

The Value of a High-speed Regional network

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Case Study: Oconomowoc Area School District

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The Value of a High-speed Regional Network

If a broadband fiber network were available what would be the cost savings and other benefits to CESA 1 districts? This case study and resulting spreadsheet were designed to help thought process for districts evaluating the use of a high-speed regional data network. Concepts behind CoSN's Value of Investment (VOI) Leadership Initiative (www.edtechvoi.org) have been used to better understand costs and benefits. When looking at the potential for a fast fiber optic network, it was determined that many of the benefits are not related to implementing such a network itself, but to opportunities opened up by having a high-speed network available; think of the proposed network as an enabler for projects that are currently discouraged by slow data/voice transmission rates.

The purpose of this effort is to identify costs, savings and qualitative benefits of a high-speed regional wide area network from a district perspective. To this end, an evaluation was done at Oconomowoc Area School District to serve as a case study for others, and a spreadsheet was developed to help other districts evaluate costs, savings and other benefits. Key to the process is an evaluation as to how districts might use this network, including having the network as a foundation for possible projects that otherwise would not be considered.

Case Study: Oconomowoc Area School District

The value of investment process for a high-speed regional WAN at Oconomowoc SD is early in evaluation phase and many savings numbers have not been quantified. Also non-financial benefits have been identified but as most of these are involve projects that rely on the basic network as a foundation, the benefits have not been quantified.

Background & Demographics

Oconomowoc Area School district has 4,600 students, serving a population of 28,000 in geography of 120 square miles in and around the city of Oconomowoc. There are currently seven schools: five elementary schools, one middle school and one high school. Two intermediate schools are being built (grades 5 to 8), and will replace the old middle school.

The technology department consists of an IT director, a network manager, two network technicians and an application/database specialist. Learning resource teachers at the high school and middle school provide on-site user support as do assigned teachers at the elementary schools.

Approximately 1,100 workstations are network attached to building LANs and 20 servers. Of the 1,100 workstations, about 200 are laptop computers; 10 carts with 15 each plus about 50 teacher and administration laptops. Voice over IP (VoIP), with 500 handsets including one in each classroom, is also supported on this network, and Power over Ethernet (PoE) has been implemented. Workstations are wired to Intermediate Distribution Frames (IDF) at 10/100 mbps and from there to the school Main Distribution Facility (MDF) router area with 1gbps fiber. The high school also has some 1gbps switches. Most classrooms have two to three network jacks. . There are also 50 network printers and 25 copiers throughout the schools.

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Wide area networking consists primarily of T1 (1.55mbps) lines to the high school from each school's MDF router in a star topology supporting both data and VoIP. There is one T1 line to each elementary school, the current middle school is across the street from the high school and a 1gbps fiber was installed. This school is being replaced by two intermediate schools which will each have 10mbps fiber to the high school. The high school has a 10mbps fiber internet connection. The T1 and fiber WAN lines are leased from AT&T; one exception being an elementary school in Verizon territory. Besides the two middle schools, a second T1 line is planned at four elementary schools

With limited WAN capacity, school-based servers manage much of the work in efforts to minimize WAN usage. Each of the seven school buildings has a server running Novell Netware 6.5 for local domain control, file directory, local workstation files and backup, printers and copiers, imaging, policies and software management. They each have a PC which acts as a caching server for United Streaming internet video usage.

Network Constraints

In this mostly rural area, there is minimal infrastructure available from commercial carriers, and what is available is expensive. Even if cost was not an issue, fiber and bandwidth outside of additional T1 lines, is just not available. The network providers (AT&T and Verizon) have their own language and method for charging for their services and it is difficult to translate the charges into a cost per line for each school. After some effort and communications with the carriers, per-line costs were estimated and are shown below under "Implementation and Ongoing Costs." Most districts are not in a position to bury or string their own fiber and tie in to a broadband POP for high-speed internet access.

