

INFOBRIEF

Building K-12 Networks to Teach the Leaders of Tomorrow

The digital transformation of education

New digital education tools have the potential to transform America's classrooms and prepare students for the global information economy of the 21st century. But K-12 networks often struggle to meet the increased performance, agility, and resiliency demands of the latest cloud-based, digital media, and 'anytime, anywhere' learning environment.

Superintendents, curriculum directors, and teachers often assume the network will be able to support these bandwidth-intensive applications, but problems only come to light when the network goes down. Network outages result in lost instruction time and frustrated teachers and students, and often occur at the most inconvenient times, such as during district-wide online assessments. A recent Consortium of School Networking (CoSN) study shows that 37 percent of school districts experience one day of unplanned network outage per year, and 18 percent experience three or more days of unplanned outages¹ due to network congestion.

Forward-thinking district leaders understand there is a direct link between having a high-speed network and improved student performance. The applications driving better learning results and increased demand for bandwidth include streaming and archived educational video, collaboration applications, machine learning, artificial intelligence, artificial reality, and online multimedia learning systems, which are replacing textbooks.

Administrative applications also contribute to demand, including 'smart' building automation, fleet management, and student information systems. In addition, Internet of Things applications like video surveillance, student electronic health records, and other requirements further strain network capacity.

On the end-user side of the demand equation, 43 percent of districts are set to achieve a 1:1 ratio of district device to student within the next three years, and more than half of districts report that 100 percent of students have access to non-shared devices. This growth is driving huge demand, with 31 percent of districts forecasting bandwidth growth needs between 100 and 500 percent.² 65 percent access growth rate per year and 50 percent annual bandwidth demand growth.³

How much is enough?

The benefits of connectivity, paired with growing demand to support student-centered learning, prompted the State Educational Technology Directors Association (SETDA) to set bandwidth guidelines based on school district size for the 2020-21 school year. These guidelines range from 300 Mb/s for the smallest districts to 2 Gb/s per 1,000 users for the largest districts. For large districts of 10,000 students, this equates to 10 Gb/s.⁴ This guidance bears out Ciena's experience with its school district customers, many of whom are installing 1 or 10 Gb/s networks today, and indicating the need for 20 Gb/s in the near future.

