

**2003**

**Advanced  
Engineering  
Taskforce Report**





# **Advanced Engineering Taskforce Report**

**June 2003**

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## MEMBERSHIP

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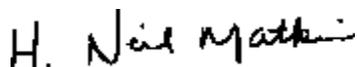
June 8, 2003

In 1997, Richard Wagner, Executive Director of Illinois Board of Higher Education (1980-1998), formed a statewide taskforce to investigate content and delivery for educational applications. Under the guidance of Robert Kustra, Sylvia Manning, and John Swalec, and partnering with the State Board of Education and the Community College Board, what emerged from year long meetings was a work product that outlined an ambitious undertaking known as the Illinois Century Network.

Funded by Governor George Ryan and the 91st General Assembly, the Illinois Century Network merged efforts from two previous educational technology endeavors and expanded service exponentially to become the most successful and far reaching education network in the nation. Far more than a route to the commercial Internet, the Network became the Illinois intranet connecting schools, colleges, universities, libraries, museums, municipal, county, and state government, hospitals, and many more entities that render services to Illinois citizens. Serving over 2,000,000 Illinois students daily, the Network determined to deliver world-class service beyond anything available on the commercial market to Illinois education.

A project of this scope could not have found wings without embracing a sound vision. Following in the steps of the initial effort, the Advanced Engineering Taskforce was founded in 2000. Chaired by George Badger, retired Chief Information Officer for the University of Illinois at Urbana-Champaign and the Chair of the 1997 Statewide Technical Committee, the group includes representatives named herein from all sectors of education and advanced communications research. The Advanced Engineering Taskforce has produced an annual report that has reached around the world. The most downloaded item from the ICN's web site, the annual report reaches an audience of 10,000.

The ICN staff concurs with the findings of the 2003 Advanced Engineering Report in full. As George Badger has elected to actually retire now, I take this opportunity to thank him publicly for his insightful leadership of this independent panel, his tremendous contributions to Illinois education, and for the fair and balanced ethic that he brought to bear on behalf of Illinois citizens. Thank you, George.



Neil Matkin  
Director

June 11, 2003

Attached is the annual report of the Advanced Engineering Taskforce for 2002-2003. It covers most of the issues we have discussed over this past year. There are two other sets of issues of concern not covered within the report. The first was covered in our interim recommendations for the process of transition to a new administration. We feel that the ICN has established a foundation that the state should exploit for the good of our future economy. The second set of issues is related, but more explicitly addresses the organizational structure within which ICN operates.

Discussions of organization, and particularly the severe limitations ICN faces operating within state government, have come up every year. Management efforts on procurement issues have been a signal success, but that is only one aspect. In the context of transition discussions they came up again, but the group did not follow through to a final position paper because they did not believe that something so successful would be vulnerable to the continuing pressures within government and from the communications industry. The AET last met at the end of February, but we did have a telephone conference after the proposal to put ICN within CMS was formally put forward. What follows reflects my personal views, tempered by those discussions. There was a significant overlap between the timing of the AET discussions and those within government as part of the budget process.

I am very aware that the current issues about ICN organization arise in the setting of significant budget problems at the state and local level. For this reason I was surprised to see immediate pursuit of possible changes which could dramatically increase the costs of the network with neither a benefit to service nor any economic advantage identified.

The Illinois Century Network is a relatively new activity that is having positive impacts on education and can have similar impacts on the future effectiveness of state government. It is still in the startup phase and needs to be nurtured.

I am aware of the changes at the top of CMS and hope that there will be major changes in approach under this new leadership. Given this, my comments should be taken as a cautionary reflection of the past rather than a prediction of the future. On the other hand, we all know how the staff of a bureaucracy can perpetuate old ideas in spite of new management. I have observed these problems over a number of years, first in my role of managing communications at UIUC and later in the transition from ICN's predecessor serving K-12 to the current program.

