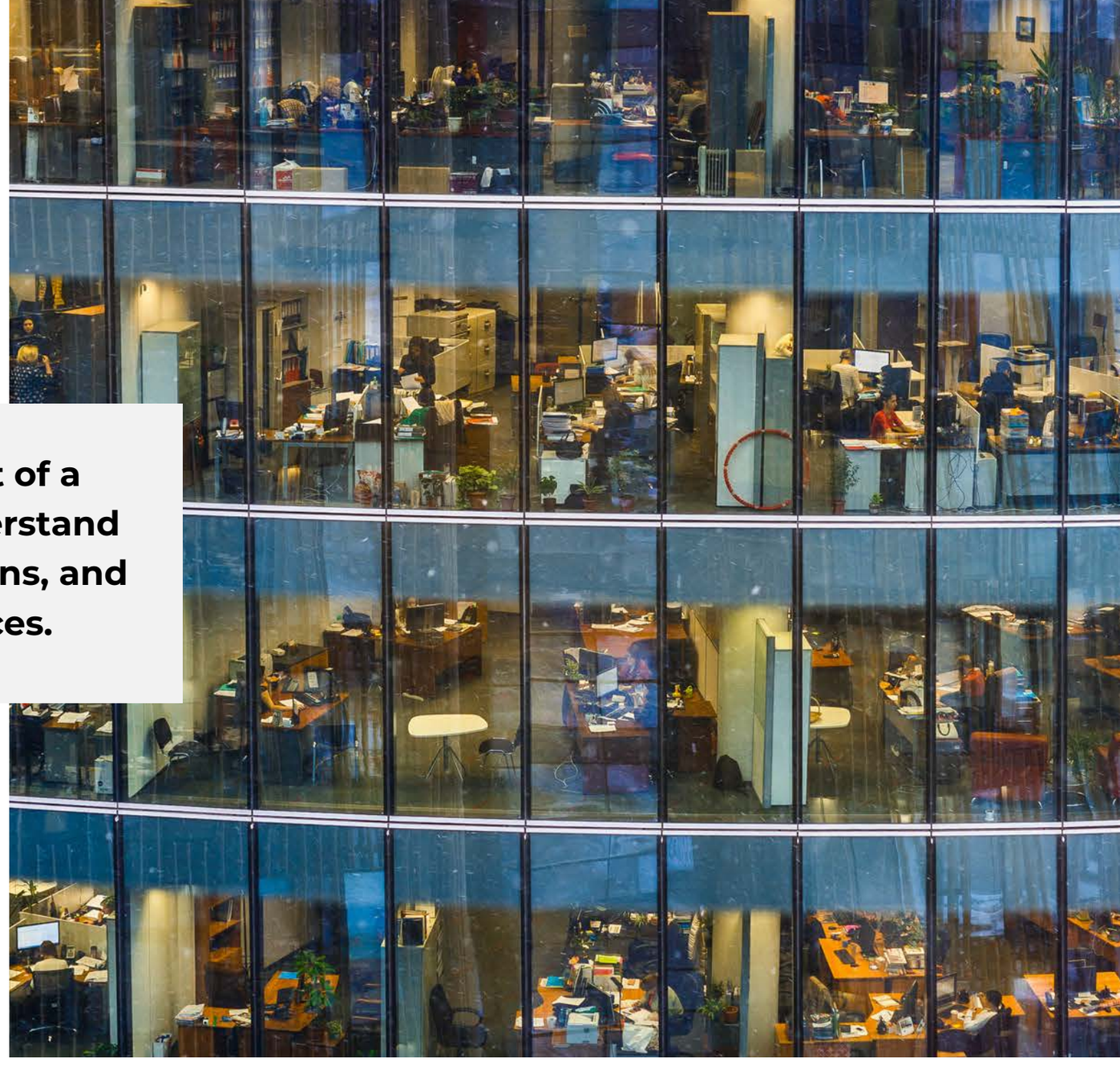
LOGICALIS
Architects of Change

Intelligent Buildings and the Smart Campus

Innovative technology, enhancing efficiency, sustainability, and user experience

Start with the vision, then create a blueprint



To create an Intelligent Building as part of a future Smart Campus, we need to understand what's possible, explore current solutions, and bring together network and data services.

