

MFP/ED COMMITTEE #1
March 23, 2009

Worksession

MEMORANDUM

March 19, 2009

TO: Management and Fiscal Policy Committee
Education Committee

FROM: Dr. Costis Toregas, Council IT Adviser *CT*
Essie McGuire, Legislative Analyst *EM*

SUBJECT: Broadband in elementary schools

Expected to participate in the discussion:

Sherwin Collette, Chief Technology Officer, MCPS
Steven Emanuel, Chief Information Officer, MCG
Mitsuko R. Herrera, Administrator, Office of Cable and Communications Services
John Castner, Manager, Network Solutions & Services, Enterprise Telecommunications
Services Division

Background

The February 9, 2009 MFP Committee meeting reviewed the preliminary Cable Plan for Montgomery County. The role of this Plan in the development and deployment of FiberNet to elementary schools was a point of discussion. Chair Trachtenberg suggested that a joint MFP/ED Committee worksession address two specific elements of the discussion:

- Broadband and its impact on classroom achievement and administrative efficiencies (MCPS lead)
- Two alternative deployment strategies to the elementary schools and their costs (including displacement costs/benefits of existing connectivity solutions) within a 5 year target to get to all schools, or a plan that continues at the current pace; please include FiberNet as well as a hybrid model with WiFi/WiMax emanating from existing FiberNet nodes as possible technology platforms (Cable Office lead)

Context for these two elements is provided in the analytic memo prepared by Council staff in support of the February 9, 2009 MFP meeting and background information provided by the cable office; materials from this memo germane to the Broadband in Elementary Schools discussion are on ©1-3.

Issues for the Committees to Consider

Broadband provides connectivity at high speeds that enables video, voice, and data transmission in real time. Broadband connectivity can be provided by fiber optic networks like FiberNet or commercially available fiber networks, by wireless signals offered by telecommunications companies or provided by County-owned networks, or by co-axial networks. The County makes use of all such technologies in its effort to connect service delivery points. Technologies other than broadband are diminishing; dial up services, for example offer such low speeds that their use has dramatically fallen off. ADSL and similar over-the-phone connectivity is providing some capacity, but the true broadband speeds are more in demand by the user community.

The questions before the Committees address two very different issues: is there evidence that broadband in the schools is beneficial to the desired MCPS outcomes, and what is the best, most cost-effective manner to provide broadband in the schools?

Council staff asked MCPS and DTS to provide answers to these two different questions. MCPS provided a response regarding the benefits of broadband found on ©4, while DTS provided technology alternative options on ©5-16.

The Committees may want to explore the following issues during the worksession:

1. Is continued investment in Fibernet expansion in the elementary schools the best use of limited resources? If yes, how do we measure success once these resources are deployed?
2. The statement is made that students are accessing web-based content at a rate greater than 200% of that 5 years ago. Is that including home-based linkages? Is access from school and home our goal, or just from school? And does this increased access have any effect on performance? How can we measure it?
3. What are the professional development and curriculum resources cited in the MCPS response (supplemented by a definition of costs to use them, and perceived benefits from their use)?
4. What are the SETDA guidelines? Do we lag far behind? In which areas? And what are plans to heal this gap (or to ignore it for internal reasons that override their importance)?
5. How do we prepare teachers to use
 - a. Computer-based education resources and learning tools
 - b. Computers and software
6. What are metrics that provide evidence that broadband is helpful? How are these metrics used in managing the MCPS allocation of resources for school support?
7. Are there connectivity alternatives to broadband that would get us to the same place?
8. Within broadband, what current technologies are being used? Under consideration? And what cost/benefit scenarios are assumed in the MCPS budget?
9. What are current connectivity costs in the FY10 MCPS budget (including Fibernet, commercial wireless vendors, other providers)?

Phase 1 of the upgrade will significantly improve the functionality of the PEG Network and TOC: (a) Multiple PEG Network channels will be able to receive and transmit emergency information, as well as live transmissions from the Music Center at Strathmore, the Bethesda North Marriott Hotel & Convention Center, the Gilcrest Center for Cultural Diversity, Olney Theatre, BlackRock Center for the Arts, Imagination Stage, AFI Silver Theatre and Cultural Center, MCT, Montgomery College, MCPS, and the Cities of Rockville and Takoma Park. (Use of the MPV will be necessary to perform such remote site transmissions.) (b) The TOC will be able to digitally monitor CCM, perform electronic diagnostics to address signal quality or disruption issues. Eventually, automated 24/7 signal monitoring and warning systems can also be implemented.

