Facilitating Anywhere, Anytime Learning

Networking solutions for today's education environment

Introduction

An educational institution's network is its digital foundation. Just as a house's foundation needs to be able to support any renovations, so too does a network need to support a campus' digital additions and enhancements. To say that education is receiving some minor technological upgrades is an understatement — it is undergoing more of a digital revolution.

Mobile devices, digital content, online assessments, social collaboration and the increasing use of technologies such as virtualization and cloud computing are all a part of this revolution that is fundamentally shifting today's learning environments. Here is just a glimpse at the impact:

- 44% of high school students[1] and 49% of college students use smartphones.[2]
- In the 2010 Educause Campus Computing Survey, three-fifths (60.5%) of the survey participants agree/ strongly agree that "lecture capture is an important part of our campus plan for developing and delivering instructional content."[3]
- The Innosight Institute predicts 50% of high school courses will be delivered online by 2019.[4]
- Studies show learners who participate in videoconferencing have higher scores on cognitive indicators and are more motivated not just to learn the material being presented, but also to find out more about related topics.[5]

The adoption of these technologies is creating more personalized, accessible and student-centered learning. This change is exactly what education needs to meet the demands of next-generation learning and prepare students for the future workforce. However, the migration to digital learning environments is creating new demands on networking, straining education's digital foundation.

Fortunately, building a new networking strategy is easier than tackling repairs to a physical foundation. A new approach to networking is creating the perfect opportunity for educational institutions to upgrade their infrastructures to support the shifts in learning that are occurring.

This paper discusses this new approach to networking, highlighting the limitations of traditional education networking strategies and outlining the
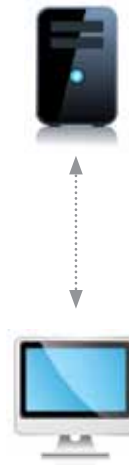
OLD Approach **NEW Approach**
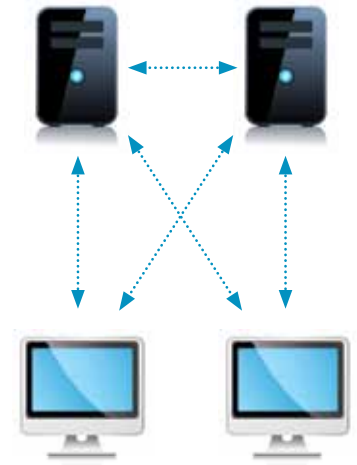
In the old approach to networking, data only moved "vertically" between client and server — north to south and south to north. Under the new approach, with data moving all over a distributed network, traffic is also dispersed "horizontally" from server to server — east to west and west to east.

benefits this newer, more distributed approach can bring. It also outlines requirements that a new networking strategy should address such as reliability, compliance, quality of services and security.

Old Approach Out; New Approach In

As new lines of thinking and new learning platforms have transformed the world of academic technology, so too is the perspective on networking beginning to shift.

Traditionally, networks have been viewed as rigid "pipes" that move data from server to client, one point to another. A new, emerging approach to networking, however, is intelligent, optimized and application-aware. It adapts to dynamic workloads. It automates management and frees IT staff for other tasks. Under this broader iteration, data traffic travels from server to server, and

may go from one point to many points. Insiders hail this new approach as broader, more far-ranging and distributed. In short, they see it as a better way.

Understanding this new approach to networking can be tricky. What does it mean to broaden the network? How can a network with thousands of users be any more distributed?

To answer these questions, picture a compass with its four cardinal directions. Under the old approach to networking, where data moved only from server to client and back again, one could argue that bits and bytes moved only "vertically" between client and server — north to south and south to north. Under the new approach, with data moving all over a distributed network, traffic is also dispersed "horizontally" from server to server — east to west and west to east. The old way was only optimized for north to south travel, so server to server (east to west) traffic had to travel circuitous routes to reach its destination, causing bottlenecks and delays. The new way is optimized for all four directions, allowing efficient north to south as well as east to west transits. This is what the new approach to networking is all about.

