MEDIA AND TECHNOLOGY

Program Review

Subcommittee Report #5

Infrastructure

Subcommittee Membership:

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Infrastructure – Subcommittee Report

I - Introduction/Assessment of the Infrastructure Environment Today

The Needham School System consists of 8 buildings (5 elementary schools, 1 middle school, 1 high school, and a central administration building), and soon to be nine. The infrastructure is supported by one Network Engineer and four Computer Technicians who work out of the Educational Technology Center, but are assigned to the buildings. The current fiber WAN provides highly successful connectivity throughout the district and the town. It was installed in 2001 with the town's RCN contract and has been running smoothly ever since. The district has very competent and dedicated technical employees, but the pervasiveness of technology throughout the district, both for educational purposes and administrative tasks, creates challenges for a limited IT staff.

Please see the attached appendix items:

"NPS Infrastructure 07-08", a diagram of infrastructure per building
"NPS Server Distribution 07-08", a description of server types, functions and locations

For this report, the scope of the infrastructure includes the following:

• *Data Cabling* – Currently, we have a minimum of Cat 5 cabling to each instructional and administrative space – newer installations have multiple connections, Cat 5e or Cat 6 cabling. Most of the buildings have fiber connections between the data closets, and all of the buildings connect back to the core fiber WAN switch (housed at town hall, as a central location).

• *Data Electronics* – A minimal amount of 10 MB hardware is in the final stages of removal, leaving a mix of 100 MB and gigabit connections throughout the district. The connection between buildings is all gigabit speed (gigabit fiber switch housed at town hall).

• *Wireless Networking* – The high school and middle school have fairly complete wireless coverage throughout the buildings, although the systems were not designed for the capacity of a full one-to-one program. There are also a few wireless laptop carts at the elementary level (which include their own wireless access points that travel with the carts.)

• *Internet Service* – We currently have a 5 MB fiber internet connection from MEC (Merrimack Education Center) and have plans to add an additional 20 MB connection (July 2008). This central connection serves the entire district, and is currently located at Broadmeadow (where the Educational Technology Center is housed)

• *Servers* – There are currently 41 servers throughout the district, with a variety of functions, from district-wide services like email (which serves all staff in the district), web serving (which serves the whole community) and the student information system (which serves staff, students and parents), to school-based document storage servers (which serve the staff and students). Maintaining this number of servers has become unwieldy with our current level of staffing (almost all of the servers are supported by one person, the network engineer), and it has become nearly impossible to support the addition of any new server-based systems. The addition of even one server-based system can add a huge amount of support time – which is something that those requesting the systems don't understand.

• *Computers (and related hardware)* – there are currently over 2000 computers district wide (administrative and instructional) and various peripherals such as printers, scanners, SMART Boards, projectors, etc.

• *IT Support Staff* – We currently have four computer technicians, one AV technician, two administrative technology positions to support information systems, and one network engineer. The high computer-to-technician ratio causes problems when there are issues that affect many computers at once. **The lack of staff redundancy at the network engineer position presents the single most critical point of failure for the school system infrastructure**.

• *IT Support Systems / Procedures* – One of the largest systems that we use to support the computers is the software deployment system. All of the installation/upgrades of software is done over the network using this system. For each new (or updated) piece of software, a package has to be built and tested. For each differently configured computer, separate configuration information has to be created and maintained by the system. The software deployment system has been instrumental in providing and maintaining the diversity of applications in the schools, however, building the master systems for deployment is taking more and more time as the number of applications and upgrades grow. Building and maintaining these systems is done by only one person: the network engineer.

II – Data Collection Methods

The Subcommittee used three primary methods of data collections:

1) Surveys: We contributed many questions to the surveys given to the staff, and reviewed the results of our own questions as well as other relevant ones from the other subcommittees. We also reviewed results from surveys given to the parents and students.

2) Phone interviews: we put together some infrastructure questions and spoke with people in a sampling of other districts that graciously volunteered their time (Ashland, Brockton, Douglas, Nauset, Walpole)

3) Personal interviews: we interviewed 3 of the current computer technicians, and had a chance to see their work environment. The network engineer (also a member of the infrastructure subcommittee) was interviewed as part of the ongoing review process.

