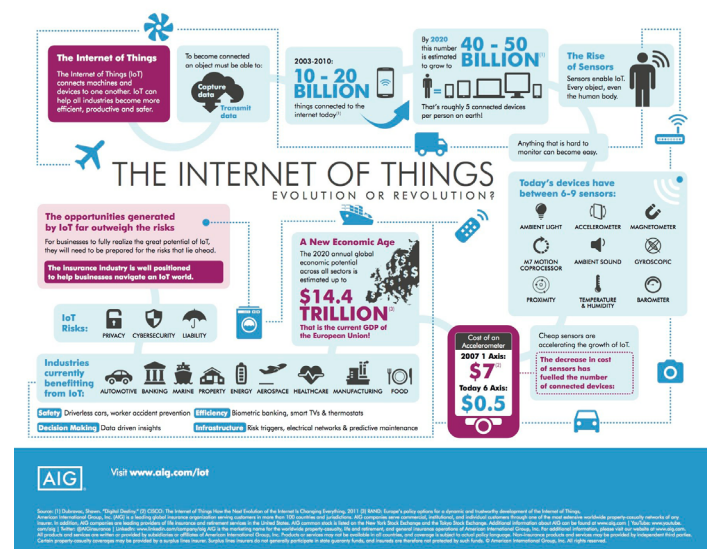


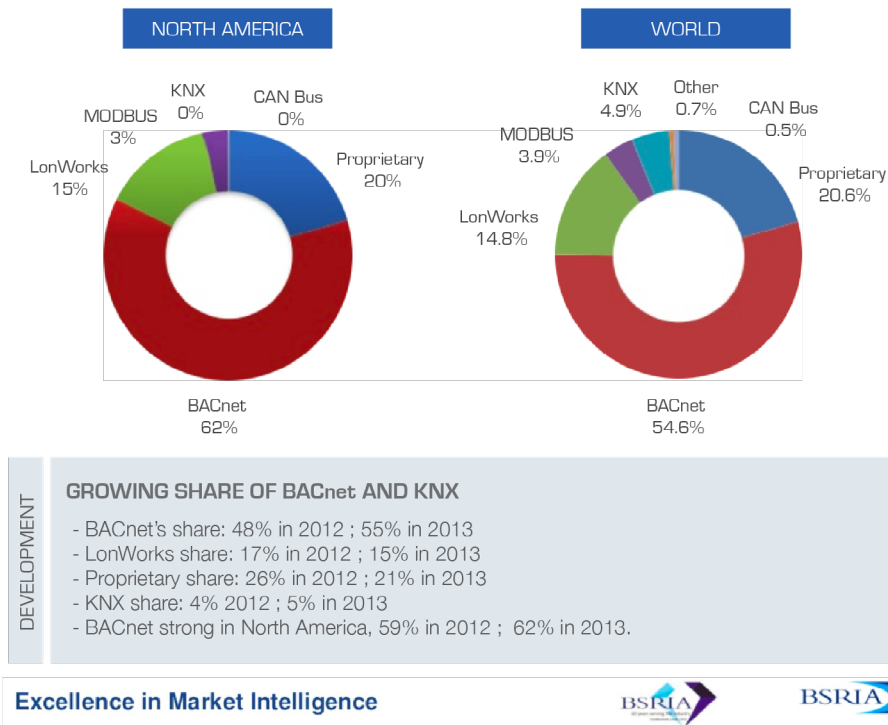
WHY SHOULD YOU INVEST IN **BACnet?**



– Ken Sinclair, Founder, Owner, and Editor of *Automated Buildings*.



BACnet EXTENDED ITS SHARE AS THE PREDOMINANT COMMUNICATION PROTOCOL



WHY SHOULD YOU INVEST IN BACnet? WHAT MAKES IT THE RIGHT CHOICE FOR YOUR NETWORKS, YOUR BUILDINGS, YOUR CITIES?

We talked to everyone — from the innovators behind BACnet to the techs using it today — to understand the power and potential challenges behind the protocol.

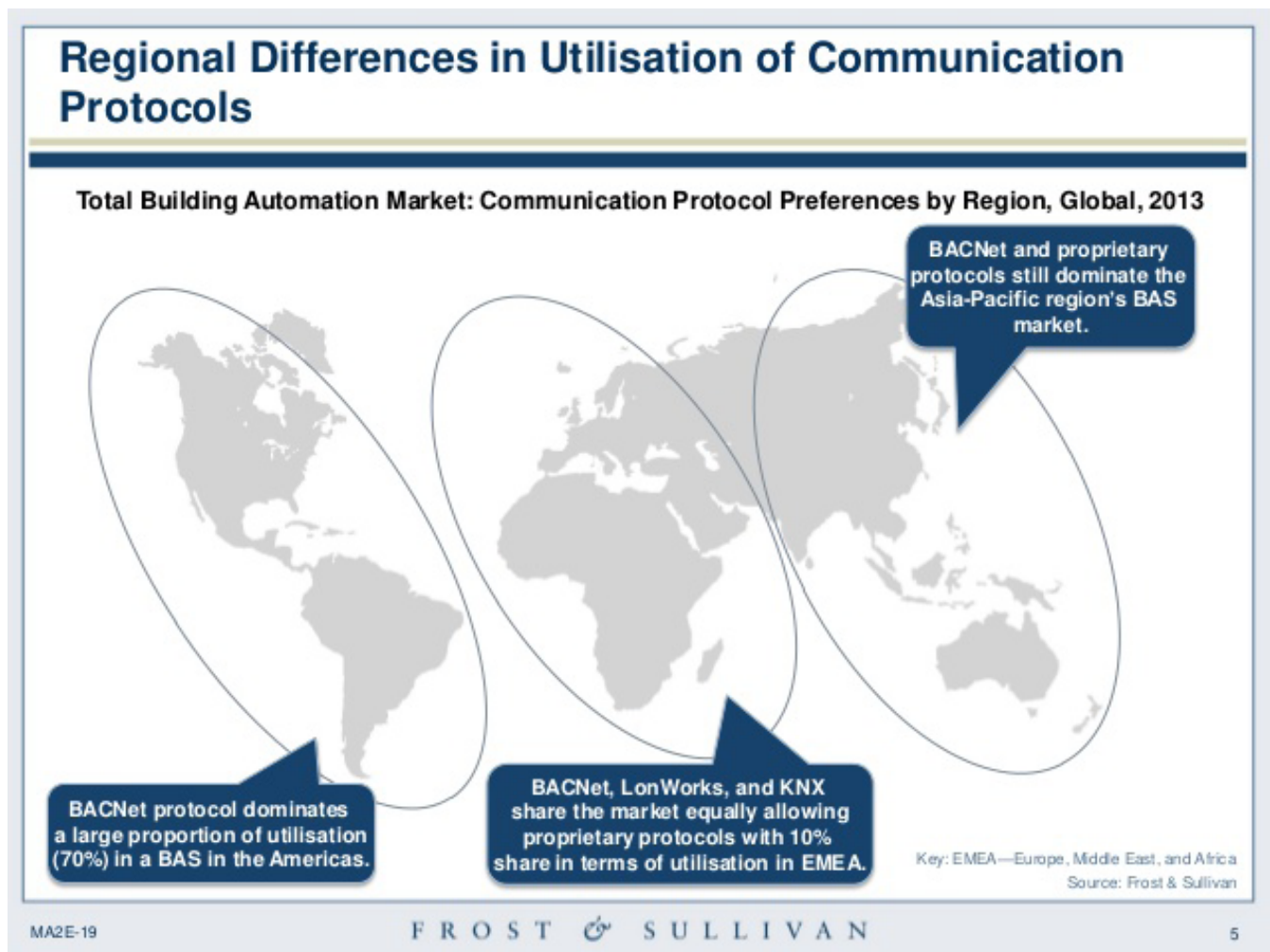
We've broken it all down by:

- 1 BACnet's dominance in the industry
- 2 Device selection and convergence
- 3 Open systems
- 4 Partnerships and acquisitions
- 5 Network infrastructure
- 6 Maintenance and management
- 7 Financial savings
- 8 And the Internet of Things

BACnet's DOMINANCE IN THE INDUSTRY

BACnet's market share

Defining BACnet's dominance in the sprawling building automation market is a massive challenge. The global market is completely fragmented between the many different protocols. There's BACnet, of course, and LonWorks, KNX, DALI, Clipsal C-Bus, MODBUS, M-Bus, OPC, EnOcean, Zigbee... The list goes on.



