ED/MFP COMMITTEE #1
September 21, 2009

Worksession

MEMORANDUM

September 17, 2009

TO: Education Committee
Management and Fiscal Policy Committee

FROM: Dr. Costis Toregas, Council IT Adviser CT

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

Summary of key issues

1. Broadband connectivity is a strong administrative and teaching tool, bringing internet-based and server-based information to all locations. The use of this connectivity and its impact on efficiency and student performance is anecdotal. More explicit analysis should be done to justify the investments made.
2. The Interagency Technology Policy and Coordination Committee (ITPCC) is recommending to the County Executive the completion of FiberNet connections to some 119 elementary schools over the next four years as their highest priority. The Committees are still discussing this topic and will weigh in on this issue once the new CIP is released.
3. The end users of broadband connectivity and their unique needs should be heard directly by the Committees.
4. FiberNet is an expensive system to deploy and maintain. In return for this expense, MCPS and other broadband users should be able to demonstrate an explicit reduction in other connectivity expenses (cable modems, T-1 lines, wireless systems, air cards, etc.), but making this analysis is difficult given the paucity of data.

Background

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. ASDL and similar over-the-phone connectivity is providing some capacity, but the true broadband speeds are more in demand by the user community.

On March 23, 2009 the Committees discussed two different questions regarding the deployment and use of broadband service to County facilities, and more particularly to elementary schools:

- 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?

Both MCPS and DTS provided information regarding these questions, which is provided again on ©1 and ©2-13, since the information is still relevant and useful to the current discussion.

However, this issue may be before the full Council during the CIP review process, as the Interagency Technology Policy and Coordination Committee has endorsed the selection of 119 elementary schools currently not connected to the County's FiberNet system as the highest priority for completion in the upcoming CIP and has submitted this recommendation to the Executive for consideration in this year's CIP process. The CIP recommendation is on ©14-16, while the process as well as the Council Staff Director's position are on ©17-18.

In order for the Committees to draw conclusions regarding the viability and advisability of such an investment, the early questions should once again be raised, and perhaps supplanted by additional ones. Here are some questions to guide the dialog of the Committees that can help illuminate this complex issue:

1. Is there evidence that establishes the desirability of broadband in all schools? While it seems intuitively obvious that the answer is yes, administrative as well as instructional benefits are anecdotal at best. Staff recommends that the default answer be "yes", but that instructional and administrative examples of successful use and positive outcomes in MCPS and elsewhere should be included in the upcoming CIP presentations.

2. Who stands ready to affirm these benefits? The Committees have thus far heard from the technology leaders in MCPS and MCG; hearing directly from representatives of administrative as well as instructional users would help make the case more explicit and convincing. The inclusion of experts in the use, rather than the provision, of the connectivity technology in this and subsequent Committee sessions will help ensure that information reflects not only the best technical advice but the experience of the end users.

3. Are there alternatives to FiberNet that should be considered or are being considered? ©13 provides a DTS analysis of operation cost comparisons for four alternate modes of connectivity: T-1, cable modem, wireless, and FiberNet. At what cost to network integrity, security or other system attributes would such alternatives be entertained? This question opens the door to a broader issue of the role and potential use of Public Private Partnerships (PPPs), under which other governments, non-profits, and private institutions may be considered for jointly absorbing the costs as well as the benefits of FiberNet. The use of PPPs is expanding in county governments across the nation, and their impact on reducing costs and expanding the benefits of FiberNet may be considerable. Staff recommends a broader discussion of this option in the context of the CIP discussions.

4. FiberNet's capacity and low cost should drive down costs currently found in providing connectivity solutions to County facilities. Technologies like T-1 lines, air cards for lap tops, and cable modems all have a budget impact, and the use of FiberNet as a substitute technology is not clear in the locations currently connected by FiberNet (a total of some 290 locations). The Committees should explore this cost reduction strategy and understand the reasons why such savings may not be present today, and what impediments there are to finding savings in future budget years.

