INTRODUCTION

This plan establishes a forward-looking path for Binghamton’s information technology to support the goals and strategies of The University Roadmap. It is a living document that will continue to evolve as our needs and priorities change and members of community bring forward new ideas. Commissioned by the Chief Information Officer the plan was developed with input from the University community during the fall of 2016 and guided by the external perspective of higher education consultants, Goldstein & Associates. The process included an assessment phase to evaluate the current state of technology and a planning phase to define strategies. The process was highly participative and included interviews and focus groups with more than 120 students, faculty and staff and a similar number of professional technology staff. Goals and strategies were created with input from planning groups, faculty focus groups, and University leadership. An Advisory Committee helped guide the process and the work of the consultant. Project participants are listed in Appendix A.

EXECUTIVE SUMMARY

The University Roadmap establishes multiple priorities that will be greatly enhanced by the effective use of technology. These enhancements are critical to providing students, faculty and staff with better tools to pursue their goals. Research and scholarship requires more robust computing and network infrastructure to handle data-intensive research programs, secure and preserve research data, and support digital scholarship and creative works. Competing for the best students will be assisted by meeting their heightened expectations to experience leading technologies in their research and coursework and to provide effective, online and mobile services to facilitate the student experience outside the classroom. Student success strategies require improved analytical tools to assess outcomes, direct resources to the most effective programs, and enable proactive interventions to keep students on track. Local and global engagement benefits from better tools to facilitate collaborations, connect individuals with shared interests, and provide the digital media and communications technologies that help connect the University with its stakeholders.

Current technology falls short of what is required to fully realize the strategic priorities of the University and meet the expectations of students and faculty:

- Present network speeds are ten times slower than at many comparable research universities, limiting research collaborations and hindering projects that require the transfer of large amounts of data or use of remote sensors and instruments (e.g., smart energy).
- Secure data storage, compute capacity and data management capabilities are not sufficient to support research that requires analysis of large data sets or extensive computations (e.g., health sciences, sustainable communities).
- Specialized capabilities including high performance computing, geographic information systems, and academic software are not organized or sufficiently resourced to be broadly available to faculty and students in all colleges.
- Student support systems are not fully integrated causing repetitive requests of students to provide similar information, difficulty for student offices to track their contacts with students and limiting the data available to analyze student success strategies and outcomes.
- Few spaces on campus are outfitted to facilitate student collaborations or to support faculty who wish to employ active learning pedagogies or pilot emerging learning technologies.
- Many foundational technologies for teaching and research lack sustaining funds to replace equipment as it becomes obsolete or to upgrade capacity as use increases.

To meet these challenges and support the Roadmap’s strategic priorities, the IT strategy outlines a five-year plan to improve information and technology capacity and capability. It is focused on the University’s most important goals in research, scholarship, transformative learning and student success. It includes strategies to make IT services easier to access and more responsive to the needs of the campus. Finally, it better positions the University to leverage technological changes, improve security, and efficiently establish transparent IT priorities.
The Advisory Committee would like to recognize stakeholders within the Binghamton University community for their time and for their contributions towards the successful completion and execution of the Technology Strategic Plan (2017-2022).

**GOALS AND STRATEGIES**

The IT Plan is organized around five goals, each with a set of supporting strategies (Tables 1 and 2).

- **Goal 1 (Support Learning)** expands pedagogically driven adoption of existing academic technologies, supports evaluation and use of newer academic technologies and innovative classroom designs, and supports adoption of digital content including open educational resources.

- **Goal 2 (Student Success)** improves the use of technology to deliver student services and better supports student success strategies by further integrating existing software, presenting more services and information to students on mobile devices. It builds capabilities for faculty and advising staff to see a more holistic picture of an individual student’s academic and co-curricular engagement and provides more comprehensive data to evaluate the effectiveness of student success programs.

- **Goal 3 (Research Computing)** provides all faculty and graduate students with expanded access to research software, data management and computing services and upgrades the campus infrastructure to provide networking speeds and high performance computing capabilities required by faculty in data intensive research fields.

- **Goal 4 (Security)** leverages the work with Gartner, Inc. to continue to deploy policies, technologies, and training to improve the University’s ability to protect data and individuals’ privacy from growing information security threats.

- **Goal 5 (IT Services & Operations)** improves the tools, training and coordination among IT staffs to provide services that are more responsive and efficient, strengthens mechanisms to set strategic IT priorities, and creates better forecasts of investments required to improve and sustain technology services.

### Table 1: Summary of Anticipated Benefits by IT Plan Goal

<table>
<thead>
<tr>
<th>IT Plan Goal</th>
<th>University Roadmap Priority</th>
<th>Anticipated Benefits</th>
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| 1. Support Learning           | SP 2                       | • More extensive adoption of pedagogically effective academic technologies that engage students and support learning  
                               |                              | • Easier access to open educational resources that support faculty teaching objectives and may reduce the cost to students  
                               |                              | • Better utilization of learning spaces, academic software and classroom technologies |
| 2. Student Success            | SP 1, 2 & 3                | • Better information to structure effective student retention programs & experience  
                               |                              | • More comprehensive and accessible information to help guide students to academic and career goals  
                               |                              | • Increased student engagement and student satisfaction |
| 3. Research Computing         | SP 1                       | • Improve success recruiting & retaining faculty with active research programs that are compute & data intensive  
                               |                              | • Greater ability for faculty to explore research questions that require collaborators or access to research instruments and infrastructure at other research universities  
                               |                              | • Better ability to pursue research funding opportunities with more stringent data security requirements  
                               |                              | • More competitive grant proposals and better success rates  
                               |                              | • Support for all faculty and graduate students to pursue research and scholarship |
| 4. Security                   | SP1 & 5                    | • Improved maturity of information security practices  
                               |                              | • Reduced or better managed risks to data and privacy  
                               |                              | • Greater assurance of compliance with security requirements of research grants |
| 5. IT Services and Operations | SP 5                       | • More transparent and effective priorities  
                               |                              | • More sustainable and responsive technologies and services  
                               |                              | • Improved reliability and availability of services  
                               |                              | • Increased satisfaction with IT services and support |

### 5 IT Strategic Goals/Strategies

- **Support Learning**
- **Services & Operations**
- **Student Success**
- **Security**
- **Research Computing**
INITIAL PRIORITIES

Implementation of each goal will occur in phases. Early implementation and investment priorities focus on foundational infrastructure, security and research support. Early investment priorities include:

- Upgrading network capacity to deliver higher speed connectivity and creating a zone of the network configured especially for research (Science DMZ).
- Determining the current and projected research support needs of each school and designing the approach to expand and sustain research computing support.
- Providing access to a set of academic and research software used frequently by faculty for teaching and research as a baseline University service.
- Deploying an identity and access management solution to facilitate providing, tracking and rescinding access to University data, software and digital services based on a person’s identity, role and affiliations with the institution.
- Continue implementing the information security plan to strengthen foundational practices and lay the groundwork to deploy capabilities necessary to meet advanced compliance requirements that impact research and other sensitive data.

