

# Merit News

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## Merit Fiber Is Now Operational

Over three years ago, Merit's Board of Directors began exploring the use of controlled fiber for Michigan's Research and Education community. The Board quickly realized the benefits and approved Merit's pursuit of controlled fiber within the backbone.

A primary benefit of controlled fiber is future cost control. As long as a network is dependent on leased circuits (with their associated metered rates), its costs will increase linearly with bandwidth growth. However, with controlled fiber and Dense Wavelength Division Multiplexing (DWDM) technology, available capacity can grow exponentially for minimal additional cost.

More important than cost control, however, are the engineering options provided by controlled fiber. While users of a leased network are dependent on the network provider for upgrades and enhancements to a shared infrastructure, organizations with controlled fiber can increase capacity and deploy new technology at their own pace. For research and education institutions, this is critical, as their users often require new applications well in advance of commercial availability.

Merit has made significant progress in our goal of deploying controlled fiber throughout the backbone. Merit's backbone links in southern Michigan are now supported by two diverse fiber paths from Detroit to Chicago. The first path runs through Ann Arbor and Kalamazoo; the second route is through East Lansing and Grand Rapids (see map inset).

These southern fiber routes are a part of Michigan Lambda Rail (MiLR), a collaboration of Michigan State University, the University of Michigan, and Wayne State University. These Merit founding Members acquired dark fiber between Detroit and Chicago, interconnecting their institutions and terminating at the "StarLight" facility in downtown Chicago. The fiber has been "lit" utilizing optical equipment capable of providing up to forty 10 Gbps wavelengths. Through a competitive RFP process, the universities selected Merit to operate and manage MiLR on their behalf.

In addition, the MiLR Members have designated Merit an "equal operational partner" and have allowed Merit access to this resource to benefit the wider Research and Education community in Michigan. Merit has subsequently installed 10 Gbps switches at Detroit, East Lansing, Ann Arbor, Grand Rapids, Kalamazoo, and Chicago. As a result, Merit's core network capacity has increased four-fold, and Merit will be able to accommodate our Member and Affiliate bandwidth growth very cost effectively well into the future.

In parallel with the MiLR implementation, Merit has independently acquired regional fiber rings in Chicago, Grand Rapids, Lansing and, most recently, Detroit. These rings provide critical network redundancy as well as enable direct fiber connections for many Merit Members and Affiliates.

Of particular importance is the Chicago ring, which provides redundant fiber connections to both StarLight and Equinix. StarLight, at Northwestern University, provides direct connections to key optical network research and development activities. These international Research and Education networking connections are now "one hop away" from Michigan. In addition, through its co-location at Equinix, Merit is able to establish peering relationships with national and international service providers, increasing network efficiency and reducing costs.

The extensive efforts of Merit, the MiLR partners and other Merit Members and Affiliates to implement this controlled fiber infrastructure, highlight the collaborative perspective these organizations share. The entire Merit community will benefit well into the future from this cooperative spirit. Merit looks forward to the exciting opportunities this and other collaborative activities will enable.

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*Mike McPherson,  
Interim President and CEO*

I was deeply honored when the Merit Board of Directors asked me to take Merit through its current leadership transition. I have been a happy Merit user since arriving at MSU in 1974, and have been deeply involved in networking issues at both MSU and Michigan.

Eleven months have passed since I assumed this role; it has been everything I thought it would be, and more. Merit is a great organization with a stellar history of innovation in networking. Assuming responsibility for carrying that legacy into the future is a daunting and humbling task, but an opportunity which I am delighted to have been given.

No doubt about it, Merit faces difficult challenges. The telecommunications world has changed, and basic Internet connectivity is available from a variety of commercial sources at prices driven by scale and market competition. Use of Merit's statewide dialin network is declining as more and more people have access to DSL, cable modems, and other broadband connections at home and when traveling. At the same time, the economy of the State of Michigan stubbornly refuses to recover, putting Merit's Members and Affiliates under tremendous financial pressure, pressure which Merit feels acutely.

