October 16, 2009

**VIA ELECTRONIC COMMENT FILING SYSTEM (ECFS)**

Ms. Marlene H. Dortch
Office of the Secretary
Federal Communications Commission
445 12th Street SW
Washington, D.C. 20554

**Re: Ex Parte Communication, 47 C.F.R. § 1.1206**
***In re National Broadband Plan for Our Future*, GN 09-51**

Dear Ms. Dortch:

On October 16, 2009, representatives of the National Association of Telecommunications Officers and Advisors, met with Tom Koutsky and BJ Neal of the Federal Communications Commission Broadband Planning Task Force. The purpose of the meeting was to discuss the importance of local government "Middle Mile" networks and the role they should be asked to play in the National Broadband Plan. Participants on behalf of NATO were Joanne Hovis, President-elect of NATOA; Nick Miller of Miller & Van Eaton, P.L.L.C.; Jim Baller of The Baller Herbst Law Group; Mary Beth Henry, Immediate Past President of NATOA; Tony Perez, Board Member of NATOA; Mark Ansboury of OneCommunity, and Matt Johnson, NATOA Legal Fellow.

The meeting reviewed a series of specific case studies of local government broadband "anchor institution" networks. The participants discussed the commonalities, requirements, and impediments to these networks as described on the enclosed materials. The participants also discussed the role these networks can and should play in bringing high capacity broadband at low cost to anchor institutions and the potential of these networks to provide "middle mile" transport for "last mile" broadband providers. Based on the lessons learned in these case studies, the participants discussed the action steps necessary to facilitate deployment of these networks in underserved communities across the country. We spoke from the attached documents.

Pursuant to Commission rules, please include a copy of this notice in the record for the proceeding noted above.

Sincerely,
*/s/ Matthew R. Johnson*
Matthew R. Johnson
Legal Fellow
NATOA

cc: Tom Koutsky
BJ Neal

**Government Fiber Networks Enable Efficiencies and Dramatic Public and Private Cost Savings**

- **Local Government Participants**
  - **Mary Beth Henry, City of Portland and NATOA Board of Directors**
  - **Tony Perez, City of Seattle and NATOA Board of Directors**
  - **Joanne Hovis, NATOA President-Elect**
  - **Nick Miller, Miller & Van Eaton, PLLC**
  - **Jim Baller, The Baller Herbst Law Group**
  - **Mark Ansboury, CTO, OneCommunity**

- **Overview**
  - **Issue Definition**
  - **Key Characteristics**
  - **Case Studies**
  - **Common Characteristics**
  - **Lessons Learned**

  **Issue: impact of government anchor/institution networks**
  - **On second and middle mile deployment**
  - **On last mile deployment**

- **Key Characteristics—These Networks Capture the Externalities of Broadband**
  - **Cost and price savings**
  - **Sustainability**
  - **Scalability**
  - **Incentives encourage**
    - **Big pipes**
    - **Aggregated demand**
    - **User defined services**
    - **Access for competing private sector providers**

- **Case Studies**
  - **IRNE (Portland, Oregon)**
    - **Overview: regional intergovernmental cooperation**
    - **Favorable state and local law**
    - **Good price and cost information**
    - **Multiple uses and users**

- **Ontario County (New York)**
  - **Regional middle mile network built through strong regional cooperation**
  - **Fiber backbone to provide foundation for private carriers to offer services**
  - **Low-cost access has spurred interest of new last mile providers**
  - **Business plan demonstrates that projected revenues will meet OpEx and repay debt**

- **Seattle**
  - **Overview: shared fiber demonstrates construction efficiencies, sustainability, and enabling of affordable higher bandwidth services**
  - **Partnership members (anchors and government agencies) control how they meet needs**
  - **Flexible access to massive amounts of connectivity at low cost**
  - **40 Gbps connections possible under this model—not available or affordable from private carriers**
  - **Enables cost savings through collaboration in other areas—eg, sharing of data storage facilities**
  - **Enables free public wireless last mile**

- **San Francisco**
  - **Overview: uses network externality to reach underserved and vulnerable communities**
  - **City fiber to public housing; private partner equipment donations for high bandwidth wireless for residents**

- **DC-NET (District of Columbia)**
  - **Overview: local government deploys state of the art**
  - **Self-sustaining**
  - **Superior architecture with greater scalability and security/redundancy than carrier-grade networks**
  - **Plans for bridging last mile in underserved and vulnerable neighborhoods**

- **OneCommunity (North-Eastern Ohio)**
  - **Overview: open, non-profit, multi-stakeholder community network**

        - **Aggregates demand and investment (both public and private) to increase availability, capacity, services**
        - **Lowers total cost of ownership**
        - **Aggregates demand across stakeholders and industries for sharp collective cost reductions**
        - **Provides open, facilities-based neutral network**
        - **Leverages shared infrastructure and aggregated services to realize greater investment and lower costs**

    - **Palm Beach County (Florida)**
        - **Overview: county-wide middle mile fiber to anchors with free last mile wireless to vulnerable communities**
            - **Construction and operations savings through shared construction and aggregated demand for anchors**
            - **Fiber enables free last mile wireless for students eligible for free and reduced school lunch programs**

    - **OpenCape (Massachusetts)**
        - **Overview: regional consortium of anchors, K-12, higher education, public safety, and local governments**
        - **Consortium ownership; private sector management and operations**
        - **High bandwidth connectivity to anchors**
        - **Open middle mile fiber for multiple last mile private providers (projected at 50 percent below current cost of existing, insufficient middle mile)**

- **Common Characteristics**

    - **Scale economies in construction**
        - **Fiber has declining incremental costs**
        - **Fiber has lower fully distributed costs**
            - **More service for less cost**
                - **Lower CapEx**
                - **Lower OpEx**
            - **Declining per unit incremental cost**

    - **Sustainable: government, ironically, has the correct incentives**

    - **More service**
    - **Lower cost**
    - **Aggregated demand—networks are sustained (and investment enabled) through lower cost, better services/bandwidth**
    - **Public institutions have lots of demand but few revenues**
    - **Local government and related anchors have many facilities spread over entire region**

- **Capture externalities**
    - **Smaller jurisdictions can share in the benefits**
    - **Non-commercial uses bring value to the network**
    - **Reaching the underserved is economically feasible**
    - **Network can stimulate economic activity without compensation**
    - **These networks can be opened to commercial Last Mile Providers**

- **Lessons Learned**
    - **First—do no harm**
        - **These are valuable and essential**
        - **Be aware of unintended consequences**
    - **Second-- aggregated demand is essential**
        - **Public institutions have lots of demand but few revenues**
        - **Local government needs high-bandwidth to many anchor buildings, widely distributed**
    - **Third--cost savings are real and make the networks viable**
        - **Multiple forms of cost savings from local government control:**
            - **Joint trenching**
            - **Overlashing and pole attachments**
            - **"Shadow" conduit**
            - **Dark fiber**
            - **REQUIRES: local government negotiating reasonable terms and condition for use of public property**
        - **Multiple forms of cost savings in ongoing connectivity expenses of government tenants and anchors**
            - **Significant savings relative to leased services, even assuming no increase in lease expenses/connectivity needs in the future;**

**once the need to scale to higher bandwidth is included, savings are even more dramatic**

- **REQUIRES: government opportunity to provide services to its own agencies and anchors rather than be forced to be customer**

- **Fourth--Capture externalities**
  - **Smaller jurisdictions can share in the benefits**
  - **REQUIRES: legal authority to act inter-jurisdictionally**
    - **Reaching the underserved is economically feasible**
  - **REQUIRES: creative financing to cover incremental costs**
- **Fifth--These networks can be opened to commercial Last Mile providers**
  - **REQUIRES: eliminating restrictions on government provisioning**

# Finger Lakes Regional Telecommunications Development Corp. (Ontario County, NY): Middle Mile Public-Private Partnership

In 2004, a countywide telecommunications study in Ontario County[1] defined telecommunications within Ontario County as segmented and diverse, and rife with issues relative to telecommunications infrastructure, including the availability of redundant, reliable and affordable connectivity, competition, and more. During the study, focus groups representing education, public safety, healthcare, business, economic development, and municipalities each cited the diverse telecommunications culture as a major negative issue to doing business in the County. Furthermore, it was discovered that technology-based businesses were considering relocating due to the lack of diversity, redundancy, competition and in general, access to broadband.