Specifically, this new networking approach should be part of a broader networking strategy that includes:

- using open standards and interfaces, which enhances flexibility (no vendor/proprietary technology lock-in), enables the ability to augment, eases management across environments, and allows resources to be allocated as a package across complex physical and virtual computing environments;
- automating a number of mission-critical processes such as the configuration of network switches and network monitoring, helping to improve efficiency and allowing organizations to better utilize human resources; and
- enabling organizations to achieve broader coverage, seamless operation and easier management across the board.

In short, the latest developments in networking lead to an approach that is sophisticated enough to meet the demands of the virtual era — a strategy that is infinitely scalable, and delivers more for less, time and time again.

Keys to a More Efficient Network

As network automation continues to evolve, more vendors will claim to have solutions that can help an organization make the transition to a virtual infrastructure. Considering the important role the network will play in the evolution of the data center, it is critical that IT administrators in both the K-12 and higher education marketplaces consider the following advice when making purchase decisions:

- **Seek an open standards-based approach.** Many solution providers claim to be open, and many claim to be standards-based. It is crucial, however, that the network truly be both. (In particular, beware of vendors that include a number of proprietary features that are "based on standards.")
- **Embrace solutions that are hypervisor-, switch- and server-agnostic.** Considering the rate of innovation and the reach of virtualization, it's important the network be able to support any of the hypervisor vendors. If institutions are not watchful of this factor, they may lose out in choice and flexibility of computing platforms.
- **Implement non-blocking, congestion-free architecture.** Though it may be more expensive in the short term, over time this approach will minimize the end-to-end latency of traffic flowing across a network. Solutions that are "near non-blocking" or over-subscribed could lead to congestion problems that impair application performance.

Networking Strategies that Help Overcome Obstacles

The digital learning era has brought with it networking challenges, including bandwidth demands, aging infrastructure, securing access, increasing complexity due to the rise in mobile technology and lack of funding. But new networking strategies and solutions can help IT administrators overcome these challenges.

Bandwidth Demands

As users turn to the network to perform more data-intensive tasks, bandwidth is becoming an increasingly significant issue. Nearly 80 percent of all school districts and libraries responding to a 2010 federal E-Rate survey said their broadband connections do not fully meet their

needs, with 55 percent citing slow connection speed.[6] This is a problem, especially considering all of the digital, multi-media content being created and used today, and the degree to which students and other users move around campus on a given day. If an institution's network doesn't have enough bandwidth to support the types of applications its users wish to use, the entire network can grind to a halt.

To meet the rigors of bandwidth demands, networking strategies should espouse comprehensive, end-to-end solutions, such as virtualization, which embrace the distribution of resources with a smaller footprint (and lower costs). Strategies should also enable flexibility in quality of service by allowing IT administrators to prioritize network traffic and manage traffic flow.

Securing Access

Considering that educational networks have a long history of being open, access is always a complex issue. Securing the access layer is a significant challenge, since campuses are often running multiple operating systems on multiple servers, and each operating system has its own unique security issues. IT staff must ensure that users accessing the network are using approved security protocols and that data is kept private and safe. They also must make sure that as users come into the network from a variety of different locations (using different devices), each user gets only the access he or she deserves.

To help secure the access layer and manage access control, networking strategies should incorporate an open, software-driven framework that facilitates efficient IT and workload intelligence. Increased automation is at the heart of this framework, and a special software agent drives the automation. IT administrators can leverage this to automatically monitor and manage a variety of key network functions (including, of course, access control) in real time. The software agent itself can be described as an "orchestrator" of resources.

Remaining Compliant

The increase in the number of devices accessing the network also raises issues with compliance. Districts must comply with regulations such as the Child Internet Protection Act (CIPA), which mandates that harmful

Managing BYOD Access

The very best bring-your-own-device (BYOD) access solutions should be able to perform some basic processes automatically. These include:
- performing automated checks via persistent and dissolvable agents; these agents are important since administrative management is usually up to the user in a BYOD program (dissolvable agents are automatically downloaded when a user logs in and removed upon log out);
- engaging in periodic inspections for up-to-date anti-virus, anti-spyware and anti-malware software;
- scanning regularly for USB storage and peer-to-peer applications and services, such as Skype and BitTorrent; and
- providing control options, including protected network access, manual and auto-remediation via directed URLs, and denial of service.

