



A Report and Estimating Tool for K-12 School Districts

Pennsylvania District Case Study



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Introduction

In the winter of the 2002–2003 school year, four school districts participated in a Total Cost of Ownership (TCO) of Distributed Computing project commissioned by the Consortium for School Networking with the sponsorship of the U.S. Department of Education and NCREL. The scope of the project, from a technical perspective, included end-user computing devices, network servers, local-area network hardware, and the labor costs associated with each of the 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 from which they came. From this, baseline 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 your district to case studies or other districts are difficult to analyze, as there are many variables for differentiation.

There are four 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 and final section discusses the TCO processes as they are related to the district.

Please refer to the section entitled “TCO Data Collection—Tables and Definitions” in the document "Preparing for TCO Analysis" for a definition of any of the table fields in this section.



Overview and General Setting

The Pennsylvania district serves 2,433 students in kindergarten through grade 12 in a rural setting. There are six schools, including a high school, a middle school and four elementary schools. The high school, the middle school and the district office are co-located in one building.

All the buildings have Local-Area Networks (LANs); however, the LAN cabling in three of the buildings was installed through a Net Day project and will be scheduled for an upgrade as resources become available. The three remote campuses are connected by a frame relay wide-area network to the district central office. The district is a member of a 22-district consortium. In addition to serving as an Internet service, the consortium provides student data and business/financial data services.

Total Cost of Ownership Metrics

Overall Cost (in US\$)

Unit	Total Cost	Direct Cost	Indirect Cost
Overall District Cost	\$680,625	\$592,118	\$88,506
District Cost per Client Computer	\$1,004	\$873	\$131

Direct Cost by Category

Unit	Hardware	Software	Direct Labor	External Application Providers
District Cost	\$291,758	\$73,000	\$164,299	\$63,061
District Cost per Client Computer	\$430	\$108	\$242	\$93

Hardware Cost by Category

Unit	Client Computer	Server	Network	Printer	Supplies
District Cost	\$250,678	\$20,480	\$5,000	\$10,500	\$5,100
District Cost per Client Computer	\$370	\$30	\$7	\$15	\$8



Hardware Inventory Ratios

Category of District Resource	Ratio
Students per Student Dedicated Client Computer	5.2
Teachers per Teacher Dedicated Client Computer	1.0
Non-Classroom Personnel per Non-Classroom Client Computer	2.1
Total Users per Total Client Computers	4.0
Client Computers per Printer	13.0
Client Computers per Server	42.4

Staffing Metrics

Direct Labor Category	Total Cost	Cost Per Client Computer (US\$)	Client Computers per Staff
Operations and Financial	\$130,550	\$193	342
Professional Development and Training	\$18,000	\$27	2,260
Curriculum Development and Support	\$15,750	\$23	2,712
Total Support	\$164,300	\$243	268

Using the data acquired from the district, the Total Cost of Ownership for the distributed computing environment during the study period was just over \$680,000, or \$1,004 on a per-client computer basis.

Interpretation of TCO Metrics

Thirteen percent of the total cost of ownership (or \$88,000) consisted of indirect costs.

Indirect costs include “underground” technology support costs borne by the end-user community such as peer support among faculty, staff and students, as well as the cost associated with downtime. It also should be noted that indirect support cost is more than half of the budgeted or direct labor cost of approximately \$133,000. While this represents a significant cost to the district, it is important to realize that, outside of education, indirect costs can typically range from 35 to 50 percent of total costs. We believe a major reason for this difference is that the data collection relied on staff interviews rather than a user survey. In any case, the responses indicate that underground support is likely significant.

The ratio of students to available client computers was 5.2 to 1.

This ratio is a key driver of the total client computer hardware cost of \$250,678. While this ratio is higher than some other districts (meaning fewer computers per student), the district has taken steps to maximize the utilization of the computers it has. Of the 678 (or about 14 percent) devices it has deployed, 100 are mobile. Many of these devices



are deployed on carts that can be taken from classroom to classroom as needed. Connectivity is achieved through the presence of a wireless LAN. In order to achieve a ratio of 4:1, the district would have had to spend about an additional \$51,000 (assuming its annual cost per client computer was \$370).

It is important to note that these are only the cost implications of the strategy. The wireless/cart approach also allows flexibility in teaching style and classroom configuration. An unexpected problem that came up during the deployment of the mobile computers was the use of the trackpad instead of a mouse. Many students (especially those with fine-motor issues) struggled with the new way of interfacing with the computer. The problem was resolved by simplifying the trackpad settings to remove unnecessary functionality. The district plans to eventually assign a cart to each department in the high school.

The total operations and financial cost for the district was \$130,550, or \$193 per client computer.