***Open Access Model***: The County considered many options to rectify the issues, but chose the development of an Open Access fiber backbone to provide consistency throughout the County. The countywide project called for the installation of 180-plus miles of fiber cabling to interconnect key middle-mile entities throughout the County, including county facilities, town and village offices, schools, colleges, healthcare facilities, fire stations, public safety facilities, communications towers, larger industries and economic development sites (current and anticipated).

The governance of this fiber backbone is managed by a Local Development Corporation (LDC) established by the County Board of Supervisors. The LDC named Finger Lakes Regional Telecommunications Development Corporation (FLRTDC) as responsible for all aspects of the project. FLRTDC is managed and supported by a Board of Directors, qualified consultants and contractors.

The basic premise of the fiber backbone is that it would directly address and resolve the fragmented nature of the telecommunications culture within the County — and potentially the Finger Lakes Region as a whole as it expanded into neighboring counties. The fiber backbone would provide a consistent foundation for all carriers, incumbent and competitive, to expand and provide services. In addition, the creation of public-private partnerships with the carriers and service-providers has proven to be a tremendous strength of the Open Access model. Low-cost access to the fiber backbone has spurred development and investment of last-mile solutions, as well as competitive access throughout the County. It should also be noted that, early on, the project's business plan showed that potential revenues from the project would be very capable of meeting operating costs as well as the repayment of debt. The projected cost of the project is $7.5 million for the entire 180 miles of fiber.

***Assumptions and principles***: FLRTDC was incorporated on October 25, 2005. The Board of Directors began meeting in January 2006. FLRTDC received New York State Public Service Commission certification as a "Common Carrier" in 2006. Not-for-profit (501(c)(3)) certification was received in 2006. The construction and leasing of the fiber backbone is well underway with an anticipated completion date of December 2010. Sixty miles completed and being leased. The project was designed using the following assumptions and principles:

- Fiber to be open to everyone to lease
- Fiber will touch all municipalities (to include police, fire and communications towers)
- Public-private partnerships with the carriers and service providers are crucial

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[1] NATOA thanks Edward Hemminger, Chief Executive Officer of FLRTDC, for this case study.

- Backbone dark fiber infrastructure only, no services (thus no competition with the private-sector service providers)
- FLRTDC will manage the infrastructure with private-sector contractors building, operating and maintaining the infrastructure
- Costs not subsidized by taxpayer funds

**Countywide Public-Private, Middle-Mile Backbone Network**

As described, Ontario County has developed a 180-mile, middle-mile Open Access fiber backbone running throughout the County with regional connections to three additional neighboring counties. This fiber backbone — which is developed in partnership with many local service providers and enterprise entities — is seen as the foundation to the 21st-century, technology-led economic development strategic plan of the County.

- **Benefit** – The middle-mile fiber backbone provides the foundation for critical, high-bandwidth telecommunications services. It also encourages competition, thus driving telecommunications costs down. The fiber provides a significant advantage for our economic-development recruitment and retention goals as we pursue our technology-led economic development strategic plan.

- **Partners** – Ontario County created the local development corporation (LDC). The LDC has partnered with numerous telecom providers, as well as the local community college and private businesses. These partnerships ensure that globally competitive telecommunications service is available to our businesses, governments and educational organizations, as well as our public safety and healthcare communities.

- **Viability** – Although it requires a considerable infrastructure investment, the costs for leasing the dark fiber, per participating organization, are lower than the current market price. In addition, dark fiber — other than the LDC's fiber — is only available in a very small area of the County. Furthermore, because the not-for-profit LDC will own the network, the monthly rates are very attractive and conducive to the use and expansion of the fiber backbone.

- **Sustainability** – The Open Access model for dark fiber provides a very sustainable model. Carrier and service providers — who, for "return on investment" reasons, have not made commitments to build infrastructure into the more rural areas of the County — are finding it viable to justify the leasing of this infrastructure. This, is turn, has enabled them to invest in last-mile solutions, further penetrating services into underserved and unserved areas. Revenues from the lease of the fiber are anticipated to cover the operations and maintenance of the fiber for the foreseeable future.

- **Scalability** – The fiber backbone has proven to be very scalable and cost-effective. Incumbents, service providers, and enterprise users are driving the expansion of the fiber backbone deeper into the rural areas, as well as into neighboring counties, making this a true regional initiative. Each of the five surrounding counties — Wayne, Livingston, Yates, Seneca and Monroe counties — are developing independent business plans to integrate with, or expand, the fiber project into their communities. Among other components, each must demonstrate sustainability and public benefit.

***Facts and Figures***

- Capital Expenditures
  - Total cost of the project was estimated at $7.5M for approximately 180 miles of dark fiber
  - As of today, the anticipated cost of the project is $5.6M
    - We take every opportunity to partner with local telephone providers to lease dark fiber, thus reducing our project costs.
- Anticipated Annual Operating Expenditures

    - The corporation operates with no employees. All operating tasks are provided by local contract support.
    - We anticipate our annual O&M to ramp to $400,000 across the following categories:
        - CEO support contract (provided by Ontario County as part of its contract)
        - Legal, CFO and Management support contracts
        - Mark and Locate contract
        - Fiber Maintenance contract
        - Lease of dark fiber contract (thus reducing our build costs)
        - Public Relations and Marketing Contract
        - Pole Attachment Fees
- Capacity Offered
    - Since we offer dark fiber, the capacity is as great as the equipment installed on the fiber. The fiber has been tested and will support virtually any level of capacity available today. Most users are running gigabit services today.
- Annual Revenues projected to ramp to nearly $1 million over five years with existing first-year revenues at greater than $225,000. Some of the existing revenues are:
    - CLEC revenues, $40,000 per year
    - Cellular company revenues, approximately $168,000 per year
    - Education Revenues, $25,000 per year
    - Healthcare revenues, $6,000 per year
    - Additional customer and revenues being developed
- Cost Savings
    - The County has and will realize a significant reduction in telecommunications costs over 20 years by pre-purchasing connectivity around the entire ring ($1M for 12 strands for 25 years).
    - Cellular and service providers are realizing savings as much as 66 percent over prior costs, which are being reinvested into new technologies and better services countywide.
- Demand Aggregation
    - The business plan is based on the aggregation of demand model, which was used to justify moving forward.
    - It is anticipated that we may enter into agreements with the towns and villages to aggregate their technology needs (networking and computer support), as well as their Internet access.
- Community Benefits
    - Technology-led economic development will make the entire community stronger with competitive wages and comfortable workplaces
    - FTTx providers are considering using the fiber backbone to offer fiber and triple-play — and potentially quintuple-play — services to County residents, which will reduce monthly telecom costs and the development of higher capacity services
    - Creating a globally competitive environment will enhance all aspects of the community including cultural, business, residential, and more. The County has already seen a number of new technology-based jobs relocating into the County as a direct result of the development of the Open Access fiber backbone.

