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Advanced Engineering Taskforce Report



Illinois Century Network

Advanced Engineering Taskforce Report - 2006

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Message - Gary E. Wenger, Chair, Advanced Engineering Taskforce

The Illinois Century Network (ICN) provides advanced communication services to K-12 schools, libraries, colleges and universities, museums, and local government and state agencies. These services include high-performance data, video, and audio communications. However, they also include many other types of specialized services required for its constituencies engaged in education, training, and information management based on information technologies.

During this last year the ICN/AET had many accomplishments including:

- Prepared for enhanced future services through the development of a strategic planning process and finalized a strategic plan to design and implement state communications infrastructure required for future services
- Improved methods for supporting existing services by expanding the “Best Practices” website
- Explored the potential for new services by implementing a collocation model for educational content on the core backbone
- Enhanced network security through the establishment of a statewide contract on antivirus and working on anti-spam agreement
- Undertook the provisioning of required staff and equipment resources by hiring additional staff for the RTCs to fill vacancies and renewing the Cisco contract for another 2 years
- Enhanced basic financial position through cost efficiency for connectivity to state government organizations

One of the accomplishments from this past year included an itemization of member benefits. These items included:

- Enable the ICN constituencies to experience 99% reliability on the largest private network in the state providing high quality professional services such as real time traffic management, network services, upgrades, and repairs to over 7,000 institutions and state government.
- Enabling all constituencies to be closely interconnected through out the State including thousands of Illinois schools, libraries, museums and government organizations as part of the “Illinois Intranet”.
- Providing a full range of services including Connectivity Consultation, Domain Name (DNS) Hosting, Internet Connectivity, IP Addressing, and Monitoring/Analysis.
- Enabling educational institutions to participate in Internet2, the national research network, a partnership of academia, industry and government, that interconnects all major universities and tens of thousands of K-20 educational institutions
- Enabling access through StarLight, an advanced international communications exchange in Chicago, to educational and research institutions world-wide.
- Providing centralized content filtering from Secure Computing (formerly N2H2) that users control from a web interface, to help with CIPA compliance.
- Providing Access to broadcast quality video from CSPAN, PBS, NASA and hundreds of others across a multicast enabled backbone and caching services to greatly reduce the time it takes to download what you need.
- Providing high quality 24/7/365 monitoring and support for resolving problems via a statewide Network Operations Center. Get local support from one of nine Regional Technology Centers located around the state.

- Realization of cost-efficiencies, such as through negotiated discounts on Cisco equipment (42.5%) and SmartNet maintenance (30%) through ICN contracts with SBC. and discounts on T-1 and DS3 leased circuits from SBC and high speed connections via local cable connections.
- Providing required bandwidth on demand through the ICN's meshed state network, backed by over 3.8 Gigabits per second of commercial Internet access from multiple service providers.
- Enabling H.323 video connections for a modest monthly cost through the ICN's IP Video service. Ensure smooth traffic flow for video and other critical applications with low cost Quality of Service (QoS).
- Allowing constituencies to stay in touch with your child's teacher and school, with the School to Home Communications Toolkit for K-12.
- Enabling constituencies to have a voice in their communication services! The ICN is member driven and receives feedback through the Policy Committee, Advanced Engineering Taskforce and regional meetings.
- Allowing a choice of access services, such as T-1, cable, fiber, wireless. Selection is possible from a variety of connection options that best meet a site's needs.
- Direct communications with an ICN Network staff stays on top of emerging technologies and is constantly on the lookout for future trends.
- Enabling advanced global communication services through access to education networks worldwide through the ICN's connection to the StarLight international communications exchange.

The Illinois Century Network provides these and other benefits to over 7,000 organizations in Illinois. The people of Illinois may or may not realize the value/benefits of the ICN and the services the state provides. The quality of the network continues to improve and the benefits continue to grow. This is not an end but a beginning of increased usage of the network with information on the Internet continuing to double every year. These services and capabilities are not those that are provided by general Internet service providers, usually termed "ISPs." They are highly specialized services that have been designed to meet the needs of the ICN community.

