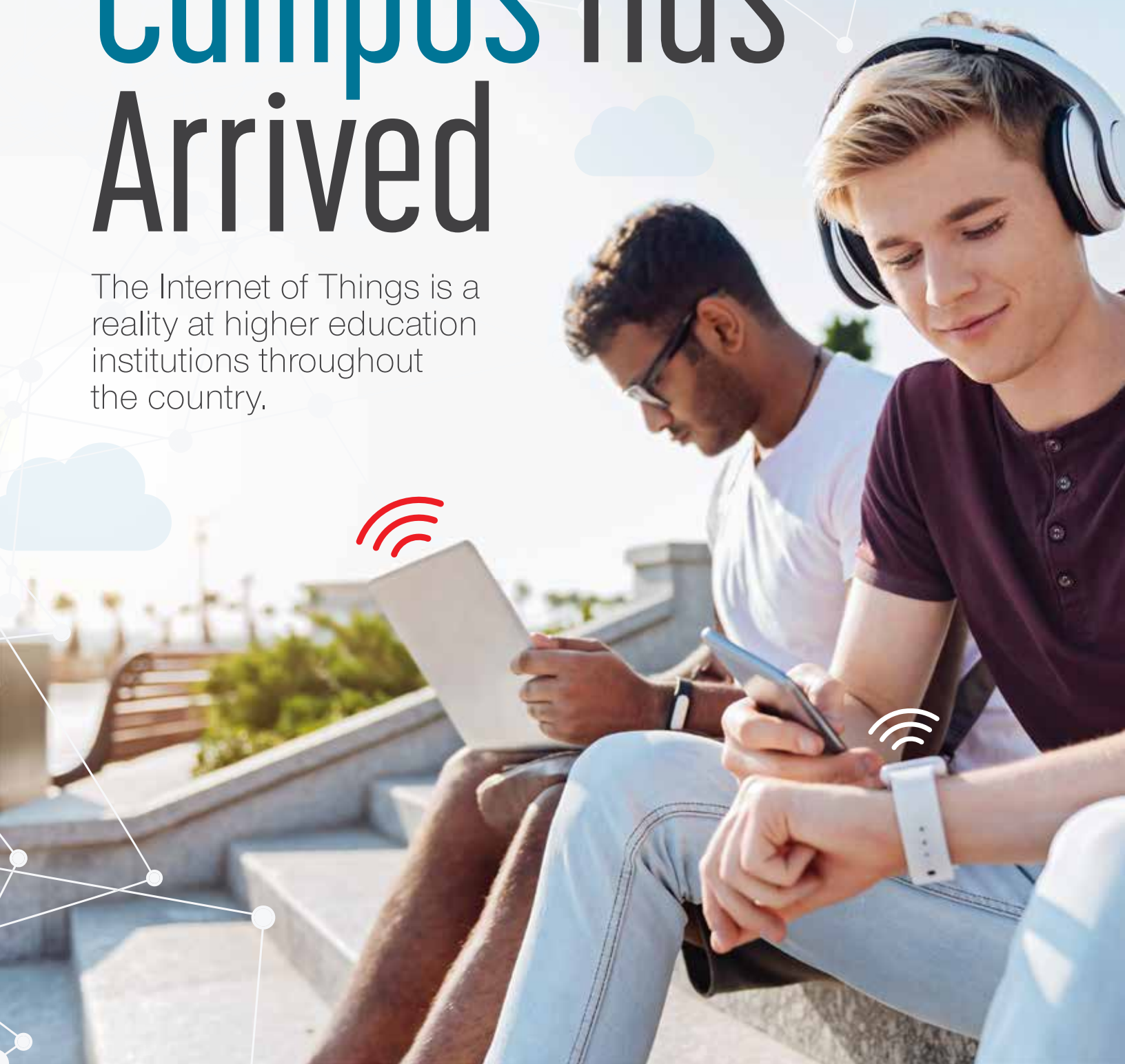
The Connected Campus Has Arrived

The Internet of Things is a reality at higher education institutions throughout the country.



INTRODUCTION

At colleges and universities across the country, the notion of leveraging Internet of Things (IoT) technologies to connect campus systems and modernize services is critical to improve the student experience. Creating these "smart campuses" is no longer an aspirational goal. It's a reality.

