



North Central Regional
Technology in Education Consortium
at



A Report and Estimating Tool for
K-12 School Districts

Texas District Case Study

March 2004

Consortium for School Networking

Introduction..... 1
Overview and General Setting..... 2
Cost of Ownership Metrics..... 4
Interpretation of TCO Metrics..... 5
 Hardware costs..... 5
 Direct labor cost..... 5
 The indirect labor cost..... 5
 External service provider costs..... 6
 Printer supply costs..... 6
 Network costs..... 6
2004 Focus Initiatives..... 7
 Voice/Data Integration and Network Costs..... 7
 Wireless Notebook Computers on Carts..... 8
TCO Processes..... 9
Definitions..... 10
Related Documents..... 12
Contact Information..... 13



Texas District Case Study

Introduction

The four 2004 Total Cost of Ownership (TCO) case studies were developed by CoSN, thanks to a grant from the U.S. Department of Education and cooperation of the case study school districts. These case studies are presented in the same format as the 2003 studies, but also have a focus on additional technologies beyond the base distributed computing model. These new technologies are voice/data integration, wireless networking, and e-learning.

From a technical perspective, the scope of the project included end-user computing devices, network servers, local area network hardware, and the labor costs associated with each of these components. Software, application service providers, content and curriculum development, and staff development and training were included as well.

Data from each district was used to develop a case study that reports pertinent TCO metrics, discusses the TCO process as related to the district, and provides background information on the district and the distributed computing environment. The metrics represent a baseline for the district; and from this baseline data, a trending analysis can be performed. In addition, the process for data collection should be refined, over time, as a first time TCO analysis often requires a great deal of manual effort. Comparisons of one's district to TCO studies of other districts are difficult to analyze, as there are many variables for differentiation.

For the 2004 case studies, indirect labor (i.e. the time users spend in performing routine system functions, dealing with system problems and receiving training) was based on user survey data. Understandably, the indirect labor cost estimates for the 2004 studies is higher than the published 2003 case studies, in which indirect labor was based on estimates by staff in the computer services department.

There are five sections to each case study. The first is an overview of the district and the general setting of the distributed computing environment. The second section contains the TCO metrics. The third section includes an interpretation of key selected TCO metrics. The fourth section provides a review of the district's participation in the 2004 case study focus initiatives of wireless communications, voice/data integration, and e-learning technologies. The fifth and final section discusses the TCO processes related to the district.



Overview and General Setting

The Texas case study school district is a fast-growing, primarily suburban district with 35,500 students on 42 campuses. The campuses are organized geographically into four Learning Communities. Each Learning Community consists of a high school and the feeder elementary and middle schools. Installed technology includes almost 15,000 Windows-based client computers located in classrooms, administrative offices, 99 shared computer facilities including computer labs and libraries, and 230 mobile computer carts with 16 wireless notebook computers per cart. The campuses are wired with enhanced category 5 data cable and run 100 mbps Ethernet on campus-based local area networks (LANs). The campus LANs are connected to a fiber wide area network (WAN), which includes 192 Windows and Unix servers plus a digital voice PBX. The fiber WAN is a high-capacity, high-speed, redundant fiber WAN carrying voice, video, and data traffic.

Much of the capital investment in new technology hardware has come from bond issues involving new school construction or major renovations of existing schools. All major purchases are amortized according to a realistic depreciation schedule, so that replacement requirements can be projected. Using a five-year “refresh cycle” has resulted in only 6 percent of the client computers being older than five years. According to a predetermined five-year schedule, each campus has money allocated to infuse new technology (i.e. “refresh” the technology available to students and staff), reallocate existing technology for other uses, or retire older technology that no longer meets the instructional needs of the students or staff.

First-level user support is provided by 24 campus-based, teacher-certified professionals who report to their respective Learning Communities. The computer services department coordinates the implementation of technology initiatives and provides a centralized help desk and second-level support for instructional computing, administrative computing (i.e. business/student applications and programming support), repair of computers and peripheral equipment, and support for voice and audio-visual technology. The district computer services department consists of 28 full-time staff, plus two part-time people. Recent reductions in the number of first-level campus-based support personnel have forced an accelerated removal of outdated equipment, in an effort to minimize the number of computer-support requests.

The district believes in making client computers generally available to students by providing 12 to 16 computers in elementary school libraries, 18 computers in middle school libraries and 40+ computers in high school libraries. The district has a respectable ratio of 3.46 students per available computer.

Recent district technology initiatives include: implementation of the fiber wide-area-network, which connects all campuses and administrative facilities with voice and data resources; development of a comprehensive web site, including parent access and online course registration for secondary students; creation of a centralized library system and consolidated catalog; implementation of a district-wide online attendance and grade book application;



implementation of centralized external email management, and the creation of a flexible computing environment based on mobile wireless notebook carts.



