Make buildings work for you:
How smart buildings can improve your bottom line

Executive summary

For enterprises today, one of the greatest sources of untapped value lies within their own four walls. Companies of all sizes rent, lease, or own real estate that house their business, but can also create unnecessary cost and waste.

Companies have visibility into spend, such as utilities, repair, and maintenance costs, but often lack insights into how to control them and place bets on the right improvements. US office buildings spend 19 percent of their operating budget on energy.[1] In addition, it is usually less expensive to maintain and upgrade facilities than replace them. Consequently, enterprise leaders have a tremendous incentive to adopt a smart building strategy, using the Internet of Things (IoT) to drive transformative operational change, as well as improve the customer experiences and employee effectiveness. By so doing, companies can increase the utility of their current assets and drive higher returns.

This white paper outlines the promise of smart buildings, sharing examples of clear ROI from across industries. It demonstrates how an ecosystem-wide collaboration between original equipment manufacturers (OEMs), independent software vendors (ISVs), and systems integrators (SIs) can help enterprises develop a smart building business case and prove out strategies for rapid ROI. It also addresses a common misconception— that enterprises need to spend millions upfront to make major equipment replacements. We show how Microsoft used its current assets and a pilot program to create a successful smart building strategy that continues to pay significant dividends.

Smart buildings can start with small steps

The term "smart buildings" conjures up a futuristic universe where technology rules the day, or where existing buildings are torn down and rebuilt using only sustainable materials. Thus, it's no wonder that many enterprise executives believe that adopting a smart building strategy will be too difficult and cost-prohibitive to pursue. They may believe that achieving gains with IoT requires end-to-end automation, large-scale equipment replacements, or tagging almost everything with sensors—none of which is true.

Enterprise partners, including OEMs, ISVs, and SIs, can help their partners unleash ongoing value by implementing a step-by-step smart building program that uses open, interoperable solutions. These partners can help their enterprise customers maximize value from what they already own by analyzing their operations, equipment, resources, and processes, to understand the total cost of doing business. By so doing, they can identify the greatest opportunities to eliminate unnecessary cost and waste or improve other processes.

With IoT, enterprise decision makers can identify and prioritize investments, maintenance, and repairs to meet their business and operational goals. They also can create spaces that are conducive to work, play, and interaction (including human to human, human to technology, and machine to machine).

IoT is a state of mind

In this paper, we demonstrate that IoT is not just a bunch of sensors. IoT is a state of mind, a way of managing business. Organizations can use IoT to meet their business goals by reverse-engineering their smart building strategy. Most enterprises will start with energy efficiency programs, because energy is the second-largest source of spend.[3] However, they can use technology to accomplish a wide array of other goals, including improving the customer and employee experience in ways that drive profitability and productivity through greater engagement.

> *"It's not about deploying every single smart gadget. It's about being in the design space and asking what could the building be, how you can make it a positive space for users, what is the optimum for today, and what could it do in the future."*
>
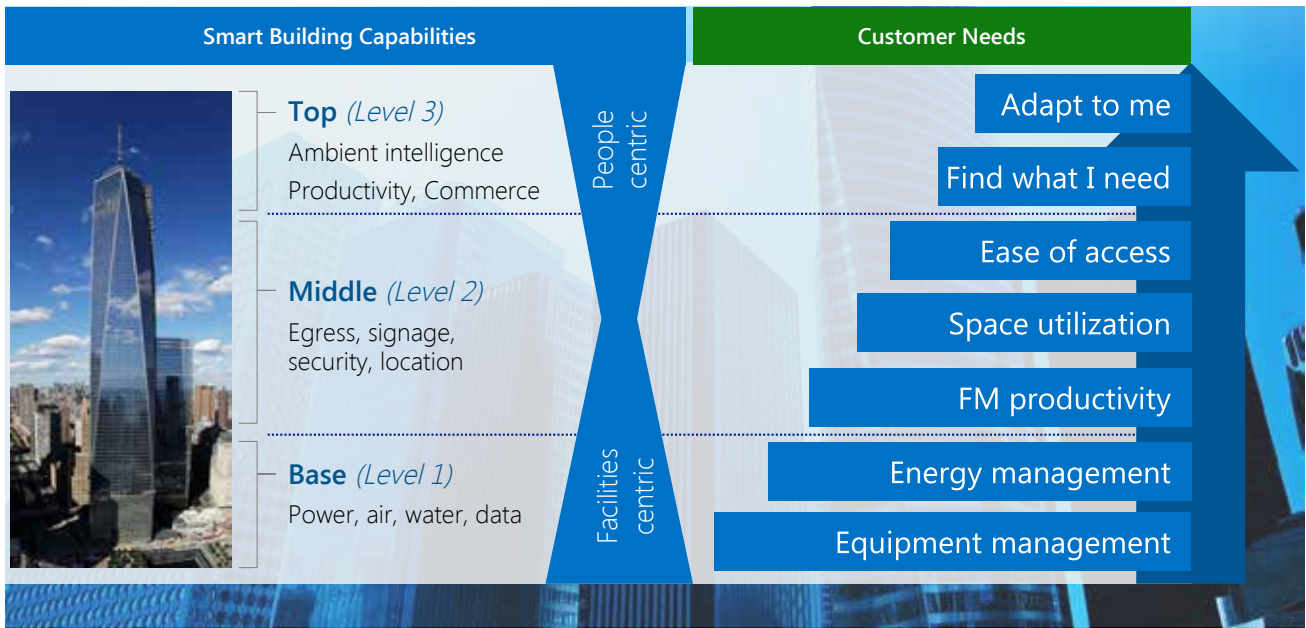> — **Preeti Bajaj,** Vice President of Strategy and Transformation, Schneider Electric[4]