Challenges

The future continues to present major challenges for the ICN to provide services required to support a mission critical environment. They include:

- *Continuing to meet the expanding communication service needs of the ICN community*
- *Planning for required future services and technologies*
- *Continuing to build the ICN constituent driven model*
- *Ensuring a highly reliable, secure network infrastructure by maintaining and upgrading core facilities*
- *Developing and implementing an appropriate funding model that considers both operational and capitalization requirements*

Most organizations connected to the ICN increasingly depend on the network to deliver essential services. Many educational institutions, K-12, and museums have online colleges that deliver course material 24 hours per day, seven days per week. Access to the Internet is mission critical for most educational institutions. However, the type of access that they require

is not the type that is generally provided by ISP providers. They require the specialized services provided by the ICN.

They depend on these services for marketing, communications, recruitment, retention and the delivery of services to their customers. In order to maintain quality services, the existing infrastructures need to be replaced and upgraded on a regular basis. The challenge to the ICN is to continue maintaining a reliable and upgraded network, which is the foundation for these services.

Most organizations' utilization of the ICN will continue to grow. The Internet will continue to be used to deliver more and more services, and the specialized services provided by the ICN will be increasingly required. Organizations will need to expand their ICN connectivity to deliver more enriched content. There are an increasing number of applications which use rich media including graphics, images, voice, and video that will expand the demand for Internet usage. Content providers will continue to increase the traffic of the network. The challenge to the ICN will be to meet the expanding needs of the user communities.

It is important to understand the user perspective when managing a large organization. Over the years, the ICN has been very effective in utilizing constituent based input in developing plans and services. The user groups assist in setting future directions for services and support by communicating their issues and concerns. Planning has become a critical component of success. Without planning, organizations are reactive not proactive. The challenge to the ICN is to continue using a constituent driven model and plan for the future.

Every state is facing critical fiscal issues that impact technology deployment, education, and other state services. Illinois is no exception and the single biggest threat facing the ICN is the impact that reduced and redirected funding could have on the network and the services provided to constituents. All of the issues identified as threats by the AET are related to funding, either in the form of reduced funding or the inability to bring pressure to bear on the vendors to keep costs down. If costs are not low enough, key constituents with significant purchasing power may leave the ICN, resulting in higher costs for the remaining ICN constituents. The funding model for the ICN state wide network and services must be competitive and continue to add value to the member organizations. The challenge to the ICN is to maintain an appropriate funding model.

Tremendous progress has been made this past year in developing a process for strategic planning and developing a strategic plan that will carry the state forward in meeting the needs of all constituents in the state. Many people from all the constituent groups have been engaged in the process of data gathering to define the future telecommunications needs of the state. The report called "Illinois: The Next Century Network" should be completed by August. Our challenge will be to provide the necessary funding for the ICN and constituents groups to meet the statewide telecommunications needs of the future.

We have included the recommendations for FY06 that we believe will address the challenges faced by the ICN over the next several years. I would like to thank all the members of the task force for this past year's contributions of their time and energy. Lastly, since this is my last year as chair of the AET before retirement this fall, I have enjoyed working with the members of the AET and the ICN staff over the past seven years. I will truly miss the collegialism of working together in providing the best state network.

-- Gary E. Wenger

Membership

Chair

Gary E. Wenger, Vice President of Information Technology, College of DuPage

Members

Karim Adib, Director of Technology, Chicago Public Libraries

Troy Brown, Information Technology Manager, Shawnee Library System

Andrew Bullen, Information Technology Coordinator, Illinois State Library

Charlie Campbell, Associate Director, Information Technology, SIU Carbondale

Todd Cooper, Information Tech. Coordinator, IL Critical Access Hospital Network

Greg DeYoung, Associate. Director for Campus Infrastructure Technology, Eastern Illinois University

Mike Dickson, Director of Information Technology, Center for the Application of Information Technology at Western Illinois University