An **Intelligent Building** uses sensors and devices to gather data about the user experience and connects this data over the corporate network. This helps optimise the building for both user experience and sustainability.

New buildings should be designed as Intelligent from the start, following a consistent architecture across the entire estate. **Retrofits** are more challenging because they need to integrate a variety of existing building systems.

A range of **mechanical and electrical** (M&E) equipment will be connected to the network. Initially, these will be closed systems, but over time, the data will be shared across multiple services to achieve complex outcomes.

Physical security systems, which traditionally had their own networks, are now integrated into the corporate network. This not only saves costs, but also enhances the organisation's physical security. In the future, the data from these systems should be available to improve the user experience.

New services aimed at improving the user experience will use the data available on the network to optimise the environment and provide services like wayfinding, space availability, and audio-visual search.

The final solution's complexity and diversity of the possible solutions will require a network of vendors and providers to deliver effectively, and efficiently.

Sustainability must be built into every part of the solution, including the IT system, component sustainability, and the resulting savings.

The foundation for all of these services is an agile and secure network. As with many IT services, security is no longer an option. Adding many previously unconnected systems to the IT infrastructure increases the "attack surface," so mitigating these additional threats is cruicial for the success of Intelligent Buildings. The network also acts as a sensor, providing data such as wireless connections, wayfinding, and beaconing.

What is an Intelligent Building?

> An Intelligent Building integrates advanced Technologies to enhance and optimise the efficiency, comfort, security, and sustainability of the building delivered, using the corporate network.

Attributes

Efficiency

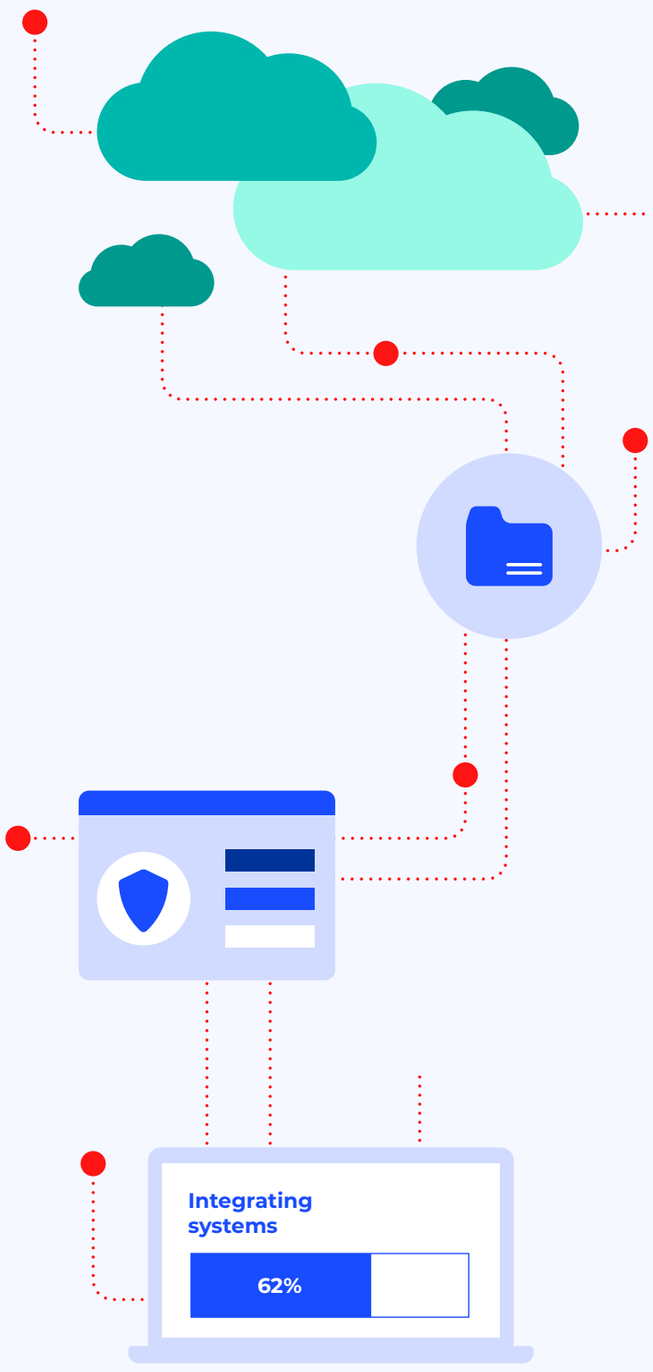
Intelligent Buildings automatically identify issues and use machine learning to operate more smoothly, conserving resources such as energy and space.

