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# Hyper-converged infrastructure (HCI) for video surveillance

An introduction for video surveillance and smart building integrators, installers and end-users

# Introduction

The video surveillance market has boomed in the past 10 years and high definition smart cameras can be purchased at a fraction of the price of a decade ago. However, despite advancements in server power and denser storage arrays, typically the underlying IT architecture (servers, storage and networking) deployed to underpin these systems has changed less drastically. In the past, there has been a lack of availability of specialist infrastructure products designed with video surveillance in mind. Where specialist solutions have been available, they have been expensive and require skilled IT-savvy surveillance integrators to configure.

In the last few years, intelligent, high-resolution network cameras at the edge of surveillance infrastructure have become more common. Thus, surveillance footage is more valuable, increasing the amount of storage required in order to unlock the intelligence of video data, raising the importance of storage platforms that are purpose-built for video surveillance. This whitepaper explores how hyper-converged infrastructure (HCI) fits within video surveillance and smart buildings solutions. What is HCI?

At a basic level, HCI is the concept of bringing together three major components of IT infrastructure (compute, storage and networking), and using software to virtualize and manage them as a flexible resource. Traditionally deployed in separate frameworks, compute (servers), storage (storage networks or direct attached arrays) and networking (switches) are brought together in HCI via a single server containing an integrated software stack providing orchestration and virtualization of all three. Typically, HCI is sold as a solution and supported by a single vendor. Virtualization software provides a hypervisor, which abstracts an entire physical server, including physical network connection and available storage. Each application is contained within a virtual machine (VM) wrapper, having its own operating system and IP address. This means available resources in compute, storage and network can be changed to suit the immediate needs of an application at any given moment. Physical device separations, connections and set allocated resources don't constrain flexibility as in traditional architecture.

HCI is typically architected in clusters - the connectivity of two or more server nodes, which aside from the VMs, provide additional layers of redundancy and high availability. Resources can be balanced across both virtual machines and physical nodes, and in the occurrence of failure, data loss or downtime is kept to a minimum as the other nodes in the infrastructure take over. Hyper-converged infrastructure can be deployed as a framework across physical all-in-one appliances or as software installed on compatible hardware.


**Only 6% of sales revenues for enterprise storage used in video surveillance in 2018 was from HCI.**

HCI gained much initial popularity in large enterprise datacenters, where the concept allowed for the efficient use of all available resources at any one time over a variety of different workloads. This trend has filtered down to smaller enterprise and edge deployments. In video surveillance and electronic physical security, adoption has been slower, with many larger installations preferring several servers, a storage area network (SAN) and separate networking. HCI adoption for video surveillance is an emerging industry trend with several leading infrastructure vendors marketing specific HCI products designed for video surveillance and other smart building applications. These are typically targeted at medium to high channel count installations, which require high performance and high availability video management and recording, potentially with integration of other smart building technologies on shared infrastructure.

# Video surveillance market trends

As video surveillance systems have increased in specification and complexity there is also a requirement for advancements in the supporting IT architecture.

## Market drivers

The cumulative effects of government initiatives for video surveillance, increased consumer awareness of IoT (internet of things) and surveillance technologies, and reduced equipment prices due to pricing pressure from low-cost vendors has meant in the last decade growth in the video surveillance industry has exploded. This growth can be characterized by a large increase in camera unit shipments and the propagation of high definition network surveillance cameras.

**It is forecast in the calendar year 2019 more professional grade security cameras will be shipped worldwide than were estimated to be in the global installed base in 2012.**

## Higher specification cameras

**Of all network security cameras shipped in 2018 84% were full HD resolution or above.**

In addition to the increase in the number of surveillance cameras, the specification of cameras has advanced in two key areas; image quality and intelligence (video analytics).

Image quality has many components and resolution is just one. The typical network surveillance camera today in addition to a high definition image sensor has advanced low light capability and a wide dynamic range. This means a high definition color image can be captured in a range of lighting conditions.

## Intelligent video surveillance

Video analytics technology has been deployed in surveillance systems for a long time. Yet, widespread usage has been inhibited by real world performance. Research and development in deep learning neural networks has led to an uplift in capabilities. This has caused a resurgence of interest in video analytics. The latest generation technologies broaden the appeal to augment both security operations, and other non-security uses. Through these applications the perceived value associated with video surveillance data can also be increased, as business intelligence and operational tools are created.

