



MichNet News

A Publication of
Merit Network, Inc.

Volume 15, No.2
Summer, 2001

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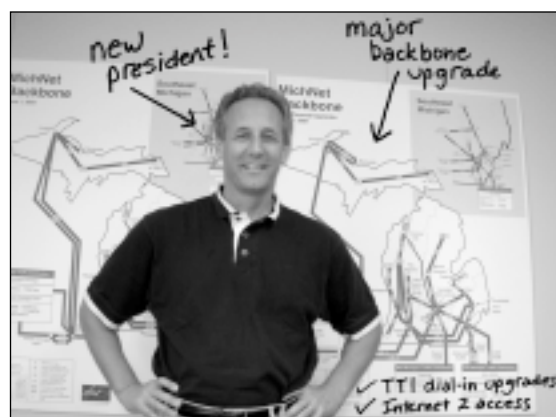
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Merit Network, Inc.
<http://www.merit.edu>

Big Changes, Big Plans

Merit Network, Inc., is a challenging and rewarding place to work. The last few years have been busy ones, but they are just a prelude to the growth and changes occurring today. We have a new president (see below); the MichNet backbone will undergo a significant upgrade (see page 6); the Teacher Technology Initiative (TTI) has driven the dial-in network to add over 600 lines and coverage of 16 new exchanges since January (see page 10); and all 13 of Merit's member institutions now have Internet2 access (see page 12). This *MichNet News* highlights these and other changes.

"And we have more changes in the works," said Elwood Downing, Merit Member and Affiliate Services Manager. "For example, with our next major website update our Members and Affiliates will be able to access



Merit's new president, Hunt Williams.

exclusive information from our database through a secure web server."

Don't blink . . . you might miss something! If you have any questions regarding any of Merit's plans, please contact your Member and Affiliate Services Support Team.

— Candice Russell, Merit



New President Arrives at Merit

We are pleased to announce that Merit's new President, Hunt Williams, officially joined the organization on July 16. Hunt (whose full

name is Huntington Williams, III) was named President by a unanimous vote of the Merit Board of Directors

See New President on page 2

New President

from page 1

and is in the process of relocating his family to Ann Arbor from his home in Baltimore. He succeeds Eric Aupperle, now Merit's President Emeritus, who has led the organization for the past 27 years. Eric remains on hand at the Merit offices, where he is providing transitional guidance and support to the new President during his first few months in office.

Hunt Williams comes to Merit from Community of Science, Inc. (COS), a spinoff company of Johns Hopkins University, where he was President and CEO. COS is a for-profit consortium of 700 universities in the U.S. and abroad, and provides Web-based expertise and funding system that help university researchers connect more efficiently with their counterparts in industry and government. A graduate of Yale and Oxford University, Hunt worked at American Broadcasting Companies (ABC) and the Gannett Center for Media Studies in New York and Washington, and has served as a strategy consultant for biotechnology, media, and telecommunications organizations. He is the author of several books and articles and has been a regular speaker at Internet meetings and conferences worldwide.

At COS, Hunt has been involved in developing Internet applications since the days of Gopher and Mosaic. "I knew about NSFNET," he says, "but until recently I was not fully aware of the extraordinary role that Merit played in the birth of the Internet. It's a remarkable history of accomplishment." Bringing a new vision of Merit's opportunities, Hunt looks forward to meeting our Members and Affiliates and to maintaining Merit's reputation for excellence.

As the new President, Hunt arrives at Merit at a time of significant growth for the organization. At its June 2001 meeting, the Merit

Board endorsed a plan that will upgrade much of the MichNet backbone in the southern Lower Peninsula to OC-48c speeds, or 2.4 billion bits per second — four times the speed of any circuit MichNet uses today (see page 6). This upgrade will make possible a wide range of Internet2 applications, such as interactive video, distance learning, and online research collaboration. Redundant OC-48c connections will be established to each of the six cities to be linked by the new circuits: Portage (Kalamazoo), Grand Rapids, Lansing, Ann Arbor, Southfield (Detroit), and Chicago. In addition to these major changes at MichNet, the Merit Board also authorized a contribution from the Member budget (the fees paid to Merit for Internet service by all 13 Michigan universities) to Merit's innovative programs in the area of K-12 professional training and development.

"These connections will bring the capabilities of Internet2 to schools, colleges, libraries, and research organizations throughout Michigan," Hunt points out. "This represents a remarkable opportunity for Merit to expand our range of activities in ways that serve the needs and interests of our Members and Affiliates." Of special interest to Hunt is online education, which he calls an area of potential growth for Merit. "The world of education has just begun to figure out the intersection of education and the Internet," he says. "Merit's community of users is an ideal place to start." Welcome Hunt!

— Susan Harris, Merit



MichNet News

<http://www.merit.edu/michnet/mnn/>

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MichNet News, published by Merit Network, Inc., is the official newsletter of MichNet, Michigan's premier regional network. Please send comments and suggestions to editor@merit.edu.

Merit Network, Inc. is a non-profit corporation charged with promoting computer networking in Michigan and beyond. Merit is governed by all thirteen of Michigan's four-year, publicly supported universities. Offices are located at 4251 Plymouth Rd., Suite 2000, Ann Arbor, MI 48105-2785.

Subscriptions: To subscribe to the paper version of *MichNet News*, send a message to mnn-paper@merit.edu. Send requests for the e-mail version to majordomo@merit.edu with the words SUBSCRIBE MNN in the BODY of the message.

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Ask the Experts: What is Dark Fiber?

If you have a question about a new network term or how a specific part of the Internet works, please e-mail it to editor@merit.edu.

Question: What is dark fiber, and does Merit use any on the MichNet Network?

Answer: Provided by Jeff Ogden, Merit Associate Director for High Performance Networks

Merit buys (or leases) some dark fiber for MichNet, and we would like to do more.

Fiber is just strands of glass. To use it for data communications you shine light down the fiber and use the light to carry a signal. When companies buy a telecommunications service such as an OC-3c (155M bps) circuit from a traditional phone company, the phone company provides the electronics at the ends and in the middle to make this work. Merit's routers connect to the phone company's equipment and not directly to the fiber. If someone has access to dark fiber, it is up to that someone to supply the electronics at the ends and in the middle to "light up" the fiber and make it usable.

You'll also hear the term dim fiber. In this case the end users (such as Merit) attach directly to the fiber at the ends, but the fiber supplier provides the amplifiers and other

equipment needed in the middle to transmit the light.

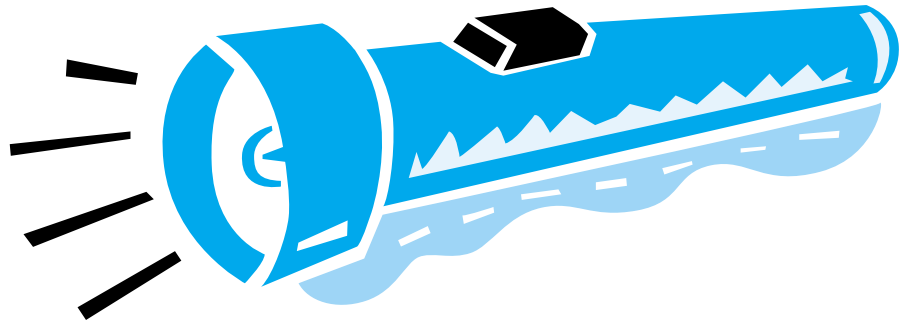
So with a traditional service from a phone company you buy a specific service that runs at a specific speed, say an OC-3c SONET link at 155M bps. If you want to upgrade from OC-3c to OC-12c (622M bps) that is a different service from the phone company and it has a different (higher) price.