In this paper, we look at how companies in three verticals—healthcare, manufacturing, and retail, which are already sophisticated technology users—can use IoT to gain an extra edge for everything from improving patient care delivery, to enabling predictive maintenance, to optimizing in-store marketing and sales.
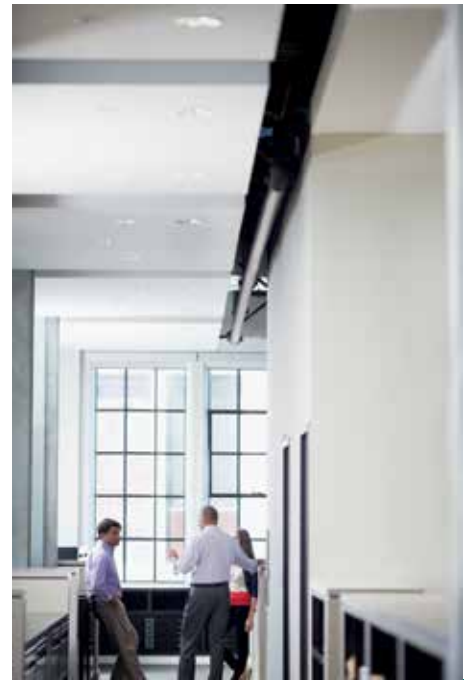
"In the past, buildings were typically heated and cooled throughout, independent of occupancy levels. Smart systems that manage lighting, temperature, and air quality and which can enable or disable controlled zones have revolutionized building management systems."

— **Chris Bilton,**
Director of Research and Technology, BT[2]

Increase gains by taking a progressive approach to smart buildings:
Smart buildings enable smart people

Smart Building Capabilities	Customer Needs

Top *(Level 3)*
Ambient intelligence
Productivity, Commerce

Middle *(Level 2)*
Egress, signage,
security, location

Base *(Level 1)*
Power, air, water, data

People centric

Facilities centric

Adapt to me
Find what I need
Ease of access
Space utilization
FM productivity
Energy management
Equipment management

Companies that start small with smart building programs typically move forward to achieve new business goals.[5]

The Microsoft smart building strategy saved $60 million in CAPEX

Microsoft piloted a smart building strategy at 13 buildings on its headquarters campus, avoiding $60 million in capital expenditures (CAPEX), gaining instant payback on energy efficiency initiatives, and setting the stage for ongoing operational investments. Microsoft software solutions and connected assets generated a torrent of data, so engineers had to learn which data was relevant to the company's strategy and which could be disregarded. They also prioritized problems, focusing on the 5 percent of repairs or changes that drove the most value. With one of the largest energy-smart programs in the world, Microsoft offers best practices from its experience so that others can progress faster to success.

Buildings generate information that can drive value

With smart buildings powered by sensors, controlled systems, and connected networks, enterprises can turn their building assets into information assets to use themselves or share with partners and customers. They can pair internal data, such as heating, cooling, lighting, water, and equipment usage, with external data sources, such as traffic, weather, and adjacent building data, to create a robust look at building performance and analyzing that data to make informed decisions. With aggregated information and analytics, enterprises can create services they can sell on the market, as Microsoft is doing with its smart building solution powered by Microsoft Azure IoT services and Cortana Analytics Suite.

Through collaboration, OEMs, ISVs, and SIs can create and integrate smart devices with existing infrastructure, helping companies connect current building equipment and functions. By creating one analytical layer of software that enables sensors, assets, and networks to communicate, they can aggregate data from both internal and external sources, making sense of it all with dashboards that reveal the greatest areas of opportunity.

By using automation, artificial intelligence (AI), machine learning, and predictive analytics they can help companies increase precision and control, prioritizing and sequencing equipment and software upgrades to achieve their business and operational goals.

A **smart building** is any building that is environmentally aware of its internal and external status and provides data to inform intelligent actions that optimize its performance and identify and resolve faults.

Companies use sensors to link building functions; control systems to automate, control, and optimize; connected networks to integrate with and communicate with smart power grids;[6] and dashboards and reporting systems that review performance, adjust, and prove the ROI of their investments.

A **smart building** can also have ENERGY STAR for Business or green certifications, but it is not required.

Build a business case: 12 reasons to pursue a smart building strategy

Companies of all sizes are using a smart building strategy to drive intelligent action from the data contained within their business walls. Here's why:

1   **Meet corporate sustainability goals.** US commercial buildings waste up to 30 percent of all the energy they use and also account for 39 percent of all carbon dioxide emissions.[7] Companies want to be good stewards of natural resources and reduce their carbon footprint.