James V. Dispensa, Special Assistant to the CEO - Technology & Telecommunications, Chicago Public Schools

Robert Dulski, Director of Information Services, Brookfield Zoo Chicago Zoological Society

Sam Ferguson, Director of Information Technology, City of Schaumburg

Jim Flanagan, Director of Technology, Maine Township High School District #207

Dennis Gallo, Technology Coordinator, O'Fallon Community Consolidated School District #90

Diann Jabusch, Director of Tech & Support Services – Canton, Spoon River College

Charlie Kline, Principal Research Programmer, University of Illinois at Urbana-Champaign

Joel Mambretti, Director of the International Center for Advanced Internet Research, Northwestern University

Cheryl Obermeyer, Director of Information Services, Chicago Historical Society

Jim Peterson, Director of Technology, Bloomington Public Schools, District 87

Alan Pfeifer, Director of Computing and Instructional Technology, Sauk Valley Community College

Steve Philbrick, First Deputy Chief Information Officer, City of Chicago/Business and Information Service

Jessica Theodor, Curator of Vertebrate Paleontology, IL State Museum Research & Collections Center

Linda Winkler, Senior Network Engineer, Argonne National Labs

Staff

Tony Daniels, Deputy Director, Central Management Services

Rich Fetter, Senior Division Manager, Central Management Services

Dirk French, Senior Telecommunications Analyst, Central Management Services

Beth O'Mahoney, Agency Representative, Central Management Services

Lori Sorenson, Chief Operating Officer, Central Management Services

Frank Walters, Senior Network Engineer, Central Management Services

Recommendations

1. Vision, Mission and Strategic Planning

The technology issues facing organizations are not unique to higher education, K-12, hospitals, local, county, state government, or large and small business organizations. The problem stems from a simple fact - technology has become an essential element in the way people work and communicate. For organizations to remain competitive and provide quality programs, old technologies must be replaced, existing and emerging technologies must have on-going support, and investments must be made in solutions for tomorrow. Understanding and planning for the future direction in the use of technology is critical to the success of an organization.

Planning should be an essential activity of every organization and a core element of strategic and operational processes. Planning is a future-oriented process that enables an organization to anticipate changes in internal and external environments and position itself to respond to changes as they occur. It should be a process that every organization follows. It is a dynamic and reflective process that ensures that goals are clarified, priorities are established, stakeholders are organized, and an evaluation system is implemented before critical decisions are made.

In 1999 the original legislation declared “the ICN would be a high speed telecommunications network that provides reliable communication links to and among Illinois schools, institutions of higher education, libraries, museums, research institutions, State agencies, units of local government, and other local entities that provide services to Illinois citizens. The Illinois Century Network shall build on existing investments in networking schools, colleges, and universities, avoid duplication of future efforts, maintain sufficient capacity to meet the requirements of the participating institutions, and stay current with rapid developments in technology. The Illinois Century Network shall be capable of delivering state-of-the-art access to education, training, and electronic information and shall provide access to networking technologies for institutions located in even the most remote areas of this State.”

The state-wide task force called “Illinois: The Next Century Network” is in the final stages of gathering data and reporting on the results. A blue ribbon planning committee chaired by Dr. John Ashcroft, President, Heartland Community College and several other high ranking state officials will be reviewing the results and making a recommendation for FY07.

Recommendation: The AET recommends continued support for the new mission, vision and planning process.

2. Core Technology Infrastructure

The ICN provides a wide range of communication services to its constituents in the State of Illinois. The ICN must continue to support the current evolving environment, while also preparing to meet future needs. The foundation infrastructure for those services consists of a suite of core resources that have served the Illinois community well for many years. However, this core infrastructure is now severely out-of-date. As more people depend on this infrastructure for additional and often critical services, the state must maintain a high performance core technology infrastructure that is highly reliable, secure, manageable, and cost effective. New network designs and technologies are available to make this possible. To provide for this

network, it is necessary to obtain capitalization funding that will support the acquisition of the required core resources. However, this initial investment will lead to lower costs for infrastructure over the long-term.

