White Paper

Cisco Digital Ceiling

Powering New Experiences and Insights

Executive Summary

The latest technology revolution is happening right above your head. As organizations look to digital transformation to gain a strategic advantage, they are connecting more devices, people, and processes to drive new user experiences and better business outcomes. Now, these trends are reshaping buildings and workspaces, as the Cisco® Digital Ceiling become the next frontier in the Internet of Things (IoT).

The Cisco Digital Ceiling can accelerate digital transformation and extend the benefits of the IoT throughout your facilities. It converges multiple building networks—lighting, heating, and cooling, IP video, IoT sensors, and much more—through a secure and intelligent network platform. It unlocks new experiences and efficiencies for workers. It lowers facilities operating costs. And it puts high-resolution sensor data at your fingertips, so you can gain deeper insight into your environment to make better business decisions.

The Rise of the Digital Building

Technology transformation is unleashing disruption in every industry. New companies, and even entire new industries, seem to rise practically overnight, and longtime incumbents fall by the wayside just as quickly. Look closely at the winners, and you'll see a common theme: Successful organizations are using digitization—the increasing connectedness of people, places, processes, and things—to create new opportunities, lower operating costs, and increase business agility. This digitization is fueling the IoT, creating a hyperconnected network of devices and people that provide new insights and previously untapped business intelligence. Successful organizations are pushing intelligence to the edge for faster, more accurate decisions at the source.

Where will the next major digital disruption take place? If you're reading this indoors, look up. The IoT revolution is coming to the ceiling of your building.

In commercial indoor environments of all shapes and sizes—offices as well as hospitals, educational institutions, retail stores, hangars, manufacturing plants, and more—the Digital Ceiling is becoming a central platform for business transformation. The key is to create spaces that aren't just smart but connected. And as more organizations use Power over Ethernet (PoE) to power and control building services, the technology framework for digital transformation is already in place.

Digital Ceilings use IP to connect disparate building networks and services. By converging services for lighting, climate control, security, and more, they enable:

- **Lower-cost, more efficient building and tenant services:** The Digital Ceiling lowers the cost of building system installation, operation, and management through unified communications and centralized control of global facilities. It breaks through silos of independently operated building systems to make it easier to automate building services.
- **Transformative new experiences:** Different building systems (lighting, heating, and air conditioning, as well as physical security and access control) can now easily and securely work together. They can adapt to users' needs in real time to make spaces work better for individuals, groups, functions, and teams. Also, they can significantly improve the productivity, safety, and comfort of building occupants.
- **New business insights:** By combining connected building endpoints with sensors, organizations gain deeper insights into how employees, customers, and guests are using indoor spaces. You can adapt workspaces to improve productivity and efficiency, and make better use of valuable real estate. You can also glean concrete data to inform decision making about building operations and planning.

Introducing the Cisco Digital Ceiling

The Cisco Digital Ceiling unleashes the power of the IoT by linking building services over a single, converged IP network. It transforms the unobtrusive infrastructure in ceilings across your facilities into a secure, distributed, and standards-based architecture that delivers building intelligence at the edge of the network. The result is a building that is not only smart, but also is seamlessly and securely connected. With the Cisco Digital Ceiling, you can improve the efficiency and sustainability of your buildings and manage them more effectively. You can use the same platform to deliver highly personalized user experiences that improve the productivity, safety, and comfort of building occupants.

The Cisco Digital Ceiling combines the latest innovations in smart IoT devices and sensors with the deep and broad portfolio of Cisco Power over Ethernet (PoE) and Universal Power over Ethernet (UPOE) products. Using Cisco Catalyst® switches that deliver PoE+ and Cisco UPOE to connected Digital Ceiling endpoints, you can create new and innovative experiences for building occupants. At the same time, you can achieve more powerful and granular energy management, control, analytics, and integration capabilities that benefit both building owners and businesses using these facilities.

The potential of the Cisco Digital Ceiling goes beyond optimizing building systems. In the same way that a smartphone is much more than just a device to make phone calls, a Digital Ceiling can be a platform for a new ecosystem of building applications and services. After lights, sensors, and other endpoints are connected, you have a high-speed data pipe connecting every area of your facilities. Plus, you have new opportunities for transformational applications, analytics, and business intelligence.

