Information technology is evolving at a tremendous pace, and many of today’s schools are taking full advantage of the benefits it offers. Applications such as distance learning, streaming video on demand, Internet access and email are becoming more and more common in the classroom. Many districts, such as Western Heights in Oklahoma City (see case study), are implementing these powerful tools now, or are planning on them for the near future. But while there are headlines every day about faster Internet connections, more powerful computers and new software applications, there is one area that is often overlooked – data storage and backup. As a technology coordinator, it is imperative to understand that these new technologies can greatly increase the demand for data-storage capacity in your school or school district.

**ASK YOURSELF A FEW SIMPLE QUESTIONS:**
Are you interested in providing students with a richer learning experience? Would you like to connect your schools to the outside world and explore alternate educational methods such as distance learning or streaming video? Are you thinking of consolidating your servers and storage into your district office? Are you planning to implement district-wide email? Would you like to give all your students access to file storage? These are the types of changes that can greatly affect your storage requirements. And how you meet those requirements will determine how efficient, affordable and up-to-date your computing environment will be. By looking at the big picture – understanding where technology is headed and how your school might be affected – you can take steps to deploy the latest technology, including data-storage solutions, while helping to lower your total cost of ownership.

Therefore, it’s worth your while to familiarize yourself with two emerging data-storage architectures – Storage Area Networks (SAN) and Network-Attached Storage (NAS). SAN and NAS share some desirable similarities. For
instance, both are client/server architectures that revolve around the concept of centralized data consolidation. (Data consolidation, i.e. storing data from many schools at one site, offers many benefits – including lower acquisition costs, less expensive upgrades and fewer staffing demands). Both take advantage of high-speed Fibre Channel technology (see sidebar). And both offer high scalability, availability and data integrity through RAID arrays and redundant hardware and software components. However, as you will see, SAN and NAS are fundamentally different in the way they handle traffic.

**STORAGE AREA NETWORK TECHNOLOGY**

A SAN is a highly scalable, specialized network – including host bus adapters, switches, bridges and disk arrays – that connects shared data-storage devices to the general-purpose (application) servers on your LAN or WAN. This arrangement makes a SAN ideal for applications such as email, file and print services, Internet usage and server consolidation. For instance, a SAN can help a large school district, using site-by-site storage to develop one centralized storage system with an automated unattended and reliable backup solution.

SANs incorporate Fibre Channel technology, eliminating the configuration limitations and performance bottlenecks imposed by SCSI technology. With Fibre Channel technology, your servers “see” SAN storage devices as if they were directly attached SCSI devices – yet the SAN-attached device can be located much further (30m to 500m) from the server, making it easy for all the schools in one district to consolidate data.

**HIGHLIGHTS OF SAN INCLUDE:**

- Remote workstations and servers at different schools can easily access a shared data-storage pool.
One or more reliable tape libraries can provide unattended backup and restore services for all the servers in the central office.

Data is transferred at 100MBytes per second per fibre channel loop, much more quickly than with SCSI technology (40-80MBytes per second).

Data is transferred over a separate FC network, off-loading traffic from your LAN or WAN.

Nodes can be removed from the SAN or added with minimal disruption.

Easily expandable using FibreChannel hubs, switches and bridges.

Redundant operation for mission-critical applications.

Storage and backup devices can be remotely located using fiber-optic cabling, providing disaster-recovery capabilities. FibreChannel drives are dual-ported, thereby allowing a failover path (via special software) for a high-availability solution.

**SAN IS A GREAT SOLUTION WHEN:**

- You have a need for large amounts of storage to attach to your servers.
- You want to serve video.
- You already have an email solution.
- You are running databases.
- You already have document imaging solutions.

