

The Adaptive Network Is the Foundation of Personalized, Adaptive Learning

To ensure that students have equal opportunities to succeed despite differences in learning styles, preferences, and pace, educators are implementing technology-fueled 'adaptive learning' initiatives.

What is adaptive learning?

The evolution of the education industry has given rise to the concept of an adaptive learning strategy—a technology-based teaching method that replaces the traditional one-size-fits-all teaching style with one that is more personalized to individual students. This approach leverages next-generation learning technologies to analyze a student's performance and reactions to digital content in real time, and modifies the lesson based on that data. Multiple technologies are combined to deliver this experience, including:

- Artificial Intelligence (AI) platforms
- Streaming and archived video
- Digital curriculums
- Immersive mixed reality
- Gamification systems
- Collaboration platforms
- Global research programs
- Digital assistants

Adaptive learning aims to emulate and complement the talents of educators to provide the best possible learning experience for every single student. Teachers are no longer just delivering content to rows of students at their desks. Instead, they are leveraging advances in educational technology (EdTech) to foster interactive and collaborative discussions, projects, and exercises involving students physically located anywhere in the world.

Education leaders are realizing that the school district communication network is critical to the evolution and adoption of next-generation learning applications. These applications are bandwidth intensive and latency sensitive:

- Running AR/VR applications can require 700 Mb/s connectivity
- Streaming video can use 100 Mb/s per user
- Accessing digital curriculum requires 25 Mb/s per use
- Conducting physics and genomics experiments can generate petabytes of data—for example, a single human genome FASTQ file can exceed 200 GB

Personalized learning and advanced education technologies are reshaping the classroom, providing flexibility in teaching, and ultimately improving education.

Student/instructor mobility and cloud-based technologies remove the constraints of the physical classroom. Students are increasingly equipped with mobile devices; desktop-based PCs were displaced by laptops, which are now being sidelined with tablets and even high-end smartphones.

Additionally, education is facing growing geographic diversity among students and teachers with the continued practice of distance learning. The traditional concept of 'school hours' is also being challenged, with teachers and classmates engaging at any time and from anywhere.

Impact on networks

The simultaneous use of these bandwidth-intensive applications, combined with administrative applications, places greater strain on education networks. Educational institutions that are unprepared for these traffic surges experience unplanned network congestion and even outages—often at the worst possible moment, such as during online exams.

Learning applications are typically housed in a district data center or in a public cloud. Students, teachers, and collaboration partners must be able to access these applications in real time whether from a physical classroom, on the move, or from home. Fast, resilient, and always-available connectivity to these applications on an 'anywhere, anytime, any device' basis is critical to enabling a personalized learning approach. Bandwidth congestion, latency, or outages can lead to lost instruction time, impacting student performance and frustrating teachers. In a survey by the Center for Digital Education, nearly one-third of K-12 district respondents indicated that the reliability of their networks keeps them up at night.¹

Additional network considerations

- **On-demand capability** – New learning applications will drive dynamic changes in traffic patterns as well as bandwidth and latency requirements at each campus, meaning networks must be designed with flexibility and adaptability in mind.
- **Edge compute** – Some ultra-low latency applications must be housed as close as possible to the users, where content is both created and consumed, not in distant data centers.
- **End-to-end traffic monitoring** – School districts should be able to carefully monitor traffic through their entire network from the local building level, through any district or regional Wide Area Network (WAN), and on to the internet service provider.
- **Manageability** – 'Single pane of glass' network operations are key to ensuring effective manageability of all aspects of network and service lifecycles—from service creation, modification, assurance, and fault management to ongoing optimization.
- **Security** – Network integrity, as well as specific security capability (such as encrypted connections, firewalls, and intrusion detection) are required to ensure student and teacher privacy is respected.

Legacy education networks often struggle to meet the increased performance, agility, and resiliency demands of next-generation EdTech and anytime, anywhere learning environments. They often involve fixed, static bandwidth capacity and physical network function devices, such as routers and firewalls, at each campus. Typical district network configurations involve aggregating individual campus internet and cloud connectivity requirements through a centralized district data center rather than directly connecting at each campus. In addition, network management tends to be reactive and involves manual processes requiring ongoing human engagement at each step. These challenges combine to

make education networks static, inflexible, costly, and highly inefficient to own and operate.

