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Simplifying the IoT Edge:
Smart Spaces Best Practices

Demand for Intelligence and Automation in Buildings

IoT adoption is growing across the world. This includes not just consumer smart home device adoption, but IoT deployments in industrial and business settings. IoT sensors and devices capture data and perform tasks, communicating over IP and other protocols with cloud or local systems to create intelligent systems and enable automation. These solutions support a wide variety of use cases, enabling more functionality while saving companies money and increasing revenue opportunities.

This whitepaper addresses the demand and growth of IoT edge solutions in smart buildings and smart spaces. It investigates top verticals and use cases such as smart apartments and MDUs, retail and warehousing, and hospitality and building management. It looks at common challenges and best practices in deploying solutions into these environments and examines new open solutions compatible with many different networking technologies, such as the use of gateways with both Wi-Fi and new IoT radios, which can create, expand, and improve services in these new smart spaces.

Top Smart Space Verticals & Use Cases

There are several specific verticals where smart space technology can play a useful role. These include energy management, retail and warehousing, and hospitality and building management. The growing smart apartment space also presents a unique area for IoT technology deployments, with specific benefits and challenges.

Energy Management

Energy management is growing in importance to businesses worldwide. It is a core component of most corporate initiatives around sustainability or specifically more ESG, which stands for Environmental, Social, and Governance. Companies are examining their business practices and energy usage profiles and identifying ways through which they can reduce their energy usage, reduce their energy spending, transition to renewable and sustainable energy sources, and store and generate energy to further resilience and protect against natural disasters.
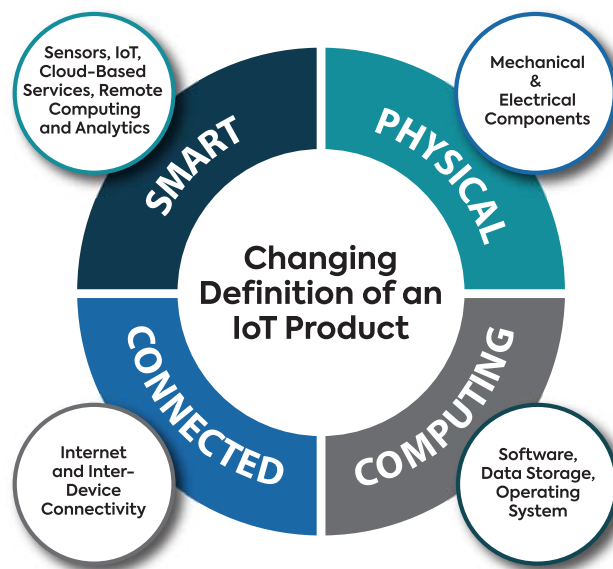
According to Reuters,[2] 40% of energy use is from buildings, and most are heated by fossil fuels. New initiatives from European Union countries are focused on renovating buildings that have the worst energy raging—a "G" energy performance certificate. This proposal would include having residential buildings upgraded by 2030 and 2033 and nonresidential building by 2027 and 2030, depending on the rating grade.

Smart spaces with energy management solutions deploy sensors to detect temperature, humidity, and occupancy among other attributes of space. These solutions are integrated into HVAC control systems, allowing businesses to offer appropriate heating and cooling to occupied rooms. Ambient lighting sensors, combined with occupancy sensors, allow businesses to adjust the amount of generated light in occupied rooms to appropriate levels while reducing lighting costs.

Defining Smart Spaces

Smart spaces can be defined in many different ways. Parks Associates defines "smart spaces" as physical locations, equipped with networked devices and sensors-based solutions, that give individuals data about the location's parameters and how the space is being used. "Smart spaces" are most commonly buildings but may be any type of location, including outdoor structures or vehicles.

Smart spaces have a strong overlap with smart home, industrial IoT, and Industry 4.0,[1] making use of the same concept of networked sensors feeding into larger data platforms.

