Access to Tier One Networks for Rural Virginia Counties

April 2004

Contents

This report was prepared as a supporting document for the Blacksburg Electronic Village "Getting Rural Virginia Connected" project. This project, funded by a Technology Opportunities Program (TOP) grant provided by the U.S. Department of Commerce, leverages the use of information technology to improve local economic conditions in several under-served communities in Virginia by providing tools and training to their residents and improving their ability to participate in the decision making process within their communities. It is undertaken as a partnership between between community citizens' teams, Virginia Cooperative Extension (VCE) and the Blacksburg Electronic Village (BEV). For more information about the project, please refer to http://top.bev.net/. Seven counties in Virginia are participating in the TOP project including Accomack, Craig, Cumberland, Dickenson, King and Queen, Louisa, and Northhampton (collectively referred to herein as the "TOP counties").

An element of the project is to identify appropriate technology and methods to promote development of broadband network infrastructure within each of the participating communities. Development of such local facilities extending true broadband access to businesses, schools, and residents has the potential to create a significant economic advantage. In order to maximize the potential value of any such investment, it will be necessary to connect regional and local infrastructure to facilities and services concentrated in large metropolitan areas strategic to the region to reach national and international networks.

The purpose of this report is to identify opportunities to establish broadband "backbone" connections for the participating counties to national and international networks, peering points, and major metropolitan markets. For purposes of this paper, we will refer to such facilities as "Tier One" networks.

The focus of this report will be on identifying fiber optic network facilities in place, planned, or prospective that might be useful for connecting community or regional networks to Tier One networks. Broadband wireless technology may ultimately play a role in establishing such Tier One links where fiber optic alternatives are limited. For instance, Local Multipoint Distribution Service spectrum owned by Virginia Tech could possibly be used to establish links to Dickenson County. However, the characteristics of the required backbone links that will be used to aggregate broadband local networks will drive a strategic requirement for fiber optic infrastructure. The scope of this report will be limited to fiber optic facilities and supported services. (The reader should not interpret this as a bias against use of wireless technology for community networks. In fact, the author believes "alternative" technologies including wireless and power system distribution may prove to play a very significant role in community-area distribution of broadband access.)

The existing national fiber optic network infrastructure is comprised of relatively few nodes located primarily in major, "tier one" cities interconnected by high capacity, long haul fiber optic cables. The so-called "fiber glut" often alluded to in the communications industry refers to these inter-city links that follow common, narrow paths. This inter-city fiber traverses a relatively small proportion of the geographic area of the country. In most cases it is largely inaccessible even within the communities through which it passes. Most of the communities participating in this project, indeed most of the rural counties in the United States, are not traversed by these "fiber interstates".

Further, even where the fiber does pass, it is largely inaccessible. This national infrastructure, much like the air travel system, can be accessed only at the major nodes it interconnects. In the mid-Atlantic region, such nodes exist in the Washington D.C., Philadelphia, Baltimore, and Atlanta metropolitan areas and, to a lesser degree, in the Richmond, Norfolk, Raleigh, Greensboro, and Pittsburgh areas.

Providing a means to link rural community and intra-regional infrastructure to these major markets yields benefits that are self-evident. The availability of multiple service and application providers within the tier one locations provides opportunity for access to a wide range of information services with competitive pricing and terms. Multiple transport providers maintain major access facilities in these areas providing opportunity to leverage flexible network technologies to connect with enterprise networks, vertical partners, service providers, international facilities, and others. For certain entities within the study area, including NASA's facility at Wallops Island, fiber connectivity to the DC area would facilitate connectivity to other enterprise computational and network resources and to national research networks like National LambdaRail.

Approach to Establishing Links to Tier One Locations

There are three fundamental approaches to establishing large capacity links to tie rural community broadband networks to Tier One facilities as described earlier in this paper.

1. Acquire capacity using "lit service" supplied by an existing provider.
2. Lease dark or dim fiber from an owner of existing facilities.
3. Construct new fiber facilities.

Ideally, links to tier one access points should offer the same degrees of flexibility, performance, and robustness of the community infrastructure described in the report this document accompanies. In practice, this may be difficult to accomplish using existing fiber facilities due to several factors.

- As previously described, long haul fiber already in place is inaccessible except for a very few locations.
- Owners of existing fiber typically offer only limited, "legacy" services and do not readily promote direct access to fiber.
- Fiber in place varies greatly in condition, specifications, reliability, and capability.
- Where fiber is available for lease it may be difficult to negotiate access at favorable terms.

Thus, while a community infrastructure may be capable of supporting a variety of needs and approaches ranging from dedicated fiber to the enterprise to high performance service provisioning, it may be difficult or impossible to leverage those capabilities for access to major network access points outside the region using existing, long haul facilities. Ultimately, this may argue for acquisition or construction of high capacity, multiple fiber links to connect the region to tier one markets.

In the very near term, the recent downturn in the telecom sector following a period of incredible expansion of facilities interconnecting large cities may present significant opportunities to acquire fiber, related materials, or even completed fiber systems at low cost. Some inter-city fiber already constructed along overbuilt north-south routes through Virginia may be available at sharply reduced cost compared to prices of just eighteen months ago. We do not expect these opportunities to exist for long; these resources are already being subsumed into inventories of the remaining industry players and speculators. Acquisition of such assets will require aggressive action but attention to expert due diligence must be carefully applied.

There are several options for gaining access to long haul facilities including construction, leasing/IRU, and buying managed transport services.

Construction and Ownership

Construction and operation of new fiber facilities to connect individual rural communities to Tier One markets will be difficult to cost justify and to execute. Significant capital cost, the need for diverse paths, high cost for remote facility operation and maintenance, right of way acquisition costs, management challenges, and political challenges are just a few of the difficulties such a proposition will entail. Construction of a new long haul fiber route cannot be undertaken lightly.

Nonetheless, no community can afford to be isolated in the absence of accessible fiber facilities to connect to the national fiber optic infrastructure. Also, the greatest degree of control and flexibility would be achieved through ownership of facilities. If all else fails, construction may be required.