Occupant well-being

Intelligent Buildings can also support the health and happiness of occupants by creating environments that are both productive and comfortable.

Connectivity

IT enables seamless communication between diverse building service systems, control interfaces, and personal devices.



System Components

IoT Sensors

Equipped with a network of sensors, Intelligent Buildings collect real-time data on temperature, humidity, occupancy, lighting, and air quality. This information informs decision making and automation.

Data Analytics

Advanced algorithms analyse sensor data, identifying patterns and trends. Predictive maintenance algorithms anticipate equipment failures, reducing downtime.

Backup Systems

Robust backup systems for power, data, and communications.

Cybersecurity

Advanced measures to protect building systems from cyber threats.

Integration

Systems with Intelligent Buildings communicate seamlessly. The HVAC system, for example, adjusts based on occupancy data and weather forcasts.

Outcomes

Energy Efficient

Intelligent Buildings adjust lighting, heating, and cooling based on occupancy and external conditions. Energy-efficient systems reduce costs and environmental impact.

Space Utilisation

Occupancy sensors track space usage, optimising layouts and resource allocation.

Security and Safety

Surveillance cameras, access control systems, and alarms enhance security. Emergency response systems react quickly to incidents.

User Experience

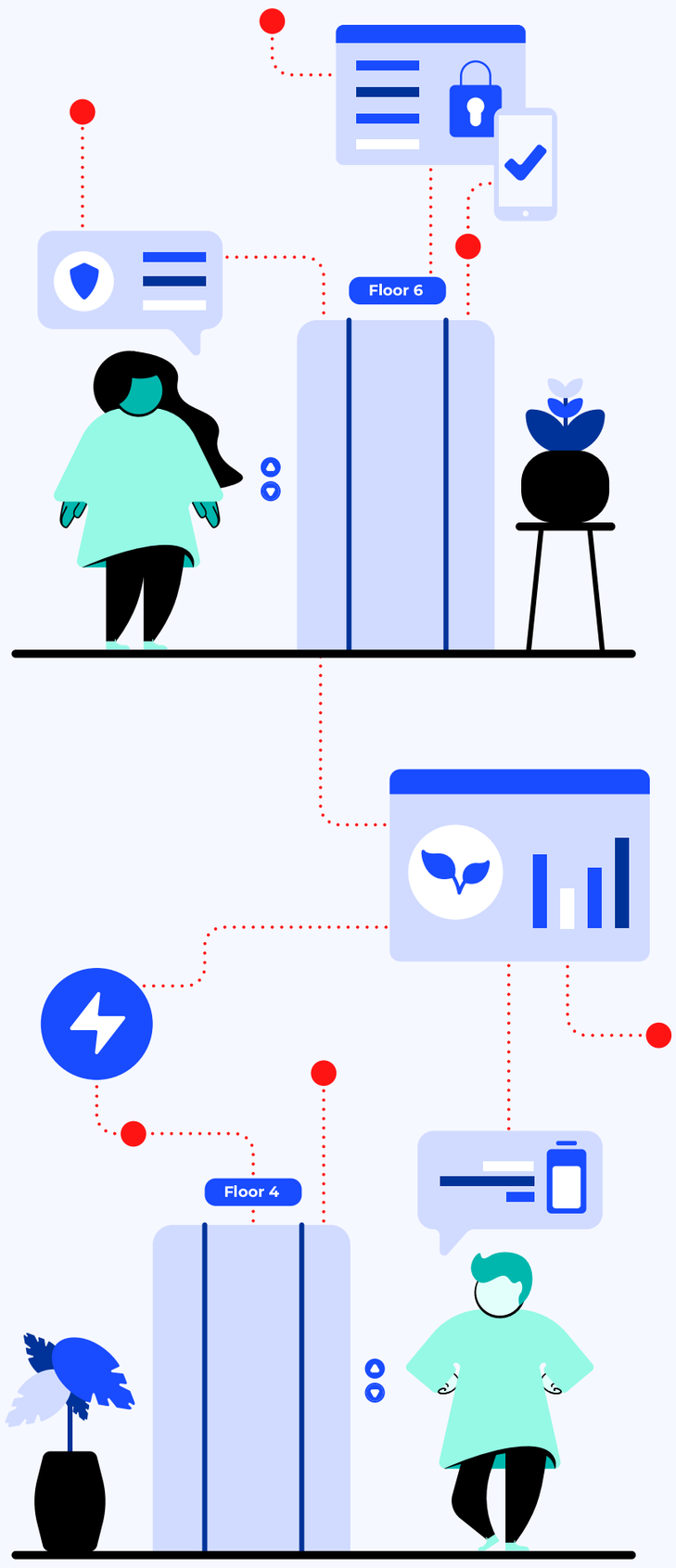
Personalised settings enhance occupant comfort, including adjustable lighting and temperature.