Recommendation: *The AET recommends that the ICN provide a core technology infrastructure to provide high quality service to support the application needs into the future.*

3. Network Operations Center (NOC)

Although the ICN has provided excellent operations services, the existing NOC's needs enhanced services. All other state networks have established such operations centers, even those that provide far fewer services to smaller constituencies. Because of the importance of digital communication services to the ICN constituencies, it is critically important that the ICN establish a 7 by 24 network operations center, which would include capabilities for supporting optical networking, implemented with the management tools required for ensuring high quality, continuous network production.

Recommendation: *The ICN should develop the requirements, design, and implementation schedule for a network operations center supporting optical networking.*

4. Equipment Replacement Strategy

The network core, distribution, and switching equipment and constituent based network equipment needs to be replaced on a cycle that protects the network performance from ineffective and damaging operations. Network equipment replacement is required when advanced features are needed; backbone bandwidth is expanded; and manufacturer end of life and end of support notices are received from the vendors. The ICN has replaced the network core as needed but will need to continue to address obsolescence in the future.

Most network equipment needs to be replaced on a three-five year cycle depending on the environment. Obsolescence must be planned and funded to guarantee a cost-effective and reliable network.

The need for an equipment replacement strategy extends to the constituents as well. With the ICN reaching its fifth year of operations, many constituents are still using their original hardware. As the equipment ages, the number of hardware related incidents can be expected to increase resulting in a greater drain of ICN technical resources and impacting service to the constituents. Many constituents rely on the ICN to provide guidance and recommendations on equipment purchases.

Recommendation: *The AET recommends the development of a technology replacement strategy for the ICN and constituents to improve overall network performance.*

5. Network Security

Network security continues to be a critical issue facing those involved in the support of information technology systems. The list of issues includes: e-mail – spam, open relay; host – virus / worms; and service impacting – DOS attack, hackers. For the most part, these concerns can be mitigated with the use of a firewall and patched systems with up to date antivirus

software installed. The ICN security team has completed much work this past year on the “Best Practices” section of the ICN website (www.illinois.net/support) to provide constituents with helpful hints and a master contract on Antivirus solutions for staying on top of and preventing security breaches.

The ICN technical staff continues to look at additional services in the security arena. Potential ICN service offerings could include:

- Intrusion Prevention Solutions – reduces unwanted traffic and provides bandwidth shaping on the network
- Patch Management – testing and distribution of software updates
- Firewall service – exclusively limits access to a local area network
- Custom router configurations – access lists to deter hackers
- Consulting service – securing the windows environment
- E-mail services – anti-spam software to minimize unwanted e-mail

Recommendation: The AET supports the exploration and implementation of expanded cost effective services that would benefit the ICN constituents and the network operation.

6. Content Providers

The ICN staff continues to look for ways to make content more accessible to constituents. Currently the emphasis is on the sharing of educational content, such as those resources provided by the state library and the museums. Collocation of content servers on the network is one of the means to facilitate access to content, yet the constituent survey indicated little interest in this potential service at this time.

This past year the AET recommended a pilot project to collocate education content from the Brookfield Zoo on the ICN backbone. The results and benefits of the collocating arrangement will be used to shape future policies and market the service. Increased bandwidth, at low or no cost, e.g. bandwidth “grants,” to content providers is another avenue that should be investigated in the on-going effort to encourage the sharing of content via the network. As the number and types of constituents continues to grow, additional opportunities for sharing content will emerge. The healthcare community has already identified several areas in which they could benefit by sharing content and in all likelihood state agencies will do the same.

Recommendation: The AET suggests that the ICN staff continue to pursue collocation, developing a service that can be marketed to constituents.

7. Quality Service Financial Model

The current quality service financial model provides an effective solution for the ICN. The model provides a fair and equitable process in providing rates for all constituents. The educational constituents receive a base line of service based on the full-time equivalent (FTE) enrollment and pay for services above that level. All other constituent rates are set based on ICN costs. The FTE model for primary constituents works reasonably well and the implementation this year of a new process encourages community sharing of bandwidth.

