

Connected Lighting Meets the IoT

Light is OSRAM

OSRAM

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The image features a night-time aerial view of a city with illuminated buildings. Overlaid on this is a dense, intricate network of glowing white and blue lines, some solid and some dotted, forming a complex web. A central cluster of bright blue particles and dots is prominent, suggesting a data hub or a specific IoT node. The overall aesthetic is high-tech and digital.

Is IoT Confusing? You Bet.

Let's Start with Some Basics.

The internet is a global communications network that hosts the largest information system in the world – the World Wide Web (WWW). Most people use the terms “internet” and “World Wide Web” interchangeably, but technically speaking, the two are different.

The internet is the transport network and the World Wide Web is an application running on the network. In addition to the World Wide Web, there are many other internet applications commonly used including email, web browsing (search), instant messaging, online communities and more.

This massive number of connected devices and applications has created a global network infrastructure of information.





IoT: The Age of Digital Transformation

What are the Driving Forces for IoT?

Simultaneous technological advancements are enabling the development and adoption of the IoT.



Device Connectivity

Beyond laptops and smart phones, almost every type of electronic device is now capable of connecting to a network.



Sensors

Primarily fueled by IoT, the global sensor market is expected to reach \$241 billion by 2022. The cost of sensors has declined by 54% over the past 10 years making it economically feasible to embed them in almost every device. Advancements in sensor miniaturization continues and is enabling the use of sensors in a rapidly increasing number of applications.

Gartner expects Software-as-a-Service (SaaS), the largest segment of the cloud market, to reach **45% of total application software spending by 2021.**

Source: Gartner



Communication

Mobile devices and wireless connectivity are now commodities making them widely available. At the same time, the cost of bandwidth has declined by 97% over the last 10 years.



Software

Big data analytics and visualization tools with supporting infrastructure such as efficient databases have emerged and evolved over the last 5 years. The cost of processing has declined 98% in the same timeframe.



Cloud Computing

IoT generates an enormous volume of data, and you need to store and process this data. Only cloud computing has the potential to scale quickly as well as store and process the enormous volume of data that IoT will generate and require. Gartner expects Software-as-a-Service (SaaS), the largest segment of the cloud market, to reach 45% of total application software spending by 2021.



Wireless Broadband

5G is the newest mobile network that will ultimately replace current 4G technology with improvements in speed, coverage, and reliability. 5G availability is just around the corner and when it deploys, we will see another hyper-speed jump in technology evolution. 5G will be 10 times the speed of 4G, 20 times at peak speeds, and network latency will be in single-digit milliseconds. 5G opens the airwaves for more internet-enabled traffic and the response speed will seem instantaneous.



IoT is Here Today and Here to Stay

IoT is already here and some businesses have begun to reap the benefits including increased productivity, streamlined operations, and adding new business models that increase profitability.

Businesses are using IoT applications to:

Optimize commercial office space and offer occupants a more comfortable, productive work environment.

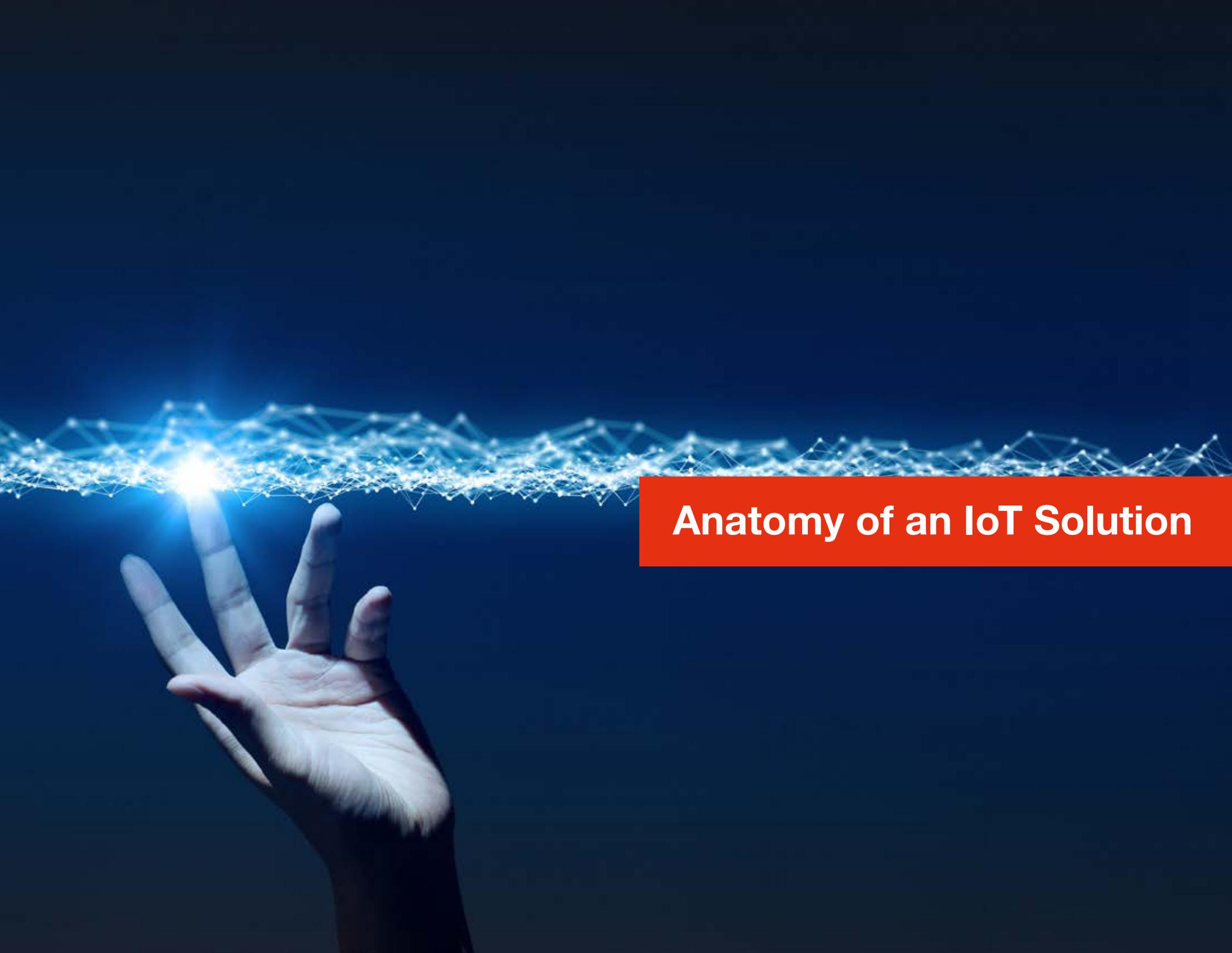
Enhance the retail buying experience with benefits to the retailer and the customer.