Phase 1 is funded and will be implemented in FY09. Phase 2 will permit the County to digitally monitor and diagnose transmission issues on all PEG Network channels and will provide transmission support to permit digital transmission of all PEG Network channels to the TOC. However, no funding has yet been identified to support implementation of Phase 2.

E. FiberNet Connections to Elementary Schools

1. Overview

FiberNet is the fiber backbone used by Montgomery County, its agencies, and municipalities to transmit voice, data, video, and public safety radio. FiberNet's second largest client is MCPS and FiberNet may play an integral role in the next generation of public safety interoperable communications and the digital IP-based traffic signaling system currently being developed.

FiberNet's construction schedule is governed by procedures approved and implemented by the Information Technology Policy Coordinating Committee (ITPCC). ITPCC approves the site list for constructing new FiberNet sites and includes input from all participating agencies. All decisions are made by unanimous consent. In FY08, unanimous consent was given by the ITPCC to make the addition of MCPS elementary schools to FiberNet an ITPCC priority. As funds are allocated to the FiberNet Capital Improvement Project (CIP), elementary school sites are connected to FiberNet. MCPS and DTS staff work together to prioritize the order in which new elementary school sites will be added to FiberNet. Overall construction costs are considered first, but may be overridden by factors unique to each school site, including the amount of Internet usage, special bandwidth-intensive applications, and location.

The costs associated with connecting elementary schools to FiberNet are projected to be significantly higher than the costs to date to connect other sites. Elementary schools are typically located deep within established neighborhoods, far from existing FiberNet connection points. Cost projections for some sites exceed \$500,000 based on the current footprint of FiberNet. Moreover, FiberNet CIP projects may be delayed when CIP funds must be reallocated to pay for state-required fiber relocation costs. State funding for state road projects do not contain funding to reimburse local governments for the cost of relocating existing fiber facilities and the FiberNet CIP does not include a large enough reserve to fund these fiber relocation costs without reallocating funding from other FiberNet construction projects.

Typically, it takes 18 months to connect an elementary school to FiberNet, largely because of utility pole-related issues. The County must purchase placement rights from utility infrastructure owners like Verizon and PEPCO to use existing utility poles along a fiber path. If the pole is too short to maintain minimum distances between different types of facilities (e.g., cable, telephone, electric) it must be replaced, at the County's expense. The pole owner must dispatch a crew to "make the pole ready" for County fiber placement. PEPCO- and Verizon-generated bottlenecks occur, making it impossible to develop precise schedules for circuit delivery. Finally, if the fiber must be placed underground in newer neighborhoods, the costs are significant higher than for sites reached by aerial construction.

2. Construction Schedule

The chart below lists elementary schools connected to, or in the process of being connected to, FiberNet:

Elementary Schools	Status	Completion
Sargent Shriver Weller Road	Connected to FiberNet	FY2008
Germantown Luxmanor Rachel Carson	Connected to FiberNet	FY2009
Chevy Chase Damascus Meadowhall Seven Locks	Fiber construction completed and terminated. Awaiting electronic connection.	FY2009
Cedar Grove Laytonsville Poolesville	Fiber construction completed. Awaiting in-building fiber termination and electronic connection.	FY2009
Gaithersburg Little Bennett North Chevy Chase Sherwood	In construction.	FY2009
Brookhaven	Awaiting construction quote.	FY2009
Bethesda	Awaiting Verizon Make-Ready.	Unknown
Beall Greencastle Lake Seneca South Lakes Waters Landing Woodfield	Awaiting utility pole licensing.	Unknown
Piney Branch Rosemont Takoma Park	Awaiting determination of utility pole ownership.	Unknown
Monocacy	In Queue.	Unknown

(2)

(25)

In coordination with ITPCC, DTS and MCPS have created a prioritized FiberNet-to-school construction list that gives the highest priority to the most cost-effective sites. Additional schools are placed in the pipeline as annual budget appropriations are made. A multi-year long range construction plan would require a multi-year budget appropriation.