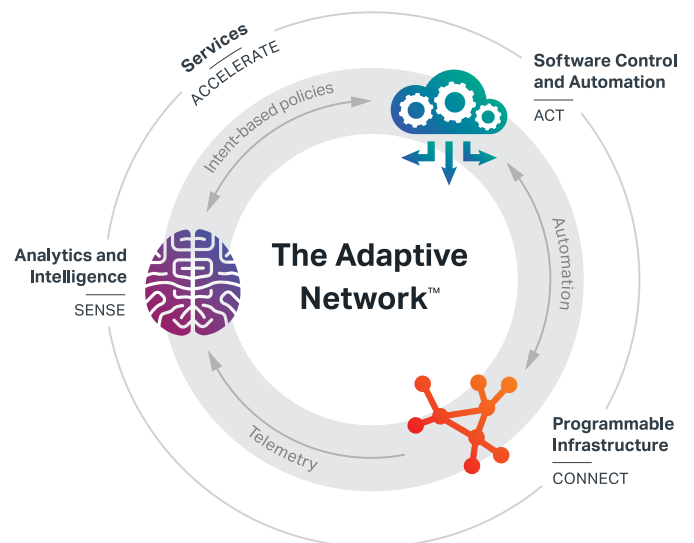
To ensure successful adoption of technology-driven learning initiatives, educational institutions require a network that is flexible, dynamic, automated, and virtualized. They need a network that can gather network traffic patterns, analyze streaming telemetry data in real time to predict potential congestion or outage situations, and then automatically adjust network performance without the need for human intervention. Ciena calls this approach the Adaptive Network™.

Ciena's Adaptive Network vision

Networks are quickly evolving from static, inflexible, appliance-based network functions with manual processes to more automated, predictive, agile, and open technologies. They are becoming faster, closer, smarter, and safer:

- **Faster**, both in terms of bandwidth capacity and data speed
- **Closer** by moving cloud-based compute and storage assets closer to the network edge
- **Smarter** via automation, analytics, AI, and virtualization capabilities
- **Safer** through technologies that increase awareness of what is going on in the network and rapidly address any concerns, in real time

The Adaptive Network is a framework that allows networks for education to be designed to meet immediate network needs, while providing a platform that can evolve to the future, as demands change. It enables network providers to optimize their existing frameworks while incorporating new technologies and ways of working.



¹ Center for Digital Education Survey Conducted December 2018

The Adaptive Network is built on key foundational elements:

Programmable Infrastructure (connect)

The programmable networking infrastructure can be accessed and configured via common open interfaces, is highly instrumented—with the ability to export real-time network performance data, and can adjust its resources, as needed, to meet the demands of the applications running on top of it and optimally connect end users.

Analytics and Intelligence (sense)

Collecting network performance data, and analyzing it using AI, provides the ability to intelligently predict potential network problems before they occur and anticipate trends by turning mountains of data into actionable insights. Leveraging these insights helps network and data center operators develop smarter, data-driven business policies to sense and adapt to customer needs securely, and in real time.


Software Control and Automation (act)

Multi-Domain Service Orchestration (MDSO), federated inventory, and centralized, intelligent software-defined control

of individual domains are critical to powering a network that readily adapts to change. Through the implementation of Software-Defined Networking (SDN), Network Functions Virtualization (NFV), and open APIs, operators can simplify the act of managing and automating their networks end to end across multi-vendor, multi-domain hybrid networks.