2   **Decrease energy costs.** In the United States, businesses spend $100 billion every year on energy, but could save up to $20–25 billion with smart buildings.[8] The average office building in the United States uses 1.4 billion British thermal units (BTU) a year.[9] IoT-driven technology can help achieve energy savings of 10–25 percent or even more.[10]

3   **Reduce unnecessary CAPEX spend.** IoT can help companies reduce capital expenditures (CAPEX) by up to 15 percent by optimizing current business assets and prioritizing maintenance.[11] Extending the lifespan of buildings—from hospitals and clinics, to manufacturing plants and distribution centers, to shopping malls and stores—can add millions to a company's bottom line over time.

4   **Gain control with centralized building management services (BMS).** Acquire a high-level view of building performance. Perform preventive maintenance, detect faults, and reduce energy consumption.

5   **Reduce complexity and redundancy.** IoT technology helps transform huge data volumes from noise into insight. Work with partners to understand the data levers that will transform your business.

6   **Improve space utilization.** Use heatmaps and tracking tools to determine where customers and employees congregate. Use this information to equip spaces, plan optimal decision making, and fuel future space planning and investments.

7   **Enhance user well-being.** Smart buildings can improve the user experience with better climate control, air quality, equipment maintenance, and other services. A study by Lawrence Berkeley National Laboratory found that improving indoor air quality alone could boost worker productivity by .05 percent up to 5 percent.[12]

8   **Engage customers and employees.** Be responsive to user needs with fit-for-purpose spaces that are well designed for focused activities, play, and work. Differentiate the customer experience with better environmental control, marketing, and service. Use digital tools to foster collaboration among workers and guide customers through spaces.

9   **Meet digitally savvy employees' expectations.** In a survey, 60 percent of workers said they expect to be working in a smart office within five years.[13] Work spaces that incorporate technology and are sustainable will play a larger factor in employees' job decision making and tenure at companies during the coming years.

10   **Increase user safety and security.** Identify equipment faults before they destroy equipment. Identify water or gas leaks before they compromise operations or hurt people. Strengthen access controls to facilities and technology with multifactor authentication. Use video surveillance to improve security of staff, equipment, and high-value materials.

11   **Plan for space and growth needs.** Growing companies are balancing their needs for a global footprint, with the need to support mobile workforces and remote contractors. Smart building programs can help drive utilization of existing spaces by driving hoteling or hot-desking programs into real time and modeling worker space needs accurately for projected building projects.

12   **Create information services.** As companies create digital ecosystems with partners and customers, they are exchanging business and operational information to gain strategic advantage, such as just-in-time ordering or services. Enterprises can provide IoT data to offer a more accurate picture of performance or create service offerings around new insights and competencies, such as customer behavior analytics, machinery performance, and energy optimization.

A look at how smart buildings can transform industry processes

In the following section, we look at the impact of smart buildings on different strategic imperatives across diverse industries. We examine how smart buildings are helping retailers engage customers, healthcare organizations empower employees to deliver better patient outcomes, and manufacturers optimize operations and transform products. We also provide a snapshot into how IoT is fueling smart energy innovation.

Engaging customers:
Using IoT and smart buildings to improve sales, service, and security

Retailers seek to provide their customers with well-designed spaces that encourage customers to congregate and socialize as they browse stores and products and use amenities like restaurants. Digital signage can alert shoppers to the location of a store or product, introduce new products, promote events, feature targeted offers that adapt to diverse audiences, and deliver interactive experiences.

Retailers can use beacons, sensors, and heat maps to identify presence and traffic patterns. They can use this information to plan public services in new or renovated shopping centers, such as walkways, outdoor spaces, information centers and special needs services, food courts and catering services, and restrooms. They can charge premium rent for shops and shelf space in high-traffic areas, providing customer analytics on traffic data and which percentage of shoppers are buying, not just browsing. Staff at convenience and other stores can use data to alter stock placed by POS systems for higher sales based on time of day and customer expectation. What business commuters buy in the morning will differ from what school children purchase in the afternoon.

Wayfinding services, powered by beacons and apps on customers' mobile phones, help shoppers find the quickest route to their desired locations, access context-specific information, locate friends and families, and receive security alerts. In existing stores, location tracking and heat maps can help retailers plan product displays and promotions for greater sales and increased revenue with data-driven, premium product placement locations. Customers who opt-in to in-store marketing can receive location-based offers tailored to their profiles and purchases, motivating them to make immediate purchases.

RFID-tagged merchandise combined with direct access to inventory levels enable staff to locate items, determine availability, and avoid out-of-stock occurrences that result in lost revenue opportunity and disappointed customers. Smart shelves, smart display rooms, and interactive kiosks aid shopping by enabling customers to review product information, assemble related products, and share items with friends.

Telstra worked with Engagis and Microsoft to create "tap and take" cards that use NFC and Windows 10 technology to enable customers to build personalized digital brochures. They simply tap the card on selected products or services and review them on digital kiosks in the store. Some 40 percent of customers who interact digitally in stores continue the interaction online. Telstra also uses Microsoft Power BI to analyze customer traffic and offer a better mix of products.