Eliminate mundane or repetitive tasks by leveraging automation solutions, allowing us to focus on more interesting or important tasks in our daily lives.

This digital transformation is reaping huge business benefits.

- + Operational efficiency
- + Workforce productivity
- + Improved customer experiences
- + Improved safety and security
- + Reduced maintenance costs





Anatomy of an IoT Solution

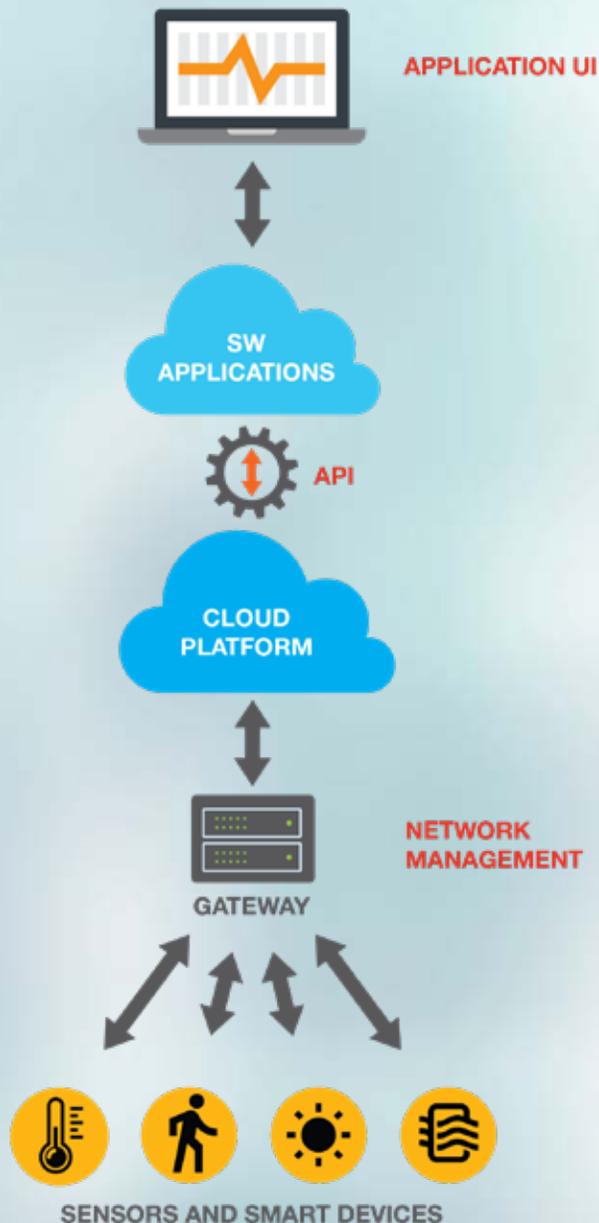
Defining an IoT Platform

According to McKinsey & Company, a platform is designed to support many applications that actually solve business problems. A platform may consist of software and hardware, which may include an operating environment, storage, computing power, security, development tools, and many other common functions.

IoT platforms are designed to:

- Deploy applications that monitor, manage, and control connected devices
- Connect and collect data from a potentially vast number and variety of endpoints
- Provide data management, computing, security and edge process control





IoT Architecture

There are a variety of use cases and one IoT application can be vastly different from another. However, at a basic level, every IoT solution typically includes the following:

User Interface (UI)

Provides an easy way to view complex data and key performance indicators to make informed decisions and actions.