Construction methods, techniques, standards, and considerations for long haul facilities are similar to those described elsewhere in this report with a few special considerations. The type of optical fiber typically recommended for long distance links is ITU G.655 compatible or “non-zero dispersion shifted” fiber. Corning LEAF, Pirelli FreeLight, and OFS Truewave are a few examples of such products. High fiber counts are typically applied to long haul builds in order to accommodate multiple uses and future expansion.

As mentioned, right-of-way challenges are significant. This is particularly within urban areas where the cost of construction can soar to several hundred thousand dollars per mile due to obstacles posed by urban development. Along with the control and flexibility of ownership comes substantial responsibilities and cost in the forms of ongoing management, administration, maintenance, etc. Recurring costs for right-of-way, pole attachments, and other fees may be substantial. In order to make use of the installed fiber, network optronics and electronics must be installed and managed. This applies also to leased fiber described below. It should be noted that the cost of designing and building the network, lighting the fiber, and managing the system can be many times the cost of the fiber itself.

An attractive approach may be to partner for a joint build with an entity positioned to take on these responsibilities. Also, several providers, including many of those listed below, offer customized managed services packages that may include design, engineering, construction, and facilities management. A typical approach is similar to condominium development with multiple tenants of the fiber sharing costs (the term “condominium fiber” is in common use).

Fiber Lease/IRU

A common approach to securing access to fiber is to lease it from the owner of an existing or planned route. This is typically accomplished through an Indefeasible Right to Use (IRU) agreement. An IRU is a right to use a specified amount of capacity for a specified time period. The "indefeasible right" is one that cannot be revoked or voided.

An acquirer of an IRU may use the capacity, leave it idle, or allow third parties to use some or all of it in return for payments or other consideration subject to the terms of the IRU agreement. IRUs usually involve a one time payment for a long term lease of the fiber spanning 10, 20, or 30 years. Short term leases for fiber are also common and may contain provisions for rollover to IRU status.

The cost for fiber leases varies widely depending upon availability, business strategy of the owner, and other factors. IRUs for fiber along overbuilt routes between major cities, for example, are currently priced typically from $300 to $1,500 per fiber mile. IRUs for fiber along paths where fiber is scarce may be priced up to $3,000 per fiber mile or more.

Owners of long haul facilities typically are reluctant to lease only a portion of a fiber between two major points of presence since that will effectively "strand", or isolate, the remaining fiber along that path. For example, an attractive IRU for fiber from the a rural Virginia county to Raleigh may be accompanied by a requirement to also pay for the portion from the region to Washington DC, presuming the route runs from Washington to Raleigh. (Depending upon the circumstances, this example could be argued to demonstrate a positive design outcome since owning routes north and south would help achieve route diversity.)

In the case of lease via IRU, in addition to the one time cost and an agreement for the IRU itself, a maintenance agreement is typically required with annually recurring maintenance fees payable to the owner of the fiber. In return, the owner will agree to perform prescribed regular maintenance and repairs. Also, depending upon the distances, characteristics of the available fiber, and planned network design, it may be necessary to include a collocation agreement for amplification and regeneration facilities which increases the annually recurring costs. The collocation agreement may include terms for collocating within the owners' major node facilities at the link endpoints for interconnection to other carriers and services.

As with construction of new fiber, leasing dark fiber will require implementation and ongoing operation of an overlying network system to light and use the fiber. Capital cost and ongoing operations cost over the life of the project may amount to many times the cost to lease the fiber. Project planners must be very careful to include ALL cost for total system implementation and operation. The cost for system operation will likely be justified only when considerable capacity growth and multiple uses are factored in.

Managed Transport Services

Because of the significant capital cost, ongoing operations and maintenance cost, and administrative challenges posed by the alternatives of building or leasing fiber and implementing a private network, most communities will seek to negotiate for links provided by existing or emerging service providers. High capacity links of the type required to connect broadband community infrastructure to the information economy

have historically been unavailable in rural areas and only at extraordinarily high cost where they have been available.

However, recent developments have strengthened the prospect for negotiating the right type of service with existing providers. In particular, Verizon, which is the incumbent local service provider for each of the counties included in the TOP program, has worked in partnership with a consortium of research universities in Virginia to develop a new fiber optic network system that may be used to provide access to rural communities through the NetworkVirginia program. A description is included below.

Generally, most owners of existing optical facilities will prefer to offer some form of managed service to provide the required long haul links. The provider will light the fiber and offer a turnkey facility that may be interfaced to the customer's network. Typical transport services offered include private line service using ATM, Frame Relay, and/or SONET services ranging from DS1 (1.5 Mbps) to OC-192 (~10 Gbps) links with intermediate services typically at 45 Mbps, 155 Mbps, 622 Mbps, and 2.5 Gbps.

For purposes of establishing an aggregate connection for a broadband community infrastructure, 45 Mbps should be considered an absolute minimum capacity. SONET or newer, lower cost gigabit Ethernet services in the 1 gigabit per second range and higher should be the objective. Increasingly, providers are offering optical wavelengths as a managed service typically configured with 2.5 Gbps or 10 Gbps capacity. Such wavelength services may offer the best opportunity for control, flexibility, and cost containment. A challenge to reasonable pricing for high capacity services, particularly new optical wave services reaching rural areas, is that for most providers serving the region, capability to offer such services requires new construction with significant capital expenditure and there are relatively few initial customers. Thus, pricing for a single wavelength for the first customer may reflect nearly the entire capital cost to construct a system capable of offering many wavelengths. Verizon's NetworkVirginia proposed offering leverages the state's research entities as an anchor tenant to stimulate initial investment in the needed infrastructure.

Regardless of transport approach, a few common concepts should be taken into consideration:

Target metropolitan areas now contain "carrier hotels" and Internet exchanges which are common exchange points constructed to house communications and computing facilities and designed to facilitate interconnection among multiple carriers and service providers. Fiber or transport services should terminate within the urban area at such an exchange facility rather than at a point of presence providing access to only a few carriers or services. It will be necessary to negotiate a collocation agreement for space within the facility which may be part of the agreement for transport services.