Sustainability

Intelligent Buildings minimise waste, optimise resource usage, and may incorporate renewable energy sources.

Disaster Preparedness

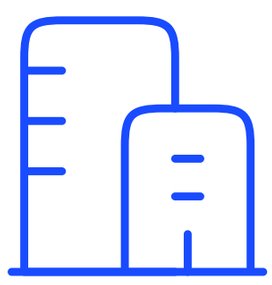
Systems and protocols for dealing with natural disasters and other emergencies.



The types of Intelligent Building:

New Build or Retrofit?

> A New Build can be designed to be “Intelligent” from the start, following a consistent architectural template across the estate. Retrofits, while more complex due to the need to integrate diverse systems, offer the opportunity to enhance and modernise older structures.

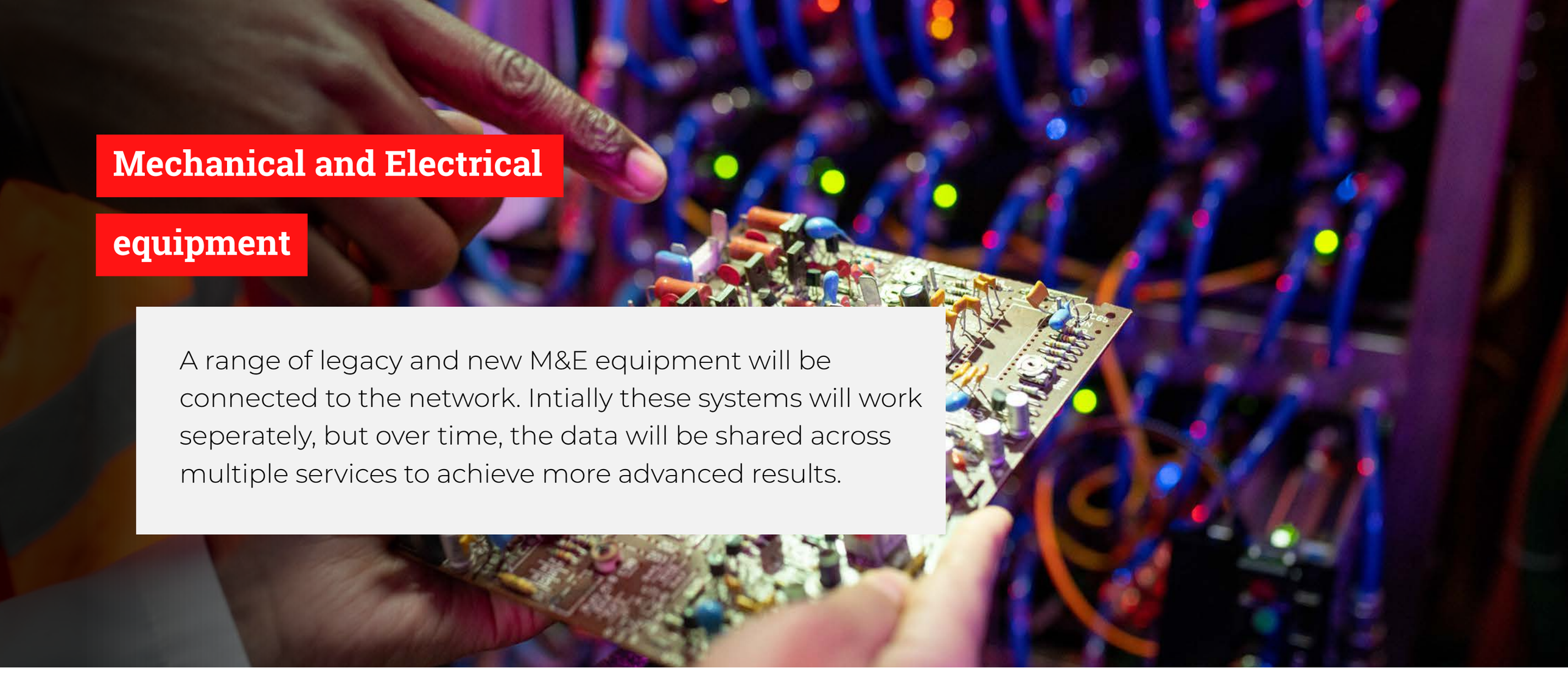


By following the right guidlines all New Builds can meet the standards of an Intelligent Building:

- Standardised physical network deployment, including IT spaces (wiring closets) with resilient services
- Wireless designed and deployed to meet all Intelligent Building use cases
- Single vendor BMS to ensure full commonality of services
- Specified physical security systems to assure inter-operability
- Take advantage of new technology, Power over Ethernet (PoE) for example.
- Deploy modern IT equipment with embedded environmental sensors and range of connectivity (BLE, EnOcean etc.)