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**NETWORK-ATTACHED STORAGE TECHNOLOGY**

NAS is high-performance, platform-independent data-storage technology optimized to perform a specific task – file service serving. NAS is characterized by specialized servers called “filers” attached directly to your network (see figure 1). Unlike general-purpose (application) servers, filers are designed solely to provide high-efficiency shared disk and tape storage and tape back-up to clients (PCs and servers) across a LAN or WAN. Filers feature a simplified, real-time operating system that eliminates functions not associated with file service. It is the simplicity of the filer’s architecture that allows extremely rapid response times and high rates of throughput. Filers are easy to set up and manage and are ideal for networks with a mix of clients and servers running different operating systems, such as Windows® 95/98, Windows NT and UNIX. Even Macintosh computers can connect to a NAS storage system using NFS or CIFS protocols through such products as DAVE from Thursby Systems.

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**HIGHLIGHTS OF NAS INCLUDE:**

- PCs access filer storage directly, without going through your application server. Data can be accessed even if your application server goes down.
- PCs don’t need a Microsoft or Novell client access license (CAL) to access files. This allows you the freedom to provide central disk space for every teacher and student to use, as with an “electronic locker.”
- Filers handle all file-management operations, freeing your application server for more important tasks.
FibreChannel drives operate at 100MBytes per second per FC loop, much more quickly than with SCSI technology.

Filers can be removed or added without disrupting your network or application server.

No additional specialized hardware is needed, and no modifications to your network are required. Your investment in your current network infrastructure is protected.

Filers can be added to scale up existing storage capacity of multiple individual systems or to consolidate existing storage in multiserver configurations.

The storage capacity of individual filers can be increased easily with additional hard drives without user disruption. Online Capacity Expansion is a valuable feature allowing for expansion without any downtime.

**NAS IS A GREAT SOLUTION WHEN:**

- A Windows NT environment is key.
- A lot of storage is needed for use by the client PCs – instead of deploying more Windows NT servers, save files on the filer.
- A school wants to give students access to storage, but doesn’t want to purchase Windows NT with client license for thousands of students.
- Snapshots or quota features are desired.
- You need FILE STORAGE without any applications (or the client runs the application and stores the data on the NAS).

**SAN OR NAS? HOW TO DECIDE.**

The fact is, many school districts might not even need a SAN or NAS. In many cases, other solutions – such as SCSI drives using RAID (redundant array of independent disks) – can provide a robust, highly available data-storage subsystem. With RAID technology, hard-disk drives can be removed and replaced (hot plugged) without loss of data or data access. In other situations, it might be best to integrate both a SAN and NAS into a single network.

If you do decide that your schools would benefit from SAN or NAS technology, choosing between the two depends on several factors, including your current network infrastructure and the type of data you wish to share. For example, NAS would be the logical choice if you need to share storage in a heterogeneous environment (i.e. Windows 95/98, Windows NT, UNIX), or in a network with heavy emphasis on read-intensive applications, such as multimedia or Internet services or streaming video.

**DELL SAN AND NAS PRODUCTS**

Dell has many of the products your school needs to implement a storage area network or network-attached storage technology, including servers, filers, disk array enclosures, tape backup drives and autoloaders. PowerEdge® and PowerVault® products are designed for simplified connectivity, greater storage capacity and higher availability, with features such as redundant caches and dual-ported drives for reliability. They are rack-mountable and can be configured to hold multiple terabytes of data.

A Dell systems consultant would be happy to meet with you to discuss your current situation and your future data-storage needs to help you decide what is right for you.

**RESOURCES**

A number of Dell white papers and other resources are available online to provide more information about SANs and NAS, including:

- Storage Area Network (SAN) Solutions
  (www.dell.com/r&d/wp/spring99/sansol.htm)
- Storage Area Network (SAN) Technology
  (www.dell.com/r&d/whitepapers/wpsan.htm)
- Network Attached Storage (NAS) Technology
  (www.dell.com/r&d/wp/spring99/nas.htm)
- Macintosh Connectivity Solution
  (www.thursby.com)

**THE DELL ON WHEELS ROADSHOW**

Come see Dell’s server and storage products in action.

