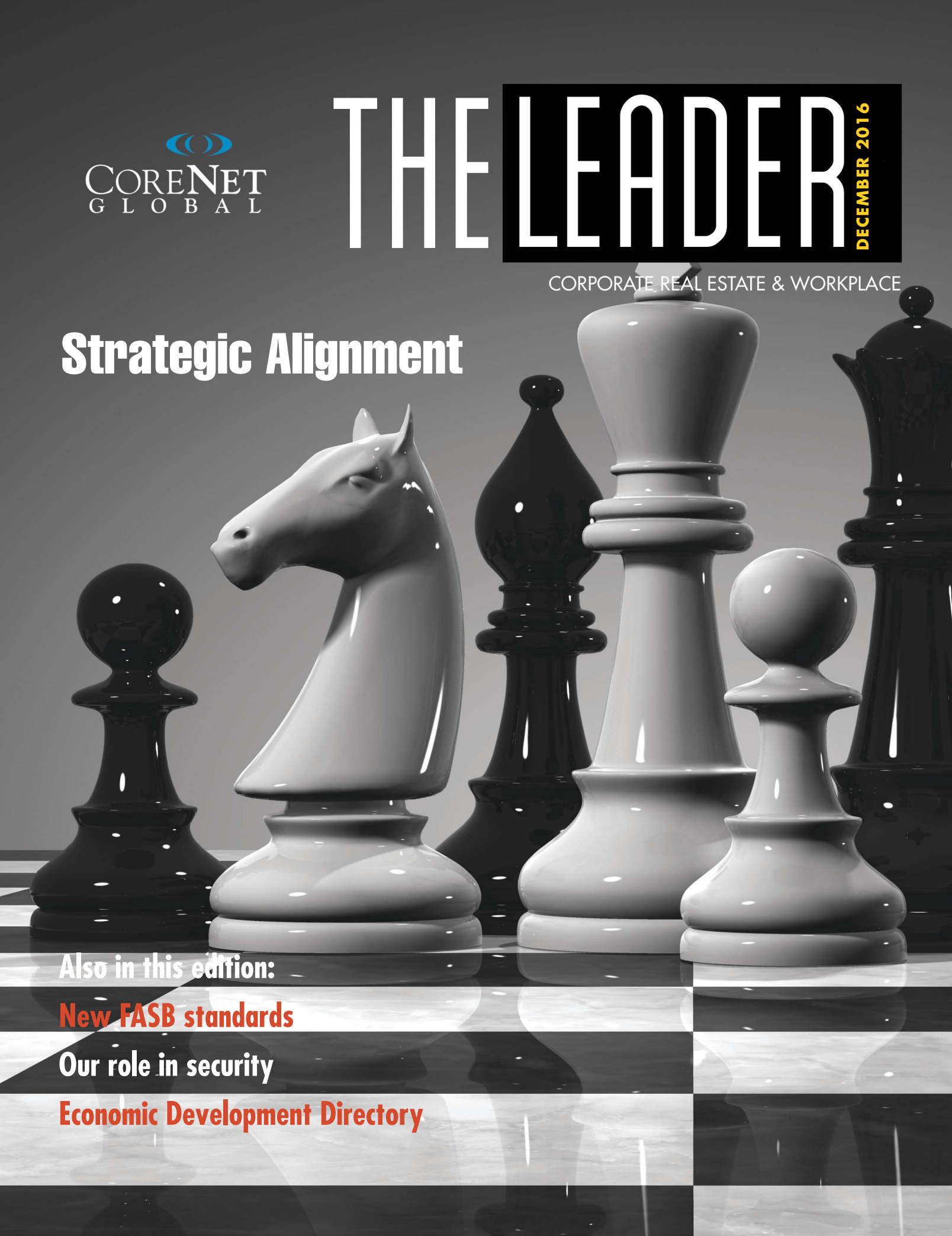
CoreNet Global

THE LEADER

DECEMBER 2016

CORPORATE REAL ESTATE & WORKPLACE

Strategic Alignment



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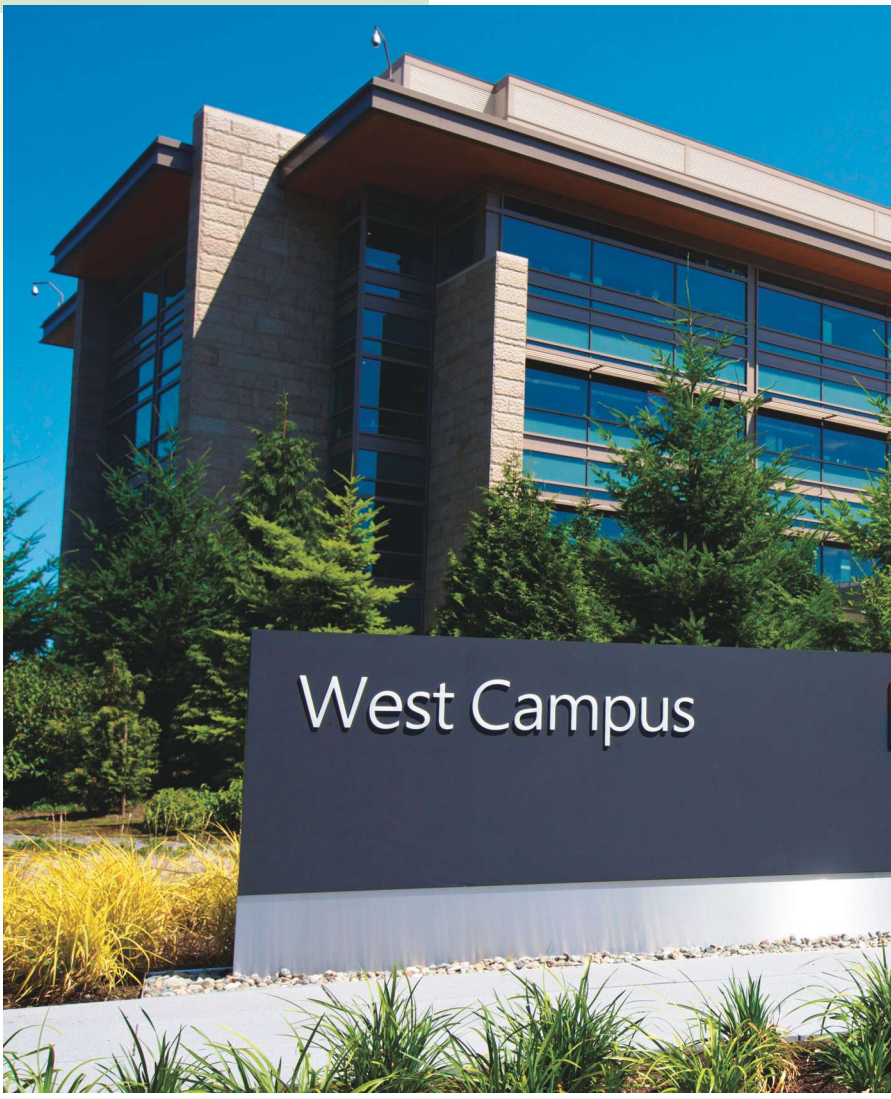
Teaching old HVACs new tricks at Microsoft

By Mohan Reddy Guttapalem

Picture Pat, a busy building technician in charge of millions of corporate square footage. She sits comfortably at "command central," surrounded by giant computer touchscreens that send continuous information about the mechanical health and energy consumption of every device in her HVAC realm.

She checks the day's "Top 500" fault list. In Building117, several lab fans have failed with their cooling-coil valves in the "open" state, significantly overcooling the space. If not addressed, that will waste thousands of dollars a year. Replacing the faulty valve actuator will stop the money leak in minutes. Pat dispatches a ticket to a technician and turns to another high-priority item. The central plant serving Building 36 has an unnecessarily high condenser-water set point, consuming much more energy than it needs. Pat clicks a few icons to override the control and instantly reduces energy consumption by tens of thousands of dollars annually.



Office and lab space at Microsoft's Redmond, Washington, campus served as the testing site for the company's cloud-based ESB technology solution, which has saved millions of kilowatts in energy and millions of dollars in utility bills.

No, it's not a facilities fantasy or a building administrator's pipedream. It's what goes on every day at some of Microsoft's largest campuses, thanks to the company's unique Energy-Smart Buildings (ESB) technology solution.