Software Application

Designed to quickly process and analyze decision-critical data generated by sensors across a network.

API (Application Programming Interface)

Enable software developers to access data sent and stored in the cloud platform from the data network.

Gateway

Massive amounts of data are collected from endpoints and can put a strain on networks. It is much more efficient to process data on edge computing devices and send only the data that has value to the cloud.

Network Management

Hardware and networking protocols enable communication across the network and to the cloud.

Cloud Platform

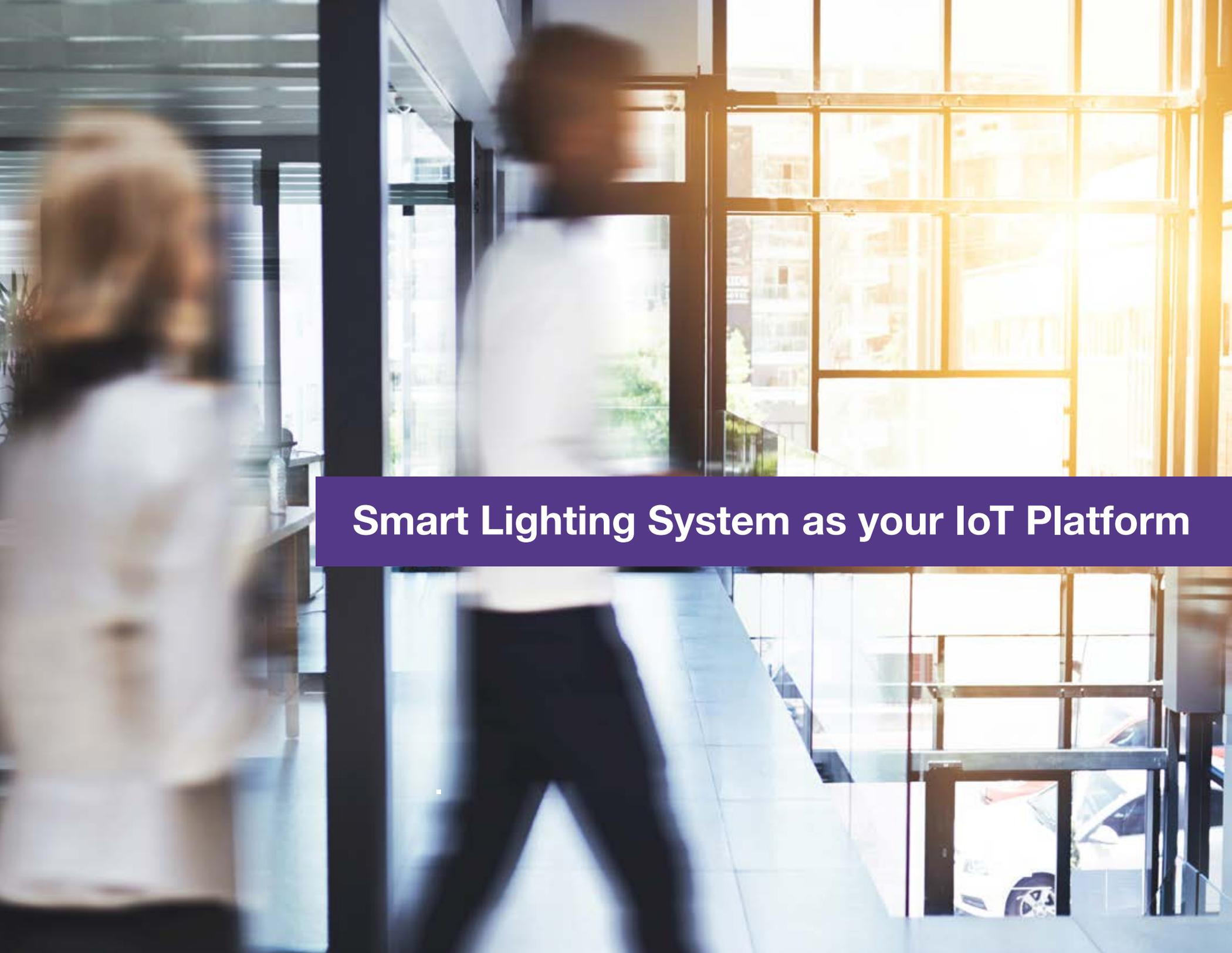
Exchanges, stores and manages data that can be used by software developers for application analytics and insights.

Sensors

Sensors monitor environmental and operational conditions such as temperature, light, heat, and air quality. Sensors perform as standalone devices or are embedded in endpoints such as luminaires.

Smart Devices

The characteristics of a smart device include the ability to connect to a network, generate data, and execute simple commands.

A blurred photograph of a modern office interior. In the foreground, a person with long brown hair is walking away from the camera. In the middle ground, another person in a white shirt is walking towards the camera. The background features large windows with a grid pattern, through which a city street with buildings and a car is visible. A purple banner is overlaid across the middle of the image, containing white text.

Smart Lighting System as your IoT Platform

What's the Connection between IoT and Smart Lighting?

An intelligent Light Management System (LMS) is an ideal IoT platform. It integrates sensors, control software, cloud connectivity, wireless communications and more to create a flexible infrastructure solution that supports data-driven automated solutions for lighting and other smart building-related applications.

