Approved: March 22, 2000 *Carl Dean Holmes*
Date

MINUTES OF THE HOUSE COMMITTEE ON UTILITIES.

The meeting was called to order by Chairman Carl D. Holmes at 9:11 a.m. on March 1, 2000 in Room 231-N of the Capitol.

All members were present except: Rep. Mary Compton
Rep. Tom Klein
Rep. Margaret Long
Rep. Gene O'Brien
Rep. Billie Vining

Committee staff present: Lynne Holt, Legislative Research Department
Mary Torrence, Revisor of Statutes
Jo Cook, Committee Secretary

Conferees appearing before the committee: Doug Heacock, Kansas Research & Education Network
Dave Nordlund, Kansas Research & Education Network

Others attending: See Attached Guest List

Mr. Doug Heacock, Executive Director of the Kansas Research and Education Network (KAN-REN), presented information on the KAN-ED network technology design (Attachment 1). Mr. Heacock stated that the network, put into service on behalf of schools and libraries, under the KAN-ED proposal must be robust, scalable, reliable, and manageable. He said that the current Internet 2 aspect of KAN-Ed was exciting and a potentially ground-breaking possibility, however, certain complexities in the routing environment must be handled properly.

Mr. Heacock stated that KAN-ED should create one backbone that would adequately serve the state's requirements, but not specifically a technology that locks into a specific hardware, software and bandwidth using a technology called Asynchronous Transfer Mode (ATM). ATM is well defined by industry standards and opens the door to a variety of solutions from a variety of vendors.

Mr. Heacock explained that, based on the past experience with the KANREN network, making a particular technology a matter of law in this process would be a mistake. Without flexibility, freedom to accommodate new technology suffers. Among the possibilities for acquiring backbone bandwidth were use of KDOT installed fiber and acquired high speed circuits from national providers. Once the backbone architecture is agreed upon and vendors selected, an implementation plan would be generated. This would include a survey of all school districts and libraries to determine which were truly ready for connection. Mr. Heacock felt this project could be completed within 12 months.

Mr. Heacock responded to questions from Rep. Sloan, Rep. McClure, Rep. Myers, Rep. Dahl, Rep. Alldritt and Rep. Holmes

Mr. Dave Nordlund, Director of Networking Services for KAN-REN, provided information about Internet 2 and the infrastructure of Internet and Internet 2.

Mr. Nordlund responded to questions from Rep. Sloan, Rep. McClure, Rep. Loyd, Rep. Holmes, Rep. Krehbiel and Rep. Dahl.

Meeting adjourned at 10:56 a.m.

Next meeting is Thursday, March 2, 2000 at 9:00 a.m.

HOUSE UTILITIES COMMITTEE GUEST LIST

DATE: March 1, 2000

NAME	REPRESENTING
Doug Heacock	Kansas Research & Education Network (KANREN)
Stan Parsons	Smoot & Associates
Mike Shilling	Manhattan, Kansas
Jim Williams	Manhattan, KS.
Ed Schaub	Western Resources
Bud Burke	Western Resources
Larrie Ann Lower	~~KAH~~ KS Govt Consulting
Chris Wilson	KGC
Doug Smith	State Independent Telephone Association
Alan Weis	KTEC
Duane Johnson	State Library
Jerry Niebaum	Regents universities
Janette Luehring	KCC
Walker Hendrix	CURB
Dave Nordlund	KANREN
Mike Falen	KPL

Kan-Ed Network Design Considerations
House Utilities Committee
March 1, 2000

Doug Heacock, Executive Director, Kansas Research and Education Network

Introduction

The technical design of a network on the scale of what Kan-Ed will become is a matter of great importance. Large amounts of money will be spent on the technology used to implement this network, and for this reason alone, the selection of the specific technologies is extremely important.

But cost is not the only important factor. In order to meet the goals of the Kan-Ed proposal, the network we put into service on behalf of schools and libraries must be:

Robust: capable of functioning properly under adverse conditions, which include high traffic loads, complex routing environments, carrier networks of variable reliability and stability, etc.

Scalable: expandable to whatever size is required to meet the needs of the connected community; by "size" we mean "capacity," or "speed," as well as the sheer number of connections. This involves not only having fast enough data circuits in the backbone, but also having fast enough equipment on the ends of those circuits.

Reliable: available for use virtually all of the time, except at scheduled maintenance downtimes. Unplanned outages are minimized.

Manageable: and specifically, *remotely* manageable. We must be able to do certain kinds of configuration and diagnostic tasks remotely (it's a big state). Included in this is the capability of network monitoring, around the clock. We must be able to determine the "health" of all routers on the network at all times.

What we have...

There are essentially two main large-scale network resources in the state at this time:

KanWIN (Kansas Wide-Area Information Network), which is the network that serves state agencies; and

KANREN (Kansas Research and Education Network), which serves colleges, universities, school districts, libraries, and other non-profit organizations.

Both of these entities operate state-wide backbone networks with similar capabilities. Both networks are designed to use the Internet protocols for data communication, and both employ the use of "core" routers located in certain geographical areas of the state as major points of connectivity to their respective backbones. Both networks have connections to Internet Service Providers and thus permit users connected to their backbones to have access to the commercial Internet. KANREN and KanWIN are also connected to one another, via a single T1 (1.5 Mbps) connection that is provided by the state to allow the Regents universities to have a more direct path for transporting human resources data to state offices. The routing on that connection is not complex, and neither KANREN nor KanWIN can use the other's external Internet connections, under the current configuration—it is a single-purpose connection at this time.