Progress will also begin on foundational work that supports other aspects of the IT plan and does not initially require new investment. These initiatives do not require additional investment and include:

- Implementation of data governance,
- Completing the implementation of a new analytics platform,
- Analyzing baseline data on present uses of academic software and classroom technology to further tailor training and support; and
- Continuing improvements to IT services.

Subsequent strategies and related initiatives will be confirmed and prioritized with IT governance committees.
### Table 2: Summary of Strategic Goals and Initiatives

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<tr>
<td>1.1. Coordinate classroom design and support services to improve the functionality of classrooms and the ability to sustain their effectiveness.</td>
<td>3.1. Upgrade network capacity to provide high-speed connectivity on the campuses and to regional and national research networks.</td>
<td>5.1. Strengthen IT governance structures and processes to prioritize strategic initiatives, coordinate technology services across the University, and align technology directions with institutional strategies.</td>
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<tr>
<td>1.2. Optimize the use of existing technology enhanced spaces and create distinct new spaces that support pedagogical innovations and provide students with varied learning experiences (e.g., Maker spaces, VR/AR teaching labs, virtual anatomy labs).</td>
<td>3.2. <strong>Determine the research computing capabilities required by each school and determine the best structures to enhance capabilities.</strong></td>
<td>5.2. Adjust funding methods to align resources with strategies, support technological change, and forecast investments required to sustain performance of technology.</td>
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<tr>
<td>1.3. Extend the availability and support for adoption of academic software including the learning management system.</td>
<td>3.3. Create a research computing investment strategy to support a growing research portfolio, facilitate successful faculty recruitment and retention, and enable more faculty to use computing resources in their research and scholarship.</td>
<td>5.3. Position infrastructure technologies, policies, processes and IT skill sets to enable the University to leverage cloud services.</td>
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<tr>
<td>1.4. Provide enhanced support and infrastructure to expand adoption of digital content, including open educational resources.</td>
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<td>5.4. Build IT organizational capacity to support technology shifts and new strategic priorities.</td>
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<th>Goal 2: Leverage Technology and Information to Improve Students’ Success and Enhance Their Outside-the-Classroom Experience.</th>
<th>Goal 4: Protect the University from Complex Information Security Threats While Maintaining an Environment Conducive to Innovation and Creativity.</th>
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<td>2.1. Expand the use of data analytics and academic planning software to provide students and their advisors information to plan academic careers and enable departments to predict demand and optimize course schedules.</td>
<td>4.1. Complete tactical security improvement projects including restructuring active directory and selecting an identity and access management solution.</td>
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<td>2.2. Present students with services that are more integrated and mobile friendly and gather data to monitor student engagement.</td>
<td>4.2. Operationalize foundational information security practices including governance, controls library and audit function.</td>
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<td>2.3. Build organizational and technological capability to use analytics to understand and predict the factors that contribute to students’ success.</td>
<td>4.3. Deploy additional basic security capabilities including improved data protection, vulnerability management, identity and access management and network security improvements.</td>
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<td>2.4. Leverage an integrated technology platform (e.g., CRM) to track student engagement, provide proactive alerts, personalize communications, and make services more efficient.</td>
<td>4.4. Implement advanced security capabilities and practices in network and data protections, and advanced security operations and analysis.</td>
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<td>4.5. Establish clear divisions of responsibility, authority and accountability for detecting and responding to information security threats.</td>
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DETAILED GOALS AND STRATEGIES

GOAL 1: Support learning with digital content, software and technology-enhanced spaces.

Effective technology in classrooms and technology enabled virtual and casual learning spaces add capabilities that faculty can elect to utilize to engage students and improve learning. These capabilities enable faculty to employ different pedagogical approaches designed to make learning more active, and collaborative and create personalized experiences even in large enrollment courses. Supporting faculty and students requires continually strengthening the partnership between CLT, Libraries, ITS and Student Affairs to inform faculty of the capabilities of classroom technology and academic software and guide the incorporation of these technologies with sound pedagogy and student success research.

Initiatives in support of this goal will better integrate support for classroom technologies and provide better tools to support student collaborations and engagement with course content. It will also engage faculty in evaluating the features and capabilities in the current learning management system and determining new strategies to raise awareness of its capabilities or, if warranted, explore new learning management system options.

Strategic Initiatives

1. Coordinate classroom design and support services to improve the functionality of classrooms and the ability to sustain their effectiveness.

Work will continue to regularly update classroom technology and remediate rooms with aging equipment that is at risk of failure. However, effective classroom technology depends on factors beyond the currency of the equipment. Technology must work in concert with the physical attributes (sound, lighting, layout) of the room and faculty must have ready access to high quality pedagogical and technical support. CLT and ITS will synchronize classroom technology upgrades with Facilities to enable electrical power, lighting, sound, furniture and technology to planned to work in concert with one another and upgraded at similar intervals. CLT and ITS will continue efforts to improve and integrate support for faculty to provide clear avenues to receive support in the classroom and while developing course content. Support for classroom based and other learning technologies will be further enhanced through coordinated outreach by CLT, ITS and the Library to each of the schools and colleges. Communication and outreach may also benefit from the designation of cross-trained CLT or ITS liaisons to each of the schools or jointly staffed office hours held in residence in each of the college to respond to impromptu questions.

2. Optimize the use of existing technology enhanced spaces and create distinct new spaces that support pedagogical innovations and provide students with varied learning experiences (e.g., Makerspaces, VR/AR teaching labs\(^1\), virtual anatomy labs).