Route diversity is important for reliability for long haul routes just as it is with regional or county network infrastructure. At a minimum, any local or regional system should have connections along two separate paths preferably on facilities owned and operated by at

least two separate entities to two tier one markets. Many permutations are possible to satisfy and strengthen this objective. An example would be to negotiate for circuits or optical waves from an entity capable of connecting to several tier one markets then add facilities as demand and engineering requirements dictate.

Scalability, meaning the ability to increase capacity and capability over time, is a crucial factor for future-proofing any solution. Construction and ownership of a multi-pair fiber path offers the best scalability. Partnering for implementation of a multi-channel WDM system with options to use additional channels over time is another good scaling strategy. Entering a long term contract to purchase "legacy" private line services may offer poor scalability.

Opportunities to Connect

Currently, there are a number of initiatives underway that may provide opportunities for the TOP Counties to connect to Tier One networks or hubs at favorable terms. In addition, we have provided a synopsis of known service providers with fiber optic facilities potentially available to connect Virginia communities to Tier One facilities. Many of these identified providers operate regional and national network systems that actually comprise such Tier One facilities.

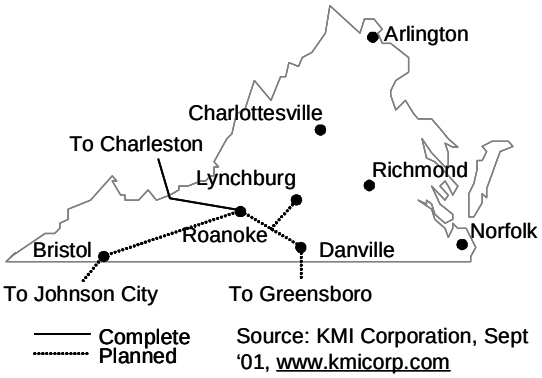
Providers with Existing Long Haul Facilities

This section identifies some providers with existing fiber optic facilities that may be available to provide links from the TOP Counties to Tier One network access points. This is not an exhaustive list of providers serving the region. The list is limited to providers appearing on a report from KMI Corporation depicting long haul fiber routes in Virginia.[1] Fiber path information is based on data from KMI Corporation last updated September, 2001 and reflects only approximate routes. Thanks to KMI Corporation, www.kmicorp.com, for permission to use this information in this report. The "offering" section displayed for each provider is, where quoted, as stated by the provider contact.

[1] KMI Corporation, *Virginia National and Regional Fiberoptic Long-Haul Networks*, KMI, Foundry Corporate Office Center, Suite 400, 235 Promenade Street, Providence, RI, www.kmicorp.com, 2001

AEP Communications, LLC

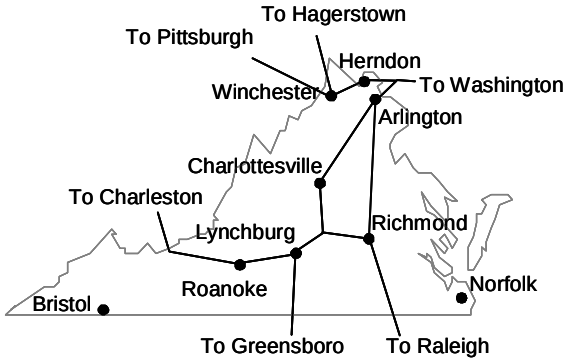
Address:	1 Riverside Plaza 11th Floor Columbus, OH 43215-2373
Telephone:	614-716-1389
Contact Person:	Scindra Kolecki
Title:	Account Manager, Asset and Bandwidth Services
e-mail:	sskolecki@aep.com
Internet URL:	www.aep.com
Offering:	"fiber leasing, construction, engineering services, network design, collocation, project management"



Source: KMI Corporation, Sept '01, www.kmicorp.com

AT&T

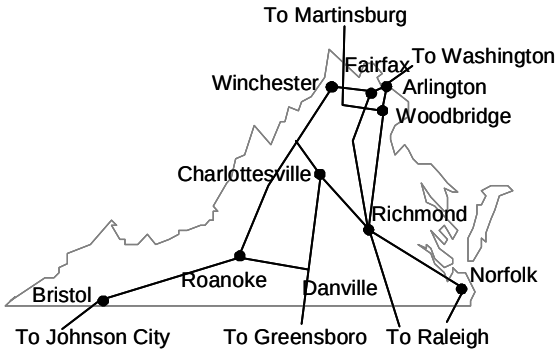
Address:	13630 Solstice Street Midlothian VA 23113
Telephone:	804-897-1734
Contact Person:	Chester Porter
Title:	Client Business Manager for VA
e-mail:	cdporter@att.com
Internet URL:	www.att.com
Offering:	"Full range of voice and data services, IT and professional services"



Source: KMI Corporation, Sept '01, www.kmicorp.com

Dominion Telecom

Address:	4355 Innslake Drive Glen Allen, VA 23060
Telephone:	804.565.7683
Contact Person:	Christian Weber
Title:	
e-mail:	christian_d_weber@dom.com
Internet URL:	www.dominiontel.com
Offering:	"Private Line (DS-1, DS-3, OC-N), WDM Waves, Ethernet. Fiber leasing and collocation are ICB."



