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wipro

Smart Tech Campus

March 2021

Introduction

A Smart Campus solution is a combination of hardware and software, designed to increase safety, reduce OpEx, save energy, increase efficiencies, and contribute to user comfort and satisfaction.

Building management systems (BMS) are the backbone of smart buildings—enabling building owners and tenants to monitor, maintain and manage the mechanical, electrical and electromechanical functions within a structure. BMS capabilities can include management of HVAC systems, as well as lighting, security and safety operations. But perhaps a building management system's biggest appeal is its proven ability to lower energy usage and save money.

Until recently, BMS deployment—involving sensors, software, network and cloud-based data store— has been costly. Realizing a sufficient ROI has been a challenge for all but the largest buildings. As a result, building owners have deployed BMS in only about 10 percent of their portfolios.

Recently the internet of things (IoT), with its low-powered networks and inexpensive sensors, has decreased the cost to deploy BMS—strengthening the business case for smart building operation.

This white paper can throw light on the converged innovative technologies and expert engineering of CommScope/RUCKUS® and Wipro Lighting to produce smart solutions.

"Controlling lighting and heating/air conditioning based on sensed occupancy provides an opportunity to significantly reduce energy consumptions and costs."

Michael Brambley,
Chief Scientist, Advanced Building Controls, Pacific Northwest National Laboratory

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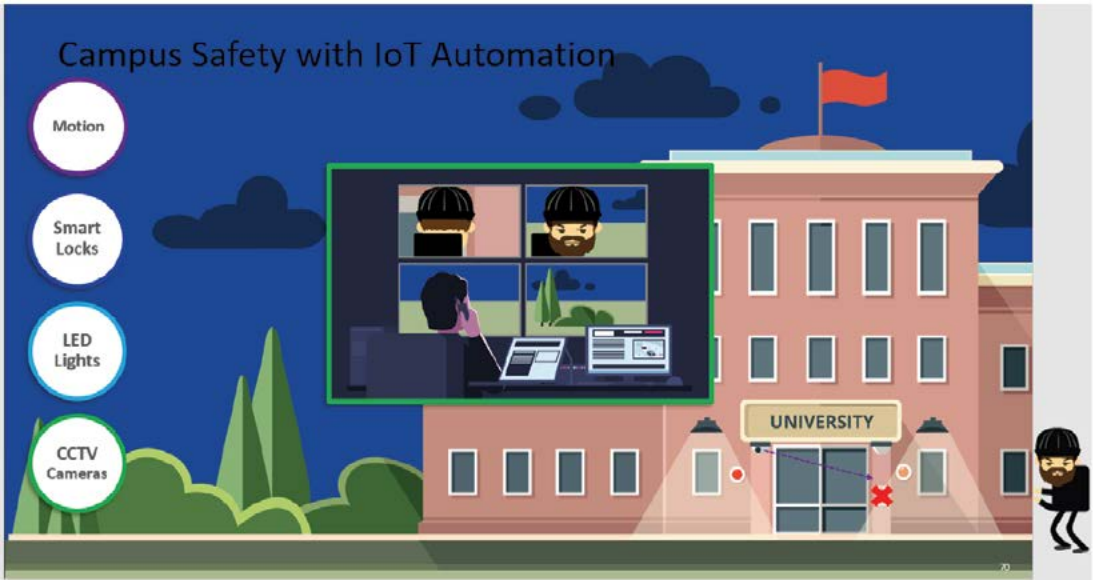
Benefits of the smart building or campus

Most recently, the enterprise C-suite has seen a strengthening in the CIO-CEO relationship. In this new paradigm, CIOs are assuming leadership of high-impact initiatives. This often involves adopting smart technologies to help their companies reduce cost and enhance productivity. Investing in a smart campus is one way of reducing operational cost and automating building operations and control that will, in turn, enhance occupants' safety, comfort and productivity while using less energy than a conventional building.

Let us first touch upon some of the benefits of a smart solution.

Increased safety and security



The primary benefit of a smart building is the improved safety and security it can provide. A smart building can detect smoke, tell occupants to evacuate the building, contact the correct authorities and prepare the structure for minimizing the spread of risk.

The deployment of cameras and the ability to stream footage from a surveillance camera to a laptop can increase safety and provide peace of mind to tenants. In healthcare, power-over-Ethernet (PoE) technology helps reduce wiring complexity, eliminates traditional wiring for the electrical power (e.g., nurse calling systems), and increases the safety quotient of the building.

