Top Questions about Smart Building Technology

Q: Can total savings be able to pay for investment in smart building? How long will it take to recover the cost? If savings is good/great, can smart building providers install it at no cost to building owners and self-recover cost from the saving? So smart building owners need not come out with the cost?

A: Yes, in many cases the cost of smart building investments can return positive operating and financial benefits within a few years of the investment. The break-even point and Return on Investment for smart building systems depends on the building type, building size, operating behavior, and applications being considered. The biggest ROI in commercial buildings is primarily driven by energy savings that are achieved through smart LED lighting and smart HVAC that works in conjunction with sensors like occupancy sensors and submeters. In other commercial buildings, like multi-dwelling unit apartment buildings, premium devices like smart thermostats and door locks result in higher monthly rent income and lower tenant turnover. In some cases, recovering the initial capital outlay from these use cases can be accomplished in the 2nd year.

Q: How are these environments protected from hackers?

A: Security can be added in various layers of the overall system in order to combat hackers. Each layer has its own set of potential solutions that suppliers can implement to provide secure barriers against hackers. The layers include manufacturing, embedded (device) security, protocol security, and cloud security. Silicon Labs has authored several whitepapers on this topic: Preparing for Next-Gen Cyber Attacks on IoT and Embedded Security is on the Move in IoT.

In brief, some of the countermeasures against hackers are secure identification measures like embedded Root of Trust (RoT) and device/user attestation (such as two-step verifications on websites), secure access protected by symmetric and asymmetric keys, and protective measures for secure communications like encryption. There is a long list of possible countermeasures, so this is why modeling the threats in your own environment is the first step to choosing the right solutions.

Q: It seem that the main focus is on commercial but what key solutions you have for residential especially in developing countries?

A: Commercial building investments tend to focus much more on operational and energy efficiency, whereas residential is more focused on comfort and convenience. Increased security is a goal that is shared by both sides. However, these vertically segmented trends of the past are starting to break down as "work from home" has resulted in accelerated attention on home energy efficiency, as one example. Smart thermostats and more connected HVAC units are being adopted by homeowners and builders at an astonishing rate. (Even during COVID, residential business for HVAC suppliers actually increased). Also, in the home, "do it yourself" security is becoming more popular with alarm systems and cameras like Ring and Arlo. In summary, comfort, convenience, security, and energy efficiency are the most popular areas for IoT in the home.

Q: What about BGM220S?

A: More information is available on the Silicon Labs website: https://www.silabs.com/wireless/bluetooth/efr32bg22-series-2-modules.

Q: Considering a Mesh topology, what type of network would you use for a 25-30 Security Camera Wireless platform for campus parking lot and Security Guard buildings?

A: Mesh network do not have bandwidth to stream video if that is what you are looking for but ETH, Wi-Fi or cellular would be better technologies. However, if the use case is just command and control then mesh networking could be used. Suitable mesh networking technologies for configuration or monitoring could be Bluetooth mesh or 15.4 based technologies.

Q: NO answer about thread VS Bluetooth. Only Bluetooth have SIP now.

A: A couple of key considerations (not all) are: Thread gives you IPv6 today but does not define application layer which is key if you want to have multi-vendor interoperability. Bluetooth mesh does not give you IPv6 (today) but does define the application layer (on/off, dimming, sensor data) which will simplify making interoperable devices between multiple vendors.

Q: Don't Zigbee ad Thread have bandwidth issues when it comes to dense networks, especially chatty networks such as real-time sensing?

A: I think all mesh technologies can have challenges with chatty devices, but chatty can be a very relative concept (1 messages/sec vs. 100messages/sec), so there might not be one answer for your question.

Q: What standards, running over BT mesh, are emerging for building automation (i.e., for allowing interoperability across equipment providers)?

A: We see a lot of traction in commercial lighting definitely because with Bluetooth mesh you can use phones for setup and configuration, gateway is not mandatory and Bluetooth beaconing enables location aware applications. For the reasons mentioned above we also see traction for Bluetooth mesh in HVAC and application layer standardization is also under way.

Q: What applications\services do you see that might be best served using 802.11 2.4GHZ & 5GHZ?

A: Wi-Fi has two clear benefits which are throughput and easily available infrastructure (APs). The clear use cases for Wi-Fi in smart buildings are network access for PC, phones and tablets as well security cameras as they need the high throughput.

Other applications can of course use Wi-Fi as well, but if you need low power and years of operation on batteries or large scale (like lighting) Wi-Fi will struggle to address those and Bluetooth or 15.4 based technologies are better options.

Q: Why is home automation struggling to gain new customers considering the history of the concept?

A: For the technology experts and early adopters, it is not new; however, for others, it is. Home Automation still has a long future ahead. Many homeowners have avoided adoption of IoT devices due to cost, complexity and security concerns. All of these aspects are being addressed by home automation providers - The cost of many products has significant decreased over the past 5 years, companies and alliances are working together to create simpler technology that is interoperable and easier to install, and security is shifting from product differentiator to requirement. Market research shows that this market segment will continue to grow at double-digit annual growth for the next 5-10 years and beyond.