Source: KMI Corporation, Sept '01, www.kmicorp.com

Note: On March 2, 2004, Elantic Networks, Inc., announced they have entered into a definitive agreement with Dominion Resources to acquire Dominion Telecom, a telecommunications subsidiary of Dominion. After closing, the Dominion Telecom name will be changed to Elantic Networks, Inc. The network will be managed by Cavalier Telephone LLC. Scheduled closing is 2nd quarter 04. CONTACT: Andy Lobred of Cavalier Telephone, LLC, +1-804-422-4100, alobred@cavtel.com

Level 3

Address: 8270 Greensboro Drive
Suite 900
McLean VA 22102

Telephone: 404.526.4782

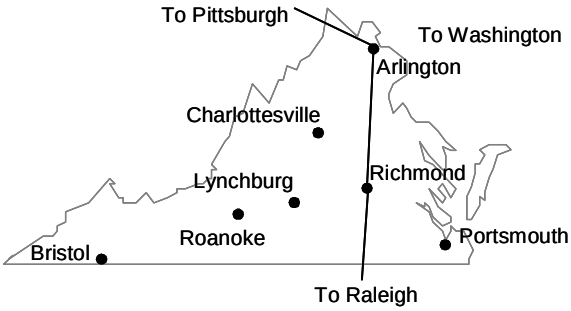
Contact Person: Kirk Foster

Title: Account Director

e-mail: kirk.foster@level3.com

Internet URL: www.level3.com

Offering: "Private line transport services, optical waves, managed services for construction, engineering, fiber leasing, collocation, MPLS transport product"



Source: KMI Corporation, Sept '01, www.kmicorp.com

Progress Telecom

Address: 100 2nd Avenue South,
Suite 500
St. Petersburg, FL 33701

Telephone: 727-820-5961

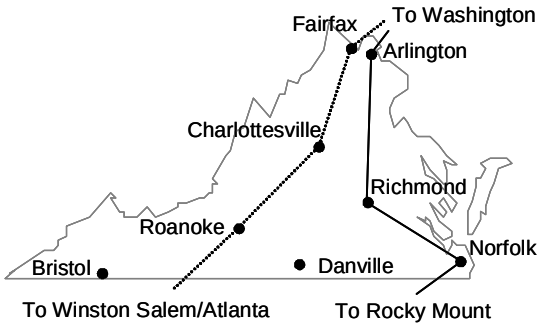
Contact Person: Steece A. Hayes

Title: Senior Account Manager

e-mail: shayes@progresstelecom.com

Internet URL: www.progresstelecom.com

Offering: Wholesale capacity, private line, optical wavelength

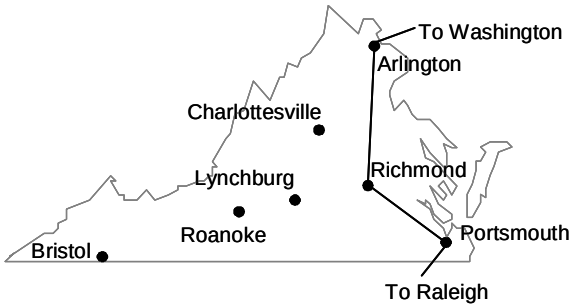


Source: KMI Corporation, Sept '01, www.kmicorp.com

NOTE: Company website map shows planned route completed as of Jan. 2003

Qwest

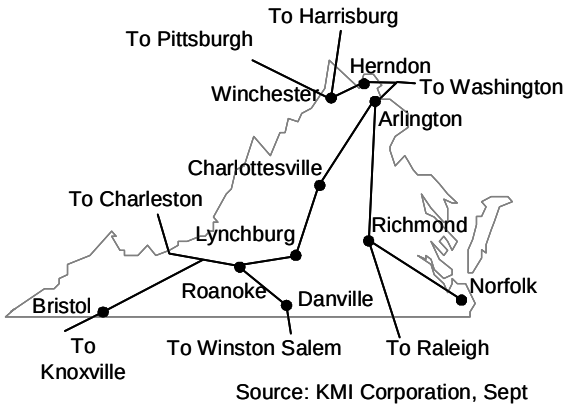
Address:	1306 Concourse Drive
	Suite 400
	Linthicum MD 21090
Telephone:	410-694-4848
Contact Person:	Joel Prescott
Title:	National Account Manager
e-mail:	Joel.prescott@qwest.com
Internet URL:	www.qwest.com
Offering:	"Private line services, Internet, collocation, fiber leasing, engineering, construction, hosting, VPNs"



Source: KMI Corporation, Sept '01, www.kmicorp.com

Sprint

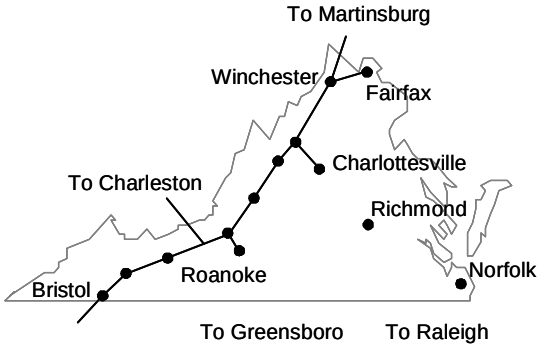
Address:	7202 Glen Forest Drive
	Suite 100
	Richmond VA 23226
Telephone:	804-285-5928
Contact Person:	Mike MacDowell
Title:	Account Executive
e-mail:	mike.macdowell@mail.sprint.com
Internet URL:	www.sprint.com
Offering:	"Full range of data network services", engineering, construction, fiber leasing, collocation, managed solutions



Source: KMI Corporation, Sept '01, www.kmicorp.com

Valleynet

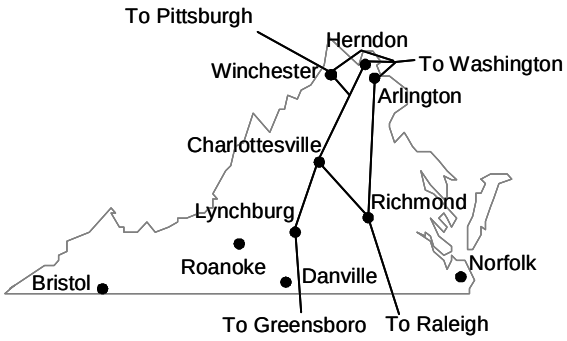
Address:	401 Spring Lane Waynesboro VA 22980
Telephone:	540-946-3525
Contact Person:	Gene Sandridge
Title:	General Manager
e-mail:	genes@valleynet.com
Internet URL:	www.valleynet.com
Offering:	"Wholesale bandwidth (DS1, DS3, OC-n, optical wavelength) member of DDR Broadband with capability to extend services to NC, SC, GA, FL, KY, in addition to Valleynet coverage in PA, MD, WV, TN"



Source: KMI Corporation, Sept '01, www.kmicorp.com

Wiltel (formerly Williams Communications)