With dark fiber or dim fiber you aren't buying a service so much as you are buying access to a facility. How you use that facility is up to you, at least within the physical limits of the facility itself. So, if you use the dark fiber to send 100M bps Ethernet or 1,000M bps Ethernet or OC-3c SONET the cost of the fiber is the same. There is no on-going cost to upgrade in this case. You do, of course, have to pay the one-time cost of the equipment at the ends needed to operate at the different

speeds. In the case of dark fiber you also have to pay the cost of equipment in the middle if the fiber run is long enough that it requires equipment in the middle. With dim fiber you don't have to supply the equipment in the middle.

Merit does not sell dark fiber, nor do we sell individual circuits. We sell a networking service, which is a higher level than dark fiber or individual circuits. The services we sell may use dark fiber or individual circuits, but we combine all of that into a network service that includes routing of traffic using specific protocols (TCP/IP) over the lower level facilities and between other networks with which we have transit and non-transit peering arrangements.

What Merit does is sometimes called "value added networking" and MichNet would be a "value added network." We take network elements from others (circuits, fiber), add some elements of our own (routers, switches, NOC monitoring, peering relationships to other networks. . .) and assemble it all into something that is more valuable when taken as a whole than it is when taken as individual parts. We add value when we combine the individual parts so they become a network that is part of the Internet.



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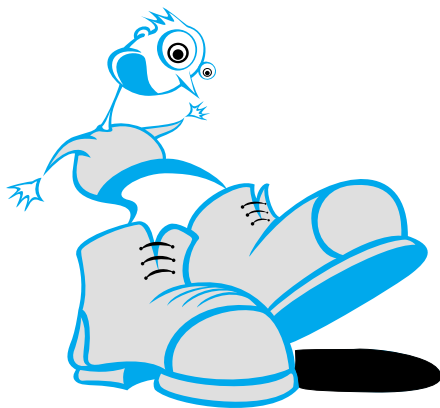


Does Tier One Mean Better?

The Internet access service provided directly by one of the national Internet providers (Qwest, Sprintlink, Cable & Wireless, and UUNet) is often described as being from a “Tier One” Provider. While it is not always clear if a given Internet Service qualifies as “Tier One,” the term “Tier One” clearly has positive connotations. Both providers and their customers often cite it as a positive characteristic of Internet service.

Implicit in this positive characterization is the theory that national providers can provide a better and faster Internet service than the ISPs to whom the national providers sell commodity Internet access. Under this presumption, receiving Internet service directly from a “Tier One” provider avoids the middleman (those secondary ISPs that buy commodity access then re-sell it). In effect, it looks like Internet service from a wholesaler rather than a retailer.

However, in this wholesale/retail analogy the primary benefit of dealing directly with the wholesaler is not lower price, but rather improved service. Service is assumed to be better/faster because it is closer to the backbone.



Is a tier one provider a good fit for you?

“Hop counts to a national backbone” are often cited as evidence of the superiority of “Tier One” service. The lower the hop count, allegedly, the better. Since each hop represents a router along the path of a given network connection and since each hop/router involves some processing to manage the traffic flow, each presumably introduces some delay into the network connection.

In actual fact, processing latencies on the routers are small compared to latencies caused by circuit length propagation delays. Aggregate circuit length of a given route is more important than the number of hops of the same route.

Unfortunately, there is no easily available tool for measuring aggregate circuit length. By contrast, any user on a network who can run the traceroute command from a DOS or UNIX prompt can obtain hop counts. Hop counts appear to provide an objective, standard measure for the time-length of a network connection path.

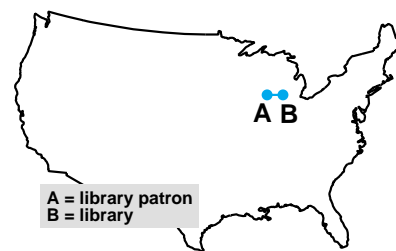
The apparent (but false) utility of this measure may be the reason it has crept into specifications for Internet service bids. In the last twelve months, many school districts have issued RFPs for Internet service that specify a maximum number of hops to a national backbone.

The “closer to a backbone is better” theory also presumes that all Internet traffic must traverse “the backbone” to connect two endpoints. This is clearly untrue, first because there is no single backbone, and secondly, if there were, it would be swamped.

If someone using a web browser at home is searching the card catalog of her local library system in Ann Arbor, that network connection ought to follow the shortest path. To send it out to the backbone from

her Ann Arbor home and then back to the Ann Arbor library would result in increased access time and inefficient use of the network infrastructure. In fact, the essence of network routing is to use the shortest path between two connection points. “Hinging” all connections to one national backbone would result in tremendous inefficiency and an attendant increase in access times.

If the hypothetical Ann Arbor library patron shares the same ISP as her library system, her connection to the card catalogue stays within her ISP’s network. It is probably a connection of very few hops over a very short distance and is likely to be very fast (see Map 1).



Map 1: Same local provider

But what if the patron and the library do not share the same ISP? Does this connection between two endpoints just two miles from each other need to travel hundreds of miles to the backbone? Maybe. If the individual ISPs buy their commodity access from the same “Tier One”

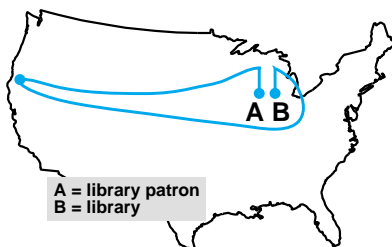


Map 2: Different local providers attached to same national provider

provider, the connection will probably be made on the provider's network, somewhere short of their backbone (see Map 2).

But, if the ISPs get their commodity access from different "Tier One" providers, the connection will probably traverse two different backbones, meeting at a point where the two "Tier One" providers have agreed to exchange traffic. National providers typically exchange traffic at "meet points" with large capacity, most of which are on the edge of the national Internet: East Coast, West Coast, and South.

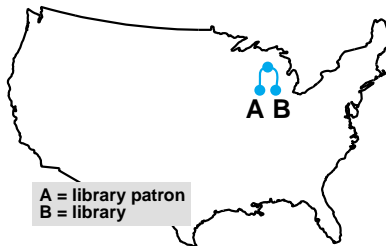
A distance of two miles will have been stretched into hundreds or perhaps thousands of miles. And despite the fact that the data is traveling at or near the speed of light, the distance is significant; applications and devices are sensitive to even the smallest delay, known in this context as latency. Further, there are many more hops in the journey to the backbone and back, and, as previously described, each involves some latency and/or potential loss even if that latency is less than that resulting from circuit length (see Map 3).



Map 3: Different local providers attached to different national providers

If the Internet is viewed as consisting only of "Tier One" providers and everyone else, then the scenarios described above would be the only way for the patron to access the library catalogue from her home. However, ISPs are not obliged to connect solely with "Tier One" providers. They can inter-connect with each other. If the two individual ISPs serving the Ann Arbor library and its patron had such an inter-

connection, the data flow between the patron and the library would follow this "shortcut," avoiding the larger Internet altogether: the traffic would stay local to Ann Arbor, and the distance of the network connection would be a lot closer to the actual two mile physical distance between the two points (see Map 4).



Map 4: Different local providers that have a peering relationship with each other

Such inter-connections frequently take the form of "non-transit peering" arrangements in which two ISPs interconnect their networks at some convenient/inexpensive point for the purposes of exchanging traffic bound only for each other's network. None of the traffic exchanged has a destination other than on the ISPs' networks.

