AI, 5G and IoT

Smart buildings in 2020 and beyond

By Juan Pedro Tomas
Introduction

There is no doubt that 5G technology is billed as the connectivity fabric that will support a new era of consumer and enterprise experiences. But, in the context of smart buildings, 5G is part of a larger equation that also encompasses artificial intelligence (AI) and the Internet of Things (IoT). The combination of the three—5G, AI and IoT—will allow for real-time data collection and analysis that will make buildings more efficient and more user friendly. Those building owners implementing a robust technology strategy will be able to leverage these rapidly developing solution sets to reduce net operating expense while leveraging the technologies to drive up lease rates by providing new services.

A smart building is any building that uses automated processes to automatically control its operations by using sensors, actuators and microchips to collect and manage data. With 5G rollouts accelerating, 5G-enabled IoT applications are being introduced, offering new opportunities for building managers and real estate firms to improve efficiencies in building operations.

Capable of near real-time data transfer speeds, 5G technology does wonders in reducing latency and improving connection speed and reliability and is expected to facilitate more and better IoT applications for intelligent building technologies over the years to come.

“When you really look at 5G, it’s all about the enhanced mobile broadband. It’s about the latency, but it’s also about the massive machine-type communications and it’s really going to enable thousands and millions of sensors that are going to be able to be lit up with the 5G platform,” Michael Flaherty, director of emerging technologies at KPMG US, said. “You’re not going to see it as much with brownfield as opposed to greenfield projects. So I think there’s really a lot that 5G can bring to the market, but it’s always about maturation of not only the 5G network itself but the sensors and the other parts of that ecosystem.”

5G is already enabling smart buildings

According to Coretrust Capital Partners, a real estate investment firm focused on the acquisition and operation of large office properties across the U.S., 5G will be the key technology that will enable the full implementation of IoT in smart buildings. “Our position is that smart buildings will be integrally tied to the IoT, and we see 5G as a pathway that will enable IoT devices to perform most effectively both from a tenant and business operations perspective,” Coretrust Capital Partners Managing Principal Thomas Ricci said.

With help from wireless services provider Connectivity Wireless Solutions, Coretrust Capital Partners recently implemented 5G technology to transform its own tower in Downtown Los Angeles into a smart building. The transformation, which included a Distributed Antenna System (DAS) comprised of 317 multi-band antennas and 20 software defined remotes for fiber optic connectivity that cover the 1,244,925 million square feet of the 48-story tower, will provide improved cellular coverage and internet connection.

Commenting on what specific 5G services or applications are already being implemented in the smart building field, Ricci said that some smart building applications and use cases include digital signage, wayfinding, augmented reality (AR) and virtual reality (VR) systems, Heating, Ventilation and Air Conditioning (HVAC) and energy control applications, as well as security-including HD video security.

Ricci also noted that the company’s focus has been on putting scalable, modular infrastructure in place...
that we deploy, the Building Management System (BMS) is technically an extension of IoT capabilities,” said Greg Corlis, managing director for emerging technologies and national IoT leader at KPMG US.

“We’re starting to see a significant uptick in clients asking to move forward with smart building initiatives. Definitely any new building that is being built needs to be built from the ground up as a smart building. It does not make sense not to leverage IoT-type technologies for that facility. Just trying to go the traditional route and not embedding these types of technologies doesn’t make a lot of sense,” Corlis said.

Swedish smart building research firm Memoori tracks how the IoT has had a transformative effect on smart building automation and control in recent years, disrupting long-established business models and offering significant new opportunities to improve the efficiency of buildings, raise employee productivity, as well as helping to stimulate the development of innovative new services.

Memoori forecasts that the global market for the Internet of Things in Buildings (BIoT) will continue to expand significantly over the next years from $34.8 billion at the end of 2017 to $84.2 billion by 2022, representing a CAGR of 19.4%. The European research firm revealed that Asia-Pacific will be the largest market in terms of adoption of IoT in buildings, representing 36% of the global market by 2022. North America follows in terms of market size, but will decline in overall global importance from 30.9% in 2017 to 27.7% by 2022.

According to KPMG, apart from...
North America and Europe, other regions or countries such as the UAE, Hong Kong, Israel, Singapore and Australia are experiencing some increasing traction in terms of smart building developments. “Everybody’s looking at doing it, and deploying smart buildings, especially for any new builds. But the retrofits, they can take a little longer to emerge but there’s definitely global demand, and growth occurring today,” Corlis said.

