Louisa County

Technology Assessment and Master Plan

September 2004

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I. Introduction

In October 2001, the US Department of Commerce NTIA (National Telecommunications and Information Administration) awarded a Technical Opportunities Program (TOP) grant to fund a proposal submitted by the Blacksburg Electronic Village, Incorporated (BEV Inc.) titled "Getting Rural Virginia Connected: A Vision for the Future,". The proposal called for the BEV to partner with Virginia Cooperative Extension (VCE) to implement this project in nine rural counties in Virginia with large populations of underserved residents. These counties which spread from Virginia's Eastern Shore to the western border with Kentucky included, going from east to west, Accomack and Northampton (the Virginia Eastern Shore), King and Queen, Louisa, Cumberland, Craig, Carroll, Grayson and Dickenson counties. Unfortunately, the start of project was delayed and by the time activities were actually underway (July 2002), Carroll and Grayson had undertaken and completed large portions of this effort by using funding from other sources. The project scope was modified in August 2003 to exclude Grayson and Carroll counties in recognition of the fact that given the significant delay in the project, there weren't sufficient resources to implement a modified project plan in these two counties.

The following reference map shows where the TOP counties are located relative to planning districts, congressional districts, tobacco regions, and the Appalachian Regional Commission areas in Virginia. The TOP Grant counties are indicated by a cross-hatch pattern. They are located in Planning Districts 2, 5, 10, 14, 18, and 22.

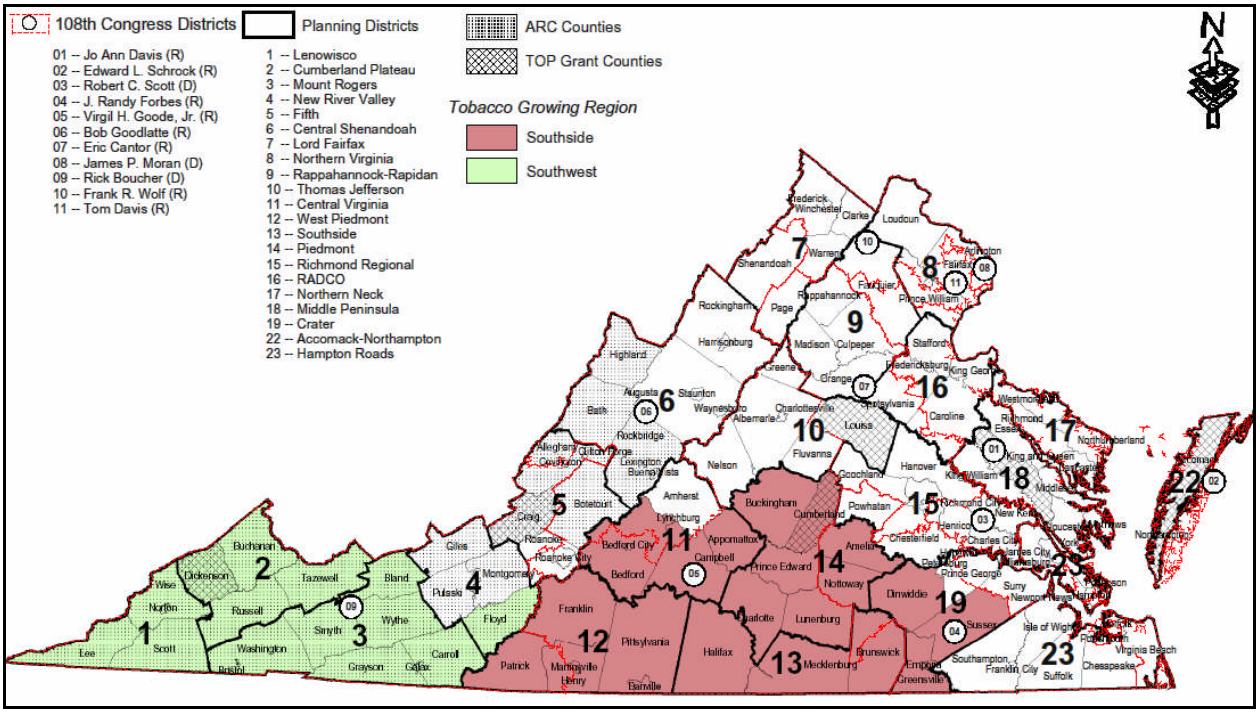

Figure 1: VT Reference Map for Projects in Virginia

The Technical Opportunities Program is designed to demonstrate practical applications of new telecommunications and information technologies that serve the public interest. A major area of

interest is affordable broadband access for everyone. The NTIA explains, "TOP projects demonstrate how digital networks support lifelong learning for all Americans, help public safety officials protect the public, assist in the delivery of health care and public health services, and foster communication, resource-sharing, and economic development within rural and urban communities." Broadband is viewed by many as essential for economic development and to support the creation of jobs in the New Economy of electronic business and commerce.

This report addresses three deliverables for the TOP grant. The first is to identify at least four social and/or economic needs in each county. These become goals for technology plans. Second, to develop strategic technology plans to address the goals. Third, identify and plan for regional technology corridors to link communities. It is important to connect community networks to other networks with access to the region and the world.

The approach used for technology planning is the Take Charge Process. In this process, leaders in each community form a Technology Leadership Team (TLT) to determine where their county is (assessment), where their county wants to be (goals), and how to get there (technology plan). Other socio-economic issues are also important, but this report focuses on the communications technology aspects.

II. Methodology

A. Computer System Policy Project

The Computer System Policy Project (CSPP) is a public policy group that advocates network readiness to "rekindle economic growth by fully capitalizing on the new ways of living and working enabled by the Networked World, while protecting our core values and our national security." The CSPP is comprised of chairpersons and chief executive officers from America's leading Information Technology companies. They have provided four key papers that describe the vision, rationale, and guidelines that communities can use to work toward becoming network ready. The papers are in the appendices and they can be downloaded from www.cspp.org.

Four key CSPP reports in the order of publication are:

- *Living in the Networked World*, June 2000
- *The CSPP Readiness Guide for Living in the Networked World*, October 2000
- *Building the Foundation of the Networked World*, November 2002
- *Choose to Compete*, January 2004

The *CSPP Readiness Guide* provides an assessment methodology to determine a community's stage of readiness to participate in and benefit from the networked world. The process entails analyzing the networked state of major sector categories, which in this report include communications access providers, government, education, healthcare, business and home. Four stages of readiness are considered. At the highest level, stage 4, affordable broadband access is readily available to all. At the low end, stage 1, only dial-up modem service is available to most people. A community needs to determine where they are in terms of network readiness so they can plan for how to work toward the goals described for stage four, the highest level.

Concepts from the *CSPP Readiness Guide* were used in this project for community assessment strategy. They were incorporated into an Interview/Survey template to provide a guide for interviews and a format for documenting information. The interview template is in the appendix. Since data, voice, and video are converging over time to an integrated digital network, questions were included for voice and video needs, as well as data. In some cases, the person interviewed, or surveyed, did not answer all questions. Overall, the information obtained was still informative.

B. Information for Assessments and Planning

Information sought during interviews/surveys included:

- Current voice/data/video services, providers, costs, and needs
- Measure of network applications in use and those expected to be used
- Network speed and throughput needed to support expected applications
- Estimated levels of network application utilization and training needs
- Desired cost for expected network access needs
- Suggestions for community network needs and solutions

In addition to interviews/surveys, other major sources of information used, where available, included results of formal take charge processes, TLT meeting notes, county comprehensive

plans, planning/vision documents, and website data. Also, information was used from demographic/census reports and GIS (Geographic Information System) data (i.e., street, boundary, business points). Much of this information is also useful for technology planning.

Major sector categories analyzed were telecommunication access providers, government, education, healthcare, business and home. Telecommunications access providers were included as a special sector due to their importance for broadband Internet access. Business and home categories are considered together, since many small businesses and homes use similar broadband access.

Additional information for businesses was obtained from MapInfo GIS Business Point Data that groups entities into 16 industry sectors. The data included entity name, address, number of employees, sales, category, and GIS coordinates (latitude and longitude). The data was used to plot their locations on a county maps and for analysis. Histograms were created that provide graphical views for businesses by number of employees, businesses by sector and number of employees, employment by sector and firm size, and sales by sector and firm size. The histograms provide an overview of industry in each TOP county.

ESRI ArcGIS software was used to plot business locations with relative employee size on county maps. Many businesses in rural areas only had post office addresses, as opposed to street addresses, so their GIS coordinates were not available in the MapInfo Business Points database.

Another type of GIS map was drawn for each county to provide a graphical view of the population density per census block, which is the smallest U.S. Census geographic boundary area. Ten colors are used from light to dark to represent population density per square mile within each census block. The thematic map provides insight into where broadband services are needed. All maps are provided as PDF files so one can zoom in on a computer to see the details.

Additional information sources included:

- VEDP (Virginia Economic Development Partnership) county profiles—the best single source found for comprehensive county profile information (www.yesvirginia.org)
- U.S. Geologic Survey GNIS (Geographic Names Information System)—the official source of named places and features within counties (geonames.usgs.gov)
- SRC custom demographic reports—a commercial online source for census and demographic information (www.demographicsnow.com)
- U.S. Dept. of Labor Consumer Expenditures in 2002—includes statistical averages for income and expenses (www.bls.gov)
- U.S. Dept. of Agriculture NASS (National Agriculture Statistics Service) census report—2004 data for 2002 was recently released; agriculture is a major business in many rural areas (www.nass.usda.gov/census/)
- Virginia Dept. of Education 2002 School Census data (www.pen.k12.va.us)
- FedStats State and County—FedStats is an online Internet gateway to over 100 sources of official statistics collected and published by Federal agencies (www.fedstats.gov)
- VDOT (Virginia Dept. of Transportation) county highway maps—only hardcopies available (www.virginiadot.org)
- Local area telephone directories and yellow-pages

- Numerous websites

C. Telecommunications Terminology

Before delving into the results, it may help to define some of the major telecommunications terms and acronyms used. An important metric for broadband is the speed of the connection in each direction (down to the user and up to the network). Speed is commonly measured in kilo (thousand) bits per second (*Kbps)*, or mega (million) bits per second (*Mbps*).

Other major terms and acronyms used in this section include:

- Dial-up: Analog dial-up modem where speeds may vary from 19 to 52 Kbps
- BRI: ISDN (Integrated Services Digital Network) *Basic Rate Interface*—a digital dial-up line usually set to provide 128 Kbps in both directions
- DSL: Digital Subscriber Lines have been set to provide up to 384 Kbps upstream and up to 1.5 Mbps downstream—speeds vary for line distance, type of equipment, and service level agreement
- FR: Frame Relay—speeds generally range from 56 Kbps to 1.5 Mbps per service level agreement with committed (minimum) and peak (maximum) information rates
- Ethernet: Ethernet speeds of 10 Mbps, 100 Mbps, and 1 Gbps are available for NetworkVirginia Transparent LAN Service (TLS) within LATAs (Local Access and Transport Areas, which designate regions where a local carrier can transport traffic without handing it off to a long-distance carrier)
- T1, or DS1: T-Carrier, or Digital Signal, at 1.5 Mbps
- T3, or DS3: T-Carrier, or Digital Signal, at 45 Mbps
- Wireless: Fixed wireless at speeds up to 3 Mbps for DCWIN (Dickenson County Wireless Integrated Network)—speed may vary with distance, path, and service level agreement

A more comprehensive list of definitions for telecommunication terms and acronyms is provided in the glossary.

Now that some of the terminology has been clarified, we can discuss the interview results and assessments for each major sector. Also, we can list needs that were identified by the communities, which may serve as goals for technology plans. Information from take charge processes, TLT meetings, comprehensive plans, and other documents is included. Estimates for the stages of network readiness from 1 to 4 are assigned for each category. The stages are similar in concept to the four CSPP stages discussed earlier.

III. Louisa County Assessments

Information in this report was obtained during 2003 and early 2004.

A. USGS Geographic Names Information System Data

It is useful to be able to refer to named populated places for planning broadband access and to be able to show the places on a map. There are user locations that do not have place names where broadband is also needed.

The official U.S. source for populated place names is the USGS GNIS (Geographic Names Information System) database. It includes the latitude and longitude of places so they can be used with GIS and plotted on a map. The GNIS database also contains other information, such as the names and locations of locales, airports, bridges, cemeteries, churches, dams, parks, and more. The GNIS data can be downloaded in CSV (Comma Separated Value) format and imported into spreadsheets, or databases, for use with GIS and for analysis.

Two Excel spreadsheets containing GNIS data from USGS for Louisa County are provided in the appendices. One contains all of the GNIS data and a second contains only the populated places that were used to print place names on the county maps shown later in this report.

B. GIS Business Points Map

As mentioned earlier, six major sector categories were analyzed. These include telecommunications access providers, government, education, healthcare, and business/home. One source of business entity information is *MapInfo Business Points Data*. MapInfo uses the term "business" in a broad sense to mean entities in all industry sectors. The database contains geographic points of business locations throughout the U.S. The data allows one to see business locations in a given geographic area and gather information on those businesses such as business name, address, SIC code, employee sizes, sales, and location. Entities are classified into 16 sectors.

The MapInfo Business Points Data was used to create a map for Louisa County that shows the location, sector, and relative business size for each entity in the county. The entity location is shown by the placement of a dot on the map. The color of the dot indicates the industry sector and the relative size of the dot indicates the employee size range for the entity. See the following map and legend for details. The map is available in a computer PDF file where one can zoom in for a better view. Notice that businesses are distributed in many areas all across the county.

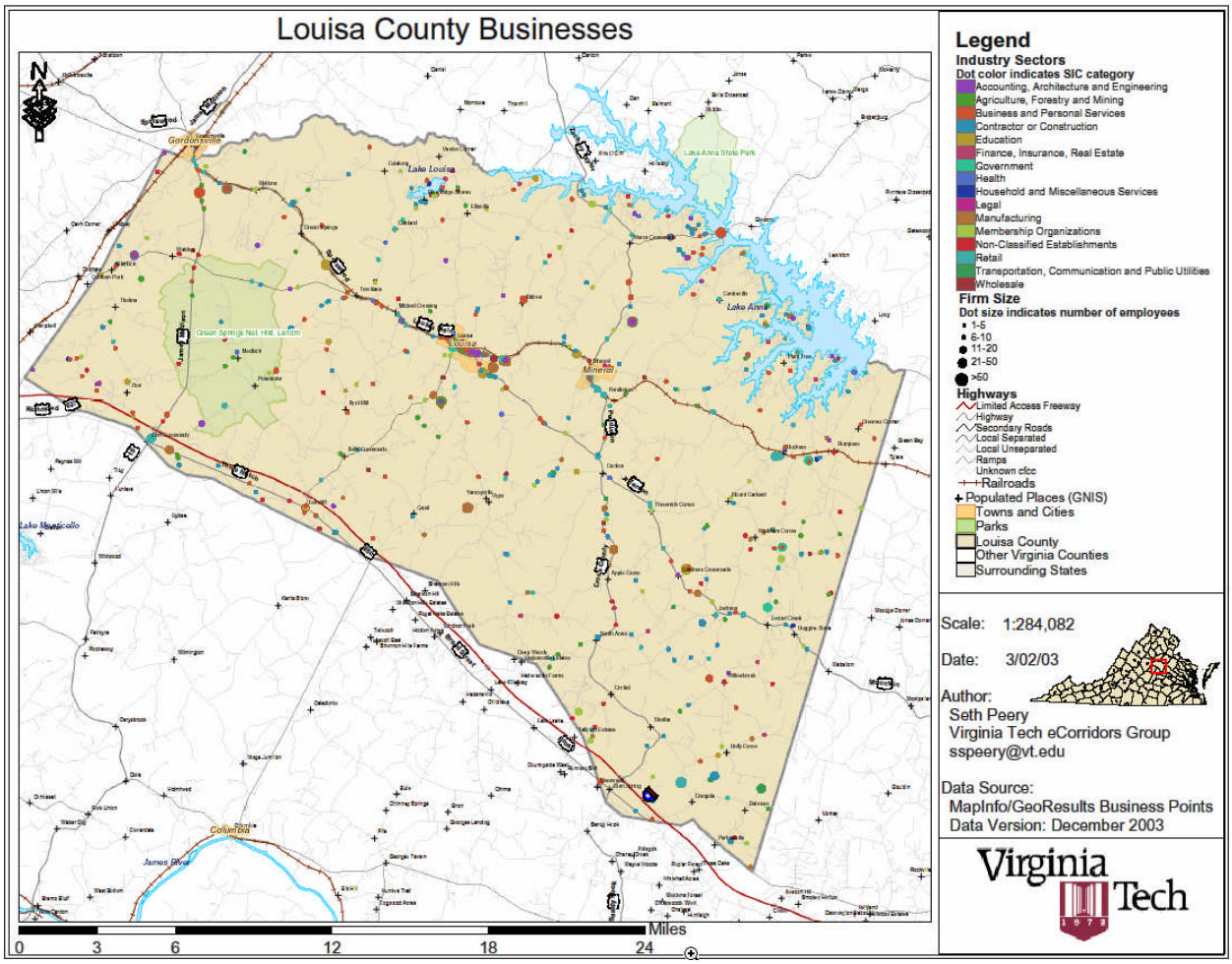

Figure 2: Louisa County Map of Business Sites

With the Adobe PDF version of the map, one can zoom in to see the details, as in the following map section that shows the towns of Louisa and Mineral. As an example of a business location, notice the large brown dot on the eastern side of Louisa. It represents a manufacturer sector entity with more than 50 employees. There may be overlapping dots that are not visible.