It is easy to see that the non-transit peering arrangement between the two ISPs in the example above benefits the end user by providing better service. What might not be so apparent is that it also benefits the ISP. Typically, ISPs pay the "Tier One" providers for commodity access at a given rate per bit transmitted. Every bit that an ISP can keep off the "Tier One" provider's network is an expense saved, and peering reduces the amount of commodity access it has to purchase. Since it is relatively inexpensive to maintain a non-transit peering arrangement compared to paying for commodity access, ISPs are motivated to find partners for such arrangements. It is in their interest to keep local traffic local.

The "Tier One" providers have no such motivation. Their business model relies on traffic traversing

their own backbone; the more traffic that crosses the backbone they maintain, the higher their profits.

Yet, while one of the national providers is probably not the best choice as an ISP for most organizations, having more than one national provider connected into your organization would probably alleviate many of the latency issues previously described. Before the traffic ever left your network, your routers would determine which national provider it should route the traffic to. The traffic would not be as likely to travel to one of the "meet points" and would be more likely to stay local.

This is, in effect, what a mid-level ISP like Merit does for its customers. Merit purchases commodity Internet access from Qwest and Cable & Wireless. In this way, mid-level ISPs provide Internet access that has an efficiency and redundancy unavailable from a Tier One provider.

Yet, the national providers are the ideal providers for the mid-level ISPs. The national providers focus their efforts on the backbone infrastructure at the expense of local considerations. With this national infrastructure so consistent and unified as to be a commodity, the mid-level ISPs are able to focus on regional and local needs. Merit uses a mixture of local and regional non-transit peering arrangements, mirrored content servers like Akamai, and frequent adjustment of commodity bandwidth connections, to tailor Internet access service to its Michigan audience.

To return to the wholesale/retail analogy, the national providers are wholesalers, and, like many wholesalers, their product is not well suited for the end consumer. Mid-level ISPs, like local retailers, re-shape the wholesale offerings and identify local resources to best serve a local community.

— Jim Moran, Merit



Merit Announces Major Internet Upgrade in Michigan

Ask your typical Internet expert how fast an OC-48 link is, and the likely response will be "That's fast. Real fast!"

Michigan's leading Internet service is about to be upgraded to OC-48 speed. The new backbone design will enable Michigan organizations to benefit from next-generation Internet applications and technologies, including high-quality interactive video, distance learning, and real-time access to the world's most powerful scientific instruments.

Merit provides Internet connectivity to all 13 of Michigan's publicly-funded universities and to Michigan's community colleges, K-12 schools, libraries, state agencies, and cultural and research organizations. Through these organizations, Merit serves almost a million people in Michigan every day.

"Merit and the state of Michigan have always been at the forefront of Internet technology," says Scott Gerstenberger, Merit Associate Director of MichNet. "With this new upgrade, we will be making a smooth transition to some of the fastest Internet speeds available anywhere in the world today."

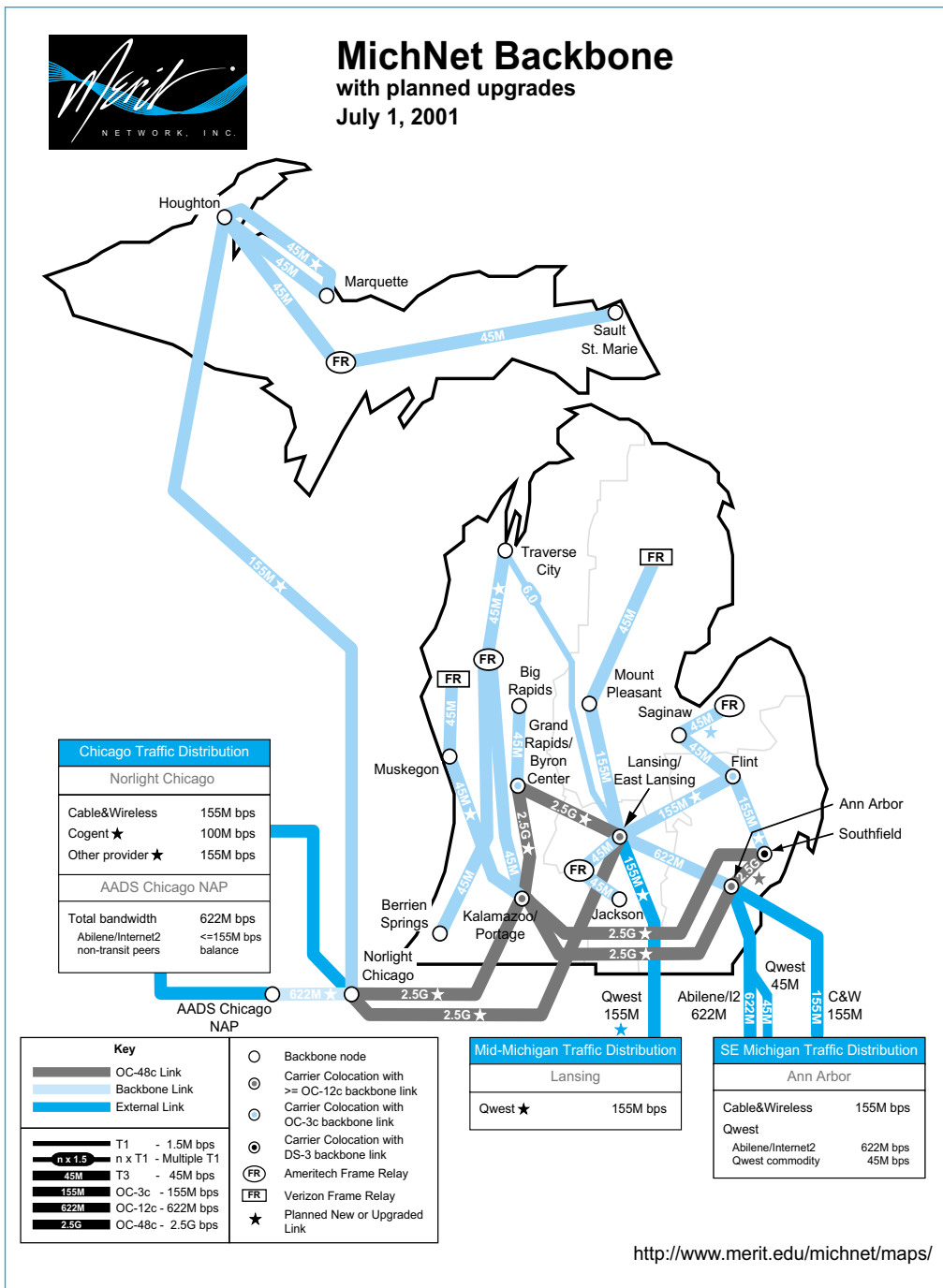
Merit will spend \$10 million on its network infrastructure over the next three years to implement the new backbone and other improvements. The OC-48 upgrade is expected to meet the growth needs of Merit's customers for the next three years, and will save money over this time period compared to other upgrade paths.

To put this story into perspective:

A standard dialup connection (like AOL) carries at most 52,000 bits of information per second. A T1 line (often used by businesses) carries

1.5 million bits per second. A single OC-48 link carries 2.4 gigabits (2.4 billion) bits per second.

see Upgrade on page 7



Upgrade

from page 6

“Internet traffic doubles just about every year,” says Brian Cashman, the MichNet Backbone Manager. “With this design, Merit’s customers in Michigan will stay ahead of that growth. This design also uses dual OC-48 circuits, which builds in redundancy and gives Michigan an even more reliable network.”

Jeff Ogden, who is Merit’s Associate Director for High Performance Networks, works closely with Michigan’s universities on Internet2, the national organization that operates the high-speed Abilene network. Currently the only way for a Michigan organization to participate in Internet2 is through Merit.