# Seattle: Shared Fiber for High Bandwidth Connectivity to Anchors

The City of Seattle[1] was one of the first cities in the nation to deploy fiber connections to facilitate internal communications. In 1986 it established a six mile fiber connection between its downtown offices and the Seattle Center to serve City voice needs and electrical substations. Building on the success of this effort, in 1995 the City planned a 1 ½ mile fiber connection between its downtown Municipal Building and the City's Emergency Operations Center (EOC). When other public agencies learned about the City's plans they inquired about participating in the project and sharing costs since portions of the City's fiber route would pass near their locations that required high speed communications services but were not being served by the private sector. At the time the commercial sector did not provide dark fiber connections.

A Model Fiber Share agreement was adopted in December of 1995 for the purpose of promoting government efficiency and establishing principles for fiber sharing among other public agencies. The Model agreement defines the roles, responsibilities, general terms and conditions and procedures for shared fiber projects among participating public agencies. The City of Seattle's Department of Information Technology (DoIT) was designated as the lead agency for 100% of the fiber share projects. DOIT plans and constructs fiber to locations based on the needs of partners and obtains all relevant permits.

Participation in any fiber project is voluntary. When a project is proposed, an email is sent or a meeting is held to determine who else may want to participate and share the costs. As a general principle partners share costs proportionately based on their ownership share of the active fiber strands in any deployment. Any special configuration, such as a routing change to accommodate a particular entity, is paid for in whole by that entity. Building entrance costs are borne by each customer. Participating agencies must pay DoIT their pro rata share within 30 days of receipt of billing. If subsequent to project completion another participating public entity wants to purchases excess fibers, they reimburse other paying parties for their pro rata share of the total project cost.

DoIT keeps track of the specific project participants, costs and other details and allocates costs proportionally based on the amount of fiber strands from each participant. The current fiber network extends 485 miles consisting mostly of 192 count fiber. Since 1995 the partners have spent approximately $20 Million in fiber and construction costs. It is important to note that the savings and efficiencies are such that no bonds were used to finance construction. Participating agencies were able to finance the shared construction out of their operating budgets.

**Partners**

The partnership includes the following City of Seattle departments: Information Technology, Transportation; Seattle Police Department; Parks; Public Utilities; City Light; Fleets and Facilities; Seattle Center; Seattle Public Libraries; and the City's EOC. It also includes the following public agencies: Seattle Public Schools; WA State Departments of Information and Department of Transportation; State General Services Administration; Washington GIS; University of Washington; Seattle Community College District; King County ; National Oceanic

[1] NATOA thanks Tony Perez of the City of Seattle Department of Information Technology for this case study.

and Atmospheric Administration; General Services Administration; US Coast Guard; Port of Seattle; City of Edmonds; State EOC; and the Pierce County EOC.

**Benefits**

- Today partnership members (anchor institutions and government agencies) control how they meet their communications needs. For example by connecting at the physical layer with dark fiber they can continue to save and use their legacy systems and control the timing of their evolution to all IP networking.
- In addition to control of their communications needs the partners receive flexible access to massive amounts of connectivity at very low cost.
- The network is extremely reliable and secure
- The partnership has been an enabler that has allowed them to do things they could not have done because they received low cost high-speed connectivity. It is simply not cost effective and at times not possible to purchase 40 Gbps connections from private companies.
- The partnership has resulted in opportunities for extensive collaboration on other issues such as sharing of data storage facilities.
- When the Seattle Public Schools (SPS) did not have sufficient funds to participate in a planned project the partners agreed to route fiber to school facilities anticipating that the schools would ultimately receive the necessary funds. When SPS finally received funding through a special levy it reimbursed partners for their proportional share of the costs.
- We are using partnership fiber to provide backhaul for the City's free public Wi-Fi locations

**Sustainability**

The partners view the partnership as a long term strategic investment. The large and increasing number of public fiber partners ensures payment of the approximately $500k annually in pole attachment fees, conduit lease and maintenance expenses. Participating agencies include their proportional share of the costs within their budgets.

**Viability**

The partnership has a proven track record and has been an unqualified success. There is simply no economical way to purchase connections like 40 Gbps economically from private providers. The relatively low costs and the flexibility and control allowed by physical layer connections continue to attract increased interest from other public organizations. In addition the Eastside cities of Bellevue, Redmond, Kirkland and other jurisdictions are currently in discussions about replicating the model.

**Scalability**

One of the greatest benefits cited by fiber partners is the ability to access almost unlimited bandwidth on demand and at very low costs since the infrastructure is in place. This positions partners to meet any future communications needs that may arise. For example the City of Seattle plans to use some of its excess capacity to support a 700 MHz radio system for first responders. In addition the physical network is continually expanding based on the needs of the individual partners.

# San Francisco: Fiber to City Anchors and Free Wireless to Low Income Communities

The City and County of San Francisco's Department of Technology ("DT")[1] has established a Community Broadband Network ("CBN") to provide broadband access via City fiber to low income communities. The network is currently providing free wired and wireless access to over 3000 units within public housing developments, as well as broadband access for several anchor community sites. This network is small prototype of what a fully-deployed fiber network could provide to residents of San Francisco.

Historically, the City's fiber network had been used to serve only other City departments. Beginning in 2004 under the direction of Mayor Gavin Newsom, the City launched its Digital Inclusion Initiative. The Digital Inclusion Initiative relies on collaboration of a wide range of community based organizations, public agencies commercial vendors and DT. This initiative seeks to leverage city assets, including over 90 miles of fiber plant, to provide broadband access, hardware, training and content—key elements necessary to bridge the digital divide.

## The Community Broadband Network Model

DT's Community Broadband Network (CBN) uses unique strands of City fiber, which are physically separate from the City fiber network used for City purposes. DT has deployed a fiber ring that connects to the Internet at a San Francisco data center. At the data center the fiber connects to DT's community fiber switch.

DT has extended this fiber network to 12 low income housing developments in San Francisco and currently provides wireless or wired broadband access at 3000 low income housing developments. Wired access is provided at locations with pre-wired CAT-5 cable to the units. At other locations, DT staff install wireless radios and associated hardware. For ISP service, we partner with the Internet Archive, a national non-profit based in San Francisco. Speeds from the core fiber switches are around 100mbps. Residents of the wired housing developments receive broadband service at speeds ranging from 45 to 50 mbps, while residents with WiFi service obtain speeds of 2 to15 mbps, all at no charge to the resident. At several developments, broadband is also available in community computer rooms, providing an access option for residents without a personal computer.

DT is also working on innovative projects beyond community broadband. This includes working with the California Academy of Science on webcam for the Farralon Islands. The islands are about 30 miles off the coast. DT installed a set of wireless radios on DT towers to deliver bandwidth to the island. In addition to a webcam that is used by scientist at the Academy the network is providing VOIP service to the National Park Rangers and others who manage the Island. The radios are connected to the community fiber network. DT has taken advantage of fiber that has been brought into public housing

[1] NATOA thanks Chris Vein and Barry Fraser of the City and County of San Francisco for this case study.

sites for community cameras and other public safety uses. When we bring fiber to projects, we always deploy additional strands for future use.

- **Benefit --** This network model provides free broadband Internet to residents of low income housing developments by connecting the housing sites to the City fiber network. In addition, anchor institutions are beginning to derive benefits from the network. For Example, San Francisco's Department of Public Health ("DPH") is working with DT and the University of California San Francisco ("UCSF") to connect health clinics via City fiber. At several sites clinicians at community clinics are able to connect to video medical interpretation services located at San Francisco General Hospital.