Sensors, IoT, Cloud-Based Services, Remote Computing and Analytics

Mechanical & Electrical Components

SMART
PHYSICAL

Changing Definition of an IoT Product

CONNECTED
COMPUTING

Internet and Inter-Device Connectivity

Software, Data Storage, Operating System

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Clean Energy Initiatives and Tracking Energy

Other components may include battery backups, on-site power generators, or on-site solar installations. Smart meters in buildings and homes continue to be deployed, with expectations that these devices will help consumers, utilities, and business owners to monitor energy usage in real-time. In addition, tracking of system and device energy usage is available to help further reduce energy consumption.

- In 2019, according to the US Energy Information Administration, there were over 11.5M commercial advanced smart metering infrastructure installations in the United States.[3]

- In Europe, close to 225 million smart meters for electricity and 51 million for gas are expected to be in use by 2024. By 2024, 77% of European consumers will have a smart meter for electricity, and 44% will have one for gas, as per the European Commission.[4]

- 36% of US small and medium businesses (SMBs) use one or more types of energy management devices, including smart thermostats and smart lighting.

- SMBs in the US report 10% savings in electricity costs with smart thermostat deployments.

Consumers continue to show growing interest in smart and clean energy initiatives, but many consumers in the United States are unaware of the available incentives or utility programs offered by energy providers on how to save energy. In addition, there is low awareness overall of energy products and solutions on the market. In other markets awareness is higher, particularly in Europe which has seen overall higher costs for energy.

- 45% of heads of US internet households would prefer to live in a community that is powered by solar energy; 35% are willing to pay more for clean energy.

- 60% of US households would be willing to pay for a power backup system, at tested rates.

- Only 24% of US households consider themselves "very familiar" with the incentive programs offered by their energy provider; only 19% were "very familiar" with energy monitoring and management products available.

- In Europe many countries are focused on sustainability initiatives. For instance, in Finland, Motiva held Energy Saving Week to bring new awareness to energy consumption and specifically behavior changes that can impact usage.

- In Europe, the 2022 IEA report notes,[5] "Tripling the current installation rate of smart thermostats - about one million homes per year - would reduce gas demand for heating homes by an extra 200 mcm a year at a total cost of EUR 1 billion. By turning down the thermostat for buildings' heating by just 1°C would reduce gas demand by some 10 billion cubic meters (bcm) per year."

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Retail and Warehousing

Retail stores have made use of intelligent sensor-based systems for some time, using solutions to analyze in-store behaviors of their customers. Deployments range from basic sensors that monitor how many and for how long customers stopped in front of a display, to Bluetooth beacons monitoring the path the consumers' smartphone takes around the store, and now to camera-based machine vision and/or Wi-Fi motion detection systems.

New technology is also finding its way into the back-of-house, with many potential use cases and applications. Sensors are increasingly monitoring the usage trends of equipment, feeding data into AI systems that predict the equipment's maintenance needs—ranging from trucks to lifts to conveyor belts and other devices. RFID tags and sensors track products throughout facilities. Sensors track workers' locations and provide safety warnings when they venture close to geofenced unsafe areas or equipment. AI solutions make precise measurements of product dimensions and, paired with AR glasses, allow companies to make the most optimal utilization of their available warehousing space.

Hospitality & Building Management

The hospitality industry is increasingly modernizing as well, with smart access control systems broadly deployed. These deployments make use of NFC readers in hotel doors to unlock doors, commonly using NFC cards or smartphones as keys. New smart hotels leverage IoT sensors, AI, and automation to create better experiences for guests and building management systems for staff and administrators.
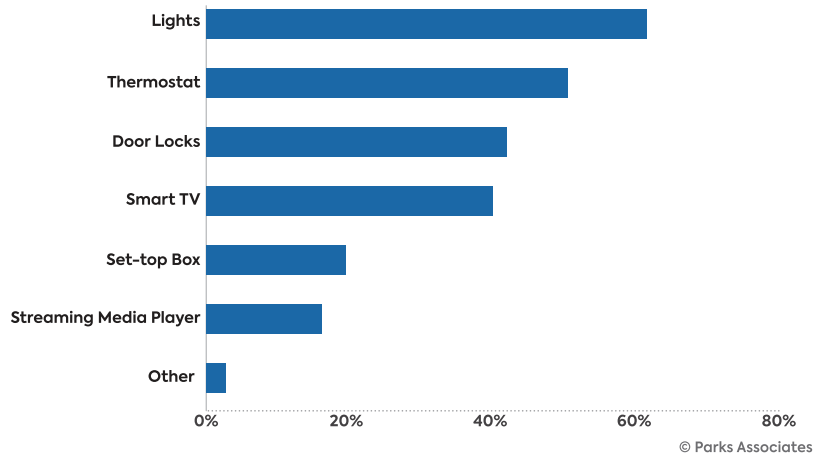
Hotel rooms are increasingly incorporating smart home technology such as smart lighting systems, smart thermostats, smart blinds, and/or enhanced TV controls in addition to more traditional access control. The smart speaker and smart display category is now a lifestyle product staple within the modern connected home, with 55% of US households owning at least one such product. A high percentage of consumers are using smart speakers and displays as the command-and-control centers for their smart home and entertainment devices.