“Michigan organizations are already participating in Internet2 with extraordinary results,” says Ogden. “For example, Michigan Technological University is using Internet2 to team up with NASA and the University of Cincinnati on a proposal to monitor remote mechanical systems in factories, highway bridges, geological fault lines, and even in-flight aircraft.”

“As Internet2 applications move into the mainstream, this traffic will place larger bandwidth demands on our network,” Ogden continues. “Merit’s OC-48 upgrade will handle this increased traffic and permit new applications to be developed that we can’t even foresee today.”

The Merit Board of Directors approved the OC-48 upgrade plan at its June 1 meeting. The plan was then presented to Merit’s customers at the Merit Annual Meeting on June 6. Organizations in Michigan will begin to benefit from the MichNet upgrade starting in the first quarter of 2002.

— Candice Russell, Merit



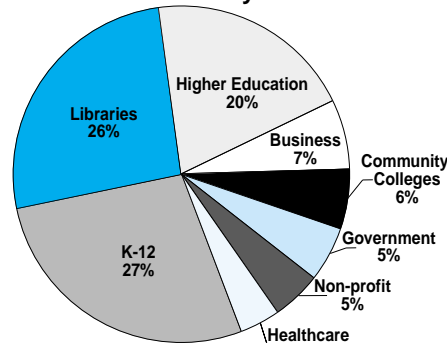
Merit’s Direct Connect Affiliates

Have you ever wondered how your organization fits into Merit’s “big picture”?

For direct connect attachments to MichNet, Merit has 13 Members with 61 separate attachments and 230 MichNet Affiliates with 425 separate attachments. Merit’s Members include the 13 publicly funded universities in Michigan, and each Member has a representative on the Merit Board of Directors.

MichNet Affiliates include community colleges, higher education, K-12 schools, libraries, government agencies, businesses, healthcare providers, and cultural and research organizations. The direct connect affiliate attachments to MichNet are distributed as follows:

Merit’s Direct Connect Affiliates as of July 2001



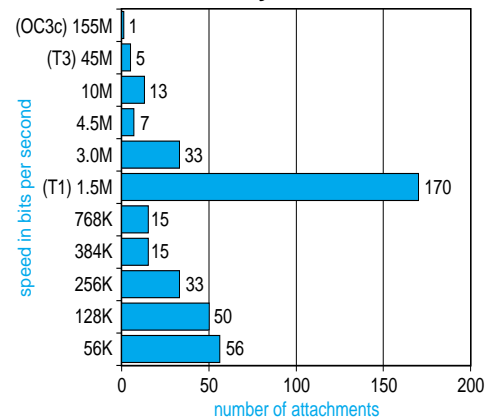
MichNet Dedicated Affiliates elect representatives to serve on the Merit Advisory Council (MAC, see page 13). The MAC chair and co-chair attend Merit Board Meetings, but not as voting members.

For the last two years, the Affiliate percentages illustrated above have held steady with two exceptions. Public library connections have increased their percentage by several points. At the same time, the business sector has decreased as many of these

Affiliates have left for other providers, or have gone out of business.

Since some organizations share attachment points, there are actually only 398 distinct attachments to MichNet. These are distributed as follows (in bits per second):

Attachment Speeds as of July 2001



The above totals include new attachments and upgrades that have been ordered but not yet installed. Merit is seeing a significant increase in the number of sites requiring more than a single T1 (1.5M bps) of bandwidth, as organizations are looking at fractional T3 (45M bps) service, or seeking to connect directly to MichNet with Ethernet, often on private fiber.

For example, in Flint, we are planning to connect Genesee ISD, UM-Flint, Kettering University, Mott Community College, and Baker College directly to MichNet via 100M bps fiber provisioned circuits. We have a 100M bps connection in place today to the State of Michigan government in Lansing via their metropolitan area fiber network.

— Mike Mosher, Merit



DIALING INTO MICHNET

All MichNet shared dial-in users must authenticate with an Access ID issued by their organization. For information on how to obtain Access IDs, contact the network support staff at your site.

Dial-in users can connect to a network access server (NAS) by using Point-to-Point Protocol (PPP) or VT-100 terminal emulation programs. Terminal emulation users should set their **communication settings** to 8 data bits, no parity, 1 stop bit.

All MichNet sites support the v.34 (28.8/33.6 Kbps) protocol and older, slower protocols. More than half now support v.90 (40-52 Kbps actual).

MichNet modems support the error correction protocols v.42 and MNP4, as well as the data compression protocols v.42bis and MNP5.

Local Access Numbers:

Before configuring your modem to automatically dial a MichNet access number, check Merit's Dialaccess searchbase to make sure it is a local number. Merit's Dialaccess searchbase is available on the web at:

http://www.merit.edu/cgi-bin/db/dialaccess__new.pl

Note: Merit Network, Inc. is not responsible for any telephone charges that might occur should you dial a non-local number.

Recommended Settings:

The following settings are recommended for use with PPP and MichNet dial-in access numbers.

Flow Control	CTS/RTS	On
	XON/XOFF	Off

CTS/RTS flow control must be enabled in your modem and your modem cable must be able to pass CTS and RTS signals. Since XON/XOFF flow control may interfere with binary file transfers, it is not recommended.

DCE/DTE Speeds	DCE (phone line) speed	DTE (computer port) speed
	34,667 to 52,000 bps (v.90)	230,400 or 115,200 bps
	33,600 bps (v.34)	115,200 or 57,600 bps
	28,800 bps (v.34)	115,200 or 57,600 bps

The DCE speed is negotiated to the highest reasonable speed by the modems and is not usually set by the user. The v.34 standard supports a range of speeds from 19,200 to 33,600 Kbps. Since many phone lines are of insufficient quality to support 33,600 Kbps, v.34 modems will often negotiate to a lower speed. Similarly, the v.90 standard supports a range of speeds from 34,667 to 52,000 bps, but typically users will see speeds in the 40,000 to 46,667 bps range.

The DTE speed (computer port) should be set higher than the DCE (phone line) speed to take advantage of compression when using terminal emulation or PPP.

About the Shared Dial-in Listing

Online listing: For the most current listing of dial-in numbers, check:


<http://www.merit.edu/michnet/dial-in/numbers/>


Terminal emulation users can find current numbers by entering **help** at the **host:** prompt and then selecting **MichNet Dial-in Numbers**.


Modem speeds: All MichNet dial-in sites are served by Network Access Servers (NASs). All dial-in sites support carrier speeds of at least 33.6K bps. More than half also support v.90, commonly called "56K." However, v.90 modems generally provide actual speeds in the 40 to 52K bps range.


Number of lines: The number of lines listed is the total number of priority and no-priority lines in a hunt group.

Limited Access Numbers: One number provides access primarily for Oakland University (OU) users and is so marked. This number provides limited access for other users.

Greater Detroit Numbers: A star (★) indicates numbers reaching a common hunt group called "Greater Detroit." See "Greater Detroit" for the number of lines available to users dialing these numbers. 

SE-Michigan Numbers: A number sign (#) indicates numbers reaching a common hunt group called "SE-Michigan." See "SE-Michigan" for the number of lines available to users dialing these numbers. 

Upper Peninsula Numbers: A plus sign (+) indicates numbers reaching a common hunt group called "Upper Peninsula." See "Upper Peninsula" for the number of lines available to users dialing these numbers. 

Thumb-Area Numbers: A thumbs-up sign (👍) indicates numbers reaching a common hunt group called "Thumb-Area." See "Thumb-Area" for the number of lines available to users dialing these numbers. 