All MCPS high schools and middle schools have been connected to FiberNet. Of the 130 MCPS elementary schools, 5 are connected to FiberNet, 12 sites will be connected in FY09 and 11 additional sites are in progress. The current budget appropriation for FiberNet CIP is \$1,760,000 million. DTS estimates that if \$4 million to \$5 million were allocated to FiberNet construction each year for FY10 through FY14, all elementary schools could be connected to FiberNet by FY16. If additional guidance is received to escalate the construction schedule, DTS and the Cable Office will refine the needs through more precise evaluation of each of the remaining school construction options and challenges.

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Question: Broadband and its impact on classroom achievement and administrative efficiencies.

High-speed broadband access is an essential utility in supporting today's instructional programs across all Montgomery County Public Schools (MCPS). Elementary schools, like their secondary counterparts, are increasingly more dependent on broadband connectivity to create more authentic learning environments by accessing more interactive, multimedia, and digital learning resources and completing online assessments. Educational trends show that elementary school students are completing and increasing the number of online research activities and are accessing web-based content at a rate that is over 200 percent greater than just five years ago.

Over 100 of our elementary schools have insufficient bandwidth to open recommended reading programs that provide individualized pacing and visual and audio interaction to better address individual learning styles and support students' mastery of the curriculum content. In addition to better supporting the convergence of data, voice, and video content in the classroom, broadband connectivity also is important for meeting the administrative needs of elementary schools. Elementary schools are increasing their use of electronic grade books and require more robust infrastructures to both manage these grade books and automatically transmit grades at the end of the marking periods. In addition, an increasing number of professional development and curriculum resources are being made available online, and high-speed connectivity would provide teachers timely and efficient access to these valuable resources directly from their schools.

Overall, high-speed connectivity to the district's elementary schools lags far behind the recommended guidelines by the State Education Technology Directors Association (SETDA) for elementary schools. As a result, our students have less access than students in other Maryland school districts. For example, Baltimore County elementary schools have ten times the bandwidth afforded to elementary schools in our county; Howard County elementary schools have 100 times the bandwidth; Carroll County elementary schools have 1,000 times the bandwidth; and Frederick County elementary schools have 10,000 times more bandwidth.

Broadband to Schools FiberNet Solutions & Alternative Options

Presented By
Dept. of Technology Services –
Office of Cable and Communication Services

Current FiberNet Deployment

- FiberNet Delivers Broadband Access to:
 - All County High Schools (26)
 - All County Middle Schools (38)
 - 11 Elementary Schools
 - 281 County Government and Agency Sites
- FiberNet Status to Remaining Elementary Schools:
 - 13 Elementary Schools in Construction Phase (FY09)
 - 13 Elementary Schools in Design Phase
 - 93 Elementary Schools to Be Considered



Current Broadband Service Levels

- T-1 Elementary Schools
 - 1.544 Mbps Bi-Directional Bandwidth
 - \$3,652 Per Mbps Per Site Annual Operating Costs
 - \$1,826 Per Mbps Per Site with e-Rate Discount
- FiberNet Elementary Schools
 - 100 Mbps Bi-Directional Bandwidth
 - <\$71.11 Per Mbps Per Site Annual Operating Costs*
 - * Cost Includes Voice and Video Operating Costs
 - 1 Gbps Future Capacity or <\$7.11 per Mbps Per Site
 - * Per Site Cost Reduced As Additional Sites Are Added



Cable Modem – Interim Alternative

- Cable Modem – Strategic Use of Commercial Alternative
 - Use Direct Peering to Keep Traffic Off Public Internet
 - 16 Mbps Download/4 Mbps Upload Shared* Bandwidth
 - * Cable Modem Speeds Are Best Effort Not Guaranteed
- Cable Modem Alternative in Elementary Schools
 - Minimal Installation and One-Time Fees
 - Estimated 6 Months to Complete Installation
 - \$93.75/\$375 Per Mbps Per Site Annual Operating Cost



