

# MMSD's Technology Environment: Current and Future State

## Introduction:

MMSD's technology environment is the supporting infrastructure for nearly all areas of our \$300 million enterprise. It plays a central role from learning in the classroom, to tracking and reporting student records, managing employee data, generating paychecks and literally thousands of other activities in the daily lives of our students and staff. The challenge is not simply to maintain a technical environment needed in the classroom but to insure that ever evolving tools are used as cost effectively as possible to help our students learn and maximize staff efficiency. This requires what NCREL (North Central Research Education Lab; see <http://engage.ncrel.org>) refers to as "robust access."

Robust access includes having technology resources strategically deployed and sufficient to meet the needs of students and district staff, having suitable telecommunications infrastructure in place, having adequate and timely support for hardware and software issues and having buildings designed to support the effective incorporation of technology resources. Further, NCREL describes robust access as insuring access to online learning and digital content to students and staff beyond the school day as well as beyond the school building. The application of technology to insure student success is part of the mission of MMSD's Teaching and Learning Division and is described in their June 2003 Instructional Technology Plan. Insuring "robust access" to technology for all staff and students throughout the district is the mission of MMSD's Technical Services Division.

This portion of MMSD's Technology Plan has been developed with extensive input from the school district community, with additional input from local public sector entities and technology vendors most familiar with MMSD's technical environment. This is designed as a working document to communicate how the district's technology infrastructure (from software and desktops to LANs and servers to district-level network services) is deployed and, how in many cases, it minimally meets what NCREL describes as robust access. Further, this document is designed to communicate the planning and investments required to achieve a learning and working environment which can more effectively meet the needs of our district's community.

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**MMSD Technology Budgets: F03, F04 and optimum F04-F06**  
(excluding labor costs)

Expenses:	F03 budget				BOE Approved F04 budget				Optimum Technical Budgets:		
	other \$\$	TEACH Wirg \$	TEACH blk grant	Tech Serv	other \$\$	TEACH Wirg \$	TEACH blk grant	Tech Serv	Year 1	Year 2	Year 3
<b>WAN costs:</b>											
1 WiscNet Internet access				\$46,828				\$47,261	\$47,000	\$47,000	\$47,000
2 eRate reimbursement for Internet				(\$23,882)				(\$24,576)	(\$24,576)	(\$24,576)	(\$24,576)
3 T1 costs	\$67,256				\$170,478				\$170,478	\$170,478	\$170,478
4 eRate reimbursement on T1s	(\$42,233)				(\$88,378)						
5 fiber: 1x\$: 4 schools, 2 admin sites:					\$100,000						
6 fiber: annual maintenance					\$90,000				\$90,000	\$90,000	\$90,000
<b>LAN upgrades:</b>											
7 Chavez	\$72,000										
8 Hamilton/VanHise		\$42,000									
9 La Follette				\$79,550							
10 Cherokee		\$20,724									
11 Crestwood		\$17,733									
12 Lapham		\$17,000		\$1,933							
13 Spare switches				\$20,241							
14 Memorial							\$118,685	\$118,685			
15 East							\$90,755	\$90,755			
16 West					\$91,415						
17 Doyle					\$168,637						
18 Pflaum Rd.					\$24,027						
19 Hoyt					\$14,196						
20 other switch purchases									\$297,560	\$507,000	507000
21 LAN upgrade consulting				\$49,028							
<b>Backup system upgrade:</b>											
22 server host for Tivoli: Inacom				\$6,844							
23 tape drive/library combo: Berbee				\$51,465							
24 Tivoli SW & maintenance: Berbee							\$23,604	\$23,604			
25 consulting/setup: Berbee							\$7,500	\$7,500			
26 BRMS software for AS400s (est\$)							\$12,754	\$12,754			
<b>Server replacements:</b>											
27 acquire used AS400 for warehouse	\$11,450	from R&E									
28 5 servers: summer 2002				\$21,987							
29 replace 2 svrns, add 25 hard drives				\$12,319							
30 replace 8 svrns							\$32,824	\$32,824			
<b>Desktops/printers:</b>											
31 Administrative				\$100,000			\$128,000	\$210,810			
32 Instructional	\$62,246		\$485,366	\$40,000			\$430,000	\$2,600,000	\$1,950,000	\$1,950,000	
33 desktop SW & peripherals	\$103,575		\$19,819				\$100,000	\$200,000	\$200,000	\$200,000	
<b>Data Access tools:</b>											
34 WebSmart: developers								\$7,800			
35 WebSmart: App.Svr SW								\$6,850			
<b>Security:</b>											
36 Consulting: Network				\$32,000				\$20,000	\$20,000	\$20,000	
37 Internet email server upgrade				\$7,263							
38 Command Anti-virus				\$17,258			\$25,119	\$25,119	\$25,119	\$25,119	
39 Citrix maintenance				\$2,000			\$2,000				
40 Citrix server upgrades (assess in Dec03)								\$25,400			

changes in T1 costs reflect combining voice & data

cost est., pending further collaboration with other metro entities

**Additional Technology Expenses other than those identified above:**

(see row #s above for costs of some specific initiatives)

Consulting (see 21,36)				\$6,713			\$25,000	\$25,000	\$25,000	\$25,000	
Operations				\$72,935			\$70,000	\$70,000	\$70,000	\$70,000	
Off.supplies/misc.				\$6,255			\$6,000	\$6,000	\$6,000	\$6,000	
Repairs/parts				\$31,234			\$20,000	\$20,000	\$20,000	\$20,000	
Computers/printers (see 31,32)				\$1,011			\$0				
Servers (see 28,29)				\$0			\$0	\$45,000	\$45,000	\$45,000	
Maintenance contracts				\$163,870			\$190,000	\$190,000	\$190,000	\$190,000	
Travel				\$8,684			\$8,000	\$8,000	\$8,000	\$8,000	
OT				\$15,489			\$15,000	\$15,000	\$15,000	\$15,000	
Night differential				\$5,147			\$5,500	\$5,500	\$5,500	\$5,500	
Training	\$21,925			\$2,738			\$0	\$16,000	\$20,000	\$20,000	
Software				\$42,921			\$30,000	\$45,000	\$45,000	\$45,000	
LAN upgrades (see 9,12,13)				\$24,812			\$0				
WAN upgrades (see 1,2)				\$991							
Backup system/tapes (see 22,23)				\$28,678			\$43,883	\$43,883			
other technology related	\$23,731		\$19,819								
<b>Budget Totals:</b>	\$319,950	\$97,457	\$525,004	\$876,312	\$570,375	\$0	\$530,000	\$877,309	\$4,451,946	\$3,434,521	\$3,434,521