Ken Sinclair points out the issue of even pinpointing protocol use between commercial buildings. “Universities are strong supporters of BACnet. I don’t think you’ll find one that doesn’t support BACnet. But then you talk about retail, or hotels...”

“Every time you shift markets, the ratio of BACnet changes. Typically it has a strong hold in hospitals, universities, and large office buildings. I would say it doesn’t have a very strong hold in light commercial or residential.”

Protocols serve drastically different purposes in various building types. Even defining the “share” in a single building isn’t as simple as it might seem at first blush. David Fisher says “there are multiple overlapping ‘markets’ that are in this space.

“If we say that the space is commercial buildings — well, what constitutes ‘share’? Simply that something uses or could use BACnet and it happens to be deployed in the space, does that constitute BACnet having a share? If we’re considering the market that something is a share of, does that include not-yet-automated buildings that could be automated? Or simply those that are already? And if a mostly not-automated space contains a humidifier that can use BACnet, for example, does that constitute an automated space using BACnet?

“I think it’s very easy to misconstrue the significance of those kinds of numbers, depending on how you answer those questions.”

BACnet’s rate of growth

Perhaps because of these and other issues, there aren’t many studies touting concrete numbers on protocol market share in traditional commercial building automation systems.

A very recent study from [BSRIA](#) does point to serious growth in BACnet’s use however, as [BACnet international](#) reports: “A new market research study indicates BACnet’s global market share has continued to rise over the last five years and now exceeds 60%. [...] The five-year outlook projects continued growth in BACnet adoption with continual improvements to the standard and its integration with IT technologies, such as IPv6 and web services.”



Ken Sinclair

Founder, Owner, and Editor of
[Automated Buildings](#)



Adam Rinderle

President and Founder of
[BluEvolution](#)

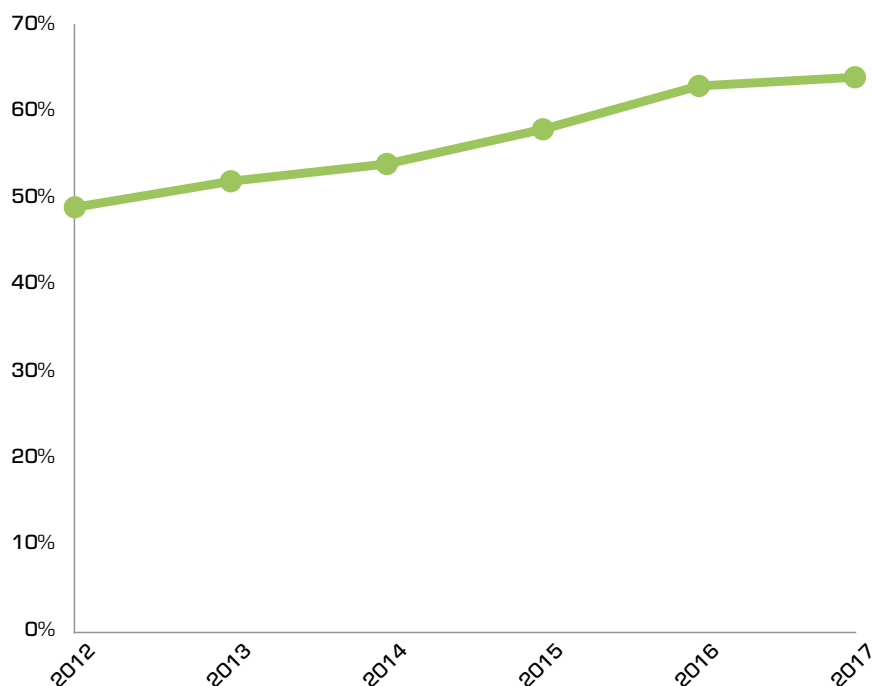


David Fisher

President of
[PolarSoft Inc.](#)

For the 5 year period from 2012 to 2017, BACnet has had strong upward market share trend as more and more users and suppliers adopt it.

YEAR	BACNET
2012	49%
2013	52%
2014	54%
2015	58%
2017	63%
2017	64%



Credit: BSRIA

When you ask other experts about BACnet's rate of growth, you get similarly glowing responses.

"If you look at commercial buildings that have a traditional building automation system in them, I think what you're asking is what piece of that pie does BACnet have versus others," says Fisher.

"Based on my own exposure to that market space, talking with our customers and others, I believe BACnet has a very large share," says Fisher. "It's probably well over 50%, and the lion's share of what remains are not things like LON or MODBUS. They're actually proprietary systems that are rapidly disappearing as technology advances and older products are being redesigned."

Adam Rinderle confirms that, in his experience, the trend is towards BACnet adoption.

"I think BACnet will just continue to command a larger market share. When you look at technologies that are standardized, a particular protocol that provides avenues for lower cost integration is going to be dominant."

Another factor affecting BACnet's rate of growth is the increased adoption of IoT and intelligent devices. While it still has a long way to go, BACnet is growing to meet the needs of new, smarter devices. Lighting systems have moved onto BACnet in recent years, for example, and these additions will only continue.

“BACnet is growing into non-building automation systems — actually, to be more exact, BACnet is growing outside of HVAC,” says Pook-Ping Yao. “It’s grown into lighting, it’s grown into access control. Now, it’s not growing as fast as I think it could, but that’s a big trend.”

DEVICE SELECTION AND CONVERGENCE

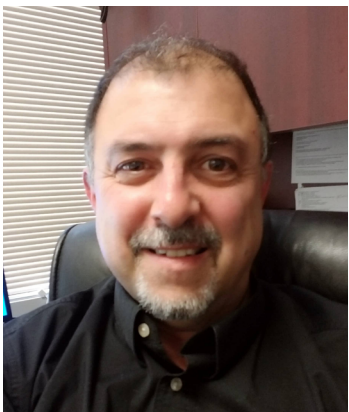
BACnet is *the* protocol standard for many — if not most — mechanical and HVAC systems, says Gerry Cellucci.

“In Canada, BACnet from my standpoint is almost the de facto mechanical industries communication protocol. [...] When it comes to integration, BACnet is a viable, proven, entrenched protocol in the mechanical side. It’s not necessarily the de facto standard in the lighting world, or the de facto standard in the security world.”