At the same time, Merit and its Members and Affiliates are rich with opportunity. The Michigan Lambda Rail (MiLR), a collaboration between Michigan State University, the University of Michigan, and Wayne State University, is up and running, with Merit providing the operational staff and expertise. As planned, Merit is shifting its southern Michigan backbone traffic to a 10Gbps wavelength on MiLR, a move which will provide much-increased capacity at dramatically lower cost.

In May, we closed on financing for the next phase of Merit's backbone upgrade, the mid-Michigan fiber backbone (or Blue Line). Merit staff are working to acquire fiber and equipment to put the Blue Line into production as quickly as possible. In preparation for Blue Line production, we are working with organizations near the fiber paths to connect them to the fiber network, providing as many Members and Affiliates as possible with the speed, reliability, and economic benefits of an owned fiber network.

We continue to work to find creative ways to extend fiber to the underserved northern lower Michigan and Upper Peninsula. Discussions about peering fiber networks are also under way with research and education networks in neighboring states and provinces.

Finally, Merit is returning to its roots as a collaborative, consortial organization, one whose strength is drawn from the collective talents and creativity of its Members and Affiliates. You should expect to see a higher level of engagement between Merit and your organizations, more activities designed to build communities of interest among Members and Affiliates (such as the recent, highly successful Disaster Recovery Summit), renewed vigor in research and development, and increased collaboration between Merit and Internet2 now that we are collocated in our new building. Collaboration and community are the unique value of being a part of Merit. We will do everything within our power to encourage and support our community.

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Merit's mission to enable and enhance world-class research and education is a great adventure and a noble cause. As we look forward to Merit's 40<sup>th</sup> anniversary next year, I am excited about the future I see.

I hope you are, too.

## Shibboleth Project Seeks to Simplify Access to Information

Imagine you are a faculty member at ABC University, which has a subscription to a set of databases offered by an information provider. You can use those databases without problem from your office, but when you're at home or on the road you can't get in: access is limited only to computers on the campus network.

Or, imagine that you are a student at Alpha College, taking a class offered jointly by Alpha College and Beta College. There is a set of materials for the class online, and it is protected by a password. Since the server is at Beta College, you need to apply for a Beta College userid and password, which are different from the ones at Alpha College.

These and other similar scenarios emerge frequently in education when users legitimately want to use the resources of another organization. [While most organizations can find ways to limit access to their own protected resources, issues become thornier when an organization wants to allow users from another organization to have the same sort of access, or to provide a way for its own users to access services operated by another organization.]

Current national efforts, chief among them the Internet2 Middleware Initiative ([middleware.internet2.edu](http://middleware.internet2.edu)), are working to build software and institutional agreements for guarding digital content while allowing efficient access to authorized users.

### A shared approach to a common problem

A desirable solution to the access problems described above would be to create a service that allows users to enter their credentials from their home organization to gain access to other organizations' resources. This would require the ability for the computing infrastructure of different organizations to pass user information between them, and for the organizations to establish a trust relationship. If these steps were accomplished, users would not need special credentials for access, organizations could easily establish new sharing relationships with other organizations and service providers, and users could gain access from anywhere on the Internet.

The Internet2 Middleware Initiative (<http://middleware.internet2.edu>) promotes the interoperability necessary for

allowing inter-institutional authentication, and has developed a number of supporting software tools. Shibboleth (<http://shibboleth.internet2.edu>), an open-source software development of Internet2 and other partners, is middleware tailored to solving the problem of sharing resources among institutions.

With Shibboleth, an organization that has users and provides them with login credentials (an "identity provider") runs a Shibboleth server on its end to provide a link to the organization's store of userids and passwords. An organization that has a service it wishes to protect (a "content provider") runs Shibboleth as a gateway to its resources.

When trying to gain access to a Shibboleth-protected resource, a user first tells the content provider site which institution he or she is from. The user is redirected to a login screen hosted by

*Continued...  
See "Shibboleth" on page 7*

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## AccessMerit: A New Dial-in Option

Merit is pleased to announce a new service that may help organizations that face challenges in providing dial-in service for their users.