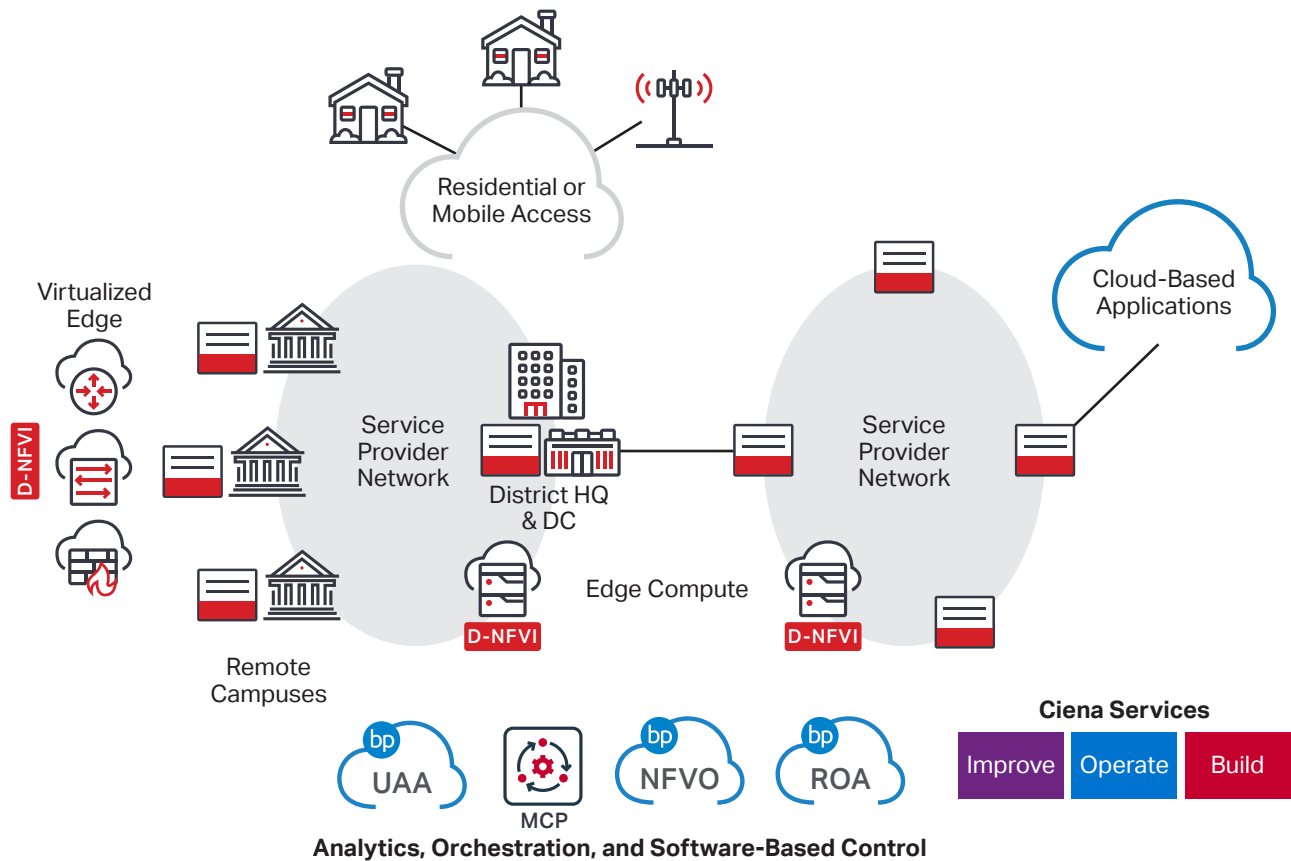
Services (accelerate)

Technical and professional services with proven methodologies are essential to help customers build, operate, and continually improve their networks—accelerating their journey to the Adaptive Network.

The Adaptive Network vision
[Learn more](#) 

The Adaptive Network for education

The figure below provides an overview of a sample Adaptive Network architecture in support of online learning that has the following characteristics.



The Adaptive Network for education

- Network edge devices or universal Customer Premises Equipment (uCPE) are located at schools, universities, and offices. They commonly feature 1GbE, 10GbE, or 100GbE uplink ports, as well as access ports, which provide connections to in-school IT infrastructure (such as routers).
 - Increasingly, uCPE is deployed to provide Virtual Network Functions (VNF) (such as routing, firewalls, and others along with D-NFVI software) on each campus location. This provides educators an ability to access new network functions without replacing edge equipment.
 - In addition, as educational institutions increasingly deploy ultra-low latency adaptive learning applications, the cloud storage and compute assets are moving closer to end users. This is achieved by hosting the applications in virtual machines and network functions with D-NFVI software either within the district data center or in the far edge of the service provider network.
- Aggregation devices collect traffic from schools and residential access networks; they are often deployed in protected architectures, such as ring-based topologies, providing a highly reliable service to school areas.
- Core networks provide ultra-high-capacity connectivity to non-latency cloud-based applications. These often capitalize on DWDM to offer exceptionally high bandwidth; DWDM networks are also typically extremely highly reliable and tolerant of failures.
- Analytics and software-based network management platforms leverage AI and advanced software to provide Bandwidth on Demand (BoD) and proactively identify and avoid potential application-impacting situations like congestion and outages.

Leveraging Ciena's Adaptive Network

Ciena's Adaptive Network approach can be tailored according to each educational institution's unique situation. Benefits of this approach include:

- Increased flexibility, scalability, and agility to quickly scale up bandwidth when and where needed to accommodate 'peak' capacity needs, and scale down when not needed
- High Quality of Experience (QoE) for students and teachers by meeting the demands of learning applications for low-latency, resiliency, and availability
- Bandwidth scalability, agility, and intelligence to support all the requirements and applications of today, as well as the innovative applications of the future
- Data-enabled decision-making using AI-based traffic analysis, allowing IT teams to proactively spot potential congestion or outage situations and take steps to avoid them
- Decreased operational expenses by replacing individual devices for each network function with uCPE and VNFs, increasing agility and minimizing the need to dispatch technicians to each campus to deploy, configure, and troubleshoot issues

Today, adaptive learning is rapidly becoming a must-have element of an effective and engaging digital learning experience. Ciena's Adaptive Network will help ensure that teachers, students, and collaborators can take full advantage of next-generation technologies.



Was this content useful?

Yes

No