James McHale, CEO at Memoori noted that 5G will initially enable certain niche applications in buildings. “In our recent IoT research there was a consensus amongst our interviewees that 5G will have a limited short to medium-term impact on smart building IoT delivery, and short-range technologies will continue to dominate for internal building systems. For the time being at least, 5G data is likely to be restricted to more niche applications in smart buildings such as augmented reality or HD video streaming,” McHale said.

The integration of legacy infrastructure with IoT sensors and applications, newer networks and cloud services is the key to making buildings truly smart, said Apurba Pradhan, VP of product marketing, systems and software at Adesto.
Technologies, a California-based provider of application-specific semiconductors and embedded systems for the IoT.

“Though the concepts of smart buildings and the IoT are relatively recent phenomena, building automation and management systems have been available for a number of years, used to operate and monitor lighting, security, HVAC, and other building systems. However, these are traditionally standalone systems without the ability to easily connect or integrate with other devices and networks,” the executive said.

Through this integration, building managers can extract meaningful data that will enable them to benefit from other technologies such as AI and achieve return on investment.

Pradhan noted that wired connectivity will continue to play a strong role in networking the core operational infrastructure of smart buildings, including HVAC, elevators/escalators, access control, lighting and emergency systems, while 5G will play a key role in other smart building systems. “These systems are embedded with a high degree of need for local networking using industry-standard protocols which will not be replaced with 5G anytime soon. However, systems for people tracking, asset tracking, and other user/tenant facing technology including security cameras will likely go the way of 5G due to the flexibility of the network,” he said.

Adesto Technologies also highlighted that AI and analytics can add value for building managers in certain areas including energy management, improved space utilization, enhanced safety, and more efficient operations/maintenance.

“The widespread use of these technologies [5G, AI and IoT] will depend on the level of integration. One of the most widespread areas will be in the area of smart lighting networks with occupancy data for space analytics. We are also seeing adoption in the area of smart predictive energy management systems. Perhaps less widespread at this time are predictive management of building equipment and assets, and augmented reality for maintenance operations,” Pradhan added.
Corlis also highlighted that KPMG is having a lot of conversations with clients regarding the implementation of contact tracing solutions as part of the response to COVID-19 in buildings. “IoT and private networks can help enable a lot of those capabilities by playing sensors, giving every single employee or visitor to a building a badge that can track their movements. But it’s just fraught with privacy concerns. So we’re seeing some challenges with that messaging and the adoption of these technologies. I think the biggest challenge right now is that people just aren’t comfortable with providing that level of detail on their movement and activities on the property.”

**5G for connecting building sensors**

Gregory Dial, executive vice president of corporate and market strategy, JMA Wireless, believes that 5G, paired with the ability to support things like private wireless networks, is going to be extremely important to enable smart buildings, but also will be key in many other critical infrastructure areas like manufacturing, transportation and large venue management, among others.

“With 5G you not only have improved speeds and lower latency, but also the ability to connect massive amounts of sensors and to process that information in real time. These sensors will form the central nervous system of the building, allowing maintenance or support staff to not only address issues immediately, but get ahead of potential issues employing new technologies like machine learning, computer vision, and artificial intelligence.

Dial also stressed that 5G technology, paired with private network capability and the added value of putting more compute power at the edge of the network, will start to automate critical operations. Some examples could be automated sensors that report on elevator maintenance or control things like automated lighting or temperate settings based on people movement. Back office functions like content delivery can be much more efficient over 5G private networks, delivering content directly on site. Hosting specific applications on local networks like augmented and virtual reality, and other high bandwidth/low latency intensive applications will also be possible. “In short, in-building 5G and private networks will significantly push the limits of automation,” Dial said.

Commenting on how 5G can interact with other emerging technologies such as IoT and AI to further improve smart buildings, Dial believes that this is the critical link. “5G speeds and low latency to things like smartphones are important, but it’s those technologies pairings that will really drive major breakthroughs. 5G paired with private wireless networks, paired with IoT, paired with edge

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Gregory Dial, EVP of Corporate and Market Strategy, JMA Wireless
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compute that allows high-end functions like AI to run. 5G is simple a standard that allows data to move faster over the air, the architecture of the networks that support 5G are truly what will make it unique. Software-based platforms and having resources as close to the user as possible are critical.”