**Note:**

- Yellow = low estimates of optimum funds needed
- all eRate reimbursements for telecommunications charges are not displayed

# 1. Infrastructure:

## A. Wide Area Network (WAN):

### Background:

MMSD's WAN consists of hardware and software enabling communications between buildings, throughout the school district's 65+ sq.mi. area. Within this discussion, we focus on inter-building communications and MMSD's AS400s. The AS400s are included here, due to the central role these servers play in hosting student and financial data. [for a schematic of MMSD's WAN, see [Appendix A](#)]

### Communications:

Current WAN data communications between buildings throughout the district is limited to T1 speeds (1.5 MB), except between the high schools and Doyle, which are connected by 3 T1 lines. T1 speeds have become a barrier to:

1. the increasing reliance on Internet use for instruction
2. server consolidation necessary to realize savings in hardware, software and technical support
3. more cost effective data backups systems and disaster recovery preparedness

MMSD's average T1 costs

are displayed to the right.

(Chavez is separately included and has such higher costs because it is outside of the Ameritech service area and therefore must be serviced by TDS

Telecom.) The average T1

line (other than T1 charges for Chavez) is multiplied by 14 because each high school has 3 lines (4 schools x 3 = 12), plus Doyle & Pflaum. (Current relevant eRate reimbursement eligibility is included and referenced below.) [see [Appendix B](#) for a detailed summary of eRate funding requests for F04]

Discussions with local telecommunications vendors and other metropolitan area public sector entities were initiated Dec.2002 to assess strategies and estimate startup and annual costs to improve current data communications speeds between buildings to a minimum of 100 MB/sec, with capacity to increase throughput to 1 GB/sec. Achieving these communication speeds would be possible through the use of existing dark fiber or by trenching new segments to connect sites. Based on further information, by fall 2003, an RFP may be released for initial parts of this project. The first goal is to connect the 4 high schools and Doyle and Pflaum Rd. (There is some incentive to connecting Chavez with fiber relatively soon in this project due to the current high cost of T1 service to this building.) Subsequent goals would be to connect other district sites currently geographically closest to existing fiber &/or all middle schools. [see [Appendix C](#) for a schematic of current fiber routes in the MMSD area] It is expected that a strategy to begin implementing this WAN upgrade will be selected by fall 2003.

WAN communications also relate to MMSD's current ~50 routers for which Technical Services pays for Cisco support (see Cisco SmartNet, below).

### AS400 servers:

MMSD currently has 8 AS400s: 1 each at each of the 4 high schools, 1 at Pflaum Rd, and 3 in Doyle (1 being the primary host of all financial and student data [= MOM] and the other 2 functioning as the district data warehouse [a used but more powerful unit was purchased in spr.2003 to replace an under-powered unit, which will be removed from service by fall 2003]). Annual hardware and software maintenance costs to IBM for support of the AS400s and their associated printers is \$35,000. (All are aging and in need of replacement to support IBM's newer operating system and insure future technical support.) With investments to improve WAN communications speed and by replacing the main AS400 in Doyle, AS400s external to Doyle could be eliminated saving over \$20,000 in annual

	monthly		annual		
	data T1	voice T1	data T1	voice T1	
Chavez	\$1,628.00	\$1,122.76	\$19,536.00	\$13,473.12	
MMSD avg T1	\$424.00	\$165.00	\$5,088.00	\$1,980.00	
(avg x 14)			\$71,232.00	\$27,720.00	T1 totals:
6 bldgs + Chavez			\$90,768.00	\$41,193.12	\$131,961.12
			times 52% for eRate:		\$68,619.78

maintenance contracts. Such a server replacement might cost \$80,000 which would need multiple-year financing

**Expenditures:**

	1 time	annual:
<b>Current:</b>		
T1 maintenance costs (including the 4 high schools, Doyle & Pflaum Rd plus Chavez)		\$131,961
eRate reimbursement for T1s		[\$68,619]
Cisco SmartNet router maintenance		\$37,350
IBM AS400 maintenance costs		\$35,000
<b>Totals:</b>		<b>\$135,692</b>

<b>Proposed:</b>		
Fiber between 4 high schools & Chavez + 2 admin bldgs (est. costs)	\$100,000	\$90,000
eRate reimbursement for fiber		[\$46,800]
Cisco SmartNet router maintenance		\$37,350
Condense AS400s to 2 (?) units	\$80,000	\$15,000
<b>Totals:</b>	<b>\$180,000</b>	<b>\$95,550</b>

Note: It is expected that the most cost effective strategy to begin moving forward with MMSD's WAN upgrade will be selected by fall 2003.

**Revenues:**

Current WAN revenues (\$68,619 / yr.) are represented by average (current) eRate reimbursements for these 14 T1 lines and MMSD's core router. Should Federal eRate reimbursements continue (efforts are underway, led by Sen. McCain, to end the eRate program), the annual charges (not initial/start-up costs) supporting fiber utilization would be eligible for eRate reimbursements: ~ \$46,800 of the \$90,000 estimate.

**FTE:**

WAN communications are managed by parts of 4 Technical Specialist positions. AS400 issues are managed by parts of 2 Technical Operations positions, 2 Technical Specialist positions and 2 Data Administration positions. [est. 0.8 FTE]

**Effectiveness:**

Data communications speed improvement would significantly improve effective use of Internet-based curricula.