- Most smart speaker and display owners own one or more smart home devices; 60% of smart speaker owners and/or smart display owners also own at least one smart home device.

- The number one self-reported use for smart speakers is streaming music and podcasts, with approximately three-fourths of smart speaker owners reporting doing so.

- Consumers ranked lights, home thermostats, door locks, smart TVs, and video cameras as the top 5 devices they would most like to control via voice assistant.

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Managers can also leverage sensor-based solutions to streamline cleaning and maintenance services. Usage information on lighting, energy consumption, and plumbing systems can help with maintenance issues, including detection of dead lightbulbs and plumbing leaks. Previously mentioned solutions such as smart energy systems and asset tracking of equipment also apply to this vertical.

Devices Consumers Would Like to Control Via Smart Speaker

Device	Percentage
Lights	~62%
Thermostat	~51%
Door Locks	~42%
Smart TV	~41%
Set-top Box	~20%
Streaming Media Player	~17%
Other	~3%

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A Closer Look at Smart Apartment Solutions

One unique market for smart spaces solutions is that of smart apartments and MDUs. Smart apartments feature smart amenities for residents, community management solutions, and building automation solutions. These solutions are growing in popularity among MDU property managers and owners in the US and Europe. In Europe, this is noted by investments in property management software, such as Plentific, which raised $100M in funding from Brookfield Asset Management, Highland Europe, and Target Global, among others. Also recently a property technology (proptech) firm based in London, Lavanda, was funded $7.25M.[7]
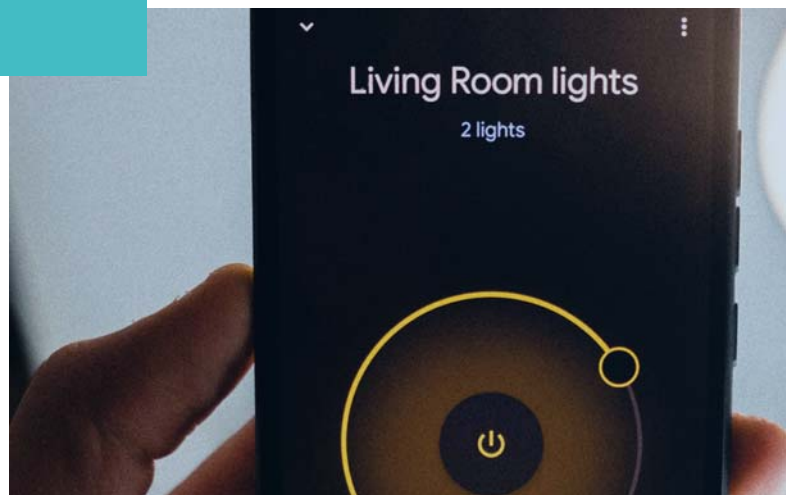
- 34% of MDU property managers in the US reported offering internet-connected or smart home devices to residents in at least one property that they manage.

- 57% of MDU managers report having a lighting control system in their largest property; 26% have an energy management/monitoring system; and 13% have a smart home device or IoT platform/hub.

- 44% of properties with energy management systems incorporate internet-connected devices such as smart thermostats and smart lighting into the system for remote monitoring and control.