When Retrofitting older buildings, it’s important to make sure current systems are as effective as possible:

- Interface current BMS campus system
- Integrate M&E systems if not under BMS control
- Integrate physical security systems
- Cost effective retrofit of sensors, “smarter” light control
- Consolidate data from diverse BMS systems of differing ages and capabilities
- Ensure the network platform is fit for all current use cases, wayfinding and data coverage use different topology for example



Mechanical and Electrical equipment

A range of legacy and new M&E equipment will be connected to the network. Intially these systems will work seperately, but over time, the data will be shared across multiple services to achieve more advanced results.

Initial Capabilities

The first set of capabilities can focus on one or more use cases with specific goals:

Lighting
Central automated control based on bookings, occupancy, time of day and ambient light levels.

HVAC
Temperature optimised while in use, energy optimised while empty.

Elevators / Escalators
React to traffic analytics and provide access control.

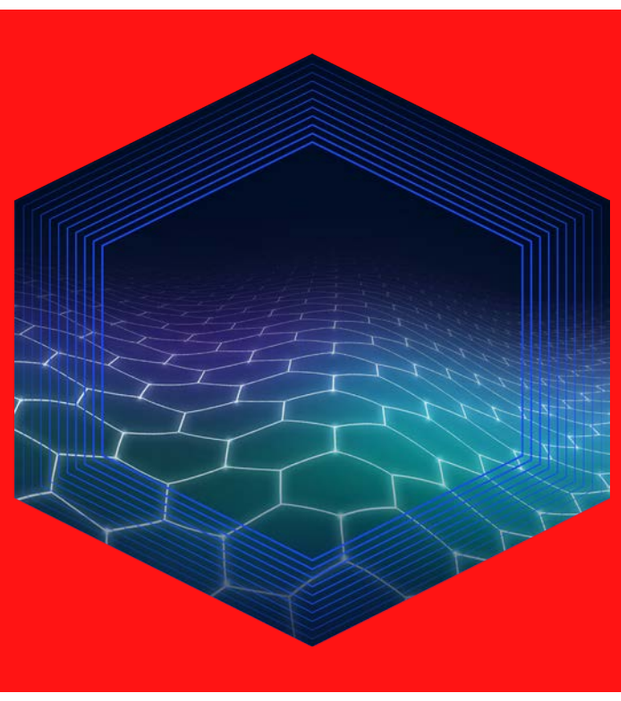
Blinds
Operate to minimise direct sunlight.

