

BOARD OF EDUCATION
The School District of South Orange and Maplewood
525 Academy Street, Maplewood, NJ 07040

Karla Milanette
School Business Administrator and
Board Secretary

(973) 762-5600 x1800
(973) 378-9310 fax
kmilanet@somsd.k12.nj.us

March 5, 2004

TO: Members, Board of Education
Peter P. Horoschak, Superintendent

FROM: Karla Milanette, Business Administrator
Peter Daquila, Assistant Business Administrator
Marge Mingin, Director of Media & Technology
Gerry Archibald, Network Manager

SUBJECT: BUDGET DEVELOPMENT REPORT: TECHNOLOGY

The Board of Education requested an analysis of the district's information technology function in preparation for upcoming budget discussions. A committee comprised of Marge Mingin, Director of Media & Technology, Gerry Archibald, Network Manager, Peter Daquila, Assistant Business Administrator and Karla Milanette, Business Administrator prepared the following report.

The report is intended to provide information for the decision-makers and for the general public to gain a better understanding of the district's computer information technology. The purpose of this report is to enable informed decision-making. It contains a set of recommendations, most of which are already incorporated into the proposed budget.

INTRODUCTION

Information Technology (IT) has quickly become the foundation for the curriculum and an integral part of the daily operations for the entire school district. The faculty, students and support staff rely heavily on the computing infrastructure. IT has offered the faculty and the students access to information and the ability to gather and share data that enhances their learning capabilities. Technology is also essential to the management of the school district. E-mail, Web access, word processing and spreadsheets have all become as critical and important to the district's operations as paper, pencils, telephones and textbooks.

Since 1993, the district has invested over \$11 million dollars into technology. \$4.5 million of that total was funded from a bond issued in 1996, \$0.6 was funded from grants and state aid and the remaining \$6 million was funded through the operating budget. Over this time period the installed base has grown to over 1,400 workstations with a server and network infrastructure requisite to supporting that number of units.

In the initial years of the Technology Plan, there may have been a perception on the part of some that technology involved a one-time cost with little impact on the annual operating budget. It was clear from the start, however, that implementation and support of computing technology required both out-of-the-ordinary one-time costs and recurring costs to manage, repair and renew the hardware and software of the installed base.

Over the years, annual spending on technology has included a mixture of such recurring costs together with one-time costs associated with expanding the installed base. Costs associated with such expansion have included those associated with increasing the number of workstations across the district and those associated with expanding the capabilities of services available to users of those workstations. Increases in workstations also required corresponding increases in the file servers supporting them. Connection of the district's municipal area network to the Internet involved such a mixture of costs, with one-time costs necessary for purchase of certain network equipment and recurring costs associated with the additional charges from Verizon and other network carriers.

This report does not review past spending but seeks to describe our current installed base, the recurring costs associated with supporting it and some additional one-time costs associated with improving the capabilities of the installed base. Interestingly, the one-time costs proposed in this year's budget for Phase 2 of the thin-client implementation are intended not just to improve the quality and reliability of service delivered, but also to lower the recurring cost of maintaining the installed base.

ANALYSIS

The Installed Base

The following table summarizes the growth of the installed base since the large-scale introduction of computing technology in 1993-94.

	1993/1994	1999/2000	2003/2004
Enrollment	4962	6195	6390
LANS (Local Area Networks)	4	14	14
WAN (Wide Area Network)	0	1	1
Servers	11	33	55
Workstations	118	1200	1400
Audio Visual Equipment	1200	783	1300
Video Distribution Centers	0	7	9
TV Studios	1	1	2
Computer Labs	5	28	26
Staff Support (total)	6	16	8
Breakdown of staff support:			
- Central Technical Support	3	3	1
- Tech Aides	2	12	6
- Audio-Visual & Phones	1	1	1

Recent additions to the installed base between the years 2002-2004 include:

- 72 laptops - 36 for each middle school lab
- 15 workstations in the social studies lab (funded by a grant to the Adult School)
- 24 workstations for special education classrooms in CHS and the middle schools (funded by federal I.D.E.A. funds)
- 15 laptops for child study team members (funded by federal I.D.E.A. funds)
- 6 workstations for the Business Department (funded by federal Perkins Vocational funds)
- 24 graphic arts lab workstations

The installed base of approximately 1,400 workstations includes approximately 150 used for administrative computing and 1,250 used for student computing. For student computing workstations, this results in the following ratios

	Students per Computer
Elementary Schools	6.7 to 1
Middle Schools	4.5 to 1
High School	4.2 to 1

The Central Technical Support Role

The staffing levels depicted above include a Central Technical Support function. This function provides support for the installed base, including: installation and repair of hardware; configuration, maintenance, ongoing upgrades and troubleshooting of software; daily operational activities such as system backup, account/password maintenance and monitoring of system health; and support of end-users in their use of specific software packages. Some of these activities are supported in part through maintenance contracts with hardware/software vendors and through the district's contract with its third-party support vendor, Synergy.

