



North Central Regional  
Technology in Education Consortium  
at



A Report and Estimating Tool for  
**K-12 School Districts**

**Wisconsin District Case Study**

March 2004

Consortium for School Networking

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## Wisconsin District Case Study

### ***Introduction***

The four 2004 Total Cost of Ownership (TCO) case studies were developed by the Consortium for School Networking, thanks to a grant from the U.S. Department of Education and the 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 were used to develop a case study that reports pertinent TCO metrics, discusses how the district approached the TCO process, and provides background information on the district and its 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. It is difficult to compare one district's TCO study to another's because there are so many potential variables.

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 are higher than the published 2003 case studies, because the 2003 projections were based on estimates by staff in the information services department rather than a survey of users.

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 each district's approach to performing the TCO analysis.



## **Overview and General Setting**

The Wisconsin case study school district is primarily urban and growing with 21,500 students on 40 campuses. The installed technology includes nearly 8,000 Macintosh- and Windows-based client computers in classrooms, administrative offices and 182 shared computer facilities, including labs and libraries. Apple client computers dominate the instructional computing environment while administrative computing and business labs are predominantly Windows based. The campuses are wired with category 5e Ethernet local area networks to 100 Windows and Apple-based servers, then to a gigabit Ethernet backbone network in the district via leased 1.55 mbps high-speed T1 communications lines. These lines are subsidized by E-rate discounts.

Instructional computing purchase decisions are made outside the information services department, but approved, installed and supported by information services. First-level user support is provided by 42 lab managers in the primary schools and instructional tech specialists in the secondary schools. District information services consists of 17 full-time plus two part-time staff positions, 11 ½ of which are technical or management and can be dispatched to individual schools as required.

Until this school year, a generous school technology grant from the state of Wisconsin (TEACH) helped with several initiatives, including efforts to keep computer technology reasonably current. The state recently eliminated this funding source, so the district is now facing reductions in its technology budget. Previously, the district had used this funding source to implement student-related technology projects. Other district funded initiatives include formalized help desk software; a substitute teacher locator system, which matches substitute teachers with daily teaching needs; pilot and roll-out of Voice over IP (VoIP) voice/data integration; testing of security alternatives for wireless communications; evaluation of thin clients connected to a terminal server; and implementation of teacher controlled Internet software for posting information accessible by students. Also, student and business systems are being upgraded and consolidated on Unix servers. Finally, a consolidated groupware and email system has been implemented to provide a single district email service for over 2,500 teachers and staff.

Currently, a Network Attached Storage (NAS) system is being implemented. This installation will allow the district to reduce the number of school-based file servers, while providing for storage in a single location for centralized backup. The district is also using a centralized network management product to assist in remote trouble shooting, to install and uninstall software, and to track software licensing.



**Cost of Ownership Metrics**

## 1. Overall Cost

Unit	Total Cost	Direct Cost	Indirect Labor Cost
Overall District Cost	\$21,266,938	\$6,648,890	\$14,618,048
District Cost per Client Computer	\$2,664	\$833	\$1,831

## 2. Direct Cost by Category

Unit	Hardware	Software	Direct Labor	External Application Providers
District Cost	\$3,449,582	\$191,490	\$2,928,515	\$79,303
District Cost per Client Computer	\$432	\$24	\$367	\$10

## 3. Hardware Cost by Category

Unit	Client Computer	Server	Network	Printer	Supplies
District Cost	\$2,799,154	\$266,700	\$236,000	\$29,100	\$118,628
District Cost per Client Computer	\$351	\$33	\$30	\$4	\$15

## 4. Asset Metrics

Category of District Resource	Ratio
Students per Student Dedicated Client Computer	3.22
Teachers per Teacher Dedicated Client Computer	2.00
Non-Classroom Personnel per Non-Classroom Client Computer	.97
Total Users per Total Client Computers	3.00
Client Computers per Printer	3.20
Client Computers per Server	78.26

## 4. Staffing Metrics

Direct Labor Category	Total Cost	Cost Per Client Computer (\$ US)	Client Computers per Staff
Operations and Financial	\$2,598,653	\$326	129
Professional Development and Training	\$164,931	\$21	3,471
Curriculum Development and Support	\$164,931	\$21	3,471
Total Support	\$2,928,515	\$367	120



## ***Interpretation of TCO Metrics***

### **Overall hardware costs are high compared to other case study districts at \$432 per client computer.**

The specific client computer annual cost (removing server, printer, supplies and networking components) is \$351. The Wisconsin case-study district has a comparatively short four-year replacement cycle for desk-top and notebook client computers and for servers; only five-percent of the client computers are over five years old. The shorter depreciation schedule increases annual hardware costs, but this approach also has allowed the Wisconsin district to stay current with technology, and reduces direct and indirect labor costs of maintaining old computers.

One approach to potentially reduce these costs, being tested by the district, is to use thin client computers, where appropriate, plus recycling old systems for use as thin clients. The district has implemented a thin client solution and will be evaluating the value of this approach via a future TCO study. There is some concern over the performance of their thin clients in a heavy graphics environment, including presentation graphics.

### **Direct Labor costs are in line with other medium-to-large urban case study districts at \$367 per client computer.**

The information services department supports a diverse client computer environment that includes several operating systems and versions, as well as desktops, laptops, and Personal Digital Assistants. The district has attempted to standardize operating systems within the families of computers it supports, minimizing the number of operating system versions. It helps that this district has minimal need to maintain old equipment.

The district is also authorized to perform its own warranty maintenance, which adds to direct labor costs, but generates offsetting warranty revenue from the vendor which is not recognized by the TCO tool as direct labor credits.