## Video surveillance footage retention times

A force multiplier in the amount of data storage required for video surveillance is the retention time. Enterprise storage systems and archival storage have meant, even in large video surveillance systems, footage can be kept for long periods.

The following are factors causing end-users to extend their data retention period:

**Legislation**

Depending on the end-user industry and geographic region, there may be regulations that specify how long video surveillance should be stored. When the video is used as evidence in a criminal court case, a copy will usually be required to be stored long-term.

**Anti-litigation and insurance**

Some regions have defined time periods during which a plaintiff can file a lawsuit. In the United States, there is a two-year period (this is known as a Tort Law). Following legal advice, many organizations that feel at high risk of litigation, store video for a minimum applicable time period as a defense. In the United States, retail and correctional facilities are two examples where this practice is prevalent. In addition to defined periods for potential lawsuits, some insurers are demanding video be stored for a certain period-of-time to comply with specific insurance policies and/or to reduce premiums.

**Operational requirements**

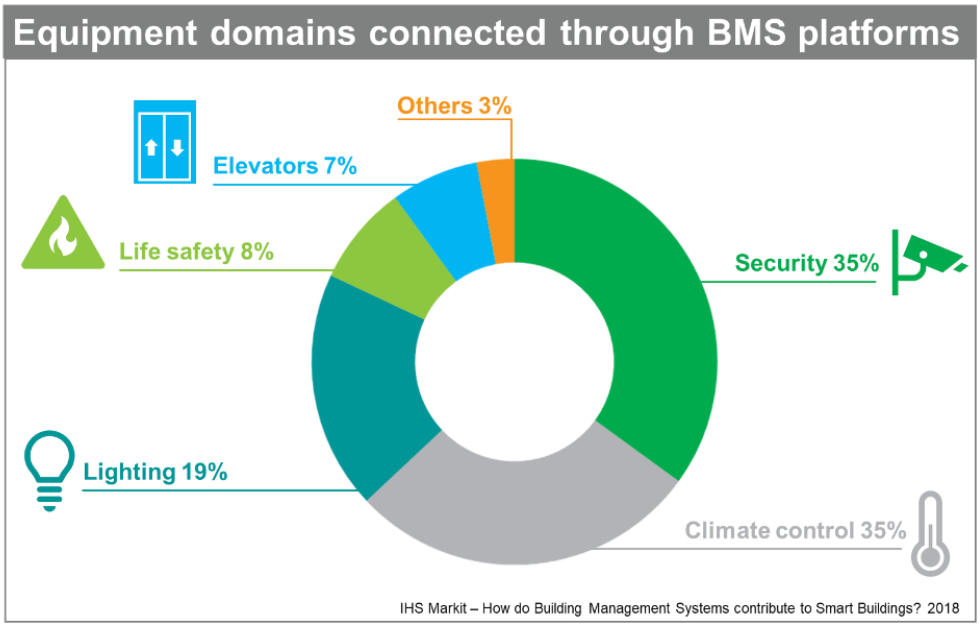
In manufacturing and logistics sites, video surveillance can also be used for safety compliance and operational applications. End-users may store video surveillance for longer periods of time to assist in enquiries regarding manufacturing batches or shipments.

Even though there is often a need to store video for a longer period of time, privacy rights and concerns sometimes prohibit this. In some regions, such as Western Europe, data protection laws like GDPR mean that without reason and explicit consent data cannot be kept for long periods. Companies and individuals found to be in breach of these laws can face severe penalties.

Regardless, as video data becomes more integrated in operations – reliable infrastructure is important. It is a huge challenge for video surveillance infrastructure to manage, view, and record a large number of high-definition network surveillance cameras simultaneously, without dropping any video frames. Requirements on infrastructure are increased further by the ability to scale video surveillance networks to potentially incorporate hundreds of thousands of cameras on the same platform.  Further still, the closer integration of other building technologies means underlying infrastructure which can concurrently support multiple applications is required.

# Smart buildings

A smart building encompasses not just electronic physical security, such as video surveillance, access control or intrusion, but also other building technology domains, including but not limited to: fire suppression and detection, other life safety, climate control and HVAC, digital signage, and lighting systems.




For real estate developers and property owners, integrating interconnected devices into smart building platforms that process advanced analytics can help cut costs by maximizing operational and energy efficiency in their assets. For facility and security managers, new predictive maintenance and diagnostic services can offer enhanced visibility into system performance throughout buildings, as potential issues can be identified before equipment failure. For their part, tenants and other building occupants will enjoy systems that automatically react to their presence to provide comfortable indoor conditions.

