

CAN2GO for Building Automation Systems

The Wireless Controller

Smart buildings' strengths and weaknesses

Building automation has a proven track record when it comes to energy efficiency and savings. Studies show consistent energy savings of 5% to 15%, with peaks reaching 30%. It provides a good return on investment and is a sustainable solution for energy consumption in commercial buildings, which accounts for 15% to 18% of energy consumption in industrialized countries.

Wires, why?

Unfortunately, most installations rely too much on wiring, increasing the costs of labor and construction materials. Wiring also complicates relocation and retrofitting, which can be troublesome when systems are replaced and when building configuration changes (i.e.: during renovations, office reorganization, etc).

Introducing wireless

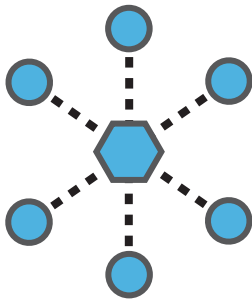
Wireless solutions are available for integrators wanting to cut installation time and save on construction material. A few years ago, German company EnOcean developed an energy harvesting technology to create wireless and battery-less end-devices. Today, EnOcean sensors, thermostats and light switches are available, ideal for simple commands and requiring no maintenance. Another technology, this time an open communication protocol called Zigbee, is gradually entering the market. Although Zigbee end-devices need a battery or other power source to function, they support the more complex communication and robust networking capabilities that are needed for smart buildings. Clearly, both technologies have merits, but industry adoption is slow.



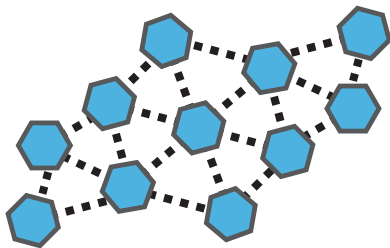
Point to point



Point to multi-point



Mesh network



Mesh networks are more robust, reliable and adaptable than other network types.

The interoperability headache

There is a reason EnOcean, Zigbee and other wireless technologies have yet to really takeover the building automation market: interoperability. Some rely on proprietary standards while others use open ones. Some use point-to-point or point-to-multipoint communication, while others offer mesh networking capabilities. Going beyond the comparative, how do you integrate wireless devices with wired I/O controllers? These new technologies and end-devices have to be integrated within one coherent and efficient building automation system, and right now, that isn't the case.

A wireless controller to bridge the gaps

What the industry needs is a controller capable of managing the up and coming wireless technologies, while maintaining the level of control and seamlessness of proven building automation systems.

Of course, such a solution implies meeting various criteria and choosing the proper technological approach. What network structure would the wireless controller use? How would it manage wired and wireless end-devices using different protocols? Interoperability must not mean vulnerability; the controller has to be secure. Finally, above theory, are the foreseen advantages true when the controller is put in place?

Selecting the proper network type

In the wireless world, there are three main network structure types: point-to-point, point-to-multipoint and mesh. For building automation, where nodes are numerous, point-to-point is unthinkable for a controller. Point-to-multipoint offers interesting possibilities, but is still linear and flawed for scalability. If a central node stops functioning, a point-to-multipoint network just falls apart. The mesh network is the model offering the most versatility and robustness. In it, all nodes are emitters, receivers and repeaters. Therefore, if one node is removed from the network, the remaining ones will continue communicating with each other and use each other to reach remotely placed units.

On the field, a mesh network also provides serious advantages to integrators. Because it is self-forming (nodes automatically detect their peers) and self-healing (if a node stops working, the remaining nodes will use each other to maintain network integrity), the mesh network can be quickly setup, rearranged and extended. This freedom of use and scalability reduces planning and project managing costs as well as equipment costs (wiring, tools and construction materials).

Accordingly, a wireless controller for building automation should rely on communication technology allowing it to function in a mesh network.