Internet sites be restricted from students under the age of 18, and the Family Educational Rights and Privacy Act (FERPA), which protects students' personal data. Higher education institutions also face similar regulations such as the Health Insurance Portability and Accountability Act (HIPAA), which mandates the protection of

Eligible Dell Offerings for E-Rate Discounts

Dell has a variety of offerings that are eligible for Priority 1 and Priority 2 E-Rate discounts, including:

INTERNET ACCESS AND TELECOMMUNICATIONS SERVICES (PRIORITY 1)	✓ Internet access hosted services: email, website hosting, VoIP (ePals) ✓ Internet bandwidth ✓ P1: Services only (no hardware or software)
INTERNAL CONNECTIONS (PRIORITY 2)	✓ LAN infrastructure: switches, routers, hubs, wireless, cabling ✓ Video infrastructure: codecs, MCUs, streaming components ✓ Servers: Eligible depending on use by customer. Eligible uses include: DNS/DHCP, email, Web, firewall, video distribution, proxy/terminal ✓ Virtualization: Eligible server uses may be virtualized (VMware®, Citrix® and so on)
BASIC MAINTENANCE (PRIORITY 2)	✓ Repair and upkeep of eligible components ✓ Basic technical support ✓ Software bug fixes/patches/minor updates ✓ Configuration changes

personally identifiable information. Educational institutions that are not in compliance with regulations such as these risk being fined and could face serious legal issues.

New networking strategies help institutions comply with regulations through features such as the automatic provisioning of access rights, so that only certain users are granted access to certain information.

Increasing Complexity

Complexity — especially as it pertains to mobility — is prompting wholesale change, too. Today's growing demand for anytime, anywhere network access has expanded to include the use of personal mobile devices such as laptops, tablets, smartphones, e-readers and more. According to a recent study, a single user will interchangeably connect to the network with up to three devices throughout the day.[7] In response to the plethora of mobile tools, some institutions are designing for as many as 75 devices per classroom, assuming five devices per student.[8] And with more organizations espousing a bring-your-own-device (BYOD) philosophy, network administrators must be ready to support a slew of different devices — which might require additional training and other initiatives down the road.

Automation helps IT staff tackle the issue of increased complexity. Administrators can pre-establish policies regarding disparate devices with different operating systems, and set the software agent to enforce those policies in any number of ways. They also can securely onboard new devices and quickly identify and resolve problems as they arise. With this feature, ensuring access to network resources or the use of anti-virus and peer-to-peer applications becomes a process that can actually be maintained without much interaction by the user or IT.

Generally speaking, deploying a broad-sweeping approach to networking that allows data to flow freely in all directions, from client to server and server to server enables networks to do more than ever before, and empowers IT departments to be proactive in the way they monitor and manage the networks themselves.

Lack of Funding

Limited budgets present a considerable challenge throughout K-20 education. Because of this reality, sometimes network upgrades are put on hold due to the impression that they will cost too much money. Furthermore, big-name solutions can sometimes be purchased instead of the most efficient ones. Generally speaking, spending more money on networking

infrastructure doesn't always mean you are getting the capabilities you require — it is more important to make sure networking infrastructure is reliable and customized to your needs.

One way many K-12 organizations upgrade a network affordably is to leverage funds made available through the federally sponsored E-Rate program. This effort, launched in 1996, is the commonly used name for the Schools and Libraries Program of the Universal Service Fund, which is administered by the Universal Service Administrative Company under the direction of the Federal Communications Commission (FCC). The program provides discounts to help schools and libraries purchase telecommunications services, Internet access and networking equipment; discounts for support depend on the level of poverty and the urban or rural status of the population served. They range from 20 to 90 percent of the costs of eligible services.