- **Partners --** DT is working with partners throughout the City on expanding broadband access. This includes neighborhood groups, tenant associations at public housing sites and other City departments. As described above, we partner with a nonprofit group to obtain Internet access and hardware for network installation. We have also worked with commercial vendors, such as Meraki, to extend the network at reduced cost.

- **Viability –** The network model is based on multiple network uses, which ensures that the network will remain viable regardless of the status of any one class of user. As described above, the City deploys fiber infrastructure for multiple purposes with surplus fiber available for community use. When DT brings fiber through a neighborhood for public safety, health clinics or for other City needs, additional fiber is deployed. This allows the cost of deployment to be spread among many users.

- **Sustainability –** Again, because the network is built for multiple purposes and has drawn the interest of a high number of public, private and nonprofit partners, we believe that this model will be sustainable over the long term. Anchor tenants such as Housing Agency, DPH, UCSF, and SF General Hospital have achieved initial success and will attract additional institutional partners.

- **Scalability –** The core network could be expanded to a City-wide network at lower cost due to the multi-user efficiencies described above. In addition, additional public housing developments and institutional partners can be added to the network at low costs.

  Most importantly, we believe that the fiber network can be deployed City-wide in a way that would allow it to serve as the "middle mile" for a fiber to the premises network that would provide fast broadband service to all San Franciscans. Such a network could serve as the backbone for last mile deployment, either by a commercial provider leasing the core network, by a public-private partnership with the City, or, if no last-mile partners come forward, by a municipally-owned network service.

# DC-NET: District of Columbia Anchor Network

DC-NET[1] was completed in 2007 and serves as a metropolitan-area network to provide data and voice services for the use of the District of Columbia Government and public educational institutions. By the end of FY2009, DC-NET has 267 lit sites with fiber, including most District government sites. This marks an increase from 135 lit sites in 2007. It currently provides:

- High-speed data network transport and interconnection services;
- Full-featured wireline voice service; and
- Network and application deployment consulting services.

DC-NET is responsible for providing the highest standard of network reliability and for responding to the needs of District agencies. The network was designed to maximize its reach to all District facilities, reliability, and flexibility to serve the diverse, separate needs of agencies.

In order to provide these services, DC-NET owns and operates the following:

- Outdoor fiber optic cable plant;
- Network electronics and management systems;
- Voice switches and management systems; and
- Telephones.

DC-NET has internal staff that plan, design, install, operate, and maintain systems and provide help desk support. DC-NET also maintains contracts with the private sector for tasks it has determined are better managed by contractors, such as fiber optic construction, fiber optic maintenance, and specialized professional services.

DC-NET bills the entities it serves for services according to published rates and fees.

- **Benefit.** DC-NET offers the District both cost and functional/ safety benefits that commercial carriers cannot offer because of its singular focus on public safety, education, and other applications. Its fiber optics enable the District to maintain end-to-end control of the entire network, providing flexibility in adding and upgrading sites and services and providing a minimum quality of service throughout the network. DC-NET can cost-effectively add new sites to diversely routed fiber optic rings because of widespread existing fiber infrastructure, business processes, and its focus on District government and school customers. The District can achieve security on the network, because it owns and controls all fiber and electronics. Densely constructed fiber optic rings and more than 30 redundant hub sites throughout the District provide the basis for a highly reliable service.

- **Partners.** DC-NET serves more than 76 District agencies. Its partners include:
    - Department of Health (DOH);
    - DC Public Schools;
    - DC Public Libraries;

[1] NATOA thanks Tegene Baharu of DC-NET for this case study.

- Office of Unified Communications (OUC);
- Metropolitan Police Department (MPD); and
- University of District of Columbia (UDC).

- **Security and Control of Infrastructure.** The District can assure security on the network because it owns and controls all fiber and electronics. DC-NET systems are documented and under the end-to-end control of DC-NET. Electronics at the site are locked and only accessible to DC-NET. All hub sites and the associated fiber terminations and electronics are under the control of DC-NET. In the event of a security alert or regulatory change (such as more strenuous HIPAA requirements), the District can rapidly increase its level of physical security at DC-NET facilities and efficiently make necessary changes.

- **Reliability.** Densely constructed fiber optic rings and more than 30 redundant hub sites throughout the District provide the basis for a highly reliable service. DC-NET offers the District demonstrably higher uptime than does Verizon because DC-NET's multiple layers of redundant architecture improve system availability. DC-NET connects all of its customers using fiber rings to the premises. Almost all of DC-NET's fiber travels through physically redundant cable pathways. Network electronics have redundant optical electronics, redundant processors, and redundant power supplies at the customer premises. At all DC-NET backbone locations, electronics are powered by UPS hardware that provide battery backup. Where available, DC-NET electronics are also powered by backup generators at user premises. In 2007, its first full year of operation, DC-NET demonstrated an almost perfect record of availability. In fact, over the course of the year, the backbone experienced no outages, and only four sites lost their connection to the network in a total of three data outages. By way of comparison, Verizon commits to no more than an average of seven hours outage per site per year. But DC-NET delivered an average of only 15 minutes outage per site per year in 2007. In 2007, of the 135 lit sites (i.e., those with active electronics), 114 were connected with redundant electronics, redundantly routed fiber paths or both, enabling fail-safe operation in the event of an electronic or fiber outage. For these reasons, DC-NET is uniquely positioned to meet redundancy and reliability requirements set by many Homeland Security initiatives.

- **Sustainability.** As a facilities-based fiber optic service provider, DC-NET has significant resources to maintain and repair the network and to add facilities to the network. Because the District owns the fiber optic capable, it retains control to restore disrupted services, flexibility to design its network to minimize risks, and capability to cost-effectively offer customized services. Its resources include:
  - Three full-time engineers and six technicians on staff dedicated to outside plant;
  - Outside contractors to handle construction of new routes and repair of fiber damage in the public right of way;
  - An outside contractor for fiber maintenance;
  - The right to add overhead aerial cables by lashing its cables to Comcast cable strand;

- The right to add underground cables by using capacity in Verizon conduit or in conduit used by the District of Columbia;[2]
- Comprehensive as-built documentation of all existing DC-NET physical plant; and
- Documentation of DC-NET, District of Columbia Department of Transportation (DDOT), Comcast, and Verizon pole lines and conduit.

DC-NET pricing is designed to result in neutral operating income, thereby minimizing the cost of maintaining the network. In fact, DC-NET's annual revenues meet or exceed costs, in part because of concerted efforts over the past year to reduce operation and maintenance expenses. DC-NET's expenses are at or slightly below projected revenues collected from the District Agencies. For FY2008, the realized operational revenue was $10.6 million and the operations and maintenance costs were $7.6 million. For FY2009, revenue is estimated at $12 million and operational and maintenance costs are estimated at $8.3 million.

- **Scalability.** DC-NET represents an infrastructure asset with a lifetime of decades that is almost endlessly upgradeable and capable of supporting any number of District applications and innovative communications initiatives. Because DC-NET currently uses only a small fraction of its potential network capacity, it can readily scale with the District's needs simply by upgrading electronics. Its benefit to the District will increase with time as the District's communications needs increase. Moreover, increased demand can be accommodated rapidly; because of its broad reach, DC-NET can add service to a new District facility within five days if the facility is near fiber and within 15 to 20 days if it is not near fiber.

  DC-NET offers tremendous flexibility and security owing to its control of fiber optics. DC-NET selects the quantity of fiber and route for each cable and constructs spare fiber for future use. It has detailed as-built documentation of each fiber route. With available staff and contractors, it can quickly extend fiber to new sites and has the flexibility of selecting a route that is optimized for adding new District facilities as needed. It can optimize its routes and hub site selection for the survivability of District sites in an emergency, particularly those sites most critical for emergency response.