Energy savings

Building management systems are the backbone of smart buildings—enabling building owners and tenants to monitor, maintain and manage the mechanical, electrical and electromechanical functions within a structure. When connected to the smart building's sensors, software, hardware and data store, a BMS helps manage heating, ventilation and air conditioning systems (HVAC), as well as lighting, security and safety operations.

The biggest benefit of a BMS is its proven ability to reduce energy usage and help save money. While a BMS offers long-term cost benefits, its traditional CapEx cost has been high. This is currently changing. Today the cost for deploying a BMS is significantly reduced due to inexpensive IoT sensors, and the cost of these sensors continues to drop.

Significant reduction of unplanned reactive maintenance

Unplanned reactive maintenance can be very expensive. Smart buildings can ensure maximum efficiency by using analysis algorithms to detect problems before expensive outages occur. This enables building owners and operators to detect and respond to incidents faster, and mitigate potential impacts in a more cost-effective manner.

POE—dc power costs and benefits compared to ac power

Power over Ethernet, or PoE, is an increasingly popular way to deliver both power and data over existing Ethernet cable, thus freeing applications from the constraint of ac-power proximity. As the number of PoE solutions has grown, so has their appetite for power.

PoE has also gained momentum for advanced lighting applications in new and existing commercial buildings. Today, it serves as a communications network and electric circuit providing internet access and low-voltage dc power to connect lighting devices.

The latest 90-watt PoE, IEEE 802.3bt technology drives high-power infrastructure for smart building systems, safe cities, thin clients, and a lot more. Facility managers and building owners can adopt the standard to future-proof their PoE networks to lower their installation and wiring costs. PoE is currently being used to power 90-watt LED lights, touchscreen PCs, PoE-powered switches, power-hungry intercoms, LED displays and more.

The technology and applications of dc power offer enhanced energy efficiency, improved power quality and reliability, and inherent alignment with renewable and clean energy development. For many smart building applications, dc power is replacing ac power. Here are just a few reasons why:

- dc-based lighting (LED) is as much as 75 percent more efficient than incandescent lighting
- dc power is significantly more energy efficient than ac power
- Electronic equipment operates on dc power. There is a 5-20 percent power loss when ac power is converted to dc power. The increasing reliance on electronic equipment creates a greater need for dc power.
- dc-based PoE technology reduces the cost of powering and managing a lighting system

Big data and analytics

Data powers smarter decisions across the enterprise. A smart building provides owners and operators the latest data on operational costs. This data is sent to a network operation center—enabling personnel to adapt to changes and maintain peak operational efficiency, predictive maintenance and building performance. Whereas a traditional building automation system (BAS) relies on preset schedules and set points for building operations, automated system optimization (ASO) relies on real-time feedback. ASO uses information and communication technologies (ICT) to collect and analyze building systems' operational and energy performance data. So, technicians can proactively adapt the building's operations based on external factors such as occupancy patterns, weather forecasts, and utility rates.

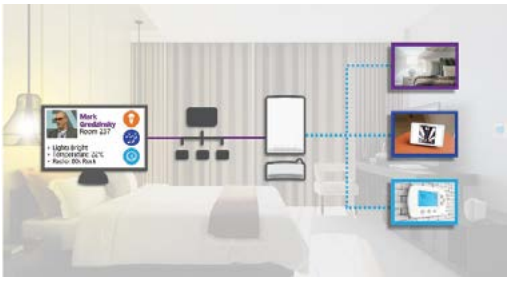
Visibility into operations and actionable information

The benefits of IoT for smart building automation, however, extend far beyond classic functions like HVAC and lighting control. Wireless sensors empower building owners with unparalleled visibility into their property operations—facility health, equipment condition, waste management, or security and fire safety.

For example, water leak detectors help identify early-stage pipe failures and enable immediate valve shut-down to prevent severe water damage. Likewise, temperature and vibration metrics of critical assets (e.g., chillers and elevators) can reveal impending or ongoing issues for timely inspection and repair.