In addition to the innovation from growing interoperability, much of the potential for smart buildings derives from the underlying infrastructure. Running smart building systems on a shared IT infrastructure breaks down the barriers between what would traditionally be separate systems and increases the ease of interaction. Combined infrastructure on a single HCI platform allows for overarching building management software to intelligently interact with its components - putting the “smart” in smart building.


IHS Markit – 2018 whitepaper - How do Building management systems contribute to Smart Buildings?

Similar to using HCI for a video surveillance system, the advantages of combining compute, storage and networking into a single platform across smart buildings technologies allow for simpler installation, maintenance, scalability and smarter use with the potential for efficiency-based cost savings.

# HCI for video surveillance and smart buildings

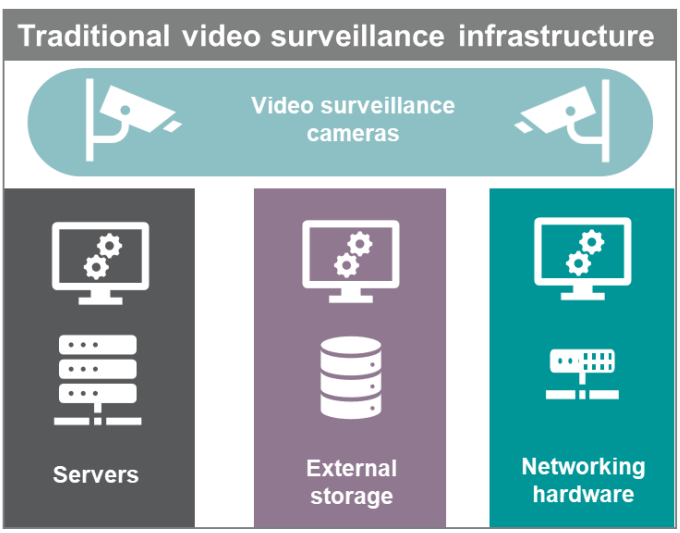
## Why should end-users and installers consider a HCI designed for video surveillance and smart buildings?

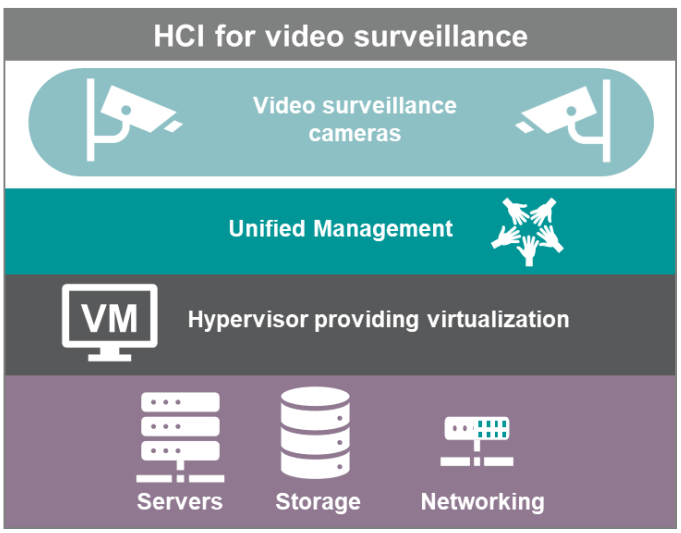
In traditional architecture, when storage requirements for video recording exceed what is available internally in the server (internal DAS), an external storage system (typically, a SAN) is then required. HCI converges separate compute, storage, and networking into a single platform and appliance. This means there is no need for separate storage networks, servers, or backup control – it is all in one solution.

With virtual machines, the physical or software barriers between separate systems are removed so resource requirements can be adjusted automatically and instantly. For example, a major video surveillance event leads to a spike in bitrate, an increase in compute is required for recording to continue without any frames being dropped. This demand is recognized by the hypervisor, which in turn, increases the compute and throughput for the recording either with additional VMs in the same appliance or a different node. A common issue with the traditional compute + storage + networking approach for video surveillance is that camera specifications are diluted by infrastructure constraints. For example, a high-resolution camera is purchased but footage is recorded at a low resolution and low frame rate to keep bitrate to a minimum to avoid overloading infrastructure.