A comprehensive analysis of existing technology and their uses by faculty will be developed to inform future design, upgrade and expansion of classroom spaces. Understanding of existing usage rates and faculty interest in expanding adoption of various learning technologies will inform the priorities for upgrading existing rooms and defining the levels of capabilities required in different types of rooms. Guided by this analysis and consultation with the Learning Environment Committee, several types of additional technology enhanced spaces will be created to complement standard classrooms. For example, some lecture halls can be converted to flexible spaces able to accommodate 40 to 80 students and outfitted with shared display screens, modular furniture, and abundant wireless to facilitate collaborative work and active learning pedagogies. A potential model for these spaces is the Scale-Up room design.

\(^1\) VR/AR refers to virtual or augmented reality technologies.
Additional and expanded specialized spaces can be developed to enable faculty to selectively incorporate their capabilities into student projects, an individual class meeting or spread throughout their course. These spaces may include additional Makerspaces, augmented and virtual reality labs, language labs, and virtual anatomy labs. The current Emerging Technology Studio serves as a foundation upon which advanced capabilities may be created. Finally, additional spaces for impromptu student collaborations will be created featuring modular furniture, smartboards or display screens and abundant wireless. New solutions for printing and virtual software libraries will enable some of these spaces to be created in what are presently Pods. As resources permit, similar spaces may be created in residential living communities. Finally, wireless networks in buildings and outdoor spaces will be expanded to offer sufficient capacity to support varied room designs, uses of devices and active learning pedagogies.

3. **Extend the availability and support for adoption of academic software including the learning management system (LMS).**

More extensive analysis will be undertaken to understand which software and software features faculty use or are interested in using in their courses. This information will aid consultations with faculty to identify the academic software that should be made widely available to all faculty along with more extensive support. Broadly used applications will continue to be complemented by very specialized software that individual colleges or departments provide.

Additional focus will be placed on supporting adoption of the features of the learning management system and monitoring if and when it should be replaced. The University’s current LMS software, Blackboard, and the learning management system marketplace have evolved significantly in the last five years. Many faculty have not had the opportunity to explore Blackboard’s newer capabilities and consider how they might be useful in their courses. Additionally, peer institutions have begun to adopt other learning management solutions drawn by their promise of more modern interfaces, better tools for incorporating varied forms of digital content, and improved learning analytics. For all these reasons, it is timely for the University to review its desired requirements for a learning management solution and either affirm its continued use of Blackboard or commit to an alternative solution through a consultative process. Semester-long pilots of alternative solutions may also be organized to provide interested faculty with a hands on experience with other learning management systems. If a clear preference emerges for an alternative product, a transition strategy will be developed. Or, the evaluative experience will be used to influence Blackboard to improve its product and to expand awareness of its newer capabilities.

4. **Provide enhanced support and infrastructure to expand adoption of digital content including open educational resources.**

Open educational resources and other forms of digital content provide faculty with the flexibility to tailor materials to their courses, facilitate student engagement with curricular materials, and can lower students’ cost of attendance. The Library, ITS and CLT will partner to provide the infrastructure to enable additional faculty to more readily identify and incorporate existing or self-created content in their courses. Search tools will help faculty identify and assemble open textbooks and other digital materials. Curated repositories will help faculty to organize self-created and assembled content and make them accessible to students.

The Libraries will work with ITS and CLT to leverage the licensed digital content it provides to enhance classroom curriculum by making such content more readily available via the Learning Management System or library-based technology platforms. Additionally, web development and multi-media support services will be expanded and made available to faculty developing new digital content. The Library, CLT and ITS will engage faculty to discuss their experiences incorporating digital materials, review outcomes, and expand interest in adoption. Finally, the adoption of industry-wide standards will promote the accessibility and interoperability of digital resources among different learning systems, users and platforms (e.g., mobile).
GOAL 2: Leverage technology and information to improve students’ success and enhance their outside-the-classroom experience.

Recruiting and retaining the best students and providing them with experiences that position them for success are primary goals of the University Roadmap. While the University has a good set of systems supporting its student services, applications are not fully utilized or sufficiently integrated with one another or the core student information system (Banner). As a result, students navigate multiple tools and field multiple requests for similar data. Further, the data captured by some of these systems are information silos, not easily combined with other data sources to provide a comprehensive view of a single student or to support aggregate analyses of student success strategies.

This goal responds to these challenges and supports a more positive service experience for students. It positions the University to more extensively use analytics to measure the factors that contribute to student success and create proactive alerts if a student is getting off a path to success. Many aspects of this goal will be accomplished by better capitalizing on existing technologies, digital communication vehicles, and improved data governance. Policies that govern the appropriate collection and use of data and will be needed to balance the desire to use information to improve service and outcomes with individuals’ privacy. The initiatives that support this goal will expand availability and sophistication of student success analytics, provide more comprehensive views of students’ curricular, co-curricular and career planning progress, and offer more mobile, user friendly student services.

Strategic Initiatives

1. **Expand the use of data analytics and academic planning software to provide students and their advisors information to plan academic careers and enable departments to predict course demand and optimize course schedules.**

The data captured by Banner, B-engaged, DegreeWorks and other systems can be used more extensively to support advising and academic career planning. Using DegreeWorks as a course planning tool will provide students and their advisors better tools to model different choices of majors and minors and their impact on course selection and time to graduation. This same information can be used to help deans and department chairs to forecast future demand for courses and the need to offer additional sections of a course.

Advising can be supported with a more holistic picture of a student’s academic and co-curricular engagement by consolidating the information in disparate systems. Further, by integrating data from these source systems, students and appropriate faculty and staff can be given dashboards and alerts to monitor if they are on track to meet academic goals, graduation requirements, their engagement with the Fleishman Center or their participation in internships and other co-curricular activities.

