Program Summary

DoIT supports NIU’s enterprise network service to the campus and its remote outreach facilities. The enterprise network is composed of fiber infrastructure in and around the campus, core/distribution network equipment, more than 12,000 wired network ports and 1,300 wireless access points (AP’s) in throughout all campus buildings. DoIT staff provide 7/24/365 support for the entire network infrastructure which includes all provisioning, installations, troubleshooting and incident resolution.

This program can create cost savings opportunities across the university by growing the wireless service while contracting wired port access. Current use cases and estimates suggest that moving from a wired to a totally wireless office or residence hall environment can save 50% in recurring costs.

Criterion 1: Importance to University Mission / Operations

Importance to Mission

This program supplies the foundation for nearly all the teaching, learning and research activities at a modern university. Whenever students or faculty access NIU’s learning management system Blackboard), regardless of their location, they rely on NIU’s network to gain access. As researchers partner with regional labs for science discovery, NIU’s network underpins their communication, collaboration, and research activity. NIU’s wired and wireless network is the foundation upon which the enterprise functions and delivers its services to NIU and the world.

Importance to Operations

Every university runs on technology and this technology has three primary components: a network, some place to store the data, and somewhere to run the applications. To do without a ubiquitous, reliable and highly-available network is unthinkable.

Of course, technology changes quickly and expectations change nearly as rapidly. Since 2011, DoIT has grown wireless by 700%, expanding the reach of wireless to almost every building and classroom on campus. But this is no longer enough. The demands on our wireless network are growing because of an increase in the total number of wireless-enabled devices (both in the absolute number of devices and in the number of devices per user) and because wireless devices are streaming more high-bandwidth content than ever before. The product of these two trends means that simply covering an area with a WiFi signal is insufficient in design and operation to cover today’s modern wireless needs.

Program Portfolio

While a robust network infrastructure cannot guarantee academic excellence, it provides the foundation for any university’s teaching and learning environment. Without the ability to securely run applications and store data, faculty and students would no longer have the anywhere, anytime access to the course materials and online collaboration tools that are now the expected features of any 21st-century university.

Students today do not ask about WiFi coverage and Internet access, they expect it as a basic human right. A 2008 survey of college students found that 90% found WiFi as essential to their education as a computer or a classroom.
Program Synergy

DoIT’s network infrastructure is available and used by every person on campus and again by these same faculty, staff and students to access NIU applications and information at home or while traveling. NIU must continue to modernize this network infrastructure to improve capacity, fault-tolerance, security, and speed – all of which is necessary for the efficient delivery of this foundational program.

Criterion 2: Quality / Effectiveness

Functions and Services

All campus network connections aggregate to central core routers that provide fault-tolerance and redundancy. Using Cisco’s network gear and leveraging both their security and Data Center suite, NIU has built a scalable network that is suitable for large virtualization deployments, high-performance computing applications, and private clouds. NIU’s network service is actively monitored 24x7x365 for up/down status and historical data.

Basic features of the network architecture and support service include:

- Incident response and request fulfillment;
- Address assignments given to every desktop and laptop on campus
- Domain names for all web sites under niu.edu;
Multicast (one-to-many) communication for imaging applications, music applications, emergency text notifications, and more;

- NAT (Network Address Translation) mapping to protect individual computers from being visible or accessed by the wide open Internet.
- VPN (Virtual Private Network) authenticated and secure access to campus resources working from home and for establish secure communications between NIU and other institutions.

**Measures of Quality**

1. System availability is measured against both planned and unplanned downtime.
2. Mean Time to Resolve (MTTR) measured by the time between the reporting and the resolution of an incident
3. Mean Time to Fulfill Requests

**Evidence of Quality**

1. System availability for the wired network in 2015 was 99.986% accounting for both planned and unplanned downtime. System availability for the wireless network in 2015 was 99.989% accounting for both planned and unplanned downtime.