One major issue for primary constituents is the baseline allocation. The original allocation was based on minimal content such as text based e-mail and simple web pages. Over the past eight years the content has changed to include graphics and steaming audio and video. The streaming content puts greater demands on the baseline allocations. Many K-12 and higher education institutions can not access this type of material for its students and community because of bandwidth limitations.

Delivering services to the digital divide areas in the state creates its own financial challenges in providing cost effective services. The ICN needs to consider any increases in the rate structure very carefully. To cost justify the ICN service, the cost has to be at or below market rates. The ICN needs to continue to define its value added service. Any erosion of service level, reliability, or cost increase without increased service value will drive constituents away. The ICN needs to continue to hold or reduce the cost of service to all constituents.

Recommendation: The AET recommends that the ICN continue to provide a quality service financial model through competitive pricing and an appropriate baseline allocation.

8. Wireless Technologies

The ICN continues to investigate the role that wireless technologies will play in providing lower cost, last mile connectivity to constituents who have limited access to such services.

Organizations throughout the country are increasingly embracing wireless technologies to provide increased mobility for users. The rapid proliferation of wireless local-area networks is having a dramatic impact on network availability. A new technology called WiMax promises to do for the metropolitan-area network what WiFi has done for the local-area network. Wireless broadband offerings such as EDGE and EVDO from the cell provider will continue to grow.

Many of these new technologies have the potential to provide constituents with a low cost fixed solution for connecting constituents within a community as well as last mile connectivity to the ICN. This strategy may provide additional solutions to address the digital divide issues within the state.

Recommendation: The AET recommends continued investigation of wireless technologies to add value and reduce cost over landline solutions for all constituents.

9. State Wide Contracts

In the past the state has provided state contracts on equipment and software that could benefit all the constituents. It has been very difficult finding out what is on state contract and understanding how to use the contract pricing. The issue can be resolved with better access to master contracts and the posting of buying opportunities to save money for all ICN constituents.

Recommendation: The AET recommends that the State develop a system providing easier access to the state wide contracts for technology as well as products and services.

10. Convergence: Voice, Video, and Data

The ICN network allows for the transport of digital data. The convergence of voice, video, and data use in all applications will continue at all organizations. We are seeing a large number of ICN constituents who have moved, or who are in the process of moving to support a converged network within their organizations. Many constituents are already using Voice over IP to transmit their voice calls and H.323 for two-way interactive video across the network. Streaming of voice and video is common place where more applications will be taking advantage of using rich media. Today, and in the future, more and more voice, video, and data transmission will utilize the network. The technology will continue to change and new standards will evolve. There are benefits available for all state organizations that must be explored to see if these current and new technologies will work in their environment, reduce costs while enhancing their operations.

Recommendation: The AET recommends the ICN continue to investigate these newer technologies and determine appropriate models that can benefit the ICN constituents.

11. Staffing Levels/Retention/Development

The current staff of the ICN provides the services that support the state-wide network. Staffing levels have continued to decline requiring more work from the existing staff. This can create a negative environment which can lead to staff retention and morale issues. The ICN needs to provide quality service to all constituent groups. This can only be accomplished through retention programs, staff development and appropriate staffing levels to meet the services needs of the community of users.

Recommendation: The AET recommends that the ICN review the staffing levels and allocate resources necessary to meet service needs. In addition the ICN should develop retention and development plans to improve staff moral and training levels.

12. Disaster Recovery/Business Continuity

As the internet is used more and more for mission critical applications, operational recovery and business continuance services are becoming required services for most operations. More and more organizations are planning for system failures and what to do next. The ICN is in a prime position to review and provide backup internet services for its constituents.

Recommendation: The AET recommends that the ICN review/recommend disaster recovery/backup services that can provide alternate solutions for internet access to the network.