Retailers can create a continuous feedback loop to improve all aspects of retailing, including employee scheduling and staffing; product ordering, merchandising, and stocking; pricing; and more. For example, retailers can create dynamic pricing models, using video (including data from security cameras), sensors, and analytics, to predict the flow and behavior of incoming customers, promoting the sale of perishable goods or special offers.[14]

JJ Foods, a leading food service delivery company, is using machine learning to revolutionize customer service. The company implemented Dynamics AX 2012 end-to-end and Azure Machine Learning to predict consumers' buying preferences and next purchases. With accurate predictions, the company can increase basket value through upselling. In addition, IoT-enabled cab sensors ensure food arrives in peak condition.

Retailers can use smart building programs to optimize energy usage hour by hour based on occupancy levels, increasing customer comfort while controlling costs; prepare gathering spaces for daily activity or events; and optimize food storage, reducing spoilage. Smart lighting can extend retailer hours and improve shopper safety. Video surveillance can help retailers reduce shrinkage and theft and improve the staffing placement and inventory levels.

Empowering employees:
Using IoT and smart buildings to increase productivity and effectiveness

Healthcare organizations seek to drive staff productivity and effectiveness, provide exceptional patient care across the care continuum, empower patients to be involved in their own care, and connect and collaborate with network partners.

Mobile staff can use apps on handhelds and tablets to capture patient information, view health histories, access patient records, and record diagnoses. They can connect remotely with experts for difficult cases via video teleconferencing. Integrated systems with cloud-based business processes and electronic health records (EHRs), mobile tools such as tablets and phones, and tagged tools, equipment, and medication ensure that staff have instant access to the right data and resources they need to serve patients, from wherever they are.

Wit-Gele Kruis, a home nursing and support organization based in Belgium, sought to empower its nurses to securely share increasing amounts of patient information with other medical and support stakeholders on an open, flexible platform. Wit-Gele Kruis deployed Windows tablets connected to Active Directory, which enabled nurses to capture service notes and collaborate with their peers on developing personalized health plans. Staff now have instant access to information on more than 300,000 patients. The 2,500 connected devices have increased nurse mobility and effectiveness and reduced service costs.

Cloud-based solutions, patient wearables, and tagged medication enable staff to track patients remotely, extending care beyond four walls and enhancing the care continuum. Wearables, with their instant data, also empower patients to participate in their own care.

Kaiser Permanente worked with Cognizant to implement a remote patient monitoring system based on Microsoft Azure IoT. The solution securely connects to smartphones and devices like glucose meters in patient homes and integrates the data with a program prescribed by a Kaiser Permanente clinician. With near-real-time, remote monitoring of vital signs and automated alerts, Kaiser Permanente has enhanced care and safety for its patients. Healthcare staff, including nurses, dieticians, and other workers, benefit with better insights into patient data and streamlined workflow.

Digital tools and analytics also benefit back-office staff by providing seamless access to integrated information, which they can use for forecasting, demand management, and reporting.

Smart buildings enable employees to reserve work stations, conference rooms, lockers, and parking spaces,[15] which can improve the employee experience for hospital staff accustomed to working long hours or around the clock. Better climate control and digital access controls can increase employee and patient comfort and safety.

In hospital and healthcare systems, maintaining wired and wireless connectivity and control over electricity, air and heating, gas and water, and waste systems is essential. Since patients are ill and often not mobile, maintaining a predictable, comfortable environment for care, surgery, and other treatment is essential. Tagging and monitoring critical infrastructures enables engineers to have a real-time view into performance, detect issues, and perform preventive maintenance to avoid process or equipment failures and ensure fire safety. Building management systems can increase employee productivity and reduce costs by enabling interactive or automated scheduling of equipment and powering equipment down when not needed.

Optimizing operations:
How IoT and smart buildings are powering manufacturing

As early adopters of operational efficiency and continuous improvement programs, manufacturers are logical candidates for smart building programs. IoT can automate production to monitor product quality and drive throughput; enable remote diagnostics; and optimize equipment scheduling, preventive maintenance, and repairs. Manufacturers can go from optimizing functions to creating holistic systems of intelligence—using data on plants, distribution centers, equipment, employees, and smart devices; IoT data from raw materials, components, and finished products that are tagged with sensors; social listening signals; customer ordering, interactions, and feedback; and partner information, along with other sources.

By so doing, they can create ongoing digital feedback loops that enable them to spot market trends and customer opportunities; optimize production and supply chain processes in near-real time, reducing cost and waste; and plan future growth.

Kuka, a German manufacturer of industrial robots and solutions, has used IoT to create a highly automated plant that connects as many as 60,000 devices and 259 assembly-line robots to a central data-managed system, enabling continuous 24-hour production and the assembly of eight different configurations of Jeep Wrangler bodies in a single floor.

With IoT, manufacturers can monitor and manage equipment remotely or on the floor, using tablets or interactive kiosks and adjusting settings as needed. They also can prioritize investments and ensure predictive maintenance that identifies risks, thereby enabling them to deliver the greatest value and protect margins. Since a single piece of manufacturing equipment can cost millions of dollars, performing proactive maintenance can maximize investments by extending their lifecycles. Adjusting energy use to fluctuating production demands, time of day, and seasons can save significantly on costs. Companies can adjust heating and cooling based on real-time power needs, costs, and usage—as well as use alternate energy sources like wind and solar power that they can sell back to the grid. They can use data to plan routine and preventive maintenance for off-hours to optimize daily production levels.