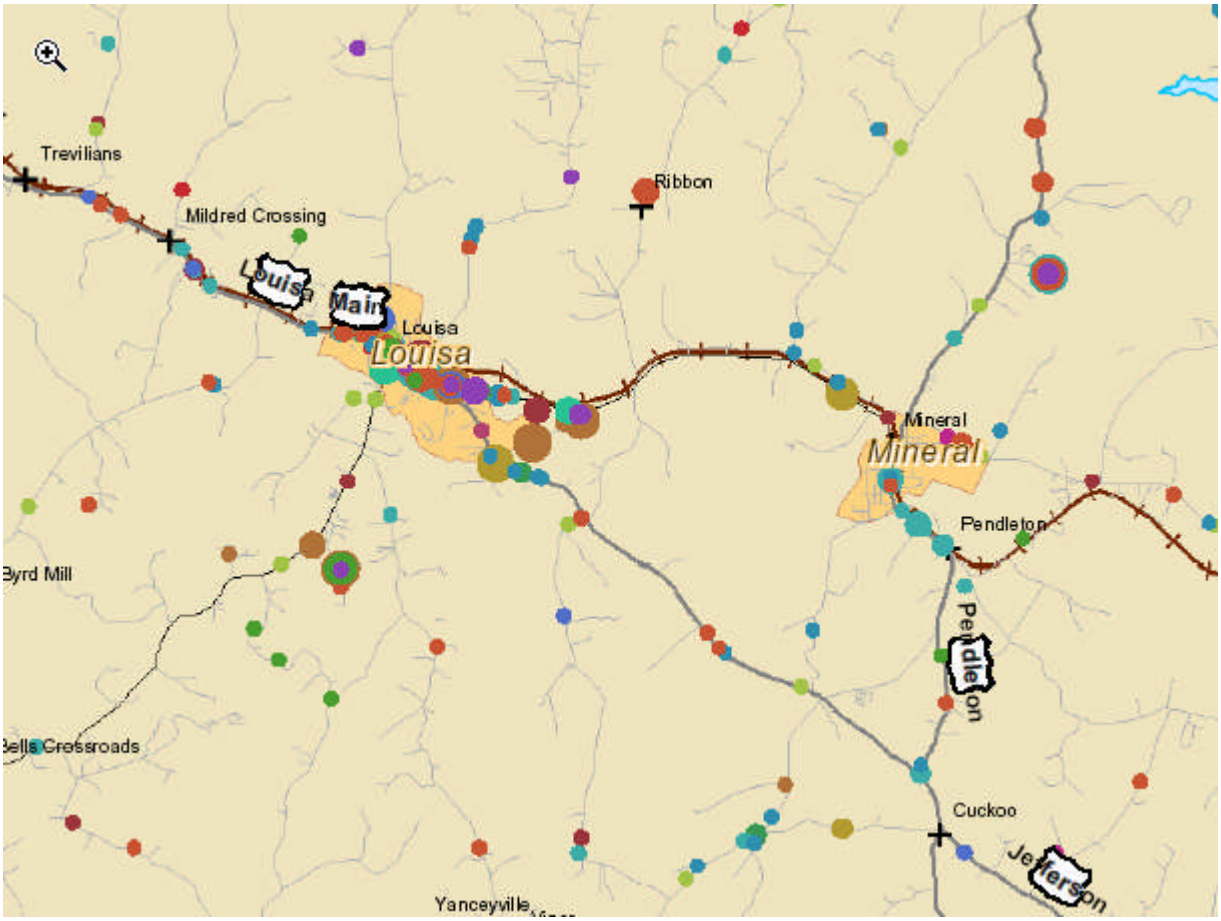

Figure 3: Louisa County Map of Business Sites (zoomed in for Louisa and Mineral)

C. Analysis of Business Points Data using Histograms

Four histograms were created from the *MapInfo Business Points Data* that provide insight into the number of businesses in the county, the numbers of employees, their industry sectors, and sales. Several people have pointed out that some of the values depicted are not correct, but it may still be useful for general insight.

The first histogram shows the number of businesses by number of employees. Notice that a large majority have ten, or less, employees. Business startups are a major source of new jobs and innovation, so it is desirable to make affordable broadband available to them.

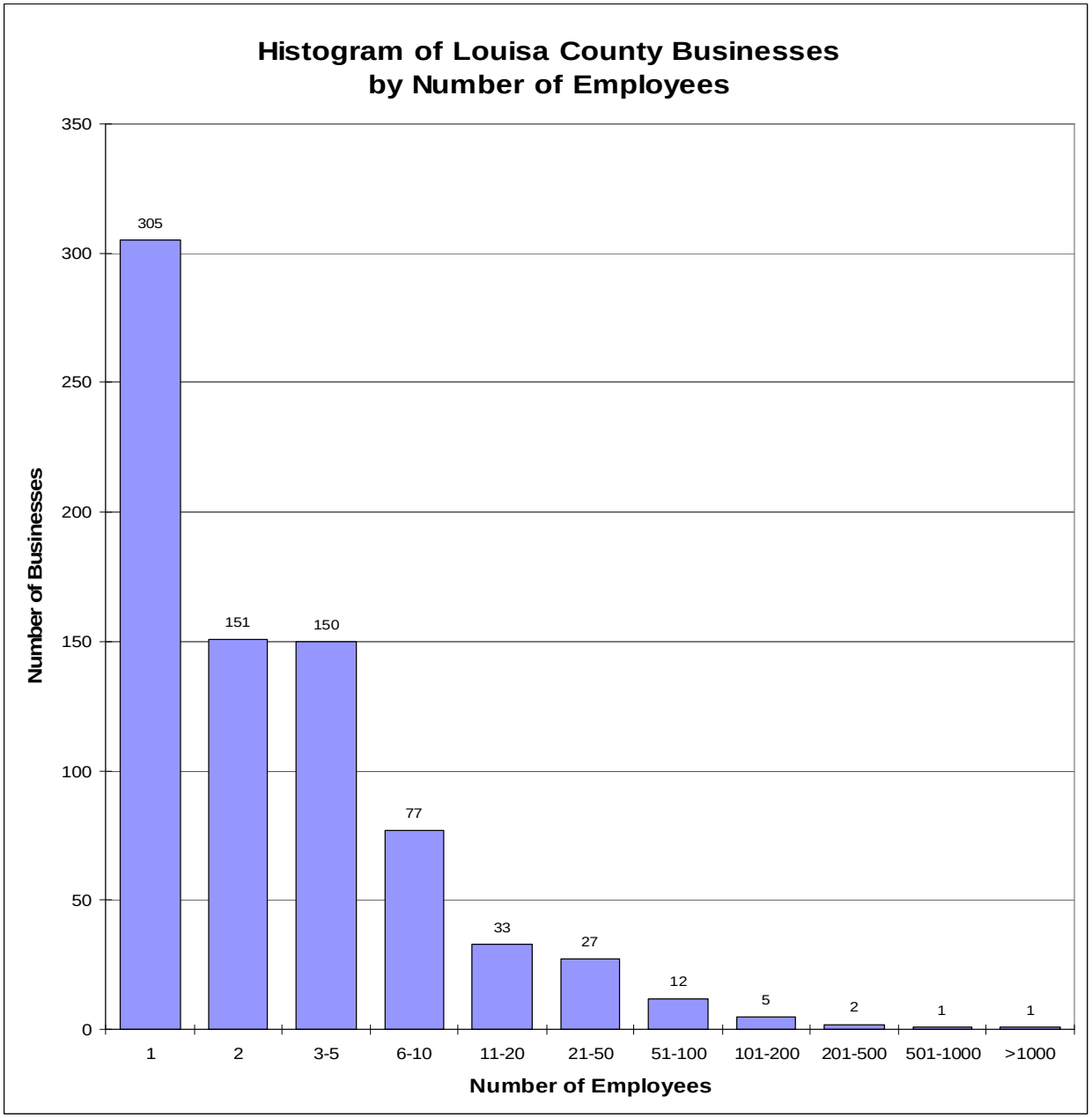

Figure 4: Louisa County Businesses by Number of Employees

The next histogram shows the distribution of businesses across 16 industry sectors. Notice that largest numbers of businesses are in retail, business/personal services, and contractor/construction sectors.

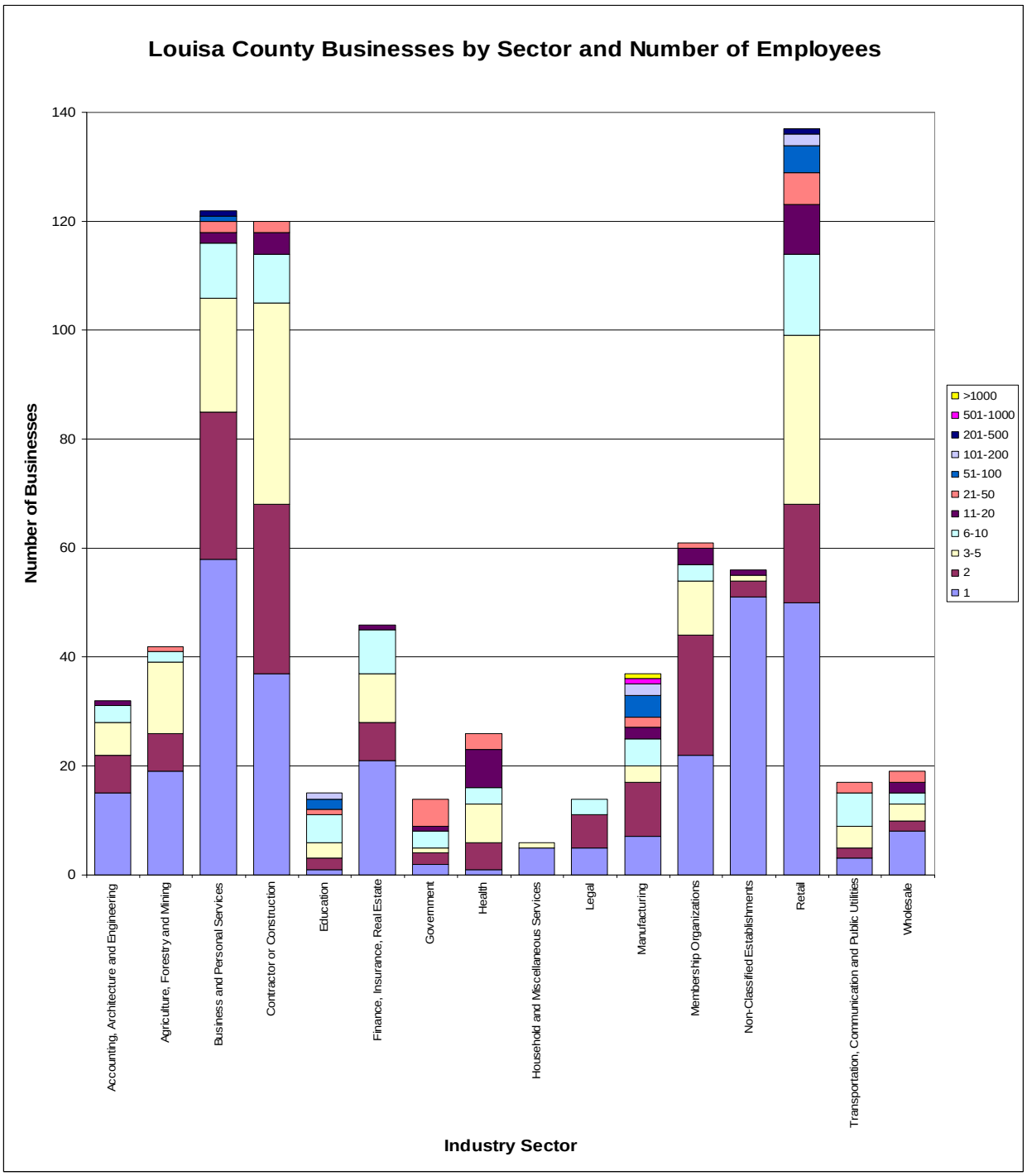

Figure 5: Louisa County Businesses by Sector and Number of Employees

The next histogram shows the number of employees by sector. Sectors with the two largest numbers of employees are manufacturing and retail. The large number of employees shown for manufacturing may include employees from other areas. This is an example of where one wonders if the data is valid. Since the database provides the names of the companies, one can check on potential discrepancies. The large yellow bar in the histogram represents the numbers of employees for manufacturers that have more than 1000 employees. There is only one in the database for Louisa County, which is Klockner Pentaplast, with 2800 employees.

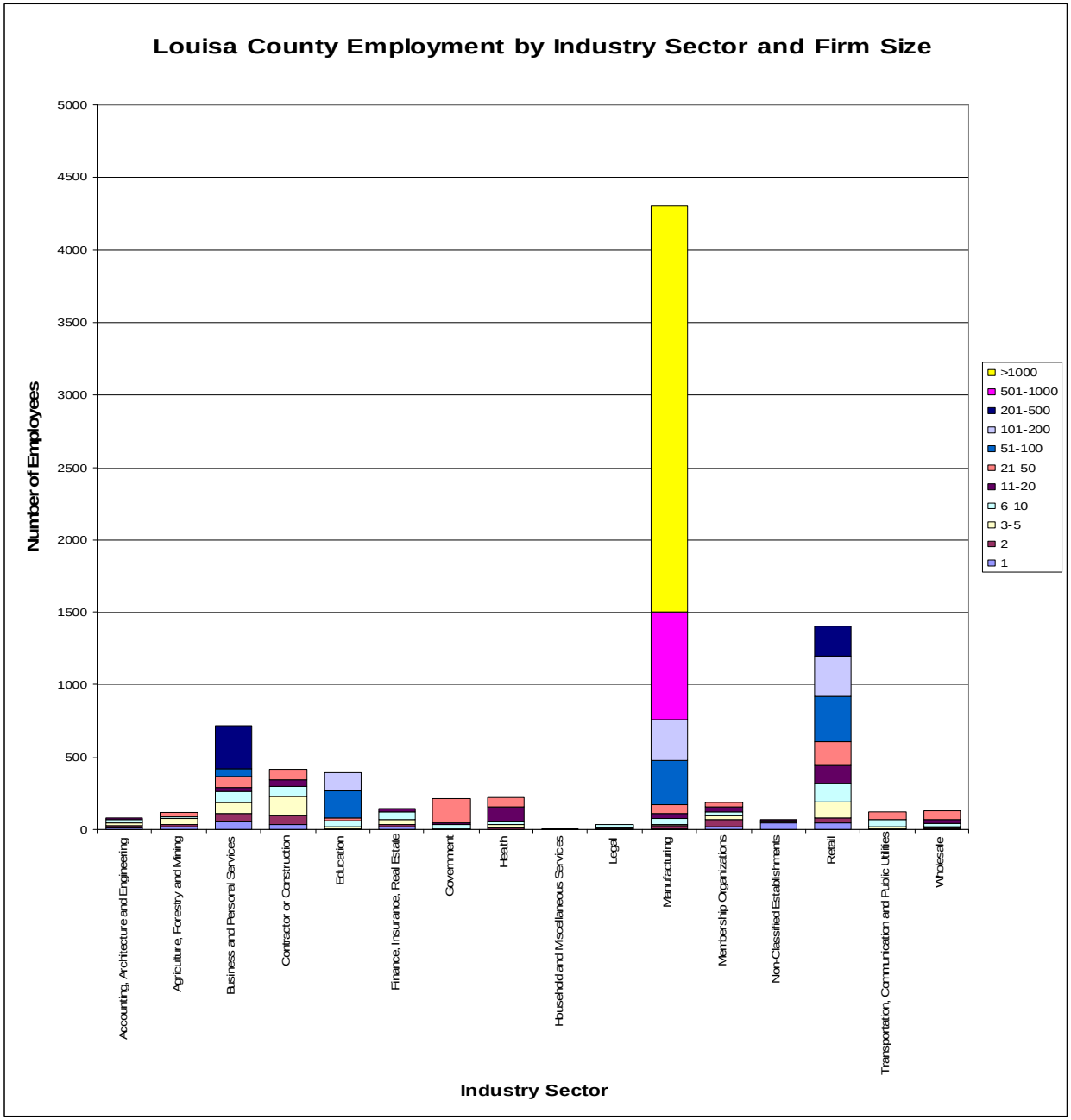

Figure 6: Louisa County Employment by Sector and Number of Employees

The last histogram shows the estimated annual sales by sector and firm size. Notice that manufacturing followed by retail account for the greatest sales.

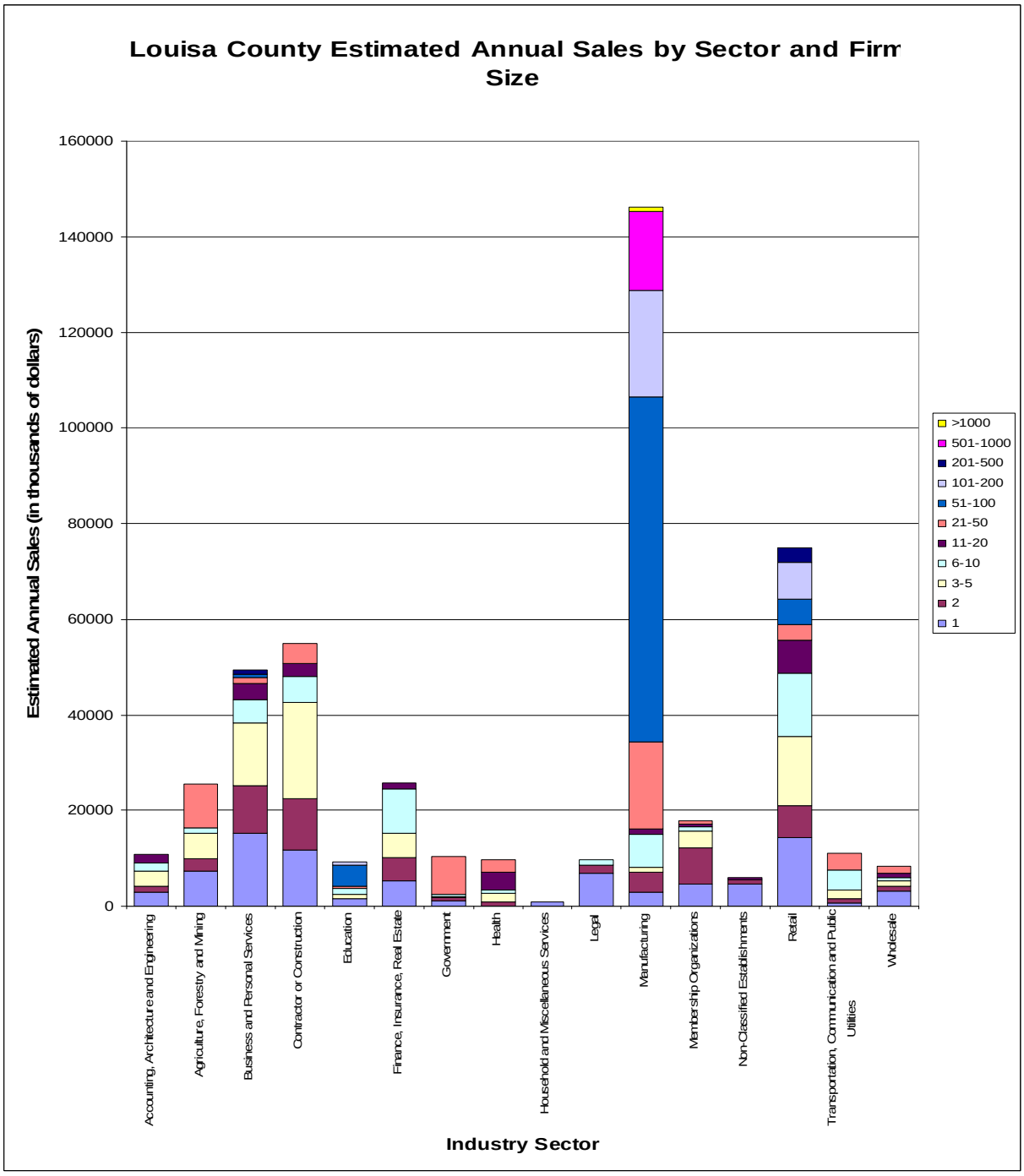

Figure 7: Louisa County Estimated Annual Sales by Sector

D. Population Density Map

For assessment and planning the location and density of population are needed. A rough idea can be determined from the U.S. Census data that provides statistics for population in each census block area, which is the smallest area available from the Census Bureau. A census block is a variable size area defined by the Census Bureau. Each area can be small, the size of a real city block, or much larger.

