

# Edge Compute to Power Digital Transformation of Real Estate

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The rapid acceleration of digital transformation in real estate fuels marketing automation and revenue growth. This paper discusses a novel approach to the digital transformation of real estate through new digital services that offer new tenant experiences, better environment control, enhanced property value, and reduced operating expenses. This paper highlights edge compute models that will help consolidate various use cases. The solution proposed here is scalable, secure, manageable, and reduces the total cost of ownership. We propose a unified approach to consolidate different solutions used in real estate and to ensure that they run on the edge seamlessly. Five dominant use cases are used to illustrate edge-based workload consolidation architecture.

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## Challenges

Property owners are adopting new and innovative digital services as demanded by their customers to improve their Key Performance Indicators (KPI), such as property value and operational costs. For example, commercial tenants require new digital services such as digital signages to provide information on demand, control the building environment (e.g., heating, cooling, and water), and easy-to-use collaboration tools, digital concierge kiosks, and so on. These tenants would also prefer passive security mechanisms and intelligent surveillance to safeguard their investments. Nevertheless, property owners face many challenges due to the fragmented nature of the available Internet of Things (IoT) solutions in the market.

### Risks and complexity

Most IoT solutions available today come with their own siloed systems that include purpose-built hardware, software, and cloud-based services that may not easily interact with other IoT solutions. The use of many separate systems increases security risks and the level of complexity in managing the setup, as well as drives up operational costs.

### One solution requires applications from multiple vendors

Most IoT solutions available on the market are stand-alone systems, where they work end-to-end in their own ecosystem. This forces owners to have to manage numerous dashboards and to manually calculate the impact they might have on one another.

### Adoption, maintenance, and reliability

When a property owner wants to implement digital transformation using IoT technology, they need to certify, acquire, adopt, and maintain many different types of end-to-end solutions and their ecosystems. It can be very challenging to make sure each end-to-end solution is secure and well-managed. The IT department of a property needs to monitor each solution and to maintain the physical space for each gateway (edge computing device), both of which consume precious resources and time. In case of hardware failure, any running IoT applications will inevitably remain down until replacement hardware can be installed.

### Efficiency

Point Solutions are common when a new use case needs to be enabled. However, when the point solution fails for one reason or another, the downtime may be unacceptable.

This paper describes a solution using a unified framework, which provides security, manageability, and scalability to land IoT solutions or workloads.

## Overview

The number of innovative IoT solutions and products have exploded in the last few years. These products constitute key technologies used in the digital transformation of properties used to host manufacturing industries, retail and hospitality, healthcare, as well as commercial buildings. Due to the challenges described earlier, the adoption of IoT technology is limited.

Each IoT solution consists of use-case specific sensors, an IoT gateway, and either a cloud service or on-premises cloud. For ease of installation, IoT gateway devices are installed in the same network where the sensors are located. In many industries, these sensors are installed in a secure network or the network where high-value IP exists. Installing many such IoT devices in a secure network can increase the risk of IP and security threats because such IoT devices connected to the outside world are vulnerable to attacks. It is also a challenge for the IT department to secure new IoT gateway devices because: (a) they are not managed by the department, (b) the OS used on most such devices seldom complies with the organization's security standards. These challenges can be addressed by running multiple IoT workloads on a single server located outside of the secure network, thus making it easier to identify and isolate compromised IoT workloads (i.e., applications).

### Smarter management reduces costs

**Building Management Technologies** reduce operational costs. By optimizing lighting and HVAC usage based on real-time occupancy in the building, energy costs can be reduced. For example, when the system recognizes that a large proportion of employees has left the building for lunch, some parts of the HVAC and lighting operations can be suspended. Lights in a conference room can be dimmed automatically when it is not being used. There is also an opportunity to transition from scheduled asset maintenance to preventive maintenance. Therefore, instead of inspecting HVAC air handlers at specific intervals, maintenance personnel can gather insights from the live sensor data and proactively check the air handlers when they show abnormal operation.