Cost of Ownership Metrics

1. Overall Cost

Unit	Total Cost	Direct Cost	Indirect Labor Cost
Overall District Cost	\$34,320,397	\$10,833,682	\$23,486,715
District Cost per Client Computer	\$2,341	\$739	\$1,602

2. Direct Cost by Category

Unit	Hardware	Software	Direct Labor	External Application Providers
District Cost	\$5,819,472	\$1,576,647	\$3,270,783	\$166,780
District Cost per Client Computer	\$397	\$108	\$223	\$11

3. Hardware Cost by Category

Unit	Client Computer	Server	Network	Printer	Supplies
District Cost	\$3,827,405	\$806,400	\$502,286	\$300,000	\$383,381
District Cost per Client Computer	\$261	\$55	\$34	\$20	\$26

4. Asset Metrics

Category of District Resource	Ratio
Students per Student Dedicated Client Computer	3.46
Teachers per Teacher Dedicated Client Computer	0.76
Non-Classroom Personnel per Non-Classroom Client Computer	1.17
Total Users per Total Client Computers	2.70
Client Computers per Printer	3.47
Client Computers per Server	76.35

5. Staffing Metrics

Direct Labor Category	Total Cost	Cost Per Client Computer (\$ US)	Client Computers per Staff
Operations and Financial	\$2,677,179	\$183	308
Professional Development and Training	\$296,802	\$20	2,443
Curriculum Development and Support	\$296,802	\$20	2,443
Total Support	\$3,270,783	\$223	246



Interpretation of TCO Metrics

Hardware costs at \$397 per client computer and software costs at \$108 per client computer are above the case study average.

The Texas case-study district strongly believes in spending a little more, when necessary, for the reliability of top-tier equipment and software and in staying current by rotating old equipment out. The value of this decision should be reflected in corresponding lower direct and indirect labor costs. Along with this practice of purchasing quality equipment, the district has a schedule to “refresh” campus-based computers every five years. According to a predetermined schedule, each campus has money allocated to infuse new technology (i.e. “refresh” the technology that is available to students and staff), resulting in the reallocation of existing technology for other uses, and the retirement of older technology that no longer meets the instructional needs of the students or staff. This initiative has worked well for the district, as only 6 percent of the client computer inventory is more than five years old. As client computers over five years old are not given a cost by the TCO tool, 94 percent of the district’s client computers are counted towards this cost – a higher percentage than most of the other case-study districts.

Direct labor cost is low at \$223 per client computer.

The low cost of direct labor is reflected in the standardization of the client computers in the district. This standardization of equipment allows the district to support 308 client computers per computer support (Operations and Financial) staff; provides for minimal client computer downtime; and allows the district to be reimbursed, from the computer manufacturer, for the authorized performance of warranty maintenance on the client computers. The investment in competitive salaries to attract qualified personnel and the use of relatively new, and thus reliable, equipment has allowed the district to support more computers with fewer staff members. There is a concern that a recent reduction in the number of campus-based staff personnel, who are already stretched very thin, may continue. Further reduction in this campus-based direct labor group is expected to lead to deterioration of campus and district service levels, driving indirect labor costs higher.

With an estimated ratio of one technology support person per 2,443 users both for Professional Development and for Training and Curriculum Development and Support, there is minimal investment in providing these functions.

The indirect labor cost at \$1,602 per client is somewhat lower than the other medium and large districts included in the 2004 case studies.

Combined with the relatively low direct labor costs, described above, the value of maintaining standards, attracting qualified staff, and the use of current and quality equipment and software, helps to drive down the Total Cost of Ownership in terms of the important indirect labor component. In order to maintain the relatively low indirect labor costs, this fast-growth district needs to manage the increasing number of students and staff, with similar increases in campus-based support staff to maintain a manageable client computer to support staff ratio. Without a growth of direct labor corresponding with district and computer growth,



it can be expected that indirect labor costs will rise as service levels to users would deteriorate.

At \$11 per client computer, external service provider costs are quite low.

The Texas case-study district has minimal reliance on external service providers. Currently, this district uses an external service provider for staff development registration and record keeping; on-line access to electronic databases; and Internet service, contracted through a local telephone company. Outsourcing applications to external service providers will be monitored as an alternative method of providing quality services at a lower cost.

Printer supply costs are higher than average at \$26 per client computer.

With a large number (3,333) of ink jet printers, and 79 percent of all printers directly attached to a client computer, the ongoing cost of providing this convenience shows up in the cost of ink cartridges. There is a concern that these “convenience printers” are, in some cases, used as expensive “color copiers.”

At \$34 per client computer, network costs may seem high.