The following thematic map uses ten colors from light to progressively darker to show the approximate population densities per square mile for each census block as defined in the map legend. In the map, the darker blue blocks show the areas of higher densities. Telecommunication service providers may have the best business cases for serving broadband to the darker blue areas first. Unfortunately, they may not have an acceptable business case for serving the lower population density areas.

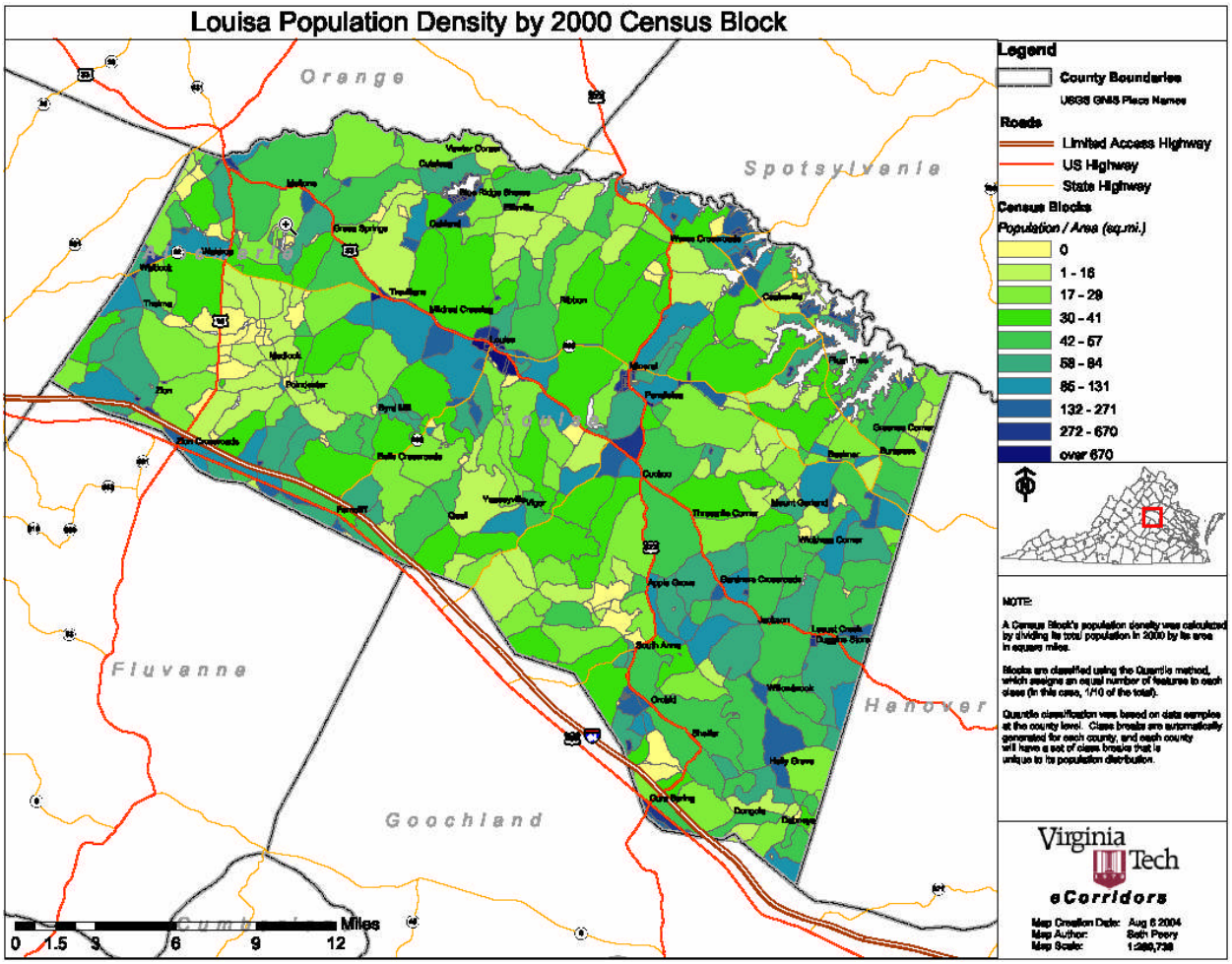

Figure 8: Louisa County Population Density by Census Block

On a computer, one can zoom in to see greater details. The following example shows a zoomed-in view for the towns of Louisa and Mineral. Notice the small census block boundaries in the towns and the variable sizes of the census blocks.

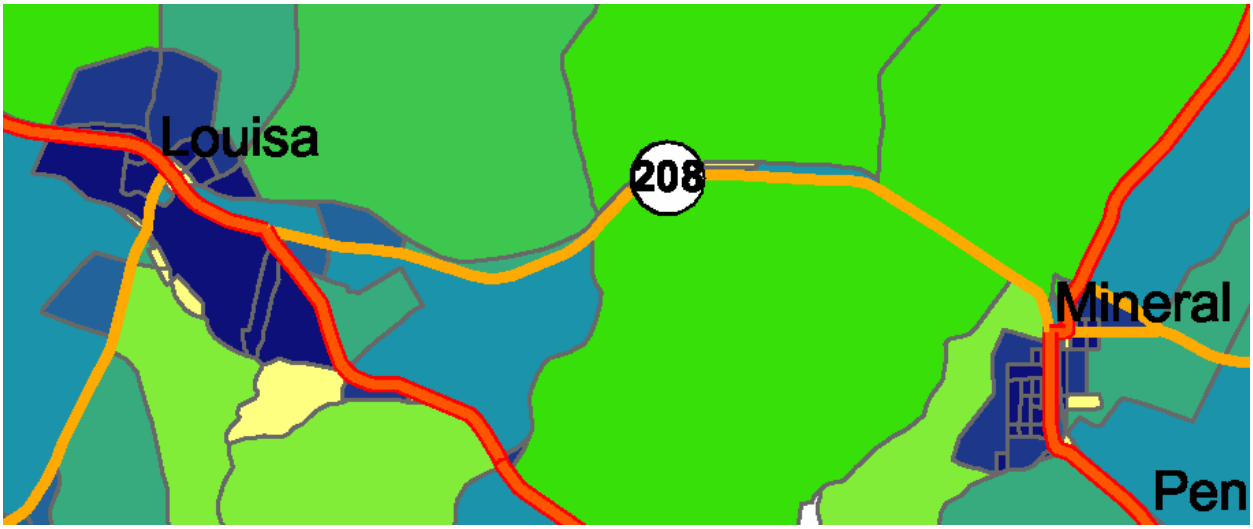

Figure 9: Population Densities for the Towns of Louisa and Mineral

E. Demographics

A useful tool for telecommunications assessment and planning is demographic information in combination with geographic location information. The business point and population density maps already covered are examples of combining demographic data with GIS location data to show where items of interest are located for analysis purposes.

The major sources of demographic information used for this project include the Department of Commerce Census Bureau, Department of Labor, Department of Agriculture, and the U.S. Geological Survey. In addition to federal FedStats reports and Census Bureau QuickFacts reports, custom demographic reports were obtained from SRC, Inc. Also, the VEDP (Virginia Economic Development Partnership) provides a comprehensive profile for each county with data compiled from several sources.

Detailed demographic reports are provided in the appendices for each TOP county, as well as listings showing data for all TOP counties so that they can be easily compared. Comparative analysis can be a useful tool for planning. Some of these reports will be referred to later.

F. Interview Data, Research, and Assessments

1. Telecommunication Access Services

In this section, prices are rounded up to the nearest dollar. Prices and conditions are subject to change.

The major telecommunications access providers for Louisa County are Verizon and Adelphia. Verizon is the Incumbent Local Exchange Carrier (ILEC) for the entire county.

a) Verizon

Louisa County is served by Verizon Central Offices in the towns of Louisa and Mineral. Verizon provides a full suite of telecommunications services that include analog, ISDN, Frame Relay, and dedicated lines (e.g., T1, DS3). DSL service is available from both central offices. It became available in Louisa June 2003 and in Mineral October 2003.

As described on Verizon's website, they offer DSL services with up to 1.5 Mbps download and up to 384 Kbps upload. The actual speed depends upon cable distance and line quality from the CO, or from a DSL service node (DSLAM—Digital Subscriber Line Access Multiplexer). Basic residential DSL service is $35 per month. A new entry-level Business DSL service is $40 per month. Full-featured Business DSL is $60 per month with a dynamic IP address and $80 per month with a static IP address. The Business DSL prices were reduced to the rates stated in June 2004 by $30 and $40 per month, respectively.

In May 2004, Verizon announced a three-fold increase of the previous basic upload speed from 128 Kbps to 384 Kbps at no increase in price, which is a significant improvement. In addition, they plan to add a new tier of consumer DSL service during the summer of 2004 with a maximum speed of 3 Mbps download and 768 Mbps upload for qualified customers (presumably, those that are sufficiently close to a DSL service node).

Verizon states that their standard DSL generally works over copper twisted-pairs at distances up to three cable miles from a service node. The Virginia Department of Information Technology map in Figure 1 shows the locations of telephone Central Offices in Virginia. Each green dot has a 3-mile radius that represents the approximate DSL coverage area for COs that may have deployed DSL. As you can see, many geographic areas are not within 3-miles of a Central Office.

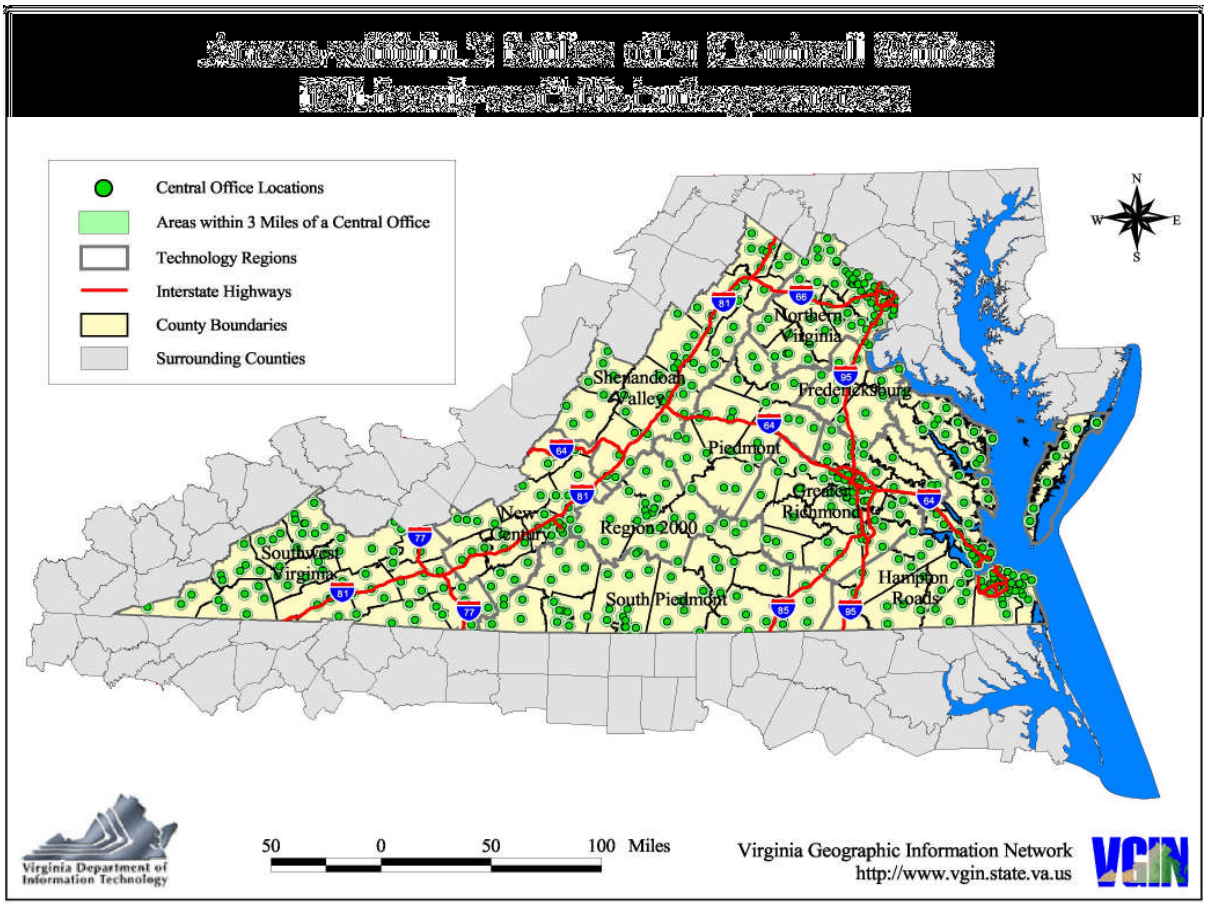

Figure 10: Virginia DIT Map of CO Locations

It is possible to serve customers much further out from a CO by extending DSL service nodes closer to customers over fiber optic cables, or other backhaul facilities. Also, new DSL technologies, such as ADSL2, provide better performance at longer distances. These options will be explained in more detail later in this report. Presumably, Verizon may provide extended distance service in the future for areas where there is demand.

Telephone Central Offices are typically interconnected by fiber optic cables, so it follows that there are existing fiber optic cable routes covering much of the state. Add to this the fiber cable routes used by cable TV and long-distance telephone companies and there is substantial coverage. Unfortunately, "last mile" fiber has not been installed to most small to medium businesses and to residences.

b) Adelphia

Adelphia provides cable TV services with Internet access in the towns of Louisa and Mineral. Download speeds are up to 3 Mbps and upload speeds are up to 256 Kbps. Cost is $43 with Classic Cable, or $55 without Classic Cable. Another class of access, Premier High-Speed Internet, provides download speeds up to 4 Mbps and upload speeds up to 512 Kbps. It costs $60 per month for residential customers.

c) Satellite

Satellite 2-way Internet services are generally available from DiRECWAY and StarBand. Performance compared to DSL and Cable is poor due to signal delays caused by the long distance to the satellite, low upload speeds, and higher costs for monthly fees and equipment. Nonetheless, in areas where only dial-up modem service is available, satellite service can offer a substantial improvement for downloads.

A 1-way satellite service is available through resellers from Internet Satellite Platform, Inc., or ISAT. ISAT provides a satellite download service called satXpress that requires a dial-up modem for upload. This method may be more usable than 2-way satellite services where upload speeds may be less than a dial-up modem, or where throughput too low due to signal delays.

DiRECWAY offers residential and commercial classes of service. For residential services, two plans are Home Service and Professional Service. Both provide download speeds of up to 500 Kbps and upload speeds up to 50 Kbps. Speed can vary with total traffic load. Data thresholds are set that throttle rates based on speed of download, duration of download, and service plan recovery rate. Standard equipment and installation cost is $600. Monthly service fees are $60 for the Home Plan and $90 for the Professional Plan. There is a 15-month term commitment. For commercial services, two plans are Small Office and Business Internet. Both provide download speeds up to 1 Mbps and upload speeds up to 100 Kbps. Costs per month are $100 for the Small Office Plan and $130 for the Business Internet Plan. Standard equipment and installation are $1000. Commercial plans have a 24-month term commitment. The more expensive residential and commercial plans offer higher data thresholds and faster recovery rates if the thresholds are exceeded. See www.direcway.com for details. Also, see www.copperhead.cc/ for user information about DiRECWAY.

StarBand offers three service plans, which are Residential, Telecommuter, and Small Office. In addition, they offer one, two, and three year contract periods. There are three models of equipment offered, which are models 360, 481, and 484. For simplicity, a one year contract period is used in this paragraph. For the StarBand Residential Plan, cost is $70/month, plus $400 for Model 360 equipment. Alternatively, cost is $90/month, plus $600 for Model 481 equipment. Model 481 equipment provides downloads up to 10 times dial-up modem (presumably up to 500 Kbps) and uploads up to 100 Kbps in *Turbo* Mode. For the Telecommuter Plan, cost is $120/month, plus $600 for Model 481 equipment. Download speeds are up to 750 Kbps and uploads are up to 128 Kbps in *Turbo Plus* Mode. For the Small Office Plan, cost is $150/month, plus $800 for Model 484 equipment. Downloads are up to 20 times faster than dial-up (presumably up to 1 Mbps) and uploads are up to 256 Kbps in *Turbo Max* Mode. Shipping and installation are extra. See www.starband.com for details. Also, see www.starbandusers.com/truth.htm for user information about StarBand.

Satellite Internet service options may improve when services are available over a new satellite that was recently launched for Telesat Canada. The satellite will be used by WildBlue to deliver Internet services in early 2005—see www.wildblue.com. WildBlue will offer several packages with download speeds up to 1.5 Mbps and upload speeds up to 256 Kbps.

d) Verizon Wireless

Verizon Wireless offers two mobile wireless Internet access services called NationalAccess and BroadbandAccess. Both services use a wireless technology developed by Qualcomm called Code Division Multiple Access (CDMA). CDMA 1xRTT is a 3G (third generation) wireless technology based on the CDMA platform. The 1x in 1xRTT refers to 1 times the number of 1.25 MHz channels. The RTT in 1xRTT stands for Radio Transmission Technology.

Verizon Wireless NationalAccess service provides CDMA 1xRTT mobile data *nationally*. The service uses the same cell sites that are used for digital voice. 1xRTT typically operates at speeds of 40-60 kbps, with bursts up to 144 kbps. A subscription starts at $35 per month for an airtime allowance that can be used for both wireless Internet access and domestic calling.