Jabil, one of the world's leading design and manufacturing solution providers, uses machine learning, predictive analytics, and the cloud to analyze millions of data points from machines to identify errors or failures before they occur.

"Since deploying the Microsoft predictive analytics solutions we have seen at least an 80 percent accuracy rate in the prediction of machine processes that will slow down or fail, contributing to a scrap and rework savings of 17 percent."

— **Clint Belinsky,** Vice President, Global Quality

Transforming products:
How IoT and smart buildings are fueling business growth

Companies that gain deep insights into their business with IoT can react to changing market and customer conditions in real time—while anticipating demand months and years out. They can manage a pipeline of ideas and align them with strategic priorities to bring new and innovative products to market faster, including regional varieties and high-value customized offerings that meet niche market needs.

Digital tools, such as video-based collaboration and enhanced productivity solutions, enable manufacturing employees to work more effectively on new solutions, hold efficient meetings, crowdsource ideas, and share files more securely. Smart building data, combined with supplier and customer networks and product information, can give a highly accurate picture of production requirements and costs. Employees can use self-service BI tools to view and manage data in a visual and intuitive manner, empowering new levels of decision-making across design, prototyping, production, operations, and sales.

Rolls-Royce, a leading manufacturer for the airline and business aviation market, has used IoT data to create an information service that enables the company to improve service to its customers. Rolls-Royce chose to build a powerful and scalable system based on the Microsoft Azure IoT Suite platform that collects and aggregates on-engine health data, air traffic control information, and fuel usage and process information in real time using the Cortana Intelligence Suite. The solution helps aviation customers improve fuel usage and maintenance planning and reduce flight disruptions. Since fuel accounts for 40 percent of airline operating costs, reducing consumption by just 1 percent can lead to savings of millions of dollars each year[16]—or $250,000 per aircraft.[17]

The Microsoft smart building strategy by the numbers:
From smart buildings to a smart campus

Microsoft invented a smart building software solution to reduce energy, prioritize maintenance and repairs, and create ongoing efficiencies. The solution avoided a $60 million capital investment, has paid ongoing dividends, and has created unprecedented transparency into the company's building operations.

41,644
EMPLOYEES

125
BUILDINGS

500
ACRES

14.9
MILLION
SQUARE FEET

DAILY CONSUMPTION OF ENERGY
2 MILLION KWH

280,000
METRIC TONS OF
CARBON EMISSIONS

30,000
PIECES OF
UNCONNECTED,
SENSOR-ENABLED
EQUIPMENT

**7 MAJOR
BUILDING
MANAGEMENT
SYSTEMS**

Challenge:

- HQ buildings mostly constructed in the late 1980s, in a variety of styles and configurations.
- Equipment was tagged with 30,000 sensors with multiple BMS.
- No universal protocol, so no consistent communication.
- Major equipment upgrade would have cost $60 million.
- Construction would have disrupted employees and teams.
- No cost-effective solution on market for large-scale smart building management.
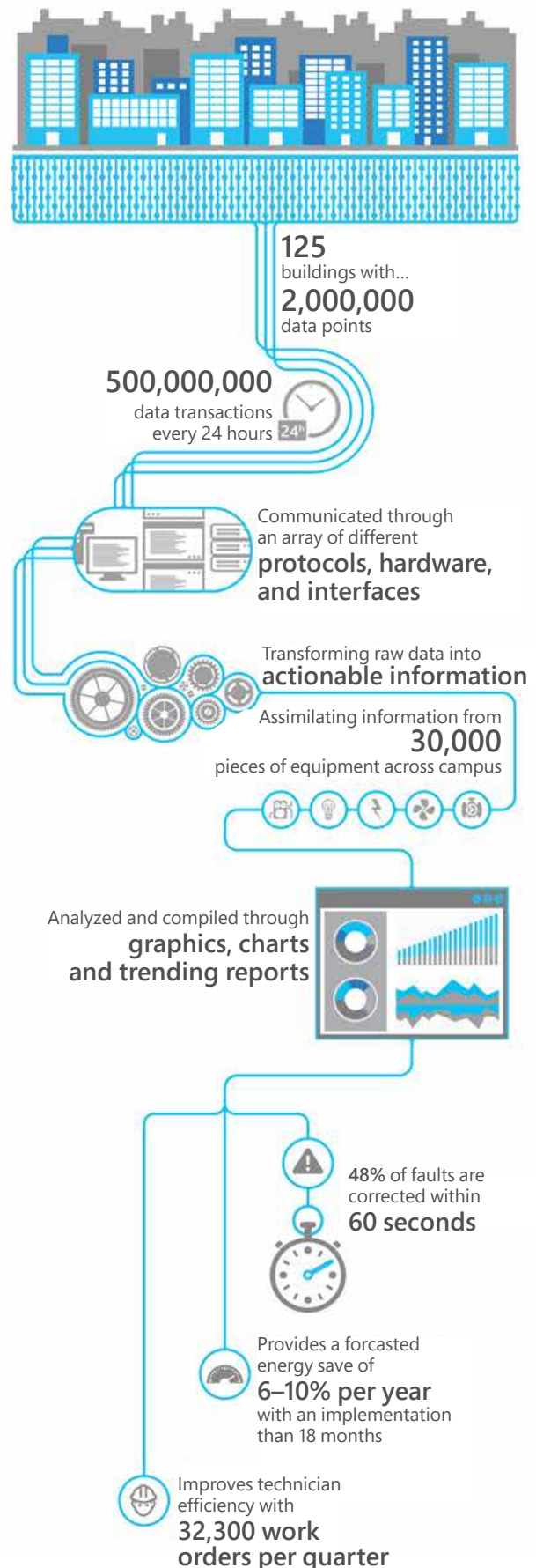
Approach:

- The building and facilities team decided to create a solution themselves.
- Partnered with three vendors to create an "analytical blanket" of software.
- Used Microsoft Azure, SQL Server, and Microsoft Office.
- Needed to provide prioritized list of which changes drove the most value.

Solution:

- New solution was linked to all building management systems.
- Enabled effective communication between the systems and sensor-tagged equipment.
- Analytics used sensors on equipment, IoT gateways, historic and real-time data from internal and external sources, BMS, and Azure Machine Learning.
- Piloted at 13 buildings and instantly provided insights into energy waste and issues.
- Simple fixes included turning off unused and replacing defective equipment, five-minute repairs.
- Microsoft rolled out the solution to its entire campus.
- IoT provides huge volumes of data: 500 million data transactions every day.
- New centralized monitoring station, the ROC, prioritizes work orders and automates processes.
- List of 500 most expensive faults considers cost, value, and impact on employees. For example, a lower-cost problem that affects critical operations in a research lab will likely be prioritized above a higher-cost fix that directly affects few employees.
- Energy cost savings grew from $250,000 a year to $1.5 million, with new processes.
- The facilities team now spends 95 percent of their time on engineering, up from 30 percent before, when they had to gather and compile data.
- About half of issues can be fixed in under a minute.
- Microsoft was able to reduce energy costs by 6–10 percent a year.
- Other wins: visibility into faults and climate data, no unnecessary equipment recalibrations.
- Provide a workspace that enhances worker morale and productivity.[18]

Microsoft campus
by the numbers

125
buildings with...
2,000,000
data points

500,000,000
data transactions
every 24 hours

Communicated through
an array of different
**protocols, hardware,
and interfaces**

Transforming raw data into
actionable information

Assimilating information from
30,000
pieces of equipment across campus

Analyzed and compiled through
**graphics, charts
and trending reports**

48% of faults are
corrected within
60 seconds

Provides a forcasted
energy save of
6–10% per year
with an implementation
than 18 months

Improves technician
efficiency with
**32,300 work
orders per quarter**

Building a smart building roadmap:
How to triumph and win with a smart building strategy

Use this roadmap to craft a successful strategy and maximize business gains.

- **Articulate your goals.** Understand what you want to achieve and why. Review best practices from market leaders like Microsoft to understand what is possible. Learn how to sequence investments for near-term ROI and ongoing value creation.

- **Create a smart building strategy and roadmap.** Create an overall strategy and partner with OEMs and ISVs to design the initiative. Use what you have, identify a high-value opportunity, and decide what to track.

- **Communicate intent.** Tracking technologies can introduce the specter of Big Brother into the workforce. Explain what you're tracking and why. Consider user privacy concerns and address them. It is likely that most enterprises will track overall user behavior rather than individuals for the foreseeable future.

- **Run the pilot.** Launch an energy efficiency pilot and chart business gains. Use success metrics to help prove the worth of a larger-scale initiative. Stair-step to greater business gains.

- **Experiment, iterate, and learn—and then repeat.** Use experience to improve data collection and analysis processes. If the project didn't deliver desired gains, explore why.
  Use a partner like Microsoft for consultative advice and best practices.

- **Consider an IoT building management system.** As companies reap ROI from smart buildings and expand their efforts, they should take a fresh look at their underlying technologies. Understand the cost, risk, and benefits of using pre-IoT systems versus implementing an IoT-driven building management system.

- **Identify and implement best practices.** Track results and document them to capture learnings for wider-scale deployments or to onboard new staff.

- **Ensure effective security.** Smart buildings need to be tightly secured to protect companies' investments and worker safety and comfort. Ensure edge-to-edge security with Microsoft solutions and ISV support.

- **Use IoT excellence to become a best-in-class leader.** Companies can use smart building initiatives to become operational savants, outpacing the competition.

- **Prepare to incorporate AI and machine learning.** While enterprises may start with humans reviewing IoT data and dashboards, they will move to running powerful algorithms that autonomously decide what needs to be done and initiate actions. Smart buildings will provide a continuous feedback loop, enabling machine learning to continuously improve results and operate buildings for peak effectiveness and efficiency. The Microsoft Energy Demand Forecasting Template with SQL Server R Services enables enterprises to implement a simple machine learning–based solution within their on-premises infrastructure.

