Digital Transformation Led Innovation in Smart Buildings

Find out how BACnet bridges the worlds of IT and Building Automation Systems

softdel

Connecting Devices, Enterprises, and People

FOREWORD

Digital Transformation in the context of the built environment requires reimagining the way buildings and communities are designed and operated to fully leverage connectivity, data, and analytics. The result is data-driven optimization that reduces cost, improves performance, and creates new business opportunities. Intelligent Buildings, Smart Cities and a resilient grid are all a part of the digital transformation in the built environment. And they are all dependent on a common enabler – an open, interoperable integration platform. Over the past 20 years, BACnet has evolved in ways that make it the best option for addressing that need.

It is easy to forget that before BACnet was launched 25 years ago, it was difficult to integrate building controls across different suppliers and building systems. In many cases it required reverse engineering proprietary protocols and development of custom software. BACnet changed all that by defining a global standard for building controls data communications. It substantially reduced the cost and complexity of system integration, leading to increased innovation and new business opportunities. But BACnet did not stop there. As Information Technology (IT) systems and building automation systems (BAS) converged, BACnet continued to evolve by incorporating core IT technologies and extending integration support to a broader set of building systems. This positioned BACnet to bridge the worlds of IT and BAS, preparing the way for Intelligent Buildings and Smart Cities.

Intelligent buildings optimize their performance by orchestrating the operation of all building systems to achieve their goals. This requires integration of BAS components across the various building systems and integration of sophisticated data collection, analytics, and diagnostics capabilities.

Cost-effectively achieving this level of integration requires a standard, interoperable integration platform with strong roots in both BAS and IT. BACnet is that platform and it continues to evolve to meet the rapidly changing needs of the industry.

Throughout its 25-year history, BACnet has served the community by enabling higher performance buildings that improve energy efficiency, reduce carbon footprint, and increase grid resilience. BACnet has also served the community by accelerating innovation and creating new business opportunities. These benefits of BACnet are accelerating as the world moves forward with digital transformation in the built environment. This book will help you see more clearly how BACnet bridges IT and BAS and it will provide you with some examples of BACnet supporting and enabling digital transformation.

Andy McMillan
President & Managing Director,
BACnet International

Sunil K Dalal

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A UNIDEL Company

INTRODUCTION

By 2025, there will be more than 40 billion connected devices installed in smart buildings. These devices will need seamless integration and the ability to communicate with each other to offer real-time actionable insights driving both operational efficiencies and new business opportunities.

The lynchpin for innovation has been the advent of a common industry communication standard in BACnet. What started as a communication standard for just the HVAC industry has now emerged as the leading global communication standard driving interoperability between a wide range of devices and equipment in modern buildings. This is bringing innovations across energy efficiency, safety, security, and comfort.

Softdel's association with BACnet International, virtually from its inception, has allowed us to build an invaluable repository of technical knowledge, application use cases, industry relationships, and most importantly, a reputation of quality and trust. Armed with this, we felt it important to share our experiences with the industry at large and help promote the case for digital transformation-led innovation in buildings, making it one of the fastest growing segments in the Internet of Things market.

This handbook brings together current technical and applications understanding along with future trends for the first time. It is an invaluable resource for business and technical leaders to plan their product roadmaps and smart building infrastructure.

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DIGITAL
TRANSFORMATION

DIGITAL TRANSFORMATION IN COMMERCIAL BUILDINGS

Today, every business and industry is under pressure to digitally transform against the backdrop of fast-evolving technology and simultaneously cater to the pressing demand for better operational and business insights. Previously, the challenge centered around businesses not adopting a common device communication protocol standard. Adopting different protocols triggered complexities like incompatible business operations, closed standards, competing priorities, and security issues. Today, technological innovations have initiated a substantial shift in digital transformation with agents like cloud computing, the Internet of Things (IoT), and artificial intelligence. As each business leverages these agents, they become digitized. They are increasingly being driven by and transformed by the impact of emerging business models and new approaches.

To upgrade their potential, organizations have been formulating strategies around cloud technologies and incorporating continuous process improvements in the backdrop. These strategies have opened multiple avenues through which a product can penetrate markets with practical solutions.

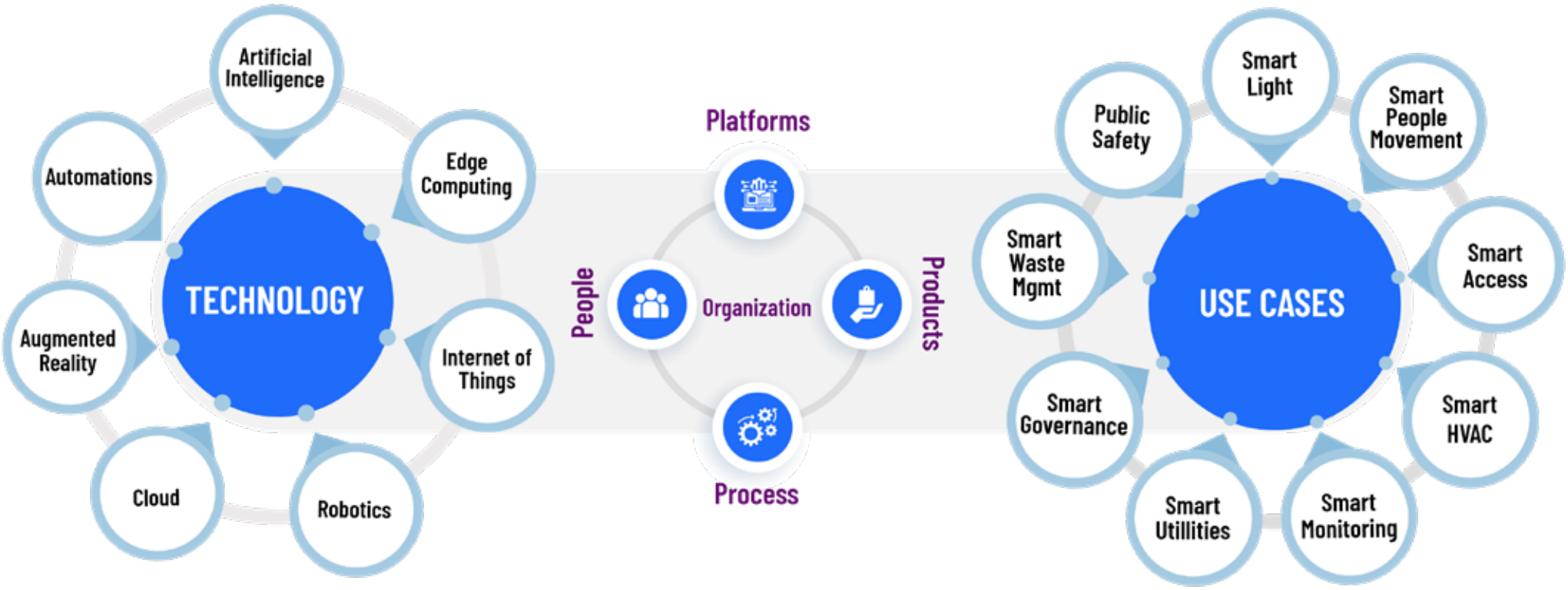
The building automation industry is no different and is at crossroads in terms of reinventing itself.

Buildings from the '80s and '90s have struggled until now, as a considerable number of hardware and software solutions were either closed and/or were proprietary. This interrupted innovation, acceleration, and integration – the three core elements that unite to make buildings 'smart'.

Digital transformation of a building requires devices to talk to each other, be interoperable, capable of self-diagnosis, and be able to always stay connected. These features enable innovation and use cases that immensely benefit not only the occupants but also real estate owners, system integrators, and service contractors.

Organizations have been in a relentless pursuit to refine their strategies and contribute to the next generation of smart buildings. Their application of existing technology for this very purpose formed interesting use cases, but they did not innovate further due to closed systems. Moreover, the building automation industry struggled to adopt existing technologies and had to rely on the legacy systems, standards, and processes that delayed the innovation.

The scenario changed with the introduction of open standard BACnet (Building Automation Control Network).



DIGITAL TRANSFORMATION WITH BACnet

BACnet is an industry initiative started in 1987, and its sole purpose was to define an open standard for a building-wide control system network. Not only was it successful in addressing the interoperability issues amongst devices, but it also provided a mechanism to connect everything reliably while also offering the flexibility to customize the solution as per specific use cases.

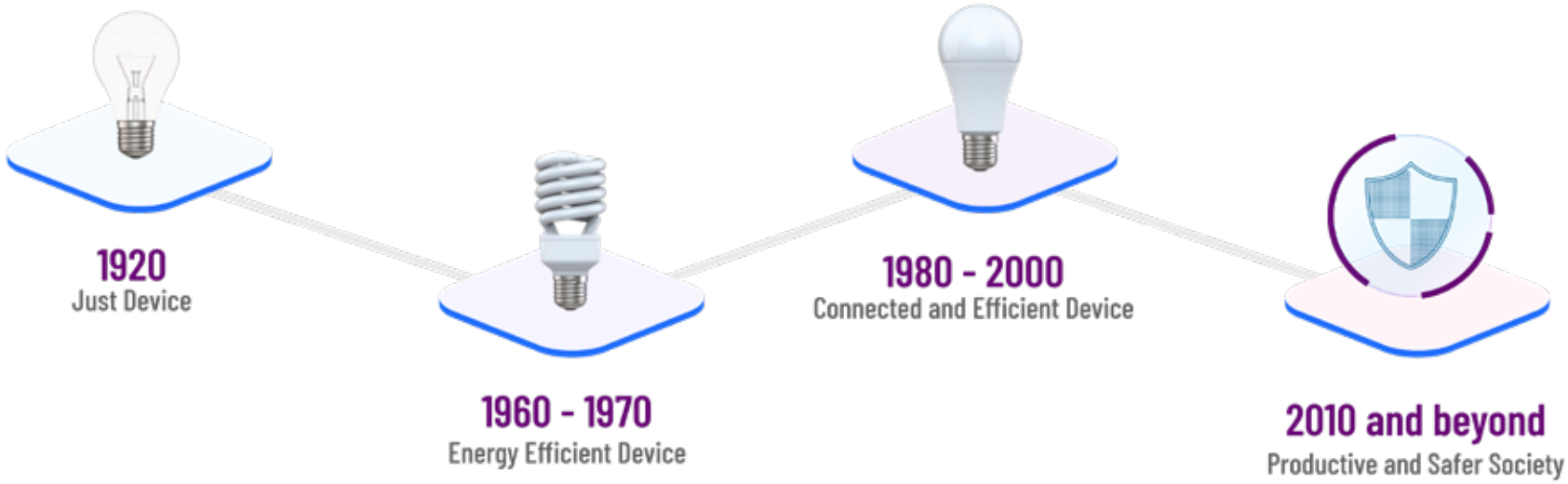
BACnet-enabled system integrators and technology vendors build systems that can efficiently perform a complex sequence of operations like monitoring, scheduling, and alarm management. BACnet also has introduced an auto-discover feature, enabling supervisory equipment to find the device in their network, thus allowing devices to detect each other. Metadata, which is critical for devices to expose their contexts to other devices, is extensively leveraged by this protocol.

BACnet is now a widely accepted network protocol that is used extensively in smart buildings to facilitate communication among devices. Interesting use cases made devices smarter while increasing the value of other devices in the same network.

For example, window blinds can now simultaneously talk to smart lights and HVAC systems to maintain a room's temperature and ambient light. Or elevators, lighting systems, and fire alarm systems can now talk to each other and significantly enhance a building's safety protocols.

These devices are assisted by an array of advanced sensors which capture specific parameters of the environment and deliver data in real-time. Sensor data is passed onto other devices with the help of BACnet to process and make intelligent decisions.

In scenarios like the above, a device exchanges information with other devices installed within the building, thereby creating an efficient and safer environment.



DEVICE EVOLUTION

DATA-DRIVEN OPTIMIZATION IN INTELLIGENT BUILDINGS

In today's technology-led world, building owners are always on the lookout for optimized solutions that make a building truly 'intelligent'. Did you know more than 65% of global smart buildings use BACnet protocol? This shouldn't be surprising as BACnet is the core component that enables interoperability, efficient maintenance, and energy efficiency and a building becomes truly **'Smart' with BACnet.**

SMART SOLUTIONS FOR SMART BUILDINGS – USE CASES

Saudi Arabian University

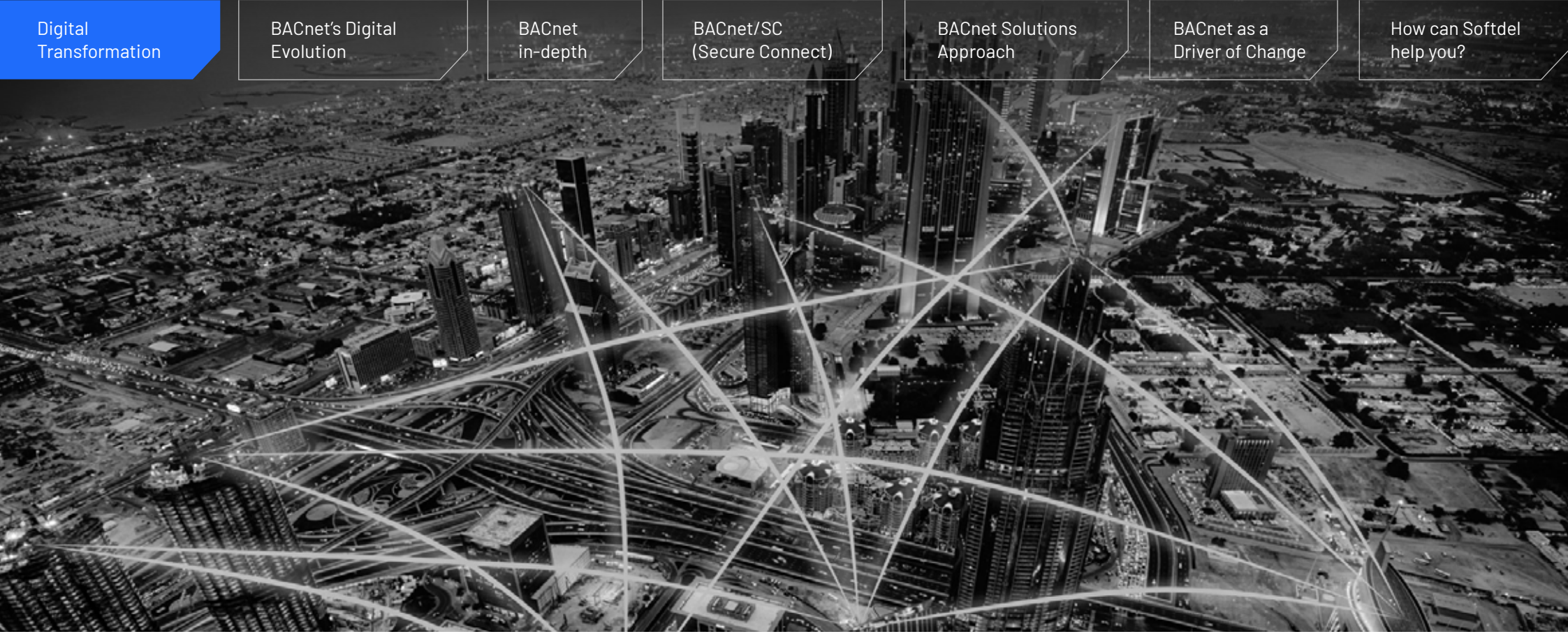
A university in Saudi Arabia altered conventional designs and installations to suit 'smart building' status. Their building – which acts as a living example for environmentally responsible construction – was designed to sustain a lifecycle of a 100 years. BACnet protocols maximized the efficiency of each installed system and reduced wastage. The building's use of skylights integrated with daylight sensors to control indoor lighting without any human intervention resulted in a 27% reduction of yearly energy costs for the entire campus. This building has since earned the prestigious status of being LEED Platinum certified.

