

White Paper

The Next Frontier of IoT: Video

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IDC OPINION

IoT remains one of the top digital transformation initiatives happening across organizations today. While much of the focus has been on digitally enabling the physical, we are starting to see IoT evolve as the harmonization between human and machine begins to happen. IoT underpins the exchange of information from "things," people, and processes. Data becomes the common denominator, and it enhances our senses and business processes by providing critical visual, audio, tactile, and environmental queues that allow us to adjust, adapt, and react to changing conditions in the world around us.

Video provides rich context, but when coupled with computer vision, profound outcomes are achieved in terms of ensuring public safety, higher-quality assurance, or physical access, for example. That said, organizations need to be ready with scalable, secure infrastructure to handle not only current but future demands. With increased demands on an organization's network, storage, and compute by the increasing amount of video content created, important investment decisions must incorporate not only the operational requirements but also the technology requirements over time. It is important for decision makers to look for solutions that offer an open, integrated, and holistic platform approach to support their video surveillance investments.

IN THIS WHITE PAPER

This white paper examines the changing requirements for video surveillance technology as we move into a world where video represents a critical data input, coupled with computer vision. Organizations are looking to deploy integrated solutions that bring together storage, security, network, and management and orchestration. This white paper also discusses drivers behind the evolution of the video surveillance market and current pain points that organizations are struggling with as they deploy video solutions that scale for the future. Moreover, it discusses the key benefits of finding a partner that understands these requirements and can help provide the technical components to build out a holistic solution. An overview of the Dell Technologies IoT Solution for Surveillance is also provided.

SITUATION OVERVIEW

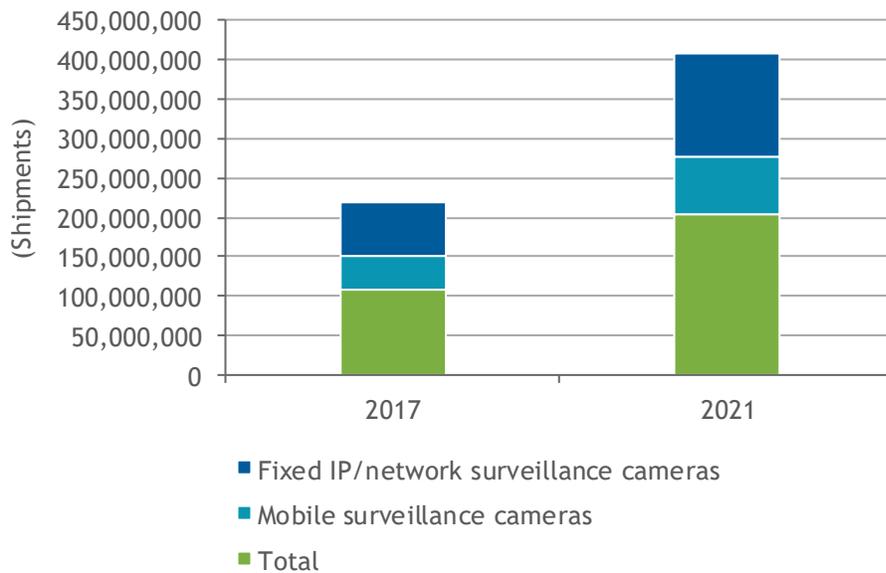
One critical, and emerging, input to the IoT is video. Video provides valuable visual data to augment other sensor data and inform decisions. Coupled with computer vision and artificial intelligence, we can "see" more than was ever thought possible – faster and more accurately – from video. However, computer vision is more than just video. When a computer "sees" digital video images, it sees data. As more 4K (and even 8K or 12K) high-resolution cameras are made available, computers will have more data to look at than ever before. Sometimes the data is high-resolution video, but it can also be an infrared heat map, an MRI image, tight tolerances on a manufacturing line, frequencies of vibration, rotational velocity, particles in gasses or liquids, or facial details, for example. This data can be integrated with other sensor data as well as business data. Unlike the human eye, computer vision never tires. It is always on and spotting important pieces of information that can be missed by a human, which opens opportunities to save money, save time, improve outcomes, and create new vistas of opportunity. Using computer vision and sensor data to augment human interaction provides a perfect example of this harmonization between human and machine that IoT is beginning to unleash.

The video surveillance market has undergone a rapid transformation in the past several years. Video is increasingly being used in drones, vehicles, body-worn cameras, robots, airports, and stadiums to ensure public safety. These video cameras and imaging sensors are being equipped with computer vision capabilities, which is driving the need for edge compute. The growing number of new devices capturing video at higher-resolution levels is creating richer images, thereby increasing storage requirements and challenging organizations to implement the supporting infrastructure to manage the increased workloads.

IDC predicts that in 2021, there will be more than 130 million shipments of fixed IP/network surveillance cameras and 73 million mobile surveillance cameras (includes vehicle-mounted cameras and body-worn cameras) (see *Worldwide Surveillance Camera and Storage 2017-2021 Forecast*, IDC #US43203717, November 2017) (see Figure 1), with **CAGRs of 19.1%** and **14.8%**, respectively. IP-connected cameras are a growing category, and the video content created by these cameras will put significant demand on network, compute, and storage resources.