### Attracting the right people

New digital signage, kiosks, and video walls tend to enhance the curb appeal of properties in medium to high-traffic areas. Outdoor kiosks that show dynamic and high-quality content are attractive to visitors. These form factors enable a new source of revenue for the property owner – **Advertisements**. These can be targeted advertisements with the use of Anonymous Audience Analytics, making it even more impactful. Using these solutions, property owners can also promote establishments inside the property. For example, when the surveillance system detects a large group of people heading out of the building around lunchtime, smart kiosks in the lobby and pathways can show advertisements (accompanied by promotions) for restaurants within the property. This helps to ensure that tenants spend their money within the property as much as possible.

Wayfinding applications are ubiquitous these days. Many people use these apps on a daily basis to travel from one location to another. However, when you reach the location, navigating around a huge property may be a challenge. Outdoor kiosks with an interactive wayfinding application can be very helpful for visitors and residents alike. Large outdoor signage within the property can also direct vehicles to available parking within the property.

### Enhancing experiences

**Digital Concierge Kiosks** in the lobby of commercial or office buildings can perform automated check-in functions, show a building directory, provide 3D wayfinding to meeting rooms for visitors, and free up on-duty personnel to interact with people and help them in other ways. Replacing regular whiteboards with interactive white boards in meeting rooms can enable collaboration with participants anywhere in the world. With these devices, content and notes are saved digitally, thus reducing waste. Digital signage placed throughout an office building can also be used to display employee communications when necessary.

### Increasing active and passive security

The cameras already used in signage and kiosks located throughout the property can complement **surveillance systems**; moreover, real-time alerts can be provided thanks to analytics performed on an edge server located in the building. For example, if the camera in a kiosk catches a suspicious person loitering in a controlled area, other

cameras can be actuated to capture video of the person and to alert security personnel in real-time.

### Example of a typical point solution

Figure 1 shows an example of a typical deployment of IoT solutions with siloed end-to-end ecosystems in a property. Each solution has its own gateway and cloud, and they don't interact with one another.

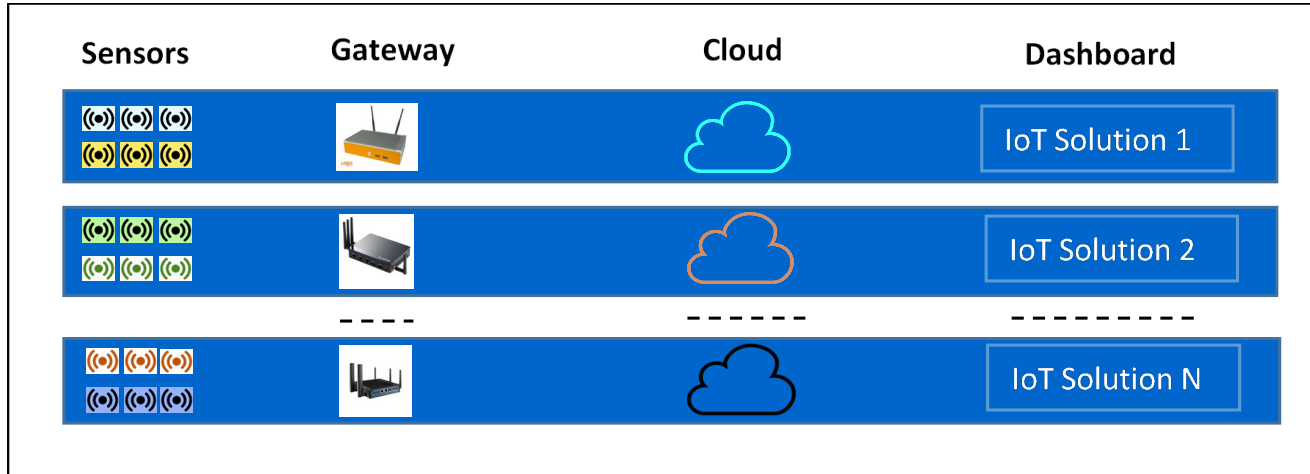


Figure 1. Typical point solutions

The following section discusses an approach to bring siloed point solutions together.