- **Technological Configuration and Architecture.** The DC-NET cable plant is 100 percent fiber optic. It extends to approximately 310 miles across the District connecting more than 200 buildings and serving approximately 76 District agencies. DC-NET manages a 10 Gbps core fiber ring connecting three data centers and OC-48 SONET MPLS city-wide backbone of 7 metro rings (including a public safety wireless ring), 16 hub sites, and 25 distribution rings with an average of 20 sites per ring. Every location in the District is within one mile of existing DC-NET fiber rings, and most locations are no more than a few blocks from existing DC-NET fiber.

[2] DC-NET Staff reports the terms of using Verizon conduit is in District of Columbia Code 34-1921.05

Standard site design provides 1 Gbps (Gigabit Ethernet)[3] symmetrical connectivity with the capability to increase data speed to 10 Gbps using standard off-the-shelf electronics. Further, minor customization and re-configuration of fiber plant can provide hundreds of Gbps to any given location, making it possible for any location in the District to become a data center, public safety center, technology center, or media facility.

- **Future Plans.** DC-NET has opportunities to expand, not only by serving more entities, but also by expanding the services and customer service it offers existing customers. Many DC-NET subscribers view DC-NET as an alternative to private voice and T1 data services. DC-NET must educate its partners about the total breadth of its capabilities, services, features and benefits in order to fully leverage its potential. DC-NET is in the midst of an aggressive expansion to the District's schools. Once expansion is complete, DC-NET may seek to expand its footprint to federal agencies, non-profits, hospitals, libraries, or other institutions that may not violate commercial use restrictions.

  A substantial portion of DC-NET's fiber conduit and utility pole attachments was obtained through agreements with Comcast, RCN, and Verizon,[4] which include use restrictions. Because of these restrictions, DC-NET is used to meet public, educational and governmental communications needs, but the District does not currently lease fiber to the private sector.

Network Efficiencies

DC-NET connects all of its customers using fiber rings to the premises.[5] Almost all of DC-NET's fiber travels through physically redundant cable pathways.[6] Network electronics have redundant optical electronics, redundant processors, and redundant power supplies at the customer premises. At all DC-NET backbone locations, electronics are powered by UPS hardware that provide battery backup. Where available, DC-NET electronics are also powered by backup generators at user premises. Such physical redundancy would be cost-prohibitive with a private vendor.

The density of DC-NET fiber rings and their location is a key technical advantage. No location in the District is more than one mile from existing DC-NET fiber rings, and 267 locations already fully functioning sites. Most unserved locations are within a few blocks of DC-NET

[3] One gigabit per second equals approximately one billion (1,000,000,000) bits per second. The capacity is greater than 600 T1 circuits, 15,000 standard telephone circuits, or the service currently provided by 80 cable modem connections or 60 Verizon FiOS connections.
[4] Fiber obtained through the Comcast cable franchise agreement is used to create a portion of the DC-Net backbone.
[5] Some of the auxiliary FEMS or MPD locations are connected over fiber spurs rather than rings. Some DCPS sites are temporarily connected over fiber spurs while ring construction is completed.
[6] Some DCPS locations are temporarily connected over rings that travel over collapsed routes for the last few blocks to the location. Locations served by underground fiber routes have collapsed routes from the street into the premises.

fiber. Because of this density, there is relatively low incremental construction cost to connect a new site to a ring and configure it with redundant electronics.
Indeed, DC-NET can cost-effectively and efficiently add new sites to diversely routed fiber optic rings because of widespread existing fiber infrastructure, business processes, and singular focus on District government and public school customers. It can connect a new facility within three to four days if there is fiber in proximity and within 15 to 20 days if fiber is not nearby. By contrast, Verizon indicated in discussions with the District that it can add services within 30 to 60 days for sites with fiber on premises and where TLS service exists at the local wire center (CO or POP). For other locations, Verizon requires that a site survey be performed, with time (and cost) to implement the service dependent on fiber availability to the site and determined on a case-by-case basis.

Costs of DC-NET construction are $15,000 to $25,000 per mile for aerial construction and $40,000 to $50,000 per mile for underground construction. The agency is simply responsible for the cost of purchasing and installing the equipment and the ongoing operational cost. In contrast to private vendors, there is no external monthly recurring charge for the service.

In order to obtain a comparable service to DC-NET from a private vendor, a District agency would need to purchase a customized service of two separate MPLS connections of the required speed to each site, plus pay the cost of construction of two separate fiber routes, with one of the two routes traveling to a second more-distant central office. Depending on fiber availability, the District would likely need to pay tens or hundreds of thousands of dollars per site for construction, in addition to the monthly recurring service charge for the service.

By avoiding these costs, the District realizes annual savings from DC-NET of $5.25 million, based on current usage. This savings will grow as the communications needs of District agencies grow. The savings arise from a combination of voice and data services, along with avoided costs for the operation of the public safety radio network, data center interconnection, and other critical communications.

DC-NET not only provides cost-effective, rapid expansion, but it also allows partners to select the appropriate bandwidth for their needs. For instance, Verizon TLS only provides basic TLS at speeds of 10 Mbps or higher. More significantly, the TLS EVPL comparable to DC-NET is currently only available at 100 Mbps. This capacity exceeds the demand at most DC-NET sites. By contrast, DC-NET provides data service with tunnels and QoS at data speeds from 2 Mbps to 1000 Mbps. A lower speed data service enables the agency to purchase a more economical service and expand to higher speeds as needed. Because it controls both ends of the fiber, DC–NET can use any equipment and immediately upgrade capacity or add new services. With a modular upgrade, DC-NET can upgrade any one of its backbone fiber pairs to 320 Gbps -- over a hundred times faster than widely available commercial service offerings.

DC-NET can work with its clients to customize their service. It can configure sites with specialized electronics or fiber routing – or potentially to simply provide dedicated dark fiber. In this way, DC-NET saves customers money by allowing them to purchase the bandwidth they need – and easily upgrade service as demand grows. One example of customization is the establishment of the Wireless Ring to interconnect District public safety wireless operations. The Wireless Ring enables public safety agencies to operate a dedicated infrastructure that is in many ways operationally separate from other agencies, and is tailored to meet the mission critical needs of public safety communications.

In short, DC-NET enables not only long-term savings relative to leased commercial services, but also enables the District to avoid the limitations of leased services with respect to performance, availability and capacity. The demands of public safety applications alone weigh strongly against the use of leased services, regardless of cost. Taking cost into account, however, a District-owned fiber infrastructure is the most cost-effective approach for meeting internal District networking needs in the long-term.

# OneCommunity: Stakeholder-Owned, Public-Private Middle/Last-Mile Community Broadband

OneCommunity[1] is a 501(c)(3) nonprofit owner/operator of a community fiber/wireless network. The OneCommunity model is based on leveraging, investing and capitalizing local fiber/network assets on behalf of the community with the intended purpose of providing community subscribers access to high capacity fiber/wireless network services enabling local innovation while lowering subscriber operational expenses. OneCommunity is focused on using broadband technologies to address the community's top social priorities.