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 that 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

(A)

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

(6)

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

(8)

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

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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

(21)

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

(13)

FiberNet CIP FY11 to FY16

Thursday, August 20, 2009, 10:00 a.m. – 12:00
COB 5th Floor Conference Room

1) The FiberNet CIP is attached and totals $13,921,019 for the fiscal years FY11 through FY16
2) The CIP schedules 119 new sites for addition to the network during first four years FY11 through FY14. We expect 70% of all 119 sites complete during this four year period. While all remaining will be in process. All 119 sites should be on FiberNet by FY16.
3) $750,000 is requested in each of FY 15 and FY16 for new sites as yet unidentified, although we are aware that MCPS has special needs schools that are not included at this time;
4) A breakdown of the sites by fiscal year and agency is shown in the following table:

FY11-FY14 Sites by Agency		
Fiscal Year	Category	Total
FY11	MCPS	40
	FY11 Total	40
FY12	MCPS	30
	FY12 Total	30
FY13	MCPS	28
	FY13 Total	28
FY14	HOC	6
	MCG	9
	MNCPPC	3
	WSSC	3
	FY14 Total	21
	Grand Total	**119**

5) The CIP makes several very important assumptions:
   a) Funding for FiberNet has become problematic over the last three years, leading to "make do" approach to the project;
   b) This CIP lays out an aggressive plan to complete FiberNet with a focus on MCPS by starting all construction over the next three years with a target of completing all 119 sites by FY16;
   c) This CIP is solely for Participating Agency pre-existing sites as of 2003 and not for any new sites resulting from leasing, remodeling or new construction. ITPCC has agreed that each participating agency is responsible for the cost of bringing FiberNet to new sites whether newly constructed or leased. For example, FiberNet will not fund the connection of new sites moving from Crabbs Branch Way as part of the County Government's Smart Growth Project.
   d) Participating agencies may self-fund a site by providing the necessary funding to perform the attachment to the network. This happens when a participating agency decides it will not wait for FiberNet to fund the site's connection or a new facility is opened. For example, MCPD funded the attachment of the Vehicle Recovery Building at the Gaithersburg abandoned car lot which had been on the candidate list for years. Additionally, Montgomery County Government funded attachment of the new Family Justice Center and the Edison Park Complex via each project's CIP.

e) FiberNet's posture in requesting funds has been based on the scale of operations in the MCG/DoT contract with Baldwin Line and Construction. This fact and obviously a lack of funding has slowed the growth of the network.
f) During FY10, FiberNet will increase its construction resource base by contracting with multiple fiber construction companies to build onto the Comcast plant for the County per the Comcast franchise agreement.
g) FiberNet will consider using other franchise fiber where this is to the County's benefit;
h) MCPS Elementary Schools are the priority. The ITPCC may review all new, urgent needs to modify priority as needed;
i) Comcast's physical plant is an order of magnitude larger than Montgomery County Government's plant; therefore FiberNet will engage Comcast as the primary dark-fiber provider for MCPS and other non public safety sites.

6) Externalities that may impact the CIP

a) <u>The Stimulus Act</u>
   i) The American Recovery and Reinvestment Act of 2009 may significantly impact FiberNet's funding if the County receives an appropriation for extending broadband within or through the County;
   ii) It is possible that the broadband stimulus component of the ARRA may cause a shortage of construction resources;
   iii) The ARRA requires that 66% of all construction be completed within two years of the grant award. This could speed the project up and lack of contractors could cause a bottleneck.
   iv) DoT is pursuing ARRA funds. There request is to extend FiberNet up the Route 29 corridor, this could reduce the cost to add sites in the eastern part of the county.

b) <u>Comcast Franchise Agreement</u>
   i) Comcast may refuse to assist the County in this effort. If this happens the cost could increase by a factor of 50% and the project could slip back to its current pattern of support;
   ii) The Comcast franchise ends in FY13. What will follow is not known at this time.

FiberNet/ATMS CIP FY11-FY16

Item	Fiber plant	FY11	FY12	FY13	FY14	FY15	FY16	FY11-FY16
1	ATMS new construction	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$600,000
2	FiberNet new construction	$1,322,400	$2,015,520	$3,537,648	$1,535,451	$750,000	$750,000	$9,911,019
3	Fiber plant relocation	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$300,000
4								
5	Fiber cost estimation fund	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$150,000
6	Backbone, OTN Cross Connect & Feeder Capacity Increases	$250,000	$250,000	$50,000	$50,000	$50,000	$50,000	$700,000
	Subtotal	$1,747,400	$2,440,520	$3,762,648	$1,760,451	$975,000	$975,000	$11,661,019
	Cross Charging & Consulting	FY11	FY12	FY13	FY14	FY15	FY16	
7	DoT Construction Related FTEs	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000	$900,000
8	FiberNet II	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$300,000
9	Subtotal	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$1,200,000
Item	Infrastructure	FY11	FY12	FY13	FY14	FY15	FY16	
10	Hub Improvements	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$300,000
11	Security Improvements	$15,000	$15,000	$15,000	$15,000	$0	$0	$60,000
13	FiberNet III Upgrade			$350,000	$350,000			$700,000
14								
15								
16	Sub-Totals	$65,000	$65,000	$415,000	$415,000	$50,000	$50,000	$1,060,000
17	Totals	$2,012,400	$2,705,520	$4,377,648	$2,375,451	$1,225,000	$1,225,000	$13,921,019

Gary,

Thanks for transmitting the proposed FiberNet implementation plan and CIP. The transmittal clearly reflects the intensive work of the FiberNet Technical Advisory Group and the CIO Subcommittee.