The most recent Economic Stimulus Act made no changes to the E-Rate program, which basically means school organizations can continue to seek these discounts as they have done for years.

As these programs evolve, however, there may be restrictions related to which funds can be counted for purposes of matching-fund requirements. In addition, the FCC is working on the development of a national policy to promote broadband access, which could lead to changes in the Universal Service Fund programs as a group.

Although E-Rate is only applicable to the K-12 space, there are also funding opportunities available for higher education institutions. Private grants and contributions are one of the more popular options at the higher education level. According to the 2011 Voluntary Support of Education Survey, private contributions to higher education institutions increased by 8.2 percent in 2011 to $30.3 billion.[9] The Maine Community College System announced in January 2012 that it received a $10.6 million grant from the Harold Alfond Foundation for a campus expansion project. The grant includes $8.35 million in capital improvements at the Kennebec Valley Community College (KVCC) campus, including $3.35 million for upgrades to the campus infrastructure.[10]

The Benefits of a New Networking Approach

In addition to helping educational institutions overcome the specific roadblocks mentioned earlier, broader and distributed networking delivers a number of features that yield general benefits for educational institutions that adopt the approach. Some of these features and benefits are listed in the table below.

Feature	Benefit
Anywhere, anytime secure access and delivery	Greater user productivity across the board
Policies and users managed in an automated fashion	More consistent policy application across the network; frees up human resources for other tasks
Simplicity	Maximizes efficiency and speed for results
Advanced services, including scoping, training, etc.	Lower operating expenses

This new networking paradigm delivers additional benefits in the world of wireless. For starters, managing devices with access points (APs) means better security overall. In addition, taking the time to on-board devices

The Dell Approach

Dell's Virtual Network Architecture is an open networking framework for efficient IT and workload intelligence aiming to virtualize, automate and orchestrate networking functions and services. The framework addresses the widest range of traditional, virtual and cloud environments with a comprehensive portfolio of wired and wireless networking solutions. For data centers, this means feature-rich Top-of-Rack and Blade Switching solutions as well as high-performance 10/40GbE networking fabrics that fit your campus and budget. For educational institutions, this means complete solutions to mobilize users, desktops and devices securely wherever they may be in the network, meeting the fast-paced needs of education-on-the-go. Throughout, Dell adds advanced management software to help save time and money.

Dell's networking solution takes into account the big picture of the education IT operation, crafted specifically to ensure institutions can continue to provide open access in a secure environment. What's more, representatives from Dell's Advanced Services team can help campuses optimize issues such as scoping, architecting, training, deployment and maintenance (among others).

from the beginning translates into easier management and less troubleshooting down the road. Embracing 802.11n facilitates density and capacity, and it supports a new crop of multi-radio high-speed devices.

There are other benefits, too. In general, the open standards of distributed networking enable academic institutions and organizations to be more flexible and responsible. What's more, the ability to scale easily with cost-effective switching elements means customers can pay as they go, instead of buying into unnecessary solutions at the outset.

Dell vs. the Competition

Research comparing Dell networking solutions to that of competitors indicates that simplifying and optimizing the network fabric leads to significant cost savings in a variety of areas:

• One-quarter of the overall price
• One-fifth of the power
• One-sixth of the space

Finally, this new approach to networking is an evolutionary endeavor. This differs from the way in which some vendors make customers commit to product roadmaps, requiring them to pay big bucks upfront and lock into certain technologies indefinitely. Instead, under this new strategy, educational institutions can build out infrastructures over time. As campuses continue to tie new efforts to sustainability, distributed networks can help there too — the new approach uses less power and takes up less space.

Conclusion

After years of operating within the confines of a rigid and inflexible networking paradigm, a new approach to networking is emerging that is more flexible, allowing data to flow up, down and all around the network to deliver administrators, teachers and students exactly what they want, exactly when they want it. Applied correctly, this new approach to networking can streamline an entire IT operation, providing welcome efficiencies and lower costs. Most importantly, it helps educational institutions build up their digital foundations to take advantage of the technological advancements that are revolutionizing learning.

Endnotes

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