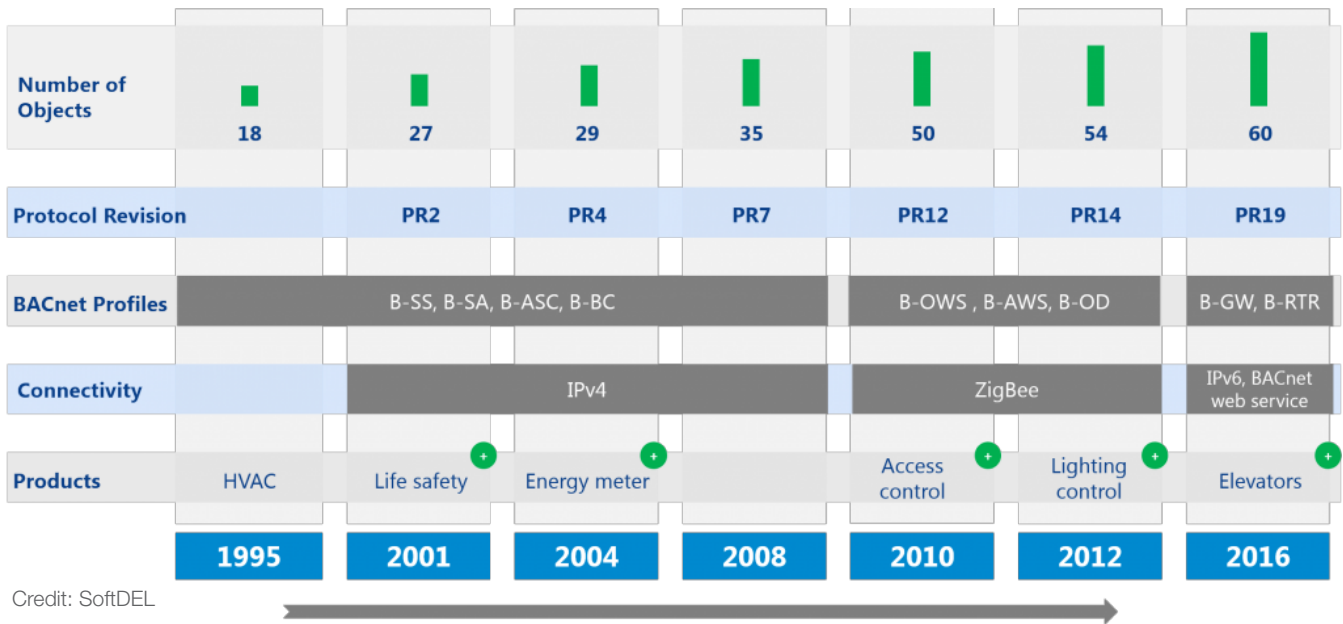
The reason it isn’t the de facto in lighting and security is likely due to the slow shift away from proprietary systems. Lighting has traditionally been very proprietary, but it’s gradually becoming the brightest new addition to the BACnet roadmap.



Pook-Ping Yao
CEO of *Optigo Networks*



Gerry Cellucci
Vice President of *Yorkland Controls*



Tracing BACnet’s evolution, from an HVAC-only standard, to life safety/energy metering on IPv4, to access and lighting on ZigBee, and now to elevators on IPv6/web services.

“Traditionally, BACnet was an HVAC standard driven by ASHRAE [American Society of Heating, Refrigerating and Air-Conditioning Engineers],” says Sinclair. “But it’s started to be viewed more popularly with IES [Illuminating Engineering Society], and there’s been a bit of work between ASHRAE and IES with energy standards. They’re realizing how much the lighting has to do with the total energy use of the buildings.”

Rinderle agrees, “BACnet’s pretty ubiquitous. Because it’s so user-friendly, it stands to reason that it’s everywhere now. So, it’s being incorporated into many, many products, and it seems to have turned a corner with lighting in the last couple years and is becoming much more prevalent.”

For Fisher, this influx of new devices running BACnet comes as no surprise: “From the very first day, the whole concept of BACnet was to allow for the unification of all different kinds of building systems, including HVAC, but also lighting, fire and life safety, access control, and many others.

“If you look at the purpose and scope in BACnet, in the very first paragraphs that say why did we make this standard, it says quite clearly, ‘all building systems.’”

For those curious to dive down the rabbit hole of BACnet vendors, BACnet.org keeps a list of more than a thousand BACnet vendor IDs. There are BACnet vendors in analytics, access control, metering, mobile network management apps, and much, much more. BACnet International also has an ever-growing list of members.

OPEN SYSTEMS, OPEN ARCHITECTURE

A free and open market

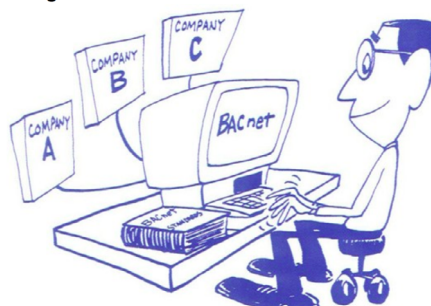
BACnet can support all these smart new devices because it’s an open protocol. That means you can manage every device on the same network, without having to learn multiple protocols or swap and hop between tools.

It also means you aren’t locked in with a single vendor for the life of a building.

He has a real problem ...



He has got a solution ...



Before BACnet was developed, proprietary systems were a major issue. You couldn't have all your devices speaking completely different languages on the network. You chose one vendor and had a Johnson building, or a Siemens building, or a Honeywell building. The only way to switch vendors would be to completely overhaul the entire system. There was no realistic, financially feasible way to switch, even if the customer really wanted to.

"Looking back, there was a huge, let's call it, latent disappointment and frustration, that owners and end-users had over their, let's face it, pretty poor treatment by the major controls companies," says Fisher. "It was a different world then, and big companies I guess could afford to be less responsive to their customers."

This led to:

- Customers tolerating poor service, and sticking with vendors out of sheer necessity.
- An industry dominated by four major manufacturers.
- A lack of innovation, with little competition to push the industry.

These huge issues were stifling the building automation industry. Eventually, disruptors like David Fisher, Mike Newman, and others collaborated to develop an open, flexible, robust standard: BACnet.

Rinderle says, "[BACnet] enables people to use the technology. It can be, but does not need to be, proprietary. You're not stuck in this — and I'm not picking on any one manufacturer — but you don't just have to be a Siemens building, or a Johnson building, or a Honeywell building, or dedicated to a particular lighting manufacturer. You're not stuck with DALI the rest of your life. You have the ability to make a break and then start to integrate other technologies over time, in a way that you can't really do with other technologies that utilize less open protocols. As more technologies are developed that make the use of more and more building data, it creates demand for normalized data that can be used by these tools. When using an open standard like native BACnet that data normalization is essentially completed for you at the application layer. When you're dealing with proprietary protocols that data normalization and convergence becomes more cumbersome and expensive.

"That's where BACnet really connects the dots."

BACnet has opened up the market, encouraged innovation, and allowed building owners to demand better service. Because customers aren't locked in with a single vendor, manufacturers have to be more responsive to their clients' needs. Otherwise, it's far too easy to swap from one company to another, if you're not getting the service you want.

Single pane of glass solution

Because BACnet supports so many different device types, and is so widely adopted by all different vendors, it is possible for a building to run almost completely on BACnet. That allows facility managers and network administrators to seamlessly manage disparate systems.

For Tom Walker, this openness is integral to BACnet's appeal. On why Penn State adopted BACnet, he explains that "the focus has always been around open architecture. We want to be able to easily communicate between whatever vendors get picked to be in here. **Ultimately what we're looking for is to create a single pane of glass solution**, so that you receive all the alarms and you're looking at all the data and everything happening in real-time inside a single pane. To troubleshoot, then you would go off to the native application.

"Without having something that's open architecture that makes it 10x more difficult."

Think of your network as a classroom, full of students who all speak different languages. To teach the students, you could learn every one of these languages; you could pause between teaching to look up words and terms. If you don't have a good understanding of all the languages though, trying to get anything done in the classroom will probably be a lot slower and more effortful.

If you have a classroom full of students who primarily speak the same language, though, it becomes a lot easier to communicate. Your students can talk to each other, and you don't have to swap between dictionaries to understand or communicate with your class.

That's the effect that BACnet has on your network. It simplifies. It streamlines. It allows you to manage all your devices without lots of extra time, effort, and tools.