Server consolidation, enabled by improvements in WAN communications speeds would:

- dramatically improve technical staff effectiveness in support of server hardware and software, including improving efficiency with software upgrades, security management and data backups
- dramatically improve ability to manage disaster recovery efforts; server consolidation must be done in concert with off-site data storage and strategies for easy hardware replacement
- reduce server HW/SW maintenance costs (not yet estimated)

## B. Local Area Networks (LANs):

### Background:

LAN issues address data communication issues within buildings and local building-level servers. Since data communication issues include data cables, and cabling is often addressed at the same time electrical and phone systems are addressed, a brief summary status of these issues is provided on 1 spreadsheet in [Appendix D](#). When funds have been allocated to address electrical issues in buildings, work has often included upgrades from Type 1 and Cat.3 data cabling to Cat.5 data cabling. Where possible, MMSD has combined upgrades to building-level data communications cabling with referendum supported projects to take advantage of TEACH Wiring loan funds. Tables to the right summarize costs associated with wiring upgrade projects done last year and those that are currently scheduled for F04. (Switches are parts of the costs in the table to the right) [Note: TEACH Wiring funds represent funds for which 50% must be paid back as a low interest loan.]

In the case of Cherokee, Crestwood and Hamilton, funding for data wiring and electrical work also contributed to costs of switches ([see below](#)).

### Communications:

Desktop computer performance problems in buildings throughout the district are often a function of not only aging desktop computers, but of inadequate network communications equipment. In many areas, whole computer labs pass data traffic through shared 10 MB hubs. Technical Services staff have even found situations where building level staff daisy-chained 10 MB hubs, each with clusters of computers, and then asked for technical assistance to improve desktop performance.

With increasing instructional computing data transmission requirements as well as ever increasing throughput requirements from productivity tools and Internet resources, MMSD must improve LAN traffic capacities as quickly as possible to insure that MMSD can maximize the performance of every computer. [see [Appendix E](#): 1 page white paper discussing LAN performance written in Mar.2003]

A review of all building LAN configurations was completed in Feb.2003 and cost assessments were prepared with the goal of migrating all buildings to an environment where every desktop is fully switched at 100 MB to its local server. Not only would this significantly help improve desktop computer performance, but would significantly improve the efficiency of desktop computer support and network security.

During spring 2003, LAN upgrades with new switches took place in Chavez and Hamilton/Van Hise. As of May2003, other funding sources have been committed to deploy switches in summer2003 to Cherokee, Crestwood, La Follette and Lapham. The next priority sites for switch deployments, as soon as funding commitments are possible, are Memorial, West and East. Costs associated with F03 and planned F04 switch upgrade projects are presented below under Expenditures. [see [Appendix F](#): 1 page summary of LAN upgrade costs per building]

### Novell Servers:

MMSD currently has 97 file servers, 42 of which are out of warranty and should be replaced. [see [Appendix G](#): 2 page summary of district servers, acquisition dates and backup schedules] However, Technical Services will replace only 10 in summer 2004 to save money in the short term and prepare for a consolidated server environment should MMSD be able to move forward with WAN upgrades. Improving WAN throughput would enable the physical redeployment of servers from schools back to the Doyle Building and

### 2002-03

Bldg	TEACH	non-TEACH	Total
West	\$129,000	\$55,000	\$184,000
LaFollette	\$500,000	\$20,000	\$520,000
Crestwood	\$172,000	\$367,000	\$539,000
Cherokee	\$152,603	\$422,077	\$574,680
Total F03	\$953,603	\$864,077	\$1,817,680

### 2003-04

Lake View	\$128,233	\$298,725	\$555,191
Midvale	\$76,810	\$43,748	\$197,368
Shorewood	\$260,053	\$218,243	\$738,349
East	\$206,854	\$306,915	\$720,623
Memorial	\$190,203	\$195,250	\$575,656
West	\$126,901	\$162,800	\$416,602
Hamilton	\$135,585	\$44,025	\$315,195
Total F04	\$1,124,639	\$1,269,706	\$3,518,984

Note: costs on page 2 only reflect the costs of switches

the clustering of servers which will both reduce the number of servers as well as increase their reliability. (Should WAN communication speeds not be upgraded by summer 2005, many additional Novell servers will need to be replaced in F05.) Technical Services has been advised by consultants that MMSD will need to upgrade server specifications in order to upgrade to the next version of Novell (Netware 6, which was released in 2001). Upgrading to Netware 6 is important to as it is required to support newer versions of GroupWise and newer Web tools. (Further, Novell will be releasing Netware 6.5 in summer 2003, so MMSD will be 2 versions behind, and Novell is requiring that all Netware trained support people upgrade their Novell Certification to Netware 6 by 1Nov.2003.)

Although some servers provide other specialized functions, MMSDs 72 Novell servers are the primary application and data storage servers in district buildings. All Novell servers in schools must have additional hard drives installed in summer 2003 to provide data storage capacity required for F04. To accomplish this 10 of the 24 servers purchased in 2000 will be replaced.

OS	1995	1996	1997	1998	1999	2000	2001	2002	2003	?	Total
AS400			6			1				1	8
Linux				1				6			7
NT 4			1	1	4	4					10
NW 5.1	2			1	4	24	7	23		1	62
UNIX				5							5
VAX/VMS		1									1
Win2000							2	1			3
Win95					1						1
<b>Total</b>	<b>2</b>	<b>1</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>29</b>	<b>9</b>	<b>30</b>		<b>2</b>	<b>97</b>

Hard drives removed from replaced servers, along with 25 new hard drives, will then be distributed among all school-based Novell servers, increasing their storage capacity sufficiently to get them through the new, 2003-04 school year. The first table under Expenditures, below, summarizes purchases and planned deployments in spring and summer 2003 associated with Novell server replacements and upgrades.