AccessMerit is a new service that helps organizations provide high-quality, low-cost dial-in Internet access for their users. The service is designed to serve institutions that want to support their users' access to the Internet but are unable to fully subsidize off-campus service. AccessMerit dial-in accounts are available only through the sponsorship of organizations, and are paid for by individuals that wish to use the service.

With AccessMerit, users visit a Web site where they verify their current association with a sponsoring organization.

After that step, users are able to establish an account, select a userid and password, and pay for the number of months of service they wish to purchase. All transactions are conducted online via credit card payment. Users are notified by email as their accounts approach expiration, and repeat the online verification and purchasing step to renew their accounts.

With an AccessMerit account, users are able to connect to any of the 170 local dial-in Internet numbers that Merit operates in Michigan, plus New York City, Washington, DC, and Windsor, Ontario. A standard account includes 200 hours of access per month, which equates to "unlimited" for most users. Accounts also include helpdesk service via a toll-free number.

AccessMerit is built to allow customization to suit organizational needs. For example, sponsoring organizations can choose to subsidize users' accounts in order to lower the price users pay. Organizations can also purchase accounts outright, as a means of providing remote access for staff members who must access services from off-campus.

AccessMerit accounts have a typical base price of \$8.95 per month for a twelve-month account purchase, with three- and six-month purchases available for a slightly higher price per month.

Organizations can learn more about AccessMerit by contacting their Merit support team.

*--Andy Rosenzweig*

## ProQuest, Internet2 and Merit – Extending Access to On-line Content via Distributed Authentication

ProQuest Information and Learning creates and publishes databases for libraries and educational institutions, providing global access to one of the world's largest online content repositories. Students, faculty, researchers, and library patrons use ProQuest's subscription-based service at thousands of schools, colleges, and public libraries of all sizes in the U.S., Canada, and more than 100 other countries.

In January 2004, ProQuest became a Merit Affiliate and an Internet2 Collaboration Site in order to join with the Internet2 community to develop new access technologies for distributed content providers. In particular, ProQuest is participating in the Internet2/MACE Shibboleth pilot project.

The Shibboleth system is geared for users who need to share secured online services or provide access to restricted digital content. It offers a powerful, scalable, and easy-to-use solution, leveraging campus identity and access management infrastructures to authenticate

individuals, and then send information about them to the resource site. The resource provider is thus able to make an informed authorization decision regarding each user.

Because only information (attributes about the person requesting authentication) is exchanged, the Shibboleth system allows institutions with different technology architectures and security systems to easily collaborate without using proxies or managing thousands of external or transitory accounts.

From anywhere in the world, users authenticate at their home campuses and those institutions pass information (attributes) on each user's behalf to the resource provider. Users don't need to remember multiple passwords for each restricted site to which they have access and may access the site with full anonymity.

Shibboleth is thus ideally suited for applications like the ProQuest online databases. Users around the world can authenticate within their own campuses and access the ProQuest database without additional logins, while ProQuest is able to rely on the local institution for user verification.

Over the past year, ProQuest, in conjunction with University of California-San Diego (UCSD) has completed internal prototyping of the Shibboleth target component, and now has a functional implementation in its corporate environment. ProQuest will continue to work with UCSD to implement a pilot, and plans to add additional universities to its Shibboleth pilot in 2005. ProQuest hopes to provide Shibboleth functionality to clients after the pilot phase is complete. Full implementation of Shibboleth by ProQuest will be another excellent example of how educational/corporate partnerships continue to advance networking technologies.

*By Jennifer Hensley*

*For more information, please visit <http://shibboleth.internet2.edu/> or <http://www.proquest.com/>*

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## Merit uses Arbor Networks' Systems for Network Analysis

Merit's Operations staff use Arbor Networks' ([www.arbor.net](http://www.arbor.net)) Peakflow-DoS application to detect distributed denial of service attacks (DDoS) and other destructive traffic patterns such as worm activity and compromised PCs that continuously transmit data. Presently, Merit Member attachments are routinely monitored. Merit engineers will also use Peakflow-DoS for Affiliate sites that are having persistent DDoS problems to aid in problem resolution.

