Smart Building Integration

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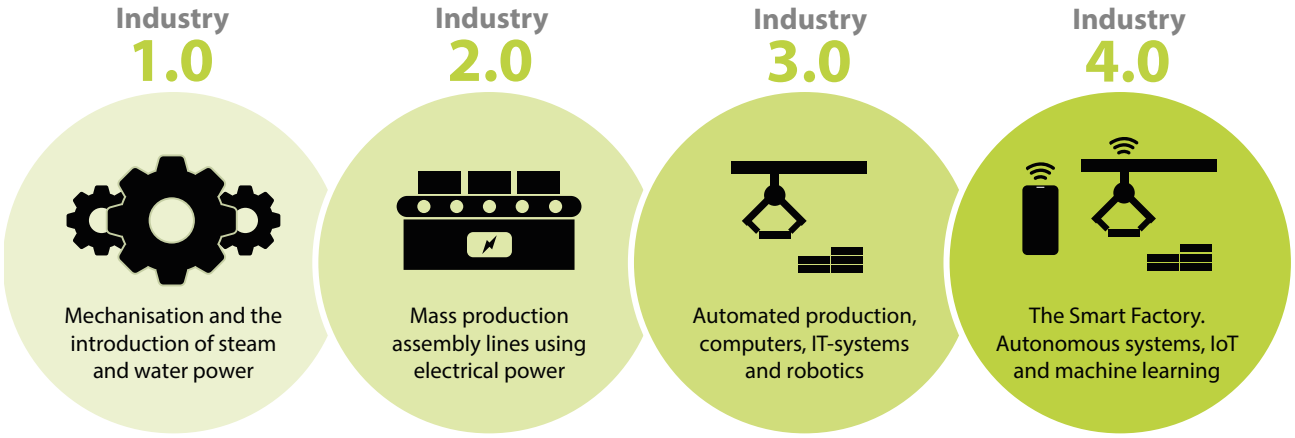
Section 16

NEW for V5

Smart Building Integration

We have been discussing Smart Buildings, Connected Spaces and Intelligent Buildings since the 1990s and it's still not an everyday occurrence. We are still constructing and using buildings employing a process that has been with us since the 1960s, which has caused resistance to new technology at times.

Things are starting change as organisations are striving to be more sustainable and energy efficient. And with the emergence of 'Industry 4.0' there is another driver towards a smart future.



This will lead to higher data rates at the edge, higher speed data logging and optimisation of both equipment and maintenance data. It is also going to need a change in mindset regarding structured cabling design in the future.

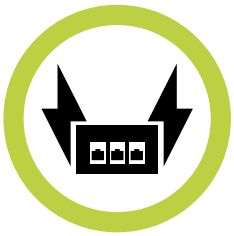
These developments will find their way back into commercial building automation as well as public buildings such as schools and hospitals; a fact that is backed by a significant move towards IP in place of the traditional Fieldbus protocols such as MODbus, HART and Interbus etc.

The global factory automation and industrial control system market was valued at USD 194.67 billion in 2020, and it is expected to reach USD 339.56 billion by 2026, registering a CAGR of approximately 9% during the forecast period (2021-2026).

In another forecast the value of the Building Automation market for 'Smart Technology' was going to double over the next 6 years.

Enabling Technology

There have been technology and standards developments in the last couple of years that will have an impact on the pace at which Smart Building Technology will be deployed in the future, those being:



Remote Powering & Power over Ethernet

The latest iteration of Power over Ethernet (PoE) - IEEE802.3bt - now allows for much greater power to be delivered across all four pairs (4PPoE) whilst still accommodating the earlier versions of 2 pair PoE covered under IEEE802.3af and 802.3at.

Class Number[1]	Input Power to Powered Device (watts)[1]	Output Power from Power Sourcing Equipment (watts)	Powered Device Type	IEEE Standard[2]
0	12.95	15.4	1	802.3af (2-pair PoE)
1	3.84	4	1	
2	6.49	7	1	
3	12.95	15.4	1	
4	25.5	30	2	802.3at (PoE+)
5	40	45	3	802.3bt (4-pair PoE, 4PPoE, PoE++)
6	51	60	3	
7	62	75	4	802.3bt (higher-power PoE)
8	73	90	4	

1. *These class numbers and wattages are shown on the MicroScanner PoE display. Note that PoE sources do not always meet the wattage specification for their class.*
2. *The tester can identify two non-standard types of PoE—PoH (Power over HDBaseT™) and UPoE (Universal Power over Ethernet)—when those sources supply 30 W or less over two pairs.*

It is estimated that the global market for all forms of PoE will be worth $2Bn in 2025 and will continue to grow at a minimum of 15% CAGR.