As a consequence of Novell server purchases and hard drive deployments and redeployments, Technical Services will insure that by fall 2003:

- each elementary school has a 50% increase in hard drive storage capacity from 36 to 54 G (except Chavez, which currently has sufficient capacity)
- each middle school has a 100% increase in hard drive storage capacity from 36 G to 72 G
- each high school has a 100% increase in hard drive storage capacity from 72 G to 144 G

Technical Services will purchase all 25 of the hard drives (shown in line 3 of the table below), plus 2 of the 6 servers (shown below in line 4) on F03 funds, at a cost of \$12,319. The remaining \$32,824 will be spent in July on F04 funds.

**Expenditures:**

Novell server replacements & upgrades <u>spring03</u> & F04:		unit \$	#	extend.\$	F03 funds	F04 funds
1	replace current 4 high school IBM xSeries 230 and 232 servers with new servers	\$4,950.00	4	\$19,800.00		\$19,800.00
2	purchase spare hard drives:					
	IBM 73.4GB 10K Ultra320 SCSI Hot-Swap SL HDD (for high schools)	\$577.00	1	\$577.00		\$577.00
	IBM 36.4GB 10K Ultra320 SCSI Hot-Swap SL HDD (for other schools)	\$259.00	1	\$259.00		\$259.00
3	upgrade <b>xx</b> IBM xSeries 230 and 232 servers with added drive space: IBM 18.2GB Ultra160 10K HD	\$249.00	25	\$6,225.00	\$6,225.00	
4	replace current 6 IBM Netfinity 5000 servers at Sherman, Okeeffe, Black Hawk, Whitehorse, Sennett, and Pflaum with new servers	\$3,047.00	6	\$18,282.00	\$6,094.00	\$12,188.00
<b>Total:</b>		<b>\$45,143.00</b>			<b>\$12,319.00</b>	<b>\$32,824.00</b>

	F03		F04	
	Tech.Serv	other \$	Tech.Serv	other \$ ?
Novell server replacements (previous to F03, usually have spent ~ \$45,000 per yr) [F03 expenses at the left represent \$21,987 spent in summer02 + \$12,319 spent in spring03]	\$34,306		\$32,824	
Novell maintenance	\$66,000		\$66,000	
Consulting to review LAN performance & switch planning	\$49,028			
Switches:				
spares, hubs & other WAN cabling costs	\$45,712			
La Follette	\$79,550			
Chavez		\$72,000		
Hamilton/Van Hise		\$42,000		
Cherokee				20,724
Crestwood				\$17,733
Lapham			\$18,933	
Memorial			\$113,552	
East			\$86,448	\$31,247
West				\$92,789
WiscNet access	\$47,261		\$47,261	
eRate reimbursement for WiscNet	[\$24,576]		[\$24,576]	
<b>Totals:</b>	\$297,281	\$114,000	\$340,442	\$162,493

**FTE:**

LAN communications are managed by parts of 3 Technical Specialist positions, 1 Technical Operations position and 2 MicroTech Supervisor positions; Novell server management requires parts of 2 Technical Specialist positions, with parts of work assigned to 13 MicroTechs and 2 MicroTech Supervisors [est. 1 FTE]

**Effectiveness:**

Server consolidation, enabled by improvements in WAN communications speeds would:

- dramatically improve technical staff effectiveness in support of server hardware and software, including improving efficiency with software upgrades, security management and data backups
- dramatically improve ability to manage disaster recovery efforts; server consolidation must be done in concert with off-site data storage and strategies for easy hardware replacement
- clustering servers reduces downtime and increases reliability

## C. Backup System:

### Background:

MMSDs data backup system currently consists of several parts:

1. tape backup hardware and software running off specialized servers, which capture data from approximately 90 servers; 72 of these servers are Novell servers [see background on MMSD servers on pages 5-7 and listing of servers in Appendix G], supporting building specific applications and local data storage, hosting district-wide applications such as GroupWise, or performing other specialized functions; servers with other operating systems including UNIX, Linux and NT perform specialized WAN security and Internet traffic functions and are also backed up by the systems backing up data from Novell servers
2. dedicated backup servers hosting the “Novell server” backup systems
3. archiving software on our Internet server dedicated to capture incoming and outgoing Internet email
4. AS400 server dedicated tape systems directly associated with our 7 distributed AS400 servers

Collectively, our current tape backup systems include 4 different tape sizes, 2 types dedicated to AS400 systems and 2 dedicated to all other servers. These systems currently backup over 2 terabytes (TB) of data. Data volume is expected to grow to nearly 3 TB by spring 2004. As a consequence of our T1 inter-building communications speed and the work load required of our backup systems, our distributed Novell servers have full backups only 1x/mo and incrementals only 1x/wk. Depending on which AS400 (and because they host financial and student record data), it is backed up either incrementally or full, nightly.

### Key concerns:

1. The backup system on the non-AS400 servers does not permit nightly incremental backups of distributed servers and is expensive and technically time consuming to maintain. It also consumes tapes at the rate of 25 tapes per month [at a cost of \$50/tape = \$1,250/mo = \$15,000 per year].
2. The backup system on the AS400s is slow, as our spring 2003 recovery effort from MOM being down (10-12Feb2003) demonstrated. This event required over 24 hours to restore data tapes, plus over 10 hours of additional technical labor. Problems from this event were mitigated by the good fortune of coincidence of timing prior to the print run of one of the smaller payroll cycles. One consideration had been the replacement of at least, the tape system on MOM, at an estimated cost of \$10,000 (before one counts for additional required tapes). Unfortunately, this plan would not address upgrades to tape backup systems necessary on at least the 4 high school AS400s.