Improved tenant/occupant wellbeing and satisfaction

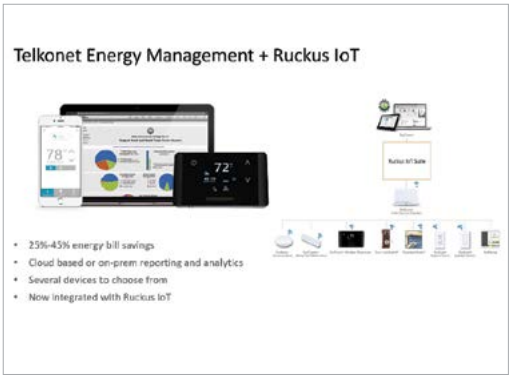
Today, the growing pervasiveness of smart home and smart building technologies has given rise to more demanding tenant expectations. Historically, indoor temperature was the pivotal metric for occupancy comfort. This is no longer the case. Air quality, lighting and humidity now all play into the ideal climate conditions for occupants' wellbeing and productivity. Wireless IoT sensors now play a central role in helping maintain a healthy and optimal indoor environment.



The smart solution

The CommScope RUCKUS IOT Suite energy management

Smart HVAC systems use multiple sensors for monitoring and control. Software interprets information from various sensor points to optimize the HVAC system's operation while improving occupant comfort. Smart HVAC controls can limit energy consumption in unoccupied building zones, detect and diagnose faults, and reduce HVAC usage—particularly during times of peak energy demand.

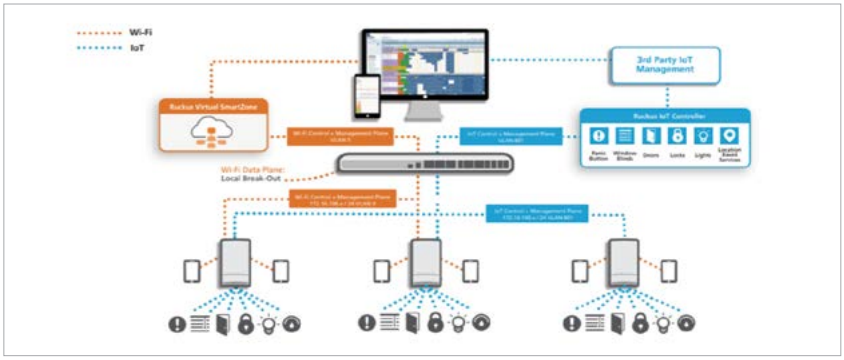


CommScope makes it easy to integrate smart building IoT applications into residences and workplaces to make them safer, greener and more comfortable. With a growing platform of building automation solutions, all running on our RUCKUS IoT suite, property owners and operators can build a flexible foundation for a world of new IoT experiences. CommScope's RUCKUS IoT Suite includes:

- Smart building applications: Support advanced solutions such as smart lighting, surveillance, and green energy monitoring from premier IoT partners like Telkonet, Assa Abloy, TraknProtect and others.
- Secure, versatile connectivity over a single platform: The RUCKUS IoT Suite offers industry-leading Wi-Fi connectivity and wired switching on a single versatile platform that connects and secures IoT devices—even those using different wireless protocols. Property owners can now deploy third-party smart building solutions to optimize comfort, convenience, safety, security and resource management. They can support multiple IoT wireless protocols and technologies on the same converged RUCKUS wireless network and connect over a single IoT gateway. All of a sudden, launching new IoT experiences and innovations becomes much simpler and less expensive.

How it works

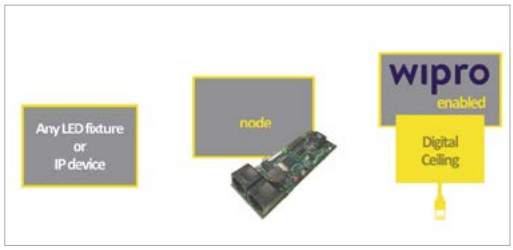
Smart building applications—such as smart lighting infrastructure, connected door locks and surveillance systems, smart HVAC controls, and more—connect using their own wireless protocols. For example, Assa Abloy door locks can connect over Zigbee, while smart thermostats and energy monitoring tools could connect over standard Wi-Fi. All endpoint devices can connect to RUCKUS IoT-enabled Wi-Fi access points, which support multiple wireless protocols simultaneously, and the RUCKUS IoT Suite. Operators can manage the wireless infrastructure for the entire consolidated IoT environment using the RUCKUS SmartZone wireless controller.