The transmittal effectively summarizes both the plan's underlying assumptions and the "externalities," such as ARRA funding, that may affect it. These issues, along with such issues as long-term funding for FiberNet and the potential for greater use of public/private partnerships, will be on the Council's agenda when it considers the Executive's recommendations for FiberNet next year.

Steve

Steve Farber, Council Staff Director

-----Original Message-----
From: Thomas, Gary
Sent: Wednesday, August 26, 2009 1:23 PM
To: Firestine, Timothy; Annie Alston; Toregas, Dr. Costis; Morrison, Diane; Johnson, Brian; Genell Reynolds-Taylor; Harrine Freeman ; Jason Blackman ; Jerry Weast (suzanne_peang-meth@mcpsmd.org); Cuff, John; Marshall Moore; Domaruk, Rebecca; Rudy Chow; Sharon Kauffman; Farber, Steve; Sue Ahearn (sue_ahearn@mcpsmd.org); Tamara Maull (tmaull@wsscwater.com); Daniell, Teresa; Tucker, Thomas; Royce Hanson
Cc: Vicki Duggan; Bruce Brizendine; Custer, Maureen; Cynthia Prather; Milo, Deborah; Dick Leurig; Doreen Heath ; Emanuel, Steven; Henry Mobayeni; Michelle Santiago ; Knuppel, Michael; Paul Coverstone; Scott Ewart; Collette, Sherwin; Tamara Aw ; Arthur Owens; Bill Gibson; Cary Kuhar; Craig Thomas; George Shambley; Harvey Mazer ; Castner, John; Ken Goldstraw; Stuckey, Max; Pace, Melissa; Nick Del Grosso; Chuck McGee
Subject: IMPORTANT--ITPCC Response needed: ITPCC level approval of FY11-16 FiberNet Plan for CIP Submission due to OMB on Sept. 4th.
Importance: High

Hello to all.

The ITPCC needs to review and approve the attached FiberNet implementation plans/CIP in accordance with the FiberNet Governance Charter adopted in November 2002. I am requesting that you review the attached document, consult with your CIO and ITAG representatives if necessary, and email your approval decision to my attention not later than Wednesday, September 2, 2009, 12:00 noon.

The FiberNet Technical Advisory Group (ITAG) unanimously approved the FY11-16 recommended FiberNet plan on August 20, 2009. The CIO Subcommittee review process concluded today, August 26, 2009 at noon. We now have approval from 5 out of 6 agencies, with one (MCPS) response remaining.

Due to the rapidly approaching September 4, 2009 deadline to submit the FiberNet CIP project to the Office of Management and Budget; these recommendations are forwarded to the ITPCC for final review and approval by September 2, 2009.

The emphasis for this project is continued/accelerated build out of the FiberNet network with priority for completing connections to MCPS elementary schools, plus several other agency sites. Maintenance and security of the existing operational infrastructure, completion of migration from FiberNet I to FiberNet II infrastructure, provision for core electronics upgrades, and necessary

support services are provided in this plan. This recommendation reflects agency requirements known as of August 25, 2009 but we are aware of additional factors that may impact the final approved project in May 2010 including potential influx of Federal stimulus funds, County Executive initiatives still under development, and other factors. The funding source is anticipated to be revenues in the Cable Fund and not County current revenues.

Also noteworthy, the FiberNet ITAG workgroup is currently working to update the FiberNet Strategic Vision/Plan last approved by ITPCC in December 2003. We anticipate completing this by January 2010. This will provide a great deal of additional information about our FiberNet network to better educate decision makers and other interested parties and will align with the FY11-16 recommendations.

If there are specific questions, please contact your agency's ITAG representatives and CIO, or call John Castner [240-777-2964], our FiberNet Project Manager.

I wish to thank all members of the ITAG workgroup who assisted in compiling and reviewing agency requirements, CIO Subcommittee members who have responded, and John Castner in particular for their efforts in preparing this multiyear plan for FiberNet II.

Gary Thomas
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