Verizon Wireless announced a national rollout of BroadbandAccess service in January 2004. It uses a 3G CDMA technology called 1xEvDO (Evolution Data Optimized). It offers typical download speeds of 300-500 kbps, with bursts up to 2 Mbps, and upload speeds of 40-60 kbps. Maximum possible speed varies. Speed declines with distance from a cell site and is limited to 1.54 Mbps at cell sites with backhaul limitations. The number of users on the access network may also affect maximum possible speed.

BroadbandAccess service is bundled with NationalAccess for $80 a month for unlimited access. The services are not intended for use with data intensive server devices and computer applications, since the bandwidth per cell node is limited.

Upgrades of Verizon Wireless cell sites in Louisa to support 1xEvDO are not scheduled, but 1xRTT service is available. Additional wireless coverage is being planned.

e) Assessment of Available Services

DSL and cable Internet services are available in the towns of Louisa and Mineral, but broadband is not available in the rest of the county. Mobile wireless broadband is not yet scheduled. Service provider network readiness is stage 1.5 of 4.

2. Government

Formed in 1742 from Hanover County, Louisa County was named for Princess Louisa, daughter of King George II and Queen Caroline of England and wife of King Frederick V of Denmark. Located in the rolling Central Piedmont region near the heart of Virginia in the prosperous Richmond, Charlottesville, Fredericksburg triangle, Louisa County is within 500 miles of one-half of the nation's population. The 514 square miles are predominantly farm and forest lands, mixed with business, industrial, and residential properties.

a) Status

- Director of Information Technology position was filled in early 2004
- Municipal fiber connects to Court House and Public Works in downtown Louisa
- ISDN BRI connects 3 remote sites
- T1 line for Internet access
- Web site hosting is outsourced to Classic Web Design in Louisa

- Zion Crossroads area is the most active for new development

b) Needs

- Affordable high-speed Internet access

c) Assessment

Louisa County government is at network readiness stage 2 of 4.

3. Education

Louisa County Public School District has three elementary schools, one middle school, and one high school serving a total of about 4000 students. The Administration Building, High School (1320 students, 102 staff), and Middle School (1040 students) are in separate building, but located close to each other (across the parking lots) in the Town of Mineral. Trevilians Elementary School in Louisa has 600 students. Thomas Jefferson Elementary School in Louisa has 700 students. Jouett Elementary School in Mineral has 600 students. There are no colleges in Louisa County.

a) Status

- All schools are cabled with a fiber-optic backbone and twisted-pairs in every classroom
- The High School Cisco 6900 Ethernet switch serves as a network hub for the other schools providing LAN interconnectivity, VoIP, and Internet access
- The High School has a T3 (45 Mbps) to NetworkVirginia
- The High School uses a Cisco VoIP PBX to deliver voice services to school sites and classrooms
- The High School is connected to the Administration Building and to the Middle School with fiber optic cable
- WLAN is used for access from temporary buildings and spaces
- Gigabit Ethernet is used between the High School and the Middle School
- The three elementary schools are connected to the High School with dual T1 lines
- One T1 line is used for VoIP and the second for access to the hub LAN and the Internet
- IT training is provided to teachers, administrators, IT personnel, maintenance staff, and students
- Each school has a website maintained by one of it's teachers

b) Needs

- Higher speeds to each primary school over fiber-optics or fixed broadband wireless

c) Assessment

Louisa County Schools has an exceptionally advanced network. Higher speeds are needed to the primary schools. Network readiness is at stage 3.5 of 4 (highest of all TOP counties).

4. Healthcare

County residents rely on hospitals in Charlottesville and Richmond for medical care.

a) Status

- VEDP states that six physicians and four dentists provide services in the county, plus visiting specialists
- Louisa County Health Department, a branch of the Thomas Jefferson Health District, is located at 101 Ashley St. in Louisa
- The Louisa County Resource Council is a private non profit organization comprised of representatives from the 25 plus local and regional human services and faith based organizations serving residents in Louisa County through Medical Outreach Services, Dental Clinic, and Community Cupboard
- The Resource Council Louisa County Medical Outreach Services, located at The Sage Building on Jefferson Highway in Louisa, provides assistance for those below the poverty level who do not qualify for government health programs
- The Resource Council Dental Clinic is located at the new community Betty J. Queen Intergenerational Center in the Louisa Industrial Development Air Park at 522 Industrial Drive
- The Louisa Healthcare Center at 210 Elm St. in Louisa provides long-term nursing care for up to 90 patients

b) Needs

- Healthcare services in county more areas where they are not available

c) Assessment

The healthcare entities in the county are mostly located in the Louisa-Mineral area and should have access to DSL. Network readiness is stage 1.5 of 4.

5. Business and Home

a) Status

- Businesses and homes in the towns of Louisa and Mineral have broadband services available from Verizon DSL and Adelphia cable
- Other areas of the county only have dial-up and satellite

b) Needs

- Affordable broadband access for all areas of the county

c) Assessment

Broadband access is not available in most areas of Louisa County, so those areas are at network readiness stage 1. The towns of Louisa and Mineral are at stage 2. Overall, the stage is 1.5 of 4.

G. TOP County Assessment Comparisons

Table 1 provides an overview of network readiness for all of the TOP grant counties. It shows the types of network access and other metrics by county for each major sector. Application and training level metrics use a scale of 1-10, where 10 is the highest level. Network readiness stages

are 1-4, where 4 is the highest. Stage 1 means mostly dial-up modem access is used and stage 4 means ubiquitous broadband access is available to all that want it.

State and federal network access are not included in the table, since they generally have higher speed access than county entities. This includes state network access for colleges (the only one is in Accomack), state courts, and district medical offices. Also, in Accomack, there are high-speed lines to federal government facilities in the Wallops Island area, but they also need access to affordable higher-speed broadband.

A synopsis of the table results is as follows:

- County governments generally have access to a T1 line, or fractional T1 line, to their main municipal building, except Accomack that has ISDN BRI and Craig that has access to 56 Kbps Frame Relay. Smaller government buildings and public safety locations typically do not have broadband access.
- High schools have access as follows:
    - T1 for Craig and Dickenson
    - 4xT1 for Accomack and 10 Mbps Ethernet for Cumberland
    - T3's for King and Queen, Louisa, and Northampton
    - Middle and primary schools are typically fed from high school hubs using T1s or ISDN BRIs
- Healthcare access varies greatly across the counties since the only hospitals in the TOP counties are only located in Accomack and Dickenson. State medical district offices have T1s, hospitals/large clinics have T1s, and others have dial-up ISDN, or dial-up modems. Physician's offices may have dial-up modems.
- Small businesses and homes:
    - Only dial-up modem access is available in most areas
    - DSL is available from 5 of 7 COs along Eastern Shore and in the towns of Louisa, Mineral, and Clintwood, with dial-up in other areas
    - Only dial-up service is available in most of Craig, Cumberland, and King & Queen counties

General stages of network readiness for TOP counties:

- County high school systems are the most network ready at stage 3, which is very important for student education and training. However, higher-speed access and support are needed for many of the primary schools that are at stage 2
- Main county government offices are at stage 2, but most remote offices are at stage 1
- For healthcare, only the larger hospitals/clinics have low end broadband and are at stage 2. Affordable broadband is needed for most small clinic and physician offices, which are at stage 1.
- Most small businesses and residences do not have broadband access available and are at stage 1. DSL is just became available in 2003 at larger populated places on Eastern Shore and in the towns of Louisa, Mineral, and Clintwood (these are moving to stage 2). King and Queen, Craig, Cumberland and most low population density places in all of the counties are at stage 1.

Table 1: Summary of TOP County Readiness Stages

(Network Readiness stages are 1 to 4, where 4 represents ubiquitous broadband utilization)

County	Metric	Access Providers	Gov	Edu	Health care	Business and Home
Accomack	Access Current	Dial, DSL*	BRI, dial	Dial, BRI, T1, 4xT1	BRI, T1	Dial, DSL*
	Access Needed	broadband	T3	T3	T1, T3	broadband
	Cost/mo Expected	-	$350	$350	$100	$40
	Application Level	-	2-7	8	4-6	2
	Training Level	-	1-7	8	3-7	2
	Network Readiness	1.5	1.5	2	2	1.5
Northampton	Access Current	Dial, DSL*	Dial, T1	T1, T3	BRI, FR512k, T1	Dial, DSL*
	Access Needed	broadband	T1, T3	T1, T3	T1, T3	broadband
	Cost/mo Expected	-	$40/100/3000	$3500	$100	$40
	Application Level	-	1-7	8	4-6	2
	Training Level	-	3-7	6	3-7	2
	Network Readiness	1.5	2	3	2	1.5
Craig	Access Current	Dial	Dial, FR56k	T1, wireless	Dial	Dial, DSL**
	Access Needed	broadband	DSL	T1, wireless	broadband	broadband
	Cost/mo Expected	-	$50	$200	-	$40
	Application Level	-	2	7	-	2
	Training Level	-	2	7	-	2
	Network Readiness	1	1	3	1	1
Cumberland	Access Current	Dial, fixed wireless	Dial, BRI, T1, PRI, FR512k,	10 Mbps	Dial	Dial
	Access Needed	broadband	100 Mbps, Pub Safety wireless	T3, wireless	broadband	broadband
	Cost/mo Expected	-	$500	$550	-	$40
	Application Level	-	6	8	-	-
	Training Level	-	6	7	-	-
	Network Readiness	1	2	3	1	1
Dickenson	Access Current	Dial, DSL*, wireless	wireless, T1	T1, FR-768, FR-256	FR-384, T1	Dial, DSL*, wireless
	Access Needed	broadband	T3, wireless	T3, wireless	broadband	broadband
	Cost/mo Expected	-	-	-	-	-
	Application Level	-	8	-	-	-
	Training Level	-	7	-	-	-
	Network Readiness	2	3	2	2	2
King &Queen	Access Current	Dial	FR T1,dial	T3,T1	N/A	Dial
	Access Needed	broadband	T1	T3,4xT1	N/A	broadband
	Cost/mo Expected	-	-	-	N/A	$40
	Application Level	-	-	2-6	N/A	-
	Training Level	-	-	3-7	N/A	-
	Network Readiness	1	1.5	2.5	1	1
Louisa	Access Current	Dial, DSL*, cable	T1	T3,2xT1	-	Dial, DSL*
	Access Needed	broadband	T1	T3, 4xT1	broadband	broadband
	Cost/mo Expected	-	-	-	-	$40
	Application Level	-	7	8	-	2
	Training Level	-	5	9	-	2
	Network Readiness	1.5	2	3.5	1.5	1.5

H. TOP County Demographic Comparisons

The TOP County demographics comparison data in this section were compiled from FedStats online queries for each county and for the entire state—see www.fedstats.gov.

For telecommunications infrastructure planning, demographic variables provide high-level insight. GIS tools and demographic data enable insight at the Census block level.

County	Area in square miles	Population	Population per square mile	Households	Firms	Minutes travel to work
Accomack	455	39,007	84.1	15,299	2,716	23
Northampton	207	12,929	63.1	5,321	1,025	21.7
Craig	331	5,118	15.4	2,060	243	34.7
Cumberland	298	8,899	30.2	3,528	374	36.9
Dickenson	332	16,216	49.4	6,732	804	35.8
King&Queen	316	6,558	21	2,673	345	37.1
Louisa	497	27,007	51.5	9,945	1,703	36
Virginia-All	39,594	7,293,542	178.8	2,699,173	480,122	27

Notice that all of the TOP counties have population densities of less than 100 per square mile. Accomack has the highest density with 84.1 and Craig has the lowest with 15.4.

On July 8, 2004, the FCC adopted the following measures designed to increase carrier flexibility, reduce regulatory costs of providing service to rural areas, and promote access to both spectrum and capital resources for entities seeking to provide or improve wireless services in rural areas:

- Adopted a default definition of "rural" as a county with a population density of 100 persons or fewer per square mile;
- Determined that smaller licensing areas may be appropriate in some spectrum blocks to encourage deployment in rural areas, and that licensing areas will continue to be established on a service-by-service (or band-by-band) basis, as appropriate.
- Eliminated the cellular cross-interest rule, which currently applies only in Rural Service Areas (RSA) and transitioned to case-by-case competitive review for all applications involved in transactions involving cellular licenses.
- Allowed licensees, at their option, to grant a security interest in certain wireless licenses to the U.S. Department of Agriculture's Rural Utilities Service (RUS), subject to the Commission's prior approval of any transfer of control.
- Increased permissible power levels for base stations in certain wireless services that are located in rural areas or that provide coverage to otherwise unserved areas.
- Amended its rules to permit certain geographic-area licensees to comply with construction build-out requirements by demonstrating that they provide "substantial service."
- Concluded that re-licensing and market-based mechanisms aren't necessarily mutually exclusive and that the two approaches can be complimentary in certain circumstances.

I. TOP County FedStats Demographic Comparisons

The TOP County demographics comparison data in this section was compiled from FedStats queries for each county and for the entire state—see www.fedstats.gov. Demographic information is useful for telecommunications planning. Additional demographics reports are provided in the appendices from the U.S. Census Bureau, Department of Agriculture, Department of Labor, and from SRC DemograhicsNow.

People MapStats	Accomack County	Northampton County	Craig County	Cumberland County	Dickenson County	King and Queen	Louisa County	Virginia
Population, 2002 estimate	39,007	12,929	5,118	8,899	16,216	6,558	27,007	7,293,542
Population, net change, April 1, 2000 to July 1, 2002	702	-164	27	-118	-179	-72	1,380	215,043
Population, 2000	38,305	13,093	5,091	9,017	16,395	6,630	25,627	7,078,515
Population, percent change, 1990 to 2000	20.80%	0.20%	16.40%	15.20%	-7.00%	5.40%	26.10%	14.40%
Population under 5 years old, 2000	2,336	724	292	564	875	355	1,524	461,982
Persons under 5 years old, percent, 2000	6.10%	5.50%	5.70%	6.30%	5.30%	5.40%	5.90%	6.50%
Persons under 18 years old, 2000	9,319	3,048	1,202	2,231	3,619	1,507	6,255	1,738,262
Persons under 18 years old, percent, 2000	24.30%	23.30%	23.60%	24.70%	22.10%	22.70%	24.40%	24.60%
Persons 65 years old and over, 2000	6,389	2,771	691	1,339	2,373	1,088	3,315	792,333
Persons 65 years old and over, percent, 2000	16.70%	21.20%	13.60%	14.80%	14.50%	16.40%	12.90%	11.20%
Female persons, percent, 2000	51.50%	53.20%	49.20%	52.40%	51.10%	51.20%	50.80%	51.00%
White persons, 2000 (a)	24,276	6,977	5,037	5,444	16,224	4,059	19,617	5,120,110
Black or African American persons, 2000 (a)	12,089	5,634	10	3,376	58	2,365	5,530	1,390,293
American Indian and Alaska Native persons, 2000 (a)	125	22	11	16	19	94	108	21,172
Asian persons, 2000 (a)	86	26	8	32	12	18	64	261,025
Native Hawaiian and Other Pacific Islander persons, 2000 (a)	23	3	0	0	0	1	3	3,946
Persons reporting some other race, 2000 (a)	1,367	278	7	53	9	10	46	138,900
Persons reporting two or more races, 2000	339	153	18	96	73	83	259	143,069
Persons of Hispanic or Latino origin, 2000 (b)	2,062	454	17	150	70	58	182	329,540
White persons, percent, 2000 (a)	63.40%	53.30%	98.90%	60.40%	99.00%	61.20%	76.50%	72.30%
Black or African American persons, percent, 2000 (a)	31.60%	43.00%	0.20%	37.40%	0.40%	35.70%	21.60%	19.60%
Amer. Indian and Alaska Native persons, percent, 2000 (a)	0.30%	0.20%	0.20%	0.20%	0.10%	1.40%	0.40%	0.30%
Asian persons, percent, 2000 (a)	0.20%	0.20%	0.20%	0.40%	0.10%	0.30%	0.20%	3.70%
Native Hawaiian and Other Pacific Islander, percent, 2000 (a)	0.10%	Z	0.00%	0.00%	0.00%	Z	Z	0.10%
Persons reporting some other race, percent, 2000 (a)	3.60%	2.10%	0.10%	0.60%	0.10%	0.20%	0.20%	2.00%
Persons reporting two or more races, percent, 2000	0.90%	1.20%	0.40%	1.10%	0.40%	1.30%	1.00%	2.00%
Persons of Hispanic or Latino origin, percent, 2000 (b)	5.40%	3.50%	0.30%	1.70%	0.40%	0.90%	0.70%	4.70%

Figure 11: TOP Counties FedStats Demographic Comparison (Part 1 of 3)

People MapStats	Accomack County	Northampton County	Craig County	Cumberland County	Dickenson County	King and Queen	Louisa County	Virginia
Births, 1997	391	155	43	113	174	76	284	91,862
Deaths, 1997	442	182	41	95	185	83	242	53,852
Infant deaths, 1997	3	4	0	1	3	0	2	714
Living in same house in 1995 and 2000, pct age 5+, 2000	60.30%	64.70%	65.80%	64.30%	72.50%	69.20%	61.20%	52.20%
Foreign born persons, percent, 2000	4.20%	3.40%	0.30%	1.30%	0.20%	0.90%	1.30%	8.10%
Language other than Eng. spoken at home, pct age 5+, 2000	6.70%	5.70%	1.80%	4.90%	1.50%	1.80%	2.60%	11.10%
High school graduates, percent of persons age 25+, 2000	67.90%	67.40%	76.60%	63.80%	58.90%	68.20%	71.70%	81.50%
Bachelor's degree or higher, pct of persons age 25+, 2000	13.50%	15.70%	10.80%	11.80%	6.70%	10.30%	14.00%	29.50%
Persons with a disability, age 5+, 2000	7,608	3,143	1,025	2,399	5,364	1,542	5,319	1,155,083
Mean travel time to work (minutes), workers age 16+, 2000	23	21.7	34.7	36.9	35.8	37.1	36	27
Housing units, 2002	19,797	6,670	2,627	4,170	7,767	3,061	12,405	3,006,877
Housing units, net change, April 1 2000 to July 1 2002	247	123	73	85	83	51	550	102,690
Housing units, percent change, April 1 2000 to July 1 2002	1.30%	1.90%	2.90%	2.10%	1.10%	1.70%	4.60%	3.50%
Homeownership rate, 2000	75.10%	68.60%	81.20%	77.20%	82.10%	82.50%	81.50%	68.10%
Median value of owner-occupied housing units, 2000	$79,300	$78,700	$85,400	$79,300	$55,900	$84,400	$96,400	$125,400
Households, 2000	15,299	5,321	2,060	3,528	6,732	2,673	9,945	2,699,173
Persons per household, 2000	2.45	2.39	2.45	2.55	2.42	2.48	2.56	2.54
Median household income, 1999	$30,250	$28,276	$37,314	$31,816	$23,431	$35,941	$39,402	$46,677
Per capita money income, 1999	$16,309	$16,591	$17,322	$15,103	$12,822	$17,236	$19,479	$23,975
Persons below poverty, 1999	6,788	2,633	520	1,360	3,460	713	2,586	656,641
Persons below poverty, percent, 1999	18.00%	20.50%	10.30%	15.10%	21.30%	10.90%	10.20%	9.60%