The Peakflow-DoS system regularly sends simple network management protocol (SNMP) traps to the Merit Network Operations Center (NOC). The NOC uses this information to help

determine if a network outage or degradation is caused by a DDoS attack. Additionally, the Merit Operations group receives and reviews email summaries that indicate compromised hosts on Members' intranets.

Merit is also testing Arbor Networks' enhanced platform, Peakflow-SP, in network engineering applications and troubleshooting routing problems. A portal function has been added to Peakflow-SP to allow Merit Members and Affiliates access to a subset of Peakflow-SP capabilities. The portal restricts the viewable data so that a Merit Member or Affiliate can only view DDoS alerts and subnet

statistics for their own subnets. Merit is currently evaluating and researching the requirements to offer the portal service to Merit's Members and Affiliates.

For more information or to participate in a beta Peakflow-SP implementation, please contact your Support Team at <http://www.merit.edu/mn/support/>.

*By Russell Dwarshuis*

*For more information, please contact your Support Team at <http://www.merit.edu/mn/support/>.*

## Cleveland Institute of Music (CIM) & Interlochen Arts Academy – Collaboration through High-Performance Networking

Pursuit of musical excellence has traditionally required travel of a pupil to study with an acknowledged master musician. In more recent years, it has also involved traveling to conferences, seminars, workshops, and summer sessions to refine techniques. Today, most of what could once only be accomplished via travel can now be easily accomplished through the use of high-performance IP networks. Merit is working with such specialized communities to show how an advanced network can positively impact their curriculum and research initiatives.

The Cleveland Institute of Music (CIM) is one organization that is using IP-based distance learning tools to become a premiere provider of music instruction, interdisciplinary programs, professional development programs and community service. The primary mission of CIM is connecting CIM's world class faculty with the world's most talented music students.

In Michigan, a great many of those students are found at Interlochen Arts Academy near Traverse City. Established in 1962 as the nation's first independent high school dedicated to the arts, Interlochen Arts Academy is the nation's top fine arts boarding high school.

For years, CIM and Interlochen had programs that sent many Interlochen students to Cleveland for instruction and exposure to music studies in higher education. However, the logistics of traveling, particularly for younger students, limited these activities.

The evolution of distance learning tools like IP-based video conferencing promised to remove the distance limits, provided the appropriate networking elements could be established. This was not a problem for CIM, who already had distance education programs.

For Interlochen, located in rural Michigan, the solution was more challenging. While the local cable company did offer

cable modem service, it did not provide the low latency and symmetrical throughput required for successful IP-based video conferencing.

Connecting to Merit at Northwestern Michigan College (NMC), Merit's point-of-presence (POP) in Traverse City, was an obvious solution. NMC agreed to host Interlochen students in their videoconferencing facilities. In addition, Internet2 loaned a high-performance MPEG2 codec and that completed the list of physical requirements, allowing CIM and Interlochen to plan a "proof of concept" master class session.

A preliminary test in April 2004 indicated that video and audio quality were unsuitable for conducting a distance education master class.

Laurie Kirchmeier, Senior Engineer, Merit Research and Development, worked with CIM and NMC to implement sophisticated end-to-end performance measurements. The investigation revealed minor issues on three distinct legs of the connection between CIM and NMC that resulted in minor latency and out-of-order packets. While not a quality issue for simple data transmission, this caused severe quality issues for the much more sensitive videoconference applications.

Following network equipment adjustments, quality improved dramatically. CIM and Interlochen decided to proceed with a prototype master class. Dr. David Cerone, president of CIM and a noted cello master in his own right took the role of master teacher on the CIM side. On Thursday, May 13, 2004, two of Interlochen's most promising string players made the short trip to NMC with their instruments as Merit, CIM, and NMC techs jointly monitored the link.

From CIM's perspective, the videoconference was a success. As the students played, Dr. Cerone was able to hear and see them almost as if they were in the same room. But, as he attempted to provide instruction using his own cello,



*This experience teaches much about how to continually improve high-performance networks to support the ever increasing demands of evolving curricula.*

it was apparent that return audio from CIM to NMC was of lesser quality and did not permit reciprocal audio clarity.