This cloud-based software platform enables every HVAC component on a Microsoft campus to deliver near real-time data to centralized dashboards for unprecedented views into the entire HVAC system. Since 2011, ESB's fault detection, fault diagnosis, and performance-management tools have saved Microsoft millions of kilowatts in energy and millions of dollars in utility bills, while shrinking its carbon footprint and improving tenant comfort.

Microsoft is currently extending the solution to include Azure Machine Learning to optimize how chiller plants use energy. It's all part of Microsoft's ongoing work to make HVAC systems smarter, more energy efficient, and less expensive to run.

High-hanging fruit

Commercial buildings consume 40 percent of the world's energy, with HVAC systems devouring 35 to 80 percent of these kilowatts and costs. Until now, getting a bird's-eye view of how all that energy is being used was next to impossible.

Most corporate HVAC systems are a collection of disparate components (coolers, heaters, fans, etc.) of varying ages and manufacturers. They send HVAC data in their own formats and require multiple building management systems and interfaces to observe, manage, and interpret.

Checking the health of these systems takes people power: employees who report that they are too hot, too cold, or hearing a noise, and techs who tune up systems on one- to five-year maintenance schedules. If a fault or failure is quietly developing, facilities managers might not learn about it for days, weeks, months, or even ever. And once a problem is detected, technicians may spend days sleuthing out its origin and how to repair it.