Today, more than three-quarters of colleges and universities (77 percent) are smart campuses — or are well on their way to becoming so, according to an October 2018 Center for Digital Education (CDE) survey of more than 130 IT and academic higher education leaders.

Connected systems are automating the complexities of facilities management, helping officials keep campuses safe and providing real-time information to students accustomed to getting it quickly in every other aspect of their always-online lives.

"Students want things right away; they want 24-hour access; and they want it everywhere on campus," says Jim Jorstad, director of client services at the University of Wisconsin-La Crosse and CDE senior fellow.

Some institutions have embedded technology in their stadiums that helps spectators find their seats and measures the noise intensity of specific sections. Others have implemented geospatial technology that allows students to receive texts as they walk across campus, alerting them to nearby events that are relevant to their majors or interests. Many institutions have even made IoT part of their curriculum, becoming research hubs for technologies that will find their way into other industries, including autonomous vehicles and analytics solutions powered by artificial intelligence (AI).

As the number of connected devices worldwide has skyrocketed into the tens of billions, weaving them into campus systems and structures in meaningful and secure ways can be a challenge for higher education leaders, particularly when they must also manage another set of "things" — the phones, tablets, laptops, gaming consoles and other devices that students bring with them to school.

This white paper examines the current state of IoT in higher education, outlines the potential of the technology and offers key issues that leaders must keep in mind as they continue their connected campus efforts.

IoT AND HIGHER EDUCATION STRATEGIC PLANS

Source: CDE IoT survey, October 2018

THE STATE OF IOT IN HIGHER EDUCATION

The Internet of Things isn't just well-entrenched at most colleges and universities. As institutions compete for students and work to contain costs, it's also become a strategic priority.

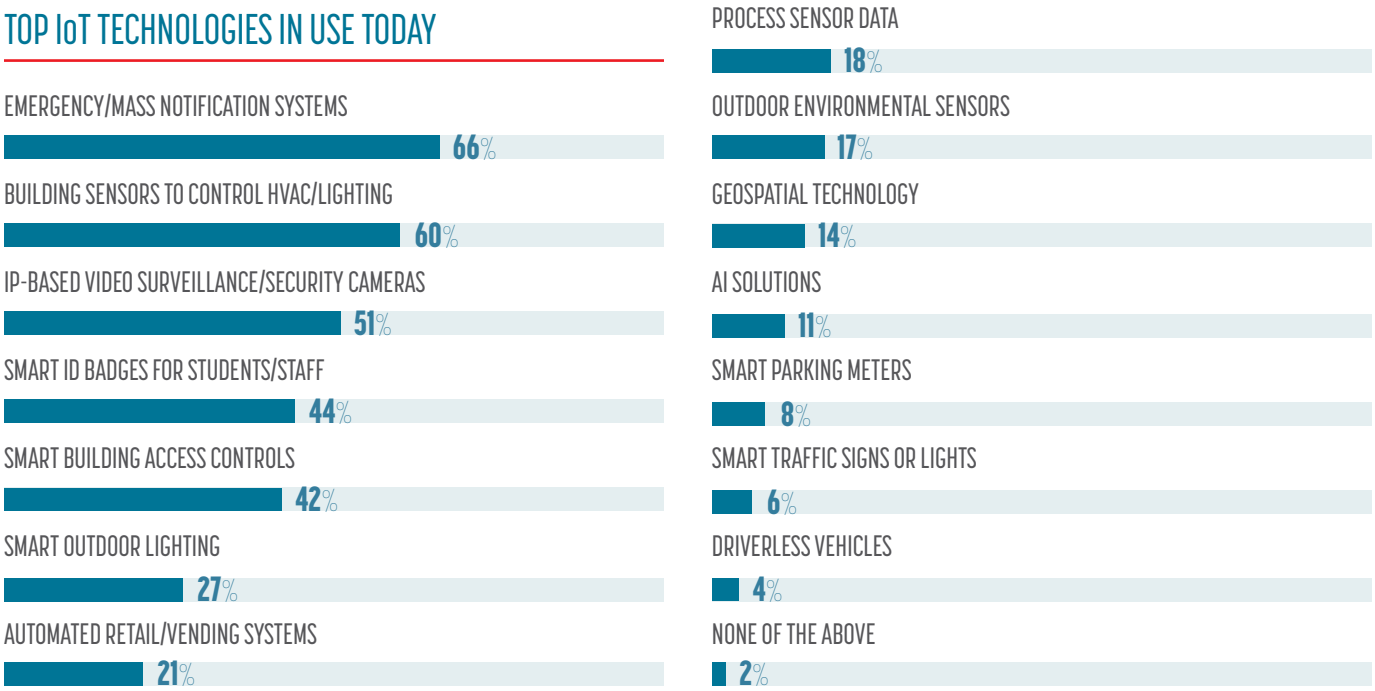
Nearly half (43 percent) of CDE survey respondents to the October survey said IoT or connected campus initiatives are part of their institutions' strategic plan; another 18 percent said their institutions are discussing IoT initiatives as part of their planning process. One-quarter (25 percent) have had IoT initiatives in their strategic plans for more than three years. Only 11 percent say there are no discussions about adding IoT to strategic plans on their campuses.