2. **Present students with services that are more integrated and mobile friendly to improve their experience and to gather more data to monitor student engagement.**

Student success will be furthered by using technology to facilitate a service experience more reminiscent of what students are used to in other areas of their lives. Student support processes will become more digital and personalized by using information already known about a student to tailor communications and automate services. Improvements to information flows between Banner and specialized student support systems will enable students to be presented with services that are better integrated and accessible from a common starting point such as a mobile application or website. This strategy will be a multi-stage effort prioritized in collaboration with student services offices with input from students.
Communications and Marketing will work with ITS to help units to streamline information flows to students and optimize the use of digital communication vehicles including web sites and mobile applications. Priority will be placed on streamlining and better coordinating communications, information requests and processes during critical times for students such as first year orientation, onboarding returning students, and graduation. An initial area of emphasis will create an integrated mobile application or web site to organize information and resources for new students and guide their on-boarding and orientation to University services. Using already owned technologies, an integrated mobile hub will become a common access point to distribute communications, access orientation videos, and disseminate and fulfill information requests. The hub will use weekly timelines and checklists to initiate common onboarding activities and encourage students to complete required tasks such as registering for housing and dining or student health services. Subsequent iterations will extend the hub to returning students, enable tailoring by college or major, and automate sharing information across systems and services so a student is not asked to provide the same information to multiple offices.

3. **Build a more capable organizational and technological infrastructure to use analytics to understand and predict the factors that contribute to students' success.**

This strategy will provide tools to analyze patterns in student retention, time to graduation and other measures of success and build processes to alert appropriate stakeholders if a student appears to be heading off track. By expanding the sources of information in the data warehouse, implementing the recently acquired analytics tools, and methodically improving the management of data quality and governance of its use the University will harness existing data to support student analytics. These changes will be accompanied by professional development to spread understanding of the University’s data sources, definitions and analytical tools among staff with responsibility for crafting these analyses. Policies will guide the appropriate collection and use of data and protect individuals’ privacy.

Capabilities will be enhanced incrementally as necessitated by the priority of analytical questions. Initial efforts will focus on analyzing the effectiveness of various student retention strategies and investments and broadening the student learning data available from Blackboard and Library databases that can be combined with Banner data to assess student engagement in their courses and identity positive relationships with successful outcomes.

4. **Leverage an integrated technology platform (e.g., CRM) to track student engagement, support proactive interventions, personalize communications and make access to service more efficient.**

To improve service to students and capture additional information to monitor student success, the University will evaluate the need for, and if warranted deploy a constituent relationship management solution (CRM). The CRM solution would complement the existing Banner student system, Slate and other function specific software applications. The CRM would capture information about students’ interactions with student service offices, advisors, and co-curricular programming and store, and make accessible to other software, information about a student’s interests, goals and engagement activities. This information would extend what is already captured in Banner and enable greater personalization of communications to students to alert them to deadlines or actions that they must take specific to their circumstances and interests. As its deployment and integration with other systems grows, the CRM would create a single place through which students can provide descriptive information once (e.g., bio-demographics, interests, service requests) and have it automatically available to relevant and authorized offices to use to deliver services to the student. Finally, as a tool to track interactions students have with various support offices, the CRM will provide information to improve each offices ability to serve students, alert appropriate faculty or advisors if a student’s success is at risk, and create an expanded data set to inform student success analyses.
GOAL 3: Provide an advanced cyber infrastructure to support greater research activity and to enable faculty in more disciplines to incorporate computing capabilities in their research and creative works.

The research activities and aspirations of the faculty require more capable and easily accessed research and scholarly computing capabilities. Multiple schools’ research programs are becoming more data intensive and research computing is increasingly relevant to scholarship in many non-science disciplines. Most faculty require access to similar baseline research computing capabilities that would be inefficient for each to maintain on their own. Research growth plans and competitiveness to recruit and retain the best faculty with research computing intensive projects will depend, in part, on offering more capable computing infrastructure with enhanced features to secure, analyze, and transport increasingly larger data sets. Further, offering all faculty members and many students access to research computing support will promote non-sponsored scholarship, help newer faculty develop their research programs, and support teaching in academic programs, such as data sciences.

Today, the campus network does not offer fast enough speeds for researchers to efficiently transfer very large data sets securely or to access the research infrastructure at a partner institution without degraded performance that could impact research results. Storage and data management services are insufficient to handle large data sets and data requiring stringent security protections. Many of the elements important to research (e.g., high performance computing, GIS, are organized within separate departments and are not easily discovered or accessed by faculty in another part of the University. Finally, the high performance research computing infrastructure is aging and without dedicated funding to support its renewal.

This focus area of the plan will meet these challenges by defining each school’s research computing needs and determining a strategy for each to develop enhanced capabilities. Additionally, continued improvements will be made to the foundational networking, security and software capabilities important to research and scholarship.

**Strategic Initiatives**

1. **Upgrade network capacity to provide high-speed connectivity on the campuses and from the University to regional and national research networks.**

The initiative creates significantly higher speed connectivity to Internet 2 and invests in campus networking infrastructure to provide researchers with connection speeds of 10 gig, and lays the technical foundation to provide 100 gig in the future. These changes create twenty times faster network speeds and offer much greater capacity to move large data sets, access remote computing facilities and work with collaborators around the world. Implementing a science DMZ on the campus network will provide researchers with a portion of the network with security settings and equipment configurations optimized for access to high performance computing resources and the bulk transfer of large amounts of data to and from collaborators. The DMZ structure will enable researchers to work within security structures appropriate to the data they are handling without degrading network performance and hampering the conduct of the research. Partnerships will be pursued with NYSERNET and the other SUNY University Centers to bring greater network bandwidth and redundancy to Binghamton, while also improving high speed connectivity to research infrastructure within NY and nationally.

2. **Determine the research computing capabilities required by each school and select the best structures to enhance capabilities.**

Researchers in multiple disciplines and transdisciplinary centers require research infrastructure and software to handle large amounts of data, compute at a high speed or high throughput, store data at differential levels of security and access speed. Further, the frequency and duration at which the infrastructure is needed varies greatly by research program. As each school articulates their research computing needs, the University will be able to identify areas of common need that could be addressed collaboratively and areas of more distinct needs. ITS will continue to provide foundational network, security and access management, and software licensing to facilitate both collaborative and distributed research computing services and needs.
Strengthening the shared infrastructure will enable the University to adopt any number of models to support its future research computing needs. One option is a highly-distributed model in which each school arranges for their own computer, storage and support infrastructure. Or, consideration could be given to establishing a University-wide research computing service to offer more broadly needed services for which there are economies of scale and a scarcity of expertise such as high performance computing, research data management, research data storage, specialized research software, and research application development. Or, the University may opt for a hybrid model that combines school specific capabilities, capabilities resident in one school but provided to the whole university, and some shared services offered by a research computing group. Shared web sites and cross trained staff supporting research can be developed to make it easier for faculty to discover the full breadth of available support and quickly access the right expertise. As the model develops, a research computing coordinating committee of faculty and IT providers should be created to assist with the coordination of services and the identification of new needs.