- (a) From the beginning of planning efforts CMS has opposed state funding of a networking initiative for education and has worked behind the scenes to delay or stop them.
- (b) Once funded, CMS has argued against planning which anticipates needs and for constraining the capacity until the service is overloaded. This despite universal experience that network traffic grows explosively (8% per month growth is the documented norm) and fairly predictably. The aggressive plans recommended by AET have been largely implemented and ICN's reputation for excellent service has been achieved.

- (c) Once underway CMS made competitive procurement of circuits and equipment difficult and slow, which diverted far too much of ICN's management effort to overcoming this barrier to success. Indeed, procurement improvement was cited in our initial report as one of the most critical problems for both implementation and cost control. ICN's recent procurements after increased independence from CMS has led to major cost reductions which have been made available to clients and CMS alike. For the first time, through ICN, the state has begun to recognize the benefits of treating the communications services market as diverse and highly competitive. Most of the commercial complaints about ICN are directly related to its impact on pricing and profit margins.
- (d) For over two years ICN has been on the path to long-term quality and cost control through the acquisition of dedicated fiber to replace far more expensive circuits. The duration of this effort and the diversion of important management attention are directly related to CMS behavior.
- (e) In addition to the problems directly connected to education, I recognize that many concerns stem from the outdated computing and communications systems on which the state depends for its operations. ICN may well be seen as a quick fix for some of these. The concern is that this not be done at the expense of changing ICN's mission and effectiveness.

With the five broad problems identified above, any integration of ICN with CMS needs to be handled very carefully. There is new senior management at CMS and the Bureau, but many of the staff who live by the past traditions are still in key roles. Their experience is largely with the CMS approach, and their role in any integrated approach should be carefully managed. While I feel there are good reasons not to go ahead with such integration, the AET did identify the critical conditions that should be put in place if such a move goes forward. I concur strongly with these.

1. ICN should be kept intact as a unit for at least two years, with its current priorities for client groups. Every effort should be made to retain the current staff and management in whom there is great confidence. During this period, ICN's Director should report directly to the Director of CMS.
2. The governance of ICN should continue to be in the hands of a strong Policy Board, which should be made more closely connected to the clientele through appointing members from institutional clients.
3. Any redirection of currently appropriated funds away from support of the primary clientele should get at least a one-year notice and provide for a transition period.
4. In planning the overall transition, consideration should be given to moving all of the state's wide area communications into the unit started with ICN. This should include voice, video and data networks.

Illinois is unique in the degree to which it has served a diverse clientele, most of whom can chose alternative vendors if they do not find the ICN attractive. While ICN does represent a state subsidized service, they could find alternative forms of organization which would allow them to be the beneficiaries of the combined buying power that now benefits all of the public sector. Some, such as large metropolitan governments or school districts, are in extremely competitive markets and are able to leave ICN without enduring any financial hardship. This loss would decrease both the cohesiveness and the buying power of the ICN, and raise costs to all other clients. Similarly, the attractiveness of the state network for the health care industry and others will be greatly diminished if ICN becomes a less responsive organization. It would be too bad to lose the momentum with these groups and with an increasing number of municipal participants, and lose the opportunity to advance communications for homeland security.

I have truly enjoyed my relationship with the ICN, from the outset of planning six years ago to the successful implementation of an excellent network. The ICN management team and staff have brought this project through adversity in the past, and I hope this success will continue. I would be happy to discuss any of these issues.

Sincerely,

George F. Badger, Jr.  
AET Chair 2000-2003

The Illinois Century Network (ICN) is one of the most successful and well-received programs that state government has ever operated. Within its first few years it has connected most of Illinois' schools and colleges to the Internet, as well as providing access for museums, libraries, and an increasing number of municipalities and hospitals. Our ranking among the states has risen to the top for both educational networking and for electronic state services. This first phase of achieving connections has made future opportunities extremely attractive in areas of the state not currently well served by education, healthcare or information services.