### IoT Unified Edge Framework

One way to solve the problem of certifying and deploying multiple systems is by using **Workload Consolidation (WLC)**. WLC brings together many different types of purpose-built hardware and cloud-based systems onto a single (or fewer) platform at the edge. Reducing purpose-built hardware and software infrastructures by using WLC helps reduce initial costs.

This paper underlines the practical implementation approaches of WLC, architectural approaches, and Intel's role as a technology advisor. Additionally, this paper offers a number of recommendations for customers who are looking to digitally transform their properties.

In this approach, the software running on different IoT gateways are migrated onto a Virtual Machine (VM) running on servers with **Intel® Core™ or Intel® Xeon™ processors**. Servers with Intel® Core™ or Xeon™ processors are compliant with the **Organization's Minimum-Security Standard (MSS) Operating System (OS)**, where security is managed by qualified IT personnel. These servers are under the full control of IT; various IoT solutions run as VM on these servers independently. This approach allows the consolidation of IoT workloads at the edge, where they are managed by IT. In this architecture, adding a new IoT workload becomes easier, as it can be deployed remotely and required hardware resources can be allocated according to workload and use cases. The cloud and the dashboard remain unchanged, while the data for each workload flows in a separate pipe.

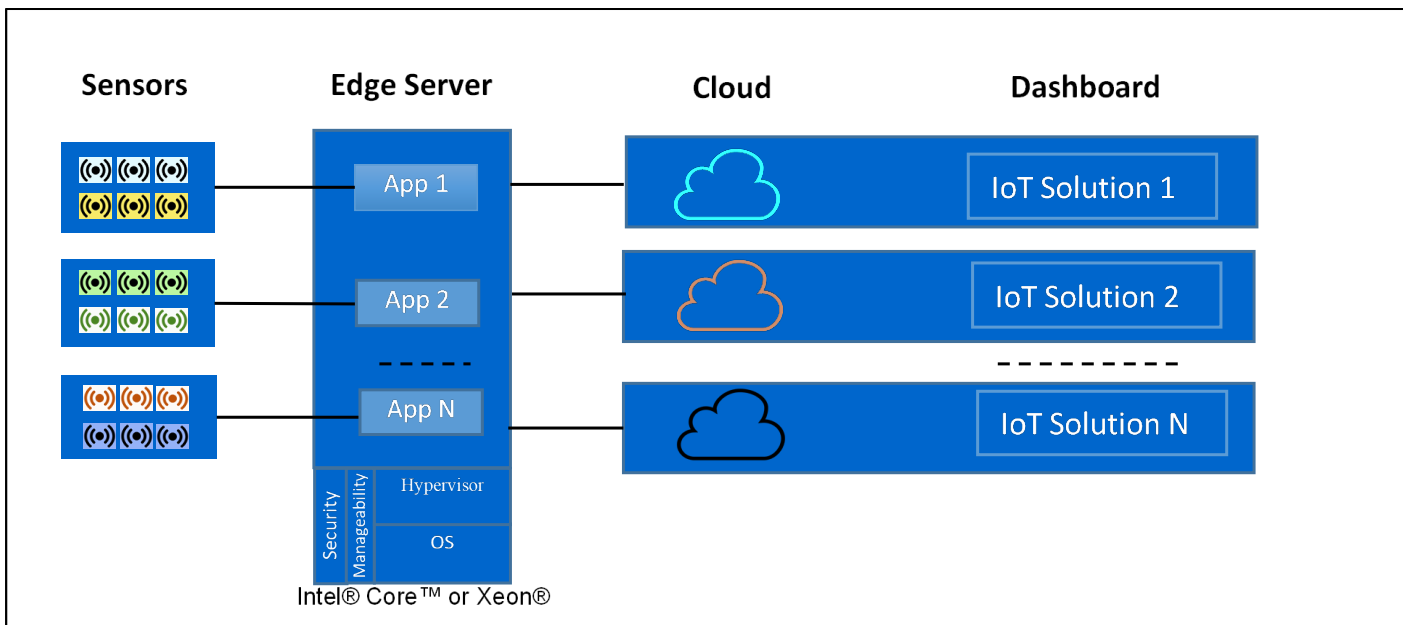


Figure 2. IoT Unified Edge Framework Option#1

In this approach, IoT workloads running on the server publish their data to a common data lake application. This application consolidates and formats the data according to a set of predefined requirements, then publishes its data to a single cloud. Consequently, the various dashboards are now integrated into a single view. This approach provides all the benefits of *Option #1* (as shown in Figure 2), but removes the need for multiple clouds, and displays the IoT data for the entire property or building in a single view.