In addition to the many activities involved in supporting the computing infrastructure and its large installed base, the Central Technical Support role is also responsible for management and support of the security alarm systems, the district-wide card access systems, the master clock systems, closed circuit television, audiovisual repair, and telephone management, repair and maintenance.

Over the years, the district has experimented with various approaches to staffing the Central Technical Support function. Up until 2000-01, the staff consisted of: a Director of Media & Technology, a Network Manager, an Assistant Network Manager, a PC/Computer Technician, a Computer Technology Coordinator and a Communication Specialist. The Director of Media & Technology is also responsible for the management

of the libraries and the TV studio. This staff handled a significant portion of annual upgrades and expansions to the installed base. In the face of budget pressures in the year 2000-01, that staff was scaled back to a Director of Media & Technology, a Network Manager, an Assistant Network Manager and a Communication Specialist. When Mr. Roth was promoted to become Assistant Business Administrator in 2001, he continued to provide some support and management oversight to the district's computer technology, working with Mr. Archibald who was promoted to replace him as Network Manager. Since Mr. Roth's departure in August 2003, the district has maintained a technical support posture that includes only Mr. Archibald, the Network Manager, supported by contract personnel from Synergy and Mr. Jeron, the Communication Specialist. This minimal level of staffing is proving to be untenable from a quality-of-support standpoint. Reliance upon a single individual as Network Manager also represents an unacceptable level of risk, given the critical nature of many of the district's computing services.

The Technology Facilitator Role

In addition to the Central Technical Support role, the district also employs Technology Facilitators in the schools, playing a variety of roles, including: (1) first-level on-site support and troubleshooting for hardware/software problems; (2) training of teachers and students in the use of software; (3) management of school computer labs and TV studios; and (4) support of school staff in their use of computers. The staffing level for Technology Facilitators has varied as well, with last year's budget resulting in a reduction from 10 to 5 FTEs. This has proved to be less than satisfactory and has resulted, in some cases, in underutilization of computing services in the elementary schools.

Support and Renewal of the Installed Base

With an installed base of 1,400+ workstations, we are close to having a full complement of workstations, requiring only minor further expansion. In the future, this will substantially reduce the number of one-time costs that have been incurred for such expansion in past budgets. However, there is still a substantial cost involved in maintaining and renewing our existing installed base. Notwithstanding the continuing decline in unit prices for PCs, the cost of upgrading each unit typically involves new versions of desktop software, which can add hundreds of dollars to the purchase price of a unit.

One objective of our technology planning has involved seeking a way to manage and reduce these recurring costs, achieving savings beyond those resulting from continuing hardware price reductions. In support of this objective and consistent with other quality management objectives, last year (after a few years of study and testing) we began a carefully considered migration to thin-client computing. Thin-client is a well-established approach increasingly used by Fortune 500 corporations, school districts and other institutions. The 2003-04 budget included a one-time allocation to fund Phase 1 of the thin-client migration. The proposed 2004-05 technology budget includes a non-recurring cost of \$180,781 to complete Phase 2 (the final phase) of the thin-client migration. The recurring portion of the technology budget (detailed further below) is included in the T&E base budget and several one-time costs, including the thin-client migration, have been listed as distinct items in various categories of a prior draft of the Separate Proposal.

(This memo contains recommendations detailed below, which modify the set of computer related items contained in the Separate Proposal.)

The thin-client effort involves adding central server hardware onto which most of the computing load is shifted. Thin-client provides us the following advantages:

- greater dependability, since all software resides on and all computation occurs on the server; desktop workstations are limited to a display/input role;
- easier software support, configuration and upgrade, since there is no software installed on the workstation and failure of individual desktop hardware can be serviced simply by plugging in a replacement unit, with no on-site installation/configuration required;
- significantly greater security, since desktop workstations no longer allow a "point of entry" for software introduced by floppy disks
- lower recurring costs because the majority of the workstations can now be replaced on a seven-year cycle instead of a five-year cycle and the majority of the workstations can be low-end rather than high-end PCs -- with no sacrifice in computing capability (there are exceptions to this for those workstations that must run specialized high-end applications).