However, this cost includes new network gear for the combined voice/data networks in the schools and the district facilities, including the costs related to providing a phone in each classroom and new data switches and routers for the gigabit network infrastructure. This cost includes 25,000 voice and data ports - almost two for each desktop client computer - connecting 9,800 client computers and 6,000 voice handsets. An additional 3,680 wireless notebook computers access the local area networks, using 802.11b wireless access points. The CoSN-Gartner TCO tool does not specifically capture voice communications costs. Costs for a separate voice communications infrastructure would need to be collected and calculated separately. However, when voice and data are merged over the same network, the additional network costs are included and show up as additional total and per-client-computer networking costs. (See “Voice/Data Integration and Network Costs” and “Wireless Notebook Computers on Carts” (below) for more information on these initiatives.)



2004 Focus Initiatives

Voice/Data Integration and Network Costs

By 1996, the district had outgrown the approach of providing telephone systems at each district facility. This approach routed calls through a single switchboard; and during busy times of the day, all of the phone calls could not be answered. The district recognized it needed to provide better communications between parents and teachers and approved a plan to build a district-wide telephone network. The heart of the voice network is a Digital PBX. Each of the 6,000 digital, voice handsets (including one in each classroom) has its own direct phone number and a voice mail box. All 47 district facilities are served by this private phone network, which maximizes the number of external phone lines that are available, while centralizing the telephone carrier trunks at the administration building.

A Fiber WAN Feasibility Study conducted by the district, with the assistance of an independent consultant, concluded that the cost of constructing a privately owned fiber network would be less costly, over a 15-year period, than leasing bandwidth from a telecommunications company. Combining voice and data networks and taking into considerations projected capacity requirements over the 15-year time, the existing 90 T1 communications lines were going to have to grow exponentially in number. Looking at the option of building and owning their own fiber network compared to leasing similar capacity, the numbers showed an out-of-pocket initial cost plus 15-year maintenance expense of about \$33 million for building and owning the fiber network, versus about \$88 million for 15 years of leasing equivalent capacity.

Funding for the fiber project was secured when voters passed a major facilities bond issue with a provision for enhancing technology in the district. The fiber WAN included the installation of fiber cable in a super ring around the 110 square mile district with sub rings connecting the remainder of the campuses. Rather than opting for Voice over IP (VoIP) technology, the district chose to provision multiple 1.55 mbps T1 channels within the fiber to each campus for voice traffic. With the speed and capacity of this fiber network, combined with the ability to securely store data off-site, the district is contemplating providing voice communications, Internet access, and secure data back-up services to other local government entities, to cover the on-going maintenance and support costs for the wide area network.

The WAN and voice equipment costs that are incurred with this wide area network are not included in the analysis. The CoSN-Gartner TCO tool was adopted from Gartner's distributed computing TCO model, which does not address wide area networks. Also, the TCO tool does not specifically capture voice communications costs; costs for a separate voice communications infrastructure would need to be collected and calculated separately. However, when voice and data are merged over the same network, the additional network costs are included and show up in the results as additional total costs, inflating per-client-computer networking costs.



Wireless Notebook Computers on Carts

In 2000, the Texas case-study district implemented mobile wireless notebook computers on carts, reducing the need for classroom space and providing better access to computers for students and teachers. The flexibility inherent in this solution allows the number of computers available to students and teachers to be determined by the curriculum, rather than by the physical placement of computers. Each cart is self-contained, with 16 Windows-based notebook computers, a laser printer and a wireless access point. The carts, which also serve as charging stations, can be placed in the classroom or in the hallway outside of the classroom, depending on available space and network access.

This mobile solution, consisting of 230 carts with a total of 3,680 notebook computers, has saved the data cabling expense (i.e. one network connection for 16 computers), saved classroom space and furniture costs, and resulted in better utilization of computers for classroom instruction. There are still scheduling considerations (similar to a computer lab) which require getting the carts where they need to be at the time specified.

Now that a baseline TCO has been performed, the district plans to specifically evaluate the TCO of the mobile carts. Some preliminary hardware costs (including the cart, printer, access point, and 16 wireless notebook computers) depreciated over five years, are about \$7,000 annually per mobile cart, or \$438 per mobile client computer. Since the initial implementation of the carts, and after addressing power-related issues, ongoing direct labor support appears to be higher when compared to traditional computer labs or classroom computers, partly due to the relatively higher cost of maintaining notebook computers based on the mobility of the notebook computers, and the need to replace expensive batteries.



TCO Processes

The TCO process is new to the Texas case-study district, but staff was able to gather the required data without too much effort. Some of the data required for the TCO analysis needed to be gathered from other departments within the district.