Our governance represents a broad cross section of public and private regional stakeholders and partners:


Our core principles include:

- **Co-investment** to address top social priorities
- **Broad community governance** model
- **Open, neutral network** that:
  - Aggregates demand;
  - Creates public/private partnership opportunities;
  - Enables sharing of public and private assets;
  - Facilitates carrier exchange and community Intranet;
  - Delivers high capacity, best of breed solutions;
- **Highest quality infrastructure** that enables access to leading edge services and applications
- **Capital-creation ability** of shared stakeholders public assets/service contracts

As a result OneCommunity has attracted more than $50 million in new stakeholder and private investment for community based projects; $15 million in network savings; and $18 million for broadband social and economic development programs directly impacting our community partners.

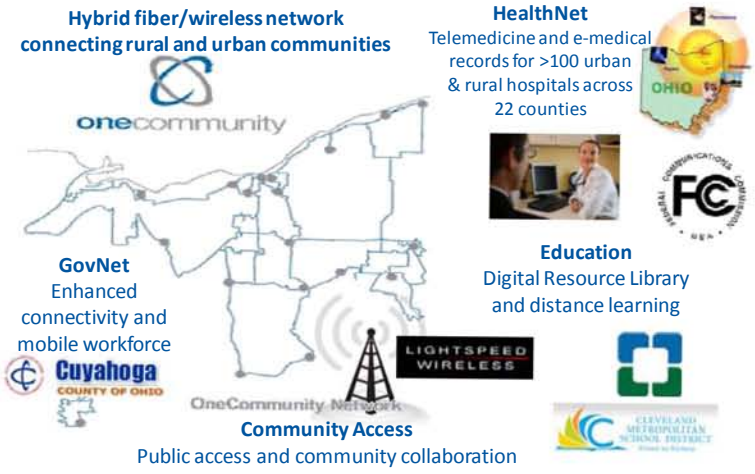
[1] NATOA thanks Mark Ansboury, the Chief Technology Officer of OneCommunity, for this case study.

OneCommunity works with local broadband partners and community stakeholders to create a financially sustainable economic environment that creates jobs. We garner support from:

- **global technology companies** in fiber, equipment, software and in-kind services for innovation and transformation
- **private and federal funds** for local community infrastructure and broadband innovation including funds that directly impacted local community interests such as schools and hospitals
- **foundation funds** for local programming that leverages the broadband to improve society, plus millions from outside of Ohio aimed at innovation i.e. Knight Center of Digital Excellence

**Building Community Collaboration and Developing Regional Strategies**

OneCommunity has successfully been working with communities interested in developing long-term commitments as subscribers for the purpose of co-investing, developing and adopting a shared community broadband network. Education, health care – and most recently, local government – have begun to work with OneCommunity on regional strategies for development of big broadband services. These efforts have also led to successful awards from the FCC and regional economic development grants. By obtaining resources (such as the FCC grant and funding from the Cleveland Clinic), and establishing open communications with interested communities, OneCommunity is in a position to expand the reach of its network while providing unique value to these subscribers and community stakeholders. Together, we are accelerating the progress of their industries, and hence the community.




**Community Shared Technology Development**

OneCommunity will build its own broadband facilities if necessary, but it would prefer not to do so. It typically tries to work cooperatively with the providers that own or control facilities that OneCommunity can incorporate into its regional network. For example, in Northern Ohio, OneCommunity has received donations of fiber from private-sector providers such as Cavalier Telecom, First Telecommunications, and CityNet. OneCommunity has also acquired abandoned or underutilized assets that could be repurposed to facilitate revitalization of distressed communities and serve the needs of public interest institutions. OneCommunity has worked cooperatively with private-

sector entities such as AT&T, Cavalier Telecommunications, CityNet, Cox Cable, First Telecommunications, Level 3, Global Crossing, Qwest, XO Communications and Time Warner Cable. OneCommunity has also worked closely with public-sector and community providers such as the Department of Education and Instructional Technology Centers that serve the needs of the region's schools, colleges, municipal wireless projects, county and municipal fiber networks, the statewide academic and research network (OARNet), and various other university and health networks.

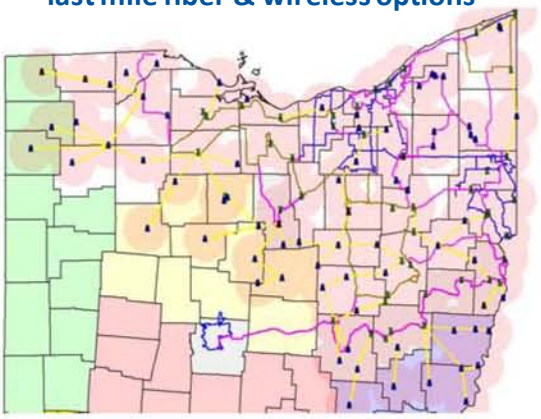
OneCommunity is not attached to any particular ownership model for broadband infrastructure, believing that the more important questions are whether the broadband infrastructure is available and whether it is being used most effectively. As long as broadband infrastructure is available on reasonable terms and conditions, broadband infrastructure is an asset to every community in the region, regardless of who owns it. When the value of the asset is increased (through effective and efficient use), it is increased for all concerned, including the community as well as the public or private asset owner. As a result, for OneCommunity and its partners, whether the network is "public" or "private" has little, if any, practical significance. OneCommunity's experience in Northern Ohio proves that, under the right conditions, public-sector and private-sector network assets can creatively be made to work for the community, to the benefit of all concerned.

**Convergence**: OneCommunity is in an increasingly strong position to facilitate collaboration, convergence and sharing among local, regional and statewide projects that consolidate the investment in tech services and applications. The scalability and transformation potential of our **tech platform and its associated broad collaborative aimed at social innovation is a very attractive investment and operating** model:

- **Improves collaboration and sharing of resources**
  - Convergence of local, regional and state interests
  - Creates options for development of new services
  - Creates opportunities co-invest existing operation dollars for greater capacity and services
- **Improved digital infrastructure creates social and economic return on investment**
  - Virtualization, aggregation and distribution of community resources across region
  - Attracts talent, businesses and outside investment with jobs
  - Increases commerce and hence taxes
  - Innovation is a media magnet for the region and its leaders
- **Increased adoption of technology drives enhanced community services, enabling innovation and reduces costs**
  - Improved health, education, workforce development
  - Innovation in both the public and private sector
  - Enhances civic pride and fosters culture of change and innovation
- **Enhanced economic development**
  - Attracting investment/grants
  - Creating sustainable funding
  - Attracting and retaining talent
  - Attracting and retaining technology intensive businesses

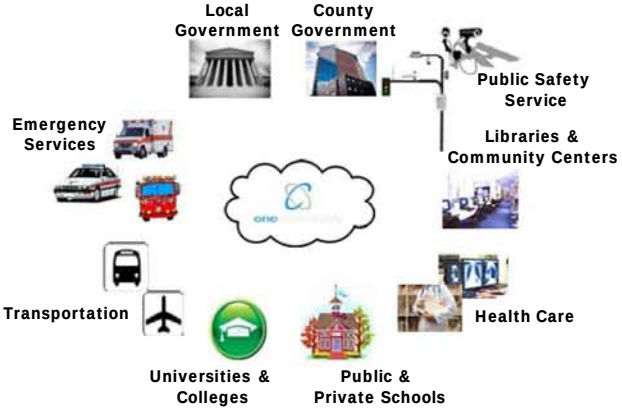
## Impact in our Rural and Urban Communities

**Solving middle mile in rural America creates last mile fiber & wireless options**



- Regional/local meet-me points
- Public/Private partnerships
- Access to shared infrastructure
- Co-investment in local communities
- Consumer choice

**Public interest users Anchor last mile community broadband in rural America**




- Creating Public/Private partnerships
- Aggregating demand
- Sharing infrastructure and services
- Collaborative community programs
- Co-investment in community infrastructure