Here are some advantages to using a smart lighting system as an IoT platform:

Lighting is ubiquitous throughout commercial spaces. When sensors are a significant part of the light management system, the solution provides the ideal means of collecting data about the environmental conditions and use of the building.

Lighting has **direct access to a power supply** and when sensors are integrated into each luminaire, they also have direct access to that power supply eliminating the need for batteries or external power.

Unlike its predecessors, LED lighting is **based on digital technology**. This means that LEDs can send information and receive commands from software or other digital devices on the network.

Each light point on the network can be configured as an **individually-addressable** data node or as groups of nodes providing significant configuration and application flexibility.

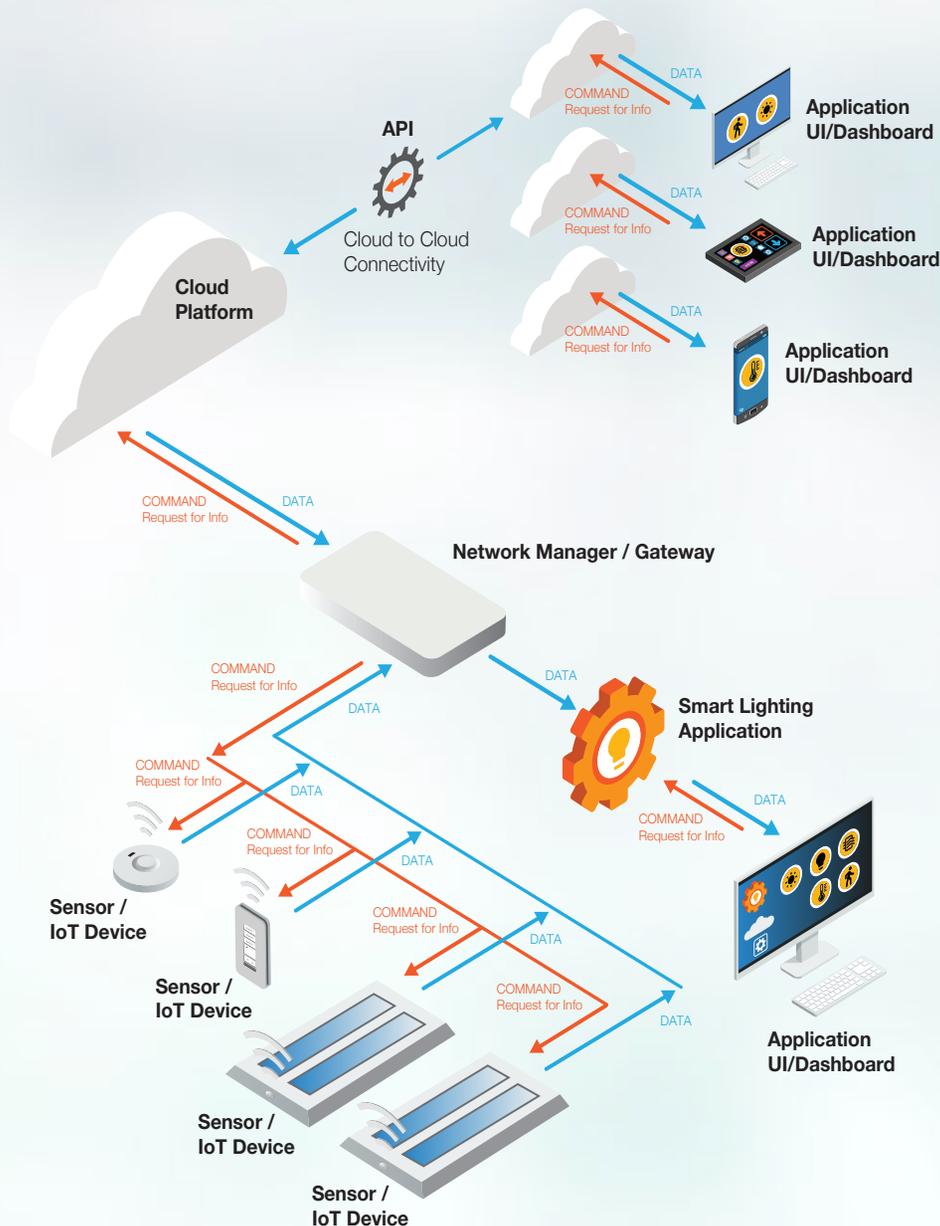
Historical and real-time data can be analyzed and used for decision-making.

Smart lighting solutions act as the **aggregation point for data collected** from lighting system nodes.

Smart lighting solutions act as the **data gateway to other smart building applications**.



Partner clouds, software and user interface for smart building applications beyond lighting.



Smart Lighting as a Data Network Infrastructure

Smart building applications are only as good as the data they are based on. Data quality (data integrity) is critical. It must be accurate, reliable and timely. Smart lighting systems create a data network infrastructure that provides quality data, at a granular level, that is meaningful and useful about a building's environment.