Of course, MODBUS and LON still have their place in the industry. You won't find many commercial buildings running completely on MODBUS or LON, though. (*More on that in [BACnet on the network: The choice for commercial spaces.](#)*) By supporting open systems and open architecture, BACnet makes it possible to build a single pane of glass solution.



Tom Walker
Network Administrator at
[Penn State University](#)

Potential miscommunications?

While there are many benefits to this open market and open architecture, it does introduce all new issues of finger-pointing. Because you can have several different vendors co-existing on a site, when things go awry and the network's acting up, it's hard to pinpoint who originally caused the problem.

"I think a big issue comes back to communication when you have to deal with other vendors on site. There's not a lot of visibility, so you have no idea what's going on in these networks," says Monica McMahan

"The finger-pointing is huge. 'It's not my fault, it's his fault. I don't know who's fault it is. I broke the network by adding one device to it, but it was already on the verge of breaking because someone else did mediocre work, but I can't prove it.'

"The technological breakdowns happen as a result of a people problem."

There's the added problem of defining what "BACnet-certified" means, as Walker explains. "One of the biggest problems in the industry is, you can say you're BACnet-compliant, but you may not meet all of the BACnet features.

"We've run into some issues where things have been put on the network that they said were BACnet-compliant, but you can't change device instance number, you can't change the port. There are several things like that, and on a large-scale BACnet infrastructure like ours, you can't do that. You have to have flexibility and be able to change those particular fields."

BACnet systems are still far more elastic and scalable than the old, proprietary networks of yore. It just introduces all new issues that we have to understand, if we expect BACnet to support a world of smart buildings.



Monica McMahan

Marketing Manager at
Optigo Networks

PARTNERSHIPS AND ACQUISITIONS

The market's open nature has also led to opportunities in partnerships and acquisitions. We're seeing an industry that is far more layered and complex and, above all, cooperative.

None of this would have been possible before BACnet.

"Nowadays, we all work together and competitors will sit down at a table," says Fisher. **"It isn't the backstabbing, super proprietary marketplace that it was in those days."**

A big motivation behind these partnerships is the desire to innovate. Bigger companies don't always have the capacity to be agile in responding to industry demands. So, they partner with smaller companies that can move quickly.

"You're seeing that the companies that have historically done controls and do most of the BACnet products struggle to innovate. Partially because they're inherently biased, and partially because they're too big," says McMahan. "So you're seeing a lot of companies popping up, and doing new stuff, offering new analytics.

"Those companies that historically haven't partnered with anyone are starting to partner. So you're seeing these alliances, these partnerships, where previously they've been able to say, 'We are a big company, we do this on our own.'"

These collaborations lead to better products and a more forward-thinking industry overall.

"It's going to be really interesting to see how the industry changes," says McMahan. "There are some acquisitions, but there are a lot more partnerships. It will be interesting to see how many new, smaller companies do partnerships with multiple bigger companies. When you're a partner, you can do that, but when you're acquired you can't."

Acquisitions are rarer, but they can be highly successful, as when Acuity Brands acquired Distech Controls a few years ago. Mathieu Houle explains the thinking behind this relationship.

"At the time that Acuity Brands decided to invest in Distech



Mathieu Houle

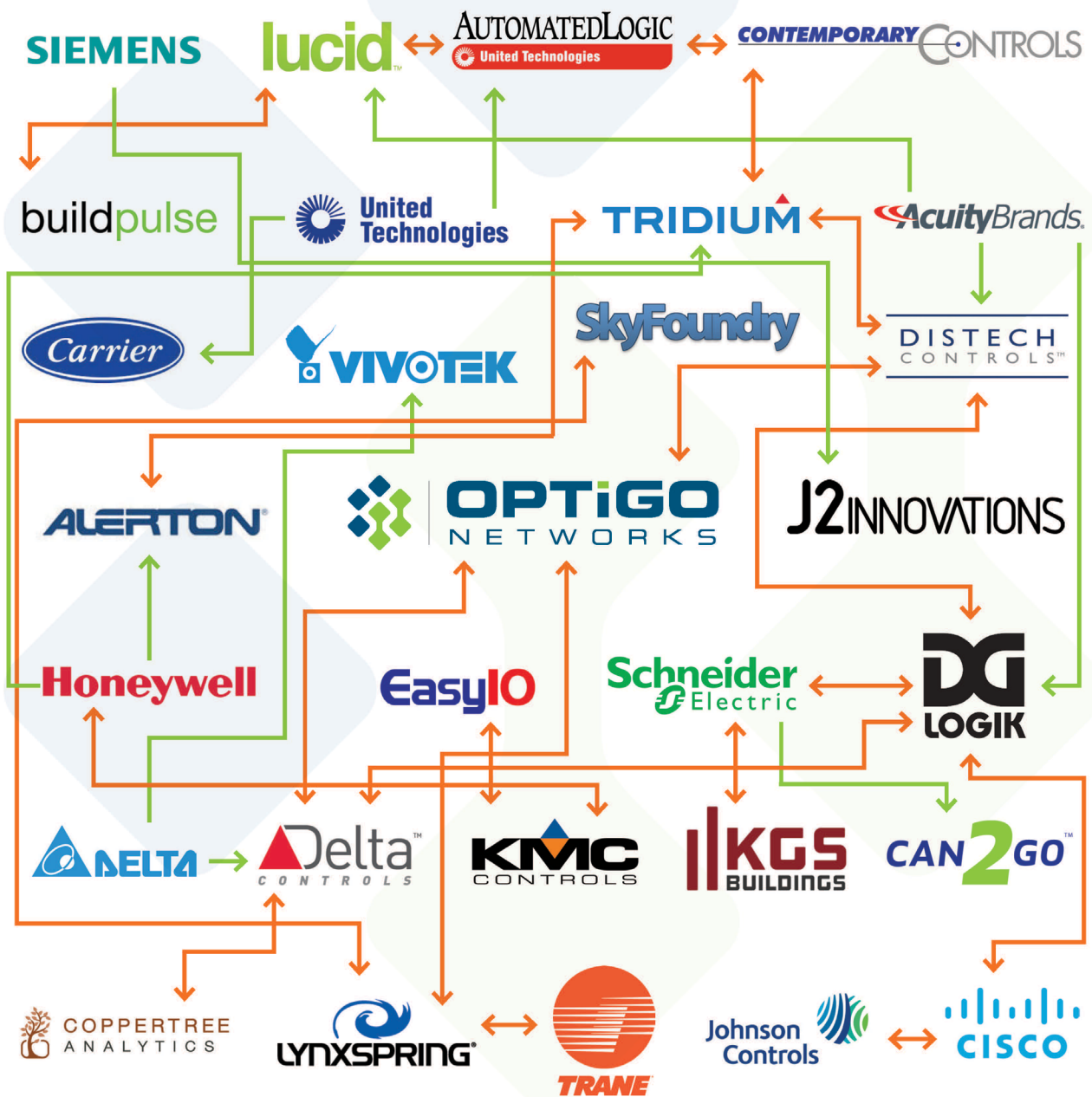
Vice-President Customer
Experience for
Distech Controls

Controls back in 2015, they communicated that their decision to do so was, in part, because of Acuity’s conviction that there is a big trend into the services and software as a service,” Houle says.

“The ECLYPSE platform is our BACnet/IP connected product series, and they saw this innovation as a good opportunity to bring it on board as part of their portfolio so as to unify HVAC and lighting controls for a true end-to-end optimization of all aspects of a building.”

BUILDING AUTOMATION INDUSTRY MAP

↔ Partnership → Owns "X"



Acuity also acquired the building operations SaaS company, Lucid, in February 2018, further solidifying their shift into BAS. Acuity is just one example of how the industry has evolved, and there are sure to be many more shifts in years to come.