The use cases and deployments targeting the smart apartment space have many similarities to solutions targeting the hospitality space. However, there are unique factors in the MDU market that introduce additional complexities and challenges.

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Dual Perspectives: Residents and Property Managers

Many smart home solution vendors perceive MDUs as a potentially lucrative channel for new business, while traditional MDU technology vendors are making investments to rapidly expand their service offerings, including through acquisitions and IPOs. This market does have unique challenges: in smart apartments, unlike in other verticals, solutions providers are serving two different clients—the property manager and the residents. The wants and needs of these groups may differ, as do the solutions that best serve them.

Over a third of MDU residents are willing to pay an additional 15% per month in rent for smart amenities.
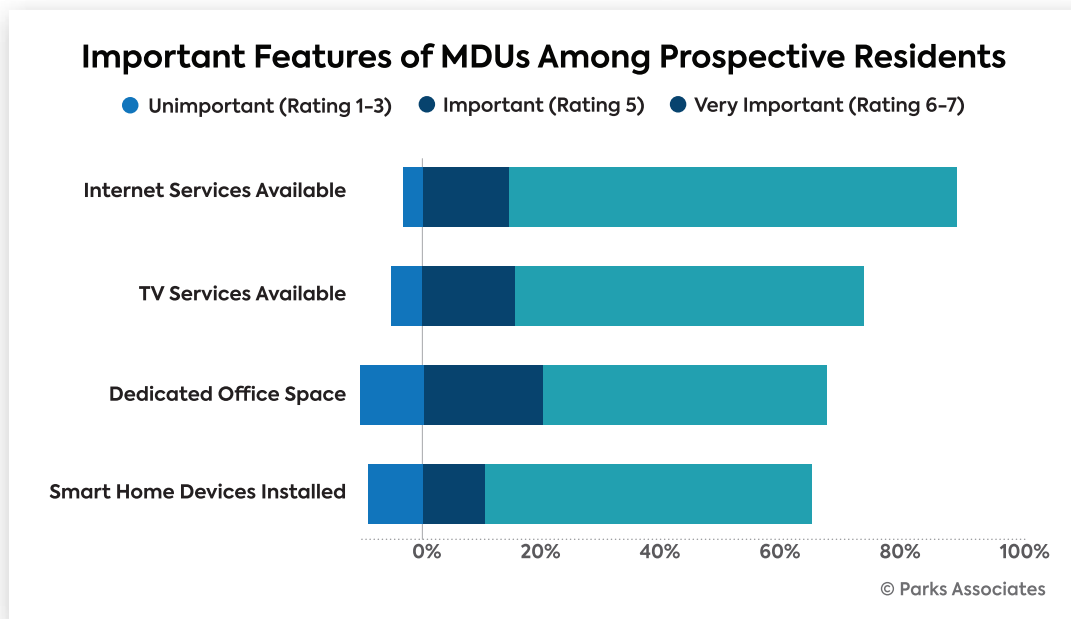
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Property managers and owners who have installed smart home solutions report significant benefits from these solutions. The top benefits include increased rental revenues, improvements in operating efficiencies, and an increased ability to attract and retain residents.

At present, MDU owners and managers are less likely to note lower property insurance costs as a benefit, but this will likely increase as the market develops and matures. According to The Wall Street Journal, insurance premiums for apartment communities in the US rose by 33% in 2020 alone. Smart home platform providers can partner with more insurance companies to offer lower insurance premiums to property managers on the basis of the lower safety risks associated with smart home device implementation. This too will drive higher return on smart home device investments for property managers and drive higher adoption rates for device and platform vendors.

Internet and Smart Home Technology as Emerging MDU Amenities

Parks Associates' consumer surveys find that internet access is a top amenity for MDU residents, while smart home device offerings are emerging as a key differentiator for properties. An increasing percentage of properties—both greenfield and brownfield—are looking to deploy new high-speed internet solutions paired with smart home and home automation products.

