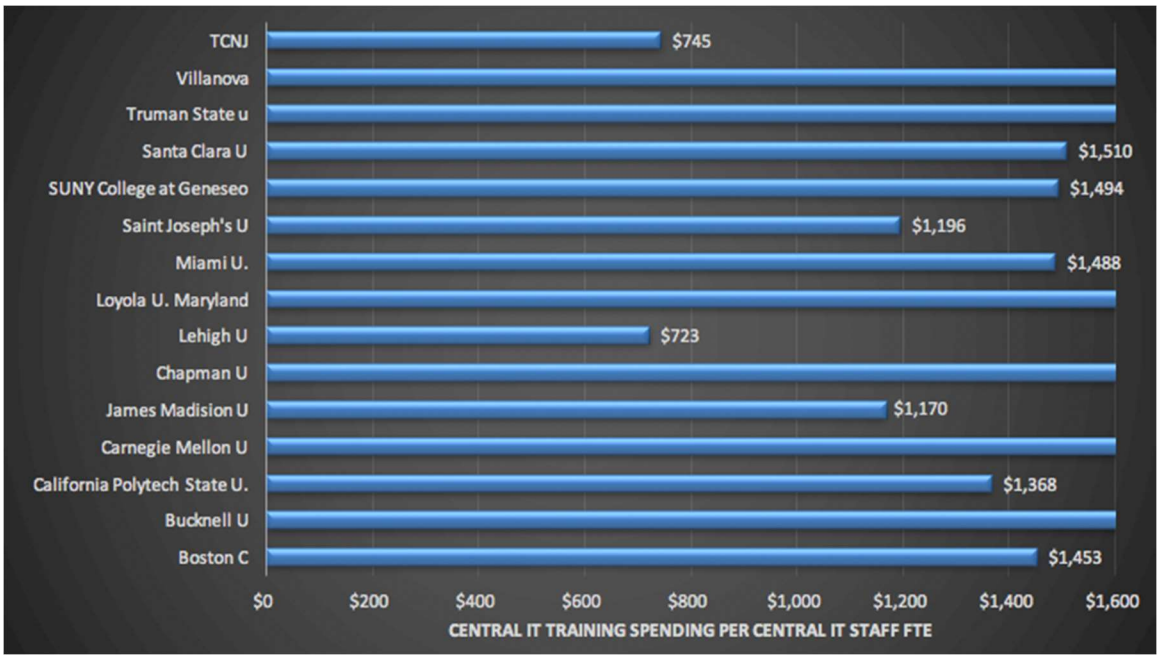
1. *Information Security:* Developing a holistic, agile approach to reduce institutional exposure to information security threats
2. *Student Success and Completion:* Effectively applying data and predictive analytics to improve student success and completion
3. *Data-Informed Decision Making:* Ensuring that business intelligence, reporting, and analytics are relevant, convenient, and used by administrators, faculty, and students
4. *Strategic Leadership:* Repositioning or reinforcing the role of IT leadership as a strategic partner with institutional leadership
5. *Sustainable Funding:* Developing IT funding models that sustain core services, support innovation, and facilitate growth
6. *Data Management and Governance:* Improving the management of institutional data through data standards, integration, protection, and governance
7. *Higher Education Affordability:* Prioritizing IT investments and resources in the context of increasing demand and limited resources
8. *Sustainable Staffing:* Ensuring adequate staffing capacity and staff retention as budgets shrink or remain flat and as external competition grows
9. *Next-Gen Enterprise IT:* Developing and implementing enterprise IT applications, architectures, and sourcing strategies to achieve agility, scalability, cost-effectiveness, and effective analytics
10. *Digital Transformation of Learning:* Collaborating with faculty and academic leadership to apply technology to teaching and learning in ways that reflect innovations in pedagogy and the institutional mission (http://er.educause.edu/articles/2017/1/top-10-it-issues-2017-foundations-for-student-success)

3.8 Educause Core Data Reports

TCNJ submitted data to the EDUCAUSE CORE DATA system which then allows the college to run benchmark tests against other participants. In many respects, TCNJ was very similar to peers but a couple of data points did stand out.

The TCNJ spend on IT professional development is markedly lower than most peer institutions. In FY17, the training budget was increased to about $2,000 per IT Staff FTE. This funding level is planned to

continue in FY18 as we bring multiple new systems on board throughout the college.



Software As A Service is another interesting area to explore. Many institutions are moving more services to the cloud to gain flexibility and decrease hardware and facility costs. This data helps identify colleges that could help us think through on premise vs cloud solutions in a variety of categories. Since this FY16 data was provided, TCNJ already moved faculty and staff email to a SaaS provider and has adopted a cloud first strategy that will encourage the college to include cloud based solutions in all future product evaluations.

Information Systems and Applications: **Systems most commonly vendor-managed (SaaS)**

	TCNJ	Boston	Saint Joseph's	Bucknell U.	Carnegie Mellon	Lehigh U.	California Polytech. State U., San Luis	Miami	Truman	Villanova U.
E-mail: student	✔	✔	✔	✔	✸	✔	✖	✖	✔	✔
E-mail: faculty/staff	✖	✔	✖	✔	✖	✔	✖	✔	✖	✖
Learning management	✖	✔	✖	✖	✖	✖	✖	✔	✖	✔
Customer relationship management (CRM)	✖	✖	✖	✔	✖	✖	✔	✖	✖	✖
Library	✖	✔	✖	✔	✖	✖	✖	✖	✖	✔
IT service desk management	✔	✖	✔	✖	✔	✖	✖	✔	✖	✖
Admissions: undergraduate	✖	✔	✖	✔	✖	✖	✔	✔	✖	✖
Facilities management	✖	✖	✔	✖	✖	✖	✖	✖	✖	✖

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