Figure 12: TOP Counties FedStats Demographic Comparison (Part 2 of 3)

Business MapStats	Accomack County	Northampton County	Craig County	Cumberland County	Dickenson County	King and Queen	Louisa County	Virginia
Personal income, 2000 ($1000)	683,759	275,295	108,516	162,963	280,207	157,368	626,474	221,077,766
Personal income per capita, 2000	17,818	21,049	21,278	18,099	17,131	23,750	24,320	31,120
Full-time and part-time employment by place of work, 2000	17,406	6,827	1,418	2,358	4,696	2,245	11,501	4,431,631
Full-time and part-time employment, net change 1990 to 2000	772	856	354	497	-517	645	3,074	704,437
Employment in government, 2000	2,827	1,434	268	419	1,048	488	1,342	807,628
Earnings, 2000	412,100	160,299	24,040	46,544	122,207	53,162	300,739	161,669,369
Average earnings per job, 2000	$23,676	$23,480	$16,953	$19,739	$26,024	$23,680	$26,149	$36,481
Private nonfarm establishments with paid employees, 2001	815	335	58	130	283	110	498	176,532
Private nonfarm establishments, percent change 2000-2001	1.10%	4.00%	-1.70%	-1.50%	-0.70%	6.80%	1.20%	0.50%
Total number of firms, 1997	2,716	1,025	243	374	804	345	1,703	480,122
Minority-owned firms, percent of total, 1997	7.20%	20.90%	F	F	F	F	18.30%	14.90%
Women-owned firms, percent of total, 1997	19.00%	24.30%	F	F	F	F	27.50%	27.50%
Manufacturers shipments, 1997 ($1000)	244,456	NA	NA	NA	NA	NA	89,333	83,814,009
Retail sales, 1997 ($1000)	180,465	73,013	3,673	31,399	64,171	5,228	77,677	62,569,924
Retail sales per capita, 1997	$5,622	$5,716	$754	$4,034	$3,739	$805	$3,257	$9,293
Housing units authorized by building permits, 2002	172	124	38	69	25	44	449	59,445
Value of new private housing units, 2002 ($1000)	22,035	14,860	4,015	6,046	1,753	4,015	57,324	6,589,270
Farm land, 1997 (acres)	92,452	56,435	45,684	61,048	9,056	50,823	79,019	8,228,226
Federal funds and grants, 2002 ($1000)	336,986	202,541	32,583	38,250	117,979	37,455	113,700	74,536,593

Geography MapStats	Accomack County	Northampton County	Craig County	Cumberland County	Dickenson County	King and Queen	Louisa County	Virginia
Land area, 2000 (square miles)	455	207	331	298	332	316	497	39,594
Persons per square mile, 2000	84.1	63.1	15.4	30.2	49.4	21	51.5	178.8
Metropolitan Area	None	None	None	None	None	None	None	
FIPS Code	1	131	45	49	51	97	109	51

Figure 13: TOP Counties FedStats Demographic Comparison (Part 3 of 3)

J. Agriculture in the TOP Counties

Agriculture is a significant business in many rural counties. The following table was extracted from the latest Department of Agriculture data.

TOP Counties USDA NASS 2002 Census of Agriculture—Published June 2004

Census Item	Accomack	Northampton	Craig	Cumberland	Dickenson	King & Queen	Louisa	Virginia
Farms number	318	187	228	283	117	154	474	47,606
Land in farms acres	91,056	52,459	48,398	62,638	11,761	58,876	87,275	8,624,829
Average size of farm acres	286	281	212	221	101	382	184	181
Median size of farm acres	86	135	133	137	60	146	120	97
Estimated market value of land and buildings 1.	580,120	673,957	418,814	506,968	146,353	700,221	523,881	490,064
Average per farm dollars								
Average per acre dollars	1,962	2,394	1,902	2,218	1,556	1,983	2,372	2,675
Estimated market value of all machinery and equipment 1.	110,795	99,056	41,669	44,544	19,248	58,347	41,385	43,303
Average per farm dollars								
Farms by size:	53	31	4	3	7	-	19	3,027
1 to 9 acres								
10 to 49 acres	96	50	54	57	31	33	122	14,082
50 to 179 acres	77	41	92	136	68	55	173	18,315
180 to 499 acres	46	29	57	57	8	44	122	8,613
500 to 999 acres	15	26	13	23	2	12	30	2,183
1,000 acres or more	31	10	8	7	1	10	8	1,386
Total cropland farms	234	156	198	259	104	138	412	41,047
acres	73,294	43,096	18,706	23,206	4,312	32,627	39,112	4,194,158
Harvested cropland farms	212	147	171	219	74	109	343	33,791
acres	70,096	39,035	9,418	13,567	1,584	30,454	24,253	2,623,776
Irrigated land farms	58	66	13	15	3	10	21	3,331
acres	9,716	9,338	130	222	(D)	743	365	98,913
Market value of agricultural products sold (see text) $1,000	109,133	44,192	3,609	28,304	736	7,052	10,113	2,360,911
Average per farm dollars	343,184	236,320	15,830	100,016	6,294	45,795	21,335	49,593
Crops $1,000	47,480	32,949	510	2,560	206	5,360	2,381	718,219
Livestock, poultry, and their products $1,000	61,653	11,242	3,100	25,744	530	1,692	7,732	1,642,692
Farms by value of sales:	50	42	76	103	60	59	208	18,424
Less than $2,500								
$2,500 to $4,999	27	14	41	45	19	13	71	6,669
$5,000 to $9,999	27	17	29	35	12	18	68	6,946
$10,000 to $24,999	48	24	43	30	22	21	70	6,737

Census Item	Accomack	Northampton	Craig	Cumberland	Dickenson	King & Queen	Louisa	Virginia
$25,000 to $49,999	20	24	26	17	3	16	23	3,060
$50,000 to $99,999	25	25	9	9	-	11	12	1,849
$100,000 or more	121	41	4	44	1	16	22	3,921
Government payments farms	93	48	66	87	4	60	125	9,206
$1,000	964	478	100	405	(Z)	759	433	54,677
Total income from farm-related sources,	93	56	58	124	19	43	161	15,317
gross before taxes and expenses (see text) farms								
$1,000	909	1,086	272	490	141	1,074	2,172	119,904
Total farm production expenses 1 $1,000	80,604	32,406	3,306	21,149	749	8,244	12,783	2,045,598
Average per farm dollars	253,471	177,081	14,501	74,470	6,404	53,880	26,911	42,970
Net cash farm income of operation (see text) 1 farms	318	183	228	284	117	153	475	47,605
$1,000	30,066	12,546	253	8,825	89	498	1,239	503,951
Average per farm dollars	94,546	68,559	1,108	31,073	761	3,252	2,609	10,586
Principal operator by primary occupation:	210	107	113	165	57	81	264	25,500
Farming number								
Other number	108	80	115	118	60	73	210	22,106
Principal operator by days worked off farm:	154	95	139	139	67	73	281	26,076
Any number								
200 days or more number	87	65	100	107	50	50	197	18,747
Livestock and poultry:	17	10	174	177	86	41	269	27,733
Cattle and calves inventory farms								
number	606	(D)	6,939	11,520	1,791	1,505	14,395	1,622,767
Beef cows farms	15	9	153	160	72	34	249	23,030
number	(D)	128	3,796	5,206	1,151	(D)	7,401	680,610
Milk cows farms	2	-	17	6	5	3	5	1,580
number	(D)	-	247	538	14	(D)	550	114,724
Cattle and calves sold farms	8	6	158	142	68	34	204	23,970
number	147	88	4,211	5,432	901	654	6,655	931,879
Hogs and pigs inventory farms	3	1	1	7	7	5	13	855
number	(D)	(D)	(D)	80	24	(D)	161	409,284
Hogs and pigs sold farms	5	-	4	5	2	7	12	834
number	(D)	-	27	67	(D)	(D)	(D)	847,002
Sheep and lambs inventory farms	9	5	8	5	-	2		1,697
number	281	138	118	106	-	(D)	295	71,819
Layers 20 weeks old and older inventory farms	7	1	17	13	15	9	24	1,937
number	(D)	(D)	450	134,199	210	263	568	3,222,127

Census Item	Accomack	Northampton	Craig	Cumberland	Dickenson	King & Queen	Louisa	Virginia
Broilers and other meat-type chickens sold farms	73	-	2	26	-	-	2	855
number	31,711,876	-	(D)	11,308,734	-	-	(D)	266,103,921
Selected crops harvested: Corn for grain farms	75	36	6	4	3	47	33	3,123
acres	23,851	5,856	363	80	12	12,173	1,395	335,692
bushels	1,887,275	457,319	24,450	2,320	410	539,804	74,437	22,656,691
Corn for silage or greenchop farms	2	2	10	11	-	1	21	2,305
acres	(D)	(D)	140	1,021	-	(D)	884	139,420
tons	(D)	(D)	1,653	7,995	-	(D)	9,750	1,637,114
Wheat for grain, All farms	55	45	-	7	-	25	18	1,793
acres	12,164	6,965	-	297	-	3,447	758	174,887
bushels	677,186	411,748	-	10,908	-	233,226	31,378	10,213,252
Winter wheat for grain farms	55	45	-	7	-	25	18	1,793
acres	12,164	6,965	-	297	-	3,447	758	174,887
bushels	677,186	411,748	-	10,908	-	233,226	31,378	10,213,252
Oats for grain farms	-	4	-	-	-	-	3	364
acres	-	31	-	-	-	-	33	5,529
bushels	-	1,390	-	-	-	-	1,450	317,353

IV. Technology Plan Methodology

The methodology for developing the technology plan was a three-step process. First, identify needs and goals. Second, identify technology solution alternatives. Third, recommend solutions that appear to be most applicable.

A. Recommendations from Previous Studies

Recommendations, goals, and strategies from previous studies are useful for planning local technology plans. This section summarizes major recommendations from federal, state, and industry levels.

1. President's Council of Advisors on Science and Technology (PCAST)

President Bush asked his Council of Advisors on Science and Technology to review the current status of broadband and suggest policies that will stimulate economic recovery in high technology and keep America competitive. The assignment was to address concrete steps to support and sustain the rapid deployment of next-generation, high-speed Internet access at reasonable cost to all Americans. In December 2002, PCAST submitted their findings and recommendations in a report titled "*Report on Building Out Broadband*."

The Council considered major publications put forth by industry, scientific, and community groups that explored the broadband issue, including:

- *Building the Foundation of the Networked World,* Computer Systems Policy Project, January 2002.
- *A National Imperative: Universal Availability of Broadband by 2010,* TechNet, January 2002.
- *Increased Broadband Deployment,* Semiconductor Industry Association, January 2002.
- *Broadband: Bringing Home the Bits,* National Research Council Computer Science and Telecommunications Board, January 2002.
- *Ten-Point Plan to Bring Broadband to More Americans*, Information Technology Council, May 2002.
- *Advanced Services, Enhanced Lives,* Alliance for Public Technology, May 2002.

PCAST built upon the above works to produce their own recommendations, which may be considered for technology planning goals.

Recommended steps include:

- Build on the "No Child Left Behind Initiative" to connect research and development in distance education and classroom technologies and join with the efforts of the private sector to exploit broadband technologies. Broadband enabled classrooms will enhance the schoolroom educational experience, and high-capacity distance education may have even more transformative effects on the quality and availability of educational resources.

- Support teleworking with special attention to how broadband can enable and expand the scope and flexibility of teleworking opportunities.

- Support telemedicine and expand interagency coordination and explore impediments to improving the quality and reducing the cost of healthcare to all Americans through broadband enabled telemedicine, including a review of provider reimbursement practices, patient privacy, licensure, and credentialing for telemedicine services.

- Ensure that the E-Government Initiative recognizes the full potential of broadband applications. Sound investments in federal broadband applications for service and information provision may also bring down unit costs for broadband facilities economy-wide. The clear strategy is: make it easy for citizen's to obtain service and interact with the federal government; improve government efficiency and effectiveness; improve government's responsiveness to citizens.

- Develop broadband connectivity to enhance homeland security through sharing of critical information among federal and local agencies and first responders.

- Facilitate wireless broadband applications including wireless home networks and innovative approaches to spectrum sharing. Truly ubiquitous broadband is likely to prove its value as a critically important driving force in this country's economy and economic recovery.

- Encourage public rights of way policies that support the benefits of broadband and fair compensation to federal entities and local communities. Access to public rights-of-way (ROW)—streets, roads and other public lands—is essential to the deployment of broadband networks, whether wireline or wireless.

2. Commonwealth of Virginia Technology Plans

Virginia's Governor Warner charged the Secretary of Technology with developing Virginia's first comprehensive strategic plan for technology based on his vision. Appropriate parts of the strategy may also be applied by governments at local levels.

Highlights of the strategic plan:

1. **Revolutionize service delivery to our customers** through implementation of a customer-facing Internet portal and increasing the quantity, quality, and adoption of online services, particularly in the area of online licensure and interactive forms.
2. **Consolidate IT infrastructure and provide centralized services** as a technology utility.
3. **Plan, budget, and track IT expenditures** by developing a capital planning and funding process for IT, developing a comprehensive technology management policy, and improving systems to track IT expenditures.
4. **Manage IT procurement** by developing and implementing a best practice model for effective and timely IT procurements.
5. **Increase federal research and development funding** to industry and Virginia's colleges and universities, including historically black colleges and universities.

6. **Increase commercialization of intellectual property** from Virginia's labs, entrepreneurs, and institutions of higher education, and grow entrepreneurial companies.
7. **Increase statewide broadband deployment**, especially in Virginia's rural areas, to enhance economic development.
8. **Promote technology-based economic development** in Virginia by "growing" technology companies.

The effectiveness of this strategy resulted in Virginia being awarded a third place national ranking of states by the Center for Digital Government in the 2004 Digital State Survey. Prior to Governor Warner taking office, Virginia was in the bottom half of the rankings and improved to sixth place in 2002 and third place in 2004. The survey measured best practices, policies and progress in the use of digital technology to better serve citizens and streamline services. It is viewed as the nation's most recognized and respected study of IT applications.

In Spring 2002, the Virginia Legislature requested in House Joint Resolution No. 163 that the Center for Innovative Technology and the Secretary of Technology study the means for advancing affordable, high-bandwidth electronic networks in rural Virginia. The final 157-page report, "*Advancing affordable, high-bandwidth electronic networks in rural Virginia*," was submitted to the Governor and General Assembly on November 30, 2002. This is an excellent report that covers many of the broadband related issues in Virginia. It can be downloaded from http://www.technology.virginia.gov/SecInfo/legReports/legRpts.cfm#hjr163.

The reasons given for the study are important for rural areas:

- The future economic well-being of Virginia's rural areas will, in large part, be determined by the degree of access they have to affordable, high-bandwidth electronic networks and how well rural Virginians are prepared to use them; and
- In the coming digital economy, rural businesses will have a growing need to be efficiently connected with business partners and customers; and
- Without this capability, rural areas will be left with only low-wage, regionally-focused businesses that are severely limited in their potential to grow and compete in the new economy; and
- Because private investors can usually obtain higher rates of return from telecommunications infrastructure investments in larger urban centers, it is not evident when, or if, market forces will cause private investors to act to meet the telecommunications infrastructure needs of rural Virginia without some intervention by the Commonwealth; and
- The Center for Innovative Technology and the Secretary of Technology have considerable expertise in the complex issues surrounding access to such telecommunications infrastructure

Goals for the study were:

1. Evaluate the present state and need for new infrastructure in rural Virginia to fill strategic gaps in present commercial networks and coordinate plans to fill the gaps;
2. Set bandwidth goals with a timetable for achieving the goals; and

3. Encourage private development and, where necessary, facilitate the extension of advanced networks throughout the state to serve rural counties, cities and towns with affordable, high-bandwidth connections for businesses, local governments, education, health care and citizens.

Further, recommend a means or criteria by which areas that are not sufficiently served by the private sector at minimally-established data rates, be permitted to create public/private partnerships to provide the necessary services or, alternatively, to create the necessary services themselves with such services to be offered to the private sector at fair market value at the appropriate time.

Recommendations from the CIT report:

1) In accordance with the Commonwealth of Virginia's Strategic Plan for Technology and the recommendation of the Virginia Rural Prosperity Commission[1], a "one stop" resource center should be established to assist rural communities through the process of infrastructure assessment, planning, and implementation. As such, The Governor will seek legislative authority to designate one state agency, as determined by the Secretary of Technology, to serve as the central coordinating body for information and activities directly associated with the deployment of broadband telecommunications infrastructure.

Activities of this entity should include, but are not limited to:

a) Providing overall coordination of broadband initiatives in the Commonwealth.
b) Serving as a general clearinghouse for information on broadband, including:
    (1) Leadership
    (2) e-Community Development
    (3) Aggregating Demand
    (4) Best Practices
    (5) Partnership Models/Alliance Building
    (6) Funding Models and Sources (grants, foundations, government, etc.)
    (7) Grant Writing
c) Developing a "how-to" manual for rural communities.
d) Coordinate with CIT's current e-Business Outreach efforts and the Virginia Electronic Commerce Technology Center (VECTEC) to further develop applications and programs to bolster the development of private-sector demand.

2) Develop stronger links between existing telecommunications programs (COVAnet and Net.Work.Virginia) and local leadership.

a) Improve information dissemination about existing programs including "acceptable uses," options (current and future), and best practices for using the networks.

[1] Rural Virginia Prosperity Commission, *From the Grassroots: Final Report of the Rural Virginia Prosperity Commission to the Governor and the General Assembly of Virginia*, 2001, p.25, pp.54 f.

b) Develop and implement creative models to link/leverage/expand existing statewide networks.
c) Support demand aggregation strategies.

3) Implement programs to encourage and facilitate greater participation in Federal Funding opportunities including the e-Rate and Rural Health Programs.

a) Provide mechanisms by which eligible institutions can be made aware of, and receive assistance with the planning of, application for, and implementation of these programs.
b) Develop a "mentoring" guide containing "how-to" techniques for maximizing individual program benefits.
c) Where appropriate, the broadband resource center should also serve as a coordination point for program applications.