✓ 56K/v.90 ★ See Greater Detroit
 # See SE-Michigan † See Upper Peninsula
 👉 See Thumb-Area

MichNet Shared Dial-in Numbers

City	Phone No.	Lines	City	Phone No.	Lines	City	Phone No.	Lines
MICHIGAN			Frankfort	231 352-4134	12	Northport	231 386-5029	9
Addison	517 547-5621	16	Fremont	231 924-5662	10	✓ Onaway	517 733-8968	31
✓ Adrian	517 265-6689	51	✓ Gaylord	517 732-1596	92	Ononagon	906 884-6495	18
✓ Albion	517 629-7450	62	✓ Goodrich	810 230-8103	#	✓ Oscoda	517 215-2200	#
Allegan	616 686-0008	19	✓ Grand Haven	616 846-2617	68	✓ Owosso	517 729-7205	60
✓ Alma	517 466-5322	96	✓ Grand Rapids	616 224-7020	529	Petersburg	734 279-1839	10
✓ Alpena	517 356-0704	180	✓ Grayling	517 348-9405	45	Petoskey	231 347-1715	48
✓ Ann Arbor	734 489-2200	414	✓ Greater Detroit		736	Pinconning	517 879-6940	10
✓ Atlanta	517 785-4927	48	Greenville	616 754-6816	11	✓ Pontiac	248 232-7800	★
Au Gres	517 876-4180	8	✓ Hadley	810 245-0204	#	Pontiac (OU)	248 370-4311	16
✓ Avoca	810 966-8812	#	✓ Harrisville	517 724-5989	64	✓ Port Huron	810 455-2200	#
Bad Axe	517 269-2693	20	✓ Hart	231 873-7798	28	Portland	517 647-5008	24
Baldwin	231 745-3182	14	Hastings	616 945-0348	39	✓ Powers	906 497-4081	‡
✓ Battle Creek	616 963-9975	48	Hillsdale	517 439-9102	29	Prescott	517 873-4837	7
✓ Bay City	517 922-2200	#	✓ Holland	616 355-0026	126	✓ Rock	906 356-6691	‡
Belding	616 794-1046	14	✓ Holly	248 531-2200	#	✓ Rogers City	517 734-3794	18
✓ Bergland	906 575-1035	‡	✓ Hope	517 832-0144	#	✓ Romeo	810 894-7800	★
✓ Big Bay	906 345-9496	‡	✓ Houghton	906 483-3120	90	✓ Roscommon	517 275-5134	65
✓ Big Rapids	231 592-1040	120	Houghton Lake	517 366-4125	48	✓ Rose City	517 685-2109	32
Blissfield	517 486-2072	9	Howard City	231 937-6069	11	✓ Saginaw	517 921-2200	#
Bois Blanc	231 634-7136	4	✓ Howell	517 586-2200	#	✓ St. Clair	810 328-2200	#
✓ Boyne City	231 582-7492	36	Hudson	517 448-2087	11	✓ St. Ignace	906 643-0077	‡
✓ Brevort	906 292-5522	‡	Indian River	231 238-4962	25	✓ St. Johns	517 224-0502	46
Bridgman	616 465-3590	21	✓ Ionia	616 527-0685	35	✓ St. Joseph	616 983-1965	120
Brimley	906 248-2098	2	✓ Iron Mountain	906 776-1202	‡	Sand Creek	517 436-3266	14
✓ Brown City	810 346-4981	👉	✓ Iron River	906 265-4810	‡	✓ Sandusky	810 682-2200	#
✓ Buchanan	616 695-0168	58	✓ Ironwood	906 932-9914	‡	Sanford	517 832-0144	#
✓ Cadillac	231 779-0683	55	✓ Jackson	517 788-6300	144	✓ Sault Ste. Marie	906 635-1533	‡
✓ Capac	810 395-8644	👉	✓ Kalamazoo	616 387-2070	840	✓ Sebewaing	989 883-5686	👉
Carney	906 639-3390	3	✓ Kalkaska	231 258-8479	16	✓ SE Michigan		1495
Caro	517 673-1422	13	Kent City	616 678-4177	11	✓ Sidney	517 328-3300	26
Carson City	517 584-6831	15	✓ Keweenaw	906 289-1045	‡	✓ South Haven	616 639-1909	42
Caseville	517 856-9215	10	Lake City	231 839-6760	17	Springport	517 857-4336	13
Cassopolis	616 445-8618	22	Lakeview	517 352-7571	9	Standish	517 846-1189	16
Cedar Springs	616 696-4941	8	L'Anse	906 524-5644	4	Stephenson	906 753-2185	16
Cedarville	906 484-6400	2	✓ Lapeer	810 538-2200	#	✓ Stockbridge	517 851-7382	48
✓ Central Lake	231 544-3056	27	Lawrence	616 674-3296	26	✓ Sturgis	616 659-0774	56
✓ Charlotte	517 543-1631	60	✓ Lennon	810 230-8103	#	✓ Tecumseh	517 424-4100	35
Chatham	906 439-5901	5	✓ Ludington	231 843-7167	120	✓ Temperance	734 847-6662	33
Cheboygan	231 627-2220	50	✓ Mackinac Island	906 847-0083	‡	✓ Three Rivers	616 279-5400	37
Chesaning	517 845-2917	16	Mancelona	231 587-0545	11	✓ Thumb Area		115
✓ Clare	517 421-2200	#	Manistee	231 398-0302	22	✓ Traverse City	231 941-9826	81
✓ Coldwater	517 279-7694	24	Manistique	906 341-5977	16	✓ Trenton	734 559-2200	#
✓ Colon	616 432-3245	18	Marcellus	616 646-2608	12	✓ Trout Lake	906 569-0013	‡
Concord	517 524-9047	11	✓ Marquette	906 226-3891	‡	Twining	517 867-4141	7
✓ Crosswell	810 679-4013	👉	✓ Mason	517 676-8600	24	✓ Upper Peninsula		288
✓ Curtis	906 586-3257	‡	McBain	231 825-8232	10	✓ Vassar	989 823-2157	👉
✓ Decatur	616 423-6023	20	✓ Memphis	810 392-3735	👉	✓ Warren	810 693-7800	★
✓ Deckerville	810 376-1113	👉	✓ Menominee	906 863-1002	‡	✓ Watersmeet	906 358-9879	‡
✓ Detroit	313 586-7800	★	✓ Mesick	231 885-2962	7	Wayland	616 792-1211	21
✓ Dowagiac	616 782-4568	57	✓ Michigamme	906 323-1001	‡	✓ West Branch	517 216-2200	#
✓ Dryden	810 796-3333	#	✓ Midland	517 923-2200	#	Westphalia	517 587-4451	8
✓ Dundee	734 529-5614	22	✓ Mio	517 826-1229	64	✓ Williamston	517 655-1370	20
East Lansing	517 353-3500	876	✓ Monroe	734 349-2200	#	✓ Yale	810 387-9368	👉
✓ East Lansing	517 432-7200	1832	✓ Montrose	810 639-4895	17			
✓ Edmore	517 427-5957	14	Morenci	517 458-2206	12	NEW YORK CITY		
Edwardsburg	616 663-5502	9	✓ Mount Clemens	810 723-7800	★		212 509-5270	10
Elsie	517 862-4141	15	✓ Mount Pleasant	517 772-6666	624	WASHINGTON D.C.		
✓ Engadine	906 477-8096	‡	✓ Munger	517 895-6493	#		202 484-4160	15
✓ Escanaba	906 789-2034	‡	Munising	906 387-3245	9	✓ WINDSOR		
Ewart	231 734-6497	16	✓ Muskegon	231 728-4253	96		519 253-7486	23
✓ Fairgrove	989 693-6758	👉	✓ New Baltimore	810 684-2200	#	✓ MERIT FOR-FEE		
✓ Farmington	248 522-7800	★	✓ New Boston	734 415-2200	#	800 NUMBER	800 232-3379	24
Fennville	616 561-7111	9	New Buffalo	616 469-5907	21			
✓ Flint	810 249-0300	#	✓ Newberry	906 293-2982	‡			

New Dial-in Huntgroup

Thumb-Area Huntgroup Provides Faster Lines, Lower Prices

Last May Merit formed a new “super-POP” huntgroup that provides local MichNet dial-in numbers for several exchanges in the general vicinity of Michigan’s Thumb.