User Interface/Dashboard

- Primary user interface that provides an easy way to understand complex data.
- Displays key performance indicators such as efficiencies/inefficiencies and other metrics in a graphical or user-friendly way.
- Offers insight about the space itself and its usage that can be used to guide future decisions.

Smart Building IoT Applications

- Software applications that increase efficiency, improve health and safety, create better experiences, and more.
- Commercial real estate can leverage smart building applications beyond smart lighting including space optimization, conference room rationalization, wayfinding and asset tracking.

API (Application Programming Interface)

- Enables third-party software developers to access and utilize data stored in the cloud platform from the data network.

Cloud Platform

- Exchanges, stores and manages data that can be used for analytics and insights.

Network Manager / Gateway

- Connection point that enables data to move between cloud platform and sensors/IoT devices on the connected network.
- Processes data and transfers/receives data of value to/from the cloud.

Sensors / IoT Devices

- Monitors environmental and operational conditions (light, air quality, occupancy, temperature, and more).
- Operates as a standalone device or is embedded in luminaires or wall stations.
- Accepts communications across a connected network.

Key Criteria in a Smart Lighting IoT Platform



Ubiquitous Sensing

Sensors for gathering detailed information about the space and occupant behavior at every light point.



Communications

Communication network that supports multiple modes of connectivity - wired, wireless or both.



Advanced Software

Software-driven intelligent light management system that supports individual and zonal addressability and control.



Cloud

Compute power, data storage and access to software applications.



Ecosystem

Access to a software developer community of smart building applications that increase efficiencies or decrease costs.



Analytics

Powerful analytics that provide useful and actionable insights.



Future-Proof Selection Criteria

There's a range of light management systems in the market and not all are suitable for IoT applications. Here is some future-proof selection criteria and basic capabilities you should use in making your decision as well as a run-through of the basic capabilities your smart lighting IoT platform should have.

Scalable

Choose a system that is able to scale from a single fixture to supporting many endpoints quickly and easily. The system should have the ability to connect or integrate with other systems.

Flexible

Staying agile and adapting quickly to change is critical. The right LMS provides flexibility in the way building space can be used and managed. Because it is software-based, changes can be made at any point by reprogramming and new devices and capabilities can be added quickly and easily.

Wireless support

Wireless removes the cost and complexity associated with dedicated wiring and allows you to place luminaires and sensors in areas where wiring is limited or too costly to implement. It's the future.

Non-proprietary

Ensure that the system works with all types of luminaires and adheres to industry-standard protocols. You should not be limited by a vendor's proprietary business model.

User-friendly

If it isn't easy-to-use, you may find you don't leverage all of the capabilities of the platform. Look for an intuitive interface that is easy enough for beginners and casual users, while being sophisticated enough for the advanced features and functionality you and your team of power users may need or want down the road.



It's all about the Data

Lighting system data is simply more granular than other methods of data acquisition within a building because lighting is ubiquitous and each luminaire can have an integrated sensor. The high density of sensors enables data collection that provides highly accurate information about the environmental aspects of a particular space.

Lighting system data delivers unprecedented transparency and control into the operations and usage of a building. This opens up the possibility of exciting new applications. That's why smart lighting systems are an ideal platform for smart building applications, including lighting and non-lighting.

IoT applications are only as valuable as the **DATA** they are based on.



A low-angle, upward-looking photograph of several modern skyscrapers with glass facades. The buildings are arranged in a way that they appear to converge towards the top of the frame. The sky is a clear, bright blue. The glass reflects the sky and each other, creating a complex pattern of light and color. A green banner is overlaid on the right side of the image, containing the text 'Smart Building IoT Applications' in white.

Smart Building IoT Applications

Smart Building IoT Applications

Companies need to get the most from their real estate budgets. It's the second largest cost to most organizations after salaries. Understanding how workspace is used is essential--too much workspace is a waste of capital, and too little creates unhappy workers which can impact productivity.

Mobility has changed our work habits. Work is something people do rather than a place people go. Remote workers are on the rise and more work is being done on laptops, smartphones and tablets. Not everyone is sitting in the office in front of a PC on a daily basis from 9 to 5.

Historically, space planning has been based on calculations using industry-standard formulas, software that addressed some of an organization's requirements, or even a manual process. Often, this took days or weeks to complete.

Now you can make workspace decisions based on occupant use in real-time. Smart building IoT applications are data-driven and take the guesswork out of right-sizing and space optimization.

'On average, most companies effectively utilize only 40% of their office space, often paying for almost double the space they really need.'