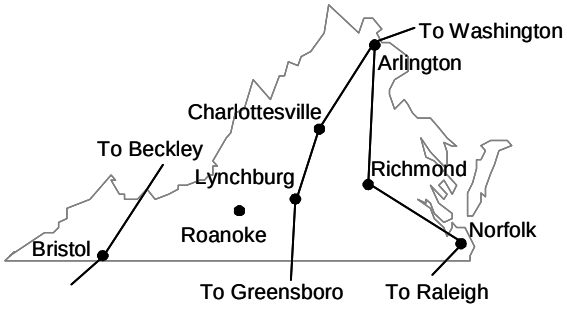
Address:	58 Camden Road NE Atlanta, GA 30309
Telephone:	678-296-4802
Contact Person:	Rob Armstrong
Title:	Regional Director, Sales
e-mail:	Rob.armstrong@wcg.com
Internet URL:	www.wiltel.net
Offering:	"Wholesale private line, ATM, frame relay, optical wave, fiber leasing, managed services"



Source: KMI Corporation, Sept '01, www.kmicorp.com

MCI

Address:	4951 Lake Brooke Drive
	Glen Allen VA 23060
Telephone:	804-527-6338
Contact Person:	Jim Nystrom
Title:	Director
e-mail:	Jim.nystrom@mci.com
Internet URL:	www.mci.com
Offering:	"Full array of voice and data services including private line, frame relay, ATM, Internet, Network Engineering and Managed Services, Worldcom is currently the enterprise service provider for the Commonwealth of Virginia including agencies, local and county government"



Source: KMI Corporation, Sept '01, www.kmicorp.com

In addition to the providers listed above that were included in the fiber path report from KMI Corporation, there are several service providers who have indicated an interest in providing inter-regional services.

Adelphia has long haul fiber within Virginia in addition to local fiber facilities in several communities. They offer typical private line services and have indicated on multiple occasions willingness to work innovatively to develop partnerships and new approaches. A contact is Tom Thompson, 24 West Main Street, Charlottesville, VA 22903, telephone 434-817-8132.

Cox also has both long haul and community area fiber optic facilities in the region and has indicated interest in working with economic development interests. A contact is Wes Neal, Director of New Business Development, telephone 757-369-4528.

Verizon has recently received regulatory relief in Virginia and may be able to address inter-regional connectivity requirements. In particular, Verizon is a prime contractor for NetworkVirginia described in more detail below.

Figure 1 displays national long haul fiber routes in place and planned as of May 2000. This map is copyrighted by KMI Corporation, http://www.kmicorp.com, and is reprinted by permission. The routes shown do not depict the precise location of fiber but rather indicate connections between nodes. This picture reinforces the point that long haul fiber is generally deployed along a relatively few paths nationwide interconnecting major urban areas. The pathways resemble large ribbon cables of fiber linking city to city with relatively few endpoints. The map in Figure 1 identifies the major nodes on the national fiber infrastructure. As previously indicated, important locations with proximity to Virginia include Washington D.C., Atlanta, Richmond, Norfolk, Raleigh, Greensboro, Charlotte, Philadelphia, and Pittsburgh.

