Will Transformed Teaching and Learning Break Your Network?

Instructional technology is great—if the infrastructure can handle it.

By Marie Bjerede

When a district embarks on one-to-one learning and takes the digital leap, everything changes. Organizations have different responsibilities than they had in the past. Many features that had been core to the organization are now obsolete, and many that were never a consideration come front and center.

One such (often unexpected) consideration is how changes in teaching and learning affect the demands on school infrastructure and network design.

Many drivers of network capacity demand affect school districts that take the digital leap:

- In the early stages of digital transformation, the growth comes mainly from expanding the technology program. Every year, new grade levels are added, or more schools are included. In bring-your-own-device districts, more and more students bring their own electronic devices, with some districts now seeing more than three devices per student.
- The content that students are accessing is changing as well. Digital curriculum is becoming larger, requiring more bandwidth to transfer lessons to student devices. Many device operating systems are becoming more "chatty," sending lots of data across the network in order to keep the student devices synchronized with the cloud. Device management software adds functionality that requires the management software to connect frequently with the device. And even simple web pages are becoming larger with more content, which increases the bandwidth required for simple web browsing.
- As teaching and learning with technology become more mature in a district, there is often a dramatic shift toward student-centered and personalized learning. That shift—and the power it gives to students, families, and teachers—is the highest good that comes from digital transformation, but it entails changes that increase student usage of the Internet, the need for rich digital resources, and use of online communities of learning for students and educators.

As a result, most districts are finding that the demand on network capacity becomes nonlinear. It is not uncommon for districts to see an increase in demand of 60% per year. Such increases mean districts need to double their network capacity *every 18 months*—a goal that seems daunting given constrained budgets.

To meet the national connectivity goal for 2017, a district of 10,000 students will need 1 gigabit per second of capacity for its network. If a rural district is paying $50 per megabit per second per month, it is paying $6 million per year—unaffordable! Fortunately, most districts pay significantly less, with most urban districts

paying on the order of $3 per megabit per second per month; in digital fiber communities, it is possible to get that cost down to $1,200 per year.

Even for districts that have a higher cost per megabit per second, purchasing in bulk can help bring the costs down.

Districts also have the opportunity to drive down the cost of Internet connectivity while increasing reliability, flexibility, and sustainability by designing Smart Networks. A Smart Network design starts by looking for the best place to connect to the Internet. For many districts, that will be an Internet point of presence where multiple Internet providers connect, giving the district the opportunity to have providers compete for their business. Those points of presence often support peering, connection to Internet2, and other cost-saving opportunities, including availability of virtualized servers.

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Once the district identifies the optimal connection place, it can do a cost trade-off analysis of the best way to connect schools to the Internet connection point(s). That may involve using "lit" fiber, where the control, operations, and maintenance of the fiber belong to a service provider; "dark" fiber where the school leases unused fiber from a provider and is often responsible for its operation and maintenance; or a fiber network constructed from scratch.

The trade-off between the costs of taking on operations and maintenance versus being beholden to a single provider who controls the costs must be considered carefully, but there are often opportunities for reducing overall costs by taking control of the district's wide area network.

Ancillary Benefits

While designing Smart Networks to minimize the cost of Internet access, districts also gain several ancillary benefits. They have the opportunity to design the network for high availability—something that was of secondary importance when the networks were used primarily for enterprise software by adults, but that has become essential now that access to the Internet is mission critical for day-to-day teaching and learning.

They also have the opportunity to "future-proof" networks by planning for performance requirements of the network five years into the future and mapping a build-out that will meet those requirements. By systematically designing a reliable, flexible, expandable network, districts can avoid the costs of having to replace obsolete or inadequate equipment prematurely.

Finally, a number of trends can help mitigate the cost of implementing a Smart Network:

- The costs of network hardware and network capacity are on downward sloping curves. It is possible for districts to plan carefully for the capacity growth that drives hardware infrastructure investments, making judgments about how long they can afford to wait to upgrade appliances and balancing their needs against how costs decrease over time. As for network capacity, many districts find that although their costs stay constant, the amount of capacity they can provide over time increases to keep pace with demand.
- E-Rate modernization has made it easier for districts to fund infrastructure to close the Wi-Fi gap. E-Rate has added $1.5 billion in funding per year for school broadband connectivity, with $2 billion available this year. It now also supports long-term planning for internal connections infrastructure by making it possible for districts to receive funding over five years rather than spending the full amount within one fiscal year.
- States and large districts are finding that they can dramatically reduce costs through the purchasing power they wield when they aggregate demand across districts or schools. Aggregation is effective not only for purchasing hardware and capacity but also for obtaining the technical human resources required for professional network architecture development, network design and implementation, and network management and maintenance. To make this approach easier, the Federal Communications Commission is encouraging consortia and bulk purchasing by removing constraints that previously prevented districts from participating with other public-sector entities, such as rural health care providers, universities, counties, and municipalities when seeking E-Rate funding.

The demands placed on networks in districts where teaching and learning have taken the digital leap can be significant and daunting. The Consortium for School Networking's leadership initiative, (www.cosn.org/SEND), addresses this challenge and provides a wealth of resources. Fortunately, there is opportunity in this situation—opportunity to build a Smart Network with the capacity, flexibility, scalability, and sustainability to serve the district for many years to come.

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