Commercial buildings in the future will require many types of service, including HD video, edge computing, and service association on basic networks. The HD video requirement of the basic network refers to HD (4K and 8K) video streaming and real-time HD communication. For example, 4K or higher HD video services are required in conference rooms and exhibition halls. In terms of edge computing, the 5G network can be used to implement local data computing and processing within the building. For example, data of the facial recognition system can be processed locally, reducing security risks and reducing the latency. In terms of service association, many sensors will be deployed in buildings. In the future, 5G networks can support the deployment of more sensors in places where cables cannot be deployed.

Another key use for 5G-enabled videos is service robots. With advanced indoor positioning and low latency, 5G networks enable delivery robots to finish the last-100 meters delivery. In addition, operators can provide dedicated service experience assurance for robot services and share service revenues with building management companies.

However, the deployment of 5G in smart buildings has some challenges or obstacles that should be considered by building owners or managers. “These networks need to be something that a standard IT workforce can understand in order to maximize usability and minimize the learning curve. In other words, these networks need to be targeted to a different audience than in the past. What took wireless engineers to set up and maintain needs to simplify to the point where data can be viewed and controlled through very simple dashboards,” Dial said.

He also explained that if critical applications all sit on different platforms with different management dashboards, automation and overall continuity won’t be realized and could stifle adoption. A key piece of this transition is moving to software based solutions. Custom, hardware based solutions will not have the ability to scale or change at the pace that’s required. This is traditionally where telco vendors have resisted change, but it’s now table stakes to ensure mass adoption and keep pace with technical progress.”

According to Schneider Electric, the IoT helps create dynamic, and intelligent cloud-based interoperable networks by connecting electrical, mechanical, and electro-mechanical systems and platforms. By communicating with each other, these systems can help monitor themselves and act when necessary (e.g. turn down air-conditioning or heating needs in a little-used area) to provide the data and analytics needed for facility managers to intelligently optimize performance and create smarter buildings.

Schneider Electric also noted in a white paper that advanced smart-energy sensors can play a critical role in Building Energy Management Systems (BEMS). These devices contain “sensing” technology that captures and sends digital data to a BEMS to enable analysis and support actionable insight. Sensors that measure and provide continuous feedback on temperature, carbon dioxide level, humidity, and air pressure, for example, can deliver valuable information. Controllers, gateways, and sensors can also increase energy efficiency and help cut costs.

These devices, systems, and
Platforms connect to a central, open IP backbone to provide a holistic view of building performance. This backbone not only integrates all the data generated by the devices, but also presents it via a friendly user interface displays (desktop, tablet and mobile) that use graphics, data-rich reports, and trend visualizations.

“Most importantly, this central backbone helps facility managers make strategic decisions through data analysis and actionable insights to ensure buildings are working smarter and running at maximum efficiency. Data analysis can also include artificial intelligence and machine learning algorithms that help buildings self-diagnose and optimize. IoT is creating enormous opportunities for information gathering and sharing that will have an astounding impact on the way buildings are managed and operated. By using a collaborative smart building IoT platform, devices are connected with software and services to realize these opportunities,” according to the Schneider Electric paper.

Vornado Realty Trust, a real estate investment trust which owns and manages nearly 24 million square feet of commercial office space in New York City, has been expanding its IoT footprint with the aim to expand the offering of smart building devices across its properties, Nicholas Stello, Senior Vice President of IT at Vornado Realty Trust, said.

“Our IoT footprint continues to grow rapidly as we have focused our attention on increasing the number of smart building devices, introducing additional tenant amenities and other technologies which enhance our building’s operation. We continue to learn about the latest trends and how to be best situated for IoT’s imminent 5G “revolution” through active participation on advisory boards and by continuing our strong strategic partnership with national carriers that we believe will be critical in this new environment.”

According to the executive, the quality of in-building cellular is directly related to the ability to attract and retain tenants as well as increase net operating income for building owners.

“We’ve seen a growing trend over the years where a prospective tenant would inquire about cell coverage. Over time as their cellular needs have become more of a business requirement, some tenants would require a complete indoor solution prior to signing a lease. There’s no doubt that there exists a correlation between a property’s technology offerings and the successful execution of a lease.”

Stello highlighted that telecom operators are very selective to invest in the in-building 5G as they...
are only investing in high-profile venues located in high-density areas. “If you happen to own or are developing a property that has a very high profile, is highly commuted and is in a high-density area where the macro is already strained, then your chances of a carrier contributing capital are better - but those properties are few and far between in most organizations,” the executive said.