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<thead>
<tr>
<th></th>
<th>2. Mean Time to Resolve Incidents</th>
<th># of Incidents</th>
<th>3. Mean Time to Fulfill Requests</th>
<th># of Requests</th>
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<tr>
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<td>245</td>
<td>134.9</td>
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<td>Campus Wireless Network</td>
<td>97.8</td>
<td>90</td>
<td>267.7</td>
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**Quality Improvement**

DoIT has several projects in progress focused on improving capacity, redundancy, mobility and underlying funding structure of the enterprise network.

- Much of NIU’s network switch gear that is distributed among throughout campus buildings is aging and must be replaced. In FY14, DoIT developed a comprehensive, multi-year, refresh plan and began upgrading campus building infrastructure.
- Over the past two years, DoIT has upgraded almost all campus buildings from 10Mbps to 100Mbps connectivity.
- During Fall 2014, DoIT migrated the entire campus to a new high-capacity network, improving core network capacity from 1Gbps to 10Gbps links. This upgrade also included implementing an enterprise firewall for required institutional cyber-security capabilities and deploying a 200Gbps fiber-optic ring. This removed the single point of failure risk of a disaster at the main campus data center.
- In early 2016, DoIT will migrate its data centers onto a new core network to enhance security and provide greater reliability and capacity.
- Over the past four years, DoIT has expanded WiFi coverage by 700%, growing from a meager 200 WiFi access points to close to 1,400. DoIT is managing a project with several campus stakeholders to expand their wireless connectivity while reducing their wired footprint. In part, this project will validate the estimate that departments can save 50% in recurring network costs by moving to a wireless-only environment.
- Later in 2016, DoIT will implement a set of fully redundant, high-capacity, 10Gbps internet links for geographic and topological redundancy to the campus. This capacity upgrade will allow for 2-3 years of growth in internet traffic for NIU modernize a legacy, aging network infrastructure that has not been replaced for more than 10 years.
Criterion 3: Productivity / Efficiency

Scope of Program

This program’s core duties include:
  • long- and short-term planning and management of infrastructure;
  • infrastructure enhancements to increase reliability, availability and serviceability;
  • request fulfillment for service moves/adds/changes;
  • incident response and resolution for individual/campus-wide network service;
  • billing to all campus departments for network service;
  • vendor management for hardware and software maintenance, Internet Service Providers (ISPs) and billing oversight;
  • planning and managing ISP link capacities to ensure cost efficiency while maintaining adequate capacity; and
  • multi-year refresh planning of core/distribution/access layers of enterprise network.

Productivity Comparison

DoIT does more with less. We have less overall staffing than SIU-C when accounting for student workers and GAs, while supporting infrastructure that goes well beyond just the university network.

Our Network and Field Service teams are skilled in industry leading technologies using best-in-class products (i.e. Cisco, Ciena) to support network service across campus and the broader northern Illinois region. The depth of skill of this team is unique, as each engineer and technician has been trained on traditional enterprise network technology (i.e. Cisco) while also on telephony/carrier-grade systems (i.e. Ciena).

Resource Comparison

NIU employs 14 FTE that support NIU’s wired and wireless network infrastructure: 2 managers, 6 network engineers and 6 field service technicians. There are over 12,000 wired ports on NIU’s campus and Outreach centers, 1,400 wireless access points, and 6,000 telephone lines. In addition, this team of 12 staff supports NIU’s broadband networks throughout the northern Illinois region, totaling close to 1,000 miles of fiber-optic network with several hundred Community Anchor Institution customers.

In comparison, Southern Illinois University-Carbondale staff includes:
  • 1 Network Engineering Manager
  • 6 Network Engineers
  • 14 Student Workers/GAs
  • 1 Telecom Service Manager
  • 6 Telecom Service Technicians

At NIU, we leverage the same number of resources to do network, telephone as well as the regional broadband networks. In addition, NIU’s support teams do not require the additional expense of student workers and GAs, to support their service delivery goals. The broadband networks heavily subsidize, using external money, the salaries and tools of the staff that support NIU’s enterprise network.
Cost and Revenues

Wired and wireless network revenue from internal network billing to departments has been steadily increasing for the past five years as the total size of the network grows, but DoIT anticipates revenue will begin to contract in FY16 especially as we push more departments to move to a wireless environment with the possibility of saving 50% in monthly billing charges.