Longer term, on-campus capabilities to support research will be extended with capabilities offered by other institutions and organizations. Pre-negotiated agreements will be developed to facilitate direct access to cloud providers of computing platforms with predictable costs and contract terms. Future improvements to networking and virtualized infrastructure will also provide flexibility to order compute and storage capability on-line and have it provisioned on-demand via on-premise or cloud resources. Advanced research infrastructure will be facilitated by improved connectivity to the other SUNY University Centers and NYSERNET. Networking partnerships will provide faculty access to private cloud research computing facilities and collaborators at other institutions.

3. Create a research computing investment strategy to support a growing research portfolio, facilitate successful faculty recruitment and retention, and enable more faculty to use computing resources in their research and scholarship.

Creating and sustaining better research computing capabilities will require investment and a financial strategy to secure funding for ongoing operations and regular replacement of infrastructure as it ages. Today, no individual organization is funded to offer a complete set of research services, nor is there adequate capacity to offer baseline services (e.g., storage, access to computing cycles, software) to all faculty. This strategic initiative will develop a long-range financial strategy for research computing to enable requisite expansion to support faculty research interests and provide sustainable infrastructure. Through a consultative process, effective methods will be defined to share costs of baseline and advanced research computing services.

Consideration will be given to effective practices at other institutions. In concept, research computing capabilities function like a core research facility and similarly require multiple sources of funding. As result, other research universities approach the funding challenge in multiple ways. University operating budgets and seed funds are used to create new capacity and fund baseline services to faculty without external funding. Overhead recoveries enable investment to expand capabilities and services in areas that align with areas of increasing research interest and sponsored funding. Finally, direct charges to grants help fund operations of some services and offer faculty an avenue to buy services and avoid using grant funds to create separate computing infrastructure. A comprehensive business plan and funding proposal tailored to Binghamton will be developed as part of the implementation of this strategy.

GOAL 4: Protect the University from complex information security threats, while maintaining an environment conducive to innovation and creativity.

Prior to developing this plan, the University completed a comprehensive assessment of its information security program. Conducted by Gartner Consulting, the assessment produced a multi-year strategy to improve policy, process, and organizational and technical capacity to mitigate security risks. The key security improvement strategies are incorporated into the IT plan as its fourth focus area. A synopsis of the recommendations is presented on the next page.
Strategic Initiatives

1. Complete tactical security improvement projects including restructuring active directory and selecting an identity and access management solution.

The first priority of the security improvement program is to make tactical improvements to current technologies and technical management practices. Several of these activities are already underway and are designed to address pressing vulnerabilities. Tactical improvements include changing practices to secure user accounts with privileged levels of access to systems and restructuring aspects of Active Directory. Measures have also been taken to improve the process for making any significant change to systems in production to minimize the likelihood of introducing new security vulnerabilities. The final component of this strategy is to begin planning for a series of projects to deploy a comprehensive solution for identity and access management.

2. Operationalize foundational information security practices including governance, controls library and audit function.

Already underway at the time the IT plan was developed, the second stage of the security plan introduces changes to foundational security practices that create the organizational capabilities and management frameworks to oversee an on-going security program. Foremost among the changes this strategy introduces is the creation of security and data governance structures. It incorporates the delivery of improved security awareness training and the introduction of security assurance functions including an IT audit role and technology controls library.

3. Deploy additional basic security capabilities including improved data protection, vulnerability management, identity and access management and network security improvements.

Once foundational capabilities are strengthened, the third stage of the security program will deploy additional baseline security capabilities. Initiatives will be undertaken to improve the ability to identify and address vulnerabilities in information assets (e.g., patching and configuration management of hardware) and increase network security capabilities through enhanced perimeter controls and a segmented network architecture. Work will also begin to improve disaster recovery and business continuity capabilities and to complete the initial projects to implement identity and access management.

4. Implement advanced security capabilities and practices in network and data protections, and advanced security operations and analysis.

The final stage of the security program will deploy advanced security capabilities that will leverage the foundational management practices, governance and technical capabilities deployed in the first three strategies. This stage will complete the identity and access management implementation, introduce a risk-tiered approach to authentication including stronger measures, such as multi-factor authentication, for users of sensitive information, and introducing additional protections of research data. Finally, a security operations center will be created to monitor threats and mine usage and log data to spot anomalies that require a response to protect the security of systems and data.
5. Establish clear divisions of responsibility, authority and accountability for detecting and responding to information security threats.

Information security requires close collaboration and coordination among ITS, the information security team and distributed IT groups. As the new security strategies area put in place, a responsibility matrix will be developed with distributed IT leaders to establish their accountability for implementing local information security practices as well as their role in operationalizing processes to detect risk and respond to security events impacting their areas or the entire institution. The accountability and authority of the CISO and Security Operations Center to work with ITS and distributed IT teams to implement security policies and practices will also be clarified and established. An initial set of focused conversations will be held to establish responsibilities and as-needed consultations will be held to adjust practices and improve collaborations as warranted.

GOAL 5: Provide technology services and operations that are efficient, effective, responsive and sustainable.

The ability to deploy technology to support institutional priorities and meet the goals of this plan presupposes a strong and sustainable foundation of technology infrastructure, support services and organizational capability. This goal presents several strategies to make IT services more responsive and technology capabilities more sustainable. It improves governance mechanisms to sequence and prioritize how the strategy is pursued and when it needs to be adjusted. It recommends adjustments to funding mechanisms to invest in new services and sustain them throughout their life cycle and new approaches to share the costs of initiatives that require the efforts of more than one division or that distribute benefit to the entire University. It focuses on developing the skills of the University’s IT professionals to adapt to technology changes and support new strategic directions. Finally, it emphasizes improved technology support services, better integration of services provided by the University’s IT organizations and continued efforts to create efficiencies.

Strategic Initiatives

1. Strengthen IT governance structures and processes to prioritize strategic initiatives, coordinate technology services across the University, and align technology directions with institutional strategies.

