

INFOBRIEF

Ed Tech, BYOD, and Digital. Oh My!

Ensuring the K-12 broadband network makes the grade

New technologies are enabling an evolution in digital curriculum, learning analytics, and personalization of education. Mobile devices are transforming the delivery and consumption of education, from exclusively in the classroom to anywhere at any time. Students today expect a 24x7 digital, mobile learning experience.

Today, education technology leaders are faced with the need to provide a technology infrastructure that can support a rapidly changing learning paradigm. The successful implementation of many educational technology advancements relies heavily on the underlying broadband infrastructure.

New and emerging bandwidth drivers

Annual bandwidth demand for K-12 broadband networks is projected to grow 50 percent year over year.¹ New educational technology applications, such as those shown in Figure 1, are placing unprecedented demand on K-12 broadband networks. While application bandwidth requirements vary, meeting these needs is increasingly complicated by multiplying the differing requirements by the number of classrooms and number of students within a school district.

On top of the growing bandwidth demands from new educational applications, broadband network managers are

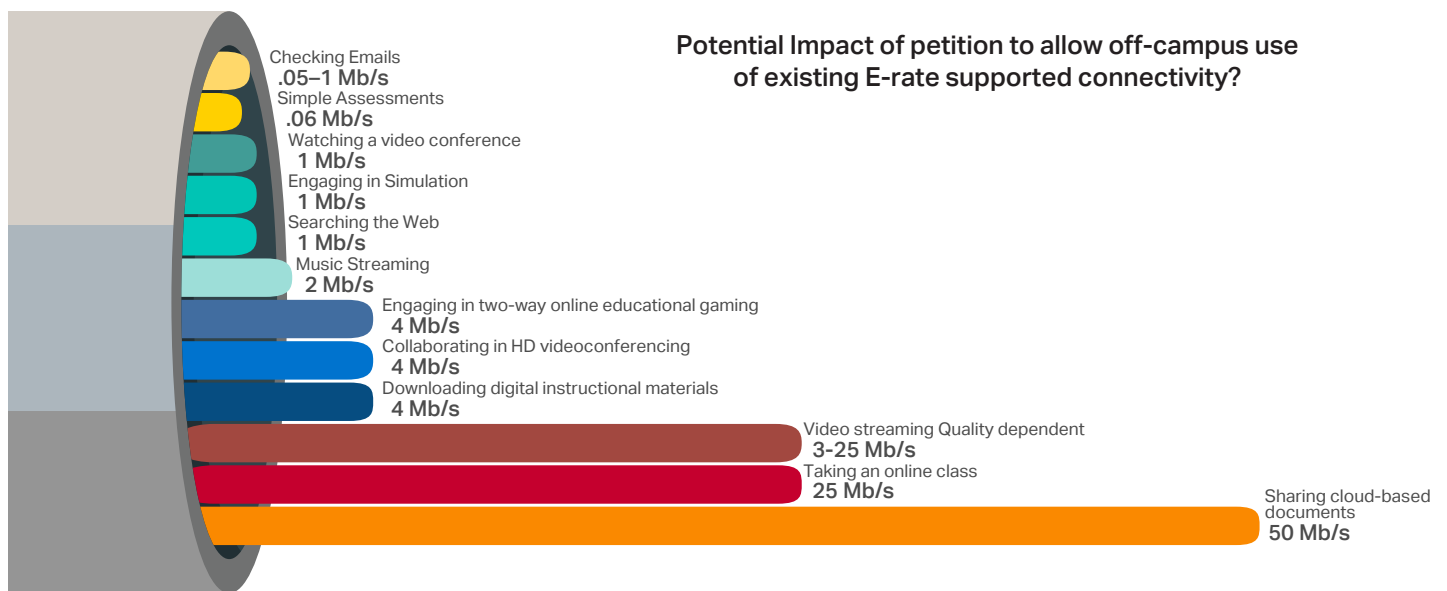


Figure 1: K-12 broadband network: bandwidth driver

¹ Education Super Highway: "K-12 Bandwidth Targets", <http://fibertoolkit.educationsuperhighway.org/toolkit/k-12-bandwidth-targets>

experiencing mounting competition for bandwidth from administrative applications. New 'smart' administrative applications such as Building Automation and Control Systems, Intelligent Transportation Systems for district fleets, WiFi-enabled buses, and student information systems are causing degrees of unpredictability in what used to be fairly constant traffic flows. When these more erratic and fluctuating educational applications are added, it is no wonder districts are experiencing an increase in unplanned network outages.

