All for one and
one for all

Aginode's Rachid Ait Ben Ali explains how to build and manage converged networks the smart way

▶ A converged network integrates multiple communication services on to a single infrastructure. Discrete systems with limited functionality and higher costs are abandoned in favour of running everything over a single internet protocol (IP) backbone. IP networks can facilitate seamless integration and communication between different types of devices and platforms, enhancing overall functionality and user experience, while bringing significant cost and operational benefits.

WHAT'S THE USE?
Such a solution is especially useful for building management. Integrating various building management systems (BMS) such as lighting, security, access control and heating, ventilation and air conditioning (HVAC) on to a single network simplifies overall infrastructure and lowers cabling and hardware requirements, while enhancing flexibility, productivity and operational savings. This is often referred to as operational technology (OT) as opposed to the more familiar information technology (IT).

Not long ago, we were still merging cabled voice and data systems. Later Wi-Fi was added, but building services were still in their own silos. Now, as IP and Ethernet become ubiquitous, everyt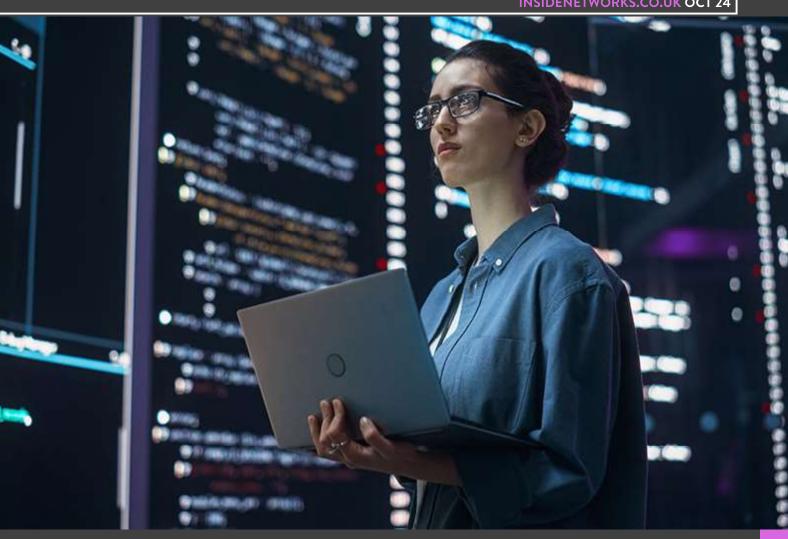hing across both IT and OT is being merged, which is expected to be significantly facilitated by developments in new technologies such as Single Pair Ethernet (SPE) cabling. SPE supports an unprecedented number of devices, including countless internet of things (IoT) sensors and actuators, combining them into single systems.

ADVANTAGES OF CONVERGENCE
First, let's take a closer look at the benefits of transmitting voice, video, data and other services, including building monitoring and management, over a single network using IP technology. This unification simplifies the overall network architecture and reduces the complexity associated with maintaining multiple network types. IP-based networks are also inherently scalable. They can easily be expanded to accommodate traffic growth and new services without extensive, and expensive, hardware changes. This scalability is crucial for businesses that need their network infrastructure to adapt with anticipated growth.

Converged networks optimise bandwidth usage and network resources by sharing equipment, boosting cost-effectiveness, performance and reliability. Organisations can introduce communication and device management methods without overhauling existing infrastructure – an essential feature in today's rapidly evolving

technological landscape. Additionally, there are substantial benefits for both employees and management, as a more efficient system creates a better working environment. Research indicates that one of the most significant advantages of network convergence – which makes smart buildings possible – is a marked improvement in productivity.

KEEP IT SIMPLE

Reducing the need for separate networks and realising single platform unification lowers costs associated with equipment, cabling, monitoring and maintenance. Consolidation leads to significant cost savings over time.

Managing a single network infrastructure is far simpler and more cost-effective than dealing with multiple discrete systems. Network administrators can oversee and maintain networks more efficiently, which reduces operational costs and improves troubleshooting and issue management response times. Network convergence also significantly enhances energy efficiency and sustainability by enabling all equipment within the system to communicate seamlessly. This interconnectedness provides better insight into and control over electrical consumption, leading to improved efficiency and a reduced carbon footprint.