Important Features of MDUs Among Prospective Residents

● Unimportant (Rating 1–3)　● Important (Rating 5)　● Very Important (Rating 6–7)

Internet Services Available

TV Services Available

Dedicated Office Space

Smart Home Devices Installed

0%　20%　40%　60%　80%　100%

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Reliable, high-speed broadband is now a must-have for MDU residents.

While the majority of MDU residents acquire broadband service for their units directly through providers via a retail service model, a growing number of properties offer managed high-speed internet access (HSIA) as an amenity. However, given recent FCC rulings on resident choice in MDU environments, MDUs are no longer able to enter into exclusive or graduated revenue-sharing agreements with ISPs and are no longer able to participate in sale-and-leaseback agreements. Vendors working to deploy IoT solutions into MDUs must be prepared to support a mix of deployment models, including multiple internet-service providers or even tenant-owned devices.

MDU residents making use of property-provided devices are keenly interested in use cases related to safety and security, as well as energy management. 43% of US MDU residents report using smart home devices, including a mix of property-provided devices and devices the resident purchased at retail. Consumers prefer to monitor and control their devices through a single user interface, and top solutions will support a BYOD approach.

As data security and privacy continue to be an important concern for smart home users, both apps and voice controls pose different pros and cons of use. Manufacturers desiring higher adoption are well advised to focus on privacy-focused policies, capabilities, and product design, particularly for camera-equipped devices.

- 60% of property managers report that they can monitor the data from smart home devices installed in individual units

- 38% also report that they can adjust any device at any time. Platform vendors providing smart home devices typically restrict these capabilities for property management companies in order to prevent invasion of resident privacy and rights.

MDU residents are more likely than consumers living in single-family homes to own smart home products, with residential owners of units in condominiums or townhomes particularly likely to use smart home technologies. Over 42% of MDU unit owners report that their property pre-installed at least one smart home device. However, most renters, by contrast, have fewer BYOD and self-install options. MDU residents looking for a more complete smart home experience must select a unit with devices pre-installed, but just over 10% of renters living in MDUs report that they are currently living in a unit with a pre-installed, property-provided smart home device.

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Almost two-thirds of prospective MDU residents report that pre-installation of smart home devices is an important factor when selecting their new apartment. Over half of MDU renters are willing to pay extra for an apartment with smart capabilities and amenities, which would also include a system that allows them to add their own devices without limitations or needing approval. Given the tech-positive tendencies of MDU households, there is considerable room for smart spaces solutions to grow in the MDU rental market.

65% of MDU owners and property managers allow residents to self-install only approved devices.

Evaluating Property Technology ROI

Evaluating the return on investment for property technology is challenging for MDUs and property owners entering this space. In addition to getting a clear estimate of the costs required—for IT and networking infrastructure, hardware installation, software-as-a-service licensing, etc.—MDUs must attempt to quantify the prospective benefits.

ROI for resident installations is easier to quantify—property managers by and large expect to charge more per month for a unit with smart home features—but proptech and building management solutions can also reduce MDU costs and enable new use cases. For example, smart leak detectors allow properties to detect water leakage issues before they become major disasters, potentially saving thousands of dollars and avoiding wasted maintenance costs and a poor resident experience. The opportunity for integrated safety applications with insurance in the future is large.

According to the US government, FEMA reports[8] that:

- from 2017 to 2019, multifamily residential building fires accounted for an annual estimated average of 106,700 reported fires,
- an annual estimated average of 400 deaths, 3,875 injuries,
- $1.7 billion in property loss
- multifamily residential building fires accounted for 29% of all residential building fires responded to by fire departments across the nation

Proptech and building management solutions can also enable new use cases, such as access control mechanisms that enable self-guided tours for prospective tenants. These benefits typically require centralized control, as well as the ability to integrate with existing building management solutions, in order to be fully realized.

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Deploying IoT in Smart Spaces: Challenges and Best Practices

Deploying IoT in these various environments has its challenges. Many of these challenges are the same, regardless of the deployment environment. On the organizational side, there is the need for proper planning and working with key stakeholders to ensure that solutions are well-designed for the task at hand, accepted and understood by those who would use them, and provide the appropriate ROI.