The MichNet Thumb-Area dial-in location replaced the existing Capac, Memphis, and Yale dial-in locations, and also provides a local number for the Akron, Bay Port,

Brown City, Croswell, Deckerville, Fairgrove, Gagetown, Lexington, Owendale, Sebewaing, Unionville, and Vassar phone exchanges. Each of these exchanges has a local number, but all calls are directed to a single bank of modems. The new Thumb-Area location offers V.90 and ISDN service, representing a service upgrade for the original Capac,

Memphis, and Yale locations. At the same time, the price for lines that serve these exchanges is now significantly lower. The Thumb-Area huntgroup currently contains 115 lines.

— Andy Rosenzweig, Merit



Merit Tackles TTI Work

624 New Lines, 16 New Exchanges

In March, Merit began to provide dial-in service for Michigan teachers under Michigan’s Teacher Technology Initiative (TTI). TTI is a state-funded effort to provide every public school teacher in Michigan with a computer and Internet access. Merit is the dial-in Internet provider for all computer systems delivered through TTI. Merit works closely with Michigan State University to build the necessary systems and provide user support.

With a potential user base of 92,000 (the number of teachers in Michigan), this is a massive undertaking. Merit staff have been working since late last year to ready the systems and the dial-in infrastructure needed to support this huge user population.

Dial-in accounts for TTI are provided through a unique mechanism whereby teachers, having received their computers, visit a Merit web site to register for access. Each teacher enters his/her computer’s serial number at the site and, if that matches a number that has been supplied by the computer’s manufacturer, the teacher is allowed to register for a user ID and password.

To date, TTI computer vendors have sent Merit serial numbers for almost 45,000 computers. Almost 10,000 teachers have registered for Internet access.

Andy Rosenzweig, MichNet dial-in product manager, reports that the registration process has been largely smooth, but not without bumps. “Since this is an entirely new system and service, we’re finding kinks as we go. For example, it’s quite a tall order for the computer vendors to compile daily lists of the serial numbers shipped to their TTI customers and get them to us in time for users to be able to register when they receive their computers. That’s an entirely new process for them. Likewise, our registration and authentication systems are custom-built for this project. I’ve been impressed with the dedication and good humor of staff from Merit and the vendors as we all work to make this a smooth service for the teachers.”

To accommodate the large number

of new users, new dial-in lines are being added at MichNet dial-in locations around the state. At press time, 624 dial-in lines have been added for the priority access of TTI users, including at least a few lines at almost every location. TTI specifications call for a user:modem ratio of 17:1, so new lines are added as needed. According to Rosenzweig, “We never know where new users will pop up. Districts tend to receive all of their computers at once, so in some areas we might have very few users one day, and the next day a hundred or more teachers have registered.”

Another activity involves providing dial-in access everywhere it is needed. Merit is required to provide local access for all teachers who register, which means new dial-in numbers must be added in the small areas of Michigan not currently covered by MichNet. Many phone exchanges have been added to the MichNet coverage area since January, and many more will be added in coming months. Merit Members and Affiliates are welcome to report new exchanges where they’d like to have dial-in service available for their users. Chances are, a new dial-in location is in development.

Phone exchanges with local MichNet dial-in access added since January

Carney	Brown City	Sebewaing
Brimley	Akron	Bay Port
Cedarville	Fairgrove	Gagetown
Vassar	Pickford	Owendale
Deckerville	Bois Blanc	Unionville
Lexington		



2001 Merit Annual Meeting Report

Each year the Merit Annual Meeting gets better — more attendees, a better program, and more extras. In fact, 100% of the attendees who filled out evaluation forms said they plan to attend again in 2002.

“This year we had 102 attendees from outside Merit,” said planning committee member Candice Russell, Merit’s Web Champion and MichNet News Editor. “That was just over our goal of 100. I expect we will set a goal of 120 for next year’s meeting.”

The planning committee has become more experienced at orchestrating the event, or at least committee members have started to recognize how much time and effort it actually takes. “We started planning nine months in advance,” said committee leader Elwood Downing, Manager, Merit Member & Affiliate Services. “Back in 1999 we only spent three months.”

The 2001 meeting was held June 6-7 at the Amway Grand Plaza Hotel in Grand Rapids. The overall theme was “Network Security,” which has always been a popular topic at past Merit events. The meeting included a mixture of presentations and panel discussions, and most time slots included two simultaneous sessions — one geared toward a technical audience and one focusing on more

general policy issues. The planning committee felt it did a good job of coming up with an interesting and informative mix of topics . . . and the meeting attendees concurred.

“For every time slot there was a presentation that I wanted to attend. In a couple of cases, I had a hard time deciding which session to attend.”

(Quote taken from an evaluation form.)

“This year’s planning committee included two members from the Merit Advisory Council,” said Downing. “Rosemary Cary [Muskegon Area ISD] and Paul Groll [Library of Michigan] provided valuable input, as well as lining up many of the speakers.”

A new feature at the 2001 meet-



The “Napster Attacks” panel: Mike Mosher (Merit), Phil Warsop (Alma College), Mark Strandskov (Central Michigan University), and Doug Nelson (Michigan State University).



Rob Kolstad’s plenary on Cyber Terrorism is available online. See <http://www.merit.edu/merit/annual/2001/schedule.html>

ing was the use of a wireless network. Merit provided wireless network cards to meeting attendees, and set up a network that reached all the meeting rooms and common areas.

A complete meeting archive is available at <http://www.merit.edu/merit/annual/2001/>. Each individual session was taped and then translated into a RealVideo format.

“If you have time,” said Russell, “I would recommend watching Rob Kolstad’s plenary on Cyber Terrorism. Kolstad’s presentation was both entertaining and informative.”

Soon plans will be underway for the 2002 meeting. Contact your Member and Affiliate Support Team if you have ideas or topic recommendations for next year’s meeting.



All 13 of Michigan's Public Universities Now Connected to Internet2

On August 10, 2001, Oakland University gained Internet2 access through the Michigan GigaPoP. With Oakland's addition, all thirteen of Michigan's publicly funded universities are now connected to Internet2. Michigan State University and the University of

Michigan were the first Michigan institutions to obtain Internet2 access in 1999.