WiFi 6

IEEE 802.3ax is an upgrade on WiFi 5 which was a massive leap forward in wireless technology. The IEEE and the WiFi Alliance wanted to make several improvements focussed on its performance under 'typical' conditions rather than the previous model, which was to look at data rates under 'perfect' conditions. One analogy describes this update as being a little like adding more lanes to the motorway as well as dedicated bus and carpool lanes to free up the traffic flow and reduce congestion.

Unlike previous models where devices competed with each other, with the additional ability to be able to use both the 2.4GHz and 5GHz bands there is no contention as each device is simultaneously scheduled to transmit data in parallel.

WiFi 6 has also seen enhancements with an operating mode for low-power, low-bandwidth devices such as sensors, automation, and medical devices. This mode separates these devices into a 20MHz only channel operating in either the 2.4GHz or 5GHz bands and removes them from interfering with latency sensitive traffic.

Standards – BS EN50173-6/IOS11801-6 – Distributed Building Services

Rather than the 18.3m square cell used the TIA TSB162-A, Cenelec & ISO Standards have adopted a hexagonal cell with a maximum radius of 12m, which is much smaller. It also places the access point at the centre of the cell rather than it being possible to be sited at any point within the square cell.

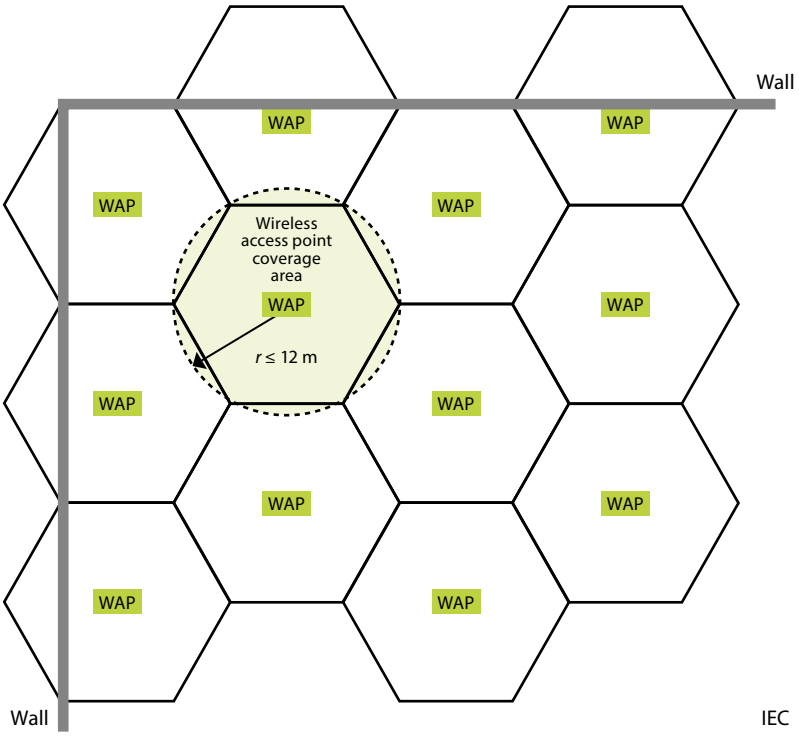
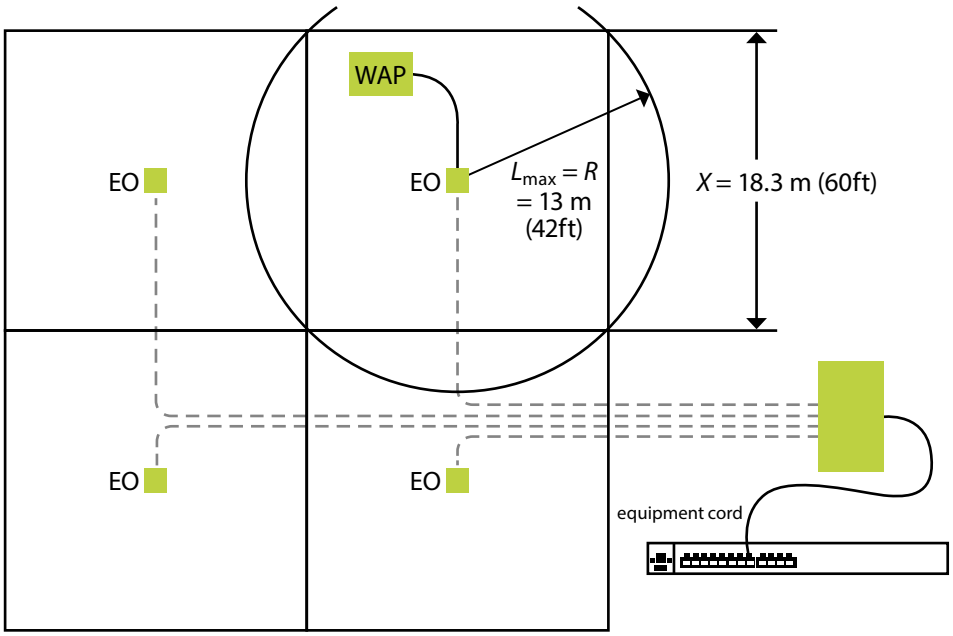