A single vendor for a video surveillance and building technology HCI means the entire architecture (compute, storage and networking) can be certified and pre-configured to run with VMS and other smart building management software. As the HCI is preconfigured by the vendor, it is easier to deploy it on site with no need for major expertise at the location. When pre-configured storage, servers or networking products are available, HCI is pre-configured as a whole, which amplifies the ease of deployment.

Choosing certified software can streamline final configuration and setup on site; however, HCI is video or building-management software agnostic so there are no further restrictions on vendor choice than with traditional infrastructure. In HCI designed for video surveillance and smart buildings, typically the hypervisor is streamlined for this purpose, meaning there are not additional capabilities not being used in these applications. This also means no extra license fees or hidden costs associated with the software.



A HCI appliance provides a single vendor for compute, storage, networking, associated virtualization and infrastructure management software. A single vendor has integrated the system as a whole and is the accountable party for infrastructure support. An inefficiency in the traditional infrastructure approach is that separate maintenance and support systems for compute, storage, and networking are required. With HCI, this maintenance is single sourced. A single vendor also means scaling is achieved by adding single building blocks. Scaling out adds more nodes to manage additional cameras or devices. Scaling up with specific appliances increases storage capacities for longer retention.

The whole smart building system can be managed on one infrastructure. Separate virtual machines run the management software and provide storage for the video surveillance, access control, intrusion, fire detection, lighting or HVAC management. This still allows for separate management if required, but all elements of the smart building can potentially be run on the same infrastructure and can be closely managed together.

HCI offers high availability and data resilience for the smart building systems. Clusters of multiple nodes in a typical HCI mean that each node or VM is available to compensate and take over in the event of an error or complete failure of part of the infrastructure. This approach is known as failover. Using this method in HCI can minimize downtime, in some cases operating a near instantaneous failover. Reducing downtime can be a primary concern in mission critical video surveillance systems where an end-user can incur severe business costs during downtime. Data protection features, such as erasure coding, protect recorded video surveillance footage in an efficient manner and can minimize the amount of data duplication required between nodes. In HCI, the levels of failover and data protection can be altered across the system from a single dashboard.

Cybersecurity is of critical concern across the IT industry. Lack of awareness and best practice of cybersecurity in video surveillance and smart buildings has, in the past, been the cause of many high-profile cybersecurity attacks. In this regard, the industry is progressing rapidly, cybersecurity is a more prominent consideration from the initial design phase. HCI allows for built-in singular control of cybersecurity across compute, storage, and networking

The features mentioned above all contribute to set up and maintenance efficiencies, which could lead to:

- Lower installation and configuration costs. With fewer onsite technicians required for setup, there is potential for labor savings.
- Maintenance of the whole system through simple dashboards without separate specialists for compute networking and storage.
- Failover and data redundancy features can minimize costly downtime.
- Cloud-like architecture, yet onsite control.

## Comparing Cloud Storage to On-Premise HCI

The movement of video surveillance into the cloud is gathering momentum; however, there is not yet a paradigm shift in the industry – presently, there is still a broad spectrum of cloud adoption. Many installations are good candidates for some element of cloud. At present, small channel count systems and those with multiple sites of fewer channels are the most suitable to offsite management and storage.

In other installations where cloud is being utilized, a hybrid approach is typical. Here not all video surveillance management and storage are moved off premise into a public or private cloud. This could be due to an organization's privacy concerns about video data, but often the cost of deploying a full cloud infrastructure over hundreds or thousands of cameras is prohibitive for deployment.

Guaranteeing high bandwidth required to move large amounts of video surveillance off-site is still expensive. When faced with these costs in many medium to large channel count installations, IT departments likely find a hybrid or just on-site approach is more affordable. Increasingly video surveillance systems are the responsibility of the IT department. In some organizations in line with a general IT cloud strategy, migrating as many systems as possible to the cloud is a priority. This may stall once the cost of the bandwidth is explored, the IT department then must explore other options. Yet, this does not mean elements of the architecture used in cloud video surveillance must be sacrificed; HCI can replicate some of the same features, such as:

- Dynamic balancing of varying resource requirements.
- Simplified management – including simple plugin of appliance installs and set up.
- Scale up or out in a “pay as you grow” style – pay for a size to match existing needs and add more as required in the same platform.
- Using HCI in lieu of an off-site public or private cloud is not an exclusive approach. Cloud can still be used with onsite HCI. For example, integrating off-site cloud to supplement mission critical storage for a select number of cameras or running an existing cloud-based access control system.
- VMS requires live video to come from the recording servers; if the servers are in the cloud, the bandwidth utilization from the cameras is up and down at the same time due to live video and motion detection. If you lose the connection, you not only lose recorded video, but also the ability to view live video. You can design around this with additional servers and storage acting as a cloud gateway, but that approach requires more servers and increases overall complexity.