In addition, software tools (InterMapper, Wireshark) were used to collect information regarding the current use of our internet connection.

III - Data Analysis

Access and Laptop Interest

Of parents surveyed:

99% have high speed internet access at home.

68% (grade 7), 76% (grade 8), 63% (grade 9) would be interested in their child having access to a laptop of their own for school work.

Of students surveyed:

(8^{th} grade): 71% feel that access to a laptop would be helpful for school work (21% already have their own laptop)

(12^{th} grade): 52% have their own laptop

Of staff surveyed:

70% feel wireless network access would be beneficial to student learning in their classroom, and 63% feel it would be beneficial in open spaces (cafeteria, library, other)

60% would find it beneficial to bring their own laptop to school to use network resources

67% feel a laptop cart would satisfy their needs when a computer lab is not available

The growing interest in wireless connectivity, along with the 1:1 Learning with Laptops study at Pollard, indicates that we need to assess our wireless infrastructure and its capacity to respond to an increased density of devices.

Classroom hardware, tech support, internet access

Of staff surveyed:

58% feel that the number of computers in their classroom is too few

29% feel that the computers in their classroom are not dependable

The typical time to get tech support is: less than an hour: 8%, same day: 36%, within a week: 36%, more than a week: 17%

90% feel that in general, the tech support staff solves their problems to their satisfaction

In rating the degree of success for tech support in the district, 38% found it to be very successful, 48% found it to be moderately successful.

Even though our internet bandwidth is being over utilized, only 16% find the internet to be slow often. (48% sometimes, 31% rarely, 5% never)

From our interviews with other districts:

Everyone has pretty much the same issues / struggles with not enough support and little or no redundancy in key positions.

All of the districts either have or are planning on implementing a help desk / work order ticketing system.

From our interviews with our technicians:

Printers consume a large part of the technicians' time, particularly inkjet printers. The flimsy construction of the printers results in a high probability of paper jamming, leading to damaged gears and other parts. Ink cartridges have a high failure rate that leads to a large amount of wasted consumables.

Due to the removal of all mobile items in the classroom each summer for room cleaning (and other factors), it has become clear that anything and everything that can be permanently mounted/installed (including furniture for the technology) should be. In particular, projectors and SMART Boards are very difficult to maintain on mobile carts with wiring across the floor. Anything that has to be plugged and unplugged from the various wall connections on a regular basis leads to deterioration of the connections, higher potential for problems, and increased support time.

Laptop carts (and laptops in general) require a lot of maintenance. A single mobile cart is the equivalent of a lab with 20-30 computers. Laptops by their portable nature, are more prone to damage through handling. Because laptops are not permanently installed and networked, they cannot receive automatic software updates and daily maintenance, instead the technicians have to schedule and perform these tasks manually.

The oldest (6-7 year old) computers are the most difficult to maintain, and are a drain on the support time. Their age increases the probability of failure, and problems with failed networking components can propagate problems throughout the network, affecting entire buildings.

From our interview with the Network Engineer:

The network engineer is doubling as a technical advisor and supervisor in many areas, as well as managing the software distribution system. Concentrating this much technical and supervisory activity on one person creates for huge inefficiencies and risks. There are big concerns with having only one person responsible for so much, both in terms of (excess) workload and no redundancy of job functions. The current job responsibilities of the network engineer occupy all of his available time when things are running smoothly. If there are failures to be attended to, the regular responsibilities get delayed while troubleshooting and fixing problems. Because there is only one person, only one failure can be attended to at a time. If more than one failure of a critical system occurs at the same time, one of the failures has to go unattended for as long as the other takes to fix. Based on the increased use of technology for administrative as well as instructional tasks, most things end up on the "critical systems" list.

There are a huge number of assorted software packages that get distributed over the network, and the task of keeping up with them all is overwhelming. There are no procedures in place for planning/testing/approving new software titles.