### Planning review:

In our ongoing effort to review strategies to improve the efficiency of our backup systems, as well as reduce the considerable time required by our most technical staff to comply with Open Records requests, we have annually reviewed MMSD’s backup system processes. Our most recent backup system review was conducted in Mar.2003 and our conclusion was to proceed with the acquisition and deployment of Tivoli Storage Manager (TSM). TSM features include:

1. it is the only system that can backup all of MMSDs server operating systems, including AS400, Novell, Microsoft and Linux: Technical Services can replace 4 different existing backup systems with 1, dramatically reducing complexity
2. saving money on tapes and storage space: Our current system streams data to tapes. Data is not gracefully segregated, thus all tapes must be retained for 7 years to satisfy legal requirements for data access. TSM steams data to hard drive media, then to tape. This allows Technical Services staff to review data stored to hard drive media and segregate subsets of data that require archiving for 7 years. The subset of data critical for disaster recovery can be directed to separate tapes that can be erased and reused over time.
3. backup schedules can be condensed, consequently reducing data loss: As our current backup system streams data to tapes (only at night when users are not accessing servers), the number of server backups performed (and the volume of data captured) each night is limited by the number of tape drives available (our current system for non-AS400 servers has 3, 1 for Doyle servers, and 2

for remote sites) and the data speed on our Wide Area Network (WAN). Due to current backup speeds, most school's servers get a full backup only once a month, with incrementals once per week. Since TSM stores data on hard drive media before it is stored to tape, it can store more data faster at night and then allow backups to tape to be "off-line" at any other time of the day or night. This will allow a higher frequency of server backups, reducing risks of data loss if/when servers in buildings fail.

4. better disaster recovery preparedness: If our current backup system were to fail, Technical Services would need to order replacement hardware, set it up, and then restore data. Since TSM is used by most state agencies as well as UW campuses (as well as Berbee) if the TSM system failed, MMSD tapes could be taken to another local compatible system, and data could be remotely restored to MMSD servers immediately. Once fiber links Pflaum Rd to Doyle, data backups could be streamed between hard drive media at each site dramatically improving disaster preparedness and eliminating the need to acquire more tapes.
5. reduced labor cost for Open Records requests: MMSD's current backup system requires Technical Services staff to load large numbers of tapes to restore files needed to comply with Open Records requests. When MMSD's current tape drives are in use, other data tapes can not be loaded until any current backup process is completed or backup libraries can become corrupted. TSM also has higher capacity tapes which will further reduce tape handling requirements and in many cases, should make it possible to restore data without any manual changes of tapes.

**Expenditures:**

	<b>F03</b>	<b>F04</b>
backup tapes & supplies for old system	\$20,729	
tape library system: Berbee	\$51,465	
server host: Inacom	\$6,844	
Tivoli software: Berbee		\$23,629
consulting for setup: Berbee		\$7,500
BRMS software for AS400s		\$12,754
	<b>\$79,038</b>	<b>\$43,883</b>

Note:

- The only alternative to this backup system approach would have been to replace the current aging backup servers add another one and purchase a new tape library system like the current ones on the old servers. This approach would have cost \$54,000 in F04, with an additional annual cost of \$15,000 for tapes, sustained the current technical complexity, not sufficiently addressed the increasing demands of data volume and not responsibly addressed disaster recovery planning concerns. (This approach also would not have addressed the AS400 backup needs referred to on the previous page, and Technical Services would have had to move forward with upgrading the AS400 backup system for the Doyle building at an additional \$10,000.)
- The BRMS software is required for installation on the AS400's to enable TSM.

**FTE:**

Backup system management requires parts of 3 Technical Operations positions and 2 Technical Specialist positions; managing responses to Open Records requests requires parts of 3 Technical Specialist positions [est. 0.7 FTE]

**Student Impact:**

Insuring rapid recovery from hardware or software failures is a critical Technical Services responsibility. Complying with legal responsibilities for data storage and Open Records requests does not appear to directly relate to an impact on student learning, but is a critical district responsibility

**Effectiveness:**

Maintaining our current data backup frequency is a minimum responsibility. Increasing the frequency of backups and reducing the time required to recover from server downs increases the efficiency of all district staff for all instructional and support functions.

## D. Security:

### Background:

MMSD's technical security system consists of several parts:

1. MMSD's network is protected from an Internet-based hacker attack by a Cisco PIX Firewall; there are no portals open to allow network access from the Internet
2. A Cisco remote access server, using 2 additional access servers running Citrix, authenticate all users of the 96 56K remote dial-in access lines
3. A VPN (Virtual Private Network), in production since Feb.2003, provides security by moving data through an encrypted communications channel with access through 2 Citrix servers. [see Appendix H for a graphic of remote access options to MMSD's network]
4. Servers and desktops are protected from virus attack by Command Anti-virus. Upgrades to the software version (which occur approximately every 6 months) and upgrades to the definition files (which occur weekly or more often) are auto-deployed from the vendor's servers to a server in Doyle and then auto-deployed to each Novell server throughout the district. Updates are then configured to auto-deploy to each desktop at the next user login. This works for PCs within our WAN environment but not for Macs.

Because of the critical nature of network security, consultants were hired in spring 2003 to review security features of MMSD's WAN and LAN configuration and the Internet email server. [see a summary of recommendations, presented in Gantt chart form, in Appendix I; the full report is available on CD from Technical Services, but is not being circulated as it contains server passwords, key IP addresses and would increase security risks.]

A key service, included here within "Security", is our VPN, described above under Background, #3. The VPN is designed to replace our higher security risk, and less elegant to use, modem pool (see the center top area of the graphic presentation of our WAN in Appendix A). The modem pool was designed to enable external users access to MMSD's servers for data entry. [see Appendix J for a 1 page summary regarding External Access to MMSD's Network] As an alternative, VPN service allows staff to access Citrix servers securely from any remote location. MMSD's current Citrix servers are 4 years old and are not designed to service the number of users anticipated by Dec.2003. With the anticipated dramatic increase in users of remote grade reporting (associated with needs to comply with NCLB) in the 2003-04 school year, these Citrix servers must be replaced with newer and faster servers to handle traffic and insure adequate performance. (Upgrades to the Citrix server system [= \$25,400] may be delayed until Dec.2003. Urgency for this upgrade will be reassessed to either implement by Jan.2004 or delay until July 2004.)