Regarding technical challenges and roadblocks, Parks Associates has identified three key challenges that players across the ecosystem must be prepared to face as well as the best practices to address them. In addition to these technical challenges, it is important that customers—property managers, construction firms, building owners, etc.—be served with complete proposals that eliminate the pain of coordinating multiple solutions across stakeholders. Ideally, solutions include software platforms with services, apps, networks, connectivity, hardware and installation. Multi-vendor environments must include clear communication and coordination between partners, with top solutions including a single point of communication—one hand to shake.

Three Key Challenges:

Integration in Multi-Vendor Environments

Need for Solution Scalability

Connectivity: A Top Challenge in MDUs

Integration in Multi-Vendor Environments

Integration is a key challenge for businesses and the vendors who coordinate their technology ecosystems; interoperability is important for the unified experience. There are many players serving the smart spaces and IoT market, including many different hardware and software players. It is critical to ensure that this technology plays nicely together. In the case of software, if integrations between different components don't already exist, they need to be written, and this work can be more expensive and time-consuming than the purchase and installation of the actual hardware.

In terms of equipment, a complicating factor is the sheer number and variety of IoT communications protocols available on the market. These range from more accessible—yet power-hungry—protocols such as Wi-Fi, 4G LTE, and Bluetooth, to lower-power IoT-specific protocols including Zigbee and Z-Wave.

As a networking technology, Wi-Fi serves many use cases and is widely available and understood. This makes it a good first choice for companies looking to deploy IoT. However, there are some environments where Wi-Fi may not be reliable, such as areas with high interference from other Wi-Fi networks and devices or with physical obstructions such as brick walls, metal framing, or certain types of insulation. Wi-Fi is also power-hungry relative to other IoT protocols, meaning that it does not serve well for use cases where IoT devices must rely on battery-power.

Other IoT-specific technologies such as Bluetooth Low-Energy (BLE), Thread, Zigbee, Z-Wave, and others are more power efficient and less likely to experience (or cause) issues with interference. However, Z-Wave and Zigbee both require hubs for translation to Wi-Fi and linking back to the source. Thread, by contrast, uses internet protocol (IP) to communicate, and as with BLE, it is increasingly being built into routers.

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The Promise of Matter – a Collaborative Breakthrough in Integration

The many IoT standards has long been an issue for product adoption and rollout. In 2019, to help resolve this complication, and improve adoption, a group including Amazon, Apple, Google, Comcast, Technicolor, and other members of the Connectivity Standards Alliance—then known as the Zigbee Alliance—announced the Connected Home over IP working group, which sought to develop a standardized IoT communications protocols over IP. That standard, known as Matter, officially launched in early 2021.

Matter makes use of several standard radio protocols, such as Thread, Bluetooth Low Energy, and Wi-Fi, for communication with and provisioning of IoT devices. Because it is standardized, it works regardless of brand ecosystem—any Matter-certified device will work with any Matter-compliant sensor or controller. This allows hardware makers to better differentiate their products, by delivering end-to-end IP to devices, and better supporting the separation between the network and application layers. New Wi-Fi gateways are also increasingly incorporating Matter and the appropriate radios into their designs—effectively serving as low-friction IoT hubs.

Need for Solution Scalability

Businesses looking to deploy solutions must also keep in mind operational efficiencies and their five-to-ten-year technology roadmap. Many businesses might start with deploying IoT solutions at a single location, which can be an excellent way to evaluate the technology, estimate ROI, and gain valuable knowledge on specifics and best practices. However, businesses must be careful that the solutions they select be capable of delivering the same returns when installed at multiple facilities, in different states or countries, and that the solutions support their technology roadmap. Scalability and adaptability are essential.

Businesses must be prepared to work with cloud-based solutions, IT infrastructure capable of taking data from multiple systems and combining it into a single comprehensive dataset, and vendors capable of providing service throughout large geographic footprints.

Connectivity: A Top Challenge in MDUs

The ownership and business models for internet infrastructure in MDUs are complicated. A property might be served by a single ISP or by several. The MDU may have financial agreements with the ISP, wherein the ISP pays them for marketing and, previously, exclusivity—or the MDU might be paying the ISP to be able to offer service to their residents. Oftentimes residents contract directly with the ISP to receive service; however, some MDUs bundle the service into the cost of rent, with CPE pre-installed and internet available at move-in.

