

Bringing Innovation Back to Campus:

Accelerating the Evolution of Higher Education



Campus shutdowns across the country forced institutions and instructors to rapidly pivot to online modes of instruction. Now that instructors and students have had the opportunity to collaborate and learn using video and other interactive technologies, the expectation is these experiences will continue as students return to new hybrid learning models in the traditional campus setting.

As institutional priorities continue to evolve, these new models of teaching and learning, as well as equally dynamic changes in research, external partnerships, and student and faculty needs, will place dramatic new demands on campus infrastructure. This issue brief describes ways institutions can ensure their network remains agile and resilient in response to immediate needs, while preparing for even more dramatic changes that will improve student outcomes and ensure campuses remain relevant in the decades to come.

▷ RESILIENCE IN A TIME OF CHANGE

The rapid — and largely successful — pivot to online learning and collaboration after physical campuses closed their doors in Spring 2020 was a testament to institutional agility and resilience, as well as a reminder of the importance of ensuring connectivity and security across all modes of instruction.

As the emphasis shifts towards repopulating physical campuses, many institutions are focusing on flexible models of instruction with the goal of seamless transitions between online, in-person, and hybrid learning.

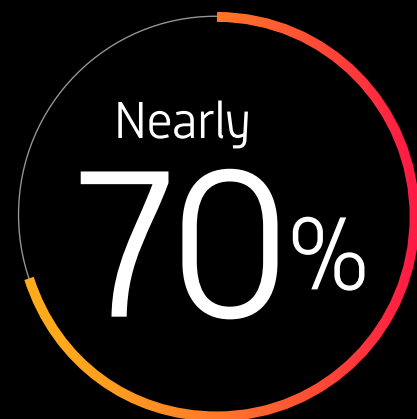
These demands come at a time when campuses are already making significant technology investments in virtually all areas of teaching, learning, research, and campus life. Nearly two-thirds (63 percent) of campuses are already using smart technologies to improve learning environments and outcomes,¹ and emerging academic and institutional objectives are placing even greater demands on campus infrastructure. Among the main drivers:

Adaptive learning augments existing courseware and learning management systems with a host of new technologies to make teaching and learning more relevant and personalized to individual student needs. Augmented and virtual reality, digital assistants, gamification, video analytics that help track student engagement, and computer vision — an application of AI that helps computers understand what they “see” — will ultimately converge in a single platform that will transform how

teachers teach and students learn. While each technology is a network driver individually, when you put them together into an adaptive learning environment, it’s even more important for a system that is flexible and agile.

Enhancements to campus life — including security and access controls as well as artificial intelligence interfaces for student services, temperature sensors and video analytics that monitor social distancing — all require growing amounts of bandwidth. And that’s before we even consider the needs of the students who live and learn on campus, often bringing multiple devices with them in the process. Nearly half (41 percent) of students rely on three or more devices for their coursework alone — and that doesn’t count the additional devices such as videogames and connected TVs that have become commonplace in dorms.² Importantly, only 22 percent of students feel WiFi is very reliable in campus classrooms.³

Large-scale collaborative research projects such as genome sequencing generate immense amounts of data which must be shared with peer institutions. These large data sets are a significant part of the 62 petabytes of data U.S. research and education institutions move and share each month,⁴ and much of this data needs to be secured to maintain confidentiality agreements.



of higher education leaders anticipate needing an increase in bandwidth over the next 12 to 24 months.⁵

Faculty/staff needs, including anytime, anywhere access to campus systems and redundant off-campus infrastructure to ensure business continuity.

External partnerships, including community broadband initiatives or opening campus buildings to large events such as concerts or meetings.

For many campuses, network infrastructure is already a limiting factor. One out of four higher education leaders are concerned their current networks lack sufficient capacity to support a connected campus.⁶ And far more — nearly 70 percent — are anticipating a need for increased bandwidth over the next two years.⁷

▷ NEXT-GENERATION NETWORKS

Traditional networking technology was not designed to accommodate the growing and ever-changing demands of today's on-demand, high-bandwidth applications and streaming video, all generated and accessed by a growing number of personal and Internet of Things (IoT) devices. As higher education continues to evolve to meet changing needs, the infrastructure required to support it must evolve along with it. Among the key components of next-generation networking infrastructure:

Flexible and adaptive technology. Networks that can adapt collect and exchange telemetry to track and respond to bandwidth usage, capacity issues, and outages. This real-time data can be supplemented by analytics and machine learning that predict traffic spikes based on historical trends and automatically reallocate bandwidth before slowdowns or outages occur.

Network virtualization such as virtual routers, firewalls, and software-defined wide area networks (SD-WANs) improve operational efficiencies by allowing campuses to simplify network management, scale cloud services, and extend networking environments across satellite campuses, research sites, and other far-flung locations.

Advanced security, including encrypting data within and across networks, has become essential to safeguard personal student and staff information, as well as confidential data generated as part of research partnerships.

Next-generation backbones. Today's fiber optic wavelength services and Ethernet services provide flexible and secure high-bandwidth connectivity between campuses and their data centers or satellite locations. Next-generation networks must be ready for even more powerful optical networking backbones, as well as advancements in wireless technology such as 5G and future WiFi standards.

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▷ STRATEGIES FOR LEADERS

Campus leaders can begin planning for next-generation infrastructure today. Among the key strategies:

Identify and prioritize network needs. Architecting the right solutions for campus network infrastructure involves considerable time calculating campus needs and determining which ones are most important. What applications need real-time, always-on connectivity with limited or no latency? Which ones can tolerate greater latency or, in extreme cases, rely on previously downloaded data to prioritize other mission-critical applications?

Justify the business case. Stress outcomes, not technology, with senior leadership. The end goals of upgrading network architecture should be things like improving student performance and graduation rates, or helping researchers secure more federal funding.

Focus on continuity, flexibility, and security. Next-generation networking technologies allow campus IT leaders to set simple rules that prioritize specific use cases as network demands grow. These rules can help institutions ensure that when there's a concert or game on campus or students are studying for exams, for instance, no one gets shut out of the network.

▷ CONCLUSION

Higher education has proven its resilience in ways that would have been unthinkable just a year ago. As campus leaders look ahead, they must ensure their institutions and the infrastructure that powers teaching and learning can continue to adapt to unpredictable conditions, as well as embrace new models of teaching and learning. Doing so will ensure campuses are prepared for the broader transformation required to remain relevant to students, researchers, and the community for many years to come.

This piece was developed and written by the Center for Digital Education Content Studio, with information and input from Ciena and Windstream Enterprise.

Endnotes

1. 2019 CDE Connected Campus Survey of 155 Higher Education Decision-Makers.
2. 2019 CDE Connected Campus Survey of 1,000 College Students.
3. 2019 CDE Connected Campus Survey of 155 Higher Education Decision-Makers.
4. <https://www.internet2.edu/blogs/detail/7185>
5. 2019 CDE Campus Experience Survey of 514 College Students.
6. 2019 CDE Connected Campus Survey of 155 Higher Education Decision-Makers.
7. 2019 CDE Campus Experience Survey of 514 College Students.

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