Hillside and Mitchell have fallen behind the other schools in their network connectivity. While all the other schools have had renovations that included upgraded electrical access and an increase in data drops per classroom (4-5 minimum in all the other schools), Mitchell and Hillside classrooms only have one each. The data electronics have not been replaced/upgraded in many years, and there are concerns about adding new equipment when the data closets are inadequate. (At Mitchell, they are small

wooden cabinets with poor space, accessibility, power and ventilation . At Hillside, the "closet" is a shelf in a custodial closet with a sink and cleaning supplies.)

From analysis of our internet bandwidth:

Our current (5 MB) connection is over utilized. Our internet provider is allowing for more than the official rate we pay. We are constantly using 200-300% of what we are allocated.

IV Recommendations

	Recommendation	Staffing	Budget Implications	Emerging Tech. or Prac.	Organizational Structure	Policies/ Practices	Prof. Dev.	Priority
5.1	Develop a process for evaluating all software requested (districtwide) to determine compatibility with existing systems (including software deployment system) and to determine impact on tech support staff	No	No	Software distribution is in practice, without good policies/procedures for software purchasing		Yes	No	High
5.2	Make sure that electrical assessment is a part of all technology planning and purchasing	No	No (may affect budgeting for other plans)			Yes	No	High
5.3	Attend to the neglected facilities (Mitchell, Hillside) as they fall further behind in their technological capabilities	Maybe (based on how much technology is added)	Yes			No	No	High
5.4	Plan for projectors, smart boards, etc. to be permanently mounted wherever possible	No	Yes			Yes	No	High
5.5	Move away from individual ink-jet printing toward shared laser/wax printers and/or network copiers	No	Yes (possible reduction)			No		High

	Recommendation	Staffing	Budget Implications	Emerging Tech. or Prac.	Organizational Structure	Policies/ Practices	Prof. Dev.	Priority
5.6	Implement a "help desk" (work request ticketing and tracking database) system	No	Yes	Not in practice	Used by everyone, managed by IT staff	Yes		High
5.7	Create staffing redundancy for key technical operations	Yes	Yes			No		High
5.8	Increase technical staff to match workload and turnaround requirements	Yes	Yes			No		High
5.9	Develop alternate operational plans for operation when server/network based services are not available	No	No			Yes	Maybe – depending on the alternate plans	Medium
5.10	Continue ongoing evaluation of room layouts for meeting the technology needs of various spaces/staff	No	No			Yes	No	Medium
5.11	Develop and maintain a process for documenting the details/configuration of the infrastructure	No	No	Minimal in practice		Yes	No	Medium
5.12	Plan for the changes in the infrastructure as we move toward a one-to-one model	No	Yes	Emerging tech.		Yes		Medium
5.13	Maintain a process for ongoing audit of needs and usage of internet bandwidth	No	Yes (if it is determined there is a need for more)	Not in practice		Yes		Medium
5.14	Investigate outsourcing new or existing server-based services where possible and appropriate	No	Yes			No		Medium
5.15	Investigate the possibilities for moving the bulk of user storage from network/server based to portable storage (flash drives, etc.)	No	Yes (possible reduction)			No		Medium

	Recommendation	Staffing	Budget Implications	Emerging Tech. or Prac.	Organizational Structure	Policies/ Practices	Prof. Dev.	Priority
5.16	Investigate consolidation of server functions (possibly through virtualization) to minimize the number of physical servers	No	Yes (possible reduction)			No		Medium
5.17	Investigate more training and advancement opportunities for tech staff	No	Yes			No		Medium
5.18	Investigate restructuring of the IT staffing model (centralized call center and dispatch, more flexibility in technician deployment, potential for IT Manager position as coordinator)	Yes	Yes	Not in practice		Yes		Medium
5.19	Work toward meeting and maintaining the state standard for computer replacement cycles	No	Yes			Yes		Medium
5.20	Investigate opportunities to substitute "thin clients" as opposed to full multi-purpose computers where functions needed may be minimal	No	Yes (possible reduction)	Not in practice		No		Low