The district discovered that they have about 7 percent fewer desktop computers than originally estimated. Only 6 percent of their client computers are over five years old, indicating that the practice of “refreshing” equipment, (i.e. infusing new computers, reallocating existing equipment based on instructional needs and functionality, and retiring older equipment) is working.

They also noted that the servers are aging. The majority of the servers fall into the three to five-year old category. Thus, the district expects that it will need to replace its servers over the next few years to improve reliability and to be able to transition to new operating systems. Consolidation of servers and server operating systems would result in a lower on-going maintenance cost for the servers.

With the high printer supply costs now documented, the district has a case to migrate from individual ink jet printers to network laser printers.

The Texas case-study district is now in a position to perform more focused studies, such as the specific TCO metrics of their wireless notebook computers on carts.

Going forward, a reliable TCO analysis should become an integral part of the planning process, as the Texas case-study district evaluates the implementation of new technology initiatives.



Definitions

Total Cost Includes all costs within the model. It is a balanced look at what it truly takes to support a computer for the district. The metric includes both Direct and Indirect costs.

Direct Costs Includes all technology and direct labor costs incurred by the school district during the study period (hardware, software, external application providers, and direct labor).

Indirect Costs Includes all of the labor incurred by the user community for the study period. Indirect Labor includes the costs of users supporting one another, time spent in training classes, casual learning, self support, user applications development and downtime costs.

Hardware Includes the annual costs for client computers, peripherals, servers, network equipment, and printers.

Software Includes the annual costs for all software running on client computers and servers. This would include infrastructure software, educational and administrative software, personal productivity software, as well as content and curriculum specific software.

Direct Labor Includes burdened salaries from personnel whose job role includes operations and financial support, professional training, or curriculum development.

External Application Provider

Includes all costs associated with organizations that provide the use of applications, and associated services to customers.

Client Cost per Client Computer

Measures the annualized cost of personal computers, and peripherals divided by the total number of client computers.

Server Cost per Client Computer

Measures the annualized cost of servers divided by the total number of client computers.

Network Cost per Client Computer

Measures the annualized cost of network equipment (hubs/routers/switches, etc.) divided by the total number of client computers.

Printer Cost per Client Computer

Measures the annualized cost of printers divided by the total number of client computers.

Students per Available Client Computer

Includes the total number of students divided by the total number of client computers located in classrooms, libraries, media centers, labs, etc., along with the total number of student dedicated client computers, not including student owned equipment.



Teachers per Teacher Dedicated Client Computer

Includes the total number of classroom teachers divided by the total number of client computers dedicated for use by these individuals.

Non Classroom Personnel per Non Classroom Personnel Client Computer

Includes the total number of non-classroom personnel divided by the number of client computers dedicated for use by these individuals.

Client Computers per Printer

Includes the total number of client computers divided by the total number of printers.

Client Computers per Server

Includes the total number of client computers divided by the total number of servers.

Operations and Financial Cost

Measures the total personnel costs, vendor costs associated with “hands-on” labor, and help desk support around client computers, servers, printers, and network equipment. It also includes any costs around planning and process management, finance and administration (budgeting, procurement, asset management etc.), and physical database administration.

Professional Development and Training costs

Includes training of personnel to provide familiarization, and proficiency with the operation of equipment and software to carry out school tasks whether instructional or administrative.

Curriculum Development and Support costs includes

Labor involved in integrating technology into the teaching and learning process.

Client Computers per Staff Metrics

The number of Operations and Financial, Professional Development and Training, and Curriculum Development and Support personnel are divided by the total number of client computers to create client computers per staff metrics. Looking at the data this way tends to normalize for high or low salaries when making comparisons.



Related Documents

Please refer to these documents (available at the www.classroomtco.org Web site) for additional information regarding TCO in the K-12 environment.

Why Total Cost of Ownership (TCO) Matters

Necessary reading before getting started

Preparing for TCO Analysis

Input fields required for the Web-based TCO Tool and extensions for further evaluations

The Web-based TCO Tool

A review of the Web-based TCO Tool

2003 Case Studies***California District Case Study***

An urban district with 140,000 students

Minnesota District Case Study

A rural district with 4,000 students

Pennsylvania District case Study

A rural district with 2,500 students

Utah District Case Study

A suburban district with 49,000 students

Other 2004 Case Studies***Missouri District Case Study***

A rural district with 450 students

Virginia District Case Study

A suburban/urban district with 166,000 students

Wisconsin District Case Study

An urban district with 21,500 students



Contact Information

The Consortium for School Networking

Name: Rich Kaestner
Editor/TCO Tool Project Coordinator
Telephone: +1-541-929-4589
E-mail: richk@alyrica.net

Name: Sara Fitzgerald
CoSN Taking TCO to the Classroom Project Director
Telephone: +1-703-351-5070
E-mail: sfitzgerald@fundsforlearning.com