## Challenges of HCI for video surveillance and smart buildings

HCI is not suited for all video surveillance or smart buildings installations. Video surveillance is one of the more demanding smart building applications on IT infrastructure. Typically, installations, which have a medium to high number of video surveillance channels and wish to integrate other smart building systems, can consider HCI. These installations may be distributed across a campus with multiple buildings or be a geographically distributed multi-site system. Several vendors offer a range of HCI appliances, so depending on requirements at each edge, the system can be constructed of many combinations of HCI appliances.

In performing a total cost of ownership on HCI for video surveillance and smart buildings, the following points should be considered:

**Consider in HCI total cost of ownership analysis:**

- ☑ What are the Installation and configuration costs of HCI versus alternative infrastructures?
- ☑ Are there license fees surrounding hypervisor software or updates? This will vary depending on HCI vendor.
- ☑ To leverage convergence of smart buildings systems can a single integrator be used?
- ☑ If using multiple integrators will they be able to work with the HCI?

# End-user industry examples

The following are select examples of how HCI could be used for video surveillance and smart building applications in specific end-user industries:

**Smart cities** – HCI is well suited to smart cities where multiple distributed sites and applications can be administered from several points on the same infrastructure. Ease of installation, maintenance, and scale, both up and out to add in new applications and integrations, makes HCI flexible for a smart city as the importance and number of sensors and the associated data grows.

**Higher Education** - Education campuses can be similar in many requirements to a small smart city. Campuses can contain many different systems spread over a number of buildings, potentially with its own command center and even police force. Bringing this together on a single HCI could offer simplification of management and maintenance across the campus.

**Casinos & gaming** – Casino resorts often have separate video surveillance systems for monitoring gaming and the general resort security. HCI offers the potential to converge these systems on a shared infrastructure along with other smart building systems, while if required, maintaining a separate gaming monitoring center.

**Airports and transit** – Airport and transit stations often have high numbers of video surveillance cameras for security, operations, and retail applications. HCI for video surveillance can provide the resilience for all these applications with the ability to architect the system for multiple stakeholders on the same infrastructure.

**Government** – HCI for government or agency use can offer high performance, resilient infrastructure and be based around strict policy-based management and data protection. This can protect the most sensitive of video data and chain of custody. It can also work with longer term archival storage if required.

**K-12 Education** - Sites across a school district could use HCI to converge video, access, smart lighting, and HVAC on a single platform. System can respond in critical events ensuring limited downtime and high availability.

**Critical infrastructure** – The quick deployment of HCI in critical infrastructure and high resilience once live are key selling points in mission critical applications, such as critical infrastructure, which may be highly regulated and cannot allow for any potentially hazardous downtime.

# Summary & recommendations

HCI designed and pre-configured for video surveillance and smart buildings should be considered as a modern high-performance approach to the supporting IT infrastructure. HCI is gaining prominence in the IT industry. Using it for video surveillance and other smart building applications has the potential for significant installation and maintenance savings across applications, and offers an easy path for the greater convergence and integration of many smart building technologies, and the ability to scale the entire system.

HCI can also offer an interim choice for migrating to the cloud. At present, the widespread use in enterprise video surveillance systems is some way off; yet, HCI can appease some of the pressures for “cloud first” migration in some organizations. The IT departments, which are responsible for video surveillance and other smart building technologies, are looking for a more advanced approach to supporting infrastructure but are finding off-site cloud is still too costly - especially with video surveillance.

| Benefits to end-users | Benefits to integrators and installers |
|---|---|
| • Single point of call for infrastructure technical support.<br>• Reliable and resilient infrastructure which can maximize performance and minimize downtime.<br>• Simple choices to scale in future.<br>• Unified operations and maintenance.<br>• Future-proof infrastructure, used by other IT operations. | • Quick to deploy and configure on site.<br>• Minimal training required for techs to be able to deploy.<br>• Pre-configuration and validation across smart building technologies.<br>• Single supplier for servers, storage, and networking. |

## For more information www.ihsmarkit.com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