Cost Comparison of Traditional Client-Server to Thin-Client Computing

From 1999-00 through the current academic year, the district has funded and managed a systematic renewal/replacement of its installed base of workstations, printers and other peripherals, while at the same time expanding to the current number of 1,400 workstations. Our plans have been based on the conclusion, articulated in prior-year reports, that it is necessary to replace PCs every five years, both because hardware wears out and because the evolution of desktop computer software requires increasingly more powerful hardware to support it. In budgeting, we have treated the cost of such five-year renewal as a recurring cost and have sought to manage the budget for computing technology at a level sufficient to sustain this replacement cycle. During that period, the cost of replacing a single workstation has declined from nearly \$3,000 in the late 1990's to approximately \$1,400 today (cost inclusive of purchase of new monitor and software upgrades). Replacing an installed base of 1,400 every five years requires replacement of an average 280 workstations per year. At \$1,400 each, that involves an annual recurring replacement cost of \$392,000 for workstations. An additional recurring amount of \$34,000 is necessary to provide a replacement cycle for computing peripherals, including printers and scanners. The annual recurring cost for a five-year cycle of replacement and renewal of our base of servers costs \$45,000. In addition to the cost of this five-year renewal cycle, recurring costs also include approximately \$139,000 annually for repairs, covering all network equipment, servers, workstations and peripherals and \$200,000 annually for maintenance contracts on all student and administrative software. Our budget for recurring costs in the prior years for support of computing technology has thus run in the neighborhood of \$600,000 to \$800,000.

Last year's proposed computing budget, for example, was originally \$318,392 for Administrative Computing and \$636,700 for Student Computing, for a total of \$955,092, which included the projected one-time cost of Phase 1 of the thin-client. The originally proposed budget was cut by \$208,000, but the thin-client implementation proceeded by utilizing a \$195,000 carryover of Distance Learning Network Aid.

Thin-Client Replacement Cycle

Begun in the year 1999-00, the first five-year replacement cycle for PCs would have been completed in the year 2003-04 if budget cuts were not made to the technology area in the last two years. There are still PCs in use that will not support thin-client. The migration to thin-client will allow the switch to a seven-year replacement cycle, which will reduce our annual replacement costs.

Because thin-client shifts computing to the server and uses the desktop only for display/keyboarding, today's workstation will work just as well seven years from now. Under thin-client, the replacement cycle will be driven not by the need to increase desktop computing power to keep pace with the needs of newer software versions, but only by the fact that hardware wears out. It is not outside the realm of possibility that we'll be able to stretch replacements to eight or more years, but assuming a seven-year cycle is prudent for planning purposes.

In addition to the cost advantage of a seven-year cycle, thin-client also enables us to shift to the use of less expensive desktop units. Our posture in the past has been to purchase relatively high-end units, knowing that by the end of their five-year life, they would barely be able to keep up with the growing demands of the software. This is no longer necessary, since any increased computing load will be borne by the powerful servers.

It should be noted that even under a thin-client approach, we would maintain certain workstations as full-function PCs. This affects the projected replacement cost. The two types of replacement units envisioned in the future are:

- Type I: low-end PC suitable as thin-client workstation replaced every 7 years (cost includes purchase of new monitor): \$700
- Type II: high-end PC that can participate in the thin-client environment, but also has substantial computing power for standalone applications (graphics, CAD, certain administrative computing functions) replaced every 5 years: \$1,400

Our present plan projects the need to maintain 500 units of our installed base as Type II workstations with the remaining 900 workstations as Type I thin client units. This results in the replacement of 129 Type I units each year on a seven-year cycle and 100 Type II units each year on a five-year cycle. (There may be additional savings generated as a result of possibly shifting the five-year-old Type II units and using them for an additional two more years as Type I units, but it is not prudent to assume that ability and potential savings for planning purposes).

Most of our entire installed base is now thin-client capable and the remainder should be taken care of in 2004-05 and we anticipate moving to the new replacement model described above in the 2004-05 year.