While ICN is operated within state government, with the oversight of a Policy Board appointed by the Governor and currently chaired by the Governor's Chief Technology Officer, it has successfully engaged its major constituents through advisory groups. The Advanced Engineering Taskforce is drawn from institutions and municipalities that are served by ICN, primarily from those with demonstrated leadership within their sector. This includes several people who have been involved in the development of the Internet from its beginnings. Included are members from school districts, all levels of higher education, museums, libraries and municipalities. Many of the members were involved in developing the proposal which eventually resulted in ICN's creation.

ICN is very unusual in that it has brought together programs from all levels of education, both public and private, into a single network. In most states there are separate organizations, and much less strategic planning. Most of ICN's public sector constituents are under primarily local governance, but the success at making this a constituent based organization has kept their view of ICN very positive. ICN is essential to a number of other state funded education projects such as the Virtual High School, the network of libraries (ILCSO) and the Virtual Campus.

ICN does not own telecommunications facilities, but is a large customer of the multitude of telephone companies in the state. The majority of the ICN budget is used to lease circuits and purchase networking equipment. It assembles these commercially available circuits and equipment into a network that ICN operates for the benefit of its members. In addition to traditional telephone companies ICN will be working with cable television companies for some local connections, and with the emerging wireless communications companies to serve less populated areas. The latest initiative, which is critical to controlling costs despite traffic growth of more than 100% per year, is to lease dedicated fiber for the central core of the network. Once in place this will support many years of growth and collaboration with the most advanced national and international networks. Illinois, primarily through the Chicago area, is the US interconnection point for much of the European, Asian and South American traffic reflecting both the history of Illinois as a national communications hub and Illinois institutions role in the development of the global Internet.

The Internet, and ICN as the provider for much of the public sector in Illinois, has the potential to help many people gain access to important services. It is particularly critical to those who live in areas which are also underserved by healthcare and education, and where government services are inconvenient to reach. These areas are typically very rural and/or have high poverty levels. They are not sufficiently attractive to utilities such as telephone and cable television to attract investment necessary to provide new services. These areas should be a continuing target for state funding and ICN attention. Some of the greatest opportunities for Illinois use of Internet services are in these areas.

The driving force for the ICN legislation was education, and ICN has connected the vast majority of educational institutions at all levels. Intended uses went far beyond simply connecting to this information resource, and included the ability to deliver courses when and where they are not normally available, such as introductory calculus in high schools where there is no local teacher available. Other examples include making job training available online, offering continuing education for those already employed but needing updated skills, and offering high school and college education to those who cannot attend regular classes. The latter range from prison inmates to the homebound, as well as many who must balance education with full time employment. A vast amount of material is becoming available, and the state should focus resources on access and promotion of such programs. The major suppliers of material include both educational institutions and the libraries and museums that are also participants in ICN. Organizations as diverse as Cooperative Extension, the National Center for Supercomputer Applications, the Illinois State Museum, and the Art Institute of Chicago provide heavily used material.

Healthcare is one of the areas where Internet capabilities are becoming very important. Collaboration of medical center specialists with rural providers can make diagnosis and treatment in rural areas both more timely and more skilled. One example where there are already success stories around the country is in treating burns from accidents and fires. This requires highly trained specialists who are available only in major medical facilities. Training of medical technicians and professionals is a process that continues during employment, and both community colleges and medical centers provide such courses. Illinois has several advanced medical centers that can use ICN to support such services. We can attract federal funding aimed at both rural medicine and other digital divide opportunities. For both education and healthcare, the bandwidth of ICN to these more rural areas needs to be greatly increased.

Security services, emergency response, and coordination of organizations can be enhanced with networked communications services without significant cost. As the municipalities and state agencies are attached to the network, they can develop effective models to communicate and share information sources, forming temporary clusters for dealing with specific problems. Most federal agencies are already accessible via ICN's attachments to the national Internet

services that are highly reliable and have redundant paths. This is an area where performance can be greatly enhanced within existing funding.

