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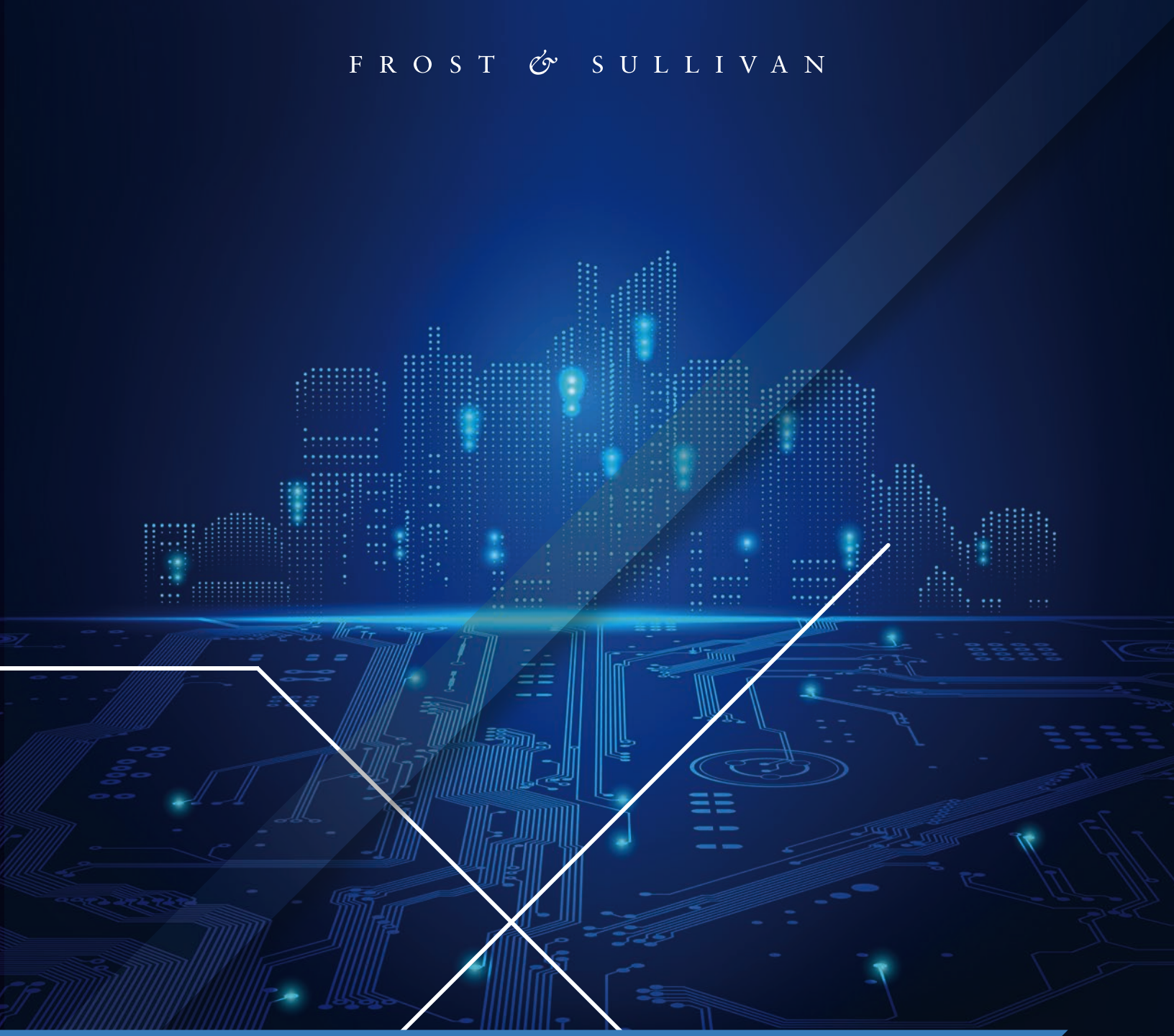

Smart Buildings

Driving Energy Efficiency, Improving Security and Enabling Sustainability

IN COLLABORATION WITH

Spectrum

A Frost & Sullivan Executive Brief

Information and Communications Technology

50 Years of Growth, Innovation and Leadership

SMART BUILDINGS: AN OVERVIEW

Smart buildings are a core area of focus for various smart city stakeholders including city governments, utilities, commercial enterprises, building systems vendors and information technology (IT) technology and service providers. Smart buildings connect operational technology (OT) such as elevators, lighting and surveillance with IT-based solutions such as building management systems to enable greater operational efficiency.

This insight focuses on building structures used for commercial and government activities. Given the size and number of these facilities, there is a significant need to employ smart building solutions to streamline management, reduce building operations and maintenance costs, extend asset lifecycle and drive environmental sustainability through improved resource utilization. Moreover, smart building solutions also enhance resident safety and comfort through effective management of access and other building control technologies such as heating, ventilation and air conditioning (HVAC).