Getting Smart and Connected

The fastest way to create a Cisco Digital Ceiling is through the building's lighting network. Lights are everywhere—often spaced within 8 feet of each other—making them prime real estate. This pervasive network can easily create a central hub of intelligence by adding sensors, such as:

- Proximity
- Temperature
- Carbon dioxide ($C0_2$)
- Visual Light Communication (Li-Fi)
- Bluetooth low energy (Bluetooth LE, BLE, BTLE)
- Presence

These sensors connect to and share information with other building networks for heating, ventilation, and air conditioning (HVAC); air quality; physical security; sanitation; and more. Together, they create a ubiquitous network of IoT sensors that can send data about building occupancy, traffic, and environmental conditions to the cloud. Now, historically "dumb" devices (light bulbs, cameras, thermostats, physical security systems, and other sensing systems and devices) can become smart IoT endpoints. They can adjust and enhance facilities in real time, without human intervention, based on analytics and software running in your ceiling. At the same time, they become valuable data sources for information across your environment that you can analyze and act upon to improve business outcomes.

An End-to-End Solution

Cisco can help you realize the promise of this IoT revolution in your building today. We bring all of the critical components together—technology, partners, architecture, and vision—to accelerate the deployment of the Digital Ceiling. We deliver it on a proven, secure, and centrally manageable network infrastructure.

We are launching the Cisco Digital Ceiling with a broad partner ecosystem. We bring together the world's leading innovators in LED lighting, control systems, and smart buildings, so you can capitalize on the IoT revolution with leaders in their domains and partners you already know and trust. With our proven network technology, close collaboration with building domain experts and innovators, and pretested and validated designs, you can quickly and confidently deploy a secure Digital Ceiling architecture. And you can start achieving real business benefits right away.

Cisco Digital Ceiling in Action

With the Cisco Digital Ceiling, you can offer new user experiences, lower costs and simplify management, and optimize business operations.

Offer New User Experiences

By linking multiple building systems in a smart, connected architecture, the Cisco Digital Ceiling enables highly customizable indoor environments and personalized employee workspaces that improve safety, comfort, productivity, and business outcomes. Integrated applications that previously required a large integration effort can now be added to an installation faster, more easily, and with less cost and complexity:

- **Optimize employee workspaces:** Many organizations are using “hot-desking” or “hoteling” to create reservable work spaces, which can support more workers with the same or less real estate. With the Cisco Digital Ceiling, workers can customize light and room temperature in their reserved spaces. A smart, connected workspace can even automatically carry over workers’ preset IP phone preferences and automatically log them in to collaboration tools. In shared spaces, the same Cisco Digital Ceiling architecture supports multiple functional working zones that can easily change to suit a new task, team, or function.
- **Create comfortable environments automatically:** With the Digital Ceiling, indoor spaces can dynamically adapt heating and cooling systems based on real-time occupancy. They can raise or lower temperature, and increase or decrease fresh-air flow as more people enter or leave a room to optimize air quality—all without human intervention.
- **Get people to destinations faster:** The Cisco Digital Ceiling can be integrated with digital signage and wayfinding applications that automatically connect with workers’ and visitors’ personal devices. Workers can quickly find a drop-in workspace or another employee’s current workspace, and customers can get right to the department or merchandise they seek.
- **Create human-centric environments:** You can control lighting intensity, color, temperature, and other factors in every space to adapt to the needs of occupants. You can achieve close to natural light to better match individual’s circadian rhythms, which industry research shows can speed patient recovery, improve learning, and increase productivity up to 16 percent.
- **Power new retail experiences:** In retail environments, smart, connected lighting in the Digital Ceiling can be used to:
  - Feature special promotions and sale items (and continually change them without having to make physical lighting changes)
  - Guide customers to specific items with light
  - Closely approximate natural light to show truer colors and reduce returns
  - Measure store traffic patterns, better understand customer and staff behavior, and optimize sales with light-fixture sensors

All of these experiences, and many more, are made possible by Cisco and our partners’ technology innovations. Cisco provides 60W UPOE to continuously power connected lights, sensors, cameras, and more. Our open-standards network platform and leadership in standardized communications and information models make it easy to converge multiple IoT endpoints and building control systems with unified management and analytics applications. And we provide the proven security and resiliency to assure that new experiences are stable and reliable.