The cause of the uneven audio problem was identified as the use of two separate frame relay backbone links in Grand Rapids. Some of the packets from NMC were directed onto one T3 and some onto the other. Since the two T3s were not (and could not) be physically linked, they were not synchronized. While this is not an issue for typical data transmissions, it resulted in out-of-order packets that are not tolerated in an IP videoconference.

The link between NMC and Merit's Grand Rapids POP has since been re-provisioned as a point-to-point OC-3 circuit. With this single link, out-of-order packets are no longer an issue and the quality issues have been resolved.

CIM and Interlochen are some of the many pioneers in distance education using IP videoconferencing. Their experiences teach us much about how to engineer, monitor and continually improve high-performance networks to support the ever increasing demands of evolving curricula.

*By Jim Moran*

## The Ann Arbor Hands-On-Museum

In 1978, a group of devoted volunteers began converting an old brick firehouse into an interactive, hands-on museum for children of all ages. The Ann Arbor Hands-On Museum opened in 1982 with 25 exhibits on two floors, one staff person and ten volunteers.

During the Museum's first year of operation, it welcomed 25,000 guests. The visitors' interest and enthusiasm propelled the Museum to accelerate expansion plans. Through the generous support of grants and gifts from the Kresge Foundation, National Science Foundation and the Capital Campaign, additional buildings were purchased and unique and exciting exhibits were revamped and created.

Today, visitors can enjoy more than 250 interactive exhibits, each with a different focus to bring physics, geology, math, music and most recently, computing, more to life. Exhibits are designed to fulfill the museum's mission of providing an opportunity for people of all ages to discover and enjoy the wonder of science, math and technology in an interactive environment that promotes science literacy through experimentation, exploration and education.

But the experimentation does not stop at the museum's doors. In an ambitious effort to reach more students, classrooms can now visit the museum through the Museum's new Distance Learning program. Teachers and students experience live, interactive programs right in their classrooms utilizing videoconferencing technology to share science demonstrations and activities.

Museum staff have found that the success of the Distance Learning programs is directly related to the quality of the videoconferencing, which in turn, is directly related to the quality of the network connectivity. In order to best manage network quality, the Museum utilizes Merit Network and Internet2 for its Distance Learning program. Staff have found that connectivity through Internet2 provides the low latency and jitter necessary for quality live program demonstrations.



*Main entrance to the Ann Arbor Hands on Museum located in Ann Arbor.*

Based on the success of this program, the museum's education and exhibit staff continue to look for new ways to fully use and demonstrate the importance of networking and computing in today's world. Currently, "Ones & Zeros," the museum's first interactive exhibit relating to computing, is on display in the Michigan Information Technology Center (MITC) building exhibit area. In addition, the exhibit "Packet Traffic: Around the World in Eighty Seconds" shows visitors how email and other data travels the Internet. One can compose an email, represented by colored balls, click SEND, and watch as the email message zips through a maze of tubes and hubs, representing the Earth's telecommunication system.

These exhibits will serve as nodes on a large "educational network", demonstrating what the Internet does best. Wrapped in the design process of these exhibits is the development of a framework for the Internet Hall of Fame, to be displayed in the MITC. The intent is to promote technology career development and a look into the possibilities of the future.

The Museum's efforts are benefiting from much appreciated input from Internet2, Merit Network, interested scholars from the University of Michigan and the high-tech anthropologists of Menlo Innovations of Ann Arbor.

*Ones & Zeros exhibit that allows visitors to use the eight levers and bright lights of this exhibit to count like a computer and crack the binary code.*



## Shibboleth...

*Continued from page 3*

his or her institution, and asked to enter credentials. Then, behind the scenes, the Shibboleth servers at the two organizations communicate to determine whether the user is allowed to access the requested resources. Through this design, credentials are never exposed to the content provider; typically just a “yes” or “no” response or other non-identifying information is passed from the identity provider to the content provider.

Shibboleth: online today

Shibboleth is currently in operation at many universities, either in production or trial services. Two major “federations” of Shibboleth-using institutions have been established to provide a collaboration point for organizations that agree to use similar identity policies and practices.