In addition to remote access options just described, Technical Services also supports alternate MMSD educational sites which access MMSD network services via DSL, cable modem and dial-up options. A summary of these options is listed in Appendix K.

### Expenditures:

	F03	F04
Security consulting review of MMSD's network	\$32,000	
Security consulting & upgrade to Internet email server	\$7,263	
PIX Firewall maintenance: (budgeted under Infrastructure:WAN: Cisco SmartNet @ \$37,350/yr)		
Command Anti-virus software annual maintenance	\$17,258	\$25,119
Citrix maintenance	\$2,000	\$2,000
Citrix server upgrades (review need in Dec.2003):		
servers: rack-mounted IBM xSeries 225 2.8 GHz 1.5 G RAM		\$7,700
software: Citrix Metaframe XPa/Windows 2000 Terminal Server for 2 servers with 60 client licenses		\$13,200
configuration setup and consulting		\$4,500
<b>Totals:</b>	<b>\$58,521</b>	<b>\$52,519</b>

Note: Anti-virus software cost increases are due to both a rise in price, as well as the need to catch up with the number of required desktop licenses.

**FTE:**

Managing MMSDs Internet and network security requires parts of 3 Technical Specialists and 1 MicroTech Supervisor, with some work assignments cascaded to 13 MicroTechs [est. 0.6 FTE]

**Student Impact:**

MMSD is a district with a \$292 million annual budget, student records for 25,000 students and Social Security #s and personnel records for 5,000 staff. Insuring data security is a critical legal and ethical responsibility. Further, insuring that data, software and hardware are not corrupted or incapacitated by hacker attack or computer viruses, clearly helps insure the best quality working and learning environment.

**Effectiveness:**

Maintaining secure and reliable data and maintaining the functionality of MMSDs computing infrastructure is critical to providing the most effective learning and working environment for the students and staff of MMSD.

## 2. Desktop Environment:

As of January 2003, MMSD had just under 8,600 desktop computers in inventory. MMSD's inventory is segregated into Administrative and Instructional computers, although this division is somewhat arbitrary in some cases. This division has been used for budgetary reasons. Because some budget allocations may persist using this division in the near term, desktop computer issues are addressed below, separately for administrative vs. instructional computers. [see [Appendix L](#) for a summary of MMSD's desktop computer inventory]

### A. Administrative:

#### Background:

1,233 computers are identified as "Administrative." 75% of these computers are distributed among instructional building level staff, while the rest are deployed for staff at Doyle, Pflaum Rd and at Hoyt. [see [Appendix M](#) for a summary of administrative computers]

#### Note:

1. 100 additional PCs are required for ESL teachers within the 2003 calendar year
2. at least 150 administrative computers should be replaced and another 470 should at least have RAM added within the 2003 calendar year to enable staff to use software necessary for their job requirements ([est. \$800 / new machine x 150 = \$120,000] + [ \$23 / RAM upgrade x 470 machines = \$10,810])
3. the newest 30 PCs in F03 were allocated to custodians to enable them to use the Honeywell building management software

This would enable MMSD to junk 150 of the oldest computers used by administrative staff and keep in service 470 aging machines through RAM upgrades. This purchase plan would also provide 100 machines needed for ESL teachers in the 2003-04 school year for student performance reporting.

Over the past 3 years, between \$160,000 and \$190,000 has been allocated annually to replace administrative computers and printers. Due to competing budget needs, Technical Services spent \$140,000 on computers, printers and data projectors in F03 (and over \$40,000 of this was actually to purchase computers, printers and data projectors for school-based instructional needs out of money allocated for administrative needs). [see [Appendix N](#) for detail summary of Technical Services' F03 expenses]

If the current 1,233 plus the additional 100 PCs needed for ESL (see # 1 under Note above) were on a 3 year replacement cycle, and an average of \$800 per machine was used as a basis for budget planning, Technical Services would spend  $(1,333/3) \times \$800 = \$355,000$  per year on administrative computers. The strategy to replace only the worst 150 machines and upgrade memory on others (as presented under Expenditures below) is an interim approach to minimize costs in F04. [unit price of \$800 can be reduced with volume purchases]

**Note:** This administrative computer plan does NOT address providing additional computers and printers within schools to make computers more accessible for teachers in response to new grade reporting requirements. This could require up to 725 additional computers for elementary schools, alone. Rather, if local classroom computers are not sufficient to support grade reporting software, teachers may be required to enter grades from machines in their LMCs.

#### Expenditures:

all expenditures from Technical Services budget:	F03	F04
administrative computers/printers/data projectors	\$100,000	
100 new PCs for ESL		\$80,000
replace 150 machines		\$120,000
add RAM (@ \$23) to 470 machines		\$10,810
<b>Totals:</b>	<b>\$100,000</b>	<b>\$210,810</b>

**Student Impact:**

49% of all administrative computers are directly allocated to support the needs of special education staff, psychologists, social workers and nurses while another 26% serve instructional building-level administrative/support functions. These computers most directly impact the daily life of students. The remaining 25% of administrative PCs serve all the administrative and support functions of staff in Doyle, Hoyt and Pflaum Rd who provide the majority of student, HR and financial data management necessary to run the \$292 million (annual) district budget.

**Service Delivery:**

Older computers are often unable to support newer desktop software or newer Internet-based data reporting applications and become a barrier to effective use of productivity tools. Further, older computers often will not let Technical Services fully utilize management tools to improve network management and more efficiently deploy anti-virus software and application upgrades.