Most higher education institutions began their IoT journeys in their facilities departments, implementing connected sensors to monitor and control HVAC and lighting systems. To help ensure student safety, higher education leaders are also looking to solutions like smart building access controls, internet-connected security cameras and emergency notification systems that take advantage of the connected devices students carry — including mobile phones, tablets and laptops.

While IoT solutions focused on security and facilities are popular on campuses, gaps between the perceived benefits of IoT technology and its present-day implementation persist in other areas. For example, improved data analytics was cited as the top perceived benefit by more than two-thirds (67 percent) of all CDE survey respondents, yet only 18 percent reported using data analytics solutions to manage the data collected by their connected devices.

In similar fashion, nearly one-third of survey respondents (29 percent) cited the value of smart signage and other technologies to manage traffic flow, but fewer than 10 percent of campuses use smart traffic signs or lights and smart parking meters. And notably, a host of learning-related benefits were cited by more than half of all respondents, but those technologies remain in their infancy on many campuses.

TOP IoT TECHNOLOGIES IN USE TODAY



Source: CDE IoT survey, October 2018

"There's been far less activity on the academic side, except on the periphery of the student experience," says Dr. Steven Zink, former vice chancellor for the Nevada System of Higher Education and current CDE senior fellow.

EVOLVING USE CASES

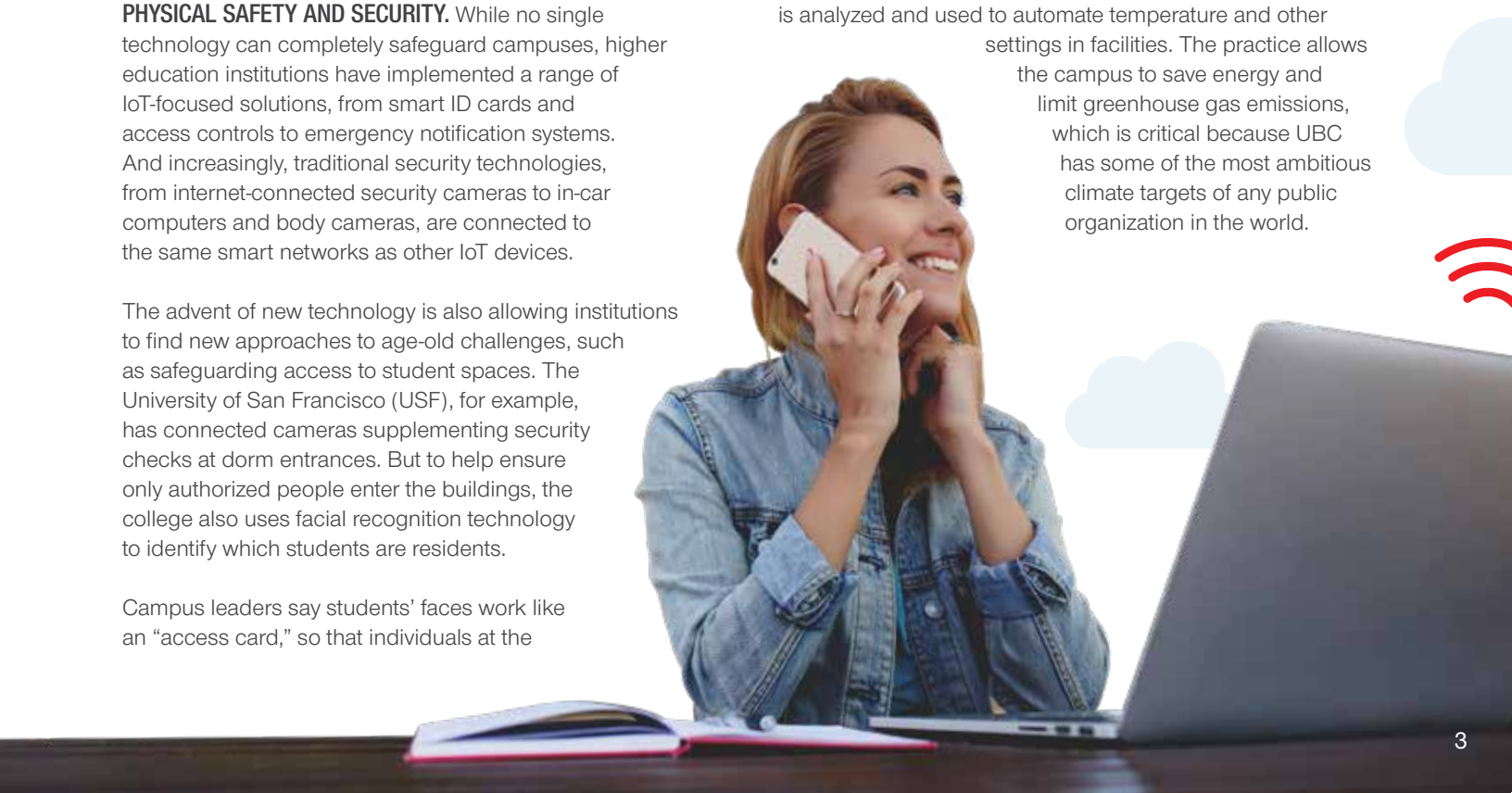
As higher education institutions continue to connect their campuses, new technologies and strategies are changing how IoT is unfolding in key areas.