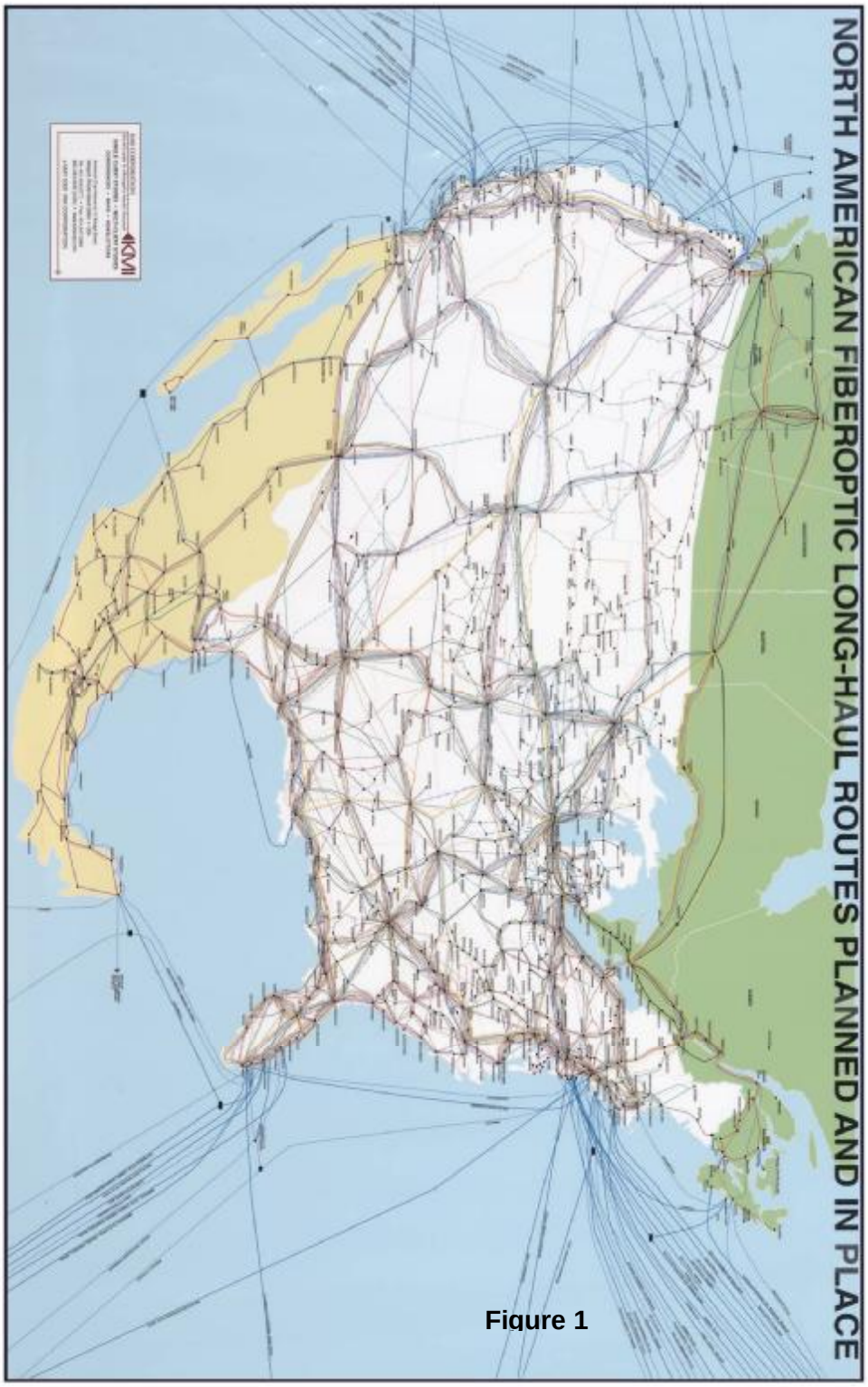

NORTH AMERICAN FIBEROPTIC LONG-HAUL ROUTES PLANNED AND IN PLACE

Figure 1

NetworkVirginia

NetworkVirginia (NWV) is a program managed by Virginia Tech to extend broadband network access to all Virginia communities on equitable terms with generally "postalized" pricing meaning prices are the same throughout the state. NWV currently connects about 1.4 million people statewide to the Internet and to distance learning programs offered by the state's education institutions. Since 1996, NWV has offered a variety of relatively high capacity access services with guaranteed availability and level pricing even in the most rural corners of Virginia. Originally open to only to public and private schools and municipal and state government, today NWV is available to anyone.

NWV is unique in that in addition to providing access to the public Internet, state education resources, and medical facilities, NWV also connects to the national Internet2 network and other advanced network systems via the NWVng gigaPOP operated by the Virginia Tech Operations Center in Blacksburg VA.

NWV service is based on contracts with multiple telecommunications service providers. The primary contractors are Verizon and Sprint. Through subcontracts, virtually every incumbent local provider in the state participates in delivering NWV services.

NWV offers access services using a variety of technologies to match application requirements. Traditional services based on Frame Relay and ATM ranging from 1.5 Mbps (or even less) to 622 Mbps are available. Newer, packet-based access services ranging from 10 Mbps to 1 Gbps are currently being deployed and are available in many areas. Verizon and Sprint representatives listed at the web site are available to discuss the options.

NWV may be employed in a variety of ways to support TOP Counties. Each TOP County today already has at least one entity with a NWV connection. It may be possible to augment the capacity of the existing or a new NWV connection to be shared by multiple entities. As another example, the county may wish to establish agreements with one or more local service providers who may be responsible for ordering and maintaining some combination of local and long distance links on behalf of the community. It is possible for a commercial entity to resell access to a NWV connection under special terms. Such an approach would not depend upon use of NWV for the Tier One links; a qualified local provider should be capable of analyzing all opportunities and recommending or implementing the best price/performance alternatives.

In addition to Tier One links, NWV offers local access services that may be used to construct a county-area network based on service provider facilities using a combination of access technologies ranging from traditional Frame Relay and ATM to newer "Transparent LAN Services" based on Ethernet. Again, service provider representatives at Verizon can describe capabilities in detail.

For more information about NetworkVirginia, pricing, contracts, and provider contacts, refer to http://www.networkvirginia.net.

National LambdaRail (NLR)

National LambdaRail (NLR) is a major initiative of U.S. research universities and private sector technology companies to provide a national scale infrastructure for research and experimentation in networking technologies and applications. NLR aims to catalyze innovative research and development into next generation network technologies, protocols, services and applications.

NLR is building a new national optical network system that will support these objectives. Scheduled for completion during 2004, the network will deliver capacity over 400 Gbps initially spanning fifteen thousand miles of fiber with nodes in Tier One research centers nationwide. In the mid-Atlantic region, the closest NLR node will be in the Washington DC metro area.

Research universities in Virginia, Maryland, and DC are cooperating through the Mid Atlantic Terascale Partnership (MATP) to implement the next generation optical network infrastructure to connect to the NLR DC node. One project of MATP called VORTEX will focus on implementing a new backbone network system in Virginia to deliver 1 Gbps Ethernet and 10 Gbps wavelengths access throughout the state.

NLR is centered on "big science" and computational research and will initially have little direct application for connecting K-20 schools, municipal governments, or health care facilities. However, the work required to implement the new state-level backbone systems like VORTEX offers stimulus for development of next generation access services statewide.

Also, access to NLR will be a fundamental requirement for research competitiveness in many areas of scientific research and innovation. The national "Teragrid" system which will establish a distributed system of supercomputing and large scale storage facilities nationwide will operate on the NLR infrastructure. Access to NLR for any community may provide large economic development benefits.

TOP Counties host research facilities that may have near term requirements for NLR access. In particular the NASA, NOAA, and Military facilities on the Eastern Shore are likely to require access to NLR or, at a minimum, access to similar technology in the near term.

Currently, MATP in Virginia includes direct membership and financial support from Virginia Tech, the University of Virginia, Old Dominion University, the College of William and Mary with the Virginia Institute of Marine Science, Virginia Commonwealth University, and George Mason University. Each of these institutions is highly engaged in development of the required optical network infrastructure.

For more information, contact Jeff Crowder at Virginia Tech, 540.231.3900, crowder@vt.edu or visit http://www.nationallambdarail.org.

Mid-Atlantic Broadband Cooperative

The purpose of this project is to promote economic development opportunities for communities located in Southside Virginia. Historically, there has been a lack of redundant, alternative fiber optic access to rural communities in Southside Virginia. Currently, the Incumbent Local Exchange Carrier's (ILEC's) (Verizon and Sprint) have fiber routes to 24 of the 56 industrial parks. However, in order to attract new-economy technology companies to the region, alternative carriers need to have affordable access to provide competitive broadband services to the area. MBC is moving forward to develop an open-access network independent of the existing ILEC routes.