Physical Security Systems
These include things like access control, remote locks and CCTV.

Power Monitoring
Optimise power utilisation, and provide real time cost information.

Middleware

- Collects data from various systems
- Normalises the data for consistency
- Formats the data appropriately for applications to use in decision making
- Ensures data access is restricted to authorised applications



Potential Outcomes

Cross Platform Integration
Use multiple data sources to achieve specific outcomes, using blinds, for example, to control solar gain and reduce air conditioning needs.

Reactive Systems
Sensors detect when a space is empty and automatically switch off the lights or HVAC systems to save energy.

Proactive Systems
By using historical data, Proactive (or Predictive) systems can predict building usage, and shut down areas that aren’t needed.

Physical Security:

The first line of defence

> Many Physical Security Systems, which used to operate on closed networks, are now integrated into the corporate network. This change can save money but also increases the risk of cyber attacks. Once consolidated on the network, the data from these systems can be merged providing better security and user experience.

Making your life easier

with Intelligent Buildings

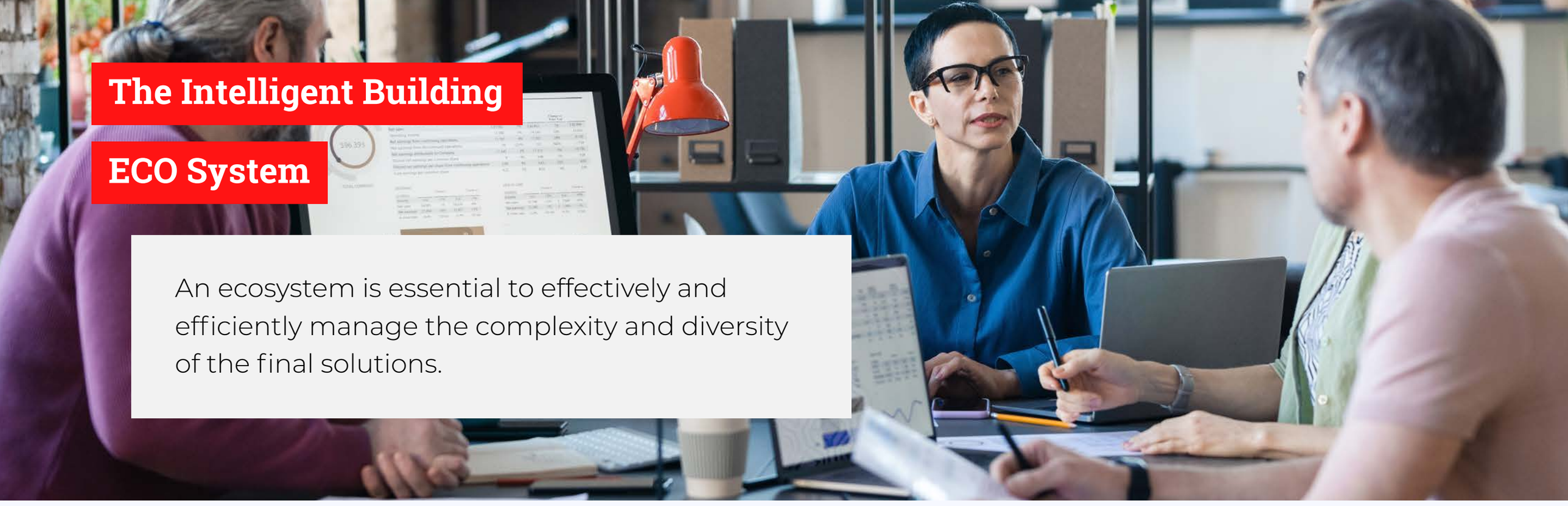
> New services will use network data to enhance user experience by optimising the environment and offering features like wayfinding, space availability, and audio-visual services.

