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Hyperaware smart buildings
save energy & increase productivity

*The convergence of IoT and building automation technologies is creating smart spaces that make workplaces safer, healthier and happier. Where IoT sensors can be considered as the eyes and ears of a smart building, it has recently been possible to join building data with context. The result is 'hyperaware' smart buildings – instrumented structures in which applications are mindful of the contextual status of the environment, occupants, energy requirements, service needs, security and safety. **Graham Martin, Chairman & CEO at industry association, the EnOcean Alliance** explains how such buildings promise energy savings alongside other substantial productivity benefits.*

Future growth of smart buildings will be driven by economic, as well as human factors. According to a 2015 report on IoT potential by consulting & research firm, McKinsey: human activity monitoring is expected to increase productivity by 5%; human productivity organisational redesign is expected to yield 3-4% productivity; augmented reality is expected to yield 10% productivity gains; and IoT should yield a 20-50% reduction in building security costs. Most significantly, energy monitoring is predicted to reduce costs by 20%. Adopting building automation and IoT-based solutions can reduce energy costs themselves through a combination of multifunctional wireless sensor networks, occupant-centric sensors and controls, advanced sub-metering and adaptive, autonomous controls.

Such savings are even more significant because these percentages are multiples of large numbers. Commercial real estate services company, Jones Lang LaSalle have observed that, in general, real estate tenants spend approximately $3 per square foot per year for utilities, $30 for rent and $300 for payroll. This '3-30-300' rule of thumb makes clear that the greatest financial benefits can be obtained by making people more productive and efficient. But pivoting toward human productivity optimisation also improves space efficiency, which in turn reduces both real estate footprint and energy costs.

Energy efficiency programmes initially led the change to smart spaces because this is one of the specialties of building automation vendors. Moving on to human productivity requires a

The convergence of IoT & building automation technologies is creating 'hyperaware' smart spaces – instrumented structures mindful of the contextual status of the environment, occupants, energy requirements, service needs, security & safety.

the rich variety of building automation and control solutions. Two of the major players representing each side of this convergence are doing exactly that. The EnOcean ecosystem, which represents innovative ISO standard wireless and energy harvesting technologies, has recently joined forces with the unified cohort of infrastructure, security and location technology partners represented by networking giant, Aruba, a Hewlett Packard Enterprise company.

EnOcean is the creator of the ISO/IEC 14543-3-10/11 energy harvesting 800/900MHz wireless standard. More than 400 EnOcean Alliance vendors build facility monitoring and control systems using this standard. The sensors require no batteries for power, and no wires to communicate, making them economical to deploy and maintenance-free. Sensors and switches save on the need for batteries by harvesting energy either from their surroundings or generating it mechanically. There is the further bonus in not having to replace batteries or dispose of them safely.

When pressing a switch, for example, an electro-mechanical energy converter is activated and uses this movement to generate energy for a telegram. This telegram can turn on/off household appliances, a light or create different scenes for LED lights. The same functionality can be used for a kinetic window contact, which registers if a window is open or closed, or a self-powered water sensor, where the energy converter is activated when water gets in touch with the swelling material on the sensor's base.

second pivot towards vendors and applications that can create cognitively-aware digital workplaces. IoT can change the way in which machines and humans interact to make people more productive. The necessary frictionless machine-human interchanges must overcome the complexities of computing, security and communications systems needed to accomplish the task. The industry is nevertheless finding new ways to simplify human interaction with complex machine-based systems.

Why is hyper-awareness important?

Without context, data alone cannot provide the ability to respond to occupants and their environment. The richer the data and context, the more adaptive the building. So, while smart buildings have limited understanding, hyperaware buildings with full instrumentation are future proof.

To make this happen, there needs to be a convergence of two worlds that are conventionally separate: data-focused building automation and control on one hand, and IT on the other, where intelligent networks and big data can add the context. The key is to provide an interface between intelligent, structured, secure IT and largely untrusted building automation.

For example, in an automated room reservation system, identity, presence, calendar and location are needed to know who is present, when meetings can start, what should be presented, if social distancing is being met, when a room can be released, the path to the closest exit, and many other aspects of

intelligence that can boost productivity or save cost. In this context, the network access point provides a platform, with various interfaces for occupancy, distancing, rest-room materials and desk usage sensors, as well as actuators, smart lighting systems, personal area network radios for heating, air quality and access control, and other energy-harvesting devices. These gateways extend the reach of monitoring and digital twin applications into legacy infrastructure, yielding deeper visibility and insights, without incurring the cost of ripping-and-replacing installed devices.