With these WAN constraints, each site has its own data server and domain controller, forcing a more complex environment than would be necessary if WAN capacity were not an issue. Network delays result in some loss of productivity when working with Software as a Service (SaaS) applications; this district uses Skyward for SIS, finance and some special education programs. The WAN capacity limitations force constraints on how the district operates and what technologies they can consider implementing. These inhibit or prevent:

- Centralized imaging of workstations
- Growth of the number of internet connected workstations
- Video conferencing
- Use of internet-based streaming video
- Centralized server consolidation/virtualization
- Effective off-site back-up or offsite data mirroring for disaster recovery
- Enhanced performance of remote SIS and finance applications
- Effective backup of school data to central servers
- Centralized management and support
- Use of mobile computing and wireless access throughout the district
- Creativity and WAN usage knowing there is not enough bandwidth
- Timely support of certain system and network availability issues

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Actions and Savings from a high-speed Wide Area Network

What is high-speed? If fiber is laid in a star or ring configuration (a ring can be bi-directional providing continued connection if a fiber link is cut or otherwise disabled, but data needs to go through intermediate points to reach its destination), it makes sense to lay plenty of capacity, as the major cost is in the design, obtaining right-of-ways, and stringing or burying the cable. Fiber usually comes in sheathed 12-fiber bundles. A minimum of 100mbps should be provided to each building and 1gbps (1000mbps) is most desirable if the cost remains reasonable. At least a 100mbps district internet connection along with a caching server should be planned. Use of VoIP on this network requires that provision be made for 911 emergencies via network redundancy or maintaining one or more POTS lines to each building.

Given a WAN infrastructure as described above, the Oconomowoc district would start planning for projects that are currently not practical, focus on simplification of infrastructure and gain user productivity:

- Video conferencing for district and potentially regional meetings, saving time and travel
- Provide a centralized caching server for internet access and streaming video
- Provide enhanced consistent performance for remote applications: SIS, finance, special education
- Centralize and consolidate servers
 - simplifying directory services, printer management, email and network administration
 - centralizing image, application, and application update loads to workstations (This is currently being performed from servers in each building - seven times)
 - Providing clustering or virtualization for reliability, providing dynamic recovery of server failure
 - Centralizing server room and related HVAC
 - Saving support and maintenance travel time by computer services staff
- Centralize security camera management, door access and public address systems
- Replace school routers (currently connecting LAN with T1) with switches

Implementation and ongoing Costs

From equipment cost perspective, consolidating servers and replacing school WAN routers with switches has an initial cost, but is less expensive over time as the school-based servers and routers would have to be replaced. This centralization could be done over time. Technology costs should be amortized over the useful life of the equipment. Costs to be considered include:

Technology

48 port switches to replace routers (and over time to upgrade school LANs)

10/100 = \$5500ea after E-rate or 10/100/1000 = \$9500ea after E-rate

Annual network access to the regional high-speed network

ISP costs – Hopefully a service provided by the regional network

Direct Labor

Implementation time to replace internal infrastructure and assure interface to Skyward

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Determination of filtering, firewall and virus protection requirements with the new network

Indirect Labor

Minimal cost which includes controlled testing by end users

Savings

Technology

- Server and storage hardware clustering – replacement cost avoidance of \$43k
 - 7 servers at \$9k each (\$63k total) to single \$20k with SAN
- 7 Routers replaced with switches – replacement cost is net 0\$, but replaces 2 T1 lines with 1gbps switch
 - 7 routers at \$9000 each to 7 switches at \$5,500 or \$9,500 each
- Discontinue leased WAN lines (T1 and Opt-E) as contracts expire
 - Total annual leased cost savings: \$109,680 (\$66,000 after E-rate) based on planned 2009-2009
- Some minimal SW license savings by server consolidation
- Simplified cabling, power and HVAC with centralized servers
- Opportunity to evaluate thin client and client virtualization technologies for reduced TCO
- Consolidation of surveillance monitoring equipment
- Potential savings to host Skyward applications internally (current cost is \$22k) if an assessment indicates savings

Direct Labor

Most direct labor savings are expected to simplification of the district network infrastructure resulting from the ability to centralize and consolidate school servers and directory services. Areas of direct labor savings are listed below; however, no attempt has yet been made to estimate the amount of time and dollar value of that time.