In this emerging, flexible, 'always-on' environment, how do school districts ensure there will be enough bandwidth to support district growth and, ultimately, student success?

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How much is enough?

The amount of bandwidth needed depends on a few key factors:

1. Enrollment size of the student population
2. Number of schools in the district, and their distance from district headquarters/primary data centers
3. Educational technology adoption plans
4. Specific school needs. Elementary, middle, and high schools may have different needs. High schools will tend to have more mobile devices and more educational technology bandwidth needs.

The State Educational Technology Directors Association (SETDA) also appears to have recognized Internet access and district WAN differences between small, medium, and large districts. The Broadband Imperative II minimum Internet access recommendations for school year 2017-2018 range from 100 Mb/s for small districts to 3 Gb/s for medium-sized districts, and 7 Gb/s for large districts.²

When assessing network needs, consider the school district's 'ilities.'

- Cost predictability – How important is cost predictability to budget planning?
- Capacity and scalability – How important is scalability to educational technology plans?
- Reliability and availability – How critical is network performance to educational delivery?

- Flexibility and manageability – How quickly should the network respond to changing user demands?
- Security and redundancy – Is data security a priority?

What are the options?

Recent E-rate funding changes have added new options to consider and created an unprecedented and potentially short-term opportunity to build the next-generation K-12 broadband network. Today, there are three basic options for a broadband network:

1. Traditional managed (lit) service
2. Leased dark fiber with management services
3. Self-provisioned private networks

With the inclusion of dark fiber and self-provisioned options in the E-Rate program, many districts are considering these alternatives to traditional 'lit' services to address the need for dramatic and continued increases in bandwidth demands, the requirement for greater network security, and the desire to be ready to respond rapidly to changing requirements. A dark fiber or self-provisioned network may not be viable for every situation, but often offers better control, flexibility, and overall cost advantages to provide an environment that helps students learn at the speed of light.

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Considerations for a private optical network

With E-Rate now allowing dark fiber and self-provisioned networks along with their modulating electronics, the option to build a private network is more attractive.

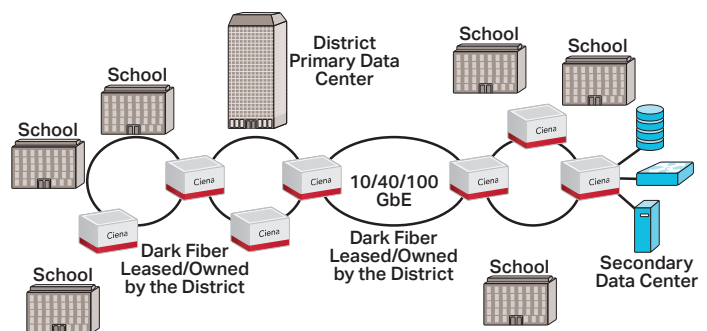


Figure 2: Dark fiber network example

² SETDA: "The Broadband Imperative: Recommendations to Address K-12 Education Infrastructure Needs", http://www.setda.org/wp-content/uploads/2013/09/SETDA_BroadbandImperative_May20Final.pdf

When security, scalability, predictability, assurance, and control are critical, a private fiber network is the best solution, offering substantial cost savings.

- Security – Greater than in a shared network service; cannot be tapped easily by intruders
- Scalability – Supports high bandwidth requirements and growth projections that exceed 10 Gb/s. As aggregate bandwidth grows, average cost decreases
- Predictability – Class of Service (CoS) assignment control ensures highest-priority applications receive the highest availability
- Assurance – Highly reliable, dependable, and trustworthy networking between district campuses and data centers
- Flexible control – Highly flexible to support a wide variety of services and protocols, as determined by enterprise needs, with rapid service turn-up

Constructing a dark fiber or self-provisioned network need not be difficult; optical transmission and packet technologies are mature and offer the ability to meet all requirements. However, the electronics of the system can have a significant impact on education delivery from both a capacity and performance perspective.

Converged electronics reduce cost

To drive down costs, districts opting for a dark fiber or self-provisioned networks should 'light' the networks with the type and size of network electronics that provide the highest transmission capacity at the lowest cost per bit. The type of electronic equipment will also likely vary by school category. For example, elementary schools with relatively little video and digital curricula may only require smaller, lower-cost Ethernet premises devices. Middle schools with more video and some collaboration may be best served by the larger Ethernet aggregation platforms. High schools with full digital learning management systems, video, collaboration, and 3D design may require larger converged packet/optical platforms. Data centers and cloud connectivity may require hyper-scale capacity equipment. Ciena offers an array of Ethernet and converged packet-optical solutions to meet these needs.