PHYSICAL SAFETY AND SECURITY. While no single technology can completely safeguard campuses, higher education institutions have implemented a range of IoT-focused solutions, from smart ID cards and access controls to emergency notification systems. And increasingly, traditional security technologies, from internet-connected security cameras to in-car computers and body cameras, are connected to the same smart networks as other IoT devices.

The advent of new technology is also allowing institutions to find new approaches to age-old challenges, such as safeguarding access to student spaces. The University of San Francisco (USF), for example, has connected cameras supplementing security checks at dorm entrances. But to help ensure only authorized people enter the buildings, the college also uses facial recognition technology to identify which students are residents.

Campus leaders say students' faces work like an "access card," so that individuals at the front desk only need to ask for ID from people who the system doesn't recognize. It's a solution that helps increase security without overburdening campus staff.[1]

FACILITIES MANAGEMENT. The idea of centrally controlling HVAC and lighting systems predates the internet, with controllers once linked via dial-up or wired connections. But today's data-informed IoT technologies create new possibilities to save money and improve the campus experience. At the University of British Columbia (UBC), Wi-Fi access points across campus track when people come and go — data that is analyzed and used to automate temperature and other settings in facilities. The practice allows the campus to save energy and limit greenhouse gas emissions, which is critical because UBC has some of the most ambitious climate targets of any public organization in the world.



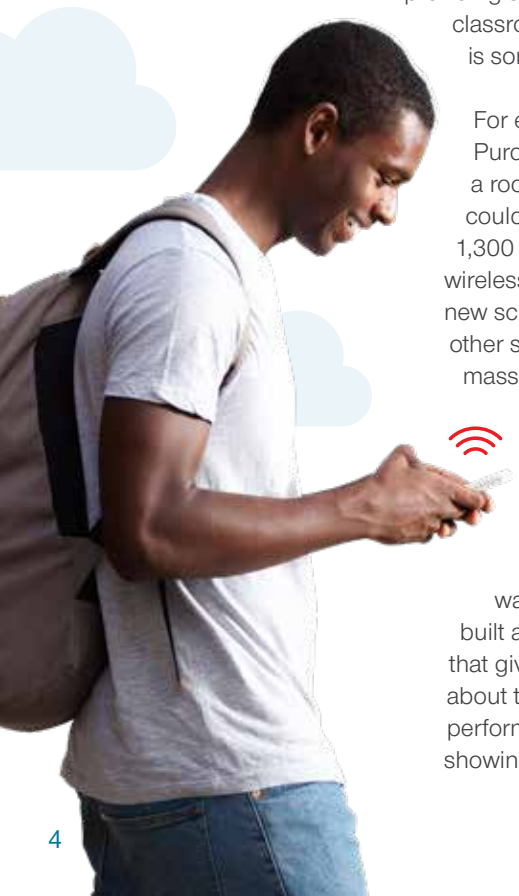
To date, these systems have resulted in a 33 percent reduction in greenhouse gas emissions and hundreds of thousands of dollars of savings annually.[2]