In February 2022, the US Federal Communications Commission issued a new ruling banning exclusive revenue-sharing agreements between landlords and ISPs in MDUs and commercial multi-tenant environments.[9] The commission also clarified that "sale and leaseback" agreements, wherein ISPs sell the wiring inside of buildings to the MDU, which leases it back to ISP, is in violation of existing pro-competition rulings.[10] These rules apply retroactively, invalidating existing agreements. This may ultimately make it easier for integrators and solutions providers to deploy IoT within MDU environments but introduces additional complexity in the short run as MDUs and ISPs work to understand the impact to existing contracts.

Networking Technology and Access Point Deployment

Another complicating factor is the structure of the community's deployments of internal wiring and access points and at times even the availability of power sources. Internal wiring may vary wildly, according to the age of the community and whether the community has decided to upgrade its internet service. Coax cable is extremely common, but solutions providers may also expect to find Ethernet or copper lines. New MDUs are beginning to install fiber to better meet the ever more demanding needs of tenants, and some also have access points that they or their ISP own and operate scattered throughout the community, used to offer public internet access and a private network for staff. Generally, residents are responsible for arranging service from their ISP, but some MDUs are starting to deploy and own the access points within renters' units.

A growing percentage of MDUs are now offering community Wi-Fi through managed Wi-Fi solutions, where access points are distributed throughout the property, providing Wi-Fi to the entire community. Unlike legacy community Wi-Fi deployments, these new solutions do not use splash pages or captive portals—instead, they allow residents to log in to their own home network regardless of where they are on a property via virtual LAN (VLAN) technology. They make use of network slicing and other virtualization tools to provide better security, and they use AI to optimize Wi-Fi performance. Headless IoT devices work fine in these types of environments—and deployments are oftentimes easier, as devices can be provisioned with one SSID and password and work regardless of their location.

To deploy IoT solutions to MDUs using these different models requires different strategies and techniques. There are no one-size-fits-all solutions. ISPs may be an additional stakeholder in the conversation, depending on the extent of their collaboration and contracts with MDUs.

A Connectivity-Based Approach to Smart Spaces

Gateway-based solutions are a sensible middle ground for IoT deployments in smart spaces. These solutions incorporate Wi-Fi and various IoT-specific radios for fronthaul and may make use of either Wi-Fi or a wired internet connection for backhaul. This allows businesses, MDUs and MTEs, and IoT deployers to make use of a range of radio frequencies and networking technologies, homing in on ones that best fit their particular needs and use cases.

New gateways emerging onto the market incorporate Wi-Fi 6 or 6E, Zigbee, and Matter, and use the Thread protocol for IoT networking. They avoid the hassle of vendor lock-in, installing a complex web of multiple IoT hubs, and can be issued as an upgrade or replacement to existing Wi-Fi access points when appropriate. This vastly simplifies IoT deployments, enabling many more spaces and communities to make use of smart space solutions.

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Futureproofing Technologies

In order to gain the full ROI on technology investments, businesses and MDUs expect their deployments to last for many years. However, the pace of technological innovation is constantly increasing. To gain the full benefit of investment, as well as the advantage of new and innovative technological solutions, IoT deployments must be as future-proof as possible.

In practical terms, this means having a platform that is flexible and extensible as well as a backbone capable of working with many devices and solutions by many vendors. Over time, many vendors may enter and exit the market—and new solutions may rise to the forefront. It is unwise for companies—including businesses, MDUs, and integrators—to bet on one protocol or closed product ecosystem. Interoperability is essential. The promise of interoperability hinges upon the convenience of controlling and coordinating multiple devices through a unified interface application, with privacy and security protection as a key feature. More than ever, open tools are available that bridge from one protocol or one platform to another.