European Stadium

A stadium in Europe has earned the label of being the most 'technologically advanced', for good reason. Messages on screens around the stadium are customized zonally via an integrated network. Players can watch a pre-game briefing simultaneously while the spectators see advertisements. Concession stands are protected from crowd surges by monitors that assess spikes in human footfalls. The stadium is also smart enough to guide the flow of traffic to avoid stampedes.

San Francisco Building

In 1996, a famous building in San Francisco was chosen to be BACnet's first-ever large-scale commercial test site. This project was successful for many reasons: it dispelled rumors that BACnet could not be customized as per vendor specifications and proved that BACnet as a protocol is cost-effective, and demonstrated the efficiency of BACnet data – a remarkable feat considering the size of this project. The timing of this project was also responsible for bringing the building controls industry into the limelight. All these resulted in making the marketplace appreciate BACnet's capabilities.



In the year 2020, real estate emerged as the primary energy consuming industry with buildings accounting for almost 55% of global electricity consumption. Building owners, therefore, are on a constant quest to substantially reduce their wastage and energy usage. While predictive, preventive, and prescriptive maintenance are essential tools for energy optimization, BACnet is the crucial backbone that helps building owners perform achieve desired outcomes. Data collected from BACnet servers can easily be analyzed to identify problem areas; this provides building owners with insights to better plan their maintenance activities. In effect, BACnet enables lower maintenance costs, extended device and system lifespan, and better safety performance.

BACnet's innovative technology can help us get the most out of our buildings, including solving interoperability issues, developing an open standard, and devising cost-effect solutions for clients globally.

Smart building design supported by BACnet protocols has a knock-on effect on the environment too. The technology in each building enables efficient and economical use of resources, which reduces overall energy consumption. Ultimately, BACnet-supported smart buildings will help building owners transition to cleaner energy usage and lower carbon emissions, thereby reducing waste, and helping the world fight climate change.

DATA IS ENABLING 'SMART' CITIES

Thanks to incredibly innovative IoT solutions, smart cities are no longer a dream for the future. Today, smart cities are quickly sprouting across the world as such urban structures are highly sustainable, efficient and provide convenience and high quality of life to residents and visitors alike. ICT (Information and Communication Technologies), often regarded as the lifeline of a smart city enables quality, performance, and interactivity of urban services, while reducing cost and resource consumption, and improving contact between citizens and city stakeholders. ICT can achieve all this because of protocols like the BACnet that help manage data in real-time.

Due to the complexity of an interconnected web of devices, these highly interactive eco-systems face major issues during energy and resource management. Urban centers need to ensure maximum efficiency of their buildings and districts, make cost-effective provisions for energy storage, and industrialize processes to improve standardization and functionality for reduced emissions. In summary, the major intervention areas must include clean energy resource generation, energy storage, infrastructure, and facility management.

USE CASES

With BACnet as the key enabler, use cases for smart cities are extensive. It is up to key decision-makers in the building automation domain to define them.

Utility Grids

A smart utility grid facilitates two-way communication between the utility provider and its customers, responding digitally to quickly changing electricity demand. Data on how much electricity is to be generated to power a smart city, how much of that energy is to be used and where, and when to minimize usage without compromising on the occupant's comfort, is increasingly being managed over the BACnet protocol allowing owners to control the grid. This utility can also be extended to deploy other essential services like smart lighting, traffic, and water solutions.

Smart Devices

Essential lighting functions can be used to turn on streetlights for a brightness. Connected lighting enables daylight harvesting which reduces the need for electrical power. This is done by automating brightness levels and tracking daily consumption to help smart cities stay green and economically efficient. Circadian lighting, which mimics the spectrum of daylight, can be used to regulate the lights in buildings throughout the day for enhanced wellbeing. In yet another use case, maintenance workers were notified of lighting failures or end-of-lighting-life scenarios to enable predictive and preventive maintenance.

Use cases involving HVAC include controlling the speed of ventilation fans according to CO levels, ensuring reduced energy usage. Another use case entails HVAC systems adjusting to temperatures as per actual occupant locations rather than cooling/heating an entire section of a smart building.

Load Management

One specific use case involves street lighting in smart cities. Although they appear to always shine brightly, they have dynamic, evolving requirements. Linked lighting systems operating over BACnet can measure occupancy to decide when lights should be turned on. This technology can even optimize stored power during outages.

Parking

Smart sensors installed at parking spots can determine if a slot is open or closed, sending this data to a BACnet operated gateway, thereby making data available to all connected devices. The information is then passed on to vehicle owners, which not only saves time but also reduces traffic congestion, making the smart city more attractive for residents. This data can also be used to provide notifications during high occupancy situations, enabling faster remedial actions.

Fleet Management – Emergency Response

Many interesting use cases are emerging on the back of BACnet and are triggering evolution in the fleet management industry, especially in the emergency response sector. Fleets for medical use (like ambulances, fire trucks) can be dispatched along the most cost-and-time effective routes using intelligent transport systems. Smart buildings can communicate directly to the emergency response vehicle, providing more information for a faster response time. Data on vehicle and driver performance, routes used, average response time, and more can also be analyzed to improve services.

Air Quality Management

BACnet technology pairs with various systems and devices to monitor indoor air quality (IAQ) and outdoor air quality (OAQ). Automatically opening doors and windows, turning on air filtration systems when CO2 levels are above a certain prescribed range, repositioning dampers in the ventilation system during a fire so that smoke from the affected location is directed away from populated areas are all BACnet use cases. BACnet infrastructure allows city-wide deployment, impacting how and when energy is generated and building a link with current weather conditions to the extent that smart buildings can generate their own electricity when required.

The transformation of cities to smart cities has been a long-drawn-out process. However, the integration of the BACnet platform allows smart cities and related technologies to work together for optimal usage of resources. This relationship can then be leveraged to address the true urban problems of climate change, pollution, transport, and more.

INITIAL BACnet FOCUS – MULTIVENDOR DEVICE INTEGRATION

Why BACnet was needed?

Imagine if every TV network had its own signal format? TV owners would then have to buy multiple receivers for multiple networks! Sounds strange, doesn't it!

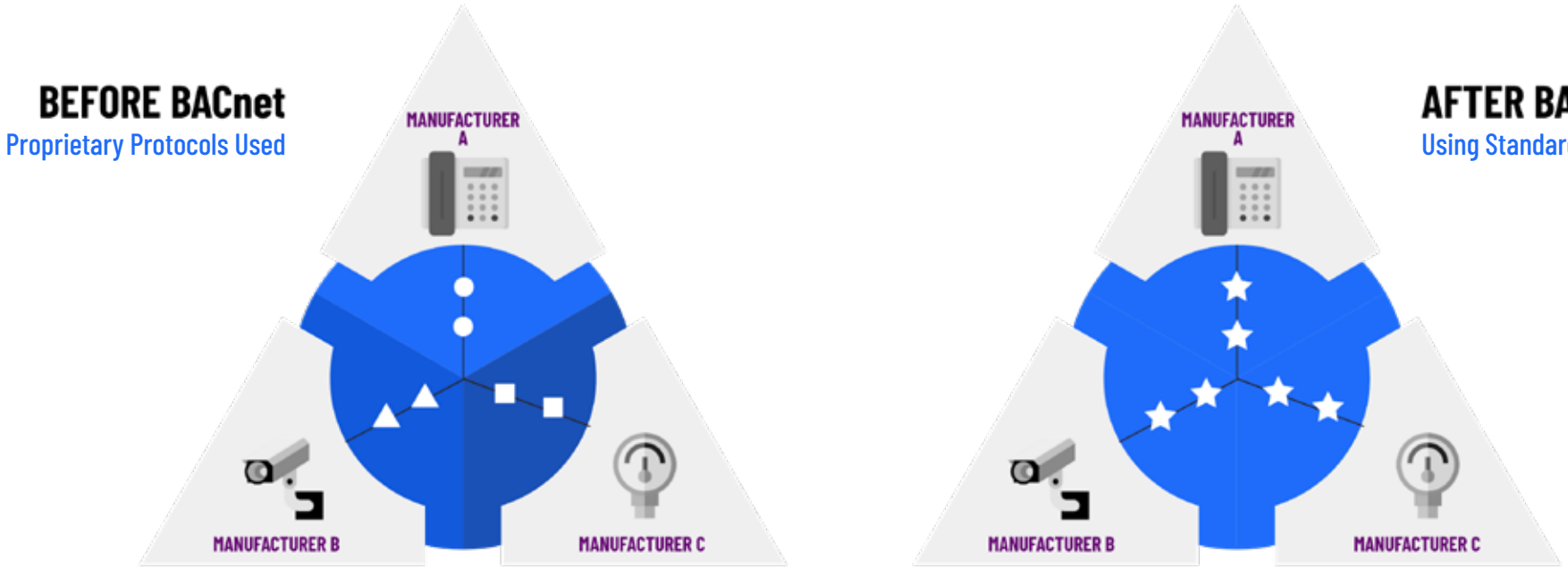
Well, not very long ago, the building automation industry functioned in the same way. Before BACnet, there was a dearth of a standard communication protocol. **Extensive software customization was required for every application-specific need. And device interoperability was just a dream.**

Then, another problem arose — compatibility. The lack of a common standard meant building systems could not communicate with each other easily. It is vital for the system architecture to be compatible with each device to ensure smooth functioning with no lapse in system operation or performance. Unfortunately, this compatibility could not be achieved without additional hardware based on custom or seldom-used software, which in turn increased the cost of the project. Thus, **adopting software for compatibility with devices turned into an expensive pursuit.**

In the early 1980s, development of computerized direct digital controllers (DDC) was characterized by the proprietary control of communication methods incorporated in these systems. Additions to DDC systems were limited to products that were exclusively created by the systems manufacturers.
Few protocols such as the ones supporting equipment functionality evolved and the communication standard was inflexible. The need for an open, standard communication protocol was widely identified but it required large-scale cooperation from all stakeholders, which was easier said than done.

Manufacturers wound up updating their protocols to support services for product configuration. Unfortunately, digital innovation led to recurring changes in products, and thus, product updates became frequent. **Maintaining this steady release of product updates was challenging.**

Due to the non-standardization of communication protocols, building automation owners had to stick to 'one vendor'. They felt trapped and limited to products made by a single manufacturer. There were means of interconnecting various manufacturer products through an 'interface'. However, designing such interfaces required co-operation and knowledge of proprietary standards, along with significant overheads, costs, and time delays. **Interoperability was, therefore, the biggest challenge.**



INTEROPERABILITY WITH BACnet

Supplier innovations and upgrades

Most industry evolutions start with innovation, and then move to standardization. The journey of BACnet was no different.

We can trace the root of BACnet's origins to the start of the internet age, in the 1960s. Back then, while a global interconnected internet network was still a few years away, the seeds of innovation had begun to sprout. The ripple effect of this internet age led to DDCs and the local area network (LAN). Devices would initially work in silos until the DDC emerged.

This protocol united devices using networking technologies like LAN. While suppliers had already responded to the changing trends by creating various protocols, they needed control over various systems, and they built different controllers for every device category. They were essentially reinventing the wheel each time, building protocols for which there was no homogeneity.

Increased interconnectivity demanded more standardization from communication protocols. And so, a standard protocol emerged — BACnet.

Standard protocol creation

It was paramount to address the rapidly growing complexities in interconnecting devices and fix it using a sophisticated yet powerful protocol that enabled seamless communication. Considering the myriad of devices and their functionalities, BACnet's revolutionary technology emerged with a logical breakdown for communication. Ultimately, BACnet delivered an exceptionally well defined and thoroughly documented solution for:

- Data definitions
- Functional objects
- Messages

ADDITIONAL INTERESTING USE CASES

BACnet and IAQ

Multiple regulators are releasing Indoor Air Quality (IAQ) standards to make the environment healthy and safe for occupants by ensuring a good balance of air circulation, temperature, and humidity. Many Original Equipment Manufacturers (OEMs) use BACnet-enabled sensors to provide fast and reliable data to supply retrofit solutions to their customers.

BACnet and Utility Meters

Many utility markets are now required to report real-time data usage to regulators or occupants. Usually, electric, water, or gas meters were designed to support communication over the Modbus protocol. These are now integrating with the BACnet eco-system using standard objects available in the protocol.

BACnet and Elevators

Elevators are essential to buildings, which, until now, operated in silos. Elevators are now evolving to make smart data exchanges with other equipment and devices in the building, resulting in very smart use cases. Elevators interface with access control devices and fire alarms to manage floor accessibility and emergency evacuation respectively.

BACnet and HVAC

Considering how HVAC is high energy-intensive equipment in a building, optimizing its energy use and simultaneously increasing occupants' comfort was paramount. An HVAC system's variable speed drives are now connected to a BACnet/IP network, eliminating the need for a gateway. This has enabled the Building Management System (BMS) system to have greater control over HVAC systems, and it can now natively diagnose inefficiencies.

BACnet and Smart Lights

BACnet protocol now inherently supports those lighting-centric objects that provide very specific control over functions like dimming, color temperature, and lux levels. This has led to dynamic environments which not only promote energy saving but also boost productivity.

"Our Mission is to transform commercial buildings, workspaces, and enterprise real estate into a more efficient, inspiring, comfortable, collaborative, and productive environment. At Molex Connected Enterprise solutions, we believe digitally connected and integrated buildings are necessary to make a strong impact on global sustainability and drastically improve people's quality of life.

Molex CoreSync® PoE (Power over Ethernet) Smart Building Platform is helping companies achieve sustainability targets well beyond energy efficiency regulations. CoreSync's approach to smart buildings is open, inclusive, and interoperable. BACnet is one of the main technologies used for building automation. The ability to integrate BACnet interface between CoreSync and other BMS is critical to turn CoreSync infrastructure into a service. Also, BACnet facilitates the synergy of valuable IoT assets with other building functions. Today's systems can collect more data leads and talk to more unrelated yet interconnected systems than ever before."