**Guiding Principles: Creating the Core Value Proposition in Terms of Return on Investment (ROI)**

OneCommunity's guiding principles are designed to help make technology invisible, removing all the barriers and providing support to our community stakeholders as needed. Our community objectives focus on scale, impact, and sustainability. The OneCommunity Broadband Coalition serves as the community's managed services partner and provides the following key differentiators' and core value proposition in terms of ROI that are realized through:

- **An Innovative Business Model**

An ***open, carrier-neutral and multi-stakeholder community network aggregates and leverages our community's investments*** to increase availability, capacity, value added services. This ***lowers overall total cost of ownership (TCO) while increasing the social value of the communities' investment.*** In addition, the community network approach can provide additional value to both the public and private sector by;

- **Reducing the burden of government** and improving health and education services;
- Helping communities leverage ultra broadband to prompt **economic development;**
- **Aggregating demand** across stakeholders and industries for **sharp collective cost reductions;**

- Leveraging the sharing of public and private assets and competencies (including phone, cable and utility) **to facilitate the delivery of the highest capacities, lowering capital and operating costs,** while helping attract additional investment
- **Providing an open, facilities-based neutral network** that serves as a gateway for all network and service providers for both physical and logical network services;
- Using strong existing partnerships and agreements with key local, state and national providers to **rapidly deliver high capacity, best of breed solutions, for sharply lower costs;**
- **Leveraging the capital creation ability** of shared infrastructure and aggregating services to invest and advance the needs for broadband infrastructure throughout the region;
- **Investing in the highest quality infrastructure, available for community use.**

- **Leveraging of Public and Private Investment to Resolve Market Inefficiencies**

Collaborative public and private investment:

- necessitates a role for the government, and community non-profit partnerships in part because benefits often accrue to society as a whole, where they are not an active part of the investment strategy of publicly traded broadband providers;
- creates community driven strategies that invest in broadband infrastructure to meet the needs of the underserved urban and rural communities through collaborative multi-stakeholder investment;
- has the potential to contribute to long-term community broadband projects that impact economic growth based on costs and benefits accrued to government, education, health and workforce programs; and
- raises the standard of living of all if the adverse market inefficiencies -promoting policies are offset, and if efforts are made to expand infrastructure access.

**Examples and Impact**

**Community and Economic Impact:** The project provides direct fiber and wireless interconnectivity between thousands of government agencies, K-12 schools, health care facilities, universities, community colleges, libraries and civic organizations. The project spurs the roll-out of next-generation, last-mile broadband solutions with speeds of 10 Mb/s to 10 Gb/s by commercial carriers leveraging this investment in middle-mile capacity to extend enhanced service offerings to their last-mile commercial and residential customers. This will create one of the largest and fastest regional broadband networks in the world, placing the State of Ohio on the global map for business attraction, innovation, investment and retention.

**Partnering to Expand Infrastructure:** A shared broadband communications network allows community stakeholders to leverage the community's broadband fiber and service partnerships (along with their own enterprise infrastructure and resources) for the benefit of the entire region. Some examples of elevating the community infrastructure to that of a shared broadband communications resource involves the:

- **Cleveland Clinic Foundation's** investment of $10 million in the CMSD Broadband E-Rate project brought $8.7 million in additional federal funds for multi-gigabit broadband while

providing seed funding for OneClassroom. OneClassroom is a broadband content delivery program that facilitates the collaboration and interconnection of up to 1,500 schools through partnerships with the region's Instructional Technology Centers (ITCs) peering with the State eTech network.

- **FCC RHCPP awarded OneCommunity/NEO RHIO $11.3MM over three years** to implement HealthNet, an expansion of our fiber-optic network to accommodate the connection of rural health care facilities. This investment will expand OneCommunity's broadband fiber network to 22 counties.
- **Cuyahoga County awarded OneCommunity $14 million** to provide "Best of Breed" broadband technology services to attract additional investment and development in key innovation zones throughout the county, saving the county $10 million over five years. In addition, aggregating over 17 municipalities' data and voice service demands, further lessoning the burden of government while increasing capacity to everyone.
- **City of Akron's sharing of facilities, conduit and fiber** to support the deployment of the city's public safety network and creating the opportunity to share the physical fiber and wireless assets to provide public safety wireless enabling OneCommunity to use the fiber to support public interest access to health care and schools, along with public community Imax and WiFi wireless access.

# Palm Beach County: Regional Public Middle-Mile Network with Statewide Interconnection and Free Wireless Last Mile to Vulnerable Communities

Since its inception, the data network owned and operated by Palm Beach County, Florida[1] has grown from several hundred devices connected in ten buildings to its current state of over 13,000 devices interconnected in 300 plus buildings, including the delivery of public wi-fi in libraries, courthouses and the County-owned airport, among others, and covering some 600 miles of plant.

In recent years, the County has taken the lead in leveraging its network to interconnect schools, colleges, municipal governments, public safety, healthcare and non-profit organizations, which helps drive down costs for all the agencies involved and reduces the burden on taxpayers. The logical next step was to expand this idea to the state level.

After becoming the first county in the State of Florida to have a direct fiber interconnect to the Florida LambdaRail for Internet and Internet2 access, Palm Beach County has become the aggregator for FLR service to all government, education, and non-profit entities both within the County and to neighboring counties. This design is now referred to as the "Palm Beach County Model."

By assisting other local and regional entities with interconnection to the FLR, Palm Beach County is providing the means for substantial savings on telecom costs for these entities. As a result, this statewide network is growing, connecting more and more local governments, universities and other institutions and realizing even more of its potential.

**Benefit** – Increased ultra high-speed connectivity at a reduced cost to all participating agencies.

**Partners** – The Palm Beach Broadband consortium, including Palm Beach County, South Florida Water Management District and The School District of Palm Beach County, among others,
The PBC League of Cities, Martin County, St. Lucie County, several Palm Beach County municipalities and the state universities already on the FL LambdaRail network

**Viability** – This project takes available connectivity to a whole new level for participating partners at a reasonable cost through the leveraging of existing resources among the partners.

**Scalability** – The basic concept, now known as the "Palm Beach Model," can be easily applied to add on additional partners across the state. As the County expands its network, as it is looking to do for the remote Glades area pending federal funding, interconnection to the FLR is an extremely valuable added benefit to any location where fiber can be routed.

In addition, through an extensive collaborative effort between a number of public agencies, dozens of low-income families have been provided wireless high-speed Internet service and a refurbished computer to access it—all at no cost to them.

[1] NATOA thanks David Frye of Palm Beach County for this case study.

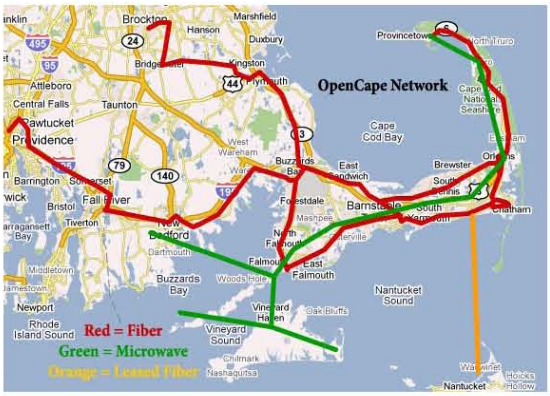
Palm Beach Broadband was formed in 2006 by six Florida charter organizations – Palm Beach County government, Palm Beach County School District, Florida Atlantic University, Palm Beach Community College, South Florida Water Management District, and Palm Beach County Education Commission. Since then, additional taxpayer-supported organizations have begun to participate, including the local health care district and multiple municipalities located in Palm Beach County.