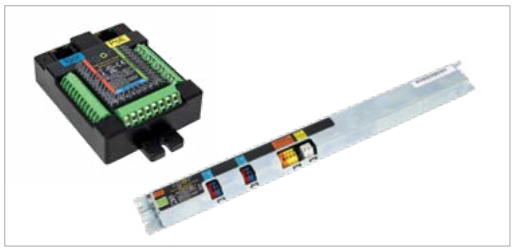
The solution eliminates the need for separate hubs and networks for each system and wireless protocol—dramatically reducing the costs and

complexity of building automation. At the same time, the solution makes it far easier for property owners to manage and continually expand innovative IoT capabilities for their residents, tenants and guests.

Wipro smart lighting



Wipro's Smart & Connected Practice focuses on providing new age digital solutions based on connected lighting, sensorization of workplaces, and software solutions that empower the decision makers to drive the experiences of the occupants in ways that are safe, secure and simple—yielding cost benefits on the existing investments of PoE infrastructure.



Our award-winning designs in lighting solutions go beyond the traditional lighting needs of enterprises and provide wellness, wellbeing, and intelligent solutions that are engineered for safety and security—enabling real-time visibility into advanced energy savings strategies.

Power over Ethernet (PoE) infrastructure enables building automation and intelligent building technologies such as lighting, sensors, smart locks, thermostats, digital signage, and other building controls.

Wipro Smart & Connected teams utilize your existing PoE infrastructure—enabling a data network for lighting applications coupled with advanced sensing technologies ranging from people-counting sensors to air quality controls. This solution is suitable for brownfield (existing workplaces) and greenfield workspaces. The solution is simple, reliable, flexible and scalable.

The potential cost savings associated with reductions in cabling infrastructure and labor costs:

Solution component	Description	Benefit
Infrastructure of PoE	Existing spare ports of PoE, PoE+, UPoE utilized	Making PoE switch useful for cost savings
Lighting	Smart lighting for wellness, emergency lighting—all in one	Existing any LED fixture
Sensors	Sensors for occupancy, guidance	Optimal utilization of the workspace
Analytics	Building, people analytics	Space utilization, compliance tracking, optimization

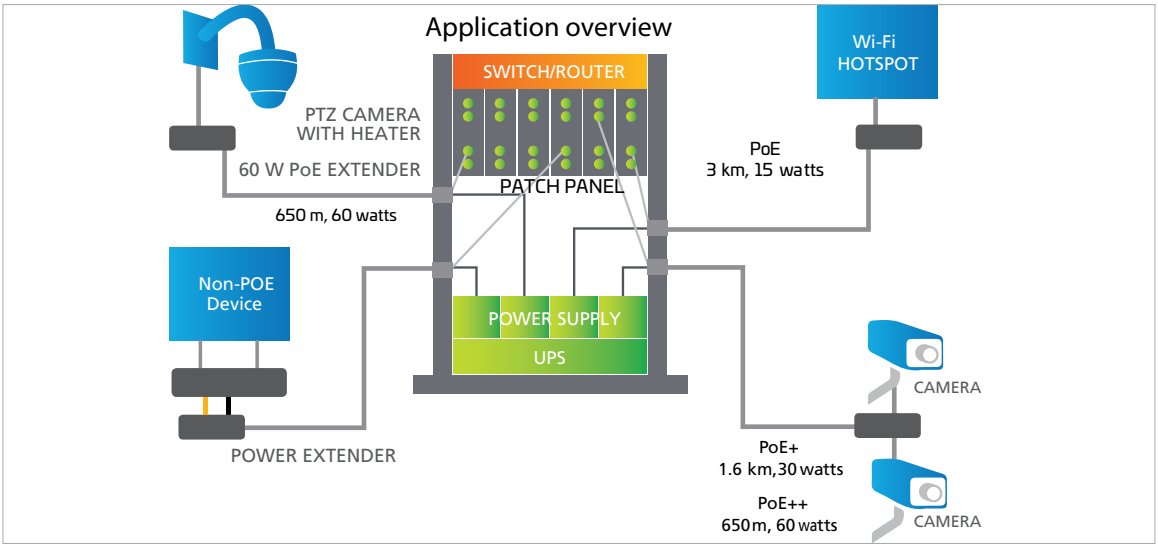
Pilot in a box concept from Wipro helps enterprises realize the investments done on PoE infrastructure and existing LED lighting fixtures to convert the facilities into smart facilities. This could be workspaces or shopfloors.