Figure A.1 – Wireless application coverage area grid

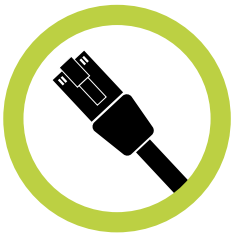


Typical Uniform Coverage Area Grid Pattern

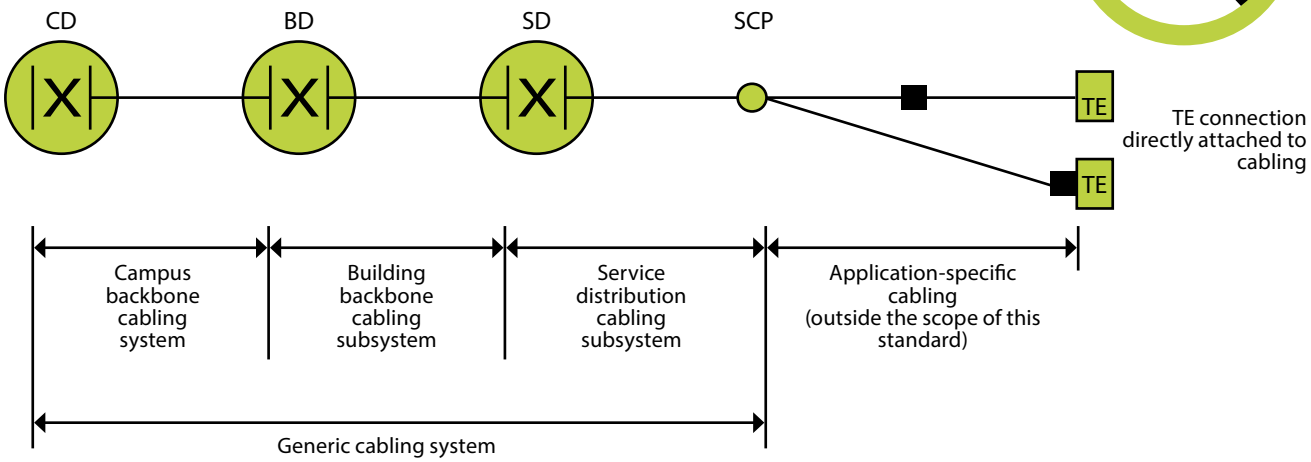
Cenelec/ISO and TIA TSB162

Further to this, BS EN50174-2 underwent changes in 2018 and included a completely new clause and annex, which covered specific guidelines for designing installations for remote powering and any potential thermal impact of High Power PoE. Clause 12 looks at installation best practices in support of BS EN50173-6.

MPTL – Modular Plug Terminated Links



With the publication of BS EN50173-6, it recognised the requirement for IP enabled devices to be directly attached to the horizontal cabling.



Whilst field terminated RJ45 plugs have become commonplace, one last piece of the jigsaw was missing; an effective way of testing the link, as previous test models would ignore the value of the RJ45 plug.