Giovanni Frezza
Director Digital Enterprise and IoT Solutions, Molex

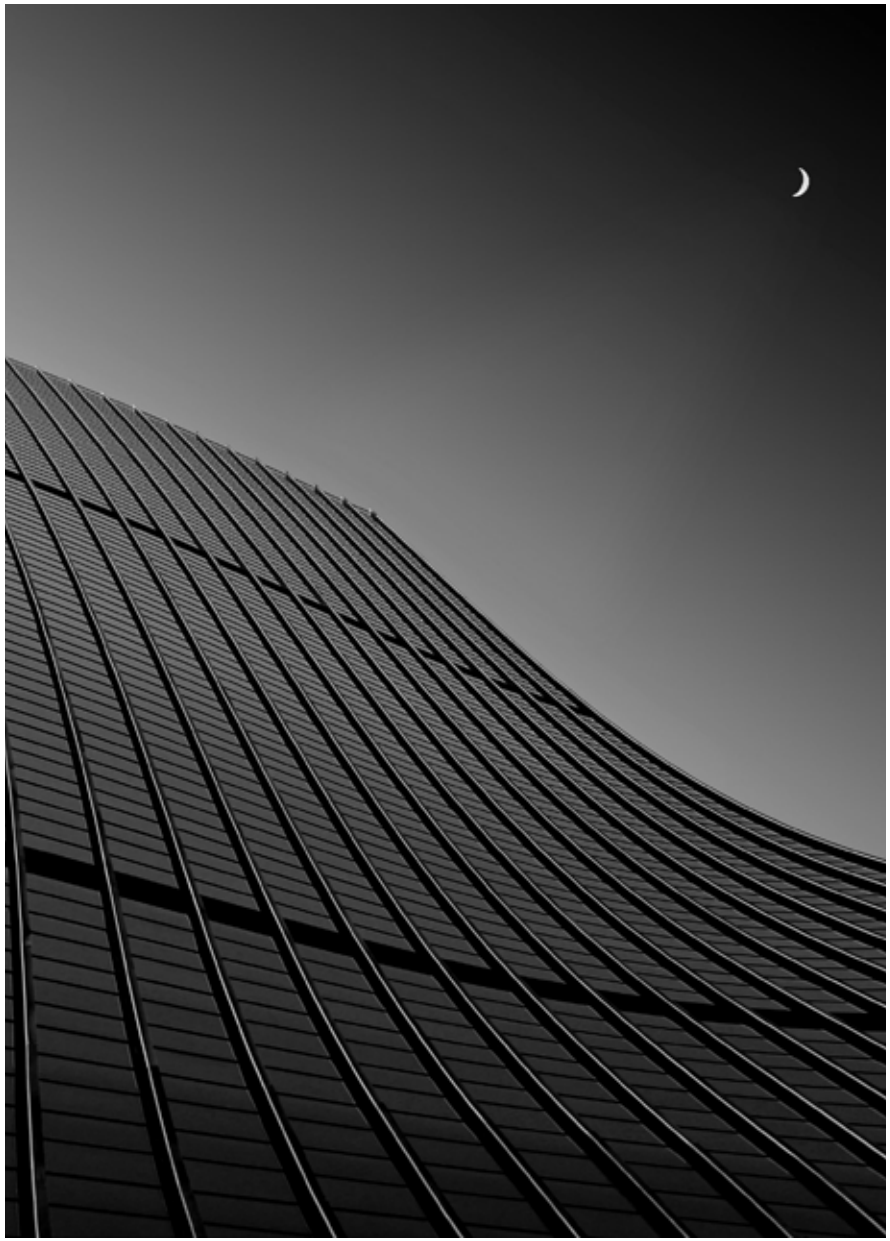
BACnet's **Digital Evolution**

TECHNICAL AND INFRASTRUCTURAL EVOLUTION

The BACnet protocol was initially designed to exclusively support HVAC systems. The dire need for a common communication standard led BACnet to evolve for multiple devices installed in buildings, bringing about its many complexities to scale – this initially was the sole responsibility of IT systems. Along the same time, Operational Technology (OT) was parallelly expanding, supporting additional devices and implementing new practical use cases at sites. Both IT and OT systems existed simultaneously in the BACnet world. IT was becoming sophisticated as it had to embrace functional systems and digital technology. However, IT and OT were not always in sync, sharing little to no data and control, and mostly relying on human intervention and oversight.

Spurred by the ubiquitous internet connectivity, among other things, BACnet too evolved in two different directions — Infrastructure and Technical. Both evolutions were equally important and have brought BACnet to where it is now — a place of synergy. BACnet successfully bridged the gap between IT and OT, converging to become a true market leader. This convergence has made it possible for BACnet to be more responsive and agile.

As BACnet continues to evolve, the result is improved interoperability, scalability, and maintainability across the building automation sector.



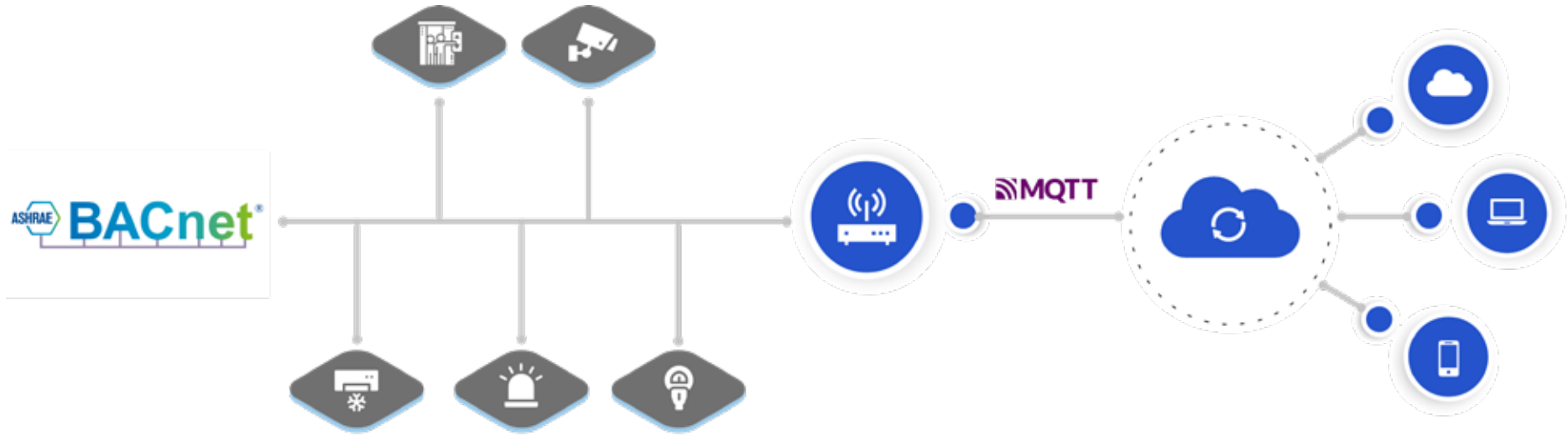
BACnet AND EDGE COMPUTING

As a protocol, BACnet has always stood out from the crowd; it was developed to handle structural metadata, which encompasses all information about devices, sensors, commands, and services. This information multiplies over time, adding to the data stored in the cloud. Such large data sets create an excessive load on the infrastructure and occupy a major part of the bandwidth in terms of speed and size. BACnet networks face multiple challenges – increasing complexity with many devices being added to one solution, deteriorating maintainability, and troubleshooting ability.

This is where the world of BACnet and edge computing converge. Edge computing can either be deployed on a separate dedicated hardware platform or be part of a BACnet-enabled controller. In either case, BACnet connects the devices and IoT gateways, enabling them with aggregation and computational capabilities.

IoT gateways provide a safe and reliable transfer of metadata to the cloud by utilizing various connectivity agents. Edge computing facilitates many business benefits too. Local analytics allow better insights and empower businesses to make well-informed decisions even before data reaches the cloud. Taking the load off cloud and BACnet-enabled devices results in better bandwidth usage.

It's important to understand that qualitative and quantitative data generated by BACnet needs to be cleaned, sorted, and analyzed at the edge. If not done right, organizations may end up slowing applications, clogging bandwidth, and even incurring higher cloud infrastructure costs for operations and maintenance.



BACnet AND EDGE COMPUTING

BACnet AND CLOUD COMPUTING

Building IoT solutions need a secure path to the cloud i.e., into and out of the cloud application — this is where BAS (Building Automation Systems) steps in. BAS are intelligent systems comprising hardware and software which work in tandem to operate devices and equipment in buildings. These devices and equipment typically are heating, ventilation and air conditioning systems (HVAC), lighting, security, elevators, fire safety, and other such systems.

The primary goal of BAS is to improve system efficiency, reduce costs, and increase safety. Within BAS, supervisory devices upload network information, individual stats, and network data to sophisticated cloud-based software applications and provide a control path back to the network and devices. This enables complete control of devices from cloud applications.

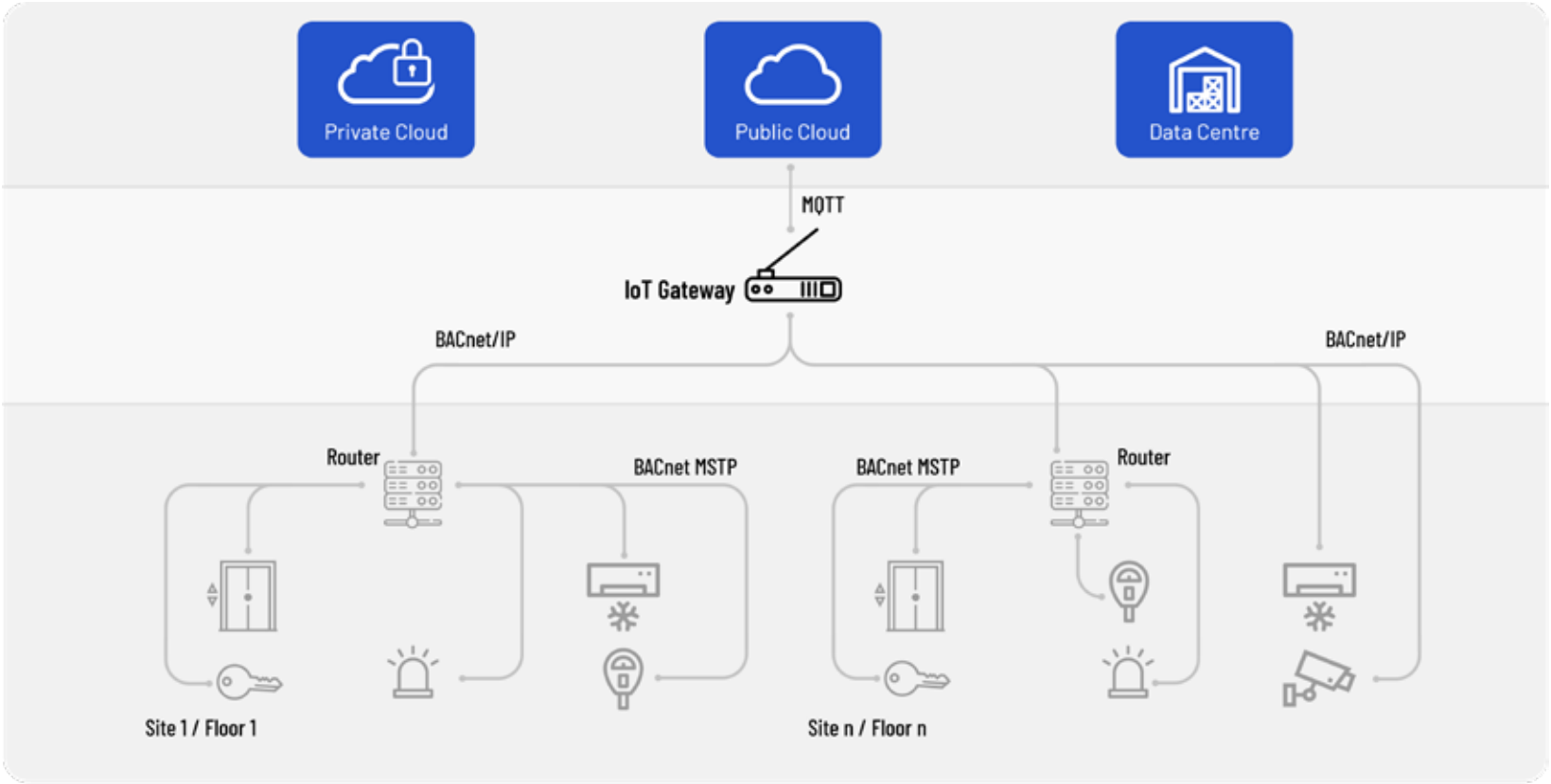
BACnet continuously undergoes a process of evolution with addendum/standards updates like BACnet/WS and BACnet/SC to help secure data that passes in and out of BACnet networks. BACnet/WS offers specifications for embedded web services that enable communication to the cloud.

BACnet/SC can be aligned with existing IT standards and best practices, allowing users to create secure building automation infrastructure as well as **unlock new cloud-based applications.**

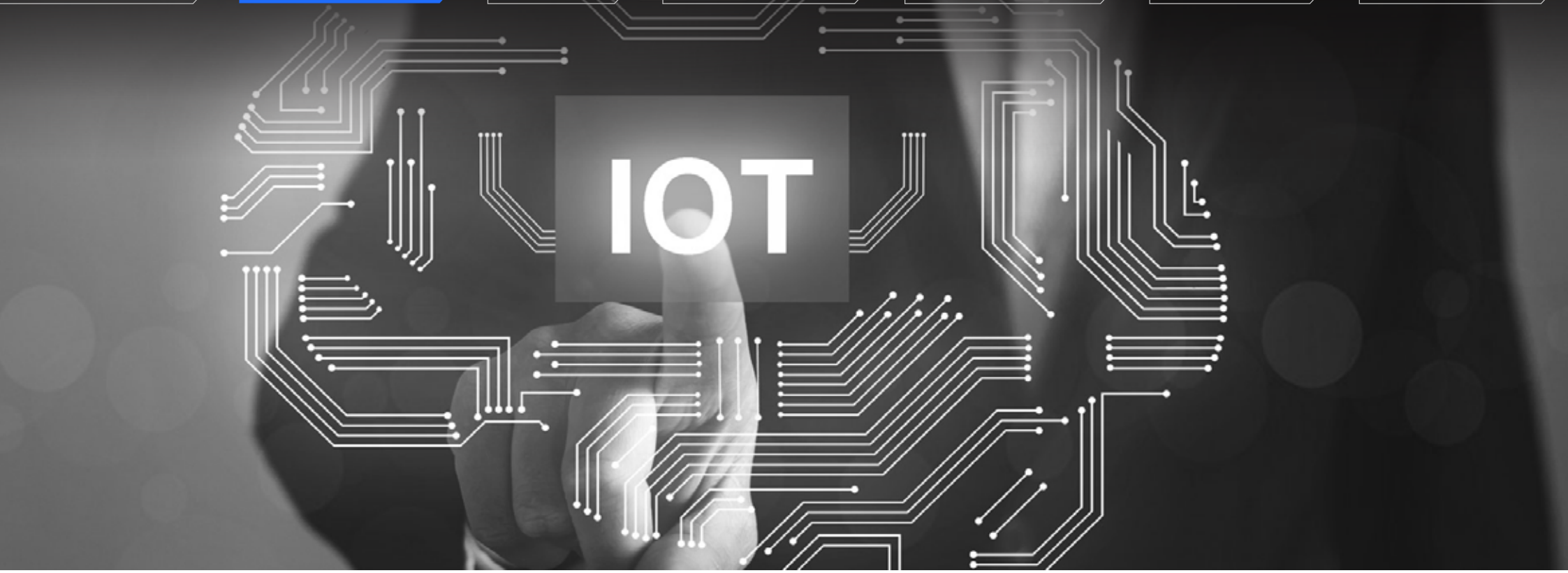
BACnet AND IOT GATEWAYS

BACnet's prominence as a building automation protocol has been reinforced by B-IoT gateways, which can be best described as the missing link in today's smart building. As cloud computing brings the power of artificial intelligence to devices, we're seeing a greater role being played by IoT gateways. While the BACnet protocol enables seamless data exchange between devices and applications, IoT gateways empower reliable data inference for making autonomous decisions. IoT architecture with the blend of BACnet and IoT Gateways offers umpteen advantages that include lower bandwidth, faster data access, tighter integrations, and remote connectivity.