Pilot proves new use cases for the CRE and CIO organizations—enabling a better experience for employees and occupants. It shows the value of investment realization and overhead reduction to manage the work facilities.

It contains hardware and services involved that is non disruptive to enable even on brownfield installations. Hardware consists of Wipro node(s) and sensors for energy, occupancy, cooling, lighting, movement, and unified Wipro iPoE's open cloud analytics platform, providing unprecedented management helping Integrated Building Management System become a cost-savings platform instead of just a monitoring platform.

Powered fiber cabling solution (PFCS)

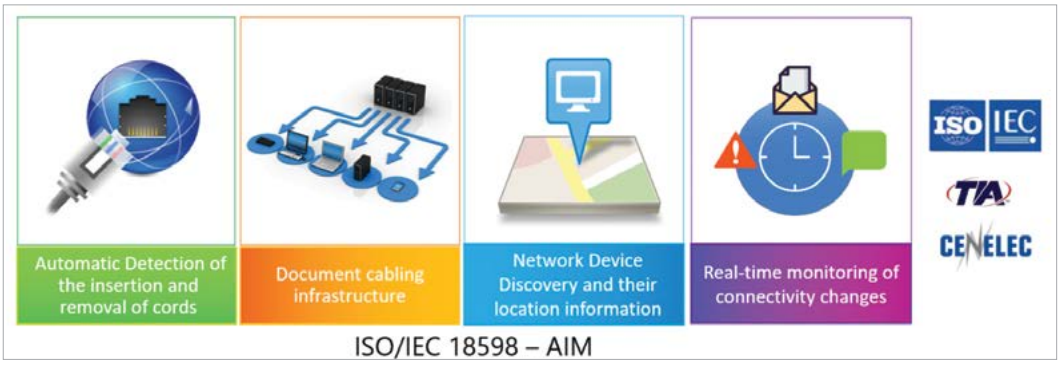
Additionally, CommScope's powered fiber cable solution (PFCS) extends Ethernet connectivity beyond 100 meters. This solution is ideal for connecting and powering outdoor security cameras or Wi-Fi access points without a separate ac power feed and solving PoE applications beyond the 100 m limitation.



Extended capabilities of powered fiber cabling

Automated infrastructure management (AIM)

Another key component for leveraging the potential of today's smart buildings and campuses is automated infrastructure management (AIM). Intelligent software, combined with network controllers and accessories, allows you to locate and identify connected equipment and ports while tracking and documenting all network changes in real time. This provides network teams a holistic view of their network and its connectivity at all times. Moreover, this instant visibility also helps protect against unauthorized physical intrusion. The result are increased asset utilization, reduced troubleshooting time, faster service turn-up and improved network security.



In-building copper solutions

When designing a smart campus, the physical layer remains the most critical determinant of how much performance and flexibility you'll get from your network—both today and tomorrow. For many enterprise networks, 1000BASE-T has become a bottleneck, an unacceptable limiting factor in network evolution. Extending the network's capabilities to support new applications and increased demand has become a business-critical priority. Network operators and managers have responded by stepping up to Category 6A technology, the next-generation structured cabling.

Currently, there are number of smart building and campus technologies and applications driving the adoption of Category 6A. They include:

- Higher-performance Wi-Fi backhaul
- Distributed compact switches
- LAN on motherboard
- HD video
- Expanding PoE applications

To support maximum throughput and higher levels of PoE, most enterprise businesses are deploying two Category 6A connectors as they prepare to upgrade to Wi-Fi 6/6E. This is true even if the remainder of their cabling plant remains Category 5e or 6. In fact, industry standards specifically recommend two Category 6/class EA connections for wireless access points.

For those networks that are not planning to upgrade to Category 6A but hope to support the first wave of Wi-Fi 6 devices over existing Category 5e or 6, it's important to understand that not all existing Category 5e and 6 cable plants will support 2.5/5GBASE-T to 100 meters. Links using these older technologies will need to be tested to ensure compliance.

For networks planning to upgrade to 6A, solutions such as CommScope's compact Category 6A copper solution is a good choice. It delivers network line speeds up to and beyond 10 Gbps without requiring increased rack space and airflow. Using our innovative optimized material technology (OMT) platform, this high-performance twisted-pair cabling features a reduced core while still minimizing alien crosstalk.