Source: Rifiniti

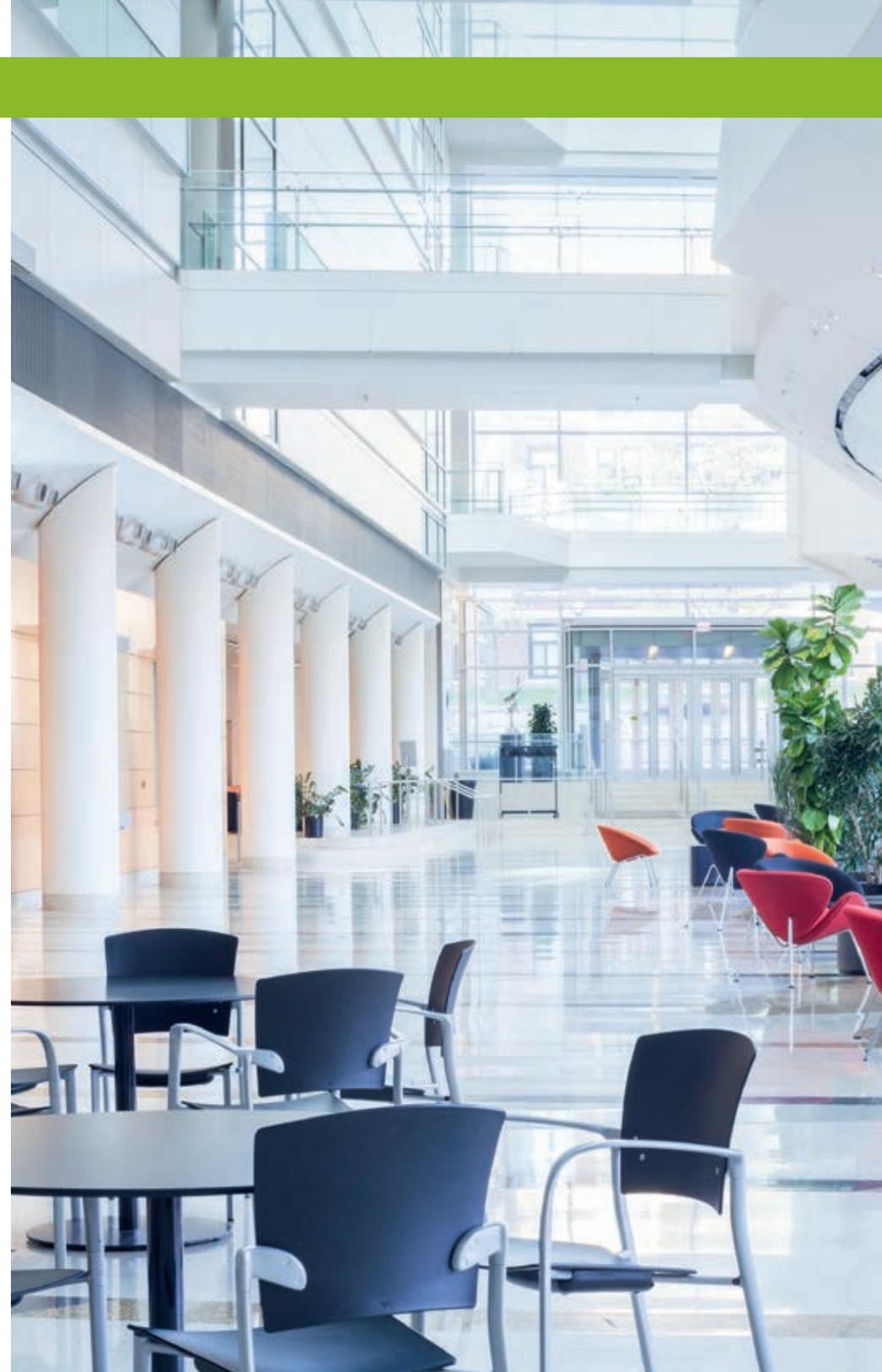


Smart Lighting

Smart lighting combines the latest LED technologies with automated controls. Initially, smart lighting solutions were designed and adopted for energy efficiency, however they have now become an essential element in creating a modern workspace.

A networked light management system provides insight about the space and its use. Sensors collect data, such as a change in daylight level or occupancy, which is then used by the controls to automatically adjust light levels in the space. Today's advanced light management systems can sense and control a change at the individual fixture level enabling a very precise solution that:

- Meets building code requirements and standards
- Cuts energy usage and costs
- Increases worker comfort and productivity
- Streamlines operations
- Increases flexibility so that lighting can easily adjust to space reconfigurations



Optimize Space for Continuous Improvement

The workplace is changing rapidly. More people are mobile and working remotely with occasional visits to the office.

Employees seek a working environment that is engaging and inspiring with different workspace options. They don't want to be relegated to a traditional office or desk for their entire workday.

A modern, connected work environment is an asset that can increase productivity and help attract and retain top talent.

There are many reasons why organizations need to continually optimize their space:

- Rapid growth or cutbacks can change the dynamics of the workspace
- Reorganization may require moving people around
- Divestitures may result in vacant office space requiring a downsizing
- An acquisition can create the challenge of where to house a newly acquired work force

Workspace changes can be expensive. Smart decisions on space utilization are now made using workplace optimization software analytics fed by data gathered from advanced light management systems.