Effective IT governance complements IT strategy by providing mechanisms to work collaboratively to establish priorities, coordinate initiatives, and solicit input to the design of solutions. The University already has elements of effective governance in place including advisory committees for individual services, a data governance committee, and a faculty senate advisory committee. This strategy builds on existing structures and adds several new elements. First, it recommends formation of a senior IT Executive Committee to approve major new initiatives, resolve competing priorities and establish funding strategies for university-wide technologies. Second, a new IT Services Coordinating Committee will regularly convene representatives from ITS, CLT and all divisions with some local IT support to improve communications and coordination among IT groups, and recommend opportunities to collaborate to improve a shared service or technology. Detailed charters and charts for the Executive Committee and the Services Coordinating Committee are presented in the Appendices of the plan. The appendices also contain a proposal to the Faculty Senate to consider adjusting the charter of the Academic Computing and Educational Technology Committee (ACET) to align it with the new governance committees and affirm its role in providing input and guidance to the CIO and other University IT leaders. Figure 1 (next page) illustrates the relationship among the governance and advisory committees.

ITS will support the additional governance structures and processes and will work with committee chairs to structure meetings and provide information about strategies, project proposals and resources to guide decision-making. Additionally, ITS will establish a project review governance process to facilitate efficient architectural, security, procurement, legal and technical reviews of new initiatives and technology purchases.
Figure 1 – IT Governance Groups

**Standing Governance Committee**

**IT Executive Committee**
- Approve strategies
- Establish major priorities
- Allocate resources
- Approve policies

**CIO, CLT and Library Leadership**
- Establish operational priorities
- Oversee IT Services
- Identify issues, risks and decisions for ITEC

**Advisory Committees**
- ACET (Faculty Senate)
- POGO (Administrative Systems)
- Data Governance

**Working Groups**
- IT Services Coordinating Committee
- Information Security Council
- Research Computing Support Collaborative
- Information Security
- Technology Standards Review
- Committee on Classroom Technology
- Business Intelligence Steering Committee (BISC)

- Recommend Priorities
- Review policies and standards
- Identify New Needs
- Coordinate Initiatives

- Improve Communications
- Recommend Service Improvements
- Identify Opportunities for Collaboration
- Support Service Improvement Projects
2. **Adjust funding methods to align resources with strategies, support technological change, and forecast investments required to sustain performance of technology.**

To optimize the impact of the IT plan and provide a more reliable and sustainable infrastructure requires a rethinking of several IT funding practices. First, the University should develop multi-year forecasts of required investment in shared infrastructure including the research computing infrastructure, classroom technology, storage, network, data centers and enterprise services to address technical obsolescence and increased utilization. While the full plan may not be able to be funded, it should inform governance groups and University budget officers as they make decisions about allocation of IT reserve funds, new one-time funds and the approval of any new projects. Likewise, new IT initiatives should have in place funding strategies for their one time and recurring costs before they are approved to avoid worsening the long-term deficit of funding to sustain technologies. Several opportunities in this plan introduce significant enhancements to technology that benefit the entire University and require the collaborative efforts of multiple organizations. These initiatives will require their own funding strategies to share the costs to initiate and sustain the service. As new investments are needed to implement the IT strategies, individual business plans will be created and submitted to the IT Executive Committee to support these initiatives. Finally, historical assumptions regarding the required investment to sustain technologies such as the network need to be regularly revisited and updated to adjust for increased utilization, changes in required performance levels, and technological change. These adjustments will be incorporated into multi-year investment forecasts for shared infrastructure and reviewed annually with the Executive Committee.

3. **Position infrastructure technologies, policies, processes and IT skill sets to enable the University to leverage cloud services.**

The plan lays the groundwork for a shift towards a more hybrid cloud computing environment where computing infrastructure will be a mix of on premise and cloud solutions and applications will increasingly available only as software as a service. The hybrid cloud direction requires several enabling changes. First, the wired and wireless network must be a priority for investment to sustain its capacity to support increased use of cloud services with appropriate capacity, reliability and security. Additionally, ITS should adopt a middleware strategy to facilitate integrations between solutions without always necessitating the development of point to point interfaces. Likewise, a flexible mobile development framework will enable ITS to incorporate cloud and on premise software solutions into mobile applications and mobile web sites that bring multiple services into a common interface and design.

Second, the University will seek to influence procurement policies and contract requirements to facilitate purchasing cloud technologies as services with annual costs based on use rather than hardware or software with single acquisition costs. Likewise, efforts will be undertaken to work with system and state officials to adjust contract terms to protect the University’s interests when procuring cloud services and to enable the University to take advantage of pre-negotiated agreements with cloud providers established by higher education associations, such as Internet2. Third, moving services to the cloud changes the work of IT professionals and increases the need for professional development. While it minimizes some tasks, such as system administration and application maintenance, it increases others including developing integrations, process analysis, financial analysis and service costing. As strategy 4 details, these factors will need to be incorporated into overall professional development and staffing plans.
4. **Build IT organizational capacity to support technology shifts and new strategic priorities.**

Staffing plans and professional development strategies will be aligned to the IT plan to develop the skill sets to manage new technologies and services. While all staff will need access to on-going professional development opportunities, the plan anticipates an acute need to increase expertise in several areas including change management, mobile development, Apple support, security, data analytics and business analysis. Additionally, most staff will need a foundational understanding of broad methodologies that will improve the effectiveness of IT service management including ITIL and project management. Lastly, the strategies will necessitate the introduction of new capabilities in one or more units to support enhanced research computing services and broader adoption of student success analytics.

This aspect of the plan requires sustained investment in professional development, additional collaboration among IT staffs across the university to share professional development opportunities and staffing plans to strategically repurpose open positions and retrain staff to assume new roles.

5. **Improve the quality and efficiency of technology through best practice management and support processes and simplifying the diversity of solutions used to address very similar needs.**

This strategy will improve the overall effectiveness of IT services to the campus and improve coordination and communication among IT groups while preserving the ability for divisions to support their unique technology needs. These changes will work in concert with the new governance structures and focus on improving the communication and management of services (IT Service Management or ITSM) and leveraging professional development to create a more consistent vocabulary and work methods among IT professionals. The core of this strategy will be the multi-stage implementation of the University’s recently acquired IT service management tool. When fully deployed, it will enhance the ability to respond to service requests, organize and analyze project requests, manage IT assets and provide collaboration tools for the IT staffs around the University. It will also be the supporting infrastructure to create workflows to track and facilitate timely architectural and compliance reviews of new initiatives.