Reconfigurable networks reduce planning headaches

Districts are challenged to anticipate the need for change and understand where new campus locations, learning management systems, or digital traffic types may need to be supported in the future. Engineering a network for new services can be costly and entail major service interruptions. In an

optical network, a Reconfigurable Optical Add/Drop Multiplexer (ROADM) allows for new traffic patterns and locations, without completely redesigning the network. Ciena's ROADM technology makes planning for future traffic growth simpler, reducing equipment sparing requirements and ultimately saving cost.

Management software simplifies operations

All hardware systems should include a robust management system that will allow districts to support all phases of network operation: planning, provisioning, monitoring, alarms, troubleshooting, advanced diagnostics, and inventory management. Ciena provides management software that supports emerging software-defined networking tools that can enable very rapid network provisioning and reconfiguration based on the needs of each application instead of a static end-user bandwidth need.

Network analytics improve efficiency

For those districts that choose to manage their dark fiber or self-provisioned networks, the ability to proactively identify potential network issues and resolve them before they happen is critical. The volume of data generated from digital curricula and 'smart' administration applications is increasing exponentially. The traffic patterns also are becoming more difficult to predict without the aid of robust network analytics. In-depth network analytics enable districts to better predict capacity requirements and guarantee optimal network performance when multiple, competing demands for bandwidth—such as online assessments, streaming education video, augmented reality anatomy lessons, streaming educational video, and cross-country video collaboration—are all scheduled for the same day.

Ciena's Blue Planet provides a powerful framework for applications that generate deep insights from multiple sources

across a district's network, allowing staff to make smarter, data-driven decisions and anticipate network failures before they take place. Ciena's Network Health Predictor provides proactive network assurance by intelligently assessing the likelihood of failures across the optical, Ethernet, and IP layers before they impact teachers and students.

Security protects sensitive data

Districts are now realizing that the porous nature of their networks leaves them vulnerable to data breach. One significant advantage of a dark fiber or self-provisioned network is the enhanced security it provides. By building such a network, districts avoid the shared networking

characteristics of services like MPLS and can ensure traffic is isolated, rides on its own network infrastructure, and can be managed exclusively by the district IT team.

The right solution for a particular network will vary based on school district size, educational technology initiatives, and available managed service provider and fiber provider options.

Evaluating the options

Options are good, but evaluating all available choices is not always easy. The FCC and USAC administrators have not provided specific guidance beyond the fundamental test of whether the chosen option is the most cost-effective alternative via a competitive bidding process. However, some key factors can help make the dark fiber or self-provision project 'reasonably defensible.'

- Length of time – Ensure the time period for the network is clearly defined. Dark fiber leases can range from a few years to 20 years; be sure to include the same time period for the list services.
- Quantify bandwidth grow rate over the duration of contract period – 1 Gb/s might suffice today, but new applications will quickly drive 10 Gb/s or higher requirements over the period considered.
- Define specific circuit service requirements between schools, connecting data centers, Internet access, and more.
- Include all costs – Up-front investment may be required in both managed and dark fiber options.
- Consider maintenance and operations costs.

Recent comments by the new leadership at the FCC suggest that it will soon become even more important to demonstrate cost-effectiveness. Although the dark fiber and self-provisioning options involve a larger up-front cost, the ongoing monthly charges can be significantly lower than a lit service. Incorporating some of the factors listed above in the RFP can ensure an equal comparison between the available options, and can help ensure that the dark fiber or self-provisioning option is the most cost-effective and reasonably defensible option.

About Ciena

Ciena is a network strategy and technology company known for its commitment to customer success. With nearly 25 years of industry leadership, we support more than 1,300 of the world's largest, most reliable networks. Our technology is complemented with a high-touch consultative business model. At Ciena, we leverage our deep expertise in packet and optical networking and distributed software automation to deliver customer solutions that support increasing bandwidth demands and maximize bandwidth cost-efficiently.

Ciena hardware and software power many of the largest U.S. and global service provider networks that provide many of the managed services already in use today. In addition, Ciena powers national and regional research and education, higher education, and K-12 networks across the U.S. Working with both managed service providers and dark fiber providers, Ciena can help determine the best solution for unique K-12 broadband networks.

Want to know more? Visit us at www.ciena.com/k12.

Ciena knows K-12 education
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