Why Microsoft

Microsoft has a strong track record of helping industry companies realize the business value of smart building and IoT strategies that drive digital transformation. That's because our holistic platform and advanced technologies, open and flexible approach, enterprise-grade solutions, and partner ecosystem build on companies' existing technology investments and deliver results quickly and cost-effectively. Working with Microsoft brings a distinct set of business advantages that no other provider offers. Across different industries, Microsoft solutions help companies achieve the insight, innovation, and efficiencies that promote competitive advantage and keep the world powered.

A trusted, flexible, and open-cloud platform

Today, the Microsoft cloud infrastructure supports more than 1 billion customers in more than 140 countries. With this unique experience and scale, Microsoft cloud services can achieve higher levels of security, privacy, and compliance than most customers can on their own. Azure has received more compliance certifications than any other cloud provider, including major global, national, regional, and industry standards and regulations.

Windows 10 accelerates time to value

Windows 10 provides one universal app platform, one security model, one management approach, one unified experience that scales across all devices—from the smallest sensor to the largest, most powerful devices. This one core operating system provides a common developer platform, enhanced security, management, store, and more, across the broadest range of devices. Windows 10 devices offer advanced integration with your customers' current infrastructure. Use Azure IoT Suite to connect your devices and things, get started quickly with preconfigured solutions, and use untapped data to transform your business.

Global

The extensive, global Microsoft datacenter footprint covers more regions than any other provider, to better meet data sovereignty requirements. We're investing in one of the world's largest technology partner ecosystems with more than 640,000 partners in 170 countries.

Edge-to-edge security

Whether you are a device manufacturer building smart devices, a retailer selling devices, or an enterprise using Azure, you must protect each and every endpoint, from the smallest sensor to the cloud. Device manufacturers are using Windows 10 IoT, the most trusted Windows ever, to build smart devices. Windows 10 IoT takes intelligence to the edge, with Secure Boot and Trusted Boot, to help ensure device integrity; integrated Windows Defender, to help keep devices safe from malware and other threats; BitLocker and TPM support, to help keep user and device data safe; Credential Guard and Windows Hello, to ensure user authentication across all devices using the latest technology; and Device Lockdown, to enhance device security in event of theft or diversion.

Enterprises benefit by deploying Windows devices that are secure by design, provisioned to connect to the trusted cloud, and that provide automatic updates. Azure Active Directory (Azure AD), a world-class identity management solution, provides enterprises with self-service tools that empower employees to access cloud services, but maintain robust controls and provide ongoing security monitoring and alerts. More information about the Microsoft commitment to transparency, privacy, compliance, and security can be obtained at the Microsoft Trust Center.

On customer terms

Azure is the only platform that supports a fully hybrid architecture, giving you complete flexibility and control of data and applications delivered between public and private clouds. The Microsoft cloud works with any operating system, database, middleware, and application framework, enabling you to build on your current technology. Windows 10 empowers the digital transformation of IoT devices and smart things, enabling edge intelligence for a multitude of ever-evolving needs, whether gathering data, monitoring security, or enabling productivity on the go.

Comprehensive, enterprise-ready solutions

Microsoft solutions span the full spectrum of business needs—data access, high-performance computing, advanced analytics, visualization, and business process automation. Windows 10 offers unprecedented universal application capability across devices, including innovative devices like Surface, Surface Hub, and HoloLens. Individual and enterprise productivity is increased by ensuring that the right information is provided to the right people at the right time for actionable insights and decisions. This is accomplished through a holistic suite of collaboration, knowledge management, work process, mobility, business insight, and advanced analytics capabilities.

Advanced technologies designed for ease of use

Azure is the only platform that supports a fully hybrid architecture, giving you complete flexibility and control of data and applications delivered between public and private clouds. The Microsoft cloud works with any operating system, database, middleware, and application framework, enabling you to build on your current technology. Windows 10 empowers the digital transformation of IoT devices and smart things, enabling edge intelligence for a multitude of ever-evolving needs, whether gathering data, monitoring security, or enabling productivity on the go.

Largest ecosystem of industry-leading partners

Microsoft has a broad ecosystem of prominent SIs and ISVs. This ecosystem uses existing technology investments and offers the flexibility to select the best solutions for each business. Our partners design and deploy innovative, industry-focused solutions built on a Microsoft foundation, coupling best-in-class technology with deep industry expertise. No other technology provider offers a comparable end-to-end portfolio as well as an open and flexible approach. Together, it's this unique perspective that helps Microsoft drive digital transformation across all aspects of an organization and change the way a company optimizes operations, empowers employees, transforms products and services, and engages with customers.

Get ready to transform your business—
Deploy a smart building strategy with Microsoft

Get started today with a smart building strategy. Work with Microsoft or one of our global partners to see how you can transform your business by harnessing IoT to drive value from your buildings and equipment. Identify and capitalize on ongoing opportunities to reduce costs, engage with customers, empower employees to work more effectively, and optimize operations.