## B. Instructional:

### Background:

Of just under 8,600 desktop computers, approximately 7,367 are allocated for instructional use. Over the past 3 years, in an effort to replace as many very old computers as possible with inadequate funds, 43% of the ~1,600 computers acquired each year have been cheaper, refurbished older model machines. As of spring 2003, MMSD still has 24% of its computers which are over 8 years of age and should be removed from service as soon as possible and an additional 32% (which are between 6 and 8 years old) considered minimally functional. [see [Appendix L](#) for a summary of MMSD's desktop computer inventory]

The table below summarizes computers purchased since 1July2000 and areas where each has been deployed:

	Processor:								Functional Area:			
	Total:	Mac	refurb. P	refurb. PII	other	Celeron	PIII	P4	Admin	LMC	Sped Ed	Instruct
FY01	1,620	193	195	32	0	1,155	45		143	113	367	997
FY02	1,651	23	421	376	0	651	152	28	533	17	65	1,036
FY03	1,625	1	0	1,089	1	403	12	119	167	5	77	1,376
<b>Totals:</b>	<b>4,896</b>	<b>217</b>	<b>616</b>	<b>1,497</b>	<b>1</b>	<b>2,209</b>	<b>209</b>	<b>147</b>	<b>843</b>	<b>135</b>	<b>509</b>	<b>3,409</b>

**Note:** This summary shows that approximately 19% of MMSD's 8,600 desktop computers have been replaced in each of the past 3 years, and that 43% of these replacement machines were refurbished (already about 6 years old, on average) when acquired. This represents an overall district replacement life cycle of approximately 8.5 years.

**IF** MMSD accepts the current student per computer ratio of 3.4 children per instructional machine (based on 7,367 instructional computers), and **IF** MMSD wished to maintain a 3 year replacement life cycle for all computers (8,600: both instructional and administrative), at a cost estimate of \$650 per PC [unit prices as low as \$600 for new machines can be negotiated depending on volume], MMSD would need to invest over \$1.8 mil/yr to replace 2,866 computers/yr. As of spring 2003, since over 50% of MMSD's inventory is at least 6 years old and ideally would be replaced within 1 year, MMSD would replace at least 4,000 computers by spring 2004. This would cost approximately \$2.6 million, if machines were replaced with new machines. **After** the oldest portion of MMSD's desktop inventory had been replaced to catch up to a minimum baseline of acceptable machines, there are alternative strategies to sustain a functional inventory. Alternative strategies to plan replacements of MMSD's computers are listed below:

Option #	Option	annual cost
1.	get to a 3 year replacement cycle on 9,000 computers = 3,000 x \$650	\$1,950,000
2.	get to a 4 year replacement cycle on 9,000 computers = 2,250 x \$650	\$1,462,500
3.	get to a 3 year replacement cycle on all high school, middle school computer lab, LMC and admin/support computers, and then: cascade 3 yr old machines (to maintain 3-6 year old machines) to non-lab & non-LMC middle school needs, and non-LMC elementary school needs = (2,200 high school machines) + (est. 275 middle school lab machines) + (est. 700 LMC machines) + (1,233 admin/support staff machines) =~ 4,400; 4,400/3 = 1,466; 1,500 new machines each year x \$650	\$975,000
4.	depend on the purchases of refurbished computers (which average 6 years old when acquired by MMSD), purchased at ~45% the cost of new machines; 1,000 refurbished machines @ \$300 = \$300,000 vs. 1,000 new @ \$650 = \$650,000	
5.	depend on acquiring donated computers (which are normally 6+ years old when acquired by MMSD) being removed from service by other public or private sector agencies (this strategy is not sanctioned from state agencies and has thus far been unreliable & in too small of a volume from the private sector)	

From a Total Cost of Ownership approach, MMSD should acquire new machines rather than used machines. One strategy to acquire new computers would be via lease-purchase. MMSD could purchase a minimum of 1,000 new PCs with 3 year financing at \$200,000 per year, which translates into \$600 per unit. A budget draft regarding the use of TEACH Block grant funds received in February 2003 for desktop computers is presented below within the Expenditures section and summarized on page 2 of this document in the Technology Budget Plan.

Based on an MMSD 8 year “productive life” (which is considerably longer than the industry standard of 3-4 years), buying 6 year old machines for an average of \$300 would translate into an annual cost of ~ \$150 for the next 2 years of use (disregarding other life cycle costs).  
 Purchasing new machines at \$600 to \$800 would translate into an annual cost of ~\$75 to \$100 over 8 years.

Regardless, MMSD should provide an adequate budget for an annual replacement life cycle, with associated budget allocations to insure that:

- students have adequate technology in their classrooms
- teachers have reliable machines enabling them to use current curricula and administrative tools for attendance, grade reporting and communication
- support staff have adequate tools to support the district’s instructional staff and efficiently perform administrative responsibilities

**Expenditures:**

Instructional technology:	F03			F04
	Tech.Serv	TEACH	bldg/grant \$	TEACH
computers/printers/data projectors	\$40,000	\$485,366	\$62,246	\$430,000
software		\$19,819	\$103,575	\$100,000
<b>Total:</b>	<b>\$40,000</b>	<b>\$505,185</b>	<b>\$165,821</b>	<b>\$530,000</b>

Note:

- see **Appendix O** for a summary of building-level and grant funded technology-related acquisitions made in F03
- TEACH Block Grant funds from February 2003, listed under F04 in the table above, summarizes a draft budget plan

**Effectiveness:**

See the June 2003 Instructional Technology Plan prepared by Teaching and Learning staff.

**Service Delivery:**

Older computers are often unable to support newer desktop software or newer Internet-based curricula (the latter often require newer browsers) and become a barrier to effective use in classrooms. Further, older computers often will not let Technical Services fully utilize management tools to improve network management and more efficiently deploy anti-virus software and application upgrades.

### 3. Applications:

#### A. Business Operations:

##### **Background:**

A review of MMSDs business operations is being conducted by Davidson Services.