Q: What is the balance between private vs. public vs. hybrid cloud services in the consolidation and delivery of data and analytics to end users?

A: The share on on-premise data processing is declining – whilst the clear global trends towards cloud and edge computing continue. There are pros and cons for each approach. For example, utilising the cloud as the primary source of system analytics enables more complex and predictive 'big data' analytics to be performed off-site. On the other hand, hybrid solutions offer low-latency and greater protection from cyberattacks while offloading the infrastructure, which has been key during this pandemic. The specific considerations for each vertical can vary too, for example, end-users in the government vertical view security as their biggest cloud computing challenge, where other verticals may see staff knowledge/education as the bigger challenge.

Regarding a clear 'public versus private' debate, it becomes increasingly difficult for the industry to determine the share of these frameworks, especially as the boundary between private and public clouds remains somehow blurry and the choice between the two can vary from a vertical/industry to another. However, Omdia believes that hybrid solutions are growing much faster than either purely public or private solutions right now. Meanwhile, Omdia projects that edge computing architectures will represent the fastest growing data processing framework over the forecast period (18% CAGR between 2018-2023), especially edge architecture with edge devices embedded in equipment.

Q: In the most general case can you describe when you would choose Bluetooth Mesh, Z wave, Zigbee, or Thread. Perhaps you could elaborate cost, coverage, etc.

A: Sometimes the ecosystem you want to connect to dictates the technology solution for you, but a few points to consider: Z-wave is <1GHz so it penetrates walls and floor better than 2.4GHz solutions. Bluetooth obviously has the benefit of phone connectivity for example for setup. Z-Wave is typically used in home security applications and Zigbee for smart home applications, because gateways like Amazon Echo's support the technology.

Q: Are there any concrete examples of Low Energy Bluetooth wireless UARTs? There is nothing found on your website and Simplicity Studio.

A: Yes, there are. Here are a couple of resources to look at: https://docs.silabs.com/bluetooth/2.13/code-examples/applications/spp-serial-port-profile-over-ble and https://www.silabs.com/wireless/xpress.

Q: How are cars using Bluetooth outside of streaming?

A: The use cases we have seen cover for example: Tire Pressure Monitoring, remote keyless entry, garage door openers and diagnostics.

Q: How is ML standing in this scenario? #smartbuilding

A: Artificial Intelligence and Machine Learning are used in smart buildings today across security, energy management, and more. ML is in the initial deployment and usage stage, and it is helping by identifying people and situations via sensors, identify faults or anomalies in building equipment, and learning patterns in HVAC/Lighting systems to proactively control them and optimize energy usage and comfort. ML can be implemented in the end nodes, at the edge gateways/servers, or in the cloud. Where ML is implemented depends on the specific use case and system constraints (power, cost, processing, connectivity, etc.).

Q: How is it possible to set the Bluetooth credentials?

A: There's a lot of options for setting up Bluetooth security ranging from the simplest solutions like Bluetooth "Just Works" (no user input) bonding to most advanced scenarios where you provision certificates to the devices to really ensure they are devices manufactured by you. A couple of good resources to look at are:

https://www.bluetooth.com/learn-about-bluetooth/bluetooth-technology/bluetooth-security/ and https://www.bluetooth.com/blog/bluetooth-mesh-security-overview/.

Q: Has there been any movement to track water usage using distributed sensors? This seems to be a growing area of concern for conservation.

A: Absolutely. We at Silicon Labs see a lot of electricity, gas and water metering use cases.

Q: Can you speak about industry adoption of Bluetooth specifically? Its use is high in consumer applications. Has it hit its stride in business applications and smart building applications?

A: We do see a lot of Bluetooth adoption in commercial and industrial applications. It can be simple applications like human-machine interfaces for almost any use case where you either replace a user interface with a smart phone application or replace cables with wireless connectivity. Another example would be for example commercial lighting where Bluetooth mesh is gaining a lot of traction at the moment. The main reason for that is that you can setup and configure the lighting with an applications, the cables between luminaires and sensors can be replaced by wireless connectivity reducing installation costs and the luminaires can act as Bluetooth beacons for location aware applications and same benefits could apply fort other use cases like HVAC.

Q: It was mentioned that Bluetooth/Bluetooth mesh is gaining traction, but if the application uses thousands of devices, Zigbee, Z wave or Thread could be better choices. So does that mean Bluetooth has a small capacity in terms of number of devices? What's the max possible number of devices in Bluetooth network?

A: Not necessarily and the answer always depends on the use case requirements and needs. For example, Bluetooth mesh can scale to thousands of nodes in a network but so can the other technologies you mentioned as well.

One of the key questions when selecting a mesh networking technology is “what are the performance requirements in terms of throughput, latency and messages/second”.

Q: Any plans to use CBRS, 5G, or LTE Unlicensed?

A: CBRS, 5G, and LTE unlicensed are used in smart buildings today. Generally speaking, these technologies are used in one of two use cases:

1) If it is simpler or more reliable to connect the product directly to the cloud than via some other device or gateway. Single, standalone components such as vending machines or embedded motors are one example of a product that might use these technologies to connect to the internet.