4) Provide adequate representation of Virginia's IT interests at the Federal level.

a) Establish a Federal level advocacy presence to advance Virginia's position regarding IT policies, programs, and funding.

5) Significantly increase the availability of statewide telecommunications information.

a) Coordinate with Secure Virginia, VGIN, local groups, and private sector providers to develop and implement a plan for the collection, ongoing maintenance and acceptable uses of statewide telecommunications infrastructure data (including service level mapping).
b) The Governor also will seek legislative authority to designate one state agency, as determined by the Secretary of Technology, to serve as the single repository for telecommunications infrastructure data.

Comments:

The CIT report provides a relatively detailed analysis of broadband in Virginia, although as pointed out, there was not time nor resources to cover everything.

The report includes several case studies. One that is exceptionally informative and relevant to a number of rural areas is the Case Study for Highland and Bath counties in Section 9. The consultant provides his views of the many issues to consider in deciding what broadband access technologies are most appropriate at a given point in time. Choices are even more complex than described, since the consultant was focused on determining the feasibility of fixed-wireless access and may not have taken long-term strategies into account.

In addition to the main CIT report, the following appendices are useful references for this report:

- Appendix 1—Broadband Technologies
- Appendix 2—Mapping Initiatives
- Appendix 3—HJR 163 Mapping Committee
- Appendix 4—Sample Methodology
- Appendix 5—Available Service Level Data
- Appendix 6—High Speed Providers by Zip Code

- Appendix 7—Areas within 3 Miles of a Central Office
- Appendix 8—COVANET and Net.work.Virginia
- Appendix 9—VECTEC
- Appendix 10—ACAF (Advanced Communications Assistance Fund) Status Reports
- Appendix 11—Funded Initiatives

Another useful CIT report is titled "*CIT's Guide to Broadband Funding for Virginia Communities*" published in January 2004. It can be downloaded from www.cit.org. Refer to CIT's website for planning broadband initiatives at www.cit.org/broadband-04.asp.

3. Virginia Tech's eCorridors Program

Virginia Tech is a land-grant university with a threefold mission of education, research, and outreach. University faculty and extension personnel are frequently called upon to assist Virginia communities in economic development initiatives. In the field of network infrastructure and services, Virginia Tech's eCorridors program is focusing on a long-term (10 year) vision of facilitating the development of next generation network infrastructure and services in collaboration with interested communities in Virginia.

Specifically, the eCorridors program serves as a facilitator and catalyst for the development of creative partnerships with municipalities, public utilities, non-profit entities and private sector companies to combine resources and expertise for the deployment of advanced, broadband network infrastructure and services made up of next generation technologies. Collaborative relationships have been developed with telecommunications industry leaders and private sector companies. This will provide them with industry experience and input, and allow them to reap the benefits of being involved in cutting edge research and testing.

One of the major objectives of the program is to provide a framework to guide community efforts toward putting in place and maintaining an advanced network infrastructure that supports economic development and competitive advantage. The proposed infrastructure has numerous technology components including fiber optic networks, broadband wireless, Ethernet, and Internet Protocols which are all technologies being used by top research universities. By utilizing a fiber backbone, business and residential users can be provided with high-speed Ethernet access at speeds from 10 megabits to one gigabit per second. However, end-user speed will ultimately depend upon the access technology used. Business and residential users can be connected to local high-speed Ethernet switching centers, known as Multimedia Service Access Points (MSAP) that can in turn be connected to core switching centers in other communities over fiber optic cables. Ultimately, all communities can be connected together via a fiber optic mesh network for reliability.

eCorridors is not just a program; it is a vision. As presented by VA Tech, "*eCorridors*" are electronic Internet routes that, when fully completed, will resemble a grid, or mesh, of network connectivity into and out of every community throughout the Commonwealth. These networks are to be specifically designed to enable communities to leapfrog existing technologies and provide next generation network access for such purposes as economic development, quality of life, education and workforce training.

eCorridors developed a major report for the 34-county Tobacco Growing Region in Southside and Southwest Virginia. The title is *Strategic Technology Infrastructure for Regional Competitiveness in the Network Economy*. It can be downloaded from www.ecorridors.vt.edu. The report proposes a backbone fiber optic network design and business model to enable the region to move beyond existing technologies for maximum competitiveness in the Network Economy. It includes a *Fiber Optic Infrastructure Design Guide* that serves as a "how-to" manual for building community fiber optic networks. Local service providers generally have much better resources for serving the last mile, but not for the large scale fiber optic backbones needed to link communities and counties together statewide.

Geographic Information Systems are essential tools for planning, designing, operating, and maintaining community telecommunications wired and wireless infrastructures. GIS was used extensively for the network infrastructure planning and design work for the eCorridors report. GIS was also used extensively for this project, "Getting Rural Virginia Connected: A Vision for the Future," to analyze and present business and demographic data. As part of this project, eCorridors developed another "how-to" guide titled "*GIS Applications in Community Telecommunications*" by Seth Peery, which is included in the appendices.

Another issue for community networks is policies and regulations. eCorridors developed a paper for this project titled "*Regulatory Issues Pertaining to Municipal Broadband*" by Seth Peery. An earlier paper is included that is titled "*What Should be the Public Role in the Development of Advanced Network Infrastructure*?" by Brenda van Gelder, Program Director for eCorridors.

4. Computer System Policy Project Guidelines

The Computer System Policy Project *CSPP Readiness Guide* published in October 2000 describes four stages of readiness for living in the networked world. Characteristics of the highest Stage 4 provide a vision and goals for technology plans.

General characteristics of Stage 4:

- Networked Infrastructure—everyone has access to affordable high-speed connections, including fixed, portable, and mobile
- Networked Places—all business, government, education, health, and home users are connected to the network wherever they are
- Networked Applications and Services—all business, government, education, health and community organizations are using the network for maximum efficiency and productivity for all internal and external users
- Networked Economy—the network fully supports economic development, including innovation, workforce development, and consumer applications
- Networked World Enablers—ubiquity, security, privacy, and policy issues are effectively addressed

The CSPP published *Building the Foundation of the Networked World* in November 2002. It contains additional findings and recommendations to consider.

Summary of findings:

- Accessible, affordable, wired and wireless, broadband deployment will bring substantial improvements in the lives of all Americans.
- To realize this potential, we need to look *beyond* the current debate over deployment of first-generation technology and set ambitious, long-term national goals for our telecommunications infrastructure's speed and mobility.

To accomplish this, the CSPP recommends:

1. Adopt a National Vision—The U.S. needs to establish a comprehensive, national vision for the next ten years regarding how to transform the basic foundation of the Networked World (our information infrastructure) into robust, universally-available network capable of supporting advanced broadband and mobile services.

   Speed: By year-end 2003, 80 percent of U.S. homes should be able to get *at least 1.5 Mbps* capacity and 50 percent of U.S. homes should be able to get 6 Mbps from at least two providers. Further, CSPP proposes that by the end of the decade 100 million homes and small businesses should be able to get up to *100 Mbps affordable broadband* capacity.

   Mobility: CSPP proposes that the U.S. make available in the marketplace 120 MHz of spectrum by 2004, with another 80 MHz made available by 2010, to be harmonized with global spectrum use to the maximum extent possible. In addition, the U.S. should implement a process to make additional licensed and unlicensed spectrum available beyond 2010 in a way that is consistent with an effective, long-term vision for its management.

2. Enact Regulatory Reform—*Government at all levels* should take steps to eliminate barriers to widespread, advanced wired and wireless broadband deployment, including elimination of regulatory burdens, creation of a National Spectrum Management Policy Group, facilitating physical site access for equipment, and creating investment incentives.

   The FCC, state and *local governments* should review all current regulations and work to eliminate barriers to infrastructure investment.

   State and *local governments* should review building and road codes to assure that new "trenching" techniques can be used where appropriate. Installation costs typically represent more than 50 percent of the costs of installing new fiber. Innovative ways of laying fiber that are permitted in Europe are not permitted in the U.S.

   Government and the industry should work together to minimize the difficulties that providers face in securing adequate sites and *facilitate carriers' access to public rights of ways*. This will spur deployment and help U.S. companies keep pace with, or surpass, foreign competition.

3. Commit to Further Research and Development—Realizing the next phase of the Information Age will require applications that are in demand by both consumers and

businesses alike. The public and private sectors must work together to develop transformative applications that rely on a robust wired and wireless broadband network.

4. Promote Industry Action—The information technology industry must also take responsibility for driving development of the 21st Century Networked World Infrastructure by resolving technical issues, creating richer content and encouraging consumer confidence in technology products.

   The industry and/or government should:
   - Commit to ease-of-use
   - Develop richer content that exceeds consumer expectations and drives demand
   - Be responsive to partnerships that may provide ways for deploying broadband technologies
   - Strengthen the security of networks and information technology infrastructure
   - Resolve copyright issues; develop a digital rights management strategy that protects content, consumer choice, and technological innovation

"Federal Reserve Chairman, Alan Greenspan, has stated that a large share of U.S. economic gains of the past decade have been due to increased productivity spurred by the Internet and information technology. In the digital age, ubiquitous broadband deployment means more jobs, higher growth, lower inflation, and tremendous new investment that will strengthen our economy for the long-term."

B. Broadband Technology Alternatives

Many reports on technology planning discuss technology alternatives. Rather than describe legacy technologies in detail, this section will cover them briefly and point out new aspects not normally covered elsewhere that may be useful for technology planning.

Readers are referred to Virginia's Center for Innovative Technology report, "*CIT's Guide to Broadband Funding for Virginia Communities,*" Appendix 1, for descriptions of legacy technologies--download at http://www.technology.virginia.gov/SecInfo/legReports/legRpts.cfm#hjr163.

1. DSL—Digital Subscriber Lines

Verizon is the Incumbent Local Exchange Carrier (ILEC) in all of the seven TOP counties, except Craig. This includes Accomack, Northampton, King and Queen, Louisa, Cumberland, and Dickenson. Of these counties, DSL is being provided from selected Central Offices (COs) in Accomack, Northampton, Louisa, and Dickenson. DSL is not being provided in Cumberland and King and Queen.

The main type of DSL Service Verizon is providing is ADSL, or Asymmetric DSL. The term asymmetric means that the download speed is higher than the upload speed. Verizon's standard ADSL speed offering is up to 1.5 Mbps to the user and up to 384 Kbps to the CO over a single twisted-pair that can also support a plain old telephone line (at distances up to about 12,000 cable feet, according to rumors). Maximum possible speed decreases with distance from the CO DSL terminating equipment, which is called a DSLAM, or DSL Access Multiplexer. Verizon says that

their service may work at distances up to 3-miles from a serving CO. At the longer distances, download speed may be up to 768 Kbps.

Verizon began making higher speed DSL available late summer of 2004 with 3 Mbps down and 768 Kbps up. Residential price is $49.95 per month, with $5.00 off if bundled with selected voice services. Verizon subscribers reported in online forums at www.broadbandreports.com that the 3 Mbps speed is supported at distances up to 11,000 cable feet. Broadband Reports is *the* place to go to for first-hand reports from subscribers about their experience with various provider services, including DSL, cable, and satellite.

DSLAMS can be located at remote terminals closer to subscribers. The aggregated data is backhauled to a CO, or network hub. Standard fiber optic transceivers support distances up to 25 miles or more, so a remote DSLAM could be located just about anywhere needed, if fiber is available. T1 lines may also be used for backhaul.

The ILEC typically owns the telephone twisted-pairs from the CO (Central Office) to subscriber premises. Other service providers may lease twisted-pairs from the ILEC to deliver DSL services over them using their own equipment. In this case it is desirable for the DSLAM equipment to be co-located at the CO. If not at the CO, then circuits must be leased from the DSLAM location to the CO and from the CO to the subscriber. This makes the circuits longer with resulting lower speeds and shorter service ranges from the CO. Co-locating at a CO may be prohibitively expensive.

The cost to provision DSL has come down substantially over the last few years. Today, one brand of *advanced* DSLAM costs about $400 per user. Standard DSL equipment is less that $200 per user for both ends. Cost is lower for large quantities. Other costs include equipment rack space, cabling, power, maintenance, and aggregated Internet connection. A quote from a telco engineer in a recent www.dslprime.com news message states: "It costs remarkably little to upgrade our remotes to ADSL2+ at 15 or 20 meg, so that seems our logical next move," a senior telco engineer tells me this week. North America's phone network was designed with nodes within 5,000 or 6,000 feet of almost every customer. DSLAMs are now small, cheap, and line-powered, making them easy to drop on every pedestal. Some locations already have fiber; most others can be fiber-fed without new rights of way or trenching. Result: beyond the initial fiber run, it costs little more to put the DSLAM port closer to the home, at greater speeds…"

A white paper from the DSL Forum, *DSL Anywhere*, states that a speed of up to 1.5 Mbps may be expected at cable distances of 12,000 cable feet and 384 Kbps at 17,000 feet—this is with old ADSL technology. A version of DSL from Paradyne has been available for several years that operates over longer distances with minimum speeds of 256 Kbps at 18,000 feet. Some links operate at up to 60,000 feet. New ITU (International Telecommunications Union) standard DSL technology, ADSL2 and ADSL2plus, operate over longer distances and/or at higher speeds. ADSL2 delivers an improvement in reach of about 600 feet. Reach Extended ADSL2 reaches up to 22,000 feet. This assumes there are no loading coils on the line, or other obstacles. To provide higher speeds, it may be desirable to keep distances under two to three miles and to use remote terminals beyond that.

Future DSL technologies can bond signals over multiple pairs to increase speeds and distances. The Texas Instruments paper, "*Uni-DSL: One DSL for Universal Service*" provides a history of DSL development and proposes future solutions to support higher speeds—download from www.ti.com. A good source for DSL technical and tutorial information is www.dslforum.org.

2. Cable TV Modem

The cable TV providers in the TOP counties are Adelphia, Charter, and Citizens. Adelphia provides Internet access in Louisa and Dickenson. Charter provides does not yet provide Internet access in Accomack and Northampton. Citizens does not yet provide Internet access in Craig. Cable services are not available in Cumberland and King & Queen. In the counties where cable Internet access is available, it is limited to a few of the larger towns.

Both Adelphia and Charter currently advertise download speeds up to 3 Mbps and upload speeds up to 256 Kbps. Operators have been upgrading their systems to support digital TV, higher-speed Internet, and voice services.

The standard for cable modems is the Data over Cable Service Interface Specification (DOCSIS®). DOCSIS 1 provides 40 Mbps downstream and 10 Mbps upstream (all speeds are per channel). DOCSIS 2 provides 40 Mbps down and 30 Mbps up. DOCSIS 2.0 doubles the channel width and triples the upstream capacity compared to DOCSIS 1.x modems. DOCSIS 2.0 was specified by CableLabs® and approved by the International Telecommunications Union (ITU) in December 2002. CableLabs (Cable Television Laboratories, Inc.) is a nonprofit research and development consortium that is dedicated to helping its cable operator members integrate new cable telecommunications technologies into their business objectives.

The Motorola white paper, *Efficiently Migrating to DOCSIS 2.0*, provides a good overview of the history and the technology. It can be downloaded from http://broadband.motorola.com/nis/whitepapers.html.

The next generation of cable technology, DOCSIS 3.0, could offer 200 Mbps down and 100 Mbps up. An article in the July 2004 issue of CED Magazine, *DOCSIS: The Next Generation*, provides a roadmap of cable development. There are updates for DOCSIS, DOCSIS Set-Top Gateway, CableHome, PacketCable, Open Cable Application Platform, and Go2Broadband. Ralph Brown, CableLabs' Senior Vice President, says "Cable has only scratched the surface of its bandwidth capacity."

3. Wireless

Wireless access is now considered essential for many fixed, portable, and mobile applications. The Computer System Policy Project recommends both wired and wireless access as goals for Network Readiness. Wireless access is especially needed for public safety (police, fire, and rescue), field work, productivity, and convenience. It may also provide alternative and/or competitive access methods for entities within a community.

Michael Powell, Chairman of the Federal Communications Commission, stated at WCA 2004 on June 3, 2004, that "Wireless broadband can bring much needed competition to existing DSL and

cable-modem service. The wireless alternative will transform the marketplace by driving down the price of broadband services and expand access to underserved areas."

Fiber optic networks are also needed to provide higher speed links for backbone and premise networks. Fiber is often the backbone media of choice to feed wireless, telephone, cable TV, and IP/Ethernet networks.

Key broadband wireless technologies that are available, or under development, for community networks include:

- Advanced Wi-Fi (Wireless Fidelity)—meaning the latest 802.11 a/b/g enhancements for performance, security, Quality of Service, Class of Service, RF/network management, smart antennas, switching, and more.
- WiMAX (Worldwide Interoperability for Microwave Access)—a family of IEEE 802.16 standards. The 802.16a and subsequent 802.16-REV-d standards (a consolidation of 802.16, 802.16a, and 802.16c) are cover broadband Internet access to stationary wireless base stations. Products are expected to be available in 2005. The mobile version of WiMAX, 802.16e, is expected to be ratified first quarter 2005, with product availability in 2006.
- Mobile-Fi is a developing IEEE 802.20 standard for Mobile Broadband Wireless Access (or MBWA). Major supporters have been Flarion, Navini, and IPWireless. WiMAX products for mobile users are expected to appear before Mobile-Fi devices, which may give WiMAX an advantage.
- Qualcomm's CDMA EVDO (Code Division Multiple Access Evolution Data Optimized) from Verizon Wireless supports mobile speeds from 300 to 500 Kbps downstream and about 108 Kbps upstream (in one review). It is also being deployed by Sprint. There have been reports that EV-DO latency increases as more users are added to the network. The round trip ping time in one review was 199 ms, or about 100 ms each way.
- Flarion's FLASH-OFDM™ (Orthogonal Frequency Division Multiplexing) supports fixed, portable, and mobile applications at speeds of 1 to 1.5 Mbps downstream and 400 to 500 Kbps upstream. It is being deployed by Nextel and other providers. FLASH means Fast Low-latency Access with Seamless Handoff. Latency is less than 35 milliseconds compared to higher delays for other technologies. For good performance of common applications, including voice, it is desirable to keep end-to-end network latency under 150 milliseconds. Flarion's technology currently offers the best mobile performance available today. One source refers to Flarion's technology as a proprietary version of 802.20. The technology may have a two year lead over the competition.

Outside wireless architectures that may be applicable for a range of applications include:

- Point to Point
- Point to Multipoint
- Mesh
- Combination of the above and/or wired networks

Example wireless networks in Virginia:

- Dickenson County is deploying a wireless municipal network for their entire county. They are using Wi-Fi equipment from YDI Wireless, Inc., and other vendors.