The overall vision for MBC is to connect all industrial parks in Southside Virginia and key connectivity points to provide access to an open-access, advanced fiber optic network. The MBC will offer dark fiber pairs and/or wholesale bandwidth to competitive carriers, existing carriers, industry, research groups, etc. who have a desire to connect to the regional network, or provide competitive broadband services in the region.

The following map shows the region of Southside Virginia.
MBC has obtained commitments from the Virginia Tobacco Commission to fund the planning, design, construction, operations and management of a regional network to provide open-access competitive broadband services to communities in the Southside region.

Additionally, MBC has obtained separate funding via the Economic Development Administration (EDA) and VTC to build a 144-strand fiber optic backbone cable route along Route 58 and portions of Route 220 and Route 360 in Southside Virginia. The EDA/VTC Project connects the communities of Stuart, Martinsville, Rocky Mount, Ferrum, Danville, South Boston, Keysville, Clarksville, South Hill, Lawrenceville, and Emporia, Virginia. The MBC network operator will provide operations support, maintenance and management services on the EDA/VTC portion of the overall network, and will integrate the Southside regional network plan to include the EDA/VTC Project infrastructure.

The Mid-Atlantic Broadband Cooperative (MBC) is a non-profit 501c(6) organized under the laws of the Commonwealth of Virginia. The MBC is composed of an interim General Manager, and a nine (9) member Board of Directors, consisting of representatives from Southside Virginia.

The Virginia Tobacco Indemnification and Community Revitalization Commission (VTC) has been instrumental in identifying innovative strategies to revitalize the economies of Southside Virginia (www.vatobaccocommission.org). The existing economies in the region have experienced massive declines in Tobacco production, manufacturing, textiles and furniture production. To attract technology companies and provide jobs to help diversify the regional economy, a technology initiative is needed to provide the foundation for economic improvement. There are many factors that go into revitalizing a regional economy, but the VTC has committed the leadership necessary to ensure a long-term, viable future for the Southside region. This fiber optic backbone project is the cornerstone of our strategy to improve the communities of Southside Virginia.

When complete, the MBC network will provide significant opportunities for intra-regional and inter-regional connections for counties in the served area. Cumberland County, one of the TOP Counties, is included in plans for the MBC network. Early plans for MBC included a long haul fiber path extending from the region to the Hampton Roads are and up the Eastern Shore of Virginia and Maryland in association with Old Dominion Electric Cooperative (ODEC). ODEC continues to play a key role with MBC network development plans.

Interstate Collaboration on the Eastern Shore

Counties on the Maryland side of the Eastern Shore have been engaged in a fairly intensive project that should prove highly complementary to efforts initiated by the Virginia-BEV project. The Tri-County Council for the Lower Eastern Shore of Maryland, the Mid-Shore Regional Council (collectively, the 'Councils') and Cecil, Kent, and Queen Anne's counties, with support from the Maryland Technology Development Corporation (TEDCO) and the Maryland Department of Business and Economic Development (DBED) have led a project aimed at expanding the Eastern Shore's communications infrastructure capacity and competitiveness. This project seeks to resolve the lack of Internet access by determining best practices for using the region's existing assets, analyzing and defining critical gaps in current infrastructure, as well as providing specific workable solutions for the nine counties in the region. The overarching goal of this project, similar to the objectives of the Getting Rural Virginia Connected project, is to improve economic opportunities for Eastern Shore businesses and citizens.

The Maryland Councils are working with a consultant to conduct a large study including needs assessment and recommendations for action. The draft report is yet to be published at the time of this writing. During the course of study, the consultant reports discovery of current and prospective backbone providers that have expressed interest creating a new

fiber backbone route through the eastern shores of Virginia and Maryland that could service local communities across the Eastern Shore, provide additional points of presence for backbone carriers, and establish route diversity. Accomack and Northhampton counties should continue to collaborate with their neighbors in Maryland to try to realize this opportunity and to capitalize on region aggregation of interests and negotiating power.

Opportunities in Southwest Virginia

Dickenson County located in the southwest portion of the state is well positioned to build on existing broadband initiatives and to strengthen regional collaboration. Within Dickenson there is already significant momentum with a county-wide wireless network initiative called DCWIN to deliver multimegabit "last mile" services. In 2003, the Town of Haysi was awarded a Community Development Block Grant to install fiber optic cabling to interconnect 23 town businesses and a medical facility.

In the region, several entities, including the Cumberland Plateau and LENOWISCO planning district commissions and the Bristol Virginia Utilities Board (BVUB) are engaged in fiber optic construction programs focused on economic development.

The following initiatives have been undertaken using funds from the Virginia Tobacco Commission, the Economic Development Authority, and other sources:

- BVUB is expanding fiber optic network facilities and services reaching businesses and other premises in the Bristol area.

- BVUB and Cumberland Plateau are constructing a two stage fiber optic link from Abingdon to Lebanon and from Lebanon to Richlands. Envisioned are extensions to Tazewell and to Buchanan County.

- Lenowisco is working with multiple partners and contractors to construct fiber optic facilities throughout Lee, Wise, and Scott counties and the City of Norton. They are applying innovative construction techniques utilizing water mains and unique aerial deployments to minimize cost. Lenowisco, Inc. has been established to hold related assets and facilitate use.

A promising idea that has been put forth on repeated occasions by key players in these initiatives is to develop a southwest Virginia regional cooperative or some other "umbrella" organization where economies of scale could be realized, possibly to purchase bandwidth, as one example (these words literally cut and pasted from an email message written by one of these "key players"). We believe such an approach could result in significant benefits to participants and has the cumulative potential to create a formidable enterprise serving the economic interests of the region.

Summary

The TOP Counties are presented with multiple opportunities to establish links to Tier One networks and metropolitan hubs, though challenges for rural areas persist in this regard.

NetworkVirginia offers pre-negotiated service contracts for relatively low cost, high performance broadband service available in each of the TOP County areas and may be the best place to start to gather baseline data for comparison shopping.

Several wide area network service providers operate fiber optic facilities in Virginia and may offer competitive proposals for service. Contacts and rudimentary fiber maps are provided in this report.