Building owners and facility managers are now able to utilize powerful use cases like fail-safe mechanisms, the convergence of IT/OT systems, and remote management with the BACnet-enabled IoT gateway functions. While BACnet feeds the device data, IoT gateways make dynamic business decisions and take instant action at the site by executing rules, processing telemetry data, and providing supervisory control even in the absence of cloud connectivity.



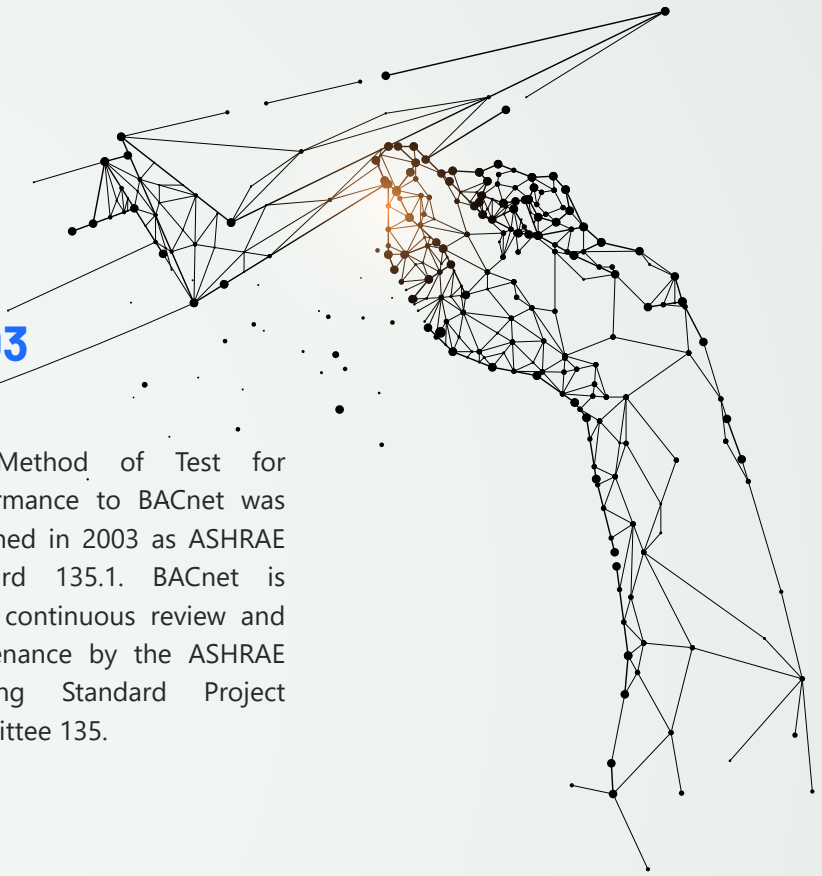
BACnet AND IOT GATEWAYS



IoT gateways are designed for vertical integrations for various applications in building automation, fleet management, and smart grids applications. With northbound data from the BACnet network, the IoT gateway enables fast and easy access between devices and the cloud, usually through the MQTT protocol. Such IoT gateways also facilitate smart and efficient services to major cloud service providers (e.g., Microsoft Azure, Amazon AWS, Google cloud), many of whom already integrate their custom servers with the MQTT protocol. Multiple services can run on the same gateway, and data from one service can be picked up by another to offer actionable insights.

Going forward, BACnet-enabled IoT gateways will play an important role to aggregate data from multiple sources in the network and take computing loads at the site to make devices even more intelligent. Enterprise IoT solutions will consequently benefit from this union (BACnet and IoT gateways) as it will isolate and bridge devices in real-time for providing better operational efficiencies and cost benefits.

BACnet COMMUNITY EVOLUTION



1980

In the early 1980s, building owners and operators were confined to products made by single manufacturers and were looking for an open standard protocol. The resulting industry conflicts prompted ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) to form SPC-135P, or the Standing Standards Project Committee, a committee with the express charter to investigate and develop a new standard to address their issues. The BACnet standard was born after nearly nine years of effort and brainstorming.

1995

ASHRAE's board of directors voted to approve the standard and publish ASHRAE 135-1995 in September 1995. Since ASHRAE is an approved ANSI standards body, the standard was also submitted to ANSI, and BACnet became the ASHRAE/ANSI Standard 135 in 1995 and ISO 16484-5 standard in 2003.

2003

The Method of Test for Conformance to BACnet was published in 2003 as ASHRAE Standard 135.1. BACnet is under continuous review and maintenance by the ASHRAE Standing Standard Project Committee 135.

ASHRAE SSPC 135 Committee

- BACnet is maintained under the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) "continuous maintenance" procedures.
- Changes can be proposed at any time by the public or a committee member.
- All changes are subject to public review and comment.
- The first BACnet standard was published in 1995 as ASHRAE 135-1995.
- It underwent changes and the latest one in the market today is ASHRAE 135-2020.
- All changes that take place before the release of the BACnet Protocol Standard are published as BACnet standard addendum.

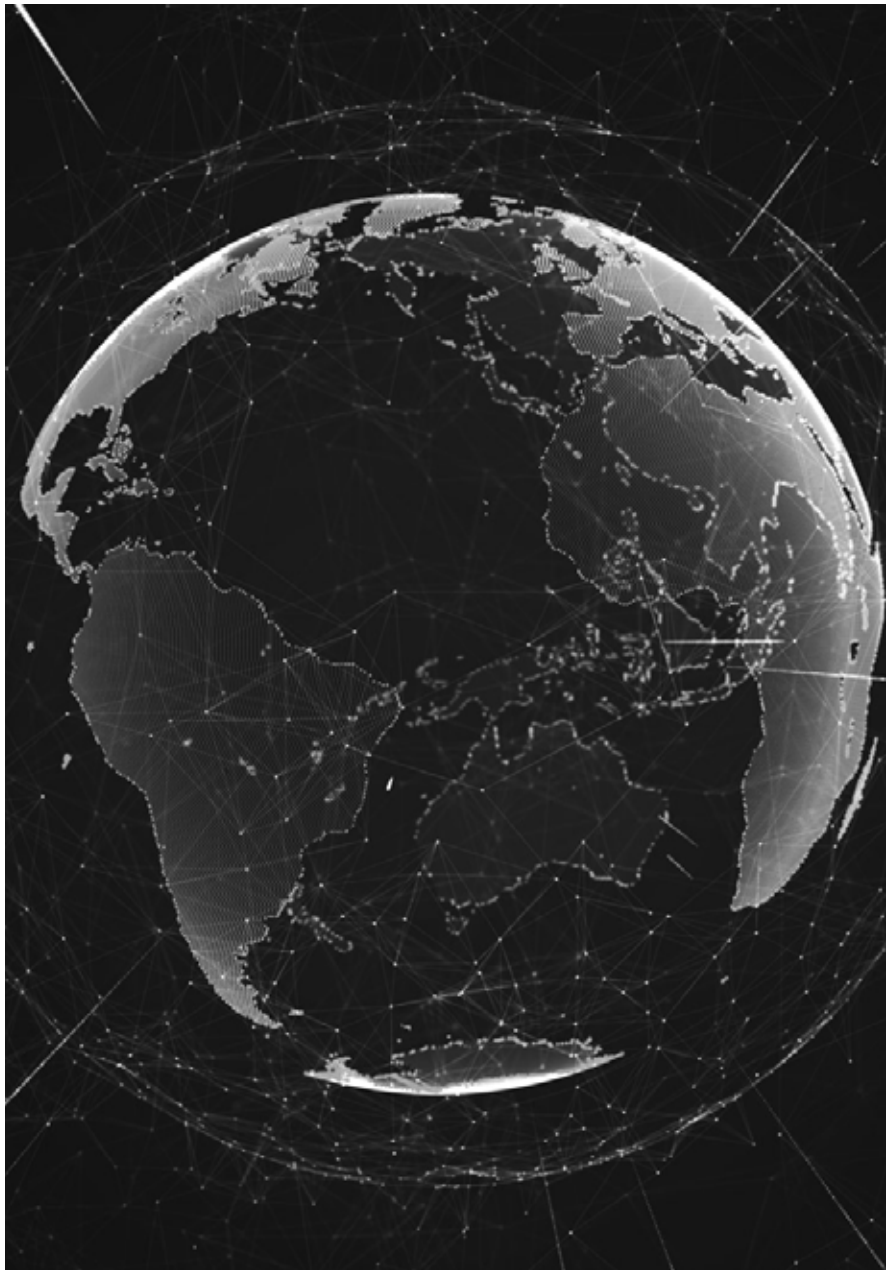
Open standard protocols like BACnet have created an eco-system in which it's easy to develop, integrate, and test devices. This has led to multiple savings on efforts and investment. The risk associated with 'downtime' in a building because of device failure and freeze has also been reduced considerably. These benefits have accelerated the evolution of smart buildings.

BACnet COMMUNITIES AND GLOBAL OUTREACH

Belonging to a community helps individuals with a sense of identity and togetherness and this is exactly what inspired the **formation of the BACnet community.**

Since its active development in 1987, the BACnet community has only grown larger. The interest in BACnet is worldwide and includes building owners and operators as well as product manufacturers and trade organizations from many countries. The initial few regional and independent efforts have now mushroomed into an integrated international community. In some areas, the community has formed BACnet Interest Groups (BIGs). The purpose of these groups is to effectively educate building owners, operators, and equipment suppliers about the use of the global BACnet communication standards in building automation. Their tremendous success is the result of countless hours of hard work put in by dedicated industry experts with a shared vision to create a process enabling effective collaboration.

This global communication protocol unites a broad group of people across the building automation and control spectrum, creating an international community with a shared identity and cause. BACnet's standardization process has been a key to its technical success, its wide acceptance in the global market, and its inclusive atmosphere that welcomed inputs from contributors around the world. The international environment has also allowed integrators and OEMs to have increased confidence in the interoperability of their BACnet enabled products and has allowed them to source from an international pool of expertise.



Active BACnet Communities:

BACnet International

Formed from a merger of the BACnet Interest Group North America and the BACnet Manufacturers Association, BACnet International promotes the successful adoption of BACnet through testing, educational programs, and promotional activities in North America and around the world. It works to help facility owners and designers to better understand open systems and their benefits. BACnet International also administers the operation of the BACnet Testing Laboratories (BTL) and The BACnet Institute (TBI).

BIG-Europe (BIG-EU)

The oldest and largest of all BACnet Interest Groups, BIG-EU supports more than 80 companies as its members. They aim to promote BACnet in the European building automation controls market, and they work to advance the BACnet standard, including meeting needs and requirements specific to European markets.

BACnet France Association

The BACnet France association was formed in 2007 to promote the BACnet protocol in France under the aegis of the BIG-EU. The association is focused on making BACnet information accessible to building owners, operators and automation suppliers in France and ensuring the needs of French industry are communicated to the rest of the BACnet community.

BIG-China & Asia (BIG-CA)

Founded in 2011, this BACnet Interest Group often organizes a 'BACnet Golden Week' which includes a BACnet PlugFest interoperability event as well as a variety of conference sessions. BIG-CA staff and volunteers have made large strides in promoting BACnet protocol – installation at the Chinese University of Hong Kong won BACnet International's Project of the Year award in 2016.

BIG-Sweden (BIG-SE)

This is a technical group within the Swedish Society for Heating, Ventilation and Sanitation (VVS Tekniska Föreningen). They aim to promote BACnet via training and publications and have even hold seminars and exhibitions to boost their cause. Their efforts have led to multiple BACnet-based articles appearing in Energi & Miljö, which is Sweden's largest HVAC magazine.

BACnet INTERNATIONAL AND BIG COLLABORATION

Broad interoperability testing requires a great deal of collaboration between multiple equipment. It is not always feasible to conduct this kind of testing within an organization. Therefore, the BACnet community has evolved a series of information-sharing and technical interoperability events called "PlugFests'. These events allow designers and owners of devices and related equipment to test their devices with other manufacturers' devices.

BACnet PlugFests create a learning experience for the building automation industry. Attendees can interact with members of the BACnet committee and other technical experts.

During these events, participants identify and resolve interoperability issues before a product is deployed. Participants build long-term relationships for the common cause of furthering the BACnet community.

PlugFests are now an annual event in both North America and Europe, with smaller events occasionally being held in other regions. PlugFests are often held in conjunction with other BACnet related events and usually include educational sessions for product developers.

MAY 1998

The first 'BACnet Interest Group', BIG-Europe, holds its kick-off meeting in Frankfurt, Germany.

OCTOBER 2000

The first Interoperability Workshop or 'PlugFest' is held at the National Institute of Standards and Technology (NIST). PlugFests have been held in North America every year since.

FEBRUARY 2005

An announcement is made —BIG-Sweden is now operational.

OCTOBER 2009

BIG-China forms and the BACnet Forum 2009 Beijing is held.

NOVEMBER 2016

BIG-CA's second 'BACnet Golden Week' includes, among other things, a BACnet PlugFest interoperability event. It is supported by BACnet International, BIG-EU, and ASHRAE SSPC135.

APRIL 2022

BACnet International's BACnet Testing Laboratories Working Group (BTL WG) plans to host the 21st annual PlugFest Interoperability event near the end of this month.

FEBRUARY 2000

The BACnet Manufacturers Association (BMA) is formed.

NOVEMBER 2003

European PlugFests commence, and the initial session is in Stuttgart, Germany. The European PlugFests have been held every two years, later increasing frequency to one event every year.