BACnet has opened the market up to more innovation and competition, but there's also a greater opportunity for collaboration. Bigger companies can move faster by partnering with smaller, more agile businesses; and companies that don't leverage BACnet can make a shift by acquiring companies that do. If the partnerships, acquisitions, and new systems adopting the protocol are any indication, BACnet is the future of smart buildings.

BACnet ON THE NETWORK

The choice for commercial spaces

BACnet isn't just the choice for HVAC any more. More and more, it's the go-to for automated commercial spaces in general. MODBUS, LON, and other protocols on offer just don't have the flexibility and scalability that BACnet does.

Honestly? They weren't designed to.



Credit: Siemens

MODBUS

Fisher explains, “We have to keep in mind that MODBUS is serving overlapping market spaces. To greatly oversimplify that, let’s call it commercial and industrial. Traditionally, MODBUS is an industrial technology and it caters to the very limited scope of automation with highly centralized control. It really has no scalability at all, and is very configuration-intensive. What I mean by that is, humans have to be heavily involved just to make it say hello and do anything.

“Today, the cost of skilled labour that knows how to do configuration-intensive stuff is way more costly, relative to the economy of a given job, than it was in the past. I mean, let’s face it, 25 or 30 years ago, people were a lot cheaper than they are now. As far as I can tell, that’s not going to change even a little.

“So going forward, we know that there will be a shortage of skilled labour. It’s going to cost more, so any technology that is overly dependent on human involvement is just dead right out of the gate.”

Rinderle agrees, MODBUS isn’t technologically advanced, especially when it comes to IP. This will inevitably stunt its use in the industry.

“You can do MODBUS over IP, but I don’t think it’s as well-supported or architected for that purpose. It functions well at a serial controller level. MODBUS will be around for a long time because a lot of these unitary controllers use MODBUS, and then if they are using a BACnet based front end application, they’re aggregated by some other BACnet gateway that converts the MODBUS to BACnet. So, I think you’ll see legacy MODBUS for a while.

“That said, if you are implementing a new BAS system, unless there is a particular component that was required that only communicated MODBUS, I don’t think the trend will be for property owners or managers to install BACnet on the IP network side, but MODBUS at the unitary controller level. That doesn’t make sense to me. Wherever you have an opportunity to choose, assuming the costs are approximate, you want to push the BACnet standard as close to the edge as possible.

“I think if you got stuck with some technology that you had to use that only communicated MODBUS, then that’s somewhat of a tough spot in the long term. **There are not lot of manufacturers in this industry touting the forward-looking technological advantages of MODBUS.** I don’t hear that very often. They just don’t roll up to the application layer very well, and I think that’s a death knell for any communication protocol. **If you’re not going to be able to roll up to the application layer, your value is limited.** You’re creating a need for a combination, where you have to accommodate a secondary protocol that eventually has to be converted to something else in order to be able to put it on a network effectively. That’s a limiting factor.”

Ryan Hughson has seen many people struggle with MODBUS over the years, though he doesn't think the protocol will be going anywhere. "The reason it's been out there for a long time is very simple: just about every device you can think of has some sort of MODBUS connectivity. It's challenging to make it work, in some cases. Some people figure it out and they can make it work really quickly. Others struggle for more success, and there are very few tools to help. **It's definitely a problematic protocol.**"

Mike Newman explains that MODBUS, while quite limited, does serve its purpose in industrial automation. There's no metadata, and no concept of a description, but you can still tie it into a BACnet network.

It's important to keep in mind, MODBUS was designed for very different purposes than BACnet was. In simple terms, it's an industrial protocol used for devices like boilers and meters. As Dan Ronald explains, "MODBUS is predominantly in the world of power systems, and it's not really going away anytime soon."

Because of that, says Fisher, we can't compare these protocols, "apples to apples": "if we talk about MODBUS, it's not a general-purpose building automation system protocol. It was created many, many years ago, for small master-slave networks, typically with less than 200 points in them. [...] You didn't need anything that had scalability, let alone many thousands of control points in it.

"I guess you could take a bunch of those kinds of devices and organize them in some kind of hierarchical structure in order to create a larger system that exclusively used MODBUS. But I don't know of any building automation system that does that."



Ryan Hughson

Strategic Solutions Manager at
Optigo Networks



Mike Newman

Retired Manager of BACS
integration at *Cornell University*
and the Father of *BACnet*



Dan Ronald

CTO of *Optigo Networks*

LON

When it comes to LON, the reviews aren't quite as positive. LON appears to be more of a lost cause: "They're doing whatever it is they're doing, I guess. I don't know," says Newman.

Rinderle has seen many buildings move away from LON because of these sorts of challenges. "I think a lot of people that have had the option to get away from LON in recent years have done it, just because it doesn't seem like the standard has kept up with their needs. It doesn't seem to have the same robust, integrative capabilities that BACnet has at multiple layers."

While LON has its advantages and disadvantages, Hughson says it's clearly been outpaced by BACnet. "There are actually some pretty good tools for LON, and it's not as chatty of a protocol. But the adoption just didn't get there, and as a result, LON is dwindling. We see reports every year that it's getting smaller and smaller as BACnet starts taking over."

Bottomline, MODBUS and LON simply aren't real competitors to BACnet.

- They aren't technologically advanced,
- neither one of them is designed for IP,
- and their use-cases tend to be quite limited.

That doesn't mean that the protocols don't have their place, or their own advantages. It does mean that the future of our buildings is in BACnet. It is the building-wide protocol, even if other pockets of the network use other protocols.

Compared to BACnet, MODBUS and LON are tremendously simple: there's no high-level alarming, scheduling, trending, or data-modelling. MODBUS and LON simply aren't built for the data-heavy world of smart buildings.

"The point is, I'm not anti-any of those things. Those are fine technologies for what they do," says Fisher. "But in terms of building automation — which is, in my view, the most complex type of automation there is next to what the human body does in itself — in terms of man-made stuff, they can't cut it. **They just don't have that expandability.**"

NETWORK INFRASTRUCTURE

BACnet provides a robust, scalable network infrastructure that you just don't see in other protocols. The way that Yao puts it, BACnet/IP in particular is the ideal network infrastructure for today's smart buildings.



Credit: Edition Analyst

“BACnet over IP really is the future. [...] Everyone can develop over BACnet, whether you're an elevator company, which already happens; whether you're access control; whether it's electric vehicle charging stations, or people-counting cameras, or vibration sensors — it doesn't really matter. **BACnet/IP is an infrastructure that you can build on today and use well into the future.**”