Service effectiveness will also be enhanced through streamlining of the IT environment and reducing overlapping technologies in areas that are not directly impacting teaching or research. Examples include moving toward more consistent configurations for staff computers and video conferencing solutions. Identity and access management technologies will also help facilitate more remote support to rapidly resolve issues and support constituents at other locations. It will also enable self-service distribution of software and better management of software licenses. Finally, bringing distributed IT groups into ITS change management and problem management practices as they mature will also improve the coordination and efficiency of the overall IT environment.
APPENDIX A – ADVISORY COMMITTEE AND PLANNING GROUPS

Project Advisory Committee
John Bay, associate dean for research and graduate studies, Thomas J. Watson School of Engineering and Applied Science
Greg Delviscio, associate vice president of Communications and Marketing
Kanad Ghose, professor of Computer Science
Lisa Gilroy, assistant vice president for Sponsored Programs, Office of Sponsored Programs
Curtis Kendrick, dean of Libraries
Michael McGoff, senior vice provost and chief financial officer
Cornelia Mead, assistant vice president for Student Affairs Administration
James Pitarresi, vice provost, Center for Learning and Teaching
Sharon Pitt, associate vice president and chief information officer

Planning Groups
These groups helped brainstorm IT goals and strategies in particular areas of technology. Additional input was received from a faculty focus group on academic technology and learning spaces and a meeting of the deans to discuss research computing.

<table>
<thead>
<tr>
<th>Group</th>
<th>Participants</th>
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<tbody>
<tr>
<td>Student Success and the Student Experience</td>
<td>Nancy Abashian, Libraries</td>
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<td>Francis Borrego, Fleishman Center for Career and Professional Development</td>
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<td>Kathy Brunt, Harpur Academic Advising</td>
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<td>Denise Dedman, ITS</td>
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<td>Jill Dixon, Libraries</td>
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<td>Nasrin Fatima, Office of Institutional Research and Assessment</td>
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<td>John Frazier, Geography</td>
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<td>Dianne Gray, Services for Students with Disabilities</td>
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<td>William Kazmierczak, Mathematical Sciences</td>
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<td>Susan Kirwan, Student Accounts</td>
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<td>Anne Larrivee, Libraries</td>
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<td>Gail Rattinger, School of Pharmacy and Pharmaceutical Sciences</td>
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<td>Daryl Santos, Provost’s Office</td>
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<td>Sharon Santobuono, The Thomas J. Watson School of Engineering and Applied Science</td>
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<td>Amber Stallman, Financial Aid and Student Records</td>
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<td>Nancy Stamp, Freshman Research Immersion Program</td>
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<td>April Thompson, Office of Dean of Students</td>
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# APPENDIX A – ADVISORY COMMITTEE AND PLANNING GROUPS

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<thead>
<tr>
<th>Group</th>
<th>Participants</th>
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| Analytics and Decision Support | Ben Balkaya, Graduate School  
Sandy DeJohn, Physical Facilities  
Tanja deMauro, Office of Sponsored Programs  
Brandy Emm, Libraries  
Nasrin Fatima, Office of Institutional Research and Assessment  
Michelle Gardner, Office of Development  
Scott Hatch, Business Affairs  
Kathy Smith, ITS  
Eric Hoffman, School of Pharmacy and Pharmaceutical Sciences  
Janet Keesler, The Thomas J. Watson School of Engineering and Applied Science  
Christina Knickerbocker, Student Affairs Assessment and Strategic Initiatives  
Leslie Lander, Computer Science  
Don Loewen, Provost’s Office  
Erin Neske, Business Affairs  
Per Stromhaug, School of Management |
| Cloud Services               | Kenneth Chiu, The Thomas J. Watson School of Engineering and Applied Science  
Patrick Collette, Communications and Marketing  
Mike Hizny, ITS  
Don Kunkel, The Thomas J. Watson School of Engineering and Applied Science  
Joe Roth, ITS  
Matt Schofield, Purchasing  
Adam Smallcomb, ITS |
## APPENDIX A – ADVISORY COMMITTEE AND PLANNING GROUPS

<table>
<thead>
<tr>
<th>Group</th>
<th>Participants</th>
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</table>
| IT Staff and Process Capacity and Capabilities | Mike Allington, ITS  
Lauri Arnold, ITS  
Melissa Biddle, Decker Student Health Services Center  
John Cordi, Business Affairs  
Juan Denzer, Libraries  
John Hagan, ITS  
Dave Hall, Computer Science  
Surinder Kahai, School of Management  
Don Kunkel, The Thomas J. Watson School of Engineering and Applied Science  
Stuart L’Hommedieu, ITS  
Mary Ann Martin, ITS  
Steve Safranek, ITS  
Duane Theleman, ITS  
David Vose, Libraries |
APPENDIX B – GOVERNANCE CHARTERS

This section presents recommended additions and changes to IT governance structures and practices including the formation of an IT Executive Committee.

IT Executive Committee Draft Charter

Purpose
The Information Technology Executive Committee (ITEC) is the senior IT governance group charged with approving University IT policies, overseeing the implementation of the University IT strategy, prioritizing major technology investments that impacts shared resources, and facilitating coordination among the University's technology support organizations.

Responsibilities
The specific charge of the ITEC is to:

- Approve the sequencing of major technology initiatives that require the support of ITS, potentially impact the resources and initiatives of another division, or require additional University investment from outside the division(s) proposing the initiative.
- Moderate and resolve IT initiatives with conflicting objectives or that could adversely impact University goals.
- Receive periodic IT and information security risk assessments and monitor the implementation of risk mitigation strategies.
- Approve and monitor the implementation of IT policies or significant changes to IT standards and practices.
- Direct and monitor the implementation of the University IT strategic plan.
- Oversee the funding of technology services and initiatives.

Decision Rights

- Approve IT policies.
- Prevent actions that violate IT policies, increase IT risks or cause significant inefficiencies.
- Negotiate resolution of competing or conflicting projects.
- Approve the sequencing of major projects that require ITS support and resources.
- Approve the one-time and recurring funding strategy for major IT initiatives and investments.
- Approve projects that require significant new funding from outside of the requesting division's budget ($50,000 or more).