Reasons behind smart solutions' success

There are many barriers to the adoption of smart technologies, such as lack of capital, a lack of information, high upfront cost, ignorance, seamless interoperability between connected devices, inertia and other priorities. But, as the infrastructure needed to support it evolves, the benefits of smart technologies begin to outweigh the barriers. The following are just a few key examples.

Lower-cost sensors

Recent advances in sensor technology include smaller-sized sensors that are embeddable in the primary equipment they serve (e.g., light fixtures). This replaces the conventional standalone sensor that must be mounted and wired separately. The wireless capability of advanced sensors and controls makes their installation and commissioning easier and quicker. As wireless sensor technology evolves further to include self-powered units, their deployment should become even more economical. The average price of an IoT sensor has declined from $1.30 in 2004 to $0.44 in 2018, according to Microsoft's "2019 Manufacturing Trends" report.

Higher-power POE and support for newer applications

In the world of digital transformation, organizations using hyper automation are gaining a competitive advantage by utilizing tools that empower employees to be more connected, engaged, mobile and secure. In this paradigm shift, PoE is proving to be a simple, efficient, and cost-effective solution—enabling newer applications and compelling use cases ranging from modern digital building architectures, hospitality, retail, healthcare, and IT. In many cases, these tools rely on higher-power PoE.

Industrial automation

PoE technology enables the centralization of power and provides high-speed connectivity to support the growing number of connected devices in manufacturing environments. For instance, as the number of IoT connected devices increases, the need to converge the data and power infrastructures to meet the demands of network assets increases as well.

Wireless devices in the industrial sector require high power and connectivity to support business-critical applications—increasing demand for PoE solutions.

Data aggregated over time from motion sensors on office LED lighting fixtures can be used to determine employee occupancy behavior. This insight helps inform better planning and decision making. So, for example, building managers can develop optimized seating capacities and configurations. Some of the other advantages LEDs have over traditional lighting systems are:

- Higher energy efficiency and reduced energy consumption
- Longer life expectancy
- Low-voltage and cold temperature operation
- Brighter and dimmable
- No mercury content

PoE helps reduce the complexity of wiring, eliminates traditional wiring for the electrical power, and increases the safety quotient of the building.

Healthcare solutions

The common mantra across healthcare echoes the increased demand for access to patient records, medical systems, and applications to record vital signs and drug dosages regardless of their location. Healthcare organizations are looking at thin or zero clients as preferred solutions for providing this access. These solutions offer a highly available, secure, and consistent virtual desktop experience for users.

PoE is also playing an increased role in advanced nurse call systems being deployed in hospitals today. PoE provides a simplified data/power solution that addresses the need for safety, surety and security throughout the hospital. By reducing the number of cords in sensitive areas such as intensive care and patient rooms, PoE helps improve both safety and system management.

The recently ratified IEEE 802.3bt standard is serving as a catalyst for the design of high-powered devices and switches capable of delivering 60-90 watts. Ultimately, we expect the industry to embrace even higher PoE levels. It should be noted that switch PoE capabilities are an important consideration when purchasing and future-proofing network infrastructure.

Network vendors have united around the single 802.3bt standard. But, while most advertise their compatibility with this standard, they typically support only the lower 60-watt power level. RUCKUS Networks (now part of CommScope) is one of the few that have implemented the 802.3bt standard to the full 90 watts.

Other use cases of high-power PoE include point of sale/retail (credit card readers and printers), IP turrets (banking, financial trade floor phone systems), thin clients, virtual desktops, PoE-powered switches, digital signages, etc.

Smart lighting

Smart lighting has the potential to help building owners lower their electricity cost—while enhancing safety and security and creating a more productive working environment. To help building owners maximize these benefits, lighting product managers at technology and service providers will need to implement five key strategic phases of smart lighting:

- LED lighting
- Sensors and controls
- Connectivity
- Analytics
- Intelligence

Most new lighting installations require some form of sensor controls, which, among other things, provides a level of system automation. The controls and lighting connect via a network that enables the lighting to be operated through a centralized dashboard. This not only makes operating the lighting system convenient, it enables the building owner to begin analyzing lighting patterns and further improve lighting costs. This is an important part of the value proposition for lighting management platforms such as the Wipro Smart and Connected solution.