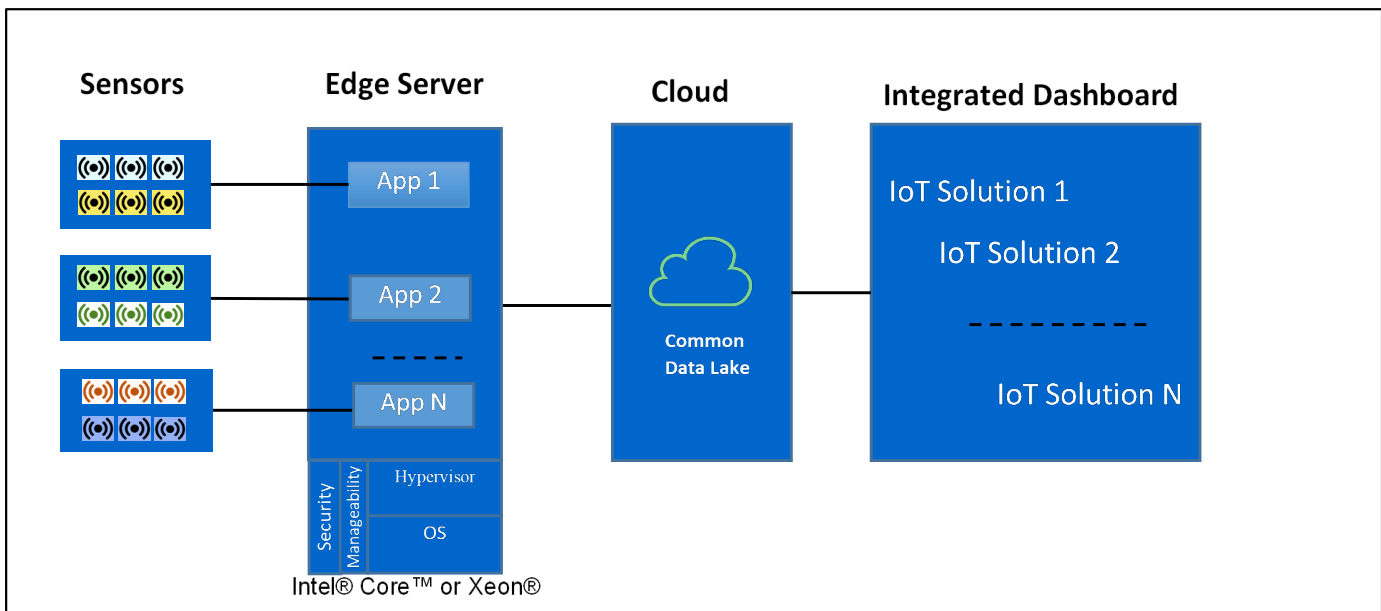
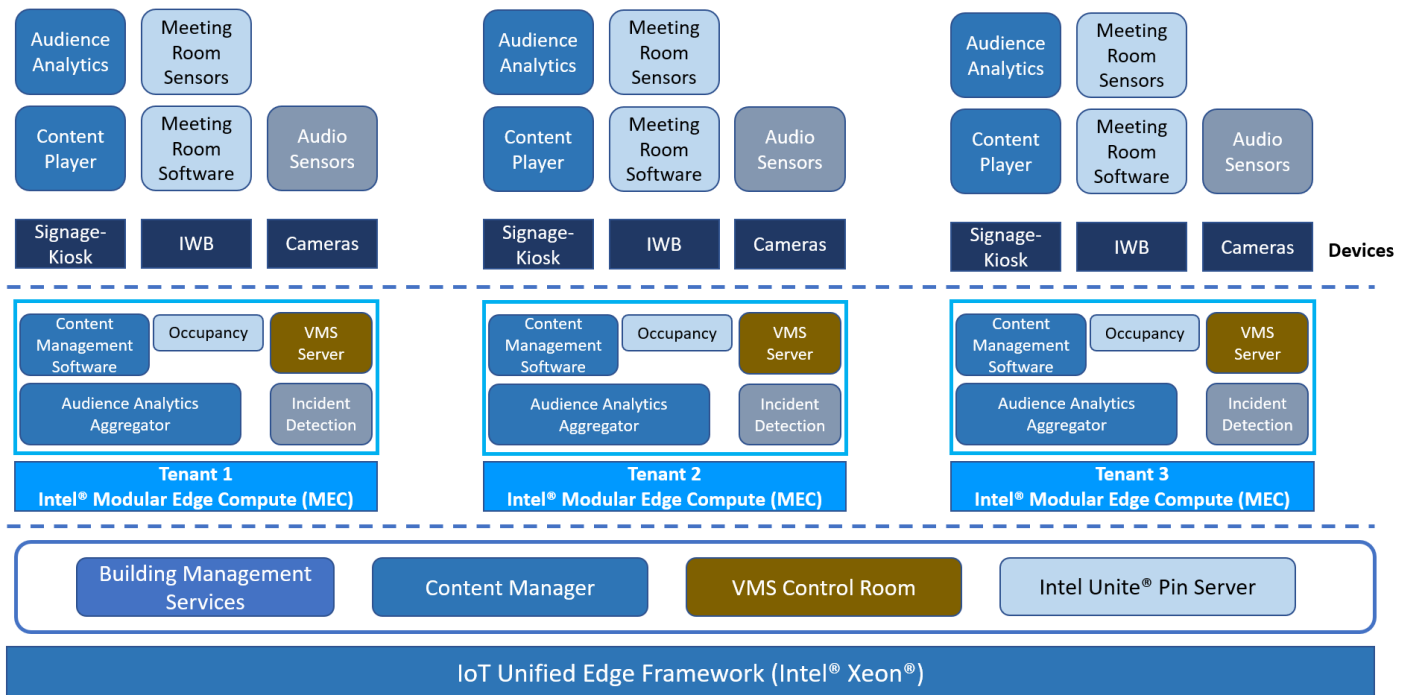


Figure 3. IoT Unified Edge Framework Option#2

Another option (*Option #2*, shown in Figure 3) used to implement the WLC platform involves implementing separation per-tenant. With this approach, each tenant is free to manage their own software, such as pin servers for meeting rooms, audience analytics, surveillance, and so on. The per-tenant edge server can be connected to the single building management edge server based on the **Intel® Modular Edge Compute (MEC) Architecture** specification, thus ensuring that the right system architecture is deployed to support the different visual use-cases as shown in Figure 4:

# System Overview



**Figure 4.** System Overview

## Implementation

This section describes the implementation of “Workload Consolidation at Edge Option #1”, as shown in the previous section.