The industry now has tests for MPTL terminations, which has been ratified by TIA, ISO, Cenelec, IEC and EIA. This test method requires the use of a Patch Cord test head at the remote end to ensure the value of the RJ45 termination is included in the result.

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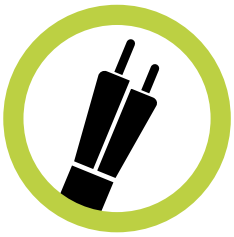
Future Enabler – Single Pair Ethernet



In 2016 the IEEE put together an 802.3 working group to discuss a call for interest in 10Mb Single Twisted Pair Ethernet. The initial meeting predominately included companies from Industrial Automation and Automotive companies. The intention was to explore the market needs and solution requirements along with the target markets, their size and potential before looking at the technical feasibility of a solution.

10Mbs Single Twisted Pair Ethernet addresses most Fieldbus applications up to 1200m. Furthermore, many devices require power and this can be easily covered by the currently proposed cables, the majority of which will be based on a larger conductor size between 18-24AWG dependent upon distance, and primarily of a screened construction.

Building Automation, whilst not part of the original call for interest has a very similar set of issues and requirements. There is already a transition underway with things like BACnet IP, however there is also a desire to converge on one network type and move away from proprietary protocols.

Power will be delivered in a similar way to PoE, however it is called Power over Data Line (PoDL, pronounced "poodle"). There are 6 PoDL power classes for 10Mbs SPE applications, up to 52W. There are a number of factors that affect the power delivery distance and level of power:

- Power class
- Conductor size
- Number of connections

Please Note: SPE is not a replacement for 4 pair Ethernet IT Networks. It is a totally new system to replace Fieldbus and other Automation based networks in the Industrial & Building Automation as well as the Automotive sectors. The ability of 4 pair cable to support four SPE links simultaneously is still under evaluation by the cabling standards bodies.

Full details of these Enablers can be found in a series of whitepapers on the Excel website:

https://excel-networking.com/downloads/whitepapers

Example Applications

Conventional smart buildings saw a wide range of applications taking advantage of these developments, including but not limited to:

- Lighting systems
- BMS systems
- IP CCTV
- Access Control

In today's society there are a whole range of sensors that communicate with AI, which are developed and installed into everyday objects.

These now fall under new colloquialisms such as:

- **Indoor Environmental Quality Services** – Monitor air/natural lighting/temperature within a premises in order to maintain a cordial environment.
- **Connected Lighting** – Sensors in lighting systems which can now communicate with meeting room booking software and BMS via SNMP.
- **Smart Surveillance** – Facial recognition protocols from the parking lot to the office working in conjunction with BMS and Access Control.
- **Building Energy Management** – From consumption through to efficiency of use and even to energy provider choice autonomously.

All of the above can communicate at a software level with each other and can be monitored, maintained and even serviced remotely leading to:

- Improved occupant comfort
- Reduced energy consumption and costs
- Improved health and wellbeing for employees and visitors
- Improved productivity and operational efficiency
- Reduced carbon footprint

There is a US company that has launched a PoE driven system that delivers an intelligent UV Lighting system to disinfect office spaces. It monitors spaces within the office and when they are not in use it provides a monitored delivery of UV lighting depending on how heavy the use was to kill off any germs that might be present.

An AV over IP application for Video Conferencing is based upon a smaller PoE driven platform, rather than the large monitors we have come used to, this is based upon multiple smaller screens that use a maximum of 25W PoE. Not only is it more cost effective on a CAPEX as the system can be sized to the room or the organisation's needs, but it is also far more sustainable as it uses less power to run.

The technology is now here to make Smart Buildings a reality however as already stated we may need to change part of our mindset regarding Structured Cabling Design. The use of Service Concentration Points (SCP) will become more common, whilst the use of the Consolidation Point (CP) in a pure data install will remain the same if not reduce. Zone Cabling typically found in data centres and POL (Passive Optical LAN) will become more common in Enterprise/Commercial installations in support of distributed edge switching which will be employed in Smart Building installations. Therefore, in the future expect to see more hybrid cabling designs that are a combination of POL and traditional infrastructure.

Excel Networking is ideally positioned with an industry leading cabling solution offering both the traditional and POL options to take advantage of the exciting opportunity presented by Smart Building Integration.

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