2) Also, IoT gateways often use cellular wireless for cloud connectivity, rather than trying to securely connect into the local building IT network. This is preferred by building operators in some cases to avoid the cost and risk of IT integration.

Q: Are you proposing a single wireless infrastructure for multiple services (e.g., lighting, security, access)? What's the layer 2 protocol? Ethernet?

A: Not necessarily although we do see consolidation of protocols and technologies in some applications to simplify things and speed up development. With wireless technologies today you still need to do trade-off for example between low power and high throughput.

Q: What do you see on the horizon for multi-housing? Market Rate Apartments/ Senior Housing/Student Dorms?

A: In the MDU space, there is a trend towards high-tech and low-touch. This offers better comfort and services to tenants, while also increasing efficiency for the building owners. Specifically, the common investment areas are security (access) and energy/climate control. Smart thermostats and HVAC are becoming essential IoT systems for both tenants and operators. Both groups prefer the convenience to remotely monitor/control their HVAC, which opens opportunities to conserve energy. Similarly, smart door locks are enabling simpler control for both tenants and operators. Tenants can control their door lock from their smartphones and remotely allow guest access. Operators can manage tenant keys and package deliveries in an efficient way. There are two of the most popular trends that are starting to take shape in MDU, apartments, and student housing environments.

Q: With increased wireless device density, is Bluetooth mesh a reliable, future-proof protocol?

A: With any Wireless technology you can of course congest the air interface if you transmit a lot - or too much. We've tested Bluetooth mesh in dense environments with other technologies present (Wi-Fi and 15.4 mainly) and it can perform very well but of course you can also congest the air interface for example if you put a thousand of actively transmitting devices in the same space. Bluetooth mesh has a roadmap for which includes new frequencies and PHYs, which can furthermore improve operation in dense environments.

Q: What is your take on cybersecurity?

A: At Silicon Labs, we do take this very seriously and are striving to solve this already at the wireless end nodes. If you want to have a quick look at what we do please go to www.silabs.com/security and feel free to contact us for more in-depth discussions.

Q: What are the top wireless technologies used? Wi-Fi, RF, Z-Wave, others?

A: This really depends on the use case and applications, but in smart buildings we see Wi-Fi, Bluetooth and 15.4 mostly.

Q: The emphasis appears to be on energy efficiency. What is the outlook for monitoring building health: air quality, water conservation, fire/smoke detection?

A: Yes, monitoring of building health is another growth area. More environmental sensors beyond the traditional temperature/humidity sensor are being added to buildings. These sensors are enabling smart dampers for better air flow and outdoor air exchange, connected equipment for predictive maintenance, flow meters for leak detection, gas sensors for air particle detection, and much more. Fire and smoke detection have always been connected, but we are seeing more wireless connectivity with long range wireless and 2.4GHz Bluetooth for an installer/operator interface. All three application - energy management, building health monitoring, and fire safety - are all adding more connectivity and digital capability.

Q: Is there a breakdown of the wireless protocols in the devices delivered in 2019? E.g., BT, Zigbee, Z-wave, etc.

A: Omdia does have such data available so feel free to contact them.

Q: Can you talk about Bluetooth vs NB-IOT vs LoRa vs X?

A: Unfortunately, we do not have time for that in this webinar, but we are happy to talk it with offline if you want to reach out to us. Generally, Bluetooth works great for applications that need phone connectivity or star and mesh networks with relatively short range (~10-200 meters). NB-IoT and LoRa are more for start network when you need miles of range such as long-range outdoor asset tracking. NB-IoT relies on operator build infrastructure and subscription fees but with LoRa you basically build and maintain your own network but do not have subscription fees.

Q: Is Bluetooth mesh focused on mains powered units as repeaters, battery powered units as repeaters, or both?

A: You can do both mains powered and low power devices but the core network must be mains powered as the core network is listening (RX) constantly which consumes milliamps rather than microamps. The low power nodes sleep most of the time and only send or receive when necessary and they can be in the microamp range and battery powered.

Q: What is the role of regulation in the promotion of wireless building management?

A: The promotion of wireless connectivity in buildings is mostly driven by the technology alliances (Zigbee, Thread, KNX, etc.). Regulation by those alliances helps in establishing baseline quality of the technology for product OEMs to integrate and apply in the real-world application; therefore, it is very important for successful deployments and user experience. Looking forward, there is a market opportunity for these alliances, technology suppliers, and product OEMs to help educate the rest of the value chain on the benefits of wireless. I expect that to be a major trend in the market over the next few years. Regulations on wireless features and capability will also be welcomed by adjacent regulations on aspects of security and energy efficiency, for example.

Q: What is the status of Bluetooth Mesh and what do you see as its long-term role?

A: The technology has been available since mid 2017 the first commercial applications started rolling out in 2019. We've seen accelerated roll outs in 2020 as more and more solutions are available. The technology will continue to evolve and new enhancements will be added in 2021 and 2022 to address ease of installation, additional security features and enhanced performance which is what we see demand for.