JANUARY 2006

BIG-NA and the BMA consolidate, and BACnet International launches.

MAY 2014

The 8th BIG-EU PlugFest attracts record numbers, with 60 participants from 30 building-automation manufacturers attending the event in Zug, Switzerland.

SEPTEMBER 2019

Another BACnet PlugFest is held in the United States.
Over the years, the venue keeps changing to reduce the burden of travel on participants.

GLOBAL CERTIFICATION PROGRAM

The BACnet community implemented a product certification program to provide users with a way to identify products that have been independently tested for conformance to the standard. The certification program is operated by the BACnet Testing Laboratories (BTL) under the administration of BACnet International. Products that have passed the industry standard tests at a recognized, independent laboratory receive a Certificate of Conformance, a BTL Listing, and the right to use the BTL Mark.

The BTL Mark is a mark of distinction and has come to represent high quality and conformance based on rigorous independent testing. The BTL Certification Program provides suppliers a way to highlight products that have successfully completed this testing, while also providing users with the assurance that these products have been independently tested and have passed industry standard BACnet testing.

The tests are designed to validate that the product correctly implements a specified set of BACnet features.

Currently, the BTL Listing of Tested Products includes over **1100 products** from over **200 manufacturers.**

What is BTL?

BACnet Testing Laboratories (BTL) was established to support conformance testing and interoperability testing activities and consists of the following:

- BTL Manager with technical advisors
- BTL Working Group (BTL-WG)

The BTL Manager, along with BTL technical advisors lead the BTL-WG and provide policy and administrative support for BTL activities

The BTL-WG develops tests for BACnet products and oversees the BACnet® conformance testing, certification and listing programs.

The BTL-WG is responsible for the technical aspects of BACnet International's testing and listing activities, including test development, testing policies, test laboratory recognition and overall test quality control. Its main goal is to improve BACnet interoperability through effective conformance testing.

Key activities of BTL-WG include:

- Develop tests for new features and capabilities as they are added to the BACnet standard
- Publish and maintain the BTL Test Package for use by pre-testers and approved BACnet testing laboratories
- Serve as a resource for recognized BACnet testing laboratories to clarify testing requirements and resolve technical ambiguities and other issues
- Award worldwide BTL Listings to qualified BACnet devices
- Establish requirements for serving as an independent laboratory for BACnet product testing and recognize organizations that have demonstrated they meet those requirements.
- Ensure the overall quality of the global BACnet testing and certification program.

Why Certification

The BTL Certification Application typically includes the following documents and information:

- Final Test Report (FTR) - provided by a Recognized BACnet Testing Organization (RBTO)
- PICS - Protocol Implementation Conformance Statement
- Product description
- Product image

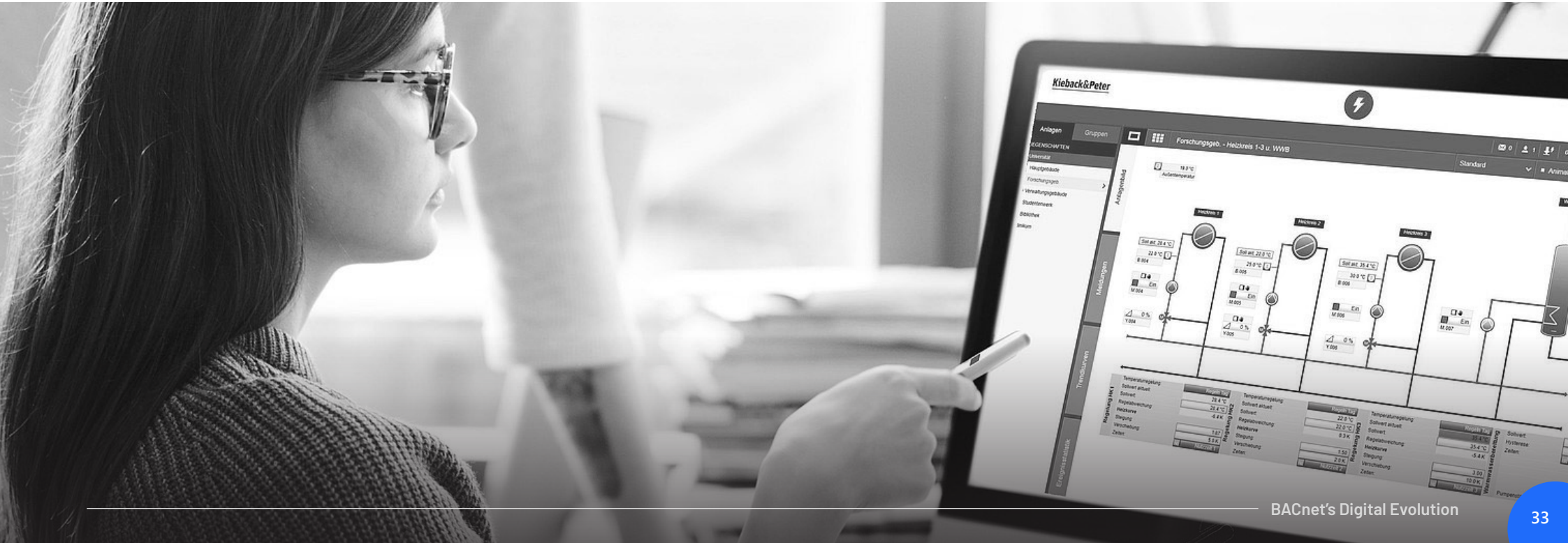
Additional documentation: An attestation must be submitted for any products/models/version changes not identified on the FTR. The need for attestation will be determined by BTL after a BTL certification application is received.

Certification Process

The complete process for BTL certification typically includes **Pre-testing** by the manufacturer, BTL Testing at a **Recognized BACnet Testing Organization (RBTO)**, and processing of a **BTL Certification Application.**

Click here to view the overview

BTL Testing & Certification Process

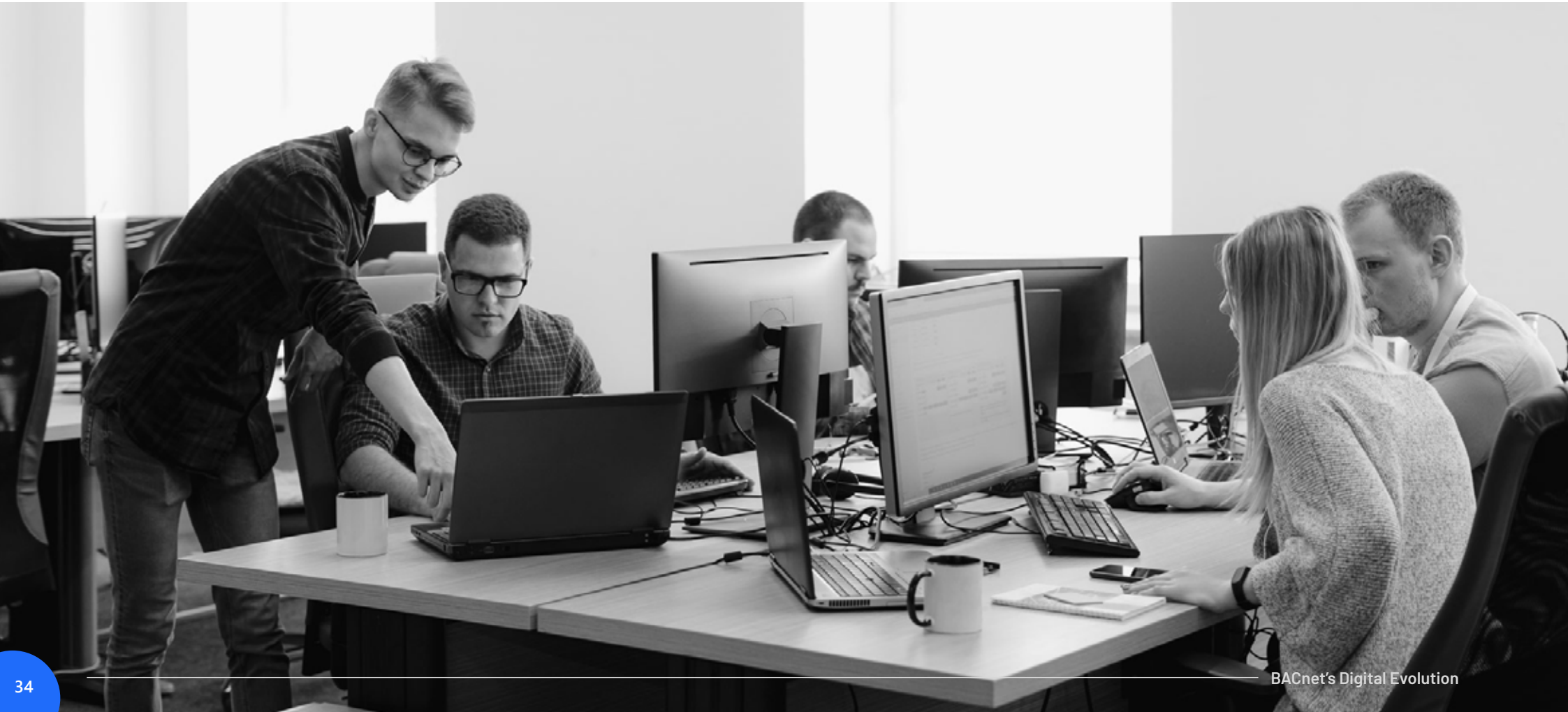


The BACnet Institute

An extensive member survey revealed the BACnet community's need for more information about the standard and how to best apply for it. Listening to this requirement, BACnet International, with the support of its members and industry leaders, launched The BACnet Institute (TBI). To increase education and information about BACnet, this institute provides, for free:

- Online, on-demand, self-paced courses
- A curated and tagged repository of information resources
- Online forums for knowledge sharing

Visit the BACnet Institute



Case Study

GLOBALIZATION OF BUILDING AUTOMATION CONTROLLERS WITH BACnet

A building automation market leader leverages BACnet to expand its portfolio and enrich existing capabilities.

Challenge

The product portfolio of the OEM supported older legacy specifications that were localized in nature. There was a need to upgrade the controller and comply with unprecedented scale for an imminent future.

The controllers needed standardization across variants. They also needed a mechanism to validate a possibly large number of setups of controllers by creating a test environment that mimics a skyscraper topology.

Highlights

The simulation tool could facilitate virtual BACnet points creation in the network and perform testing according to the OEM's use cases.

Theoretically, the tool could scale up the simulation of multiple buildings in one site.

Solution

The existing solution went through intense customizations to enable a balance between legacy functionalities and help it co-exist with the standard BACnet protocol.

A tool was developed to simulate the end device points and communicate over the BACnet protocol. The solution supported BACnet across all its product lines, ranging from advanced building workstations to building controllers to field sensors and actuators.

Benefits

Products previously confined to the local market now had greater outreach with the standardization. Simulation of BACnet points made it possible to enact field operations in the shortest possible time, with the actual infrastructure of the devices.

Enterprise applications in the OEM's product portfolio became interoperable with existing devices in the building, enabling seamless connectivity and control of those devices.

"Azbil, as a pioneer of Japanese Building Automation Systems, has provided more than 28,000 building automation systems and has been a leader in the Japanese BA industry. Based on the Azbil philosophy of "human-centered automation", we aim to apply our measurement and control technology to provide people with safety, comfort, and fulfillment while contributing to global environmental preservation.

Our proprietary environmental control technology provides the comfort, functionality, and energy efficiency required of today's buildings. BACnet is one of the key technologies to realize this goal. Integrating building automation with new technologies like IoT provides services that fit customers' building life cycles. Rich BACnet features help achieve these ambitious goals by integrating various types of environmental information.

Azbil IBMS BACnet servers/controllers in savic-net™ G5 build upon Azbil's proven achievements throughout the evolution of building environments and incorporate cutting-edge IoT, AI, and big data technology."

Tsuneo Isei

Director Development Department 1, Azbil Corporation, Japan

BACnet in-depth

BACnet ARCHITECTURE

BACnet is based on a four-layer collapsed architecture that corresponds to the physical, data link, network, and application layers of the OSI model as shown below.

Application

- Provides an interface for the application software
- Provides the required communication services
- E.g., monitoring and control of HVAC and other building systems

Network

- Routing BACnet messages
- One network to another network

Data link

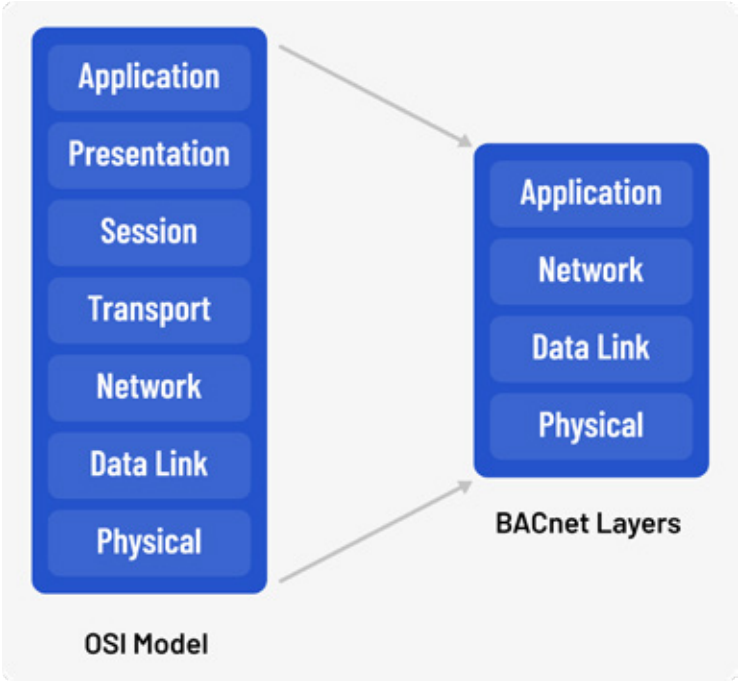
- Organizes the data into frames or packets
- Regulates access to the medium
- Provides addressing
- Handles error recovery and flow control

Physical

- Provides a way to connect the devices
- Transmits the electronic signals that convey the data

Key terminologies as defined in BACnet, which are explained subsequently

- Objects
- Object properties
- Services
- BIBBs
- Profiles



OBJECTS

- Objects can be defined as a collection of information related to a particular function that can be uniquely identified and accessed over a network in a standardized way.
- Objects are standard functional entities that have their own set of predefined properties, making them unique.
- Objects may represent:
  - Single physical "points", e.g., temperature sensor or thermostat, or an output device like a fan or pump or valve position.
  - Logical groupings or collections of points that perform a specific function, e.g., non-physical concepts like program logic, schedules, and historical data.
- BACnet objects only define the outside behavior of the devices and systems.