Wireless FiberNet Extension Alternative

- General Deployment Issues
 - Unknown Cost to Extend FiberNet to Base Stations
 - Line-of-Sight Needed Between Antennas For High Frequency Operations (e.g., WiMax, WiFi, Point-to-Point Microwave)
 - Montgomery County Has Challenging Terrain and Many Obstructions (e.g., Trees, Buildings, Hills, etc.)
 - Tall Antenna Siting Issues
 - Zoning Restrictions in High-Density Neighborhoods
 - Community Opposition
 - Estimated 12 Months to Complete Installation



Wireless FiberNet Extension Option 1

- Point-to-Multipoint Network Architecture
 - Must Use Unlicensed Frequencies
 - Range Severely Limited By FCC Rules
 - Higher Coordination & Deployment Costs
 - Unknown Interference Issues
 - 10—50 Mbps Reduced Effective Bandwidth
 - At Least 15—20 Base Stations Required with Elevated Mounting Structure for Antennas
 - Cannot Simultaneously Provide Maximum Bandwidth to All Sites
 - Shared Bandwidth Per Base Station to Multipoint Sites
 - 50 Mbps Theoretical Capacity Divided By Number of Sites

Wireless FiberNet Extension Option 2

- Point-to-Point Network Architecture
 - May Use Licensed or Unlicensed Frequencies
 - Higher Deployment Costs Than Multipoint Network
 - Paired Equipment Required for Each Site
 - Licensed Frequencies Increase Reliability at Increased Cost
 - More Bandwidth Possible Than with Multipoint Network
 - 50 Mbps Bandwidth Would Be Target Capacity
 - More Than 50 Mbps Available Only in Ideal Circumstances



Wireless Is a Non-Strategic Alternative

- Significant Investment to Achieve Cable Modem Speeds
 - Inherent, Non-Expandable Bandwidth Limitations
 - Requires Creation of New Network Support
 - Cost Effective Only If Combined with Other Uses
- \$2 Million to \$5 Million Stranded 5 Yr Capital Investment
 - 5-Yr Technology & Equipment Replacement Lifecycle
 - \$1—\$2 Million Network Electronics & Installation
 - \$500,000 Annual Tower & Circuitry Leasing
 - \$100,000—\$200,000 Annual Network Maintenance & Monitoring Support

FiberNet As a Strategic Solution

- Strategic Construction Leverages Multi-Agency Assets
 - All FiberNet Construction Is Coordinated
- Fiber Extended to an Elementary School May Enable:
 - Traffic Signaling/ Traffic Cameras
 - HOC/ Public Housing Broadband Services
 - Telework Centers
 - WSSC Pumping Station Monitoring
 - Public Safety Communications
- FiberNet Is Future Proof
 - Cost-Effectively Update Electronics to Expand Capacity

FiberNet As a Long-Term Solution

- FiberNet Benefits:
 - Speed/ Bandwidth
 - Security/ Redundancy/ Remote Monitoring & Support
 - Cost-Effective Service
- FiberNet Enables:
 - Voice-Over-Internet Protocol (VoIP) Telephony
 - Video Streaming
 - Video Conferencing
 - Secure Intra/ Inter-Agency Communications (including State of Maryland) and Database Access
 - Continuity of Operations/ Disaster Recovery

FiberNet to Elementary Schools Cost

- Current Deployment Appropriation
 - 15 Yr Build-Out
 - \$1 Million Per Year for New Construction to Elementary Schools
- Accelerated Deployment
 - 5-7 Yr Construction Schedule
 - 5% Per Annum Construction Cost Escalation
 - \$13.7 Million Present Value = \$15.4 Million Over 5 Yrs
 - \$3 Million Annual Average Cost Over 5 Yrs

Strategic Operation Cost Comparison

- T-1 Service: 1.544 Mbps Dedicated Bandwidth Capacity
 - \$597,840 Annual Operating Costs
 - \$298,920 With e-Rate Discount
- Cable Modem: 16 Mbps Down/4 Mbps Up Shared Bandwidth
 - \$159,000 Annual Operating Costs
- Wireless: 50 Mbps Shared Bandwidth
 - \$500,000—\$700,000 Annual Operating Costs
- FiberNet: 100 Mbps Dedicated Bandwidth Capacity
 - Net Zero Direct Additional Annual Operating Costs
 - Incremental Use of Existing Operating Resources
 - Only Option with Future Capacity to Support Media-Rich Future Applications