One of the biggest drivers of cost in the distributed environment is related to complexity and the diversity of the environment. The Pennsylvania district has almost an equal number of Windows- and Macintosh-based computers. This diversity drives cost because the district loses leverage in technical training, has less of an ability to take advantage of volume purchasing discounts, and leaves itself vulnerable to technical problems related to interactions between the two platforms (for example, one product causing the other to fail or work unreliably).

In order to reduce complexity and respond to user complaints about interoperability, the district decided to standardize on a single platform. This strategy has both cost and end-user acceptance implications. Each situation such as this is unique, and districts must make trade-offs between the advantages of migrating to one platform vs. another.

From a cost perspective, one needs to understand both migration and ongoing expenses. Migration costs typically only occur one time, and they include the installation of new hardware and software, applications modification, file conversion, image creation and testing, and end-user and staff training. Ongoing costs include day-to-day operations such as maintenance and repair, responding to typical user questions, and small moves and modifications to hardware and software. Indirect costs such as user downtime, and time spent seeking support, may also come into play when changing platforms, and they should not be ignored. These costs tend to spike during migration, but they exist afterwards as well.

From a user acceptance perspective, many people are reluctant to change platforms because of investments in their time spent learning and getting used to systems and applications. “Soft skills” may be as important or more important than hard analysis when undertaking these types of initiatives.



Ultimately, the district decided to migrate to the Windows platform. The district technology coordinator said that, given the usage pattern in the district and the experience of the technicians, the differences in using and supporting OS 9.x vs. OS X would have caused more migration costs than one might have typically expected in a Macintosh environment. This also made it a very opportune time to do such a migration.

Many districts facing these issues also may need to take into account support provided by vendors (particularly Apple) in Professional Training and Development, and Curriculum Development. Spending in training and integration may offset expected savings in operations and financial areas.

While many districts are interested in standardization for the reasons mentioned above, not all are able to achieve it. The small size of this district made it a good candidate for the following reasons:

- It would have been very difficult to achieve the critical mass necessary to efficiently support multiple platforms
- Smaller districts typically have fewer legacy applications
- Smaller districts typically have less-complicated organizational issues to manage.

The TCO metrics and the data should be understood to be the result of a first-time effort by the school district and is at best a rough baseline measurement. The metrics are most valuable for the district from which they came, and should be used to base a refined process for data collection and analysis before relying upon the metrics for reaching conclusions or making decisions. In the lexicon of TCO measurement, the process should mature through data collection and data definition refinement before the results are considered entirely reliable.



The TCO Process

The Pennsylvania district was the first of the four case study subjects to be interviewed. The district technology facilitator and assistant were instrumental in refining the interview questions to incorporate K–12 education language and understanding. The TCO data-collection process employed in this district foreshadowed the experience of each of the participating districts; data was pulled from disparate sources and there was some reliance on institutional memory and estimation.

Although the district is moving in a direction of standardizing the hardware and software resources, the data collected through the TCO interview process reflects the eclectic nature of the inventory.

When reviewing the Pennsylvania district TCO data and TCO metrics, the reader should take note of the following:

- Services provided through the consortium membership reduced expenditure on servers and technical support of the servers.
- The district technology leader understands the instructional uses of the technology and provides direct support for technology using teachers. The instructional intent is a driving force for the deployment of technology. *Still, readers should note that the degree of classroom technology use is an important factor in comparing relative costs, and at this stage of the district's TCO process and experience, classroom use is at best an estimate.*
- Staff development for teachers is offered, but not required. The exception is for elementary school teachers asking to use a cart of laptop computers—they are required to attend training before they can reserve and use the wireless laptops in their classroom.

The Pennsylvania district entered the TCO process with no cost modeling experience, but enthusiastically endorsed the concepts. Throughout the interview process, the Pennsylvania team asked clarifying questions and expressed confidence in the overall value of the project.

There was not a highly developed Information Technology Asset Management (ITAM) repository in place. Such an inventory would have served to increase the convenience, speed and reliability of the cost data.

As with each of the study participants, the Pennsylvania district was left to estimate the indirect labor (non-budgeted, informal) costs. A user survey would allow a better estimate of indirect costs. The basic procedures for collecting and maintaining the TCO data are within grasp; and with the addition of a formal inventory process and end-user



surveys, the school district should be able to collect information with greater levels of detail and reliability.

The data categories used in the interview process can be used to establish the framework for continued effort, and the Pennsylvania district is inclined to continue with TCO analysis initiatives. The beginning effort represented in this case study might be reviewed and amended if further review of the data collection leads to corrections in cost and effort data.



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	Include 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	Include all of the labor incurred by the user community for the study period. Indirect Labor includes the costs of users supporting one another, 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 administrative software and 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 and development 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 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 them.
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, and 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 IT 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

California District Case Study

An urban district with 140,000 students

Utah District Case Study

A suburban district with 48,000 students

Minnesota District Case Study

A rural district with 4,000 students



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