- Pittsylvania County Schools has deployed a county wide school network using multiple point-to-point microwave links with equipment from Proxim-Western Multiplex. Wireless backbone links transport Ethernet at 45 Mbps, or 100 Mbps.
- Cumberland County Schools is receiving 10 Mbps Internet access via a 45 Mbps microwave link from their wireless provider, Compusec, Inc., at less expensive rates than available from other sources.
- In Grundy, Verizon Avenue, in an alliance with Alvarion and Virginia Mountain Micro plan to provide wireless, high-speed, Internet access to qualifying homes and businesses at speeds up to 1.5 Mbps. Verizon will use Alvarion equipment in the unlicensed 900 MHz, 2.4 GHz and 5.8 GHz bands. Virginia Mountain Micro, a local company in Grundy, will process orders and provide installation and maintenance services for the network. Verizon also plans to offer DSL later in the year. Wireless and DSL broadband services will be deployed in a coordinated manner to maximize coverage to Grundy and surrounding areas. (from Verizon and Alvarion press releases, August 23, 2004).
- The Town of Shenandoah applied for funding from the USDA with the assistance of Virginia's Center for Innovative Technology. In September 2003, The Town was awarded $643,493 to develop a wireless broadband system throughout the Town. It will provide free service for two years to Critical Community Facilities, including the Town Office, Community Computer Center, Police Department, Volunteer Fire Department, Volunteer Rescue Squad, Community Library, and medical/pharmaceutical facilities. The grant funding will also be used to renovate the first floor of the old Town Hall for a Community Computer Center that will provide 25 public computer terminals with free access to the Internet. Two classrooms will be available with videoconferencing equipment for distance learning, telecommuting, and professional training courses.

4. BPL—Broadband Over Power Lines

Broadband over Power Lines is a new technology that uses power lines for last mile local access. Local access to subscribers may be through Wi-Fi wireless modems, or HomePlug modems within premises that plug into A.C. power outlets. Subscriber data is passed from premises through, or over, the transformer that feeds the premises to RF injectors that send it along medium voltage power lines toward substations. At substations, or where desired, the signals are captured and routed over fiber, or other backhaul, to the Internet. The BPL Internet service may be provided by the power utility, or by a partner, that uses the power distribution system for RF data transport.

There are at least three BPL deployments, or trials, underway in Manassas, Nelson County, and Salem-Roanoke. D-Tel, of Salem, is using Amperion BPL equipment for the Salem-Roanoke trial. Some DSL trials have been discontinued due the creation of RF interference and other issues.

One of the best sources of information about BPL is from the Dept. of Commerce NTIA—see http://www.ntia.doc.gov/ntiahome/fccfilings/2004/BPLComments_06042004.htm.

5. Satellite

Satellite 2-way Internet services are generally available from DiRECWAY and StarBand. Performance compared to DSL and Cable is poor due to signal delays caused by the long distance to the satellite, low upload speeds, and higher costs for monthly fees and equipment. Nonetheless, in areas where only dial-up modem service is available, satellite service can offer a substantial improvement for downloads.

A 1-way satellite service is available through resellers from Internet Satellite Platform, Inc., or ISAT. ISAT provides a satellite download service called satXpress that requires a dial-up modem for upload. This method may be more usable than 2-way satellite services where upload speeds may be less than a dial-up modem, or where throughput too low due to signal delays.

DiRECWAY offers residential and commercial classes of service. For residential services, two plans are Home Service and Professional Service. Both provide download speeds of up to 500 Kbps and upload speeds up to 50 Kbps. Speed can vary with total traffic load. Data thresholds are set that throttle rates based on speed of download, duration of download, and service plan recovery rate. Standard equipment and installation cost is $600. Monthly service fees are $60 for the Home Plan and $90 for the Professional Plan. There is a 15-month term commitment. For commercial services, two plans are Small Office and Business Internet. Both provide download speeds up to 1 Mbps and upload speeds up to 100 Kbps. Costs per month are $100 for the Small Office Plan and $130 for the Business Internet Plan. Standard equipment and installation are $1000. Commercial plans have a 24-month term commitment. The more expensive residential and commercial plans offer higher data thresholds and faster recovery rates if the thresholds are exceeded. See www.direcway.com for details. Also, see www.copperhead.cc/ for user information about DiRECWAY.

StarBand offers three service plans, which are Residential, Telecommuter, and Small Office. In addition, they offer one, two, and three year contract periods. There are three models of equipment offered, which are models 360, 481, and 484. For simplicity, a one year contract period is used in this paragraph. For the StarBand Residential Plan, cost is $70/month, plus $400 for Model 360 equipment. Alternatively, cost is $90/month, plus $600 for Model 481 equipment. Model 481 equipment provides downloads up to 10 times dial-up modem (presumably up to 500 Kbps) and uploads up to 100 Kbps in *Turbo* Mode. For the Telecommuter Plan, cost is $120/month, plus $600 for Model 481 equipment. Download speeds are up to 750 Kbps and uploads are up to 128 Kbps in *Turbo Plus* Mode. For the Small Office Plan, cost is $150/month, plus $800 for Model 484 equipment. Downloads are up to 20 times faster than dial-up (presumably up to 1 Mbps) and uploads are up to 256 Kbps in *Turbo Max* Mode. Shipping and installation are extra. See www.starband.com for details. Also, see www.starbandusers.com/truth.htm for user information about StarBand.

Satellite Internet service options may improve when services are available over a new satellite that was recently launched for Telesat Canada. The satellite will be used by WildBlue to deliver Internet services in early 2005—see www.wildblue.com. WildBlue will offer several packages with download speeds up to 1.5 Mbps and upload speeds up to 256 Kbps.

6. Fiber Optics

Fiber optic cables are the media of choice for long-haul and metro network backbones. This is because fiber has significant bandwidth capacity that can be utilized when needed by upgrading, or adding to, the network layer equipment instead of having to run more cables. As the need for bandwidth to homes and businesses increase, then fiber to the premise, or FTTP, becomes more desirable. For example, T1 lines are typically provisioned over twisted-pairs, whereas T3 and higher speed lines are typically provisioned over fiber. FTTP can easily support 100 Mbps or 1 Gbps Ethernet to the premise. Switched 100 Mbps Ethernet is the speed used today over Local Area Networks for businesses and homes.

Many applications, including voice, music, web surfing, and low-end video work reasonably well at 768 Kbps to 1.5 Mbps per traffic flow. Voice and text email need less bandwidth, but moving files around frequently need more. Files transfers between machines and to servers can easily use 100 Mbps and more. Also, as technology and content advances, higher speed connections are needed to take advantage of it.

While fiber may be the most expensive to install today, it may be the least expensive over the life of the system. The value depends upon how it is used to deliver affordable services. The same can be said for other local access transport technologies.

The Town of Haysi, Virginia, has deployed FTTP. It became operational in May 2004. It delivers Gigabit Ethernet to each premise. Subscribers may connect at any of three common Ethernet speeds at 10 Mbps, 100 Mbps, or 1 Gbps. The hub site connects to Net.work.Virginia for Internet access.

Many independent cities have deployed fiber to interconnect government buildings and schools. Regional fiber optic backbones are being deployed in Southside and Southwest Virginia. The Bristol Virginia Utilities Board has deployed FTTP and regional fiber backbones. LENOWISCO PDC is deploying regional fiber backbones and FTTP. Cumberland Plateau PDC is deploying fiber optic backbones. In Southside Virginia, the Mid-Atlantic Broadband Cooperative was formed to interconnect counties and industrial parks within the region over fiber.

V. Technology Plan

This is a work in progress pending revisions by the Technology Leadership Team.

A. Goals from Local, State, Federal, and Industry Sources

This section combines the lists of goals from the preceding sections that are applicable at county levels, including the community interviews and recommendations from leaders in the Federal Government, Virginia State Government, and from industry experts. Since there is some redundancy and overlap of the goals and recommendations, they will be grouped by category and consolidated in the next section to form a high level technology plan.

(1) Promote affordable high-speed Internet access county-wide
(2) Deploy higher speeds to each primary school over fiber-optics or fixed wireless
(3) Improve broadband enabled classrooms
(4) Improve high-capacity distance education
(5) Support teleworking over broadband
(6) Promote telemedicine over broadband for improved healthcare
(7) Develop broadband applications to enhance homeland security
(8) Facilitate ubiquitous wireless broadband access
(9) Support public ROW policies that promote deployment of wired and wireless broadband infrastructures
(10) Promote e-Government/e-Education/e-Healthcare/e-Business initiatives that recognize the full potential of broadband applications:
    - Revolutionize service delivery to customers through implementation of a customer-facing Internet portal and increasing the quantity, quality, and adoption of online services, particularly in the area of online licensure and interactive forms.
    - Consolidate IT infrastructure and provide centralized services as a technology utility.
    - Plan, budget, and track IT expenditures by developing a capital planning and funding process for IT, developing a comprehensive technology management policy, and improving systems to track IT expenditures.
    - Manage IT procurement by developing and implementing a best practice model for effective and timely IT procurements.
    - Increase federal/state research and development funding to schools.
    - Grow entrepreneurial companies by leveraging intellectual property from Virginia's labs and institutions of higher education.
    - Increase broadband deployment, especially in rural areas to enhance economic development.
    - Promote technology-based economic development by "growing" technology companies.
(11) Coordinate initiatives with the Center for Innovative Technology (CIT) that may serve as a general clearinghouse for information on broadband, including:
    - Leadership
    - E-Community Development

- Aggregating Demand
- Best Practices
- Partnership Models/Alliance Building
- Funding Models and Sources (grants, foundations, government, etc.)
- Grant Writing
- "How-To" guides
- Coordination of e-Business Outreach efforts and VECTEC to develop applications and programs to bolster the development of private-sector demand.

(12) Leverage existing telecommunications programs (COVAnet and Net.Work.Virginia) and local leadership.
- Improve information dissemination about existing programs including "acceptable uses," options (current and future), and best practices for using the networks.
- Develop and implement creative models to link/leverage/expand existing statewide networks.
- Support demand aggregation strategies.

(13) Seek advice and coordination with CIT for greater participation in Federal and State funding opportunities, including e-Rate and Rural Health programs.

(14) Work through CIT to leverage other Virginia agencies, such as Secure Virginia, VGIN, local groups, and private sector providers.

(15) Advocate IT interests at local, state and federal levels, including with CIT, the Planning District Commission, technology councils, economic development, public safety, homeland security, education, healthcare, business, and home.

(16) Coordinate the documentation of community telecommunications information with CIT to facilitate planning.

(17) Develop broadband initiatives with the education sector, including county schools, colleges, and universities:
- Review Virginia Tech eCorridors' guides and papers for planning telecommunications infrastructure involving fiber optic design, Geographic Information System, and regulatory issues.

(18) Adopt a County technology vision for the next ten years regarding how to transform the information infrastructure into a robust, universally-available network capable of supporting affordable, advanced, broadband and mobile services:
- In the short-term, premises should be able to get at least 1.5 Mbps capacity
- In the mid-term, 50 percent of premises should be able to get 6 Mbps from at least two providers
- By end of the decade, 50 percent of premises should be able to get 100 Mbps

(19) Enact regulatory reform to take steps to eliminate barriers to wired and wireless broadband deployment:
- Review all current regulations and work to eliminate barriers to infrastructure investment.
- Review building and road codes to assure that new "trenching" techniques and innovative ways of laying cables can be used where appropriate.

- Work to minimize difficulties providers face in securing adequate sites and facilitate carriers' access to public rights of ways.

(20) Work with other sectors to develop transformative applications that rely on a robust wired and wireless broadband network.

(21) Promote action for driving development of Networked World Infrastructure by resolving technical issues, creating richer content, and encouraging consumer confidence in technology products:
- Commit to ease-of-use
- Develop richer content that exceeds consumer expectations and drives demand
- Be responsive to partnerships that may provide ways for deploying broadband technologies
- Strengthen the security of networks and information technology infrastructure
- Resolve copyright issues; develop a digital rights management strategy that protects content, consumer choice, and technological innovation

B. Technology Plan Recommendations

The vision and goals for this technology plan are derived from the lists of goals and recommendations in the preceding sections. They include community interviews and recommendations from leaders in the Federal Government, Virginia State Government, and from industry experts.

1. Create Technology Advisory Council

The Technology Advisory Council should be chaired by the county IT director, or closest equivalent, with representatives from all sectors of local government (including e911, police, fire, and rescue), education, CIT, PDC, technology council, economic development, healthcare, business, telecomm service providers, and others. Core leadership from county government, the Planning District Commission, and CIT are needed for planning county-wide and regional initiatives. Adopt a mission to drive implementation of the Vision and Goals.

2. Vision

(1) County-wide Network Readiness will be transformed over the next ten years into a robust, universally-available network capable of supporting affordable, advanced, broadband and mobile services:
- In the short-term, premises should be able to get at least 1.5 Mbps capacity
- In the mid-term, 50 percent of premises should be able to get 6 Mbps from at least two providers
- By end of the decade, 50 percent of premises should be able to get 100 Mbps

(2) Service delivery to citizens, customers, students, and employees (i.e., everyone) will be revolutionized through implementation of Internet portals and increasing the quantity, quality, and adoption of online services.

3. Goals

This section consolidates the needs and recommendations previously outlined. Broadband access solutions are substantially horizontal in that they are applicable across all vertical market sectors.

However, utilization of broadband infrastructure to deliver full services in each sector may be vastly different. For example, school Information Technology departments were generally found to be the most advanced, whereas elements of public safety and healthcare were at ground zero. By assessing Network Readiness by sector, as recommended by the CSPP, it increases awareness of where deficiencies exist and provides metrics for measuring progress. In addition to making affordable broadband access available to all, it is important for each vertical market sector to put the network to full use.

a) Collaboration and Partnerships

(1) Be responsive to partnerships that may provide ways for deploying broadband technologies.

(2) Coordinate initiatives with the Center for Innovative Technology (CIT) that serves as a general clearinghouse for information on broadband, including:
- Leadership
- E-Community Development
- Aggregating Demand
- Best Practices
- Partnership Models/Alliance Building
- Funding Models and Sources (grants, foundations, government, etc.)
- Grant Writing
- "How-To" guides
- Coordination of e-Business Outreach efforts and VECTEC to develop applications and programs to bolster the development of private-sector demand.

(3) Seek advice and coordination with CIT for greater participation in Federal and State funding opportunities, including e-Rate and Rural Health programs.

(4) Work through CIT to leverage other Virginia agencies, such as Secure Virginia, VGIN, local groups, and private sector providers.

(5) Coordinate the documentation of community telecommunications information with CIT to facilitate planning.

(6) Advocate IT interests at local, state and federal levels, including with CIT, the Planning District Commission, technology councils, economic development groups, public safety, homeland security, education, healthcare, business, home, and others.

(7) Develop broadband initiatives with the education sector, including county schools, colleges, and universities:
- Research for this project clearly shows that county schools are furthest ahead within each county in deployment of broadband access and information technology, so leverage their expertise where possible.
- Contact your closest colleges and universities to request their support for broadband access, content development, and network utilization initiatives.
- Review Virginia Tech eCorridors' guides and papers for planning telecommunications infrastructure involving fiber optic design, Geographic Information System, and regulatory issues.

(8) Work with other sectors to develop transformative applications that rely on a robust wired and wireless broadband network.

b) Infrastructure Development

(1) Make affordable high-speed Internet access available county-wide
(2) Deploy higher speeds to each primary school over fiber-optics or fixed wireless
(3) Improve broadband enabled classrooms
(4) Strengthen the security of networks and information technology infrastructure
(5) Facilitate ubiquitous wireless broadband access
(6) Increase broadband deployment, especially in rural areas to enhance economic development.
(7) Consolidate IT infrastructure and provide centralized services as a technology utility.

c) Content Development and Application Utilization

(1) Commit to ease-of-use
(2) Develop broadband applications to enhance homeland security
(3) Provide interactive online services across all sectors
(4) Develop richer content that exceeds consumer expectations and drives demand
(5) Improve high-capacity distance education
(6) Promote online training and workforce development
(7) Promote teleworking over broadband
(8) Promote telemedicine over broadband for improved healthcare

d) Enablers

(1) Resolve copyright issues; develop a digital rights management strategy that protects content, consumer choice, and technological innovation.
(2) Support public ROW policies that promote deployment of wired and wireless broadband infrastructures.
(3) Plan, budget, and track IT expenditures by developing a capital planning and funding process for IT, developing a comprehensive technology management policy, and improving systems to track IT expenditures.
(4) Manage IT procurement by developing and implementing a best practice model for effective and timely IT procurements.
(5) Increase federal/state research and development funding to schools.
(6) Grow entrepreneurial companies by leveraging intellectual property from Virginia's labs and institutions of higher education.
(7) Promote technology-based economic development by "growing" technology companies.
(8) Enact regulatory reform to take steps to eliminate barriers to wired and wireless broadband deployment:
    - Review all current regulations and work to eliminate barriers to infrastructure investment.
    - Review building and road codes to assure that new "trenching" techniques and innovative ways of laying cables can be used where appropriate.

- Work to minimize difficulties providers face in securing adequate sites and facilitate carriers' access to public rights of ways.

4. Regional Technology Corridors Plan

In the online appendices is a special report for the Regional Technology Corridors Plan titled *Access to Tier One Networks.* It was prepared by Jeff Crowder, Virginia Tech's Director of NetworkVirginia. An overview of NetworkVirginia is shown in the following figure.