Various state agencies are moving towards Internet delivery of both information and transactions. The potential is there to reduce cost by moving more of these functions online, and by consolidating delivery of multiple services via a consolidated site with access to all state agencies. In addition to controlling costs, the service to the citizen is improved in both timeliness and convenience. Many services can be delivered using home computers in addition to public access locations in libraries and government offices.

The most difficult issue for ICN and the state to deal with is economic development based on Internet services. In many areas there is a robust and competitive market among service providers. In other areas, both in the inner cities and in more rural areas, there is a total abrogation of the American tradition of universal availability of services. With the exception of the federal program known as e-rate, which subsidizes poor areas educational communications, there is no commitment to making all geographic areas able to grow in the new economy. This is not just a burden for ICN to face, but an opportunity that state government can attack to assure the future of the state and all its citizens. While the state should simply provide a good environment for development for areas where there is adequate competition, it should develop a policy and financing strategy to provide equitable opportunity in those areas which will not otherwise flourish.

ICN has had very favorable impacts on the economics of networking for its clientele, and on state telecommunications costs. The most obvious is that the state appropriated funds of approximately \$25M, which help cover the costs of the broad infrastructure. Beyond this, however, the impacts are even larger. Though its consolidated purchasing power ICN has been able to get much lower costs from telecommunications companies, and drawing on the AET familiarity with the competitive nature of the market has done far better than traditional state procurements of these services. This has fed back into some lower costs for other state organizations. ICN has also consolidated the procurement of circuits paid for by member institutions, getting both better pricing and more rapid delivery. More recently this has been expanded to include some of the equipment used in the network. Taken together these efforts have helped avoid major budget increases despite very rapid growth in capacity. The ICN budget is a small fraction of the total networking costs of its clients, but has had a disproportionate impact on keeping those costs under control.

What is needed to continue the success of ICN is the same as what has been critical during the initial phase. The relatively independent organization with constituents involved in planning and governance is essential. Focused goals and the ability to move rapidly towards them depend on both the organization's leadership and its ability to conduct independent purchasing

and contracting. ICN is a good place to work and has been able to attract and retain a very competent staff, and this too depends on their ability to carry out plans in a timely fashion, consistent with the rapid development of Internet technology and use. Finally, the clarity of the educational and service mission and support of that mission at the highest levels of state government is essential. With this continuing support, ICN can help Illinois provide all its citizens with greater equity in education, health care and government services. Establishing an active role in economic development can add to that success.

This is the third year of operation for the Illinois Century Network Advanced Engineering Taskforce, a group drawn from the clientele of ICN. The AET advises ICN management on issues of emerging technology, opportunities in the market, and the most likely areas for demand growth. We also review policy directions when requested by the management.

In an area developing as rapidly as networking, there is a tendency to take successes for granted and to focus on what needs to improve or on new opportunities. Lest we do that we would like to report our continuing pleasure at the progress ICN has made with both its general mission and with our past recommendations, including these highlights:

- 1) The ICN is operating a highly reliable network that is coping well with the rapidly increasing levels of digital information. The addition of a network operations center that operates 24 hours per day will help to continue this essential service and improve its reliability.
- 2) ICN has been very successful in exploiting the falling prices of essential network resources such as large capacity circuits, and using its bulk purchasing power to reduce the costs for many of its constituents.
- 3) The ICN service to support content filtering has offered an economical and convenient alternative for school districts which require it, including all public schools.
- 4) The ICN has provided a base for future growth of video distribution by implementing key technology not usually provided by commercial Internet providers, such as multicast. The transition of the video education network to Internet technology is progressing and will result in both economies and broader availability of courses.
- 5) ICN has enhanced cost-effectiveness through reallocating staff from the process of connecting additional schools to the operations center and other tasks, establishing an important precedent of using existing budget on the most critical efforts.

In our interim report emphasizing the important issues during a transition to a new administration, we pointed out that the ICN's accomplishments to date create a solid foundation for great future opportunities for the state's educational systems and the Illinois economy. ICN is an infrastructure that enables many uses, and the ICN can be the organizer of some of these. In most cases other organizations must be the ones to identify and exploit the opportunity. For example, rural medical services can be provided over the network, but the provision must be initiated by medical centers. Similarly, services of state agencies can be made available, but the agencies are responsible for the content.