Direct Benefits

- Wayfinding apps using a combination of wireless technologies
- Building information / Digital signage
- Environmental monitoring, control and reporting
- Car park services - space availability applications and overhead indicators
- Real-time safety alerting
- Tracking of high value assets
- AV enabled collaboration spaces

Indirect Benefits

- Application based control
- Less wated time finding available space
- Less stressful in many ways
    - Easier to operate in
    - Good conditions, temperature, humidity, air quality
    - Adaptive lighting
    - More capable security systems



The Intelligent Building ECO System

An ecosystem is essential to effectively and efficiently manage the complexity and diversity of the final solutions.

Sensors, Controllers, “Things.”

Think about all the different gadgets and items, previously unconnected tot he network, that make a modern building work. It could be anything from a simple light bulb to a car park barrier.

Powered by

CISCO Meraki

Connections

A range of connectivity options can be tailored to meet each set of challenges:

- **Wired Network -** many campus connections, high capability
- **Wireless LAN -** flexible campus connections
- **Bluetooth (BLE) -** short range low powered connections and location services
- **enOcean -** very low powered local telemetry
- **LoraWAN -** wide area, low bandwidth telemetry and control
- **CURWB -** wireless alternative to fibre point to point links
- **Private 5G -** Metropolitan area high bandwidth

Powered by

CISCO Meraki

Middleware Data-normalisation

An Intelligent Building seamlessly connects a variety of systems that traditionally wouldn’t communicate with each other.

This interaction is a key feature of any Intelligent Buiding, and there are several platforms that make these integrations possible.

Trend and Cisco Spaces, for example, add spatial network capability.

Powered by

CISCO TREND

Services

The user service, or building system delivering benefits:

- **Environmental controls**
- **Wayfinding**
- **Self-administration**

Powered by

iQ VISION, MazeMap, splash access., DegreeAnalytics, Grid Edge

A holistic approach to sustainability in Intelligent Building solutions

> Sustainability must be integrated throughout the of the Intelligent Buildings systems, including the building's IT infrastructure, the sustainability of individual components, and the resulting cost savings.

IT Sustainability

Modern devices are designed to be more power efficient. They can manage power to connected devices and reduce service when not in use, saving energy.

Improved silicon design means these devices use less power while delivering higher performance.

Higher throughputs are achieved with lower power budgets, making them more efficient.

Power over Ethernet (PoE) supports a variety of controllable assets, making it versatile and effecient.

Standardised modular products allow for flexible deployment and easy re-use, adapting to different needs.

IT switch stacking optimises power usage and reduces the number of power suppliers needed, making the system more efficient.

Smart energy consumption | **Cisco Silicone 1** | **Wi-Fi**

Supply Chain

Highly recyclable packaging (minimal plastic)

Ethical manufacturing and supply chain:

- Raw material selection
- Fully recyclable product design
- Paint free chasis
- IT "takeback" schemes
- IT remanufacture / reuse where appropriate in support of the circular economy

Material use | **Standardise and modularise** | **Packaging and accessories** | **Disassembly, repair and reuse**

Energy savings

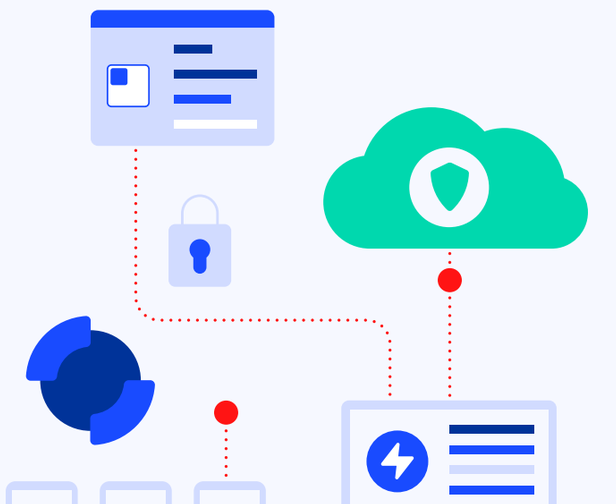
Lighting control enables energy efficiency.