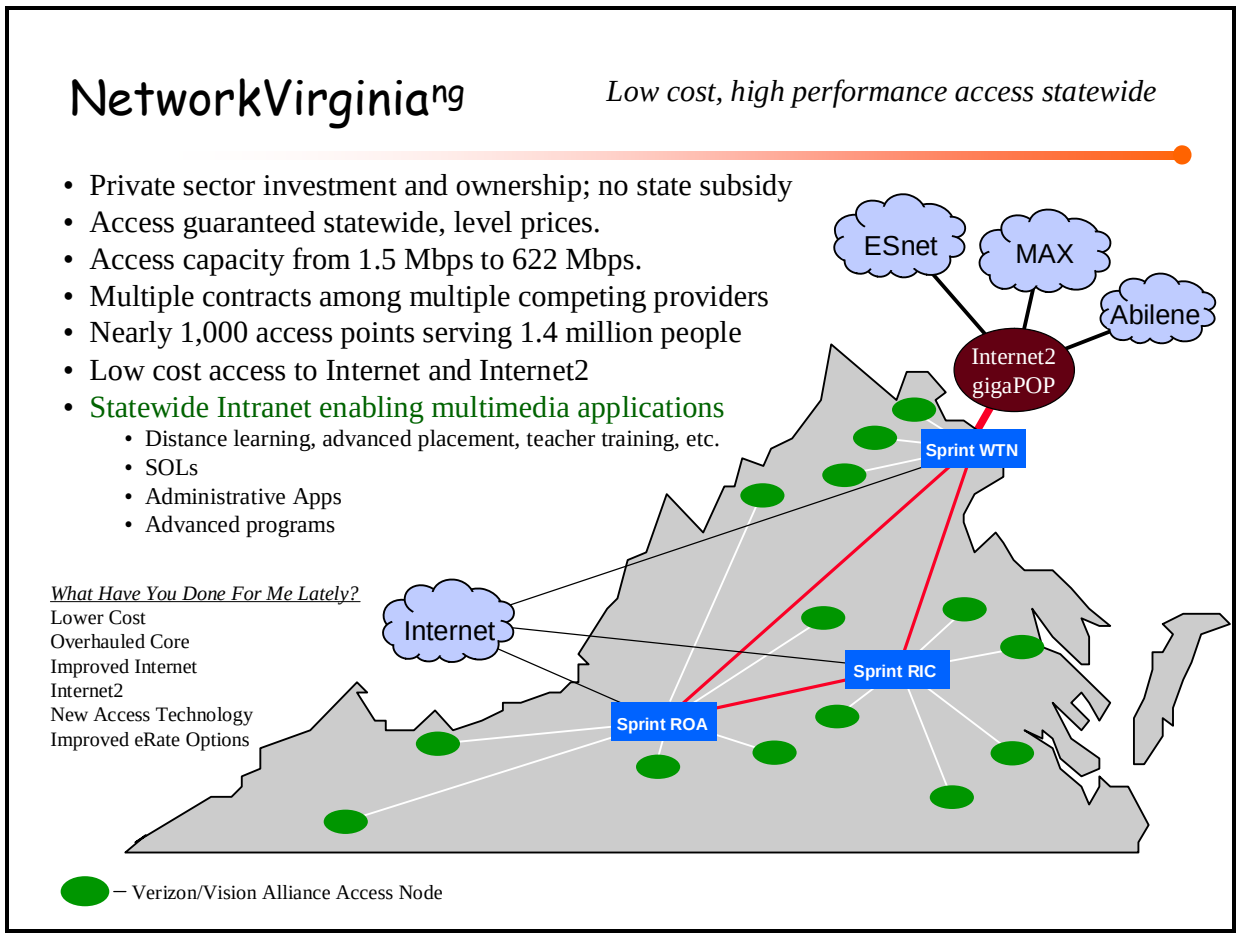

Figure 14: NetworkVirginia (ng--next generation)

Jeff has been involved in developing access to higher tier networks at Virginia. Another project is planning for access to a *next generation* national network called the National LambdaRail, or NLR (see Figure 14 and www.nlr.net).

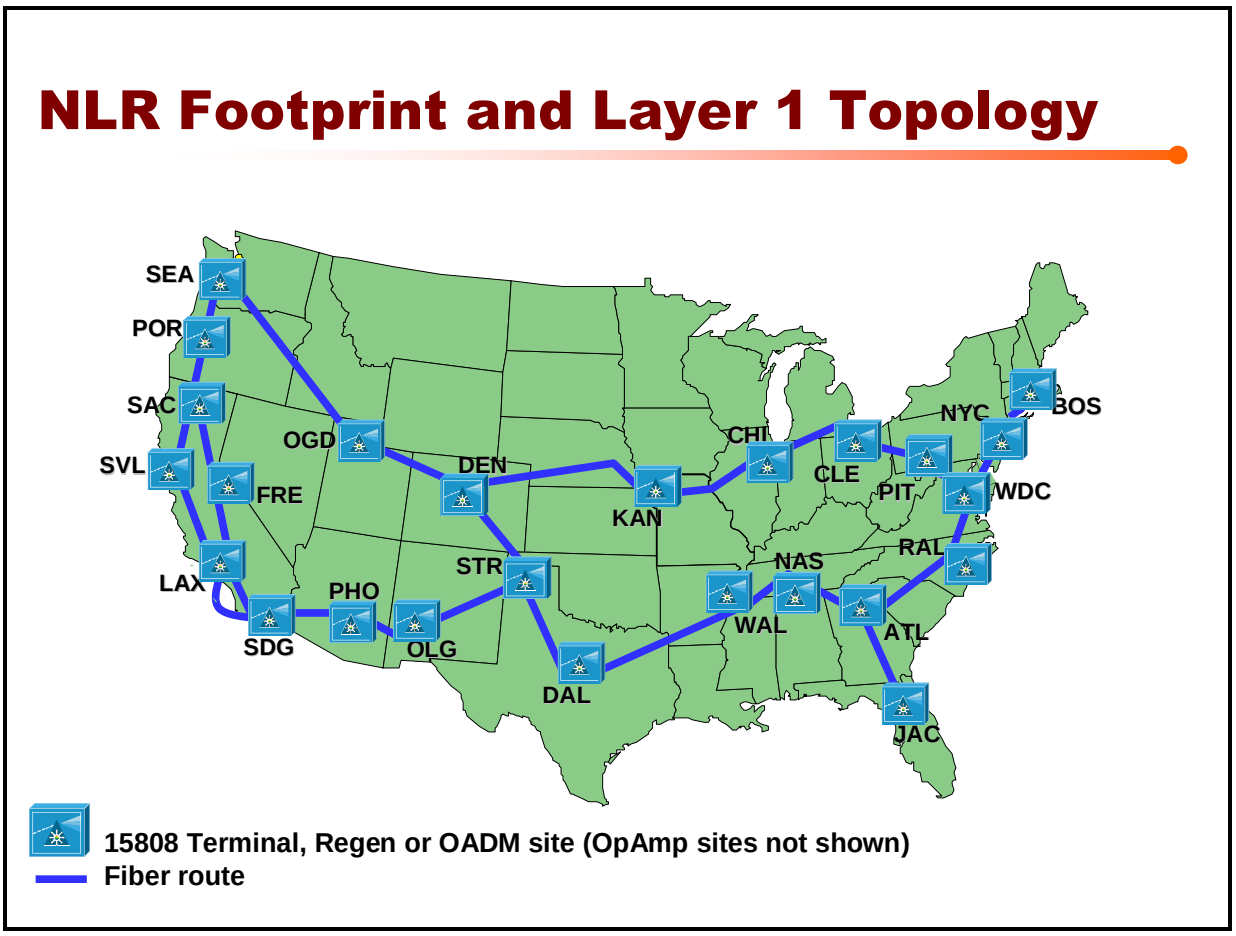

Figure 15: Planned National LambdaRail Research Network

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. It supports multiple 10 Gbps channels. Similar technology will be needed at some point to interconnect county networks state-wide.

A regional fiber optic network recently funded by the Tobacco Commission and the EDA is planned in Southside Virginia--see Figure 15. A non-profit organization, the Mid-Atlantic Broadband Cooperative, was formed to manage the Regional Broadband Initiative. Cumberland, one of the TOP counties, has a fiber node on the network planned at their Riverside Industrial Park, which is close to Farmville.

Figure 16: Southside MBC Regional Broadband Initiative

Cumberland County needs to plan for linking the rest of the county into the regional MBC Network. A potential solution is to form a partnership with Compusec, a fixed broadband wireless provider that currently serves the Cumberland Schools with a 45 Mbps wireless link. Compusec also provides fixed broadband wireless to Farmville, which is near the Riverside Industrial Park. Cumberland County government personnel are currently in negotiations with Compusec for expanded wireless Internet access services to Cumberland communities.

Local and regional networks need to connect to each other and to higher tier networks over diverse routes for better reliability. Also, many regions only have one major fiber network service provider, whereas at least two are recommended for competition and for diversity. Interconnecting, or peering, networks provide an increased base of businesses, services, and customers for higher levels of economic development and quality of life. The MBC Southside network needs to connect to the East Coast Tier-1 hub site in Washington, DC, over diverse roués. One such route would be along Eastern Shore.

The Accomack-Northampton Planning District Commission could potentially lead a project to build fiber along Eastern Shore as shown in Figure 16. The route was suggested in an article published by LIGHTWAVE magazine in December 2003. Other planning district commissions, including LENOWISCO and Cumberland Plateau have lead development of fiber optic backbone projects in their regions. The New River Valley Planning District Commission is also planning a regional fiber network. If these regional networks are interconnected, then the value is increased for all. County government representatives should work with their respective PDCs to

Haysi Electronic Village, in Dickenson County, has deployed local access Fiber to the Premise (FTTP) to deliver Gigabit Ethernet to users. Haysi needs a high-speed fiber link to the other regional networks, including LENOWISCO, Cumberland Plateau, Bristol, VA, and others.

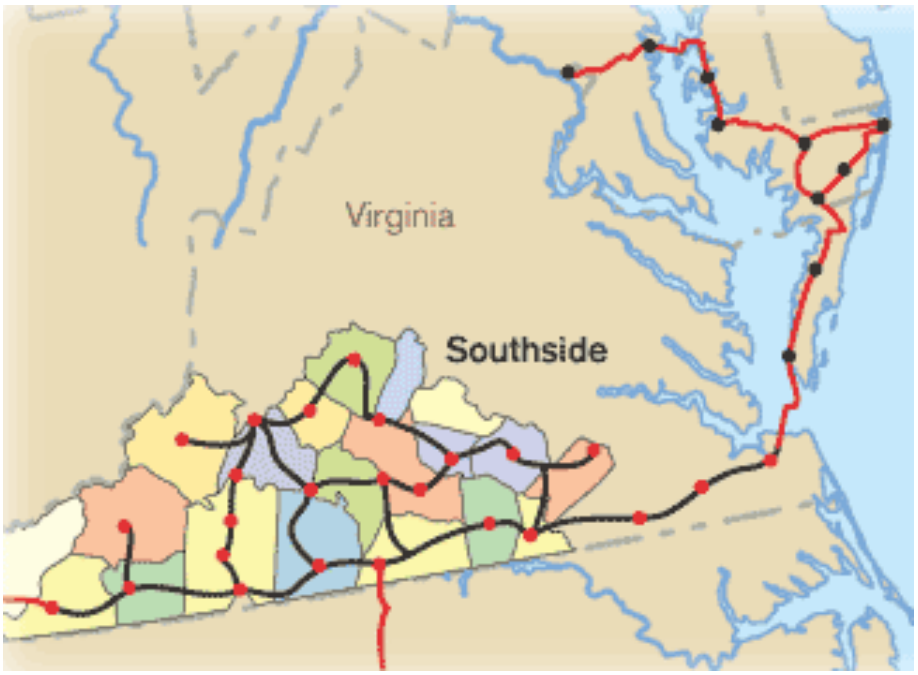

Figure 17: Conceptual Fiber Route along Eastern Shore

The following snippit about the MBC fiber project is from the same article:

> "A key objective of the open access fiber network is to provide at least one alternative carrier to businesses in the region. To date, the incumbent local exchange carriers (ILECs)—Verizon Communications and Sprint—operate fiber routes to 24 of the 56 industrial parks in the Southside region. Other major providers such as Level 3 Communications and Williams have fiber in the area as part of their north and south networks, but they do not have fiber access points in the region that would allow other providers, schools, and public entities to connect to their networks.
>
> A request for information (RFI) was issued by the Tobacco Commission in August, which advised respondents to "strongly consider" ITU-specified G.655 nonzero dispersion-shifted fiber for longer routes and G.652.C fiber for local access. Each cable must contain a minimum of 144 optical strands. The planned network is a DWDM-based infrastructure.
>
> "If we are going to get more companies that are going to be global suppliers, then we need to address the fact that the industrial parks are wired and ready to do business globally," explains Tobacco Commission grants manager Tim Pfohl. "The thinking was, we've got 56 industrial parks across Southside, Virginia, and what can we do to make sure that those sites aren't crossed off of company-prospect lists? One of the great needs was redundant high-volume fiber capacity.
>
> If we can get all of these parks connected, then that lessens the chance greatly that they would be crossed off of prospect lists when companies are looking to locate. The RFI was

sent out to test the waters from that standpoint, and the responses indicated, yes, it is feasible."

The Mid-Atlantic Broadband Cooperative subsequently issued a request for proposal (RFP) for network design and engineering services in the first week of November. Under the procurement rules of the EDA, the winner of that bid will then issue an RFP for construction.

The infrastructure will be operated as a wholesale open access fiber-optic network. "Whoever wants to buy services or dark fiber will only have to provide the card that goes into the box," says Hudgins. "What we are doing is leveling the playing field, where the interstate level and the toll are the same for everybody, and the local ISPs [Internet service providers] or the ILECs or CLECs [competitive local exchange carriers] compete on service and price."

The commission has been working with the local communities on this project for three years. In 2001, Virginia Polytechnic Institute and State University began to work with business and community officials to analyze how access to advanced technologies provided by optical networks could stimulate Virginia's economic development in a series of reports entitled "Strategic Technology Infrastructure for Regional Competitiveness in the Network Economy," as part of its eCorridors program. The report examined the telecommunications providers and placement of their fiber networks in the region and discussed a low-cost mesh-network design based on a financial model that could be duplicated in other rural areas of the United States.

"The commission reviewed the reports, and they kind of modeled the RFI on the open access network to deploy fiber into areas where it isn't currently available," says Hudnall Croasdall, a professor at Virginia Tech and assistant to the director of technology programs at the Tobacco Commission. "They are also planning to integrate some type of broadband wireless technology into the network, which for this region is very, very advanced."”

Additional details on the Southside Regional Broadband Initiative can be found at http://www.vatobaccocommission.org/SS_RBI_main.htm and at http://www.mbc-rbi.org/.

5. General Implementation Outline

Projects may range from relatively simple in-house projects to large county-wide projects. It is important for county government to lead the way.

1. Create Technology Advisory Council
2. Include Information and Communication Technology planning in the county comprehensive plan
3. Create Information Technology Department, if it does not already exist, to develop infrastructure, training, utilization, and to work toward goals/recommendations
4. Increase partnering between county government and county school Information Technology personnel for joint projects

5. Prioritize goals and objectives
6. Propose projects to address priorities using alternate technology solutions, or as appropriate
7. Coordinate with the Virginia Center for Information Technology and other appropriate parties
8. Obtain approvals
9. Obtain funding
10. Put out RFPs, if appropriate
11. Implement projects
12. Monitor and measure results periodically

VI. List of County Specific Online Appendices

A. Craig

1. **Business Analysis**
2. **Business Sites Map**
3. **Census Employment Comparison**
4. **Census Overview Comparison**
5. **Consumer Expenditure Summary**
6. **Demographic Executive Summary**
7. **GNIS Data**
8. **GNIS Populated Places**
9. **Population Density Map**

B. Cumberland

1. **Business Analysis**
2. **Business Sites Map**
3. **Census Employment Comparison**
4. **Census Overview**
5. **Consumer Expenditure Summary**
6. **Demographic Executive Summary**
7. **GNIS Data**
8. **GNIS Populated Places**
9. **Population Density Map**

C. Dickenson

1. **Business Analysis**

2. **Business Sites Map**
3. **Census Employment Comparison**
4. **Census Overview Comparison**
5. **Consumer Expenditure Summary**
6. **Demographic Executive Summary**
7. **GNIS Data**
8. **GNIS Populated Places**
9. **Population Density Map**

D. Eastern Shore (Accomack)

1. **Business Analysis**
2. **Business Sites Map**
3. **Demographic Executive Summary**
4. **GNIS Data**
5. **GNIS Populated Places**
6. **Population Density Map**

E. Eastern Shore (Accomack-Northampton)

1. **Census Employment Comparison**
2. **Census Overview Comparison**
3. **Consumer Expenditure Summary**
4. **Demographic Executive Summary**

F. Eastern Shore (Northampton)

1. **Business Analysis**
2. **Business Sites Map**

3. **Census Employment Comparison**
4. **Census Overview Comparison**
5. **Consumer Expenditure Comparison**
6. **Consumer Expenditure Summary**
7. **Demographic Executive Summary**
8. **GNIS Data**
9. **GNIS Populated Places**
10. **Population Density Map**

G. King And Queen

1. **Business Analysis**
2. **Business Sites Map**
3. **Census Employment Comparison**
4. **Census Overview Comparison**
5. **Consumer Expenditure Summary**
6. **Demographic Executive Summary**
7. **GNIS Data**
8. **GNIS Populated Places**
9. **Population Density Map**

H. Louisa

1. **Business Analysis**
2. **Business Sites Map**
3. **Census Employment Comparison**
4. **Census Overview Comparison**
5. **Consumer Expenditure Summary**

6. **Demographic Executive Summary**
7. **GNIS Data**
8. **GNIS Populated Places**
9. **Population Density Map**

VII. List of Common Online Appendices

A. Main Project Papers

1. **Access to Tier One Networks**
2. **GIS Applications in Community Telecommunications**
3. **Interview-Survey Preface**
4. **Interview-Survey Template**
5. **Public Role in Telecomm**
6. **ROW Statutes for VA And Adjacent States**
7. **Virginia Reference Map**
8. **Virginia Regulatory Issues**
9. **What Is Broadband**

B. TOP County Demographic Comparisons

1. **Census Bureau QuickFacts Comparison**
2. **FedStats Demographic Comparison**
3. **FedStats MapStats Comparison**
4. **SRC-Census Employment Comparison**
5. **SRC-Census Overview Comparison**
6. **SRC-Consumer Expenditure Comparison**
7. **SRC-Demographic Comparison**
8. **SRC-Demographic Snapshot Comparison**
9. **SRC-Housing Units Comparison**
10. **SRC-Total Establishments Comparison**
11. **SRC-US Census Overview Comparison**

12. **SRC-US Executive Summary Comparison**
13. **USDA-NASS 2002 Census Of Agriculture Comparison**
14. **VDOE-School Census 2002 Comparison**

C. TOP-VA-US Combined Demographic Reports

1. **SRC-TOP Combined Demographic Snapshot Sum**
2. **SRC-TOP Combined Executive Summary**
3. **SRC-US Consumer Expenditure Summary**
4. **SRC-US Demographic Detail Summary**
5. **SRC-US Demographic Snapshot Summary**
6. **SRC-US Executive Summary**
7. **SRC-VA Census Employment**
8. **SRC-VA Census Overview**
9. **SRC-VA Census Places Executive Summary**
10. **SRC-VA Census Places Population**
11. **SRC-VA Census Places Summary**
12. **SRC-VA Consumer Expenditures**
13. **SRC-VA Demographic Detail Summary**
14. **SRC-VA Demographic Executive Summary**