A cost comparison between fat-client and thin-client support costs follows:

Recurring costs under existing client-server “fat client” model:

Item	Recurring Cost
Annual replacement of 280 workstations @ \$1,400 each (replaced every 5 years)	\$ 392,000
Annual replacement of peripherals	\$ 34,000
PC Maintenance: 1,400 @ \$85 each	\$ 119,000
Maintenance Contracts on Software	\$ 200,000
Server and network hardware maintenance	\$ 20,000
Server and network hardware replacement	\$ 45,000
Miscellaneous	\$ 10,000
Total recurring cost for Information Technology with Fat Client	\$ 820,000

Recurring costs under anticipated “thin client” model:

Item	Recurring Cost
Annual replacement of 129 Type I workstations @ \$700 each (replaced every 7 years)	\$ 90,300
Annual replacement of 100 Type II workstations @ \$1400 each (replaced every 5 years)	\$ 140,000
Annual replacement of peripherals	\$ 34,000
PC Maintenance: 1400 @ \$85 each	\$ 119,000
Maintenance Contracts on Software	\$ 200,000
Server and network hardware maintenance	\$ 20,000
Server and network hardware replacement	\$ 45,000
Miscellaneous	\$ 10,000
Total recurring cost for Information Technology with Thin Client	\$ 658,300

The cost of PCs will hopefully continue to decline in coming years for both the fat-client and the thin-client workstations. The cost differential between the two types of PCs will persist and likely grow, preserving the cost advantage of thin-client. Thin-client is thus a compelling alternative both on a cost basis and because it improves reliability and simplifies service and support.

The Proposed Budget for 2004-2005 for hardware/software

Item	Recurring Cost
Recurring Costs:	
Annual replacement of 129 Type I workstations @ \$700 each	\$ 90,300
Annual replacement of 100 Type II workstations @ \$1400 each	\$ 140,000
Annual replacement of peripherals	\$ 34,000
PC Maintenance: 1400 @ \$85 each	\$ 119,000
Maintenance Contracts on Software	\$ 200,000
Server and network hardware maintenance	\$ 20,000
Server and network hardware replacement	\$ 45,000
Miscellaneous	\$ 10,000
Total Recurring IT Costs with Thin-Client	\$ 658,300
One-time Costs:	
Thin-Client Phase II	\$180,781
Total One-Time Costs	\$180,781
Total Hardware/Software Budget	\$ 839,081

Changes to Separate Proposal Items Related to Computing

The single one-time item reflected in the above budget is the server upgrade to complete the planned thin client migration.

Further analysis, still ongoing, has raised the possibility that we may be able to forego some of the planned annual workstation replacement/renewal provided for in the 2004-05 operating budget. The set of workstations purchased in the 1999-2000 budget year will be five years old at the end of this year. Depending on their precise hardware configuration, and the level of wear, it may be possible to avoid replacement of some portion of the 129 units slated for replacement with Type I workstations. We won't know the extent to which this is possible until we perform hardware inspection and diagnostics this spring and summer (in addition to inspecting the condition of each system motherboard, we need to determine precisely what level of bios each machine has, whether that allows for remote booting and diagnostics and whether the bios is "flashable", i.e., upgradable).

There are other workstation redeployment scenarios that might yield savings as well, but given the disparate set of software configurations in different environments this might not be feasible. We will make a determination during the same spring-summer onsite physical assessments described above.

Given these possibilities for extended use and redeployment, we estimate there is a potential for \$60,000 to \$90,000 of savings in the operating budget described above. It is proposed to use these savings, to the extent that they're realized, to fund some of the one-time workstation purchases currently suggested as part of the Separate Proposal. This raises the possibility of removing those items from the Separate Proposal and only making the purchases to the extent we can fit them within our existing operating budget. We have recommended this course of action and the 2004-05 budget proposed above reflects our assumption that this will occur.

Items being removed from the separate proposal, some of which may be funded from the operating budget if potential savings are realized, include:

- Update of the CAD Laboratory \$60,000. The CAD Lab might receive twenty-four (24) new Type II workstations. The current CAD classes are offered using computers in the business lab. The business lab applications are being converted to thin-client, but thin-client will not support the CAD software. Creating a separate lab is necessary if we are to continue this course offering.
- Addition of 24 Laptops for the Middle School Labs \$24,000. In the middle school labs, laptops are utilized instead of desktop computers to enable us to move the computers to each classroom on a cart rather than requiring students to move to a computer lab. The Middle School Labs may each receive twelve (12) new laptop machines. The current middle school labs are each outfitted with 36 laptops. The addition of twelve (12) laptops for a total of 48 in each school would make it possible for two full classes in each school to utilize these computing resources simultaneously.
- Addition of 60 Type I Computers for Classrooms at CHS \$30,000. The Columbia High School classrooms might receive 60 additional computers (Type I thin-clients) in order to complete the long-time plan of putting a computer in every classroom. The SASI administrative software has already been made thin-client capable so teachers would be able to take period-by-period attendance in the classroom immediately, as well as having access to their email and all other district computing services (word processing, spreadsheets, the Internet, etc.).