The information services department re-images the computers in most of its labs on an annual basis. This effort results in fewer problems during the school year, by cleaning up and standardizing the operating environment for these systems, thus reducing future direct and indirect labor.

### **Printer costs are low at \$4 per client computer while supplies are high at \$15 per client computer.**

Over time, the district has accumulated a large number of ink-jet printers, with one installed for every three client computers, many of which are not shared. Although these printers are reliable, convenient and have low initial cost, the high cost of regularly replacing expensive ink cartridges has shown up in the relatively high cost of supplies.



**Network costs may appear to be somewhat high at \$30 per client computer.**

The Wisconsin district has implemented a pilot Voice over Internet Protocol (VoIP) solution to integrate voice and data communications over a single network. Much of the cost of this initiative, which is designed to reduce communications costs over time, is initial investment for equipment and is reflected in the network costs. These up-front costs were \$100,000 for this district. The portion of those costs that includes enhancement or expansion of the existing data network is included in the TCO analysis.

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 more information on the voice/data integration initiative below, under “2004 Focus Initiatives, Voice/Data Integration”



## **2004 Focus Initiatives**

### **e-Learning**

A need to provide cost-effective solutions to meet the non-traditional learning requirements of individual students led the district to implement online learning products in a client/server environment. The district elected not to go with the Application Service Provider approach, as they have concerns about their lack of control over the communications infrastructure and host system environments when using an ASP. The existing client/server approach is both client and server compute intensive. This approach also drives direct labor higher, as updates need to be made to the 200 individual client computers. The district is working to bring the web-based offering of the course management system in-house, to be run on a district-owned web server. This approach places all application software on the server and will reduce the need to provide updates at the client computer. The web-based offering also reduces software licensing costs and requires less compute resources.

The cost for the district's e-learning environment is about \$8,000 annually for the software, plus costs for dedicated computers and additional direct labor costs of supporting the application at the individual client computer level.

To do a meaningful TCO analysis of the e-learning environment, it would be required to do a base TCO of the entire district, as was done for all case studies, followed by a specific TCO analysis of the e-learning environment, attributing the portions district-wide technologies (servers, network, and district software) and direct labor supporting this environment. This specific TCO has not yet been done.

### **Voice/Data Integration**

In efforts to provide network efficiencies, the Wisconsin case study district is moving towards integrating voice and data communications over a shared network. To that end, a Voice over Internet Protocol (VoIP) pilot installation consisting of 50 IP phones connected to a server-based call processing application has been implemented. The district plans to implement VoIP in a new elementary school scheduled to open in 2004, and in the rest of district buildings between 2004 and 2006. District analysis shows that VoIP will generate overall cost savings of over \$400,000 annually versus current Centrex phone system costs, as there will be no charges for intra-district calls over the T1 data lines. The ongoing direct and indirect labor cost implications of this conversion are projected to be minimal.

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 in the results and show up as additional total costs, inflating per-client-computer networking costs.

Once fully implemented with over 1,700 IP phones, this network is projected to be largest installation in Wisconsin.

### **Wireless Networks**

The Wisconsin case-study district has 15 wireless Apple-based mobile labs in place with plans for more. Currently, one-quarter of the elementary schools and all middle schools have at least one mobile lab. These “Computers on Wheels (COWs)” consist of 10 to 15 notebook computers, a printer and either an access point or Apple G4 wireless server on a mobile cart. The cart also serves as a charging station and carries extra batteries.

Wireless network security is a concern to the information services group. The district is utilizing a wireless security product which validates the physical wireless adapter address (Media Access Control or MAC address). The district is also evaluating industry standard WEP (Wave Equivalent Privacy) and follow-on standards.

This initiative has been driven by the instructional management department and the information services group has not yet fully evaluated the cost implications of mobile wireless labs. Depreciated hardware costs for these carts come to about \$1,000 per notebook computer including access point, cart and printer. This is compared to an overall annual cost of \$432 plus per-client computer for the district as a whole. It is anticipated that direct and indirect labor costs for the COWs are somewhat higher than their stationary desktop counterparts. There also is an additional cost for replacement batteries. These costs can be offset by the reduced space requirements and better overall utilization of computers.



## **TCO Processes**

The Wisconsin case study district is new to the TCO process and spent considerable time tracking down and reporting data in the various categories. The data retrieval was heavily manual, in that disparate data sources needed to be searched to retrieve data. Throughout the interview process, the district technology staff was able to obtain much of the required data from departmental files or from other central office staff. A new business system is being implemented which will make it easier to obtain the TCO input data in the future. The district now feels that an annual TCO analysis could be done by a team of three business office and information services people in two or three meetings over two weeks.

There are 3.22 students per student-based client computer. This relatively high penetration of computers among the student population speaks well for the Wisconsin case-study district. As these are relatively new client computers, the district is positioned well to use its technology effectively. However, the district is concerned whether it will be able to maintain this environment, now that the state has terminated its funding program.

The district staff was not permitted to survey students for their input to the indirect labor portion of this analysis, based on concerns over privacy issues. As a result, student time spent dealing with system functions or problems is not recorded, but generally has minimal effect on direct labor costs.

The analysis resulted in few surprises to the Director of Information Services, but does provide a basis for analysis of future technology initiatives. The district also plans to use its TCO analysis as a basis for ongoing review of the costs of specific technology environments within the district.

Going forward, a reliable TCO analysis should become an integral part of the planning process as the Wisconsin 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** 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](http://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

***Texas District Case Study***

A suburban district with 35,500 students

***Virginia District Case Study***

A suburban/urban district with 165,000 students



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