THE CAMPUS EXPERIENCE. With each student arriving on campus with as many as seven connected devices, campus leaders are managing an "Internet of Things" whether they intend to or not. Doing so requires a robust network with wireless access points wherever students may want to connect. But the opportunities to improve the always-connected student experience have expanded to include providing students with information when and where they need it.

Wayfinding stations and beacons can help students navigate around campus. Particularly on campuses with large commuter populations, smart traffic lights and parking solutions can reduce congestion and even allow students to reserve parking places. Some institutions are moving information even closer to students. St. Louis University (SLU) in Missouri placed 2,300 Amazon Echo Dot smart speakers in each dorm room on campus, with a customized version of Amazon's Alexa smart assistant programmed to answer student questions about facility operating hours, athletics and event schedules, as well as other aspects of student life.

Campus leaders note that every minute they can save students from having to search for the information they need online is another minute students can instead spend focused on their education.[3]

STUDENT SUCCESS. Always-available digital resources help students collaborate with each other as they learn, though providing such resources in classroom and lab settings is sometimes a challenge.



For example, leaders at Purdue University note that a room with 500 students could easily have 1,200 or 1,300 devices competing for wireless traffic. Additionally, new scientific machinery and other systems can create masses of data very rapidly.[4]

At the same time, institutions can apply analytics to this data and help students learn in new ways. For example, Purdue built an app called Forecast that gives students information about their behaviors and performance. Based on data showing that engaged students do better in their classes, Forecast analyzes students' use of wireless access points and smart card swipes at the gym, residence halls and dining facilities.[5] At the same time, geolocation technologies help campus leaders track student attendance and provide opportunities for faculty and staff to intervene when students routinely miss classes or other learning opportunities that put them at risk of failing out.

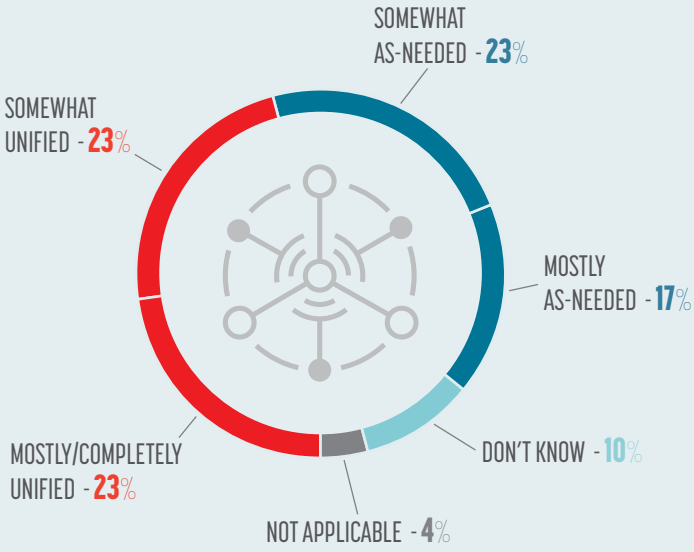
BUILDING A SMART CAMPUS

Creating a smart campus from these discrete IoT technologies requires a vision centered in the student experience — what students expect and need to be successful. It also requires careful consideration of a range of change management, technology and policy issues, including:

IMPLEMENTATION APPROACHES. Some institutions manage IoT and smart campus initiatives centrally (often through the IT department), while others allow individual departments and programs to experiment with and add smart technology as the need arises. Nearly half of CDE survey respondents (46 percent) said their institutions are undertaking a more unified approach to IoT adoption, while slightly fewer (40 percent) said their institutions are more likely to allow departments to adopt technology on an as-needed basis.