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<th></th>
<th>FY11</th>
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<td>$2,184,990</td>
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However, these increasing revenues do not cover the costs when one factors in the capital equipment refresh required to maintain the currency of the network infrastructure. Total program costs in FY15 were approximately $4.41M:

- Network vendor contracts: $526,000
- Network service contracts: $700,000
- DoIT staff salaries: $945,000
- DoIT overhead: $239,000
- Network equipment refresh: $2,000,000

These network expenditures have been increasing, in large part due to required refresh of legacy equipment. With refresh currently unfunded, the monthly $11 charge for a wired network jack and the $50 monthly fee for a wireless AP are not sufficient to annually fund $2M for network equipment refresh. This is simply an unwise and unsustainable practice.

Criterion 4: Internal & External Demand

External Demand

NIU's enterprise network extends to key points of interconnection in Chicago, which allow NIU connections to higher education-affiliated networks like Internet2 and the Midwest Regional Education Network (MREN). These connections allow faculty to conduct research with their colleagues in other institutions, leveraging high-speed networks of up to 10Gbps.

Internal Demand

NIU faculty, staff and students live in a world of interconnectedness. Demand for secure, reliable and highly-available network connectivity will continue to rise as each person brings more devices to campus and consumes more and more bandwidth with network-reliant applications like email, conferencing, course assignments, and online exams. But demand for a wired network jack that tethers a mobile device to a wall must lessen as NIU refreshes and enhances its network offering with more wireless coverage and capacity.

Finally, our decentralized security camera infrastructure at NIU requires updating to remain current. NIU has a number of analog cameras attached to physical recording and storage devices. Digital cameras offer better security, but require twice the initial cost and a monthly network connection. Centralizing funding for the enterprise network could include the camera infrastructure and create a more consistent and highly reliable network for this application as well.
Criterion 5: Opportunity Analysis

Cost Savings Opportunities

Funding for network access at NIU is based on a re-charge model that sets monthly network rates and bills individual departments for each port and access point. Over the past ten years, this has led to slow adoption of new technologies. DoIT recommends centralizing network access charges to eliminate, or reduce, the unequal network access on campus and relative slowness towards adoption of new network technologies. Polling in residence halls indicates a vast majority of students expect wireless to be both ubiquitous and fast. Allowing locally-controlled departmental budgets to artificially restrict wireless coverage results in an uneven experience across campus and has the possibility of affecting NIU’s reputation and student retention. Finally, a centralized funding model reduces the billing overhead within DoIT and in each department’s administrative suite.

Future Revenue / Resources

All revenues generated from NIU’s enterprise network are internal transfers from other departments, as a re-charge mechanism for network services. Therefore, there are no tangible means to drive new revenue from this service.

In the short term, two opposing forces will affect networking rates for other departments. DoIT must reset rates to allow us to replace networking equipment that is already past its end of life and stabilize the network for the entire community. However, rates for networking will also experience downward pressure from the expansion of WiFi as it replaces wired networking. The net of these two forces is unknown at this time.

Improvement Opportunities

A majority of plans in place go a long way in addressing some of the longer term challenges within this program. Up through FY12, this core infrastructure was old and had no reserve set aside for capital refresh to expand capacities, improve redundancies and serve the growth needs of the institution. Since that time, DoIT has developed comprehensive plans to renew the core network, upgrade campus wiring, enhance cybersecurity functions, implement topological redundancy and serve the greater needs of the NIU community. Additionally, DoIT is working with central administration and distributed IT groups to expand wireless service in more areas to promote device mobility, so students, faculty and staff can access their enterprise applications anywhere on campus.

Opportunities in the Field

DoIT has developed training plans and certification levels for network engineering and field services staff to expand our knowledge-base and skills. In addition, by implementing a number of the current projects already described, the overall enterprise network will become more robust, fault tolerant, and capable of handling device growth as well as localized outages in a more transparent fashion. Because the same DoIT staff that support the enterprise network, also support the NIUNet network infrastructure, DoIT has successfully developed a broader group of technical assets, with deep knowledge and expertise of enterprise and carrier networks. This is a unique asset to NIU’s DoIT organization, which makes us different than most organizations in the same field.