Visit www.dell.com/wheels or ask your account team for more information.
**Western Heights Public Schools: Taking Full Advantage of Advanced Technology.**

**Challenge:**
- A teacher on medical leave joins her class via videoconferencing and helps her substitute reveal the intricacies of advanced biology to her students.
- A ninth-grade class reviews historical data from the Smithsonian Institute using video streaming.
- Eleventh-graders exchange notes on their forms of government with their counterparts half a world away in London.

These are just some of the real-life applications technology is bringing to Western Heights Public Schools in Oklahoma City. With the help of Dell Computer Corporation, Western Heights schools have extended their educational opportunities far beyond the boundaries of a traditional classroom.

“Our students and teachers are learning in ways that we never thought possible, even a short time ago,” said Joe Kitchens, Superintendent of Schools.

With Dell lending its technical and visionary support, Western Heights has built an advanced network to offer students an educational experience as rich and rewarding as the world around them. Western Heights first sought Dell’s solutions early in 1998 when it encountered hard disk drive problems and delays in delivery from another vendor. They asked Dell to provide a desktop, workstation and server for its administrative offices. After a successful installation, the district continued its relationship with Dell late that summer.

“We wanted to get PCs installed before the start of the school year,” Kitchens said. “I thought it would take several weeks. We ordered on a Tuesday, and by the next Monday we had the equipment. Every hour was critical for us and Dell exceeded our highest expectations.”

Thanks to Dell’s direct model, by the beginning of the 1998-99 school year, Western Heights was equipped with 400 Dell OptiPlex® PCs and 100 Latitude® CPi notebooks.

“Our goal was to make technology a relevant, useful and familiar part of day-to-day classroom activity,” said Kitchens. “Dell has helped us achieve that goal.”

The district’s vision also included wiring the school system for fast Internet access to support “JetNet,” Western Heights’ own district-wide Intranet. In the spring of 1999, Western Heights installed several more Dell products to support its growing technology infrastructure and JetNet program, including five PowerEdge 6300 and ten PowerEdge 2300 servers. As one of the first education customers to receive the PowerEdge 6300, Western Heights implemented a high-power, failure-safe server to support videoconferencing. Western Heights also incorporated a Fibre Channel Storage Area Network (SAN) complete with Dell servers, RAID enclosures, Fibre Channel switches, disk arrays and a tape drive.

The equipment allows the district to store large amounts of streaming data, making video streaming and videoconferencing an invaluable educational tool. Now students and teachers have access to 2,000 hours of “on-demand” video to study history, science, geography, foreign language and more. Western Heights can also store videos of “best practices” for teacher training or link with external training resources. Connecting with the “real world” also spurs communication among students inside and outside the district. All students and teachers have access to email and are encouraged to use it often.

Moving forward, the district expects to add one multimedia computer per classroom each year. The district also plans to purchase notebook computers for middle school and high school students, teachers and parents for home use in connection with Internet applications.

“Western Heights must continue to make the right investments that will keep our students and teachers on the leading edge of technology,” said Kitchens. “We believe Dell can help us do just that.”
NEW FCC DECISIONS TO INCREASE AMOUNT OF DIRECT REIMBURSEMENT FOR E-RATE RETROACTIVE PURCHASES FOR SCHOOLS AND DISTRICTS