- Single point of management and maintenance (saves 2 hours per week in travel time alone, not including actual time on-site for maintenance, migrations and server application changes x 7 locations)
- Simplified directory services maintenance
- Centralized remote workstation software updates and workstation imaging (currently done 7 times)
- Centralized network engineering expertise
- Reduced travel time to individual schools for workstation maintenance and problem resolution
- Simplified email account management (currently a tree structure: district to school to user)
- Reduced backup tape handling and elimination of backup transmission over WAN
- Consolidation of school server storage into the SAN saves maintenance time and time dealing with overnight backup problems
- Consolidated printer/copier usage statistics and management
- Single set of standards, fewer copies of documentation, simplified scheduling

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Indirect Labor – End User Productivity

- Simplified, more reliable infrastructure and ability to provide better support centrally should reduce time users spend dealing with system/network issues.
- Convenient network access via login from any district location
- Centralized surveillance, door access and public announcement systems and their operation
- Video conferencing a possibility to reduce travel time and expense
- Faster, more reliable access to SIS, financial and special education applications hosted by Skyward will enhance productivity of users of these applications

Other Benefits

Schools are in the business of education for the public good; non-monetary benefits are important as they relate to school/district goals and strategic plan. These benefits should be stated in measurable terms as much as possible in order to determine attainment and assure constituents that their money is being spent wisely. Other benefits may not relate directly to goals or strategic plan but would be recognized as important nonetheless. Some of these benefits, listed with district and technology strategic plans in the attached Excel workbook, are listed below:

- Security – one controlled location for servers
- Opportunity for dynamic disaster preparedness and remote backup
- Opportunity for better reliability and scalability through virtualization
- Opportunity to evaluate and use centralized asset management software
- Centralized SAN for user and support simplicity
- Opportunity to evaluate thin client and client virtualization
- Ability to promote more computer/internet use by students and teachers
 - Affects behavior, attendance
 - Public view: school of choice with reasonable student/computer ratio, driving usage in the classroom and enhanced teacher to students' home communications
 - Curriculum change to take advantage of computers and networks: Accelerate use of technology and 21st century learning
- Ability to implement video conferencing – district and perhaps region wide
- Ability for more internet-based video streaming for enhanced learning (still recommend caching server)
- Ability to utilize WiscNet, BadgerNet, BOREAS-Net for internet and other services
- Ability to develop and tap into potential regional resources/applications such as:
 - Student Management Systems
 - VoIP
 - Security systems (network and facility)
 - Human Resources
 - Fiscal
 - Data Warehouse
 - Professional Development (Tracking, course catalogs....)
 - Curriculum Repository

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Cost/Savings/Benefits Workbook

The attached Excel workbook is designed to help you through your own cost-benefit analysis of a high-speed regional communications network. The first four worksheets, based on the CoSN online Value of Investment (VOI) Project Cost Estimator, will help you to identify potential costs. The fifth worksheet, based on CoSN's VOI Project Benefits worksheet, will help you to identify savings and other (qualitative) project benefits. Understanding that much of the value of the network is in the other projects that higher capacity enables, you can look specifically at the high-speed regional network for costs and benefits or include projects that the network would enable in a broader scope.

Costs

A TCO assessment of current costs would be useful for estimating some of the project costs. Project planning and implementation costs as well as required technology also need to be included. If there is anticipated disruption of service or retraining of users, these indirect labor (end user productivity loss) costs should be included as a project cost as well. The CoSN VOI Leadership Initiative (www.edtechvoi.org) has a project cost estimator that may be useful.

The Project Cost worksheets allow you to input initial costs with useful life plus annual costs to develop annualized costs. Select the costs that apply to the scope of your project. An initial cost summary and project TCO are displayed based on your input sheet.

Savings

Savings include out-of-pocket dollar savings, enhanced user/staff productivity, cost avoidance and estimated additional revenue. Direct equipment and services savings can be entered as negative costs in the cost worksheet or entered as savings in the benefits worksheet. Work with carrier(s) to obtain real cost/line. Understand current vendors, capabilities and costs for comparison, territories and E-rate process. Don't forget include direct labor time savings – all people in the district who have responsibility for technology; and indirect labor savings – time spent in lost productivity by users due to current network problems, infrastructure and speed.

Other benefits

These qualitative or non-monetary benefits are more important to the district than dollar benefits for many projects; especially those focused on student learning. In order to provide perspective and articulate benefits to school leaders and constituents, these benefits should relate to district or school mission, goals, mandates, strategic plan or other imperatives. Note that some of these benefits may also result in dollar savings.

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Respectfully submitted by Rich Kaestner, March 1, 2008