The National LambdaRail, the Mid Atlantic Terascale Partnership, and economic development efforts like the Mid Atlantic Broadband Cooperative are driving development of cutting edge fiber networks and services throughout the state in partnership with private sector providers. NLR and MATP have particular relevance to connecting research facilities such as NASA, NOAA, and Navy facilities found on the Eastern Shore. Descriptions and contact information are provided in this report.

Regional efforts are ongoing surrounding all of the TOP Counties. The Tri-Counties efforts on the Eastern Shore, MBC in the southside region, Lenowisco/BVUB/Cumberland Plateau joint efforts in the southwest are a few examples. Community leaders in the TOP Counties are gaining position to effectively participate in and to lead new collaborative efforts that can help drive success for rural Virginia by ensuring the right type of information infrastructure which has become a crucial factor for economic development and quality of life.

Glossary

Cyberinfrastructure - A Blue Ribbon Panel was commissioned by the National Science Foundation to evaluate current investments in computing and network technology and to recommend areas for future emphasis. The Panel published a major report entitled "Revolutionizing Science and Engineering Through Cyberinfrastructure: Report of the National Science Foundation Blue Ribbon Advisory Panel on Cyberinfrastructure".

According the Executive Summary:

> "The Panel's overarching finding is that a new age has dawned in scientific and engineering research, pushed by continuing progress in computing, information, and communication technology, and pulled by the expanding complexity, scope, and scale of today's challenges. The capacity of this technology has crossed thresholds that now make possible a comprehensive "cyberinfrastructure" on which to build new types of scientific and engineering knowledge environments and organizations and to pursue research in new ways and with increased efficacy.
>
> Such environments and organizations, enabled by cyberinfrastructure, are increasingly required to address national and global priorities, such as understanding global climate change, protecting our natural environment, applying genomics-proteomics to human health, maintaining national security, mastering the world of nanotechnology, and predicting and protecting against natural and human disasters, as well as to address some of our most fundamental intellectual questions such as the formation of the universe and the fundamental character of matter.
>
> The Panel's overarching recommendation is that the National Science Foundation should establish and lead a large-scale, interagency, and internationally coordinated Advanced Cyberinfrastructure Program (ACP) to create, deploy, and apply cyberinfrastructure in ways that radically empower all scientific and engineering research and allied education. We estimate that sustained new NSF funding of $1 billion per year is needed to achieve critical mass and to leverage the coordinated co-investment from other federal agencies, universities, industry, and international sources necessary to empower a revolution.
>
> The cost of not acting quickly or at a subcritical level could be high, both in opportunities lost and in increased fragmentation and balkanization of the research communities."

Full report available at http://www.cise.nsf.gov/evnt/reports/toc.htm

Dark Fiber Service - service provided by local exchange carriers (LECs) for the maintenance of optical fiber transmission capacity between customer locations in which the light for the fiber is provided by the customer rather than the LEC. (source: searchNetworking.com)

Dim Fiber Service – fiber optic service in which the carrier provides regenerators, but does not originate the optical signals at one-or-both ends of the link. Some carriers apply the term Dim Fiber, dubiously in the opinion of the author, to refer to a service in which the customer provides and manages the equipment to originate the optical signal yet pays a fee for service that varies with the capacity configured. (Such an approach illustrates blatantly to the need for facilities based competition.)

Ethernet – is the by far the most widely installed technology for local area networks and is now gaining stature as a wide area network technology. Fast Ethernet provides transmission speeds up to 100 megabits per second. Gigabit Ethernet provides transport at 1000 megabits per second (1 gigabit or 1 billion bits per second). 10-Gigabit Ethernet provides up to 10 billion bits per second.

Indefeasible Right to Use (IRU) – the granting of unconditional right to use of a facility. As applied to communications, the term "facility" can be flexible and may refer to capacity on a satellite transponder or a pair of fiber contained in a bundle cable. IRUs are typically specified in terms of a certain number of channels of a given bandwidth. An IRU for fiber is granted by the company or consortium of companies that built the fiber optic network and typically retains ownership and maintenance responsibility.

Lambda - the 11th letter of the Greek alphabet is the symbol for wavelength. In optical fiber networking, the word lambda is used to refer to an individual optical wavelength. (source: searchNetworking.com)

Mid-Atlantic Terascale Partnership (MATP) - a consortium of research institutions in Virginia, Maryland, and Washington formed to promote cooperation for development of terascale computational and optical network infrastructure in the region. http://www.midatlantic-terascale.org

National LambdaRail (NLR) –a major initiative of U.S. research universities and private sector technology companies to provide a national scale infrastructure for research and experimentation in networking technologies and applications. http://www.nationallambdarail.org

TeraGrid - The TeraGrid takes its name from two concepts from high-end computing. "Tera" is the metric prefix for "trillions" as in teraflops (trillions of calculations per second) and terabytes (trillion of bytes of data) and reflects the scale of the computing power provided by the TeraGrid… The "Grid" portion of the TeraGrid reflects the idea of harnessing and using computers, data storage systems, networks, and other resources as if they were a single massive system. In other word, Grid computing uses software

technologies to allow researchers to create "virtual supercomputers" far larger than the individual hardware components.

Terascale – computational power beyond a "teraflop" – a trillion calculations per second.

VORTEX – the Virginia Optical Research Technology Exchange is a project of the Mid-Atlantic Terascale Partnership to implement optical network infrastructure to connect Virginia research institutions to the National LambdaRail.

Wave Division Multiplexing (WDM) - a technology that puts data from different sources together on an optical fiber, with each signal carried at the same time on its own separate light wavelength. Using WDM, up to 80 (and theoretically more) separate wavelengths or channels of data can be multiplexed into a light stream transmitted on a single optical fiber. (source: searchNetworking.com)

The Author

Jeff Crowder is Director of Strategic Initiatives in Information Technology at Virginia Tech. Jeff has been active in the development of advanced communications infrastructure for nearly twenty years. Recently, he has served as director for NetworkVirginia and has helped to found and develop Virginia Tech's eCorridors program, the National LambdaRail, and the Mid Atlantic Terascale Partnership. Jeff can be reached via email at crowder@vt.edu.