Business operations is segregated into the following parts:

1. Finance
2. HR: Human Resources current projects include the Time Clock Project, On-line applications...
3. Building Management: current projects include Honeywell Building Controls, improving linkages between site-specific data and AutoCAD files
4. Food Services: current projects include Pt-of-Sale upgrades and B2B food ordering & meal preparation processes

Technical Services staff perform key support roles for operations, particularly with respect to AS400 business functions involving finance and HR. Services include:

1. Support for the AS400s, including:
  - production job management (for all AS400 sites)
  - backup management
  - hardware & communications management
2. Print job management, including:

Doyle-based printing of over 1,000,000 pgs /yr of all production paychecks, labels, etc. (includes ~ 68 different specialty, project-specific forms); printing done between 6am and 10pm, in 2 shifts)

[Note: additional printing, performed by operations staff, associated with grade reports, attendance and other student data responsibilities is addressed in the section on Applications: Student Data]

##### **Expenditures:**

Operations, excluding Electronic Repair: \$465,000

##### **FTE:**

Most of 3 operations staff positions are allocated to business operations functions. [est. 2.6 FTE]

##### **Student Impact:**

Support for business operations computing and its associated printing functions has a direct impact on our entire student support infrastructure.

##### **Effectiveness:**

Insuring MMSD meets its business and student data functions is critical. We must improve our business processes to more efficiently use technology and our technical support staff.

##### **Redundancies or Availability of the Service Elsewhere:**

In the past year, some printing functions previously performed solely in Doyle have been cascaded back to individual schools. Due to the complexity of forms and due to some security issues, based on current business processes, over 85% of the printing functions that remain in Doyle, continue to require Technical Services support.

## **B. Student Data:**

### **Background:**

MMSD's AS400s host all student data on our 25,000 students. (In addition, either on these servers or stored on backup tapes are all of the additional student records for the preceding 7 years.) Student data includes the following kinds of information:

1. grades
2. attendance
3. transcripts
4. suspensions and disciplinary information
5. scheduling information (with links to teacher load & class size information)
6. information on children participating in special programs (including IEPs & ESL data)
7. all test scores
8. enrollment & registration information

### **FTE:**

Research and Evaluation staff include 3 programmers, a user support specialist, 2 research and data analysts, 1 psychologist, 1 sr. program assistant and 1 team director

Technical Services staff allocated to technical operations also serve this functional area; est. 0.3 FTE for printing all student area reports including attendance data & forms, grade reports, etc.

## C. Data Administration:

### **Background:**

MMSD's student, human resources and financial data are maintained on the district's 7 AS400s. It is critical that these data are properly organized, accurate and readily accessible both to serve business needs and meet legal reporting requirements. Rules of data normalization must be followed to maintain an efficient relational database. Data modeling diagrams, flowcharts, and metadata repository tools help insure data quality and aid in the collection of new data as well as facilitate meeting new data reporting requirements.

### **Expenditures:**

front-end tools to access the data warehouse: \$20,000 in F03

## 4. Staff Training:

Staff training consists of training for both technical staff and end-users. End-user training within the category of “productivity tools” includes:

- Acceptable Use Policy (AUP), Ethics & Copyright
- Network Access & File Management
- Standard Application Suite
- Email: GroupWise & Eudora
- Internet Use

For a review of staff training as it relates to integrating technology within instruction, see the June 2003 Instructional Technology Plan prepared by Teaching and Learning staff.

### A. Technical Staff:

#### Background:

Technical staff have especially high demands placed on their efforts to stay current with technology, whether it pertains to advances in hardware, operating systems, application software and drivers, anti-virus and security measures, WAN and LAN network management tools, requirements of new peripherals, etc. All these technical skills are made all the more demanding, the more complex our technical environment becomes. In the past few years, we have focused technical staff training on Netware and ZenWorks (Novell server and LAN management tools), desktop operating systems, router support and GroupWise administration, as well as to support technical certification costs, per MOUs with MTI. Among the 28 staff in our Division, we hold a total of 29 technical certifications. (see Appendix P)

#### Expenditures:

Training for Technical Services staff:

F02:	\$36,102
F03:	\$15,000

An on-line training package currently available for both end-user and technical staff training, would cost approximately \$16,000 for unlimited access (for 16 people for 1 year) to a menu of productivity tools application training, plus technical training to facilitate preparation for certification exams, plus access to an on-line library of technical resources. This approach may be used in F04.

## **B. End-users:**

### **Background:**

#### Productivity Tools:

We refer to basic technology skills for district staff within the umbrella of “Productivity Tools.” These skills include understanding of and/or proficiency with the following:

- Acceptable Use Policy (AUP), Ethics & Copyright
- Network Access & File Management
- Standard Application Suite
- Email: GroupWise & Eudora
- Internet Use

As a budget cut, the district eliminated the position for a Productivity Tools Trainer in the Technical Services Division in F02. Although Technical Services continues to support 2 technology training labs at the Hoyt building, approximately \$15,000 allocated to support end-user training in productivity tools was cut from the Technical Services budget for F03. It is a concern to many people in the district, how ineffective many district employees are in their ability to exploit the functions available within the core software application suite made available on all district computers. Not only does this result in reduced efficiency of instruction and support activities, but often results in efforts to purchase specialized software products which have redundant features to tools already available on the desktop. Buying more products costs additional money and further compounds technical support challenges.

One approach taken by Technical Services during the past 2 years has been the hiring of one district middle school computer teacher, on an as needed and/or as requested basis. She has taught specific productivity tools skills to staff within schools when requested by a principal or when schools have been actively migrated from a mixed platform site to an all PC building.

#### Instructional Integration:

Another aspect of end-user technical training as it specifically relates to instruction is helping train teachers to effectively infuse technology in the education of our district’s children. This issue is addressed within the June 2003 Instructional Technology Plan.

### **Expenditures:**

The use of a middle school computer teacher to provide end-user training has cost Technical Services less than \$2,000 per year for each of the past 2 years. Any other costs have been external to the Technical Services budget for the past 2 years and have been funded within other local building-level budget areas.