Learn more about how Microsoft is enabling digital transformation on a global stage: www.innovateonwindows10IoT.com

Get more information on Microsoft smart building services: https://www.microsoft.com/en-us/microsoftservices/campaigns/smartbuildings.aspx

Read the Microsoft smart building case study: https://www.microsoft.com/en-us/stories/88acres/

Learn more about our solutions for:

- **Healthcare**—https://enterprise.microsoft.com/en-us/industries/health/

- **Discrete manufacturing**—https://enterprise.microsoft.com/en-us/industries/discrete-manufacturing/

- **Process manufacturing**—https://enterprise.microsoft.com/en-us/industries/process-manufacturing-and-resources/

- **Retail**—https://enterprise.microsoft.com/en-us/industries/retail-and-consumer-goods/

Find a Microsoft partner: https://partner.microsoft.com/en-US/

Read customer case studies: https://customers.microsoft.com/

[1]"Managing Energy Costs in Office Buildings," Fact Sheet, National Grid, https://www9.nationalgridus.com/non_html/shared_energyeff_office.pdf.

[2]"Dr. Nicola Davies, "How the Internet of Things Will Enable 'Smart Buildings,'" Article, Extreme Tech, July 14, 2015, https://www.extremetech.com/extreme/209715-how-the-internet-of-things-will-enable-smart-buildings.

[3]"Managing Energy Costs in Office Buildings," Fact Sheet, ibid.

[4]Microsoft Österreich, "Smart Buildings and IoT," SlideShare, September 26, 2016, https://www.slideshare.net/MicrosoftAT/smart-buildings-iot.

[5]Phillip Tracy, "What is a Smart Building and How Can It Benefit You?" RCR Wireless, July 15, 2016, http://www.rcrwireless.com/20160725/business/smart-building-tag31-tag99.

[6]"Improve Energy Use in Commercial Buildings," Energy Star, Web Page, undated, https://www.energystar.gov/buildings/about-us/how-can-we-help-you/improve-building-and-plant-performance/improve-energy-use-commercial and Steve Raschke, "Cost, Savings, and ROI for Smart Building Implementation," CANDI, Blog Post, June 20, 2016, https://candicontrols.com/costs-savings-and-roi-for-smart-building-implementation/.

[7]Jennifer Warnick, "88 Acres: How Microsoft Quietly Built the City of the Future," Case Study, undated,

[8]https://www.microsoft.com/en-us/stories/88acres/88-acres-how-microsoft-quietly-built-the-city-of-the-future-chapter-4.aspx and Energy-Smart Buildings: Demonstrating How Information Technology Can Cut Energy Use and Costs of Real Estate Portfolios, Accenture, Report, 2011, http://czgbc.org/energy-smart-buildings-whitepaper.pdf.

[9]"How Much Energy Does an Office Building Consume?" DVIRC, Web Page, undated, http://www.dvirc.org/how-much-energy-does-an-office-building-consume/.

[10]Steve Raschke, "Cost, Savings, and ROI for Smart Building Implementation," ibid.

[11]Chris Wood, "5 Technologies That Are Making Smart Buildings Smarter," Article, Construction Dive, November 2, 2016, http://www.constructiondive.com/news/5-technologies-that-are-making-smart-buildings-smarter/429582/.

[12]Put Your Buildings to Work: A Smart Approach to Better Business Outcomes, White Paper, October 2015, Honeywell and IHS, https://honeywell.com/Documents/Honeywell_Smart_Building_WP_FINAL.PDF.

[13]David Karpook, "Smart Buildings: It's Still About The People Inside," Article, Facility Executive, September 8, 2016, https://facilityexecutive.com/2016/09/smart-buildings-the-people-inside/.

[14]Darlene Pope, JLL, "The 3-30-300SM Principle: Smart Buildings Unlock Exponential Value," Blog, August 8, 2016, https://eponline.com/blogs/environmental-protection-blog/2016/08/smart-buildings-unlock-exponential-value.aspx.

[15]Brad White, "SES Consulting's 'The Trillion Dollar Opportunity in Transforming Existing Buildings,'" June 3, 2016, Control Trends, http://controltrends.org/tag/330300-rule/.

[16]Brad White, "SES Consulting's 'The Trillion Dollar Opportunity in Transforming Existing Buildings,'" June 3, 2016, Control Trends, http://controltrends.org/tag/330300-rule/.

[17]"The 3-30-300SM Principle: Smart Buildings Unlock Exponential Value," Environmental Protection, Blog, August 8, 2016, https://eponline.com/blogs/environmental-protection-blog/2016/08/smart-buildings-unlock-exponential-value.aspx.

[18]"Rolls-Royce and Microsoft Collaborate to Create New Digital Capabilities," Case Study, Microsoft, August 10, 2016, https://customers.microsoft.com/en-US/story/rollsroycestory.

[19]Rolls-Royce Uses Microsoft IoT Tools to Cut Down on Engine Faults and Fuel Costs, and Wants to Sell the Insights back to airlines," ComputerWorld UK, Article, November 3, 2016, http://www.computerworlduk.com/iot/rolls-royce-uses-microsoft-iot-tools-cut-down-on-engine-faults-3648777/.

[20]Microsoft case study content derived from "At Microsoft, The Internet of Things Powers Smart Buildings," Blog, February 25, 2014, https://blogs.microsoft.com/work/2014/02/25/at-microsoft-the-internet-of-things-powers-smart-buildings/; "88 Acres" Online Case Study, and Accenture's Energy-Smart Buildings Report

[21]88 Acres," Chapter 4, ibid. and.

Microsoft