By Charles Blaschke, President, Education Turnkey Systems

In August 1998, the FCC approved use of the Billed Entity Applicant Reimbursement (BEAR) Form 472 by districts which had purchased eligible products and services retroactively to January 1, 1998 prior to official notification of their E-Rate discounts. Because of the lengthy, draw-out process, between $800 million and $900 million could have been requested by districts and schools under the BEAR process — in the form of a check rather than a credit — and these funds could be used to purchase other technology products and services. On July 5, 1999 the FCC announced the Tenth Order on Reconsideration, which allows first year E-Rate applicants that have been approved for discounts for reoccurring telecommunications and Internet services under contracts which expired before December 31, 1998 to receive six additional months for discounts. This extension was designed to solve the so-called “black hole” problem. Virtually all of these funds (estimated to be between $100 million and $200 million) represent additional direct reimbursement funds for schools and districts. On July 21, 1999 the SLD announced that during the second round of funding, the BEAR process would once again be used for retroactive purchases. Somewhere between $300 million and $500 million could be available for direct reimbursement under the BEAR process. The SLD also extended the deadline for Year 1 completion of the BEAR forms to December 15 and for Year 2 to December 31. The net effect of these decisions is that, over the next six to eight months, as much as $1.2-1.5 billion will be available through the direct reimbursement process to schools and districts to purchase E-Rate-eligible items as well as complimentary products such as hardware, software and staff development.

As of July 15, 1999, only $150 million had been requested for direct reimbursement under the BEAR process, as many districts are choosing to complete only one BEAR form initially before the August 15 deadline, now the December 15th deadline. Interested district staff should contact the E-Rate coordinator in the district to determine whether or not the BEAR process has been, or will be, used for requesting direct reimbursement in the form of a check and how those funds are to be used. Some large urban districts which will use the BEAR process will determine how much of the E-Rate savings were generated by participating buildings and will reallocate such funds to principals in those schools.

As for the future, opposition from several quarters to the E-Rate program has been dissipating, particularly after the Fifth Circuit of the U. S. Court of Appeals ruling in June that fees supporting the E-Rate were, indeed, fees and not a Federal tax and that the current SLD/USAC administration of the program was within the general legal framework Congress intended. The window for submitting Form 471 for the third round of funding will likely be in early fall. As of the end of August, notification letters for almost $500 million of the $2.25 million for Year 2 had been sent to applicants.

FEDERAL EDUCATION BUDGET POLITICS HEATS UP WHILE DISTRICT PROGRAMS LIKELY TO SUFFER

Pre-election year politics are resulting in an impasse with serious detrimental impacts on school programs. Currently, the House and Senate Appropriation Subcommittees have passed resolutions that would cut education funding between 15 and almost 20 percent to stay within the discretionary budget caps which Congress placed on itself several years ago. The President has requested moderate increases in certain programs for FY2000 and has vowed to veto any Appropriations Act similar to the Congressional resolutions. While moderate Republicans and virtually all Democrats want to increase education funding, no one has the “political will” to propose lifting of the discretionary budget caps because of perceived political consequences.

In order to live with the discretionary caps, Congress – and now the Administration – is now proposing to expand the use of “advanced funding,” which could create a disaster in many districts as early as October unless the budget stalemate is resolved. For the 1999-2000 school year, Congress appropriated approximately $8.4 billion for Title I, of which almost $6 billion was “advanced funded,” not to be available until passage of the FY2000 budget. Hence, Title I programs were notified this summer that they would be getting only 20 percent of the Title I allocation this summer, with 80 percent no earlier than October. In some states (e.g., North Carolina), this is already creating a problem as staff development services, summer school, and purchases of materials have been postponed. If Congress passes a stop-gap “continuing resolution” by the end of September, the remaining 80 percent will not become available then. Rather, districts must await the passage of the FY2000 budget before the remaining portion can be allocated. For the FY2000 budget, the Administration has proposed a slight increase to $5.5 billion in IDEA/ special education funds, but almost $2 billion of that, like Title I this year, will have to be “advanced funded” for next year. The proposed Title I budget would also be mostly “advanced funded.” Concerned school district officials should communicate the impact of the above scenario on their district programs and the general effects of budget uncertainty created by advanced funding to their Senators and Congresspersons.

* This is provided as an informational service only. Educators should consult their lawyer, accountants, and education funding specialists regarding applicability and availability of funding and funding practices.