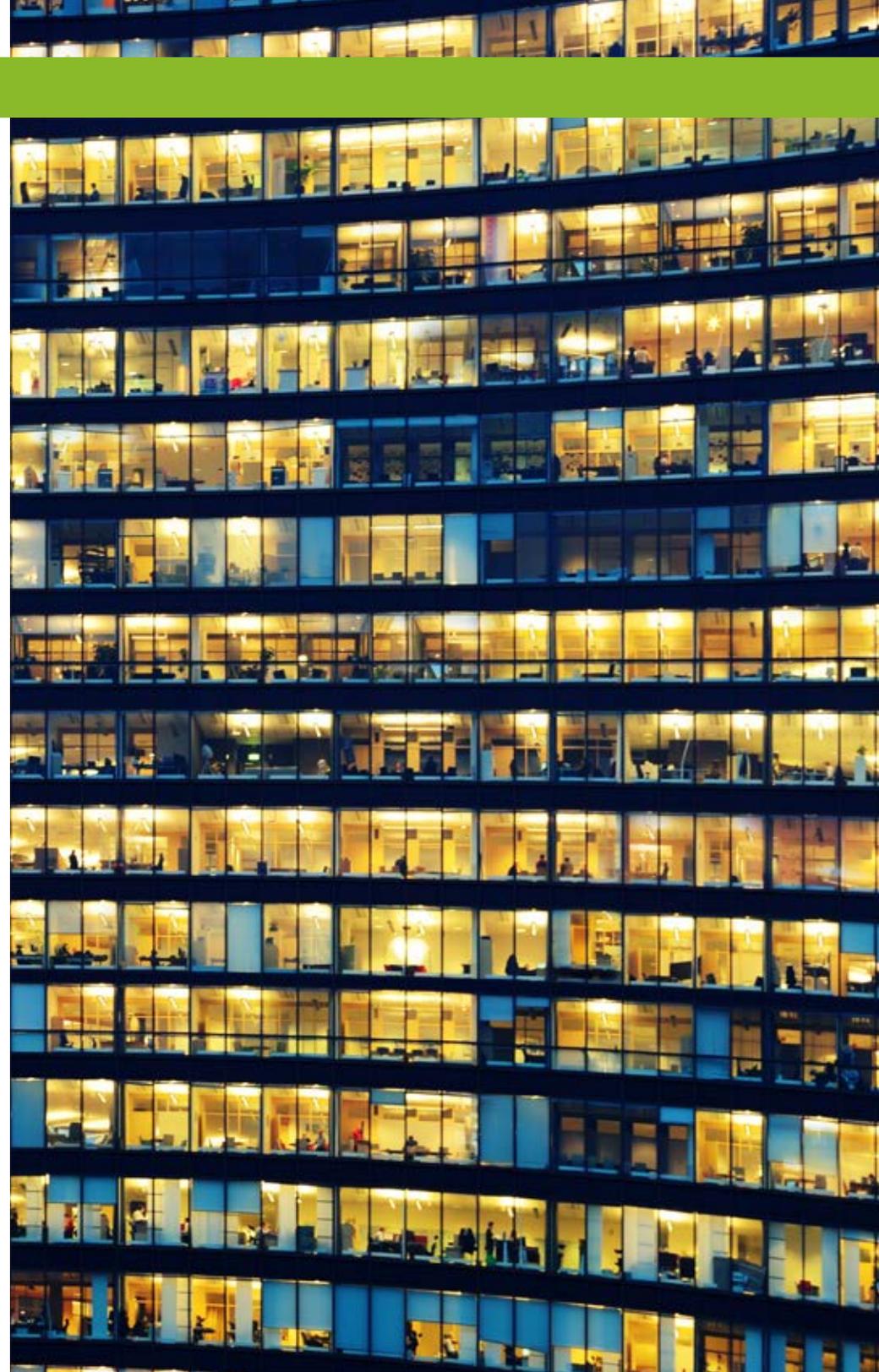


Optimize Space for Continuous Improvement

Restacking

Restacking entails more than increasing or decreasing space. It involves a re-thinking of the workplace to create a more efficient, collaborative setting that reflects an organization's objectives and workflows. According to Rifiniti, some companies will move over 50% of their staff every year to continually optimize their space.

- Physically locate teams that work closely together near each other to increase efficiency.
- Create more collaborative, open work space or informal space to increase discussion levels and support a team approach to problem-solving.



Optimize Space for Continuous Improvement

Increase or Reduce Square Footage

Using occupancy analytics, optimize space based on who actually uses the space, how they use it, and when they use it. This reduces unused space and the related costs, and enables planning for future space requirements based on historical usage and trends.