OBJECT PROPERTIES

- Each object is characterized by a set of attributes or "properties" that describe the object's behavior or govern its operation.
- Properties specify the characteristics of the objects.
- Each object has several mandatory and optional properties.
- Some properties are read-only, i.e., other devices can look at the property's value, but not change it. There are another set of properties that can be written and changed.
- Vendors may define vendor-specific properties.
- Vendors may also add proprietary object properties or vendor-specific objects to a device.

SERVICES/FEATURES

BACnet defines over 40 services and classifies them into the following 5 categories:

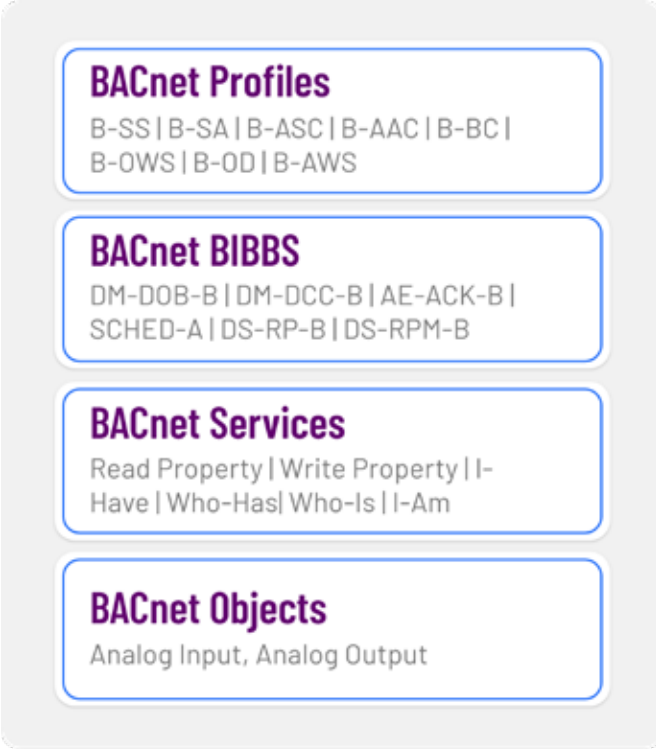
- **Object Access Services**
- **Alarm and Event Services**
- **File Access Services**
- **Remote Device Management Services**
- **Virtual Terminal Services**

BACnet devices are not required to implement all services.

- **Just one service, Read-Property, is required to be processed (executed) by all BACnet devices.**
- **Communication between BACnet devices and systems is done using specific services.**
- **Services can be used to read object properties.**

BIBBS

BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet Services.



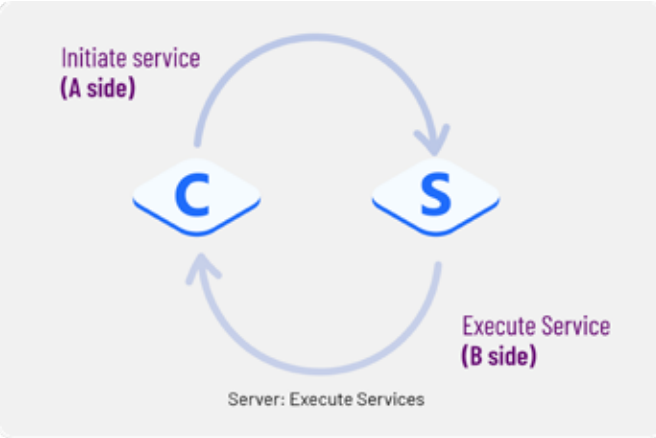
BACnet PROFILES

CLIENT/SERVER PROFILES

A BACnet device may trigger (send or initiate) a service request, or it can react (receive or execute) on a service request.

Client: Initiate Services
Server: Execute Services

The one who acts as a user of the data (client) is the initiator and the provider of this data (server) acts as the executor.



INITIATION SERVICE

Case Study

EXPANDING THE ECO-SYSTEM FOR POE-BASED SMART LIGHTING SOLUTION WITH BACnet

A conglomeration of smart devices to redefine comfort.
BACnet enabled a leading manufacturer of connectivity products to connect a smart lighting solution to the building management system (BMS).

Challenge

Equipping lighting systems with technology to interpret the sensors that monitor multiple environmental parameters, and then relaying this data to the building's automated hub. The result? Create efficiencies that can sustain energy savings north of 50%.

In addition to saving money, smart lighting systems must now provide for dynamic work environments that enhance well-being, sharpen concentration, and promote learning by ensuring access to controlled, comfortable natural light.

Solution

The solution integrated BACnet and PoE as both could leverage the IP network infrastructure of a building. This unique amalgamation of technologies not only powers smart lights but also provides a highspeed pathway for sensors to feed data into the building management system.

BACnet stack maintains its own device and object databases and can be manually configured or dynamically populated from existing devices on the network. This makes stack integration appreciably faster for other devices in the platform.

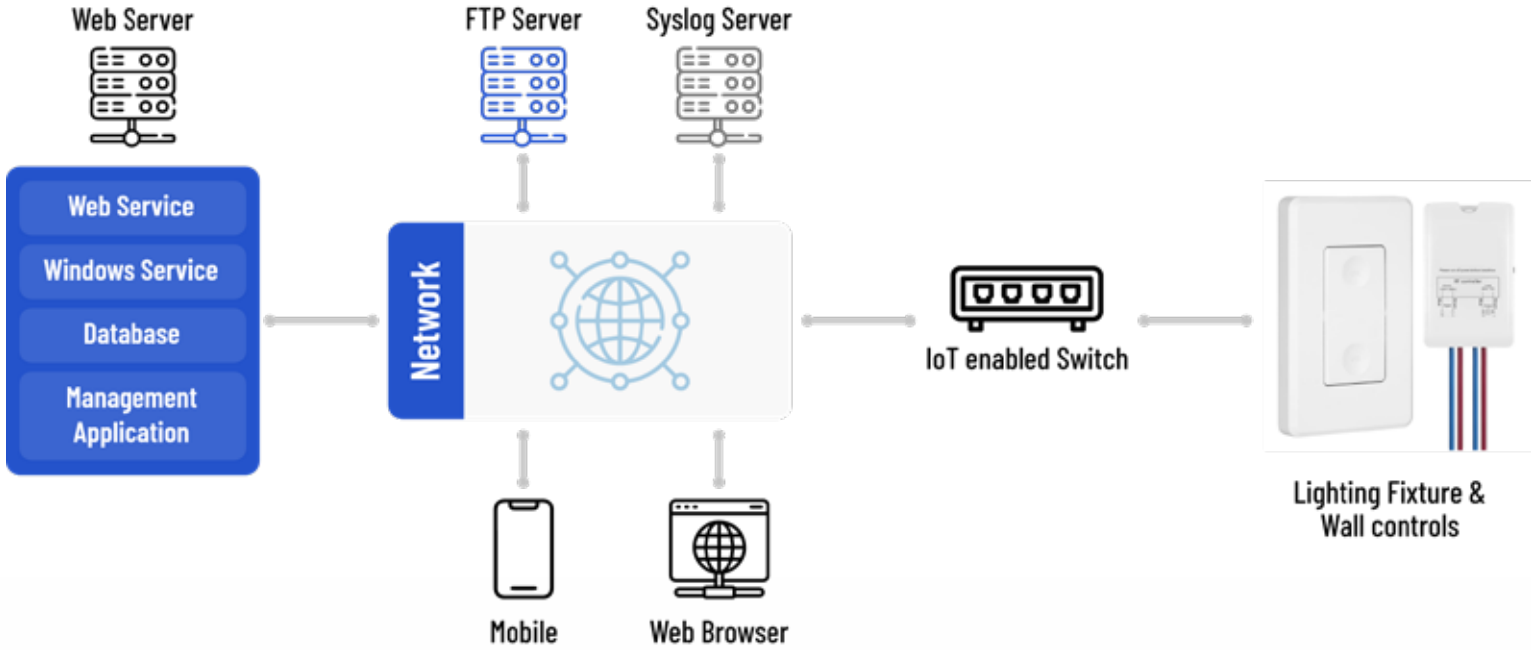
Benefits

BACnet gateway opened up the possibility of seamless integration of solutions to building management systems, which otherwise would have required architectural changes.

Standardization ensured smart lighting solutions could now onboard various BACnet compatible devices onto their platform and make impactful use cases for the buildings.

This standardization – which enabled scalability of the platform – also had very little implication on the overall solution cost of a building or site.

System overview



Highlights

The solution enabled a control scheme for various parameters like LED light status, real-time energy consumption, ambient temperature, zone humidity, and air-quality monitoring.

Advanced features like grouping of fixtures and daylight calibration over the network firmware upgrade were also possible due to BACnet.

The BACnet support ensured all devices on the platform were interoperable and compatible with global standards.

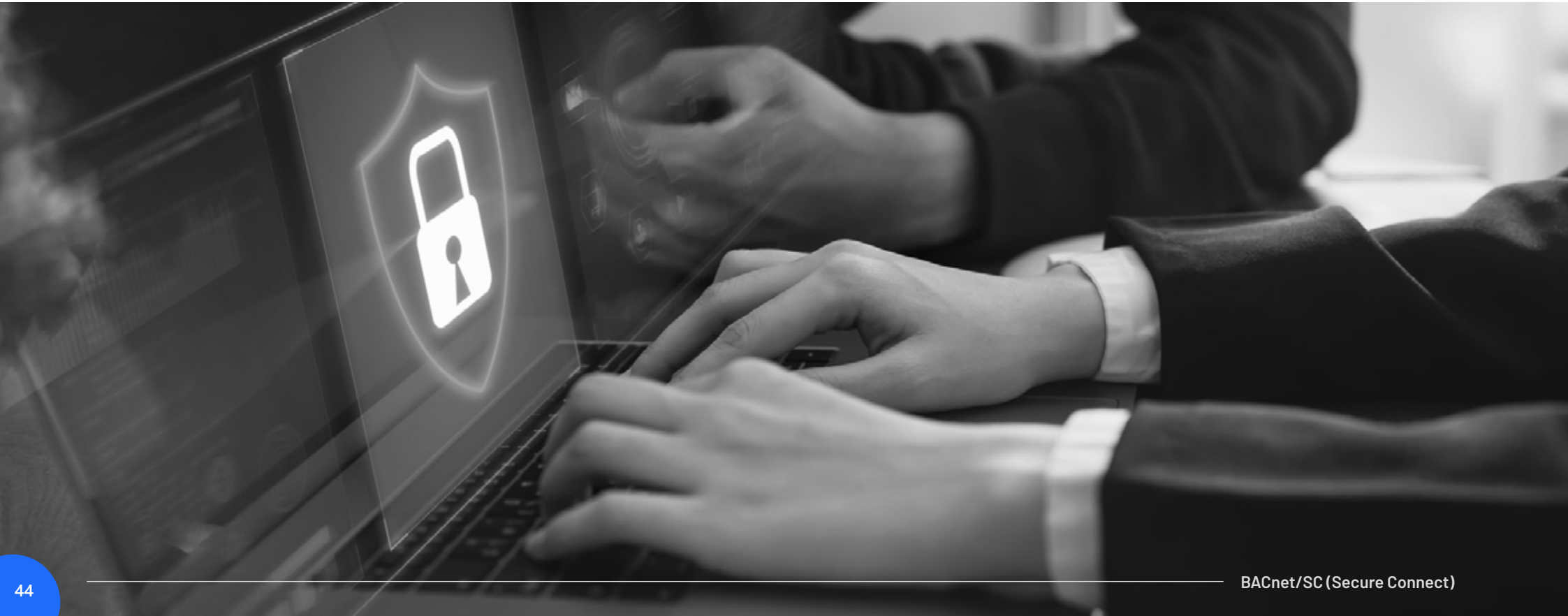
BACnet/SC
(Secure Connect)

Every day, we hear about concerns over cybersecurity and the disruptive effects it could have on building infrastructure and operations. Frequently cited concerns include network and information security, and infrastructure integrity. The growing interest in cloud-based applications has put building owners, managers, BAS, and IT professionals under pressure to create BAS infrastructures that provide high levels of security.

These concerns resonated strongly with BACnet's Project Committee, which has been working hard over the past few years on a new technology called BACnet Secure Connect (BACnet/SC), which is now part of the BACnet standard.

BACnet/SC provides the means to create secure communication connections between BAS devices across the cloud and within facilities.

BACnet/SC uses the latest techniques for security and integrates easily with IT infrastructure. At the same time, BACnet/SC preserves 100% of BACnet's capabilities and is backward compatible with all existing BACnet deployments and devices.



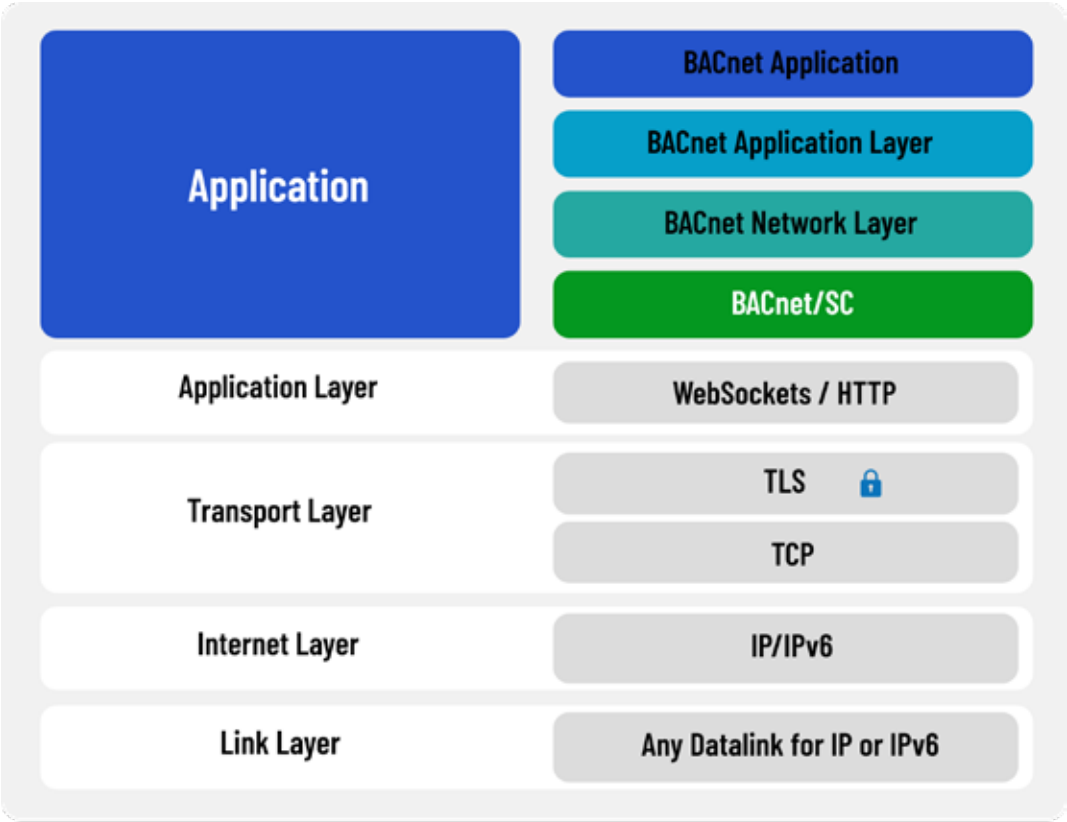
WHAT IS BACnet/SC?