Among the coalition's first initiatives were two successful Digital Inclusion Projects, which were completed in the cities of West Palm Beach (Pleasant City school neighborhood) and Delray Beach (S.D. Spady/Village Academy neighborhood). Both of these projects targeted families with school age children who participated in the subsidized school lunch program, who could not afford the luxury of Internet service or, in most cases, a computer at all. A plan was developed by the coalition to install a wi-fi antenna on the roof of the closest neighborhood school building to serve these families and provide computers for their use at no cost.

# OpenCape: Regional Public and Commercial Middle-Mile Network

The OpenCape project[1] in southeast Massachusetts presents a model that combines public interest, ownership, and control with licensed private operation. This model is well suited to regions where some broadband services are available, but broadband is not ubiquitous, and anchor institution needs are not met due to a lack of capacity or high cost.

The non-profit 501(c)(3) OpenCape Corporation represents the interests of the region and will own the network. Its board is composed of anchor stake holders from the county, towns, public safety, healthcare, K-12 and higher education, research institutions, and economic development interests. The for-profit RCN Metro Optical Networks (RCN) will be licensed to operate the OpenCape network under a 25 year indefeasible right to use (IRU). RCN will pay OpenCape both a flat fee and a percentage of RCN's gross revenues. OpenCape will use the revenues it receives from RCN to address its operating costs, to replace, repair, and expand the network over time, and to aid anchor institutions in developing applications that will benefit the region.




OpenCape will consist of a core fiber backbone on Cape Cod with extensions to two major regional network connection centers in Providence and Brockton, numerous fiber optic laterals extending off of the backbone, a high capacity optical transport system, a microwave radio overlay, and a regional collocation center. All of these elements combine to provide a robust, high capacity communications infrastructure. Fiber optic based services will range from traditional bandwidth based offerings to dedicated wavelengths of light to dark fiber leases. The OpenCape collocation center will serve as the focal point of network operations and provide leased collocation space for public and private organizations in the region.

The cost to construct the OpenCape system is $40 million. OpenCape Corporation has applied to the National Telecommunications and Information Administration (NTIA) under its authority to grant funds under the "Broadband Technology Opportunities Program" (BTOP) for $32 million. OpenCape has secured commitments for $8 million in matching funds from the Massachusetts Broadband Institute ($5 million), RCN Metro Optical Networks ($2 million), and Barnstable County ($1 million).

[1] NATOA thanks Dan Gallagher of OpenCape for this case study.

**Benefit** – The OpenCape network will reduce the barriers to entry for last mile providers by providing a middle mile solution that delivers multiple points of interconnection, at speeds suited to the specific provider, at rates that allow them to operate in a competitive market place over time across the entire region.

OpenCape also provides the technologies, speeds and redundancy required of a varied anchor institution community and other enterprises at costs significantly lower than are available today at commercial rates, with a further 15% discount for non-profits, and 25% discount for government anchor institutions.

OpenCape will connect over 70 anchor institutions to the network using laterals as part of its initial build-out. The OpenCape path was specifically selected to permit many additional anchor institutions the ability to rapidly obtain service from the network. In addition, the OpenCape network will support expansion of services into the communities of the South Coast where unemployment in Fall River and New Bedford is nearly 15 percent.

**Partners** – The many anchor institutions of the region, such as the world-class research institutes of Woods Hole, regional medical facilities, public colleges, school districts, municipalities, and libraries have participated fully in the definition of need and the development of solutions. Barnstable County has partnered with OpenCape and identified the network's construction as a top priority for meeting goals such as the creation of a regional umbrella service model for towns and school districts in the region. OpenCape's ongoing interactions with executive departments of the state government are also ensuring that the Commonwealth's direct interest in building a statewide network are addressed.

**Viability** – Comprehensive support across a broad spectrum of stake holders, three years of extensive work on the project, and financial analysis, clearly indicate the viability of this model. It is widely supported throughout the region and the state. One hundred percent of the towns and school districts on Cape Cod and the Islands have submitted letters of support for the effort. Seed funding was provided by Barnstable County, the John Adams Innovation Institute, the Massachusetts Broadband Institute, Woods Hole Oceanographic Institution, and Cape Cod Community College. The Cape legislative delegation successfully increased the Broadband Bill Incentive Fund by $5 million in the Massachusetts legislature that will be used as a portion of the match in the BTOP application. The federal legislative delegation has provided letters of support, as well as essential liaison with federal agencies such as the Army Corps of Engineers.

**Sustainability** – A comprehensive market analysis, business plan, and financials have been developed by professionals that clearly indicate the long term viability of OpenCape. Essential to the long term sustainability of the system is the inclusion of a profit driven operating partner, a capital replenishment plan, and mechanisms to ensure an open access competitive network. OpenCape, and in turn its operating partner, RCN Metro Optical Networks (RCN), recognize that a sustainable business model for

OpenCape is in large part dependent on expanding market. Attracting new last mile providers and aiding incumbents in the expansion of services, across a broad range of technology options, is key to OpenCape's sustainability.

**Scalability** – The OpenCape network is designed to be easily upgraded and expanded. Fiber optic based services will range from traditional bandwidth based offerings to dedicated wavelengths of light to dark fiber leases. The core equipment can be in-service upgraded to support both a larger number of wavelengths and higher data rates. By building laterals using fiber optic cable instead of copper lines the project is ensuring that there is ample expansion capability at every location served. The microwave backup system for public safety is also rapidly upgradeable with the swap of end point equipment. The regional collocation center is integral to the network and is designed to provide services in a modular manner with the quick swap of equipment and rapid patching to create wide area networks and aggregated services.

**Capital Costs** – OpenCape specifically selected its operating partner, RCN Metro Optical Networks (RCN), in advance of submitting its BTOP application because there is great advantage to planning the network with an experienced builder and operator of middle mile networks. This proved essential in designing and estimating the cost of building and operating the network. Prices were determined by canvassing several vendors with whom RCN has had experience with in the past.

**Financials** – OpenCape developed a business plan that included financials for both the non-profit OpenCape Corporation and its licensed operating partner. In this model the non-profit owner must understand the financials of the licensed partner as well as its own financials. A third party professional firm was contracted to develop these financials for both capital and operating budgets.

**Efficiencies** – The creation of a regional middle mile open access network offers efficiencies in both capital outlay and operating costs for anchor institutions and private last mile providers. OpenCape's extensive long term contact with regional stake holders has ensured their needs were included in the network design. None of these stake holders alone could build the infrastructure they need, but their needs can be addressed within a comprehensive regional middle mile project. For example:

- The Commonwealth of Massachusetts is planning to create a state-wide network for all government services it provides. OpenCape will provide the southeast Massachusetts portion of that network.
- The regional power provider, NSTAR, seeks to develop and expand smart grid applications. OpenCape is negotiating pole rights with NSTAR in exchange for fiber strands.

Operating costs are also reduced significantly for both commercial and public entities. A simple two tiered pricing model for middle mile broadband services - on-Cape and off-Cape - was developed. The pricing is approximately 50% less than the currently available middle mile services offered on Cape Cod. These prices will attract last mile

providers to Cape Cod and allow them to develop a sustainable, long term business model. Anchor institutions and other enterprises will also benefit substantially from these lower rates. In addition to these highly reduced commercial prices, there is a 15 percent discount for non-profit organizations, and a 25% discount for government anchor institutions.

**Building Blocks** – A large capacity middle mile network in the region offers opportunities for continued growth and expansion. For example, OpenCape is analyzing undersea fiber to Martha's Vineyard as a follow on expansion of the OpenCape network.