Respondents cited standardization across departments as a way to reduce training and maintenance costs, but many stressed the benefits of both approaches.

STRATEGIES FOR IoT IMPLEMENTATION



Source: CDE IoT survey, October 2018

"Unified approaches might prove efficiencies of scale and more deliberate decision-making," one said. "As-needed approaches might happen more quickly."

"I think a balance of the two is ideal," another respondent added. "There should be an overall plan, which assists in keeping costs as low as possible, but at the same time there needs to be flexibility for special circumstances."

NETWORKING NEEDS. Regardless of approach, growing numbers of connected devices require a comprehensive and planned approach ensures an institution's networks can accommodate them.

IT officials must examine their existing networking infrastructures to determine whether their capacity can handle a range of connected devices — sensors, cameras, video, student devices and more. Location also matters: An early challenge for colleges and universities adding sensors and smart controllers to HVAC systems was that many were in Wi-Fi inaccessible locations. As universities begin experimenting with autonomous technologies like driverless vehicles, though, it will become important to ensure networks blanket the entire campus with enough capacity to stream large amounts of data in real time.

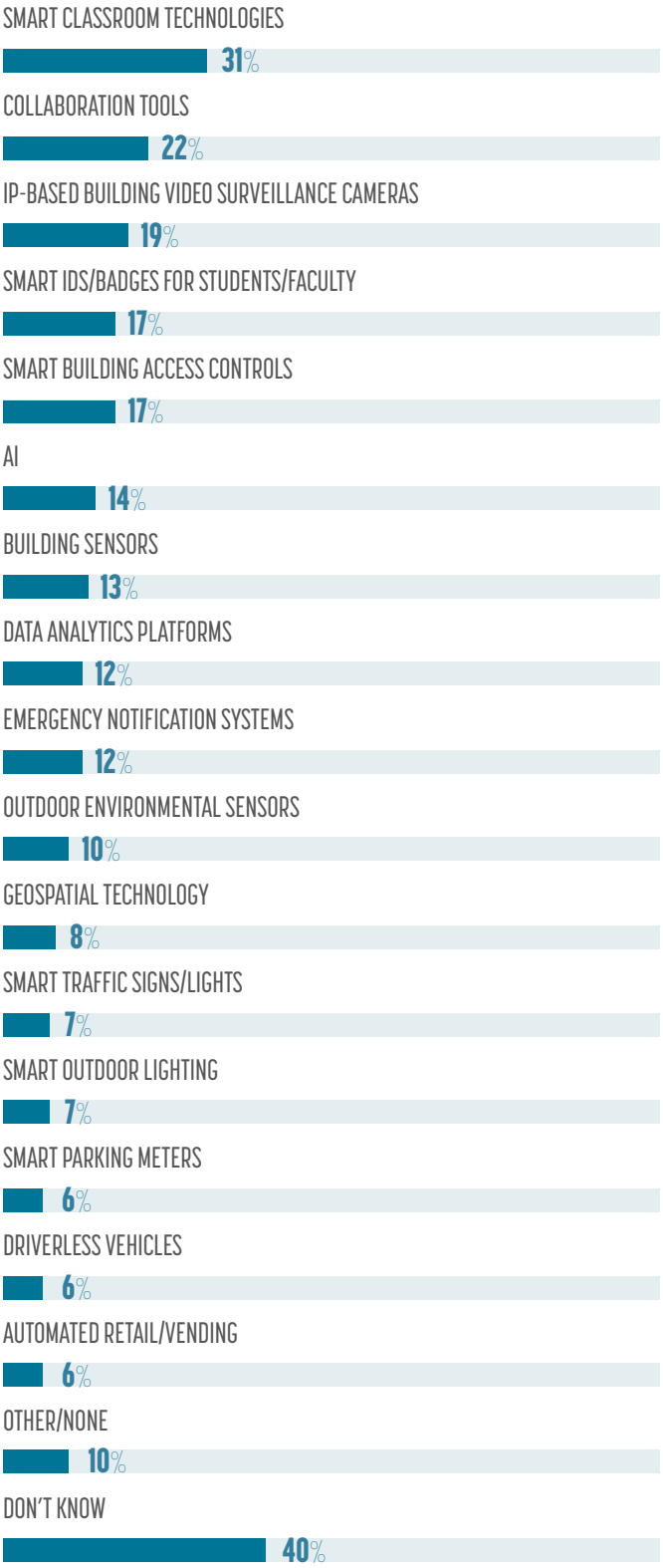
It also will become critical to find ways to automate network management. Emerging AI and machine learning technologies will make this job easier for IT officials and help ensure that finite bandwidth is maximized.