With more people working from home, there is ongoing discussion about the necessity of traditional office spaces. While offices are still needed, the shift towards a more flexible working environment demands that buildings themselves become more adaptable. Managing workspaces efficiently, effectively and securely requires knowing who is in the building – and where they are. Even with a reduced office size, the benefits of automation and convergence in managing these spaces remain significant.

MAKING IT HAPPEN

SPE technology has been designed to support high-speed data communication over a single twisted pair of wires. Unlike traditional Ethernet, which typically uses four pairs (eight wires) in a Category 6 or Category 6A cable, SPE simplifies cabling infrastructure by reducing it to a single pair. SPE can support various data rates, including 10Mb/s, 100Mb/s and 1Gb/s, whilst providing power using a single pair version of power over Ethernet (SPoE).

SPE allows for a unified communication infrastructure. Data from various sources including sensors, controllers and actuators can be transmitted over a single network protocol (IP) along with power. Reduced cabling and installation costs make SPE an attractive option for deploying IP networks. Compatibility with existing Ethernet protocols and standards ensures seamless integration with existing networks and devices. Networks can be easily scaled and adapted to new devices and applications.

However, it's important to point out that developing an SPE solution for cost-effective and scalable converged and 'all over IP' networks introduces a few challenges – ensuring reliable data transmission over long distances with minimal signal loss and maintaining compatibility with existing Ethernet standards, for example. You also need to investigate interference and electromagnetic compatibility and ensure robust cybersecurity.

PUT INTO PRACTICE

SPE can be implemented in several ways. One approach involves adding a separate SPE network for OT applications in addition to the standard four-pair network for IT. However, this results in two networks instead of one, leading to extra costs, increased management complexity and inflexibility if the network needs to be modified.

The concept of structured premises cabling aims to provide a single network that supports a wide range of future applications. This requires ensuring that the network can accommodate future OT device requirements, particularly the large number of devices that need to be connected and powered. An alternative approach is to install a single structured cabling system with the flexibility to support these devices. One proposed solution is to run four SPE services over each of the four pairs in a typical LAN cable, thereby multiplying the capacity by a factor of four to accommodate additional devices.

CAREFUL PLANNING

By leveraging a unified IP backbone, organisations can achieve greater

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efficiency, flexibility and cost savings, while maintaining high standards of communication and security. As demand for connected devices continues to grow, SPE is set to become an increasingly important technology for achieving efficient and reliable network convergence. However, ensuring consistent and reliable service quality can be challenging.

Managing network traffic to avoid congestion, ensure optimal performance and resolve issues across all connected devices and systems is essential. Proper network design and management practices can mitigate the risks of congestion and maintain efficient network operations. Implementing quality of service (QoS) mechanisms to maintain high performance, protecting the network from cyberthreats and ensuring secure transmission of sensitive data are also paramount.

With the increasing number of new devices being integrated into systems, managing infrastructure becomes significantly more complex. As we continue down this path, infrastructure management will become increasingly critical. A properly specified and implemented automated infrastructure management (AIM) solution provides a comprehensive record of ports and panels, and maintains effective monitoring of the cabling and device infrastructure, ensuring optimal performance and reliability.

SOLUTION PROVIDER

Key issues in implementing converged networks, all over IP networks and SPE include security vulnerabilities, increased complexity, network congestion potential, compatibility with legacy systems, higher initial set-up costs and the need for specialised expertise to manage and maintain the integrated infrastructure. Each application and location must be mapped and simulated to arrive at the most effective, future ready solution without overspecifying or overpaying! If in doubt, speak to the experts. ∎

RACHID AIT BEN ALI

Rachid Ait Ben Ali has worked in the cable industry for 15 years. After a stint teaching electronics and physics, he joined a French structured cabling brand in 2009 as product manager for racks and copper. He joined Aginode in 2023 as a product solution manager in charge of defining the strategy for smart buildings and data centres.