Lower Costs and Simplify Management

The Cisco Digital Ceiling yields major cost savings by converging previously disparate networks over a single, centrally controlled architecture.

- **Reduce power and lighting costs:** With the Cisco Digital Ceiling, you can combine modern smart LEDs with intelligent building controls and automation. Integrated sensors throughout the environment lower costs through daylight harvesting, automatic dimming controls, and presence-based lighting.

- **Streamline maintenance:** With all spaces in the building linked through one smart platform, indoor spaces can automatically notify cleaning and maintenance services when a space has been used and needs cleaning or service, or, when they can skip a space because it's unused.
- **Simplify installations:** In new building construction and deep-retro-fit scenarios, network-powered building systems are easier and less expensive to install, manage, and maintain. Using structured low-voltage Ethernet cabling eliminates the need for separate electrical conduits, and generates up to 14 percent cost savings in new deployments according to Cisco research. According to a Cisco 10-year TCO analysis, capital expenses for first-in building costs can decline by as much as 20 percent.
- **Reduce operating expenses:** The Cisco Digital Ceiling turns multiple building devices (light fixtures, thermostats, IP cameras, and more) into networked, controllable IoT endpoints on a consolidated IP platform with buildingwide visibility and control. You can often make changes in software instead of reconfiguring hardware. Fixtures are easy for just about anyone to relocate, so additions, moves, and changes are much faster and easier. You can maintain a single network for lighting, data, and building controls, instead of spending the extra resources to operate multiple standalone infrastructures.
- **Optimize energy efficiency:** Improve energy management by taking advantage of the granular energy information, common control, analytics, and integration capabilities of the Cisco Digital Ceiling. Your buildings can integrate data and power networks with diverse building systems, along with Cisco PoE and UPOE metering capabilities and Cisco Energy Management software. With better insight and control, you can more easily achieve sustainability and energy management goals and certifications, such as Building Research Establishment Environmental Assessment Methodology (BREEAM) and Leadership in Energy and Environmental Design (LEED).
- **Shift from capital Investments to operational savings:** With an open-standards platform for your building systems and controls, you can explore new cost-saving operational models. For example, you can use performance contracting and remote monitoring and management for building systems and share the operational cost savings with your partners.

The Cisco Digital Ceiling delivers the essential capabilities needed to make these cost savings a reality. With our expanding partner ecosystem of domain experts, you can choose from the best and most efficient connected IoT endpoints from proven innovators in lighting and other building control systems.

Our PoE+ and UPOE leadership means you have a PoE infrastructure with the scale, capacity, and resilience that you can rely on as a core foundation of your building installation. With our long track record of continually integrating new devices as IP endpoints, the foundation for simplified building operations is already in place. The same IP intelligence that changed the game for managing building telephony systems makes it just as easy to manage other building control systems.

Optimize Business Operations

By taking advantage of built-in sensors in your Cisco Digital Ceiling, you can harness analytics from everywhere in your environment to drive better business outcomes.

- **Better use your real estate:** With in-depth analytics embedded in your Digital Ceiling, you gain more visibility into real-world usage of your space, so you can better manage, plan, and optimize your real estate. You can measure occupancy patterns, identify areas where it makes sense to make changes (such as increasing desks and decreasing meeting rooms, or conversely), avoid excessive heating or cooling in unoccupied spaces, send janitorial to heavily trafficked areas, and more.

- **Improve physical security:** Integrate physical security applications, video surveillance, and security controls that use presence sensors embedded in the Digital Ceiling. For example, connected lighting can use sensor-activated closed-circuit television (CCTV) and access controls to secure sensitive areas, or in a retail environment to reduce shrinkage and theft.
- **Boost business results with analytics:** Use the Cisco Digital Ceiling to collect light, sensor, and usage data for your environment. You can also use those insights to optimize traffic flow in retail stores, track and optimize sales, and identify premium locations for featured products and services.

The Cisco Digital Ceiling makes these and other opportunities possible. We provide a secure, scalable, and distributed infrastructure with which you can collect much more information about your environment and push intelligence to the edge for faster, more accurate decisions at the source. We also provide a broad and growing suite of solutions, from both Cisco and our partners, to deploy advanced physical security, Wi-Fi analytics, and retail applications that turn sensor data into concrete business outcomes.