## EDUCATION RELATED ISSUES

From the outset, ICN has been viewed first of all as a means to make networked education available and to enable Illinois students to have access to the rich resources of the Internet. Much progress has been made in this arena, but there are at least three major areas in need of improvement. First, the educational materials such as online courses, resource material and course development assistance must be available. Second, the bandwidth and responsiveness to the end user must be improved in connections to school buildings. Third, there must be a general availability of good access from students' and teachers' homes, since that is where much of study time is spent.

Educational material is obtained through a combination of acquiring and customizing already available materials, and by individual teachers creating new online materials. Both require an investment of time and some expense, neither of which is generally available to either K-12 or community college teachers. In both cases the normal workload of directly teaching classes consumes all of their available time. This is the case despite recognition among many school leaders that online courses are important to their institution's future. The education boards should undertake a selective program that enables some development and increase that investment if the results prove worthwhile. ICN should also be heavily involved in training the local technical staff in support required and in helping organize teacher training. ICN can also assist by operating content servers and by licensing for resale the critical commercial software packages where there is enough aggregate demand to generate steep discounts.

In our last report we identified the need to increase bandwidth to schools which want to receive online education for their students. Last year that was in anticipation of need. This year we restate the need but report that it has now become immediate in that current inadequate capacity is blocking efforts to use such material. That is, already available material for which there is an educational demand cannot be delivered because of inadequate bandwidth between the ICN backbone and the local school building. This need will increase rapidly now that some important material is available, but too little early success has the potential to kill off interest. The cause of inadequate bandwidth is sometimes the expense of upgrading, but it is also the case in some areas that upgrades are not available at any price. ICN has been very successful at reducing prices where services are available, but not yet at increasing their availability. This is one aspect of the digital divide where ICN and state government should play a key role. We feel this should be a primary goal of the ICN program.

As more educational uses of the Internet begin to take hold, the third of our concerns will become critical. Increasingly, students and teachers will use network resources from home. This has certainly been the established pattern for college students ever since widespread ownership of personal computers became a fact of life, even when home network access depended on slow phone modems. The majority of students live in

homes with personal computers, and with at least dialup access. Unfortunately, this is not yet nearly 100%, nor do most homes have access to communications beyond about 30kbs. This is the maximum delivered speed over most telephone circuits with old wiring. While the Federal Communications Commission estimates that over 80% of American homes could purchase broadband services (200 KB or greater) in fact many fewer do. The fact that they are near a telephone office or served by cable television or wireless is not a real indication of penetration. In areas of low income, low population density or low historical interest in technology, the availability and purchase of such services is almost non-existent. It is not clear whether federal initiatives to cross this digital divide will actually begin to make a change in this inequitable situation.

While ICN can have a substantial impact on each of these problem areas by wise investment in its infrastructure, and in cooperation with the education boards, it has not directed much attention to approaches that will address the digital divide and especially the home access issue. In both cases it is clear that demand for educational networking alone will not stimulate the investment in facilities which are needed. To attack these issues ICN needs to take a diverse approach. First, ICN can work with the Illinois Commerce Commission regulatory process to make improvements in the legal and business environment that better serve the public interest in educational networking. Second, ICN can work with prototype communities for joint investments that will bring alternative technologies into use and help provide for their interconnection to the ICN backbone. Third, ICN and its Policy Committee can work to allow selective cases of joint networking projects where the dual purpose includes both economic development and public sector access. In this third case, partnership with both a community organization and local communications companies is critical both economically and politically. Broader cooperation with municipalities, healthcare organizations and state government locations are all promising opportunities.