1 CoSN 2017 Annual Infrastructure Survey Report

2 Ibid.

3 Ibid.

4 SETDA Broadband Imperative II

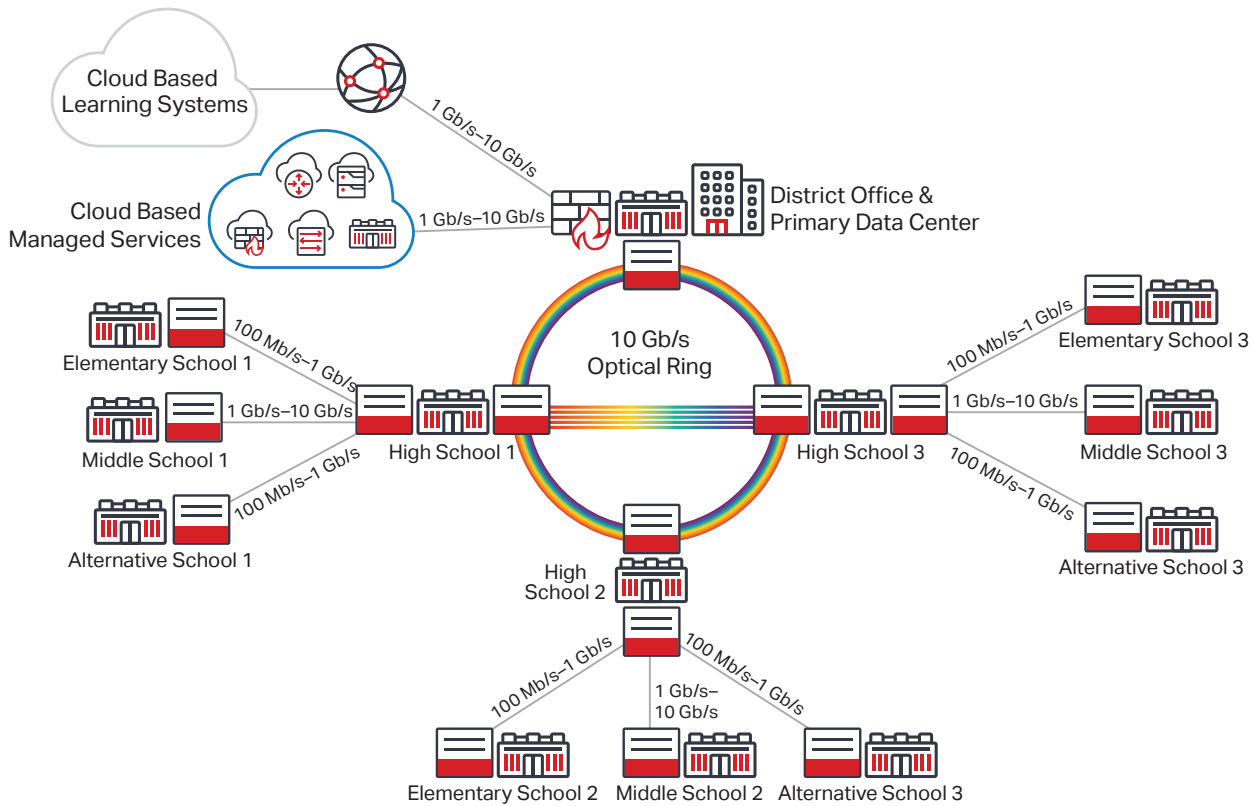


Figure 1. Reference architecture for K-12 networks

Ciena has developed reference architectures for K-12 networks, incorporating the needs of different sizes of schools as well as the age of the users, as shown in Figure 1. Elementary schools, which tend to have smaller numbers of students, also are less likely to be consistently heavy users of high-bandwidth content, such as video on demand or complicated interactive online digital content. At the other end of the spectrum, high schools have larger student bodies and more devices per student, and would be accessing more bandwidth-intensive multimedia content.

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As a result, elementary schools typically only require 100 Mb/s to 1 Gb/s connectivity, whereas middle schools and high schools would require 1 to 10 Gb/s. Larger school districts would install 100 Gb/s optical rings for their headquarters and data centers and to some of the bigger schools, with Ethernet and MPLS connectivity out to their smaller elementary and middle schools.

The networking components that comprise this reference architecture include:

Elementary schools

Ciena’s 3930 and 3916 Service Delivery Switches are advanced packet networking systems that focus on the transition to high-bandwidth applications requiring sophisticated Quality of Service (QoS) capabilities, such as Ethernet business services.

Ciena’s 3903 and 3904 Service Delivery Switches provide cost-effective Ethernet service delivery in compact form factors for small and medium-sized locations.

Middle schools

Ciena’s 5160 and 5142 Service Aggregation Switches efficiently deliver and aggregate large quantities of data over 10GbE while meeting stringent SLAs, all in a compact form factor.

Ciena’s 3931 Service Delivery Switch is an advanced weatherproof system able to deliver Carrier Ethernet services to almost any environment without sacrificing functionality.

Administration buildings and high schools

Ciena’s 8700 Packetwave® Platform is specifically optimized for 10GbE to 100GbE switching and aggregation, allowing customers to deliver higher-rate ports, services, and connections to meet demand.

Who picks up the tab?

To pay for this infrastructure, a majority of U.S. school districts rely on the federally funded E-rate program, which subsidizes between 10 and 90 percent of a district's Category 1 connectivity costs, based on the district's eligibility levels for the National School Lunch Program. Upwards of 95 percent of this funding goes toward managed lit services from service providers, with the remaining five percent going to fund dark fiber networks or new fiber roll-outs. While Ciena expects dark fiber and self-provisioned projects to increase in the next few years, conversations with Ciena customers indicate that the bulk of funding will continue to go to managed services.

Six Reasons Why Your E-Rate Funding Request Will Be Denied
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Another network financing option K-12 district leaders might explore is whether their state and local governments and other educational institutions or co-operative utilities would be willing to build a community network, for which the school board can be the anchor customer, or pool needs and negotiate better terms from a service provider.

Bandwidth is not always the answer

While the much of this paper focuses on discussing bandwidth, the primary need is really reliable connectivity, which goes beyond raw Gb/s capacity measurements to include:

- Manageability
- Reliability
- Low latency
- Security
- Redundancy
- Scalability

All these factors make SLAs easy to monitor and enforce, keep unplanned outages to a minimum, and can be easily diagnosed when failures or bottlenecks occur.

Ciena's K-12 solution powers 100G network in Houston

The Cypress-Fairbanks Independent School District (CFISD), the third largest school district in Texas, deployed a private optical network leveraging high-capacity networking solutions from Phonoscope LIGHTWAVE, a leading private fiber-optic network service provider, and Ciena. CFISD built a 100G network with the vision of providing students and staff 'anytime, anywhere' broadband access so they can interact and collaborate easily with peers and engage in distance learning initiatives.

CFISD is utilizing this robust fiber-optic network to improve access to Web-based educational resources for its approximately 114,000 students and 14,000 staff across more than 100 campuses and service centers, while enhancing learning and collaboration. The network was funded in part by the E-Rate program and designed in accordance with the Smart Education Networks by Design (SEND) initiative through CoSN.

CFISD's Vision 2020 program includes a Bring Your Own Technology (BYOT) policy, which the school district expects will result in the need to support up to three devices for each student (depending on the grade level of the student), teacher, and staff member.

Ciena's 6500 Packet-Optical Platform offers reliable, high-capacity connectivity between CFISD's six main hubs and three data centers through Phonoscope LIGHTWAVE's extensive dark fiber network footprint. The network also provides reliable connections between CFISD's educational campuses and its three data centers, one of which is a collocation facility located outside of the district, used to back up all mission-critical information.

"Our mission is to maximize every student's potential through rigorous and relevant learning experiences by preparing students to be 21st century global learners. To achieve it, we are proactively building a high-capacity network that will support the increased demands of wireless technologies, mobile devices, and high-speed connectivity. The Phonoscope LIGHTWAVE and Ciena solution provides the scalability and security we need to support these innovative programs that facilitate new types of classroom instruction, while also managing our mission-critical data and enabling future growth."

- Frankie Jackson, Chief Technology Officer,
Cypress-Fairbanks ISD

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