Potential Membership
To effectively engage senior leadership, the Senior Officers Group will fill the role of the IT Executive Committee. The CIO, Vice Provost CTLT and the Dean of the Library will meet with the SOG three or four times a year to review progress implementing the strategic plan, seek approval of recommendations to prioritize major initiatives or change to policy, and adopt funding plans for University IT initiatives.

Chairs of other IT advisory committees and leaders of other IT groups will attend these meetings as-needed to provide updates on particular issues or initiatives and to serve as subject matter experts.
Initial Activities
The SOG will dedicate meeting time to its role as the senior IT Executive Committee to undertake the following types of activities:

• Conduct an annual review of the portfolio of major ITS projects (in-process and anticipated) and provide feedback on alignment with Roadmap and IT strategic plan goals.

• Review (quarterly or as-needed) requests for new projects that require decisions to alter the sequencing of the existing ITS project portfolio or the investment of additional funds not currently in the ITS or requesting division’s budget.

• Review and approve proposals and business plans for significant new or expanded IT capabilities with University-wide impact associated with the IT strategic plan.

• Receive an annual assessment of the University’s major information security, disaster recovery and business continuity strategies and vulnerabilities and discuss recommendations to further mitigate risks.

Recommended Adjustments to ACET’s Charter for Consideration of the Faculty Senate

Purpose
Designate the committee’s focus as an advisor to the CIO and the director of the CLT on technology strategies and decisions and as the primary interface between the faculty senate and the IT governance processes.

Responsibilities

• Provide a sounding board and advisor to the IT leadership on ways to improve and communicate existing and proposed University IT policies.

• Advise ITS, CLT and other technology support organizations on ways to improve technology support for learning and teaching and research.

• Identify emerging needs for new technology or technology services.

• Review and provide input to help set annual priorities for technology strategies that support faculty and students.

• Convene and organize efforts to communicate with and solicit input from faculty and students about available and needed IT solutions.

• Advise ITS and CLT on structuring processes to gather stakeholder input to select new technologies to support faculty and students.

Decision Rights
ACET would continue to be advisory to the IT leadership.

Membership
Continue current composition and consider broadening the committee to include representation of the Professional Staff Senate.
IT Services Coordination Committee (Draft Charter)

Purpose

The IT Services Coordination Committee (ITSCC) brings together ITS services leaders with leaders of other technology groups to improve internal communication, identify opportunities to collaborate, and coordinate shared processes and technologies.

Responsibilities

• Advise ITS on the continuous improvement of incident, problem and change management processes.
• Provide input to the development and maintenance of a comprehensive catalog of IT services at Binghamton.
• Recommend and support procedures to coordinate technology maintenance windows for applications, databases, servers and networks.
• Identify opportunities to work collaboratively or share solutions among IT groups.
• Share successful practices and lessons learned from pilots of new technologies.
• Recommend University-wide technical standards.
• Serve as a technology advisor to the CIO.
• Recommend and sponsor mechanisms to improve communication within the University IT support community (virtually and in-person).

Decision Rights

The ITSCC is an advisory committee and makes recommendations to the CIO and the Information Technology Executive Committee.

Potential Membership

The ITSCC membership could include:

• ITS directors of Technology Support Services, Operations and Infrastructure, and Enterprise Systems and Applications
• Director of Watson Computing
• Director of Computer Science IT
• Representatives from CLT, Library, University Center for Training and Development, Binghamton Foundation IT team, Communications and Marketing, Physical Facilities, Student Affairs and the Division of Research
• Representative from ITS Security Operations
• ITS communications manager
Technology Standards Review Process and Review Team

Purpose

A process to organize concurrent reviews of multiple facets of proposed projects or technology acquisitions to facilitate their incorporation into Binghamton's existing systems and infrastructure, plan for resource availability to support implementation, and to help select solutions that fit within agreed upon standards (security, accessibility, integration). The process will be led and executed by a review team that will evaluate technology acquisitions and/or technology development from all University units for compliance with security standards and accessibility standards as well as standards required to integrate with other enterprise systems (e.g., Banner) or be hosted in a University data center.

Scope

The process would be used to review and inform projects that:

- Require integration with an existing University system to provide or share data.
- Incorporate Software as a Service or hosted application that provides, stores or receives confidential or sensitive data.
- Require application software or hardware to be hosted in a University data center (ITS, Watson).
- Involve physical security, access controls and building monitoring equipment that connects to the campus network.
- Need significant implementation support from a University IT group (ITS, CLT, others).
- Require coordination with ITS teams responsible for infrastructure (e.g., networking) regarding optimal configuration, capacity and readiness to support a new application or hardware.

Excluded from the review process are:

- Acquisition of individual computing devices including laptops, desktops and tablets.
- Academic software used for individual courses that meet accessibility, security and privacy standards.
- Specialized research software that will be supported by the investigator.
- Pre-approved cloud services for storage and compute that do not use or manipulate sensitive or confidential data.
Process Attributes

The review process will be conducted by appropriate subject matter experts and will be facilitated by ITS. The review process will be executed in advance of purchase or development, regardless of cost or purchase price. The review will strive to:

- Ensure compatibility with the current suite of enterprise systems and applications;
- Verify compliance with current and planned technical architecture and technical standards;
- Verify compliance with federal, state and university policies; and
- Reduce duplication with existing university systems and applications.

ITS will coordinate and track consultations with relevant subject matter experts and facilitate their timely completion. Subject matter experts engaged in review will routinely include cyber security, accessibility and technology integration experts, but may be extended to procurement, privacy and legal professionals, as needed. Process scope and efficiency will be monitored by the IT Services Coordinating Committee, which will make recommendations to the CIO to improve its efficacy.

Features of the process will include:

- Simple form to describe the project and facilitate the review process;
- Engagement of identified stakeholders from ITS, CLT, Communications and Marketing, and Watson to provide subject matter expert reviews to evaluate security, data integration, architecture, and infrastructure requirements/needs of the proposed project or acquisition.
- Process to engage requesting areas to discuss any constraints or concerns and propose resolutions.
- Early engagement and disclosure of proposed technology initiatives to the ITS Project Office to enable timely reviews and constructive feedback.