BACnet/SC is a new BACnet data link that eliminates several BACnet concerns that worry owners, facility managers, and IT professionals. It is based on standard TLS security with options for 128-bit and 256-bit elliptic curve cryptography.

It quashes the need for static IP addresses and network broadcasts. It also simplifies configuration by removing BBMD devices and their need for frequent configuration to match network topology.

BACnet/SC is the same except for the new **virtual datalink.**

BACnet/SC allows two BAS devices to establish a highly secure and encrypted connection between each other, over which conventional BACnet messages can be sent and received.



BACnet SECURE CONNECT VIRTUAL DATALINK

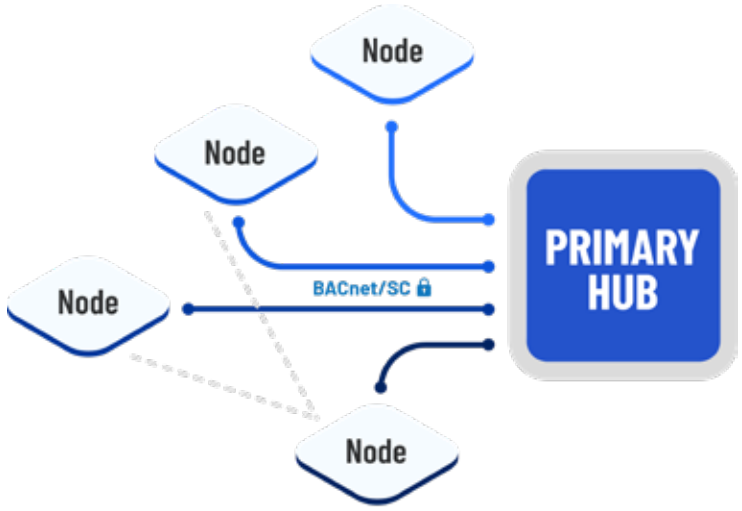
These connections cannot be "hacked" and cannot be decrypted without proper certifications, and the certifications themselves cannot be forged or faked. This assures that only legitimate devices can get connected and that the content of their communications stays private.

The mechanisms that assure this security are based on established international standards and best practices and are fully aligned with the IT standards. What that means is that BACnet/SC uses the same mechanisms that banks, armed forces, and other entities use to secure their communications.

We are likely to frequently see two kinds of BACnet/SC devices that make such connections directly with each other:

- A BACnet/SC "hub" that acts as a centralized conversation manager
- A BACnet/SC "node" that makes a connection to the hub and sends all messages through it, which in turn redistributes the message(s) to recipient nodes

In any system with centralized components, such as the BACnet/SC hub, it is desirable to have a possibility of redundancy. BACnet/SC allows you to have primary and failover hubs. If nodes cannot reach the primary hub or lose connection and cannot re-establish themselves, they turn to a failover hub. When the primary hub recovers, the nodes switch back to the primary.

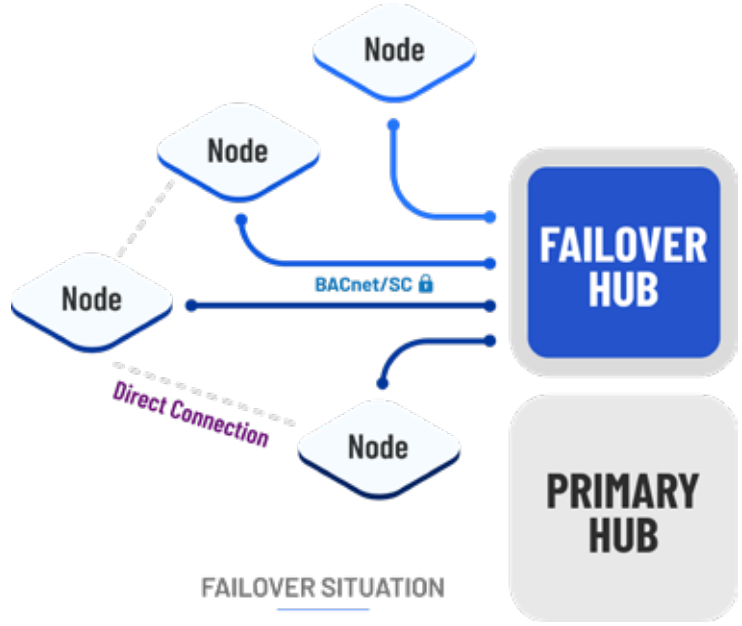


NORMAL SITUATION

WHY DO WE NEED BACnet/SC?

There are many ways to deploy BACnet/SC for distinct benefits. But "What is that one threat that concerns you the most?" If it is securing all BACnet devices against internal threats, then you can convert all existing BACnet devices to use BACnet/SC. In this scenario, even hackers with physical access to the network, i.e., inside a firewall, will fail to disrupt the BACnet network.

BACnet/SC will make it much easier to create secure and standardized BA infrastructure that is fully compatible with existing BACnet deployments, compatible with IT best practices and is one that enables cloud-based applications.



FAILOVER SITUATION

Case Study

SMART WATER MANAGEMENT LEVERAGING THE POWER OF BACnet

Achieving sustainability goals with smart water management.

Smart sensors are changing the dynamics of the water industry, improving efficiency in water consumption monitoring, distribution, quality control, and supply. LoRa technology further brings advantages of robust transmission, superior performance, and a longer life span.

Challenge

Smart water management has become an integral part of Intelligent Buildings. This calls for continuous monitoring of the devices to make calculated decisions.

For buildings to operate at maximum efficiency, the building management system required access to water management parameters from various valves and faucets.

Customers wished to integrate their newest family of LoRA-based sensors with the building management systems, to scale up operations without losing out on critical insights.

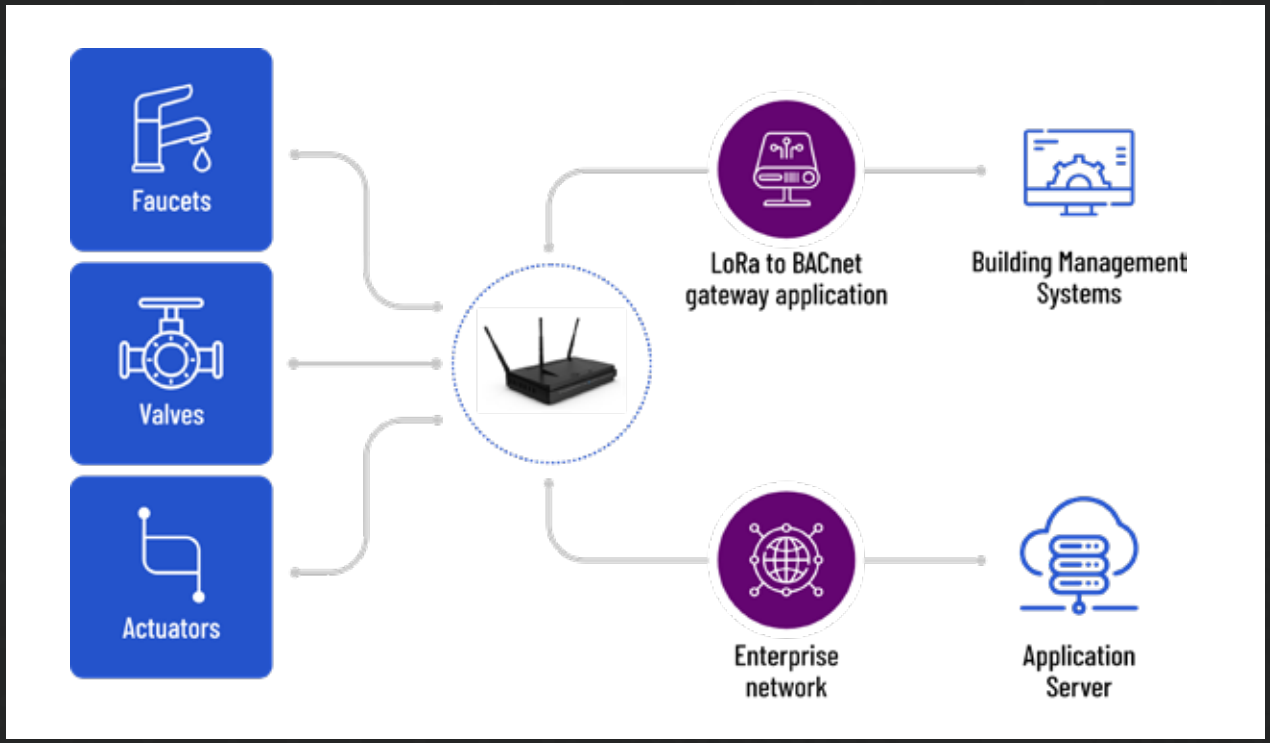
Solution

The solution was engineered by integrating LoRA connectivity in all their new smart devices, ranging from faucets to valves largely used in commercial buildings.

Critical parameters were passed on to the BMS, for monitoring and control of assets from a central building controller.

The solution was given an overhaul with a customized LoRA to BACnet gateway application, which leveraged the BACnet protocol's primary strength of mapping every parameter on these devices with BACnet-exposed objects.

System overview



Benefits

The BACnet-enabled solution helped customers meet the requirements of smart building specifications and seamlessly integrate with BMS.

The gateway provided a reliable interface between a wireless network of sensors and a wired building automation systems network.

Water management using BMS reduces the need for site visits and wet checks. Access to real-time water usage helps facility owners monitor and manage water supply effectively in smart buildings.

Highlights

The solution brought the best technologies together for Intelligent Building operations — LoRa technology, known for low-cost sensors and reliable long-range communication, and BACnet technology, known for its open interoperability.

This gateway solution could scale with no technical limitations on size and was operational on out-of-the-box integration and minimal configuration specific to the sites.

BACnet Solutions Approach

A BMS, in general, consists of several separate devices that handle varied functions like HVAC, lighting, elevators, etc. The BMS also consists of a centralized application for monitoring and controlling different devices. These applications and devices communicate amongst each other using different protocols, with BACnet being the leading protocol used by most manufacturers. BACnet as a standard caters to a vast range of requirements from devices installed in a BMS.

To enable BACnet support for a particular system/device, it is imperative to identify/define the role of the proposed BACnet-enabled system/device in the BMS field. This helps in determining a few BACnet-related aspects:

- **Type of BACnet device – client or server or gateway**
- **BACnet functions required – scheduling, alarms, trending, etc.**
- **BACnet network types to be supported – BACnet/IP, BACnet/MSTP, etc.**
- **BACnet objects to be supported**

APPROACHES

There are two major approaches for adding BACnet support in a device/system:

NATIVE

BACnet features (objects, functions, etc.) are natively implemented in the device. This approach is well-suited for rolling out a new product family.

GATEWAY

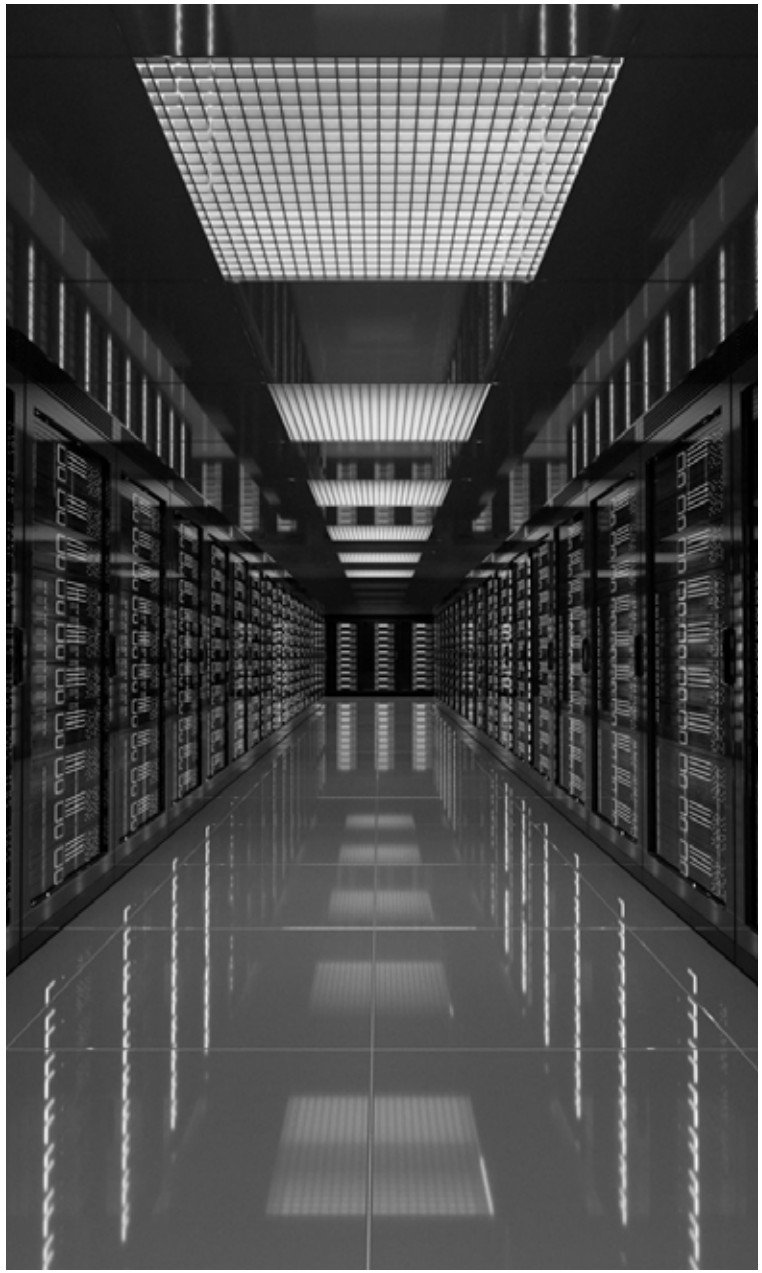
The device in question might not support BACnet natively. Therefore, an additional solution is added which communicates with the BMS over BACnet and with the device over another protocol. This kind of arrangement is called a gateway solution. This is well-suited for devices/systems where changes to the existing system are not needed or recommended.

UPCOMING TRENDS

BACnet is a continuously evolving standard and is being adapted, recommended, and demanded in new domains.

Here are some trends we foresee in our 'smart' future:

- **BACnet/SC support in devices**
- **Cloud connectivity for BACnet devices**
- **Collaboration with other standards like Project Haystack, Brick Schema, etc.**
- **Research and development to support smart grid, life safety and security (e.g., fire alarms), lighting, etc.**



Case Study

INTEGRATING ELEVATORS, ESCALATORS, AND AUTOWALKS WITH BUILDING MANAGEMENT SYSTEMS (BMS)

Coordinated systems mean higher efficiency.