One area of growth that was not widely anticipated is use by municipalities. These units of government are increasingly finding ICN attractive, and are a good complement to the local schools and libraries in building a strong local base in a community. With their increased efforts at cooperating in security and law enforcement, network technology is central to improving effectiveness while controlling cost. ICN and its policy makers must be careful to retain the confidence of this group regarding both service quality and responsiveness.

ICN cannot take on some of these missions without the endorsement of the political leadership. Its track record of building partnerships, operating in a very cost-effective manner, and providing a commercial grade of service make it attractive to help ICN to provide this support of the economic future of the state.

## ENCOURAGING CONTENT PROVIDERS

The AET was invited to comment on strategies for dealing with content providers who will have increased costs if Illinois education uses their material. An example is the Art Institute of Chicago (AIC), which has developed a great deal of material consistent with the curriculum of schools in the state. If this is widely used, then the additional bandwidth to AIC will be taken up with providing this service and their costs will be increased. In this case there is no offsetting charge for use of the material which could pay those costs. Another example is colleges offering online education. In this case there is an income from the tuition and we feel that one legitimate use of this income is to cover additional bandwidth costs.

We have not been able to establish very general principles to guide ICN policy, but we do have interim suggestions. First, the content involved needs to relate to the mission of ICN and its clients. Second, if there is a direct income the costs should largely be covered by the providing institution. Third, ICN should work to reduce the cost of providing materials as a barrier to developing and making them available. In order to move ahead we suggest that ICN establish a review panel and solicit proposal from potential providers. There are several alternative forms of support ICN could offer, including providing server space at a backbone location or subsidizing the increased bandwidth to the content provider's server location. As proposals are reviewed and initial projects undertaken, policy should be developed around what is learned and criteria for the duration of support can then be defined.

It is also likely that licensing commercial content can be made more economical by providing centralized servers and negotiating statewide licenses. Terms such as home use of licensed educational material are also likely to be more flexible with such centralized control. Potentially, the ICN's library constituents could play a role in developing this area.

## TECHNOLOGY AND THE DIGITAL DIVIDE

In order to provide services throughout the state, it will be necessary to exploit the full range of technical solutions available. Wireless systems are becoming increasingly practical as are non-traditional approaches such as transmission of data over the electrical power grid. Even with this increased capability being available, ICN cannot generate enough demand in some areas to cause services to be available, and should not be dependent on solutions that only serve the public sector clients. ICN needs to find partners who will make these investments in new areas, create incentives, and work cooperatively with them. An example would be a partnership with a company providing local services but having no reasonable means of connecting the local service to a backbone provider. In exchange for the company initiating the local part of the service ICN should be allowed to exchange some of their long haul backbone capability. As the

market develops and commercial solutions can be depended on, ICN should create a transition plan accommodating open competition as the long-term solution.

Wireless technology is developing rapidly and addressing many of the concerns that have made it unattractive in the past. ICN should be setting up prototype areas of service using wireless technology for local distribution, either in partnership or on their own.

ICN has not worked extensively with cable companies and should seek them out for both their local facilities and their wide area distribution systems. Cable modems are the dominant form of residential services at the low end of broadband (200kb to 3mb), and offer good opportunities for distribution to schools and libraries in many areas. The service required is somewhat different than residential services, particularly in the amount of traffic actually generated per connection, and ICN should initiate partnerships in a small number of areas. In some cases the cable operator uses a corporate fiber network to reach the local community, which also could serve as the connection method to reach the ICN backbone. This presents an opportunity to bypass the slow development process of small town telephone companies. Cable access is a major element in the FCC argument that much of America has access to broadband, and ICN needs to take advantage of this option.

Electrical utilities are emerging as an interesting participant in Internet services. There are examples of local service distribution through the power grid as well as use of power company poles which can support aerial fiber over long areas. Rural electrical cooperatives are particularly rich opportunities.

It is clear that a comprehensive coverage of all areas of the state will require a mixed media approach and some cases state or local financial incentives will be needed. ICN can serve as the focus of organizing such efforts, and in seeking federal funding such as that provided by the "Rural Utility Services" program to promote Internet access in small towns and rural areas.