Converged solutions (wired and wireless)

The edge network is growing in complexity, and IoT only adds to the challenge. To simplify networking, CommScope's RUCKUS Converged Edge Network brings wireless, wired, and IoT networks into a common network architecture. For smart building owners, the ability to support network convergence at the edge simplifies management, provisioning, assurance and security. It also addresses the fear many organizations have regarding the cost, time and resources required to build new overlay networks just to support a single vendor's IoT solution.

With the CommScope RUCKUS IoT solution, for example, organizations leverage the existing RUCKUS access points, switches, and network controllers to aggregate and backhaul IoT traffic over the existing Wi-Fi infrastructure—regardless of the wireless protocol used by the sensors or devices. A common dashboard provides visibility of all IoT devices on a single pane of glass. An advanced rules engine allows orchestration across devices regardless of manufacturer.

Big data and cloud

Before the emergence of cloud-based services and infrastructure, deploying a server-based network required a significant investment of time and money to set up, configure and troubleshoot back-end servers. With the movement to cloud-based computing, the financial investment has been significantly reduced and the time needed to set up and establish new server instances has gone from weeks to minutes.

The cloud isn't just about saving time and money; it's about multiplying compute power. Meanwhile, the focus on IoT systems is on the operation of connected appliances. Combining the strengths of cloud and IoT creates ideal systems to support big data applications and analytics. Networks of IoT devices capable of processing at the edge can respond more quickly to events. Finding the right combination of edge and cloud promises to deliver the best big data capabilities at the lowest possible demand on resources—therefore, the lowest cost.

Overcoming communication protocol issues for smart devices

A common concern from building owners considering implementing smart building or campus technologies is IoT interoperability. These issues can often be traced back to the abundance of diverse operating systems (OSs), programming languages, data structures, architectures and access mechanisms for things and data. To improve IoT interoperability, researchers have leveraged numerous approaches and technologies, referred to as "interoperability handling approaches." These approaches have solved (or are helping to solve) many of the interoperability issues. For example, gateways or adapters can be used to bridge different specifications, data types, standards, etc., and improve interoperability between IoT devices.

Other approaches involve virtual networks or overlay-based solutions. The idea is to integrate sensors, actuators and other IP-smart objects seamlessly with the internet for end-to-end communication. The result would be a virtual network on top of physical networks that would enable communication with other types of devices, including sensor nodes. Within each virtual network, end-to-end communication is possible using different protocols.

Other approaches to the interoperability issue that are currently being explored include SDN, IP-based solutions, network function virtualization, fog computing and open standards.

Smart technology in older buildings

Advances in smart technology are making it easier than ever to retrofit older buildings with smart technology. Older buildings are the biggest consumers of energy, and there have been misconceptions that they cannot be upgraded with smart building technology. Some of the world's most iconic older buildings have embraced smart technology today with amazing results. Take, for example, the Empire State Building. Completed in 1931, it has been completely retrofitted with smart technology in the past decade and seen more than $4.4 million of energy savings each year—and a 38 percent reduction in energy consumption.

Conclusion

Smart buildings save energy by automating controls and optimizing systems. Whereas an upgrade to a single component or isolated system can result in energy savings of 5-15 percent, a smart building with integrated systems can generate 30-50 percent savings. With the cost of technology significantly reducing and the adoption of technology rising, it is just a matter of time before all devices are connected. The faster that building owners and managers adopt these technologies, the quicker they will realize the savings and benefits.

As the world readies itself for mass vaccination and a return of the office worker, now is the time to start incorporating some of the long-term IT strategies within the building refresh cycle. Network convergence offers opportunities to both standardize and beef up security around connected devices and traffic flows.

Owners can start by deploying more flexible fiber nodes for the backhaul, then look to incorporate copper cabling and hybrid PoE cabling to power their edge devices. Data flows between edge devices and the cloud will be faster and large, so building and campus network managers should begin preparing now.

> ""By 2020, component costs will have come down to the point that connectivity will become a standard feature, even for processors costing less than $1. This opens up the possibility of connecting just about anything, from the very simple to the very complex, to offer remote control, monitoring and sensing."
>
> **Peter Middleton,**
> **Research Director, Gartner**

RUCKUS®

CommScope pushes the boundaries of communications technology with game-changing ideas and ground-breaking discoveries that spark profound human achievement. We collaborate with our customers and partners to design, create and build the world's most advanced networks. It is our passion and commitment to identify the next opportunity and realize a better tomorrow. Discover more at commscope.com.

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