The district's installed base could possibly increase by 108 workstations (48 Type II machines and 60 Type I machines) if savings realized from the operating budget can cover the three items listed above. This appears to be a full complement of the workstations that the district requires. The potential increase in the annual replacement costs if the 108 workstations were added would be \$20,300. It is likely that this incremental annual cost would be more than offset by declining hardware prices.

Staffing

A key issue that still needs to be addressed is staffing. There are currently eight employees handling technology tasks and issues throughout the entire district, supported by contract personnel from Synergy for some Central Technical Support functions. There is a Network Manager, a Director of Media & Technology, five Tech Facilitators and a Communication Specialist. The Director of Media & Technology and the Tech Facilitators work in the schools and their primary purpose is to ensure that the teachers can access the necessary computer applications and that the teachers' equipment is functional. The Tech Facilitators are not fixing or addressing computer problems so all of these tasks fall to the Network Manager. The Network Manager is responsible for the entire installed base of the district. He is currently supported only by contracted services. The Communication Specialist handles the phone system for the entire district and supports the audio-visual infrastructure.

Technology ("Tech") Facilitator

There are currently two Tech Facilitators covering six buildings at the elementary level. It is recommended that one additional Tech Facilitator be provided so that each will be responsible for two buildings instead of three. The cost of this additional FTE is \$55,200. To offset a portion of this cost, it is recommended that we forego filling the stipend positions paid to teachers to serve as Computer Trainer Liaisons (10 @ \$3,320) for a savings of \$33,200. In place of the training they provided, we recommend that the Essex County Educational Technical Training Center, housed in Columbia High School, be utilized more frequently for staff training. The cost of the additional Tech Facilitator should remain listed as a Separate Proposal item.

Assistant Network Manager

This year's hardware/software budget for recurring costs is \$658,300 and achieves a savings of \$89,000 in comparison to last year's reduced budget for recurring operating costs of \$747,092. Part of this savings should be used to fund the restoration of the Assistant Network Manager position, the cost of which is \$72,390. The cost of the Network Manager should remain listed as a Separate Proposal item.

Summary

The technology budget for 2004-2005 is intended to keep pace with technology and provide the best possible tools to the students and staff in the district, while remaining conscious of the need for cost-efficiency. We feel it strikes the right balance and meets the adopted budget priority to "stabilize technology support capabilities."

Summary of Recommendations

1. Restore one FTE to the Central Technical Support staff as the Assistant Network Manager to help stabilize the existing infrastructure and reduce the risk of reliance on a single individual.
2. Proceed with Phase 2 of the thin-client installation.
3. Leveraging the thin-client capability, move to the modified workstation replacement cycle, with the thin-client workstations being replaced only every seven years. The new thin-client workstations no longer need to be top-of-the-line PCs to support the needs of desktop software, but merely adequate to serve as thin-client display stations. Maintain a portion of the installed base as Type II PCs, which are capable of running standalone (in addition to accessing thin-client services). Work over time to reduce this segment of the installed base in favor of a greater proportion of thin-client workstations.
4. Restore one FTE as a Technology Facilitator for the elementary schools to stabilize technology support services.
5. Explore the potential of using a small portion of the Technology Facilitators' time to provide an online/phone helpdesk service that would be accessible to all users throughout the district.
6. Also explore the cost of outside services for providing such helpdesk services.
7. Explore the feasibility of and cost savings resulting from a migration away from Windows to the Linux operating system and use of open-source software.
8. Draft a plan for execution in the 2004-05 school year that ensures that all district staff members are adequately trained on all computer applications that they need to use in the course of their jobs.
9. Design and implement a disaster recovery and backup plan to supplement the onsite backups now maintained. This will enable the district to preserve its data in the event a site is lost due to fire or other disaster and maintain critical district operations.
10. Continue working with the Assistant Superintendent for Curriculum to assure that the computing infrastructure is used to maximum educational advantage and that it remains capable of supporting the specific software programs and services needed for specific curricular offerings.