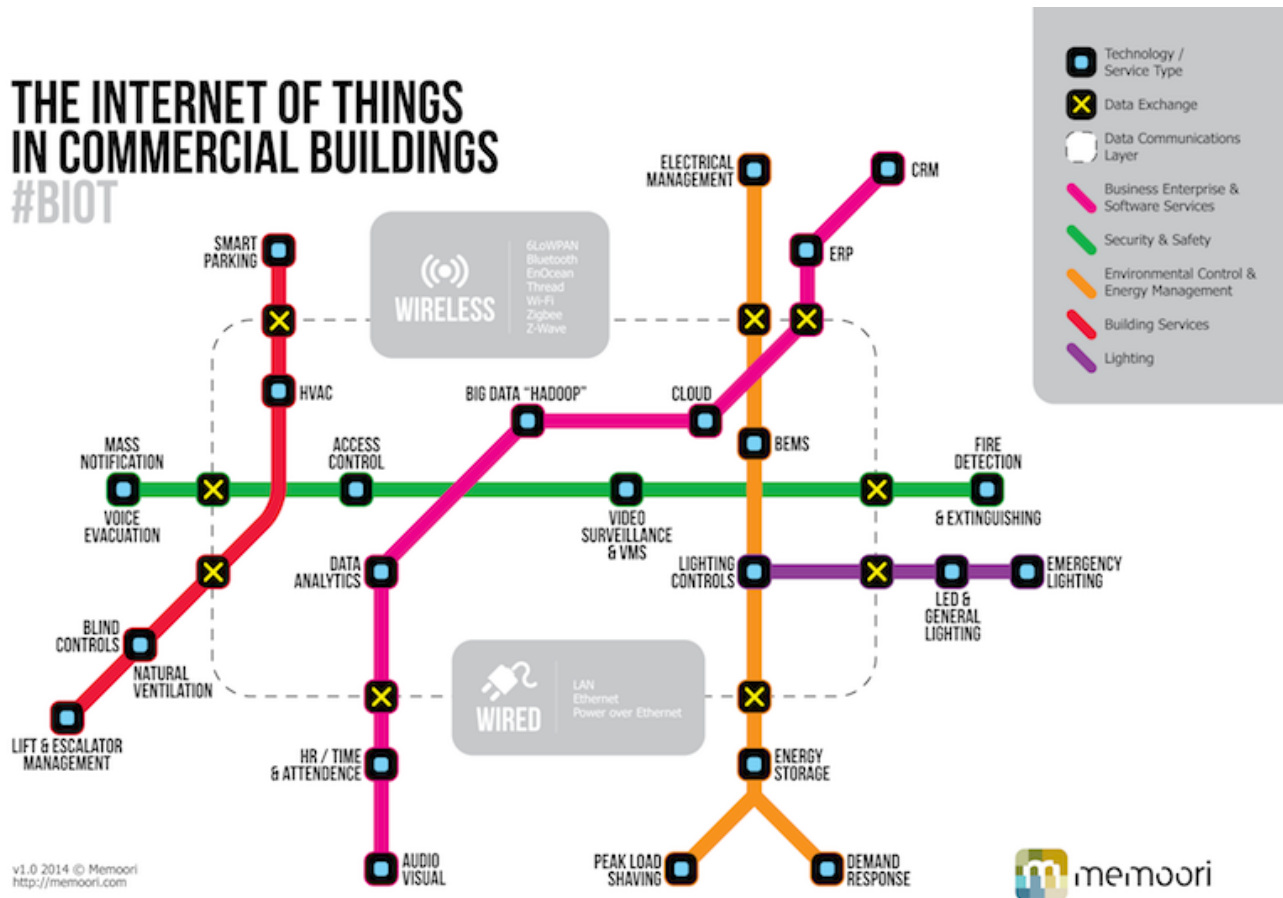
That scalability and future-readiness are big points in BACnet's favour. When the dominant protocols were proprietary, building owners weren't prepared to scale for the future, as Rinderle explains.

“When you saddle yourself with something proprietary, you don't really even want to scale that. That's definitely not in your interest from a long term cost and ease of integration perspective, and trying to manage that in an environment with more than one or two sites, it's really difficult.”

An open, standardized protocol with a development roadmap like BACnet's is much more in your favour, Rinderle says. “It's the ability to say, ‘OK, I don't have to get a whole new building automation system to integrate some other key technologies that are going to help my building perform better, I'm just going to leverage the BACnet protocol and I'm going to bring in other components or complementary technologies that are for the most part plug-and-play.’

“And I think it's good for BAS manufacturers as well. You're going to be able to maintain your foothold in that building, and they're going to get to bring in some other technologies. As opposed to you being proprietary and them eventually saying, ‘You know what, it took me 10 years but I've got to break up with you, this is just not working for me anymore, and I've got to go to something that's open.’ That's a big part of the scalability of BACnet and the future-proofing.”

That means you have to plan for the future right from the ground up, as Yao explains. “I think one of the big things is, be aware that BACnet is open. That means that you’re never done. It means that if you build a good system that uses BACnet, tomorrow could come around with another idea of adding a few other devices, or collecting more data, or using that data differently. That means, really build a system that you know can grow. So that you can add more devices, add more ports, segment things so they can avoid collisions.”



There are big considerations when managing and designing your BACnet network infrastructure, as far as scalability is concerned. You have to put in the work, if you expect your system to grow (painlessly) over time.

BACnet is leading the way in our smart buildings today, though, because it's the protocol that building managers want to scale on. More manufacturers are shifting their devices onto BACnet, because they see how it benefits them, building owners, and the buildings themselves.

MAINTENANCE AND MANAGEMENT

All this being said, there are some challenges with managing BACnet networks. A common issue is chattiness, if the system is not properly configured.

“BACnet is a very chatty protocol, so without proper segmentation, configuration, isolation, BACnet systems will grow to a certain point where it basically breaks apart,” says Yao. “Segmentation is possible through IT approaches like VLAN, or BACnet approaches like using the BACnet port.

“But the question is, **what happens when we go from 100 devices to 1,000 devices?** Are we going to have enough naming space? Or, if I’m collecting a lot of data, am I going to create so much data that a device that doesn’t need data still gets it? That’s what we mean by chattiness: broadcast. Would it break apart? Because 1,000 is not that big of a deal, but you go to 10,000 or 100,000 and it starts being very difficult.”

McMahan hears all different challenges from people who use BACnet from day to day: “I get complaints that it’s clunky, it’s much chattier than other protocols, it’s a little bit less streamlined. I hear that there are some cybersecurity concerns, although I believe those are being addressed.”

Walker says that chattiness really depends on the vendor and how the network system is set up. In his experience at Penn State, if you pinpoint broadcast issues then you can greatly reduce network activity.

“[Some systems, when they’re first put on the network], there’s a setting in place that goes out and scans the network for all devices every minute. And I mean all devices, it does what’s called a Blank Who-Is. So, every single device on the network will report back. And when you’re talking hundreds of thousands of devices, that’s a lot. That’s where we’ve seen some of those problems of it being chatty,” Walker explains.

Additional “chattiness” can come from “configuration as far as COV increments, and just misconfigurations when they’re programming,” says Walker. “A lot of times they’re taking a program, copy-pasting it from another project, bringing it over, making a couple of tweaks — well, they forget to go back in and maybe change the COV intervals or change some of the pieces of information. And then we get hammered with thousands of alarms.

“We had one where the COV increment was 0.01 on a temperature. Every 100th of a degree of a temperature change, it was sending a message. **Those kinds of things can have a big impact.**”

Developing and maintaining a device ID or instance numbers standard is another headache on larger networks. Yao explains that “the BACnet ID has no standard guidance. No one says OK well, if it’s a Siemens product you should name it starting with 7, have four digits, the last one being this one, the third one being that one. There is no such thing, and by not doing that, and vendors coming in and plugging in whatever they want, it creates collisions and conflicts.

“Having multiple devices with the same ID, it’s extremely difficult to track, but more importantly it’s extremely devastating to the performance of the system. So, as an industry, we almost need to create some of these best practices that can complement the standard. To say, ‘You don’t have to do this, but we recommend’ [...] There are lots of vendors, lots of integrators that have their own standards, which is great. We can learn from them and push that forward.”

Walker agrees, device instance numbers and IP addresses are very important to track and standardize. “You can’t have duplicates. But managing that across multiple ports, across multiple campuses, multiple different vendors... Some of the jobs that happen out of Commonwealth, they just use their default for device instance numbers. Then when we have to bring them onto our network, we have to go through the whole building, change all the device instance numbers, get them up to our standards that don’t conflict with us, and then bring them online to our network.”

Unfortunately, there’s currently no application out there to help network analysts and facility managers track these numbers and prevent duplicates. At best it’s a spreadsheet or an Access Database, and at worst, it’s nothing at all.

BACnet is very well-standardized, and brings so many benefits to our smart buildings. But these issues and others mean that you have to be careful, organized, and strategic in how you implement and scale your BACnet network. You have to start tracking device IDs, instance numbers, and IP addresses right from the start — before you have 10,000 devices on your network and no idea where the duplicates are.