“While still critical and important to an organization, the remaining portfolio may not be as attractive to the carriers and hence no capital funding would be made available to build them out - this “second level” of properties is where we are focusing our recent in-building cellular coverage efforts,” he added.

Stello also considers that 5G technology will allow Vornado to enhance the ability of CRE operators to attract and retain tenants. “We feel that the advent of 5G will play a big part in our technology offerings as the tenant/consumer will continue to have a growing number of mobile applications made available - many of which will be primed to operate on 5G.”

The executive also said that despite some challenges to secure capital investments by national carriers, the firm will continue its efforts to engage with them in some strategic projects. “The seemingly unchangeable shift to landlord/venue funded systems is something that we need to adapt to and figure out how best to move forward. Historically, we have made our properties, our portfolio for that matter, as open as possible to the national carriers by crafting beneficially reciprocal cellular agreements. Our desire to continue to increase our cellular installation base using the carrier’s capital is, at best, a difficult one to satisfy. We will continue to work closely with them on strategic projects that we both view as important to our brand.”

AI in smart buildings

A clear example of how artificial intelligence is already being used in smart buildings is a solution developed by Canadian firm BrainBox AI, which specializes in autonomous building technology.

BrainBox AI offers a technology combining deep learning, cloud-based computing and autonomous decision making to support a 24/7 self-operating building. BrainBox AI, which claims to have installed its technology in over 15 million square feet of commercial properties in 15 cities, says its solution enables the HVAC system in a building to operate autonomously, in real-time, generating up to a 25% reduction in total energy costs and a 20-40% reduction in carbon footprint.

How aware are building owners of this technology opportunity? Despite the increasing interest in 5G and other technologies such as IoT, Ricci, of Coretrust Capital Partners, opined that the real estate community still needs some additional evangelization about the advantages of 5G technologies...
in the smart building field. “More education and awareness is needed in the real estate community. Many still consider wireless inside the building to be outside their domain, when in reality it is the property owner’s responsibility to provide connectivity - be it wired or wireless to their tenants. Building owners and managers need to have a general knowledge of these systems so that they can take appropriate action to serve their clients in the building and support future technologies.”

“We can’t speak to whether the real estate sector is already aware of the benefits of these technologies in commercial buildings, but there is certainly well-understood value for building operators and property management. A space that is less costly to operate, provides better and ready insights on space utilization or people movement, offers more comfortable or customizable space for tenants. We are seeing more and more demand for IoT driven analytics, so I would say that owners and operators are definitely seeing value and putting projects to work,” Pradhan said.

Corlis, of KPMG, considers that building managers and building owners still have to learn about the full potential of technologies such as 5G, IoT or AI and how these can be used to improve buildings operations.

“I think a lot of buildings operations companies are being approached by different suppliers, with point solutions. I’d say they’re all starting to look at it. But trying to understand which technologies make the most sense for their facilities is a challenge. On the private LTE and private 5G networks, I’d say there’s very limited knowledge about it. They’re being approached by traditional carriers about leveraging their commercial 5G and LTE networks for these services, and they’re not really aware that they don’t have to use a carrier for this as they can go their own route and deploy their own private 5G network in the facility and operate it like they operate Wi-Fi and wired networks today. They’re just not aware of that,” Corlis said.

Meanwhile, Dial, of JMA Wireless believes that the use of 5G and other emerging technologies in the smart building space is in the early stages. “Private wireless networks, initially starting on 4G/CBRS, will be a major catalyst to see exactly what could be done with the technology. For multi-use spaces like the real estate sector, 5G capabilities like network slicing and variable quality of service will be critical. Many of these themes are not evident on 4G LTE or WIFI today, so grasping those concepts and how to use them to monetize things like unlicensed spectrum will be major eye-openers. 2020 is the year of seeing that light bulb go on with private wireless and it will catch fire in 2021 and beyond as those private wireless networks move to 5G and we see a massive ecosystem emerge around IoT and edge based intelligence.”

Conclusion

The combination of emerging technologies such as 5G, IoT and AI will facilitate the task of smart building managers who can automate multiple processes and can also achieve lower energy costs for building occupants, among several other capabilities. The combination of these three technologies still faces technical implementation challenges, and building owners and managers have yet to learn more about the advantages these technologies can offer in the design of smart buildings. However, IoT networks with thousands of sensors are already enabling several smart buildings in the world and this is a trend that is only just beginning. (0-0)
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