## PRIVATE FIBER NETWORK

In our past reports we have emphasized the importance of ICN obtaining dedicated fiber access for major portions of the backbone. We reiterate the importance of getting this completed as quickly as possible to isolate ICN from increased costs associated with growing traffic. We also feel that the market is about to change as more of the communications companies which own the fiber already in place rethink their willingness to sell dedicated use of fiber. Their preference will be selling more expensive bandwidth services. ICN has offers in hand and the basis for completing the negotiations, but this opportunity may well vanish if not brought to a conclusion in the near future.

The portion of the network which can be served by currently available fiber represents one major portion of ICN's circuit costs, and capping these costs through long term contracts can do a great deal to protect ICN's ability to provide service in the face of the current economic hard times. To fail to follow through on this contracting will cost the state far more in the long term, although it might offer short-term cash savings.

We are pleased with the progress ICN has made in selecting the equipment and fiber vendors to implement dedicated fiber, and in gaining the staff knowledge critical to its implementation. We are disturbed at how long it has taken to reach this point on such a high priority issue which has occupied so much management and staff attention. We are also disturbed at the lack of aggressive cooperation from other state agencies in exploiting fiber already under contract, but sitting idle because it was not made available to ICN.

## COMMUNICATIONS TECHNOLOGIES CONVERGE

One of the most interesting developments in the evolution of communications services is the use of Internet technology as a means of providing telephone services. Known by the name of "Voice over IP" (VoIP), this approach uses the same methods of transmitting information that is currently used for Internet video, email and web services. The objectives are manifold, but include the huge conservation of bandwidth by compressing sound into digital form and not using bandwidth to transmit silence and the greater reliability of packet switched networks. Many corporations are using VoIP in their private phone networks serving sites worldwide. Phone companies are also using this technology within their networks. The AET had several discussions of the role VoIP might play for ICN clients and concluded that at the present time there is not enough traffic between them to justify implementation. A second popular use of this technology is to provide access to the long distance network at points of favorable economics, bypassing local exchange carriers and avoiding that substantial part of long distance tariffs. Again, we did not find enough traffic to justify the investment is probable. The most likely first governmental use of this technology would be in the telephone services for state agency offices, which do have a great deal of internal traffic.

There are currently several barriers to VoIP becoming an important opportunity for ICN clients. Many of the myriad added-value services in the telephone system are not readily available yet, and the interconnection to the public telephone system is still incomplete. Requirements for 911, service during power failures, and a host of things like call forwarding are not completely implemented. It is unlikely that simply replacing the telephone circuit will be enough. For this service to really become important outside large corporate settings it will probably have to offer much more capability than the telephone, including convenient conferencing and video, and get away from the telephone instrument as an integral part of the necessary equipment.

The convergence and redefinition which does seem to be moving rapidly is the emergence of a large set of communications based services emphasizing mobility and utilizing the wireless generation of telephony. Pagers, both simple and with enhancements for messaging, were early examples. Personal Digital Assistants (PDAs) are another example. The current generation of cell phones that include web and email access, paging, video reception and small embedded cameras, as well as traditional voice services, are becoming massively available. They depend more and more on Internet technology, and are becoming an integral part of the global Internet. This will probably be the driving force which compels telephone companies to finally embrace the Internet as their base technical approach for more traditional services as well. It is unclear how these devices will play a specific role in education but their role in students' lives and those of working adults is becoming very significant. The increased mobility of this basic form of access will also raise expectations for mobility in other devices such as personal laptop computers.

## USER REPRESENTATION

Over the past three years there has been substantial change in the activities of ICN Regional Technology Centers in dealing with user organizations, and continuing discussion of the most appropriate forum for user organized input. The AET commends the regional user meetings held this past year and the inclusion of this input in planning processes. We do, however, feel that it is extremely important to provide a regular forum for user input and to develop a process to integrate this input across the various types of constituent organizations and regions. There are very substantial differences in issues faced in rural versus urban, educational versus professional, and skilled versus beginning groups. We do not feel strongly that one particular way of organizing this activity is preferable, but hope ICN will initiate some regular practice that occurs more than once a year. We have suggested in the past that someone in senior management should be responsible for logistics and integration, and that individuals from a variety of organizations should be involved on a continuing basis. The AET model of overlapping terms and broad selection from constituencies is one workable approach.