Smart building solutions deliver significant operational efficiencies while also enhancing resident safety and comfort.

The smart building market opportunity is rather significant. The Continental Automated Buildings Association (CABA) estimates show that there were 6.5 million commercial (non-residential) buildings in the U.S. and Canada in 2015.

EXHIBIT 1: **Commercial Buildings in US and Canada**

Source: CABA's 2015 Intelligent Buildings and Big Data Report and Frost & Sullivan Analysis

Industrial buildings typically include manufacturing/production facilities, refineries, utility company plants and other similar structures. Commercial structures include retail and wholesale buildings/ shops, hospitals, school and college campuses, private offices, mass transit facilities, stadiums and

convention centers, lodging and others. Examples of federal government buildings include defense and law enforcement facilities, judiciary buildings as well as numerous federal agency offices. The continuing expansion of the U.S. economy over the past 18 months is likely to have a positive impact on the construction industry leading to a potential increase in new building permits thereby further expanding the number of smart buildings.

FACILITIES-RELATED OPERATING CHALLENGES

Given the sheer number and variety of non-residential structures, building owners and managers face numerous challenges in effectively and efficiently operating these facilities. Some of the key building management challenges include:

- Rising utility costs
- Need to extend asset lifecycle
- Need for real-time visibility into building systems and operations
- Ensuring property protection and tenant/visitor safety
- Compliance with various building codes and changing regulation
- Environmental sustainability

SMART BUILDINGS CORE COMPONENTS AND FUNCTIONS

A smart building system combines a package of sensors, controllers/hardware, and software that allows a facility to sense its own environment and react to both real-time and historical data for maximum operational efficiency. Smart building technology can be used to monitor and control building operations such as HVAC, lighting and security to reduce energy consumption and provide the best environment for tenants.

Today's smart buildings are increasingly enabled by the Internet of Things (IoT) and made functional by the ongoing convergence of operational and information systems in buildings. The building automation system (BAS) or a building management system (BMS) has moved considerably from the physical realm to one with IT enabling all aspects of its functioning. With IoT, a host of new elements such as the cloud, remote access, data sharing and analytics and connected and shared networks are becoming an intrinsic part of a smart building's operational dynamics, fundamentally changing how buildings are used and operated. The implementation of IoT-enabled smart building solutions also raises the need for deploying robust network and device security protocols.

From a deployment perspective, building infrastructure varies greatly based on the type of facility or the commercial activity performed. For instance, a retailer is likely to have a need for IoT solutions that not only monitor and manage HVAC systems but also large refrigeration units. Similarly, a healthcare facility has a much more complex BAS/BMS that may involve multiple elevators, access systems that may require close monitoring to prevent unauthorized personnel from entering certain areas, etc. Moreover, varying legacy operational technology is likely to influence implementation and management of smart building solutions.

ANTICIPATED BENEFITS AND OUTCOMES

Smart building solutions are a critical element of any smart city initiative. These solutions encompass both operational and informational technology. For instance, many commercial buildings are switching over to light-emitting diode (LED) lighting to reduce energy consumption and maintenance costs. More efficient LED lamps not only improve energy efficiency, they can also be effectively integrated with other IoT-enabled lighting controls to further optimize energy consumption and conservation. Similarly, smart building access solutions, while improving security, can also help identify occupancy trends thereby enabling managers to effectively plan maintenance.

Some of the key benefits of deploying smart building solutions include:

- Transforming siloed systems to converged solutions that streamline building management.
- Reducing energy-related expenditures and eliminating waste such as loss of water due to malfunctioning plumbing fixtures.
- Proactive asset maintenance and management to avoid untimely outages of core operational systems such as HVAC, elevators and refrigeration units.
- Preventing unauthorized access and timely resolution of issues.
- Creating a conducive environment for building tenants and other constituents such as customers and suppliers that require access to the facilities.
- Thwarting cybersecurity threats that target both central BAS/BMS as well as individual connected-systems such as lighting.
- Helping to adhere with local building safety code requirements such as air and water quality.

THE ROLE OF CONNECTIVITY IN SMART BUILDINGS

Smart buildings employ a range of connectivity protocols including wireless, wired, and cellular. The presence of various networking protocols such as Bluetooth Low Energy (BLE), Wi-Fi, and others renders it critical to employ a provider that has a robust, reliable and secure network. Moreover, the provider must have significant understanding and experience in network security to be able to anticipate, identify and address various cybersecurity risks inherent in smart building solutions. In addition, growth in implementation of cloud-based smart building solutions further accentuates the need for secure and reliable network management.

THE LAST WORD

Demand for IoT-enabled smart building solutions is expected to continue to grow as these solutions offer significant return on investment in the form of reduced operating costs and streamlined building management. Moreover, an effectively managed commercial building also materially enhances quality of life for its occupants thereby driving tenant satisfaction and retention. Effective implementation and management of smart building solutions relies upon strategic partnerships and alliances between public and private sector entities, operational technology providers, IT vendors and network service providers.

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