SECURITY NEEDS. More than half — 60 percent — of campuses reported a data breach in the past year, according to a 2018 survey.[6] On smart campuses, each new connected device represents another possible point of entry that needs to be secured. Connected sensors and other smart campus devices must be configured to use strong passwords — and, importantly, not their factory default passwords. Networking solutions with security features built into core technology such as routers and switches can simplify the process, and, as with network management, emerging AI and machine learning technologies can help keep information secure across the network.

It's also important to help students secure their own connected devices. The University of Wisconsin-La Crosse provides incoming students with a sheet of cybersecurity tips as part of the check-in process, according to Jorstad.

As real-world security solutions are intertwined with smart campus initiatives, additional security considerations must be taken into account. For example, the sensitive biometric data needed for next-generation security solutions bring with them stricter security requirements. It's also important to check that cybersecurity insurance and other risk-management policies extend to embedded systems and IoT devices, according to Zink, former vice chancellor for the Nevada System of Higher Education.

WHAT'S NEXT: PLANNED IoT TECHNOLOGIES



Source: CDE IoT survey, October 2018

IoT on Campus: Higher Ed Gets Smarter

In many ways, college campuses are the ultimate environment for the IoT to flourish. They operate much like small cities – with buildings and other facilities, transportation systems, waste and recycling, security personnel and more – and their inhabitants are digital natives who thrive on using technology to go about their daily lives or solve problems.

Many campus IT and academic leaders are already taking advantage of this unique position. In the October 2018 CDE survey, 77 percent of respondents said their campus was already "smart" or "connected," or it was in progress. More than one-third said IoT had been part of their strategic plan for more than a year.

See how IoT can help you transform your campus.

Better Manage Your Facilities & Improve S

Inefficient or unnecessary use of facilities can add costs that quickly escalate due to the scale of campus infrastructure.

The University of British Columbia uses Cisco Wi-Fi access points as a sensor network to connect to building control systems and easily adjust lighting and heating according to demand. Implemented campus-wide, this saves hundreds of thousands of dollars a year and dramatically decreases energy use.[1]

Help Your Students Succeed

IoT technologies can link class attendance, participation in activities and more to provide insights on student learning and engagement.

Some universities are getting students' permission to track their attendance with geolocation via devices. With this data, they can identify signs that a student is struggling and intervene before they unenroll.

Create a Better Campus Experience

Incoming students expect a digital, connected campus with ubiquitous Wi-Fi, context-aware services and more.

Deakin University in Australia uses IoT technologies from Cisco to create a smart campus that "knows who you are, knows where you are, and can deliver you the right information at the right time and the right experiences at the right time."[2]

Increase Physical Safety & Security

Safety and security is the No. 1 priority for campus leaders – IoT technologies serve as a force multiplier to minimize threats.

The University of San Francisco uses Cisco video surveillance and facial recognition technology to distinguish between campus residents and visitors.[3]

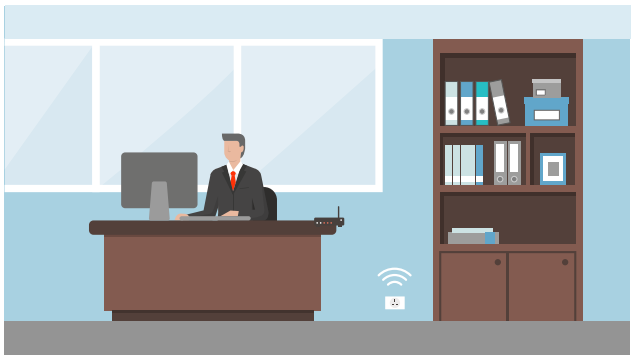
Streamline Campus Traffic

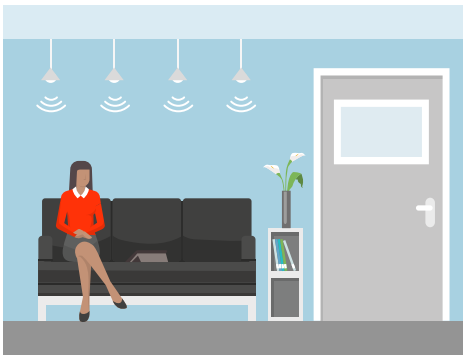
Stalled traffic and the inability to find a parking spot frustrates students and campus visitors and increases greenhouse gases.