Wired and wireless and inputs and outputs

The next generation of building automation systems will have to integrate wired and wireless end-devices seamlessly. A wireless controller should therefore be able to manage both types of devices to avoid controller duplication. A solution with separate controllers for each device type doesn't make economic sense. Besides unit costs, the increase in installation costs would be a major deterrent. Hence, both wired and wireless inputs and outputs are required on a single controller.

Wired I/Os are limited by physical constraints (from 8 to 14 I/Os on most controller models), but wireless or "virtual" I/Os can almost be added up at will. The wireless controller doesn't have a definite number of I/Os, it can control the number of wireless devices its processing power and communication protocols can support. The ideal controller would offer the regular wired I/Os in sufficient number and the capabilities to manage a large number of wireless I/Os. For a full building automation system, we're talking hundreds, if not thousands of nodes. This will require efficient coding and communication standards.

Integrated control and interoperability

In typical building automation systems (BAS), control comes from a central interface using wired controllers to relay commands. The integration is made at the base of the system and room controllers seldom know what they are doing because they are basically used as wired repeaters. These conventions need to be turned upside down by giving intelligence and autonomy to each wireless controller. This will enable micro control in a macro infrastructure. Also, if one controller was separated from the network it could still control lighting/HVAC by itself, acting as a control loop. This would be useful during retrofit, renovations and in buildings or compounds where some sections are separated from the rest for aesthetic or functional reasons.

Local in-node control will force the wireless controller to be more polyvalent; it will have to listen, translate, interpret and respond to the wide variety of end-devices it is in charge of. It will need to talk many languages: Zigbee, EnOcean and BACnet or Modbus or LONworks, etc. This is what will allow the integration to be seamless.

How secure is wireless technology in building automation?

Will wireless controllers be in conflict with other wireless technologies found in commercial buildings: wireless phones, cell phones, Bluetooth, other wirelessly linked devices or machinery, etc?

Communication between wireless controllers and end-devices will need to be secure. As imperative will be the communication between controllers, knowing that as messages converge towards the backbone of the system, the number of messages will increase. The wireless controller will have to depend on tested protocols and standards.



One candidate on the horizon

All these criteria and questions are relevant and need to be taken seriously for the smart building industry to evolve. As it stands now, at least one candidate tries to answer them all.

The CAN2GO wireless controller, developed by SCL Elements, has set its sights on those challenges. Using Zigbee and CANopen to communicate with each other, these controllers deploy in a mesh network pattern to provide a flexible, robust and scalable structure.

Security-wise, Zigbee and CANopen have a proven track record. CANopen, originally used in industrial automation settings and processes, is estimated to get an undetected error once every several thousands of years of continuous use. Zigbee, for its part, uses low-power digital radios based on the IEEE 802.15.4 standard for low-power and low data-rate applications such as building automation. Zigbee boasts AES 128 military grade encryption for maximum protection and reliability.

When communicating with end-devices, the CAN2GO uses the 2.4GHz frequency for Zigbee and the 868