KANREN also has some additional capability by virtue of its relationships with the major Regents universities. The KANREN network is connected to the Great Plains Network for Earth Systems Science (GPN), which is a multi-state regional network that supplies inter-state connectivity, commercial Internet access, and access to Internet 2, a research-oriented, high-performance network under the oversight of the University Corporation for Advanced Internet Development (UCAID). Both the University of Kansas (including the KU Medical Center in Kansas City) and Kansas State University are members of the Internet 2 consortium.

The KANREN/GPN/Internet 2 connection is important to Kan-Ed, because under recent UCAID policy revisions, Internet 2 access can be granted to any educational institution, if authorized by an existing UCAID member university, provided there is a connection of some type to that institution.

The Internet 2 aspect of the Kan-Ed picture is an exciting and potentially ground-breaking possibility, but it also introduces certain complexities into the routing environment that must be handled properly. For this reason (among others), it is extremely important that the Kan-Ed backbone architecture be designed with great care. UCAID is fairly particular about who uses Internet 2, and this requires that special measures be taken to insure that commercial Internet traffic and Internet 2 traffic be kept separate.

...and what we want

At this point in the development of network technology, and for the foreseeable future, there is essentially one backbone technology that will adequately serve the requirements noted above, but it is not a technology that locks us into specific hardware, software, or bandwidth solutions. That technology is ATM (Asynchronous Transfer Mode). The use of ATM as the primary backbone network technology meets all of the criteria noted above, but does not place any undue restrictions on the selection of equipment, the choice of bandwidth providers, or the choice of Internet access providers.

In fact, ATM is well-defined by industry standards, and opens the door to a variety of solutions from a variety of vendors. ATM is easily scalable—lower-bandwidth backbone circuits may be replaced with higher-bandwidth circuits, and the various ATM switches can be upgraded and configured as necessary to accommodate higher speeds.

ATM is also in use on both the KANREN backbone network and in the Great Plains Network.

What we don't want

We would encourage the various legislative bodies who have a stake in all of this to consider one very important thing: it would be a mistake to make a particular technology a matter of law in the process of creating Kan-Ed. Our experience in designing the KANREN network is useful here:

When the network design team, primarily at KU, began talking about KANREN in 1992, there were certain limitations of cost and technology that made high-speed connections for member sites nearly impossible. At the time, our only real choice for connecting sites in all parts of the state was dedicated data circuits, which were expensive, and distance-sensitive in cost. As a result, the maximum connection speed to the KANREN backbone network for all but the very largest institutions was going to be 9600 bits per second. We did the design work and made the necessary financial calculations, based on the available technology, and that was the best we could do. (It sounds almost silly by today's standards.)

While we were still working on the design, Southwestern Bell frame relay technology was introduced into Kansas (it had been unavailable here before), promising much higher speed connectivity to the local sites for the same cost. Since our design team had the flexibility to respond to changes in available technology, we began investigating this new offering, and made the decision to include frame relay in our plans. It turned out to be the right decision.

Had that flexibility not been there, we would not have had the freedom to accommodate the new technology, and consequently our member institutions would have suffered for a period of time with inferior connectivity at a premium cost.

The Kan-Ed design process needs to have that same kind of flexibility. The industry upon which Kan-Ed will rely changes very rapidly. It is important that the Kan-Ed network engineers from KANREN and DISC be free to make changes in technological direction when it is clearly the right thing to do, and where it is in keeping with our overall design goals.

How this process might evolve

Initially, we anticipate that Kan-Ed will be born (in a technological sense) when KANREN and KanWIN are connected via a high-speed link, and when the necessary routing configuration is completed to allow proper routing of traffic among KANREN, KanWIN, GPN, the commercial Internet, and Internet 2. Existing backbone links in both KANREN and KanWIN will be inadequate as we begin connecting districts and libraries to the backbone core sites, and will have to be upgraded. We anticipate using frame relay for the individual district and library connections, simply because it is the only suitable technology that is available in every part of the state, and because it is still a viable technology. As other options become more widely available (including xDSL), we would anticipate utilizing those technologies, where it makes sense, and where the cost savings would be significant.

There are several possibilities for acquiring backbone bandwidth, any of which would be technologically feasible, but some of which may be more reliable and/or less expensive than others. One scenario involves the use of bandwidth obtained in the KDOT fiber installation. Another involves simply purchasing high-speed circuits from any of several national providers.

Early in the process, KANREN and DISC engineers will need to discuss in great detail the routing environments in their respective networks, and come to some agreement concerning the use of advanced routing protocols to insure that Internet 2 routes are not "leaked" to the commercial Internet (this is an important proviso of KANREN's relationship with GPN and Internet 2). In addition, a plan for backbone bandwidth expansion and implementation will have to be developed, because neither the KanWIN backbone nor the KANREN backbone is capable of handling all of the Internet traffic that will be generated when the district and library connections are in place.

After the first iterations of the backbone architecture design, we would anticipate a bid process for various parts of the backbone, possibly including a variety of vendor presentations for the engineering team. The final stages of the design and the implementation would naturally have to be conducted in close cooperation with any vendors who were selected in the bid process.

Management of a network can make it or break it, so to speak, and early on in the process, we will have to make some decisions in this area. Existing DISC network operations center (NOC) facilities will have to be evaluated to determine whether they are adequate to take on more than 600 additional sites. Monitoring a network of this size is no small task, and whether existing monitoring tools are capable of operating at this scale will have to be determined. If not, new solutions must be explored. This is not an insurmountable task, but

Once the backbone architecture is agreed upon and vendors have been selected, an implementation plan (or project management plan) would need to be generated. A survey of all school districts and libraries would be conducted to determine which districts are truly ready for a connection, and which are not (for a variety of reasons, including inadequate local- or wide-area network infrastructure). We would anticipate that backbone modifications and upgrades would come first, followed by a tiered schedule of individual district and library connections. It would seem reasonable to project that the entire process could take place within 12 months.