Internet2 is the organization that operates the high-speed (2.4 billion bits per second) national Abilene network. Internet2 is used to develop and deploy next-generation applica-

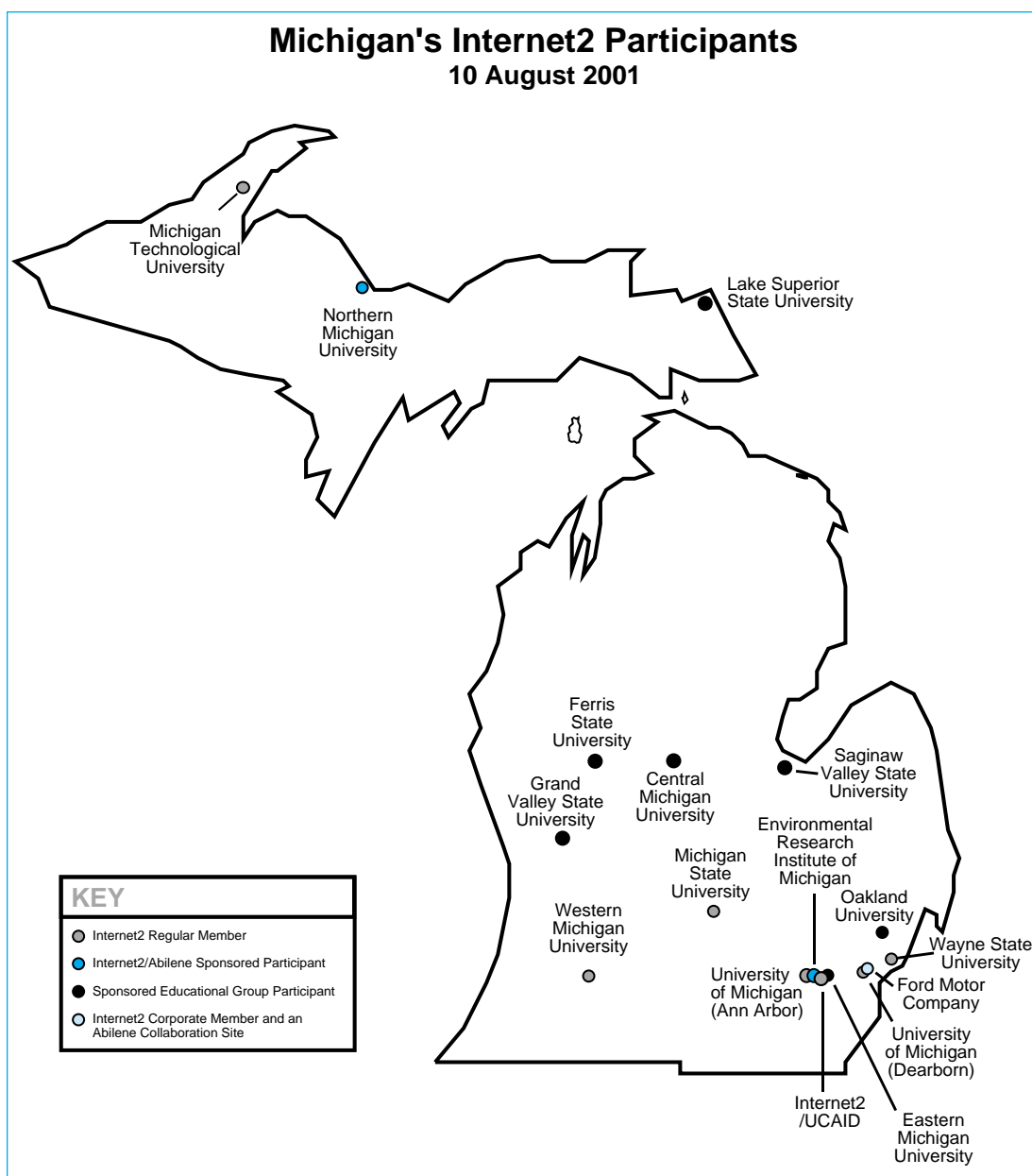
tions and technologies, including Internet-based learning, tools for online research and collaboration, and high-quality interactive video. For example, Michigan Technological University is using Internet2 to team up with NASA and the University of Cincinnati on a project proposal

to monitor remote mechanical systems in factories, highway bridges, geological fault lines, and even in-flight aircraft.

Michigan organizations obtain access to Internet2 through the Michigan GigaPoP which is operated by Merit. Internet2 GigaPoPs are regional aggregation points or gateways that connect multiple organizations to the Internet2 backbone. The Michigan GigaPoP is one of 28 Internet2 GigaPoPs nationwide.

Oakland's Internet2 access is through a 45M bps link that runs from Oakland's campus in Rochester, Michigan, to Merit's MichNet backbone node in Southfield, and onto the Michigan GigaPoP. See page 14 for information on how your organization can gain Internet2 access.

— Candice Russell, Merit



Merit Hires New R&D Director



Mike Donnell joined Merit on July 2 as the new Associate Director for Research and Development. Merit had this position posted for a very long time and had been unsuccessful in finding a suitable candidate.

"In June we finally had two candidates that we considered excellent prospects and chose Mike," said Eric Aupperle, Merit President Emeritus. "He has both business and academic experience."

For the past thirteen years Donnell was on the faculty of George Washington University as a tenured Associate Professor of Systems Engineering and Engineering Management. He has also run his own business and worked for research-focused companies, including the Institute for Defense Analyses and the Center for Naval Analyses. Donnell's many skills include writing research proposals and winning research grants.

"I am hoping to revitalize Merit's Research and Development activities," said Donnell. "Right now I am learning about Merit — both the organization and the people — and the more I learn the more excited I am about being here."



MAC Welcomes New Members

Election Results

The Merit Advisory Council (MAC), an elected group that meets regularly to discuss MichNet Affiliate concerns and provide feedback to Merit staff, greeted four new members at its May 23 meeting. The council also welcomed back one re-elected member.

The four new members include:

- Kyle Warner, Saginaw Public Schools (K12)
 - Wayne Schneider, Flint Area Library Cooperative On-Line Network (libraries)
 - Jim Lundberg, Bay de Noc Community College (community colleges)
 - George Pratt, Almont EXPRESSion (government agencies, hospitals, and other non-profit agencies)
- The re-elected member is:
- John Grden, Lawrence Technological University (private colleges)

These members will all serve on the council through 2004.

In addition, the council elected a new chair, Phil Warsop (Alma College), and vice-chair, Eric Grandstaff (North Central Michigan College). Each position is a one-year term.

Meeting Notes

MAC members discussed plans for the Merit Annual Meeting, including preparations for the MAC BoFs that were held on June 6. Council members listened to several reports from Merit staff, including updates on the following:

- Merit's budget
- Internet2
- Content filtering
- Merit's presidential search
- MichNet backbone upgrade plans
- KLC Dial-in Status
- Teacher Technology Initiative

Next Eric Grandstaff provided feedback on North Central Michigan

College's experience with H.323.

According to Eric, you need "a total of about two 768K bps to achieve the equivalency of 30 video frames per second, a nominal rate expectation," available to provide good quality.

"With Merit's online statistics," continued Eric, "you can look at your bandwidth statistics to see how your span's bandwidth is being utilized."

Scott Gerstenberger reported Merit's plans for testing and managing H.323's potential impact on network traffic. "Overall the performance and quality is pretty impressive," said Gerstenberger. "We believe that this technology is going to be used more and more as the equipment becomes less expensive."

Mike Wahl, Kirtland Community College, presented information on the Michigan Community College Virtual Learning Collaborative (MCCVLC) Online Learning Project. The Michigan Community College Association, with support from the Michigan Virtual University, has created a virtual learning collaborative (VLC) among Michigan's community colleges. The collaborative is designed to allow current Michigan community college students to take courses from other member colleges while still receiving support services and maintaining their academic record at their designated home college.

Complete MAC meeting minutes are available online at <http://www.merit.edu/merit/mac/>.

Feedback, Next Meeting

The next MAC meeting is scheduled for Wednesday, December 5, 2001. For more information about the MAC, please see Merit's website at <http://www.merit.edu/merit/mac/>. There is an online MAC feedback form that you can use to make comments or to ask questions.



Internet2 Access for Michigan Educational Organizations

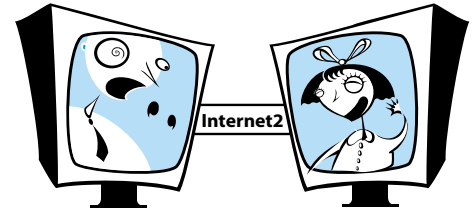
Educational organizations in Michigan are able to take advantage of the new opportunities available through the advanced networking capabilities of Internet2. MichNet, the Michigan statewide network operated by Merit Network, was one of the first five networks to apply for and receive designation as a *Sponsored Educational Group Participant* in Internet2/Abilene. As a result, Michigan K-12 schools, community colleges, public and private colleges and universities, libraries, museums, hospitals and clinics involved in education can use Internet2 for a wide range of activities that are simply not possible, or which do not work well, over today's commodity Internet.