As for getting a complete view of HVAC energy use in hopes of relieving a bloated electricity budget? Haul out the utility bills, meter reports, and screen shots from multiple systems, then have everyone push up their sleeves on the hunt for complex patterns using information that is already stale and out of context.

This was the situation Microsoft faced in 2011 when it sought a holistic view of all things HVAC in its 14.5 million square feet (1.35 million sq. m.) of office space and labs in Redmond, Washington. The option of renovating equipment to talk the same language came with an unwelcome $60-million price tag, so the facilities and energy group did what Microsoft does best: they worked with an industry partner to create their own unifying technology solution for a fraction of the cost.

The idea for the ESB pilot was simple. Integrate thousands of compatible building sensors across a diverse mix of HVAC-system types in 13 buildings (2.6 million square feet or 241,547 sq. m.). String them together onto one cloud-based software solution – an Internet of Things (IoT) network built on Microsoft technology. Turn it on, harvest billions of real-time data points per week, and then use big data analysis to create visualization dashboards packed with actionable data for centralized monitoring, fault detection and diagnosis, and energy management.

And visualize they did. Immediately after the pilot's deployment, a stunning (if not also alarming) number of active failures, potential problems, and impressive wastes of energy began pouring in. In one parking garage, exhaust fans had been mistakenly left on for a year ($66,000 in wasted energy). In another building, the software reported a pressurization issue in a chilled water system. The problem took less than five minutes to fix, but would have cost $12,000 in energy a year had it never been found.

With the ESB concept proven by the pilot, Microsoft began a two-year plan to adopt ESB across all 125 Redmond buildings. The company saved $700,000 in the first year alone, with less than half of the portfolio connected. ESB is now fully deployed at three large campuses: Redmond; Las Colinas, Texas; and Silicon Valley, California. Two deployments are under way in Shanghai and Beijing, China.

Savings by the numbers

Like HVAC systems, the ESB platform never sleeps. At Redmond, for instance, it collects more than 500 million real-time transactions per day from over 2 million connection points on 50,000 pieces of equipment and thousands of energy and monitoring meters. All this mega-data is immediately converted into easily comprehended charts, tables, and dashboards that technicians use to prioritize fixes and adjust system parameters. This enables them to make the most of every kilowatt dollar as conditions and needs change.

For example, each day's Top 500 chart lists the most energy-expensive faults, grouping them by cost and priority and keying them to related information, such as business or employee impact. Important trends are a click away – such as current kilowatt consumption, long-term performance of individual assets, or potential trouble brewing among similar kinds of systems in multiple buildings. Technicians can take a campus-wide view or quickly zoom in on one building, floor, office, or piece of equipment, reducing investigation time by as much as 80 percent. A third to half of the fixes can be made remotely, resolving HVAC problems so quickly that employees never experience a distracting change in their environment.

The solution has saved Microsoft $3.5 million in energy costs over the past two years in Redmond, and a combined $172,000 across Las Colinas and Silicon Valley to date. Other benefits include a smaller carbon footprint in support of Microsoft's corporate sustainability initiatives, and timely employee-comfort resolution, which helps keep people focused on their work and significantly reduces the number of work orders.

Of course, making such sweeping changes to HVAC management is not without its challenges. Aside from the initial work of exposing all the sensor data, aligning data formats (units, variable names, etc.), and aggregating it all onto one software platform, resources must be ready to handle the truths that inevitably surface within moments of going online.

On deployment day at the Silicon Valley campus, for example, ESB immediately revealed thousands of HVAC faults and weak spots. Big, small, and mostly previously undetected, each anomaly and inefficiency required resources to address, even if half of them could be handled through the software. Within 30 days, most had been fixed, recovering $240,000 in immediate savings, or 6 percent off the energy baseline. At that rate, most companies could expect to recoup costs within two years.

What's ahead for ESB

The ESB platform is now in Phase 2 of development. Microsoft is adding Azure Machine Learning to improve the energy performance of its chiller plants by at least 15 percent. Chiller plants are notorious energy eaters, working 24/7 to cool water for use by air conditioning units in other buildings.

By crunching billions of gigabytes of historical chiller data, Microsoft is exposing all the settings that were active at all the times when the chillers were using the least amount of energy. Analyses can then expose the ideal parameters for predicting and continuously optimizing energy consumption for each component under varying loads.

The first stage of the pilot analyzed one and a half years of data for one chiller that handles 365,000 square feet (34,000 sq. m.) of HVAC space at the Redmond campus. Microsoft is currently applying the data and recommendations to multiple, interconnected chiller plants to validate the pilot's findings.

The Microsoft ESB technology has broken the invisible barrier that kept HVAC systems isolated and is showing how businesses can reap huge savings on HVAC usage with relatively little up-front investment. The more ESB is used, the more it continues to help Microsoft lower energy consumption, control utility costs, and reduce HVAC's carbon footprint – all while maximizing tenant comfort. It is just one example of how, by embracing the cloud, IoT, big data, and machine learning, buildings can become "smart" about everything, from basement to rooftop.

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