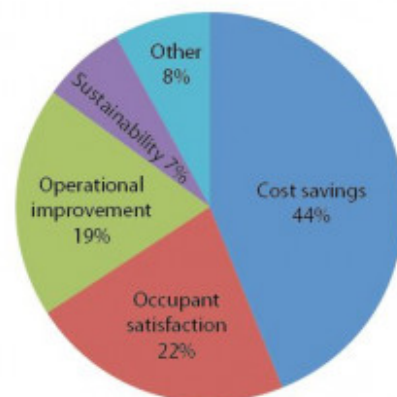
FINANCIAL SAVINGS

Smaller teams

Because BACnet is an open standard, it’s relatively easy to manage an entire network, across separate buildings, with a single protocol. That means fewer tools, platforms, and people to manage a building or campus network, and more financial savings. If building owners are able to leverage the cloud, the savings can be even greater, as Cellucci says.

“It allows building operators to manage multiple buildings quite effectively, without having dedicated on-site support people to actually manage that building. So **one individual might be able to actually handle five to 10 buildings as opposed to having eight guys manage 10–15.**”

Most important drivers for investment in intelligent building technology (%)



Credit: Installation Magazine

In fact, Walker says that they have a relatively small team managing their massive network of 15,000 devices and 200+ servers at Penn State University. “It’s me and two guys focused on the network side. Then I have a staff of three members that are dedicated to the server and application side of things.”

Managing a network that big with only six people wouldn’t be possible without open, cloud capabilities.

When your Operational Technology (OT) team is empowered to manage their own network, this also opens up IT resources, as Cellucci explains.

“These devices that are doing the heavy-lifting are now IP-enabled — where do they put them? Where does the owner put these devices? Currently, the de facto is well, we’ll give it to the IT department. They’ll figure it out, they’ll stick it on. But IT resources themselves are not familiar with [Building] IoT systems yet. They know how to connect computers, laptops, that sort of thing, and they’re very guarded about the devices that are actually put on their network.

“One of the healthy trends we see is being able to go to clients and talk to them about separating the enterprise network from the IoT network, so that all these sensors and all these controllers that are IP-enabled, they’re being managed on a separate layer, or separate network. That gives them security, and means the network doesn’t need IT resources and involvement as much as if they were all on the enterprise network.”

When OT folks have the knowledge and resources to manage their own networks, everybody wins. That doesn’t mean that IT shouldn’t be involved in building-IoT at all — in fact, there’s important information sharing that can happen between these two groups. It means that if the two teams are empowered to manage their own systems, you end up with better, more secure networks. Even better, IT teams can save time, energy, and money if they aren’t spread so thin.

Bigger industry talent pool

With more buildings running on BACnet, the industry talent pool is also far bigger than it used to be. After all,

- BACnet requires less configuration than many other protocols on offer
- You don’t really need to know IT in order to manage your BACnet network
- And moving between companies is easier, because they use the same protocol

BACnet’s relative simplicity makes it easier to adopt. Even better, it’s far easier to find staff, contractors, and integrators who can work with the protocol. You aren’t restricted to one contractor because they hold all the knowledge, Hughson explains.

“BACnet’s an open system. Just about every integrator and controls vendor out there can work on it. If you have a bunch of disparate systems, then you have a closed system, and can only really work with one guy. That one guy knows that, and he’s going to start raising the prices.

“When you move into a more open system, then you have a bigger talent pool to go engage or hire. That’s huge.”

This openness is one of the biggest benefits for Cellucci. “It’s more of a user-friendly interface that’s agnostic, that doesn’t keep the information in what I call the ‘specialty trade arena.’ You don’t have to be trained in any one vendor to look at the graphics and grab the information.

“It’s the ability for any vendor to bring that information to non-operators, or control contractors, or wherever they want to go. **I call that the democratizing of information.**”

You don’t need to hire the five guys who are experts in 10 different protocols anymore. There are buildings running mostly, or entirely, on BACnet now. Because more people know BACnet, and BACnet can support all different systems, your talent pool is far greater than it used to be. However, this also means companies need to up their game to keep talent, since employees have more options.

Huge energy savings

More and more of our focus in smart buildings is on energy. We’re reducing our consumption to save money and be more environmentally friendly, without sacrificing tenant comfort.

Now, with some careful thought and design, you could probably do that with most protocols. But BACnet has a distinct advantage here, Hughson says.

“If everything’s on one platform, it’s easier to do more advanced algorithms so that you can save energy. For example, I can detect when your access control key fob comes into the building. I can turn on the lights and I can do sequences specific to you. That’s the power of personalization.

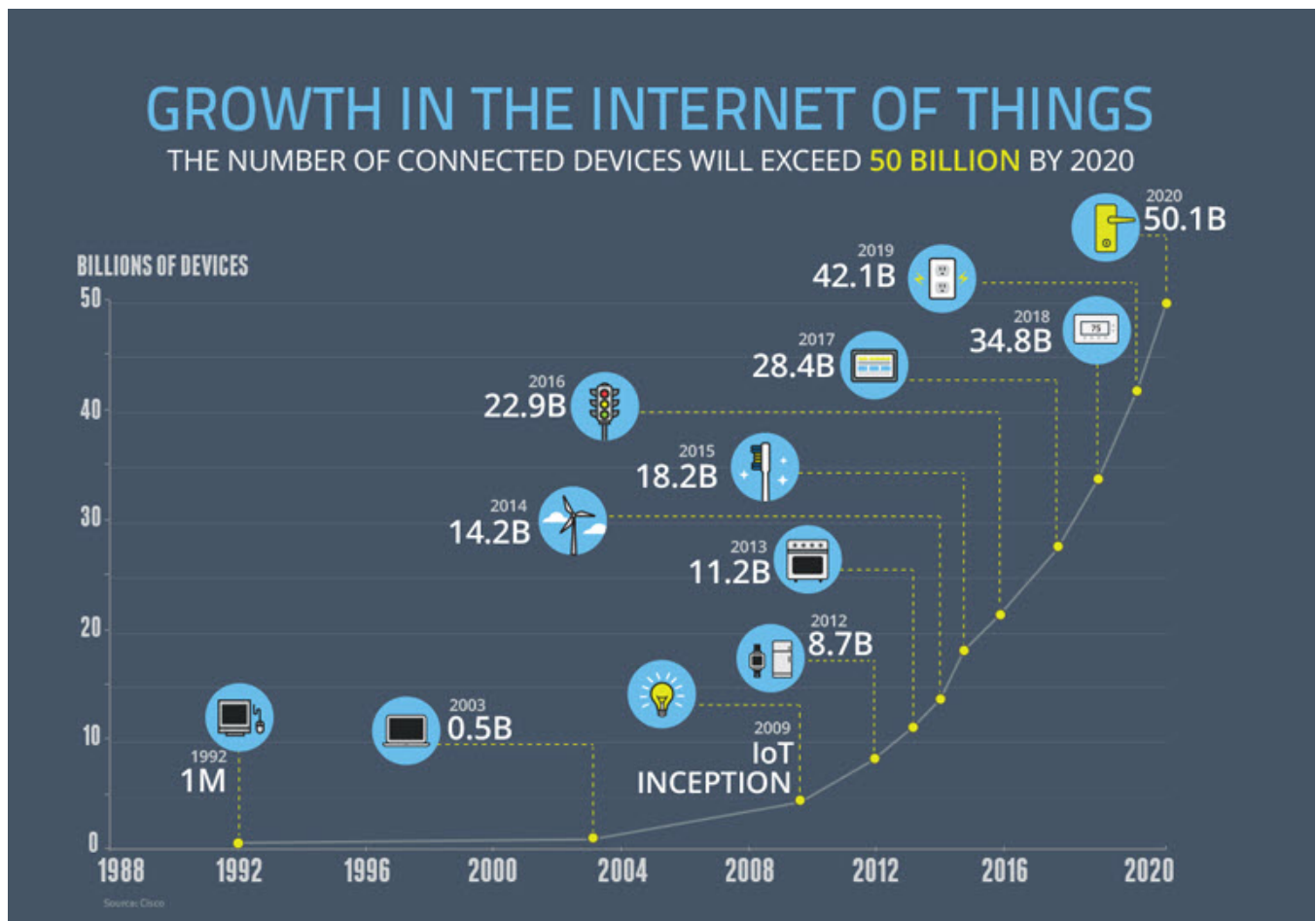
“On the other side, I also know everything about when the building’s full of occupants, and when it’s not. In the old days, people would walk in, motion detectors would turn on, and all the systems would start up. All this would happen for one person, for an hour and a half or two hours before everyone else gets here. It’s such a waste! By having more widespread knowledge across one platform, I can now detect that it’s just one person. I can hold off turning everything on until later. That means huge energy savings.”