**Use Cases:** For the purpose of WLC pilot, the following five use cases were selected from the list of Market Ready Solutions (MRS) provided by Intel's partner companies.

#	Use Case	Product Name	Partner / MRS Provider
1	Energy Management	NANTUM®	Prescriptive Data®
2	Data Visualization, command, and control	KMC Commander®	KMC® Controls
3	Smart Surveillance	Gorilla Technology®	Gorilla IVAR™
4	Smart Conference Room	Intel Unite®	Intel Unite® Team
5	Digital Signage	Media Manager	Acquire® Digital

**Source of Live Data:** One of the buildings on the Intel campus was selected to pull data from sensors connected to its Building Management System (BMS). This included data pertaining to HVAC, power meters, and occupancy. A thorough process was followed to obtain approval from various groups within Intel and InfoSec, as well as going through privacy reviews.

The following diagram indicates the Market Ready Solutions (MSRs) installed as Point Solutions and consolidated on a server with an Intel® Xeon® processor.

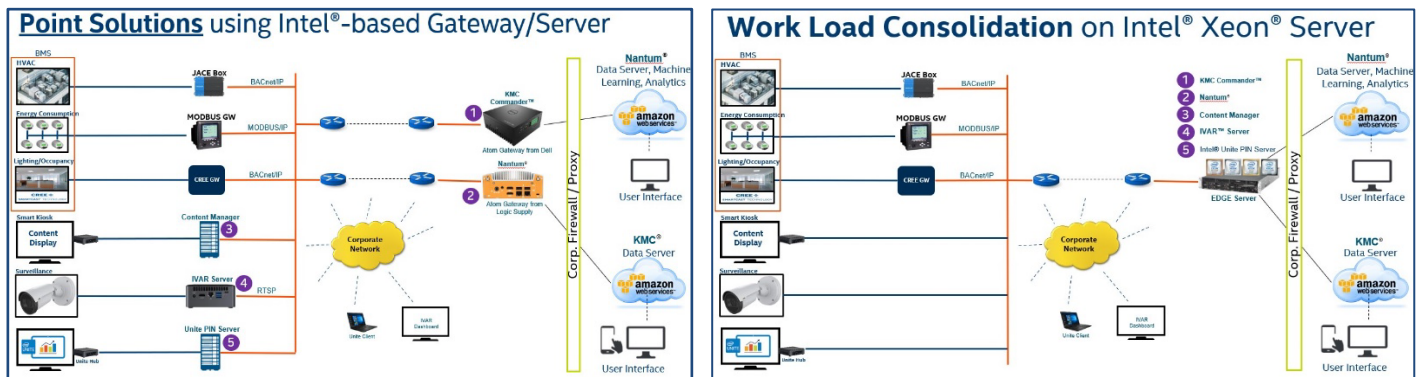


Figure 5. Market Ready Solutions were installed as Point Solutions

The consolidation of five IoT workloads was achieved by closely collaborating with all five solution providers to move their solutions to a VM. The following diagram displays all five solutions consolidated on a server running an Intel® Xeon® processor.