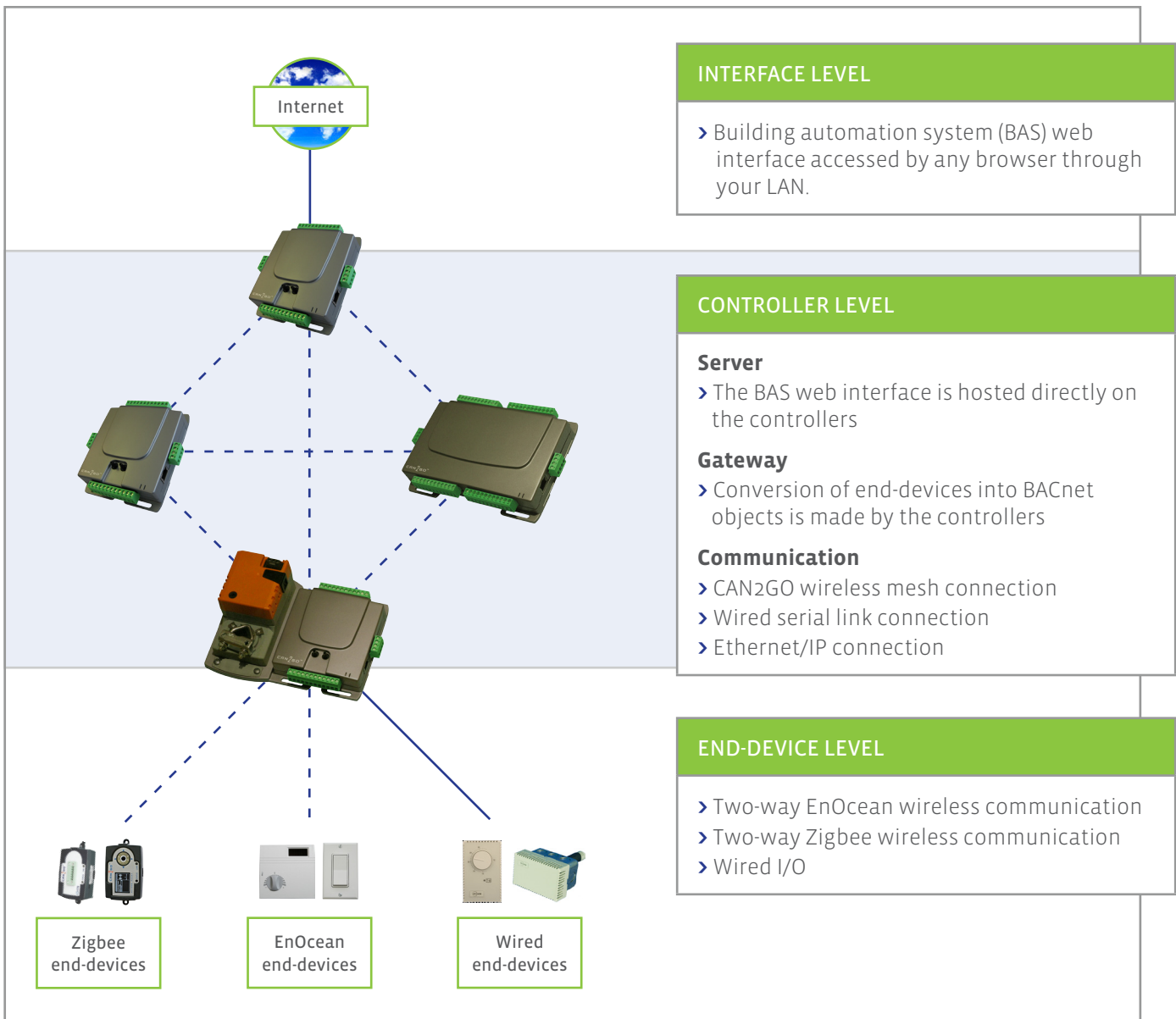
MHz or 315MHz frequencies for EnOcean. For full network integration, it has privileged the open BACnet protocol.

The integration of these languages and protocols is made in-node in each controller for true interoperability. This local intelligence also allows for local autonomous control as well as centralized system control. No software, driver or USB installation package is needed for the units to start working.

In a building, a BACnet IP compatible CAN2GO controller is linked to the central system on each floor. Wireless controllers can then be added at will to cover the field, as they will detect and connect to each other automatically. In a room, the wireless controller has wired and wireless I/Os to control both types of end-devices. Using application driven programming, as well as exploiting the potential of the Zigbee and CANopen protocols, each controller can manage thousands of virtual I/Os.

Fixing the interoperability difficulties of new wireless end-devices while greatly reducing installation costs and increasing system flexibility is a daunting task. The CAN2GO wireless controller is positioning itself to do the job.

CAN2GO BACnet building automation network structure



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