This also means that you can easily add technology that will help you save energy: energy valves, meters, and analytics devices — whatever the case, you can add it to your network and manage it on the same platforms that you manage everything else. Even better, you can add the very best devices from all different vendors. That was never possible before BACnet.

“You’re not stuck with one vendor who’s only giving you the list of stuff they have. You can have BACnet energy valves, you can have BACnet meters, you can have BACnet lighting. All the little widgets and gadgets and stuff in between can all be BACnet,” says Hughson.

“Now what you get is a full and rich set of controllers and devices you can play with. You can implement a whole building suite of systems. Now we have that opportunity to integrate BACnet access control, BACnet lighting, BACnet energy. **It really gives our building owners a leg up that they never had before.**”

THE INTERNET OF THINGS



Credit: Enterprise Irregulars

New opportunities

The Internet of Things is completely altering our brick and mortar buildings — for better or worse, depending on your point of view. Our buildings are becoming much, much smarter. That intelligence affects devices, the languages they speak, and the networks that connect them all. While some question how BACnet will work with this diverse new ecosystem of devices, it seems to be the best-qualified for the job.

Yao absolutely thinks BACnet can and will support the new world of the Internet of Things. “BACnet can definitely work with IoT. It can definitely benefit IoT and can benefit from the growth of IoT,” he says.

Though, he cautions that this will take an evolution in the protocol’s standards: “I think one of the biggest threats to BACnet is not LON, is not ProFiNet, is not MODBUS. It is the protocol we don’t know yet. It is protocols that are developed by consumer electronics, by your Apple, your Google, your Amazon. It could be something that already exists today.”

Ronald agrees that BACnet can work with IoT, because it's standardized, has wide adoption, and keeps moving forward. "The reason BACnet is dominating is because it's got a well-defined standard — an immensely long, well-defined standard — and the adoption rate has been high. It's got that critical mass to drive it forward.

"The other reason BACnet is good is because it has a roadmap. It's been adapted for IoT and it moves forward; not at a high speed, but it does have a roadmap and a group of people pushing it forward."

Rinderle doesn't doubt that BACnet can support IoT, but wonders how it will be used in the years to come. "What will be interesting for me to see is, in this whole Building IoT space, if other manufacturers of technologies outside of your standard controls, building automation, lighting, and metering start to leverage BACnet. Because **we're still on the bleeding edge, I think, of where IoT is in buildings.**"

New challenges

"IoT falling on the industry is very much like DDC falling on the pneumatics industry. It's a radical change." – Ken Sinclair

While BACnet appears to be the most robust protocol to support IoT in our buildings, others agree with Yao that the protocol will have to evolve if it will support this new world of big data and smart devices.

Sinclair sees a parallel between where we are in BACnet with the new wave of IoT, and where we were 30 to 40 years ago with the Direct Digital Controls (DDC) revolution. At that time, DDC was shaking up the pneumatics industry in a big way, to much alarm.

"IoT right now is exactly where DDC was in the early '80s. **It's the Wild West, and anything can happen. Anything can change," says Sinclair.** "They don't have standards, and the chances of a whole bunch of IoT devices working consistently in the building are probably pretty slim right at this point in time..."

"I think we're starting to look at BACnet as a safety standard of stringing some of this stuff together in a known fashion. I think it'll stay that way, but I think it needs to evolve, it needs to get better hooks and handles into IoT."

Ronald also believes the protocol will have to change, and quickly. "I'd love to see things move a little faster, in terms of working groups, finding ways to push things forward. [...] Continuing to expand the protocol to make it more secure, easier to integrate new systems onto it," Ronald says. "I think that will go a long way to helping solidify BACnet as the protocol of choice as smart buildings move into the new era of IoT."

He adds that, specifically, BACnet will have to adjust to the new, modern IoT requirements of data collection. "The other issue with BACnet is that it has not yet been adapted for the modern-day IoT nature of going from the edge directly to the cloud."

McMahan agrees that BACnet will have to evolve in order to handle all the devices and data that will soon be running on BACnet networks. Depending on the size and settings of your network, BACnet can be a loud and highly active protocol. And the bigger your network, the bigger a problem that becomes.

“In terms of BACnet and IoT, at some point the chattiness could become a big problem, because we’re going to add so many devices to our networks,” says McMahan. “But really, it comes down to ensuring that vendors are adhering to the protocol, and using tools to configure the network properly to minimize chattiness.”

On the other hand, Fisher questions whether the Internet of Things introduces a host of new issues that we’re not yet prepared to handle.

“The biggest issue that I have with [the Internet of Things] is that it suffers from a total lack of standardization, and a lot of hype,” says Fisher. “I’m as enthusiastic as the next guy about new stuff, and about the potential for these new things to bring many benefits.

“Back when we were just trying to standardize the way building automation devices talked to each other, that was a much, much, much simpler problem to solve. Here we are 30 years later and we can’t even say with a straight face that we’ve totally solved it. So **anybody that thinks that IoT is [a solution] — just because we say it is going to solve all those problems that are 100x more complicated — I don’t think they’ve thought about this clearly enough.**”

On the key issues he sees in Penn State University’s network, Walker immediately pointed to big data. The power of IoT lies in collecting data and understanding device usage. It allows us to make our buildings more comfortable, energy efficient, and secure. If not done properly, though, this data collection can wreak absolute havoc on a larger network like Penn State’s.

“It has an impact. I don’t care what vendor out there, they can come in and say, ‘Oh, it doesn’t impact, it doesn’t have an influence.’ I can prove them wrong. I can show you a building where the building does not function collecting all the data that’s being done there. It has an impact. So there need to be some strategies to collect that data without impacting the building functionality. So you’re either collecting it from trend historians or up from the application level side, instead of trying to pull that data directly from the controllers themselves.

“Any vendor we’ve talked to, [...] all of them have been wanting to focus around data, they want to put a JACE on our network, and let it talk BACnet directly to the controllers and read the data back in. And on a non-critical building classroom, that’s probably not a problem. You start trying to do that on a lab facility, or a bio level 3 facility, and you’re going to start seeing issues.

“It’s a nice thought in principle and ideal but, in functionality on a big network like this one, it just doesn’t do.”

BACnet is currently the most robust, widely adopted, standardized open protocol available. While it will need to adapt and evolve to new demands if we expect it to support the Internet of Things in our buildings, there are lots of building owners, managers, manufacturers, and integrators — not to mention ASHRAE and the BACnet Committee — that are seriously invested in seeing that change happen.

The BACnet ROADMAP

This is the biggest question on everyone's minds today: where is BACnet going? What is its relationship with the Internet of Things, in the years to come? We've researched, talked to the experts, and done some sleuthing. Stay tuned for our next white paper, on where BACnet's going.