Bringing it together

To make these things happen, there needs to be a bridge between complex IT systems and

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EnOcean and Aruba
The secure connection of IoT and IT

Other sensors from the EnOcean Alliance can harvest energy from ambient light. Even at low levels of 200 lux or less, tiny solar cells can harvest this source of energy for a broad range of battery-less sensors. This includes temperature sensors, CO_2 sensors, occupancy sensors, solar-powered window contacts or humidity sensors.

A third option is to garner energy from ambient heat. A temperature difference of just 2°C delivers enough energy for electronic devices, enabled by the combination of a DC/DC converter and a Peltier element. This harvesting technology operates self-powered heating valves, for example, which use the difference in temperature between the heating radiator and the environment to provide energy for changes in stroke, as well as for wireless communication with a solar-powered room controller.

RS-232, RS-485, ModBus, LONWORKS, BACnet, KNX and DALI control systems and devices are supported via locally powered, EnOcean-enabled gateways. These gateways extend the reach of monitoring and digital twin applications into legacy infrastructure, yielding deeper visibility and insights without incurring the cost of ripping-and-replacing installed devices.

EnOcean and Aruba have partnered to allow Aruba Wi-Fi 5 and Wi-Fi 6 access points equipped with EnOcean 800/900MHz USB adapters, and using Aruba OS version 8.7 or later, to communicate bi-directionally with ISO/IEC 14543-3-10/11 compatible devices. With literally thousands of such devices and gateways from which to choose, virtually any smart building monitoring application can be

Feeding Wi-Fi™ Access Points the Sensor Data They Crave
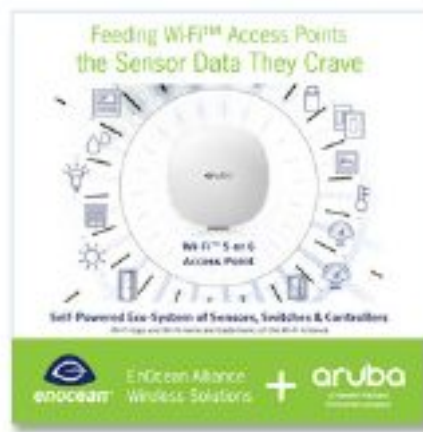
accommodated. The joint solution can be retrofitted to existing Aruba deployments, extending the value of sunk capital investments.

IoT platforms for device data

Aruba access points stream EnOcean telemetry data in real time via Protobuf (protocol buffers: language- and platform-neutral mechanisms for serializing structured data for use in communications protocols, data storage and more) to monitoring applications via a secure WebSocket connection. Applications can be on-premise, or in a public or private cloud. The EnOcean Alliance includes software application vendors, as well as device vendors, and ensures interoperability between both.

By securely interfacing those IoT devices with new and existing Aruba Wi-Fi 5 and Wi-Fi 6 Access Points via a plug-in 800/900MHz radio, building control and business applications can become hyperaware of their operating environments. This information can be used to better model cloud-based digital twins, and to

optimise human activity monitoring, organisational redesign, augmented reality, human productivity, and occupant health and safety.

The ideal solution

The goal is to make hyperawareness simple and inexpensive, and that is what the collaboration between Aruba and the EnOcean Alliance achieves. The simplicity of the solution makes it possible for facilities, IT and other managers to easily add services, collecting data from 'peel and stick' sensors across an entire building without pulling any new cables, nor ever having to change a battery.

Fast adoption of these solutions is facilitated, for example, by the introduction of starter kits for use in European or North American markets. Used in conjunction with a separately purchased Aruba access point, the new IoT starter kits include an EnOcean EMSIx multisensor, an Easyfit wireless switch, an EnOcean USB stick and demonstration software.

The EMSIx multisensor combines temperature, humidity, light level, acceleration and magnet contact sensors, making it well suited for a variety of IoT and smart building applications. An integrated NFC (near field communication) interface enables the multisensor to be configured and commissioned quickly and easily. In parallel, wireless Easyfit 'battery-free by EnOcean' energy harvesting switches can be placed anywhere lighting control is needed, including architecturally sensitive areas that are difficult to wire, such as glass, marble, reinforced concrete and room dividers

In this way, it delivers a quick and easy start to IoT applications with self-powered EnOcean devices. Customers only need to attach the included sensor and switch where they want to collect data and stick the USB device into their Aruba access point. The included USB stick opens the world to 5,000 products from members of the EnOcean Alliance. You could call it 'Hyperaware Buildings on a Stick'.

Wireless, battery-free 'peel and stick' EnOcean sensors & energy harvesting switches can be easily combined with Aruba access points & plug-in USB radios to create 'Hyperaware Buildings on a Stick'.