Elevators are essential components of life safety systems within a building, and hence, we need to integrate them with other sub-systems of a building.

A Finnish firm wanted to be the world's first elevator company to implement native support for BACnet in their advanced controller systems. They knew BACnet compliance helps deliver real-time diagnostics and brings greater visibility and control into elevator operations in smart buildings.

Challenge

An increasing number of control systems need to be integrated and interoperable with building management systems for a building to be called a **'smart building'** in the truest sense.

Sophisticated and legacy tech elevators, escalators, and autowalks need to be integrated with smart buildings to gain better control and monitoring of building operations.

While elevators and escalators have been a part of buildings for decades, they were developed and operated in silos. The elevator manufacturer wanted to establish connectivity with the BMS for improved field service and higher efficiency.

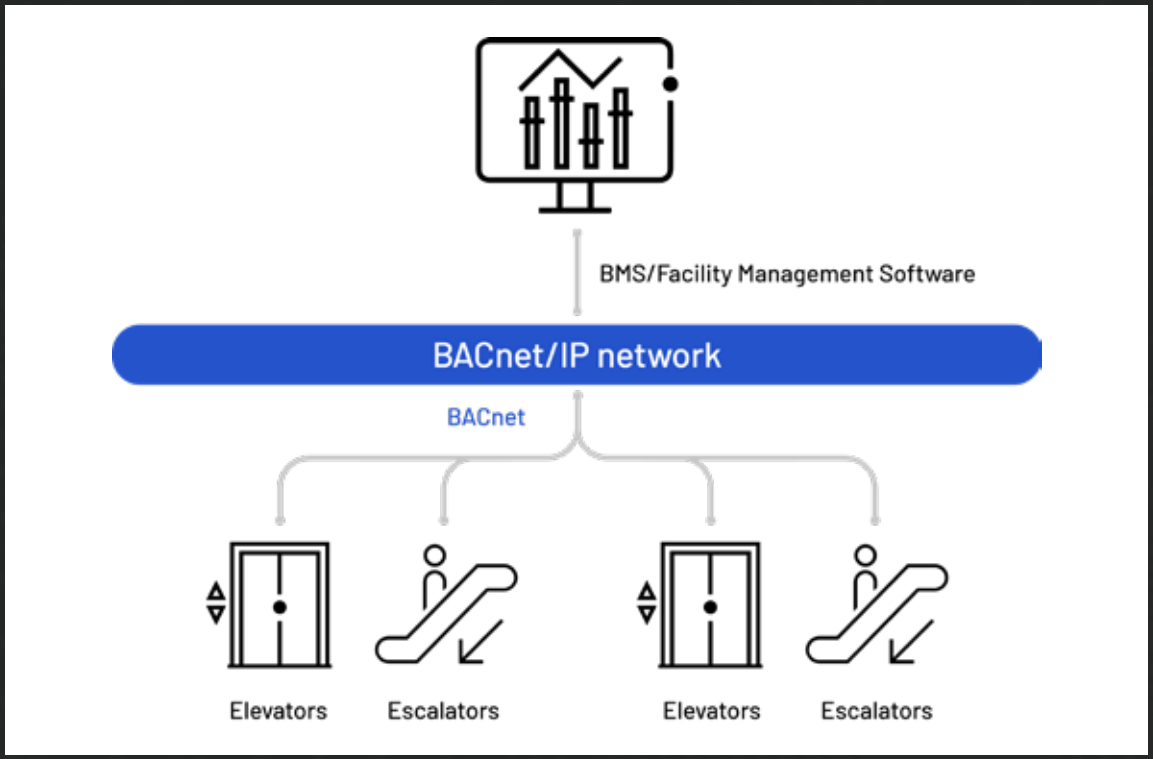
Solution

BACnet proved to be the protocol of choice to integrate elevator control systems with the BMS as it is the most widely accepted interoperability standard in the building automation industry.

Integrating elevators into BACnet eco-systems within a building allowed capturing alarms and events in real-time for the BMS and provided a mechanism for the BMS to take control actions.

The Elevator Working Group (EL-WG) under the ASHRAE SSPC 135 has developed extensions in the BACnet standard to support the requirements of elevator control applications and is published in Protocol Revision (PR-18) of BACnet standard.

System overview



Benefits

Seamless integration of elevators with building management systems was achieved, which paved the path for a successful digital strategy.

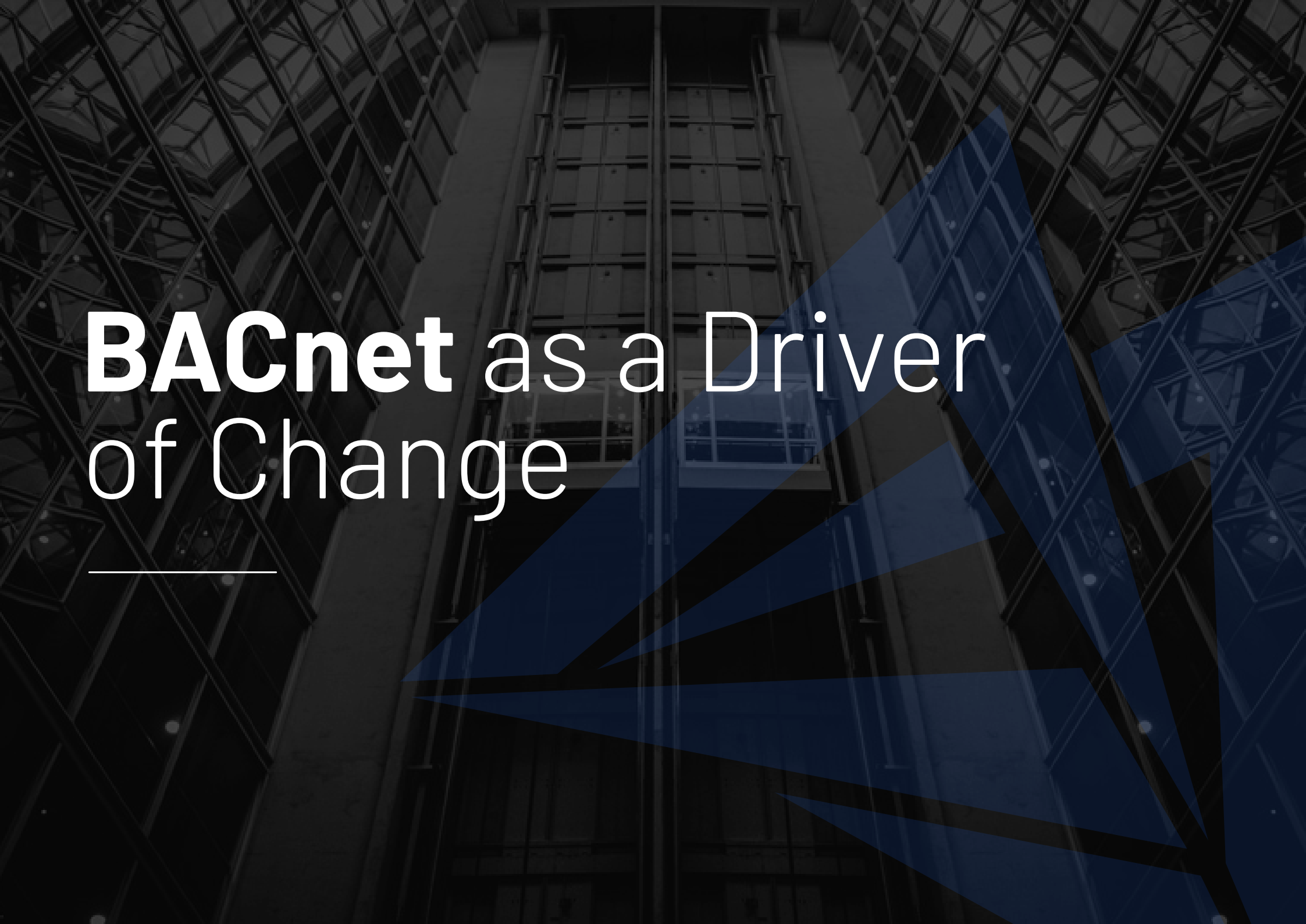
Native support helped eliminate the need for external third-party protocol translators and even eliminated complexities involved with the commissioning and configuration of those converters at the field site.

Counterfeit tampering of elevator controls was reduced due to standardization, including the implementation of a pairing mechanism and an inherent authentication.

Highlights

The BMS has a real-time view of equipment status and other critical elevator parameters like car position, carload, landing door status, out of service, etc.

Going beyond monitoring capabilities, the BMS can also send control commands to elevators in response to specific events using the BACnet network.



BACnet as a Driver of Change

BACnet's global adoption has shown continued growth over the years. At this very moment, there are more than a million BACnet devices in use worldwide. The development of this standard protocol has caused a series of impactful changes that has transformed the world we live in.

Smart buildings (and smart cities)

The protocol was developed to standardize communication among devices inside a smart building and a smart city. As BACnet serves as the foundation for thousands of building automation systems around the world, it is safe to assume that automation systems and smart cities would not have been possible without BACnet.

Greener built environment

A faster and smoother integration of various building systems has reduced operating costs and enabled more accurate energy provision and consumption. The result has been a lower energy profile and a greener environment.

Market growth

If the building automation market has grown tremendously, it is because of BACnet. If not for this open standard protocol, integration across multiple vendors would be too expensive, and the market would not have grown. We would not have nearly as many successful suppliers or the jobs these suppliers, in turn, created. BACnet was the catalyst that caused rapid market growth, and consequently, precipitated its evolution.

Start-up companies

BACnet made it very easy for innovative startups to enter the building automation sector, allowing these companies to easily integrate with the industry-standard communication protocol. This way companies do not have to invent means to communicate, as a result they are free to turn their attention elsewhere. With BACnet as their foundation, smaller companies can easily 'talk' to other organizations for collaboration thereby designing common solutions.

Accelerated innovation

BACnet not only opened up domains, use cases, and platforms but has also led the future of building automation. BACnet offers a future of easy expansions and modifications, with the open-ended choice to boost productivity and innovation.

"Sustainability and wellness initiatives globally have created great demand to improve the operational intelligence of commercial buildings. BACnet-enabled subsystems help achieve this goal by providing a secure, open, inter-operable backbone for networking across a unified platform. Automated shading systems can play a key role in buildings as they optimize access to views, natural light and its associated heat gain which can be integrated via BACnet to enhance performance across the other Building Automation Systems (BAS) like lighting, HVAC, security, and life safety. In turn, this can help drive value and return on investment for building owners through reduced operational costs based on energy and human performance delivering smart, productive and healthy buildings that people want to occupy.

BACnet integration has been a key feature within Mecho's shade control and automation systems for decades as the importance of proper daylight management has grown as a tool for both energy conservation as well as human comfort, productivity and wellness. This progression has helped evolve shading systems as a key sub-system within any commercial smart building project. In addition, Mecho's industry-leading SolarTrac® automation and use of sustainable building materials within its ElectroShade® products has also led the industry in offering solutions that positively support people and the planet."

Stephen Hebeisen

Director of Engineering, MechoShade Systems, LLC

How can **Softdel** help you?

Softdel is at the "Heart of Smart" where device connectivity, enterprise connectedness, and people converge.

Softdel connects devices, enterprises, and people. Our distinctiveness lies in simplifying enterprise connectedness in Smart Buildings and Smart Factories creating unprecedented benefits for our customers and their eco-systems.

Softdel is a global leader in the Building IoT technologies space and a preferred partner to OEMs and ISVs in their digital initiatives around Smart and Connected Buildings. We offer a range of products and services for the smart buildings segment and are continuously expanding our bouquet of offerings.

OEMs can leverage Softdel's ready technology products, stacks, and solutions to speed up product development and achieve faster time to market.

BACnet Stacks

We offer multiple solutions to help implement native BACnet support in building automation devices and equipment.

Our BACnet stacks conform to ASHRAE Standard 135-2020 which is the latest in the industry today.

The stacks support both client-side and server-side profiles. Softdel stacks are ideal for server-side devices ranging from simple smart sensors to high-end building controllers and even to client-side building workstation software.

Server-side profiles supported	Client-side profiles supported
B-SS, B-SA	B-AWS
B-ASC	B-OWS
B-AAC	B-OD
B-BC	
B-GW	

Softdel stacks are pre-built on various hardware and RTOS platforms, including FreeRTOS, Linux (Ubuntu, CentOS), Windows, and many more. All Softdel BACnet stack profiles support **BACnet/SC** functionality and we also provide upgrade service from BACnet to BACnet/SC.

Looking to integrate BACnet devices with enterprise applications?

Enterprise applications can easily access data from BACnet devices through easy-to-integrate RESTful APIs. Softdel's containerized BACnet stacks with REST API have BACnet messages that are converted in JSON format.

Softdel BOSS

Softdel's BACnet simulator is a popular tool amongst the building automation community -- it boasts benefits for a wide audience ranging from software design teams to quality assurance to field engineers and system integrators.

BOSS has the capability to create multiple BACnet IP virtual devices. One can create up to 125,000 BACnet Object instances (like AI, AO, BI, BO, etc.) in one instance of the BOSS tool. These virtual devices support the generation of alarm and events, COV, scheduling & trending functionalities, etc. Such an environment can be used to debug, test, and analyze the behavior of your real BACnet devices. In addition to the above functionalities, BOSS can also be used as a BBMD or foreign device.

The BOSS tool is of great help to software engineers in product development as well as to field engineers while troubleshooting complex BACnet networks.

BACnet INTEGRATION SERVICES

Softdel has helped scores of OEMs integrate BACnet into their devices. Our 15+ years of experience in BACnet integration makes us the ideal partner for all your BACnet needs. We boast a dedicated and experienced team of BACnet professionals that serve global OEMs on their BACnet initiatives.

SOFTDEL PRE-CERTIFICATION SERVICES

Softdel boasts a state-of-the-art lab equipped with all the specialized equipment required to test your BACnet functionality. Our pre-certification testing service with consulting support can help OEMs reduce the time for actual certification and get a certified product to the market early.

SOFTDEL BACnet TRAINING SERVICES

Softdel's BACnet training program is widely popular across geographies and continents. Our training program is designed for product developers, test engineers, field engineers, and technicians. It offers classroom training as well as hands-on instruction on varied subjects, from the basics of the BACnet protocol to advanced application-specific use cases. Sharpen your BACnet skills by enrolling in our Basic and Advanced courses on BACnet.

SOFTDEL PRIME

Softdel Prime is an industry-wide subscription platform offering a comprehensive range of benefits to companies. As part of this subscription, our members enjoy preferred access to Softdel's world-class B-IoT consulting services, B-IoT stacks and tools, and different training programs throughout the year. Softdel Prime is the all-in-one solution to all your B-IoT needs.

Know more about our subscription plans and how they can help your company innovate faster.

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