As ICN moves into providing a broader range of technical support, including training, consultation, content filtering, network operations beyond the backbone, etc. the user representatives can be helpful in both setting priorities and in determining the most responsive design of the service.

## ICN AND STATE GOVERNMENT AGENCIES

One of the continuing and difficult issues the AET has dealt with is the relationship ICN should have with state agencies outside its primary clientele of education, libraries and museums. As ICN has proven successful at operating a highly reliable and efficient network, there has been increased interest by other agencies in using the network to access both state information systems and the Internet in general. The services of ICN are consistent with the approach and quality of large "corporate" private networks, and thus can be one major factor in modernizing the computing and communications approaches of state government's operating agencies.

By contrast to the education sector, state agencies generate little traffic on ICN and tend to be more concentrated in the major cities. Much more of their costs are in the metropolitan area and its interconnection to state information services. Certainly all agencies and other ICN clients should share these statewide portions of the network, but it is less clear that ICN should go beyond its backbone services and get into the design and operations of the more localized portion.

We feel that agencies should be encouraged to use ICN, and that state information services should become much more oriented to a network approach. We have always been concerned that integration will be taken too far and that ICN will lose its effectiveness on behalf of education and public service. Education should not be sacrificed in the name of a quick fix for the problems of state information services. Any integration of digital services should take place without adversely impacting the excellent services currently offered or planned by ICN.

## THE TELECOMMUNICATIONS MARKET

The market for all types of telecommunications services, with the single exception of local exchange, is both competitive and chaotic. The deregulation process has not come near to completion, and the convergence of service offerings has not yet occurred. Separate regulatory processes are in place for cable versus telephony, with little coordination despite increasing overlap in service offerings. In this environment there are two continuing imperatives for ICN. First, there is a tremendous advantage of being a service integrator, buying component services and equipment from a wide variety of vendors. Because of the chaos in the marketplace, it is critical to take opportunities to have multiple vendors whenever practical, and to constantly assess the market. Second, there is real potential to obtain favorable pricing for both ICN and its constituents, through the use of aggregated buying power and good procurement practices. ICN has done very well on this second front and has a good reputation for dealing honestly with vendors.

The costs of local loops, the segment of the network connecting client sites to the ICN backbone, represent a large expense item for ICN clients. These circuits are provided primarily by the local exchange carriers throughout the state, of which there are dozens of small monopoly vendors and several large ones. ICN needs to continue to put pressure on local pricing and to continue its support of acquiring federal e-rate funds as long as they remain available. In addition, ICN needs to look at alternative carriers such as cable, wireless, and other utilities to create some amount of competition wherever possible.

ICN staff has documented the unreasonable variability in both prices and availability of circuits throughout the state. Even with the federal e-rate assistance, some areas still have high costs, and the future of e-rate funding is highly uncertain. The mixture of technologies and companies involved in providing Internet access ranges from electrical utilities through more traditional providers such as telephone and cable. Current regulation, and the current implementation of e-rate, does not apply equally to all providers and there is great pressure to make changes.

This chaos in the market makes it valuable to have a diverse group such as the AET whose members also deal in many of the same markets as ICN and who are independently aware of best prices and services. Much of the price improvement results from citing concrete cases of the best available pricing elsewhere.

While there has been a continuing expectation that regulatory issues would be resolved, the record is not good. Until that occurs, the advantages of private networks will continue and ICN should continue its role as an integrator/operator. At some time in the future it may become practical to buy integrated services from network operators, but that is not something which can be outsourced in present circumstances.

As ICN moves forward we wish you continued success.





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