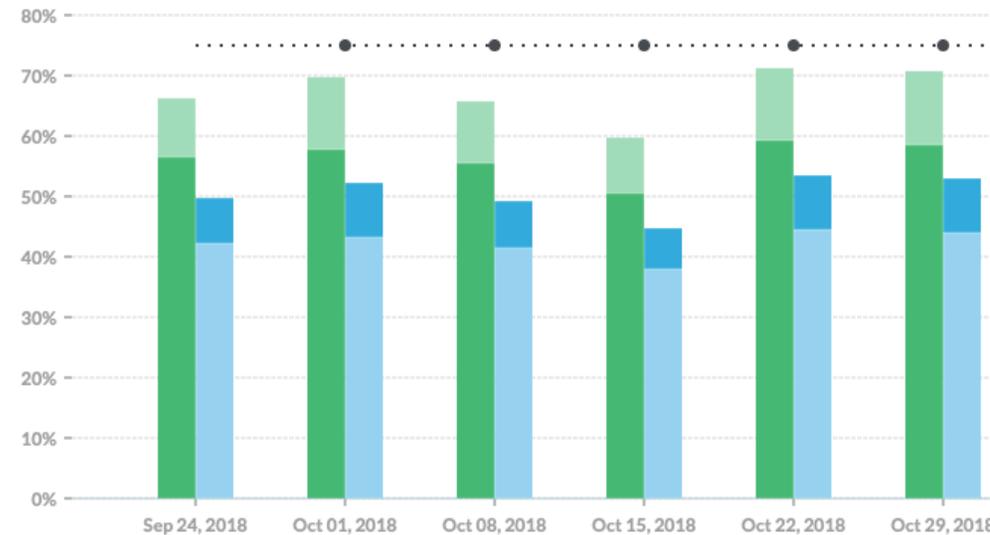
- Provide hot desking for employees that only sporadically come into the office. Employees choose their workspace when they arrive.
- Use hoteling--reservation-based unassigned seating--for workers that travel frequently or are typically remote.
- Encourage people to move around the workspace and decide where and how they work to maximize their productivity and comfort levels by not tethering them to a particular desk or office.

Upgrade Your Space

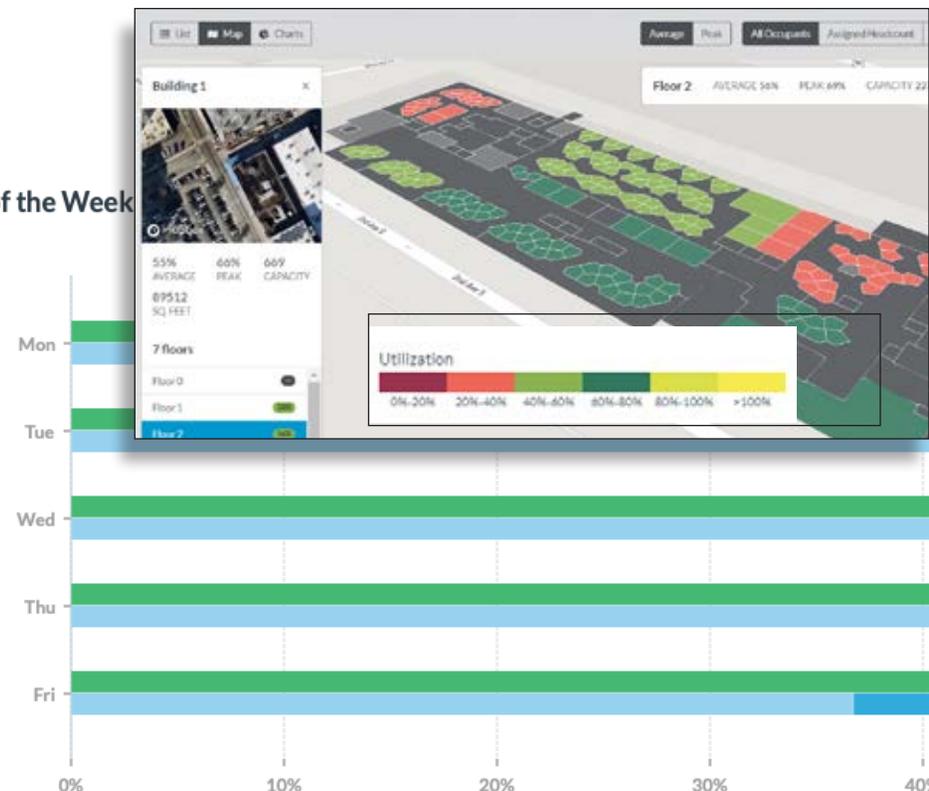
Are you dreaming of premium Class A space but find it hard to justify? What if the space you really need is a smaller square footage than what you are currently paying for?

- Consolidate your square footage based on lighting system data, and upgrade. You could find that what you need for square footage is significantly less than what you are paying for, and that more modern Class A space with a better location and more services is not out of your reach.

Utilization Over Time By Capacity



Days of the Week



Conference Room Rationalization

Meeting spaces are at the heart of any organization.

Whether they are large conference rooms or smaller huddle spaces, meeting space is coveted particularly in modern, open office environments.

Analytics using lighting system data will help you uncover trends on how conference space is being used such as

- the busiest times of day
- most popular types of rooms
- most common size of meetings

Once you understand how the space is being used, you can balance supply and demand effectively and adjust it as demand changes.

For example, splitting a 12-person conference room into two smaller conference rooms may better serve the needs of the organization based on actual occupancy usage of the space.



Guide People with Digital Wayfinding

Wayfinding helps people understand where they are in a building and how to get to their desired location. Traditionally, maps and signage have handled this.

Today, large or complex environments such as museums, hospitals, universities, and corporate campuses are difficult to navigate, particularly as space becomes more dynamic and occupant preferences and task requirements are addressed.

Digital wayfinding is a smart building application that leverages lighting system data and a mobile indoor navigation app to guide people to meeting locations or other destinations, as well as specific individuals, even as targets change or move.

Whether you have primarily visitors, daily users or a combination of the two, digital wayfinding can help get them to where they want to go quickly and efficiently.



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