Technology Innovation

All of these new capabilities and experiences are possible when you can build the Digital Ceiling on a secure, scalable network infrastructure. As the worldwide leader in networking, Cisco provides the architecture to accelerate digitization of the enterprise. Only Cisco has optimized its IP infrastructure for the Digital Ceiling with optimized Cisco Catalyst switches that deliver:

- Support for Constrained Application Protocol (CoAP), the emerging industry communications standard to link diverse IoT endpoints and applications
- Easy configuration through Cisco Smart Install
- Perpetual PoE to maintain power to the luminaires during warm reloads
- Fastboot technology for quick power restoration during cold startups

Cisco also provides:

- **Strong security,** with security features such as virtual LANs (VLANs), 802.1x port security, and certificates embedded into the Digital Ceiling infrastructure itself.
- **Scalable network platform** that's capable of converging disparate networks (HVAC, metering, lighting, CCTV, physical security) to lower capital and operating costs across the architecture, simplify management, and drive new experiences and business intelligence.
- **Proven energy efficiency** with Cisco Energy Management Suite capabilities embedded in the network infrastructure, so you can see, measure, and manage the energy usage of all the devices in your IT network.
- **Built-in resilience** with Cisco Catalyst PoE+ and UPOE switches that dynamically manage power across your network and keep the lights on even if there is a network issue.
- **An open-standards solution** that uses proven industry standards, such as CoAP and PoE+, and broadly-accepted protocols and information models. The Cisco Digital Ceiling interoperates with a wide range of third-party solutions, eliminating silos among building and IT systems, and making it easy to share data and deploy innovative applications.
- **Investment protection** with the ability to support growing IoT data needs as new building-control applications and sensors are brought online and scale well beyond the capabilities of alternative solutions.

The Cisco Advantage

Cisco is the ideal partner to bring the Digital Ceiling—and the full value of the IoT—to the enterprise. In addition to our unparalleled network capabilities, we provide:

- **Proven industry leadership:** Our industry-leading secure and scalable network platform is already helping large and small customers worldwide connect and monetize digital-enterprise opportunities. You can unleash new capabilities while using your existing Cisco investments, such as Cisco Catalyst switches—the most widely deployed enterprise-class switching platforms in the industry. We provide an end-to-end architecture that spans from the data center to the WAN to the campus access. And, we have a long, distinguished track record of successfully converging disparate technologies across the network. Cisco was a pioneer in integrating voice, video, and many other services with the IP infrastructure, and Cisco defined many of the technology protocols that are now industry standards for converged services.
- **Strong security:** We understand the critical role of security in capitalizing on the IoT and enterprise transformation. We know how to protect data end to end across the network, so you can take full advantage of the digital ceiling without exposing your business to new security threats. Cisco security technologies are used daily by stock exchanges, and military and government customers to protect their most sensitive data and transactions.
- **A growing ecosystem that lowers risk:** Cisco is the only vendor creating a platform that includes everything you need to confidently deploy the Digital Ceiling. Our Digital Ceiling partner ecosystem spans the building value chain from lighting- and building-control systems to sensors and analytics. We've invested significant time and resources collaborating with our partners to deliver complete, pretested solutions that span from the Digital Ceiling endpoint to the control application. We provide detailed documentation and Cisco Validated Designs to help you deploy a secure and reliable solution, using technologies and applications from the partners you already know and trust. We continue to add to this global portfolio of partners who best meet our customers' needs.
- **A platform for innovation:** The full value of your Digital Ceiling involves much more than lower costs and more efficient building operations. With our open-standards architecture and broad partner ecosystem, you can put in place a platform for a world of new applications and user experiences. This includes emerging applications that draw on the combined intelligence of your real estate, distributed sensors, and IT systems to power new capabilities. However, it also includes new opportunities for business partnerships inside the building and even new business models for buying and consuming building-control services in your facilities.

Digitization and the IoT hold enormous potential to drive new experiences, cost savings, and revenues in every enterprise. The Cisco Digital Ceiling can help you start capitalizing on it in your buildings today.

To learn more the Cisco Digital Ceiling, visit http://www.cisco.com/go/digitalceiling.

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