In addition to the group partici-

pation arrangement with Merit in Michigan, the Internet2 organization now has similar arrangements in Missouri, Oregon, Virginia, Washington, California, Oklahoma, Indiana, Ohio, Wisconsin, Rhode Island, and Pennsylvania.

What is Internet2?

Established in 1997, Internet2 is a collaborative effort among the nation's leading research universities, teamed with government and industry partners, to build the next generation of the Internet. While higher performance is one cornerstone of this effort, an equally important emphasis is developing and promoting applications that take advantage of the high performance network's capabilities.



Today 17 Michigan organizations have access to Internet2 capabilities. Michigan State University and the University of Michigan were the first to receive access, beginning in February 1999. See "Michigan Organizations with Internet2 Access" (see sidebar) for a complete list.

Nationally there are 185 Internet2 member universities, and 74 Internet2 Non-profit and Corporate Collaboration Sites. In addition Internet2 maintains gateways to over 21 international high performance research and education networks and five high performance federal agency research networks in the U.S. Check the Web at <http://www.internet2.edu/html/members.html> and <http://www.internet2.edu/abilene/html/peernetworks.html>. These lists provide a sense of the scope of Internet2 and the resources that may currently be reached. The scope of sites available via Internet2 will soon expand much further as K-12 schools, libraries, community colleges, and other educational organizations gain access as part of the Internet2 Sponsored Educational Group initiative.

What new educational applications are possible?

Many of the new applications that are emerging involve people communicating or collaborating with each other. Interactive video often plays an important role in these activities. Video delivered over Internet2 can support combinations of video delivered from and to

Michigan Organizations with Internet2 Access

PARTICIPANT	CONNECTED	INTERNET2 AFFILIATION
Michigan State University	February 1999	RM
University of Michigan, Ann Arbor	February 1999	RM
Internet2 Ann Arbor Office	August 1999	RM
Michigan Technological University	September 1999	RM
Wayne State University	September 1999	RM
Western Michigan University	March 2000	RM
Northern Michigan University	November 2000	SP
University of Michigan, Dearborn	December 2000	RM
Environmental Research Institute of Michigan	May 2001	SP
Eastern Michigan University	May 2001	SEGP
Ferris State University	May 2001	SEGP
Grand Valley State University	May 2001	SEGP
Saginaw Valley State University	May 2001	SEGP
Central Michigan University	May 2001	SEGP
Lake Superior State University	May 2001	SEGP
Ford Motor Company	July 2001	CM
Oakland University	August 2001	SEGP

RM - Regular Member
 SEGP - Internet2/Abilene Sponsored Educational Group Participant
 SP - Internet2/Abilene Sponsored Participant
 CM - Internet2 Corporate Member and an Abilene Collaboration Site

computer or office desktops, classrooms, conference rooms, laboratories, large lecture halls and auditoriums. Depending on the type of video encoding used, the video and audio quality can be similar to the quality available today over H.320-style switched video systems, but without the per-minute usage charges that are usually associated with such video sessions today. Depending on the encoding standards used and the bandwidth available, video and audio quality can be better than broadcast quality video.

See "Applications Possible with Internet2" (sidebar) for Internet2 examples.

Is this a new network that replaces my current network?

Probably not. All organizations that have access to Internet2 must also have access to the commodity Internet. While some organizations choose to implement separate local area networks (LANs) and/or wide area networks (WANs) to support their high performance applications, most organizations use the same LAN and/or WAN infrastructure to carry both Internet2 and commodity network traffic. MichNet will carry both types of network traffic and automatically route each to the appropriate Internet2 or commodity backbone network.

While Internet2 access is often talked about in terms of its high speed, there are no minimum speed requirements to be able to use Internet2. Instead, organizations need to evaluate the applications that they expect to use and determine the network requirements that will allow those applications to operate well. In some cases, such evaluations will find that characteristics of Internet2 other than speed are important. For example, good quality interactive video can often be done at the relatively modest speeds of 384K or 768K bps, as long as the round trip network delay is reasonably constant (low jitter) and doesn't exceed 100 or 150 milliseconds (bounded delay).

Applications Possible with Internet2

NOTE: This is a list of examples, and not a complete list of what can be done over Internet2.

- Language students talking "face-to-face" with students in a foreign country.
- Music students coached by virtuoso teachers from a distant site.
- Virtual field trips to museums or remote sites made more meaningful because of greater detail, responsiveness, and "virtual reality" exploration of a room or space.
- Interaction between a student teacher and an established classroom teacher, or involving college faculty.
- Science students who utilize rare or expensive remote instruments such as electron microscopes, telescopes, or other devices that allow them to explore worlds outside their classroom.
- High quality video interaction with remote experts at the Smithsonian or astronauts working on the international space station.
- Using multicast video technology to deliver lectures, demonstrations, and performances to large audiences distributed across the country that would normally require broadcast television or satellite video delivery.
- The University of Michigan's Visible Human Project that makes it possible to "fly" through and view the detailed digital anatomical database of the human body that is being created by the National Library of Medicine.
- Access to extensive photographic and video archives maintained by NASA and many other organizations. Access to extensive archives of environmental, social, and other science data.
- Access to high performance computational clusters and other forms of "Grid" computing where computers, data, and other resources from many separate locations are coordinated to work on problems that are too large for any single site or organization to take on alone.

To be able to take advantage of Internet2 capabilities, organizations may need to upgrade some portions of their existing network infrastructure. Such upgrades might include replacing old copper wiring with new Category 5e twisted pair copper wiring, replacing older 10M bps Ethernet hubs with switches that support both 10M and 100M bps Ethernet ports, replacing older 10M bps Ethernet network interface cards in some personal computers with 100M bps cards, installing fiber between buildings, or upgrading the local access circuits that link the organization to the MichNet backbone with faster circuits. For some organizations that have recently installed new or upgraded network infrastructure such upgrades may not be necessary or may be fairly minor.

There are currently no additional "Internet2 access fees." The same MichNet Affiliate fees that organizations pay for access to the commodity Internet will cover the cost of Internet2 access. However, before enabling Internet2 access, individual

educational organizations and Merit will need to work together to ensure that appropriate local networking facilities and MichNet access exist to support the organization's Internet2 applications or that there is a commitment to obtain the appropriate facilities when they don't already exist.

What are the next steps?

Merit is very interested in learning about the kinds of applications that members of Michigan's educational community believe are important. We would appreciate any feedback or expressions of interest. Please send e-mail to internet2@merit.edu, including any comments or questions you may have or simply state that you would like to be notified as further information is made available. For more information on Internet2, see <http://www.merit.edu/i2/>.

— Greg Marks and Jeff Odgen





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Register Now for the Fall MichNet Seminar

Where: Lake Superior State University

When: Friday, September 28, 2001,
8:45 AM to 3:45 PM
(8:15 AM Registration)

The K-12 and Library Support Team (Merit's Member and Affiliate Services) is coordinating plans for the fall seminar. Seminar topics include High-Speed Connections, Net IP Services, the Teacher Technology Initiative,

the Children's Internet Protection Act, and the MichNet Caching Hierarchy. Online registration is available on Merit's website (<http://www.merit.edu/>). If you have any questions, please contact your support team (<http://www.merit.edu/merit/m&a.services.html>).