Closed loop HVAC reduces energy costs.

Custom Silicon uses less energy

Greater environmental operating ranges allow Datacenters to be run at higher baseline temperatures, reducing AC costs and energy consumption.

Cisco Silicone 1 | **Solar power**



Network attributes and services

The backbone of all these services is a flexible and secure network. This network also acts as a sensor, collecting data that can be used for navigation and wayfinding, wireless users and to support incident resolution.

In order to achieve this, there are seven attributes a network must have; **capacity, reliability, reach, agility, security, observability and sensing.**

A journey through an Intelligent Building's network attributes

Capacity

- The ability of the network to deliver enough bandwidth to support all use cases
- The correct connectivity solution for each application

The modern network is typically 10 times faster, and can handle 5 times more capacity on edge connections, all using the same cabling.

Reliability

- A reliable network that presents a consistent experience
- Resiliant design to ensure constant levels of service

Networks are built to be fully resilient up to the edge switch, using simpler protocol stacks to keep traffic flowing smoothly.

Reach

- The ability for the network to provide connectivity to any user or device anywhere at any time

With wireless options that range from in-room to several kilometers and long-range fibre options, reach becomes a key design factor.

Agility

- Capability to be reconfigured to meet a range of use cases
- Ease of network operations through a coordinated set of interfaces

Software-defined networks can be adjusted to meet ever changing and even unknown future requirements.

Security

- Network support for a range of modern security demands, including segmentation and detection
- The ability for the network to have security embedded by design

User identification and authentication, segmenting user groups, and detecting unusual network behavior all contribute to strong security.

Observability

- The telemetry to enable a smart network to adapt to changing demands
- The ability to quickly identify and remidiate network issues via embedded tools

The telemetry needed to run a modern network is invaluable for gaining insights that support network operations and security enforcement

Sensing

- The network delivers a range of telemetry that can be used in an Intelligent Building
- Increasing numbers of embedded sensors in network devices to support smart initiatives

Attributes like the number of connected users can help gauge occupancy, and new sensor technology can be embedded in network devices.

Ideas in action: Intelligent Buildings working in real-time

Environmental Control

A University with 1970's modernist buildings, which experience high solar gain and have low thermal mass is aiming to reduce utility costs. They're using sensors embedded in Cisco access points to monitor heat and air quality, which helps manage the heating, ventalation, air conditioning, and blinds. These sensors are integrated with a Schneider Building Management System.

Smart Bins and Waste Collection

Logicalis conducted a Proof of Concept (PoC) in Granada. They equipped commercial bins with sensors that could weigh the waste and detect its smell. These sensors were connected via LORAWAN, allowing collections to be triggered based on either weight or smell. This system reduced the number of collections and optimised routes, resulting in a 30% cost saving for the service, and environmental impact.

Desk Utilisation

Overhead thermal sensors track how many desks are occupied and provide real-time status and occupancy figures. The data from Kontact.io sensors is exported via API to a PowerBI dasboard. This will help determine the real office desk requirement to support staff efficiently now that hybrid-working is becoming a standardised model of working.

Conference Systems

Within the UK research community, Cisco video equipment is widely used. These devices can count the number of people in a room and send this data to an API to be visualised in PowerBI. This allows for meeting room utilisation to be monitored and future provision optimised.

LOGICALIS
Architects of Change

We are Architects of Change. We help organisations succeed in a digital-first world.

At Logicalis, we harness our collective technology expertise to help our clients build a blueprint for success, so they can deliver sustainable outcomes that matter.