The National Science Foundation soon expects to announce the ability to access its FastLane service using Shibboleth authentication. FastLane is a Web-based service used to transact business between the NSF and its user community, such as in submitting grants or requesting funds. This is an early implementation in the federal government’s own middleware initiative, which will also use Shibboleth as an authorizing mechanism for access to many federal resources.

For Shibboleth and other middleware projects, the value of the solution will grow as more organizations adopt the software and associated identity practices. Institutions of any size can get an early start on this key future technology by investigating Shibboleth and other middleware tools, and by examining their internal identity management policies and technologies. The payoff will be significant in the increased ability to collaborate with other institutions, participate in national projects, and offer flexible services to its users.

## Voice over Internet Protocol: IP-Based Converged Network Services

Converged services are an emerging trend in networking. The ability to combine video, voice and data communications onto a single network, simplifies network management. Voice over Internet Protocol (VoIP) transmits traditional voice traffic over an Internet connection. Given the increased costs for telecommunication services, the question for many organizations is not if they should consider implementing VoIP, but when and how.

The simplest implementation allows use of existing telephony equipment, including handset, PBX/switch and local wiring with only a gateway or converter installed to translate the traditional telephone signal to IP. Members and Affiliates can incur significant savings and realize tangible benefits all with minimal network disruption.

Merit Network has engineered its backbone to support advanced applications such as VoIP to ensure that latency and packet loss are not problematic. Through our peering connection to the VoIP provider Voice Exchange (VoEx) in Chicago, long distance calls are carried and delivered on the most direct and secure route with the fewest hops possible.

### Using a converged network results in many benefits:

- Long distance VoIP can be implemented with minimal effort or capital investment.
- Long distance VoIP can be the first step in a gradual migration to a fully converged network.
- Traditional and VoIP handsets can coexist on a single network, thus allowing a gradual transition for staff and equipment.
- Implementation of VoIP services can reduce overall telecom and network expenses.

*By Vicki Meza*

*For more information on VoIP services, please contact your Support Team at [www.merit.edu/mn/support](http://www.merit.edu/mn/support)*

## Fiber Art: College for Creative Studies Makes the Merit Connection

The College for Creative Studies (CCS) has been a Merit Affiliate since 1996. Located in the heart of the Detroit Cultural Center, CCS offers Bachelor’s degrees in Fine Arts and an Art Education program that leads to State of Michigan K-12 teaching certification. In addition to its academic buildings, CCS maintains a 12-story residence hall that houses 263 students, and off-campus townhouses provide additional residential space.

Situated in close proximity to Wayne State University, CCS connected six academic and residential buildings to Merit using T-1 circuits. The student residence Internet traffic was segregated by means of a separate routed connection to MichNet.

CCS’ need for Internet connectivity kept growing, but its budget did not. With its close proximity to Merit’s Metro Detroit Fiber ring, Merit and CCS investigated the cost of a fiber alternative for CCS’ connectivity. By taking advantage of existing infrastructure at the College, CCS is building a fiber lateral connection to Merit’s Metro Detroit fiber for an annual cost that is 45% lower than the telco circuit fees it has been paying for its 6.0 Mbps connection to Merit.

*The five year payoff period for the fiber lateral construction saves CCS nearly \$39,000 in circuit costs*

The five year payoff period for the fiber lateral construction saves CCS nearly \$39,000 in circuit costs. In addition, once the fiber lateral costs are paid, CCS’s circuit costs are limited to the cost of fiber maintenance and administration, which are less than the cost of a single T-1 circuit. As an added benefit, CCS can increase its bandwidth at any time without incurring additional one-time circuit costs.

*By: Eileen Peck*



1000 Oakbrook Drive  
Suite 200  
Ann Arbor, Michigan 48104

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**Merit News**

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**Editors**

Elwood J. Downing, Jennifer Hensley, Vicki Meza

**Contributors**

Brian Cashman, Russell Dwarshuis, Susan Harris, Jennifer Hensley, Mary McLaughlin, Vicki Meza, Jim Moran, Eileen Peck, Andy Rosenzweig, Bob Stovall

**Art Direction**

Steve Burdick

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