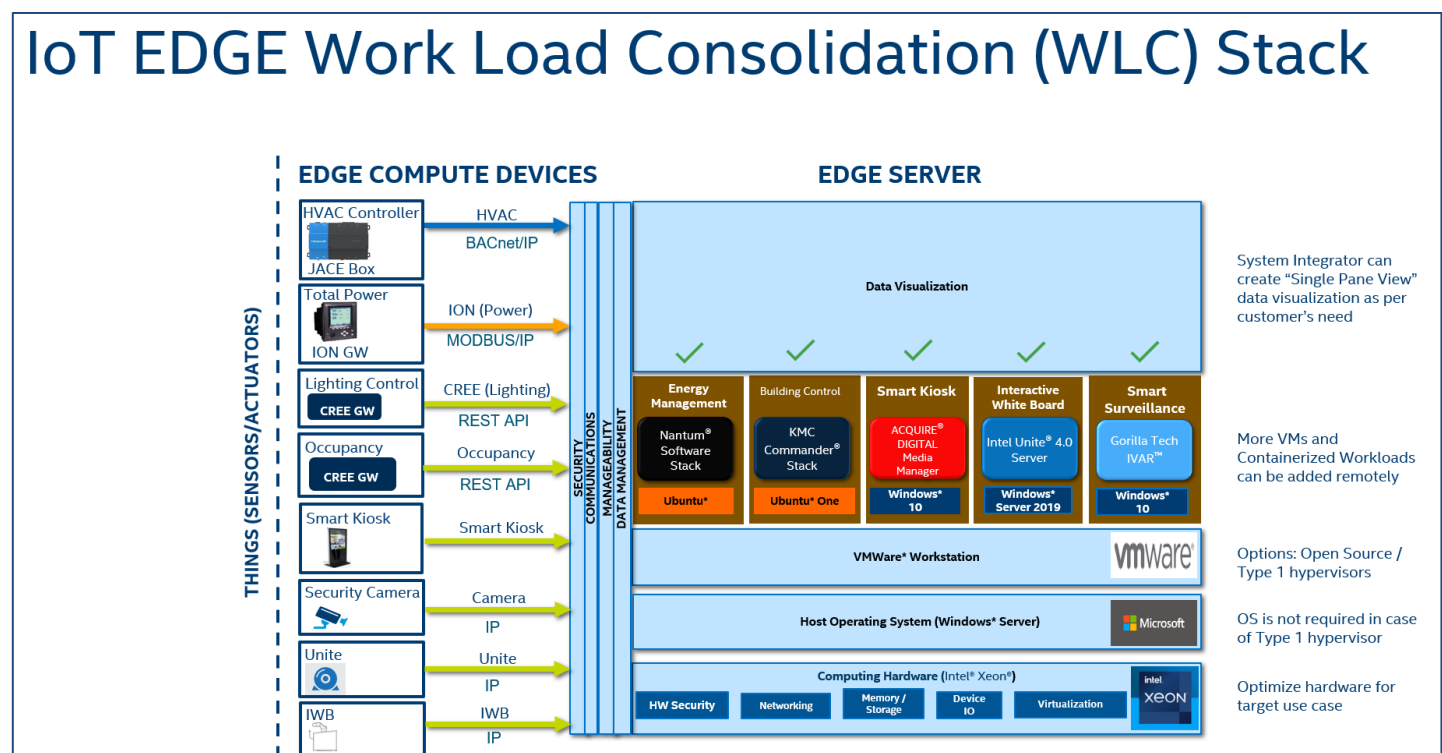


Figure 6. Edge Workload Consolidation (WLC) Stack

## Summary

The digital transformation of real estate properties can be accelerated using a unified edge framework, as describe in this paper. We summarize the primary benefits of using a unified edge framework thus:

**IT controls OT Workloads:** The WLC server becomes another IT device on the network, with IT maintaining full control over this device.

**Ease and efficiency of deployment and manageability:** A server can come preloaded with requested apps for a property from the manufacture. Instead of having to manage a large number of hardware devices, IT needs to only manage a single device. New IoT solutions or applications can be deployed on the server remotely, without the need for additional gateway devices, power sources, network cables, or physical space.

**Better Security:** Physical and digital attack surface is reduced, which is a basic security measure. IT controls outgoing/incoming ports for various IoT workloads running on the server, thus making it easier to block them in the event of a security breach.

**Reduced total cost of ownership (TCO):** Consolidating IoT workloads on a single server eliminates the need for custom-built hardware and dependency on many different hardware vendors; it also removes the need for real estate required for each piece of custom hardware.

Intel® IoT Unified Edge Framework using workload consolidation to efficiently scale Industrial IoT solutions:  
<https://www.intel.com/content/www/us/en/internet-of-things/industrial-iot/resources/unified-edge.html>

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