Building the Open IoT Edge Solution

Open-source software has existed for longer than the modern web, helping to drive new innovations and standardization. Without open source, it is unlikely that the internet as we know it would have been able to come into existence. Over the past decade, we have seen the concept of open source increasingly move into the hardware space, starting with cloud technologies and whitebox servers and moving into networking products and standards—both helping to build next-generation wireless and wired access networks as well as driving the industry towards true software-defined networking. The move to open software and open hardware has helped drive adoption of new solutions, increase the pace of innovation, remove vendor lock-in, enable new use cases, and cut costs.

In practical terms, we have seen the emergence of a new deployment model for applications via routers and gateways. This model, by which a software agent runs locally on the gateway and communicates bi-directionally with cloud-based systems, allows for detailed analytics and insight on traffic running across networks as well as deeper forms of automation. Of particular interest to companies with smart spaces deployments is gateway-based cybersecurity, a new cybersecurity model that offers network-level protection and monitoring for IoT devices.

The next frontier for open source is that of operational technologies, especially those incorporating the IoT. Many of the current pain points and roadblocks of IoT deployments are solvable through open platforms and open hardware. Openness supports the creation of new partner ecosystems, enabling companies to deploy new applications as needed while avoiding vendor lock-in.

End Notes

[1] Industry 4.0 refers to the fourth industrial revolution, which digitalizes industrial processes through the use of IoT technologies and cyber/physical systems. It provides businesses with new levels of visibility and control, allowing them to collect and analyze data, optimize operations and logistics, and automate processes and decision-making.

[2] https://www.reuters.com/markets/commodities/europes-buildings-line-energy-saving-overhaul-2021-12-15/

[3] https://www.eia.gov/tools/faqs/faq.php?id=108&t=3#:~:text=In%202020%2C%20U.S.%20electric%20utilities,metering%20infrastructure%20(AMI)%20installations

[4] https://energy.ec.europa.eu/topics/markets-and-consumers/smart-grids-and-meters_en

[5] https://www.iea.org/reports/a-10-point-plan-to-reduce-the-european-unions-reliance-on-russian-natural-ga

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[8] https://www.usfa.fema.gov/downloads/pdf/statistics/v21i7.pdf

[9] https://www.fcc.gov/document/fcc-acts-increase-broadband-competition-apartment-buildings-0

[10] Ibid

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About Parks Associates

Parks Associates, a woman-founded and certified business, is an internationally recognized market research and consulting company specializing in emerging consumer technology products and services. Founded in 1986, Parks Associates creates research capital for companies ranging from Fortune 500 to small start-ups through market reports, primary studies, consumer research, custom research, workshops, executive conferences, and annual service subscriptions.

The company's expertise includes new media, digital entertainment and gaming, home networks, internet and television services, digital health, mobile applications and services, consumer apps, advanced advertising, consumer electronics, energy management, and home control systems and security. www.parksassociates.com

For more information, visit **www.parksassociates.com** or contact us at **972.490.1113**, **info@parksassociates.com**.

About Technicolor

Technicolor, with decades of leading experience in the connectivity space, offers a complete IoT edge solution based on robust, secure, interoperable and futureproof hardware. Propelled by a culture of innovation and research, Technicolor teams foster partnerships with a thriving ecosystem of companies enabling its wide range of customers to bring an ever-growing number of value-added services to market. Using a state-of-the-art framework, Technicolor's R&D engineering teams design first-class platforms allowing applications, connected devices, data flows and networks to interact seamlessly. And through these, help simplifying the integration of IoT services, supporting complex use cases in a cohesive manner therefore allowing fast go-to-market strategies and cost-effective installations. **www.technicolor.com/connect/iot**

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Kristen Hanich heads Parks Associates' consumer electronics and mobility research, with expertise in other verticals including connected cars, mobile networking, healthcare, wellness, and independent living. She leads a mix of custom and syndicated research projects throughout the year, with a focus on major players and emerging trends. Kristen specializes in bridging the gap between data-driven and narrative approaches to understanding the consumer markets via a mix of qualitative and quantitative research approaches.

Kristen has dual master's degrees in applied anthropology and public health from the Universities of North Texas in Denton and Fort Worth. She earned her BSc in health at the University of Texas at San Antonio and has a graduate certificate in Geographic Information Systems.

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