1. https://www.cisco.com/c/en/us/solutions/industries/education/connected-campus.html#~-stickynav=2?socialshare=lightbox-cs
2. https://www.cisco.com/c/en/us/about/case-studies-customer-success-stories/university-british-columbia.html?socialshare=vjs_video_3
3. https://video.cisco.com/detail/video/4263245195001

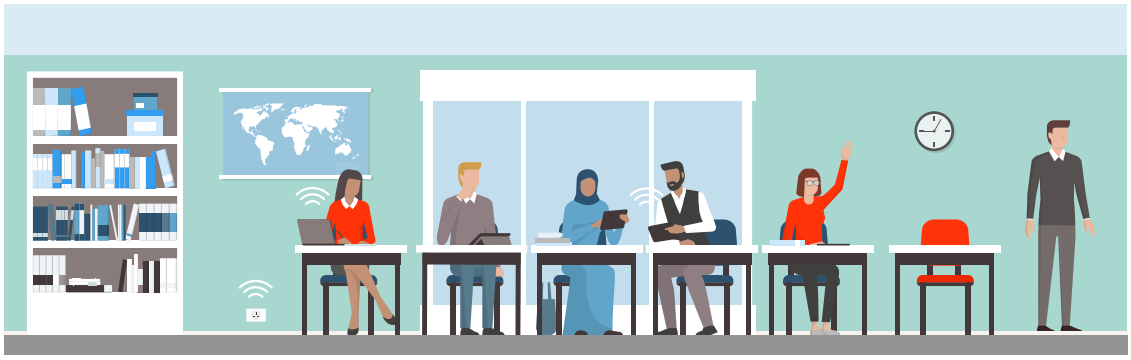
Sustainability

58% of IT and administrative campus leaders say IoT technologies **like smart buildings and utility monitoring** are a key benefit for campuses.





56% say IoT helps **improve academic administration**.



55% say IoT helps them **create a better experience** for prospective and current students.

54% say IoT technologies like IP **video surveillance cameras and smart lighting** can help make students, faculty and staff safer.

29% say IoT technologies like **smart signage** help them better manage traffic flow.

POLICY AND PRIVACY ISSUES. Greater public understanding of the need to keep campuses secure has helped temper heated concerns about privacy — once-contentious issues like the presence of security cameras are becoming more accepted, as individuals trade privacy for security. However, as campuses collect more personal information about students' whereabouts and habits, they need to develop and communicate strong privacy policies that encourage students to share information in ways that will help them. Purdue's Forecast app, for example, includes a lengthy discussion about how — and why — data is collected, and gives students the option of opting out completely.

LOOKING AHEAD

The number of devices connected to IP networks will be three times as high as the global population in 2021, according to Cisco.[7] Many of those devices will be developed and used regularly on college and university campuses. In the more immediate future, CDE survey respondents identified one area as having the greatest potential for growth — teaching and learning, where smart campus solutions have lagged.

That appears to be changing. The two most commonly cited planned technologies focus squarely on teaching and learning, with more than half of survey respondents (53 percent) planning to acquire new smart classroom technologies or collaboration tools.

As these new technologies proliferate, tomorrow's connected campuses will become smarter, safer, more secure and more suited to the needs of each student. To get there, institutions should ensure their networks are capable of evolving as technology evolves and have a team of experts in place who understand how best to implement and leverage new tools.

ENDNOTES

1. https://www.cisco.com/c/dam/en/us/products/collateral/physical-security/video-surveillance-manager/c36-733333-00-usf.pdf
2. https://www.cisco.com/c/en/us/about/case-studies-customer-success-stories/university-british-columbia.html
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