FIGURE 1

Video Surveillance Camera Shipments of IoT-Powered Solutions, 2017 and 2021



Note: Mobile surveillance cameras include vehicle and bodycams.

Source: IDC, 2018

Globally, video is progressively being used to fight crime, provide oversight in large crowds, and help save lives. In Chicago, more than 30,000 cameras are used as part of its Operation Virtual Shield network to provide real-time insights to city services and emergency response teams. China is possibly the world's most pervasive user, drawing footage from its pan-national surveillance and data-sharing program called "Sharp Eyes," which today has 170 million surveillance cameras deployed throughout the country. With public safety top of mind, governments and public safety organizations view video surveillance as a vital tool in managing and monitoring large public spaces and venues.

With the increased digitization of video and the increasing number of cameras, types of cameras, resolution of these cameras, increasing retention requirements, and the changing usage models (such as applying advanced analytics to images), the market is dramatically different than it's ever been.

Factors Transforming the Video Surveillance Market

There are several factors affecting the video surveillance market today. These factors include:

- **Proliferation of new devices.** There are many device form factors for video capture. These devices such as video surveillance cameras, body-worn cameras, and in-vehicle cameras are no longer just used for physical security surveillance but found in drones, vehicles, robots, and mobile devices. Because of the proliferation of camera devices, significant video content is being created, and this content needs to be stored somewhere. According to IDC's Global DataSphere, by the end of 2018, 80% of all data created will consist of video and images.

- **Need for higher-resolution video with faster frame rates and better color night vision capabilities.** Many cameras are capable of frame rates up to 30fps, which increases bandwidth and storage requirements. This higher-resolution video also provides better manual assessment of incidents and more data to inform the automated analytic capabilities built into many modern systems.
- **Need for longer video retention times.** Increasingly, there is a need to store video data for longer periods of time (upward of a year) because of regulatory or other requirements; however, retention policies differ across different jurisdictions and applications. Generally, surveillance video retention times are increasing, driven mainly by government legislation and regulations. In addition, some organizations are retaining surveillance video longer to combat false claims and mitigate liability. Also, some organizations are retaining surveillance video for longer periods to later run analytics using video analytics solutions.
- **Integrating video with IoT data.** While a video camera is considered an IoT endpoint on an organization's network, video images can also be used in conjunction with other IoT data to create a richer, more holistic view of a situation. Simply put, video can just be another sensor capturing information. For example, a door held open may trigger an alert, but with video, more context is provided to decision makers and helps prompt an action.

The Pervasiveness, and Changing Requirements, of Video

Video surveillance is becoming ubiquitous across many industries. Some of the largest venues or facilities using video surveillance are:

- Public safety scenarios (i.e., large public spaces, sports venues)
- Transportation hubs (i.e., airports, train stations)
- Large distribution facilities
- School and business campuses
- Healthcare facilities
- Retail
- Casinos

The responsibility for video surveillance in most organizations fell to the facilities management or physical security department, given that video surveillance was used primarily for perimeter and access control and/or general security. However, with growth of IP cameras that place a heavy load on networks and the advent of improved and lower-cost video analytics and the associated enterprise servers and high-capacity storage systems required to enable video analytics, the responsibility for surveillance is being transferred to enterprise IT to help with creating solutions that are trusted and scalable and utilize existing best practices for managing the demand for additional compute, storage, network, and software applications. Yet building a surveillance solution has significant implications to operational overhead of managing different manufacturers' hardware and software. IT is struggling to handle the interoperability challenges and patching and upgrade requirements across a diverse mix of infrastructure. In addition, IT is tasked with ensuring the interconnectivity of IP cameras with other parts of the operations technology (OT) environment – bringing more intelligence to the infrastructure.

Currently, most organizations store and retain surveillance video on-premise. Yet cloud storage is increasingly being explored as a cost-effective alternative to on-premise storage, especially if video analytics services are bundled with the cloud storage service. In addition, hybrid on-premise and cloud storage deployments are steadily being adopted, where recent surveillance video likely to be accessed is stored on-premise, while the older video that is less likely to be queried is moved to the cloud.

Organizations using video surveillance today are experiencing a radical shift in the demands for video capture, consumption, analytics, and storage. Because these cameras are now residing on network resources, organizations must consider how they will adapt their infrastructure to support this changing requirement. Robust architectures that are open, scalable, and enterprise ready for the management of their current and future disparate data sources are required.

Because of the capabilities of IP-enabled cameras and the increasing image quality, organizations are refreshing their systems. With these new systems and the higher caliber of video footage, more data is created, which means more storage space is required. In addition, organizations are looking to retrieve the information more quickly to react in real time to situations. This means that servers and storage systems must be powerful enough to respond and analyze immediately.

FUTURE OUTLOOK

Video surveillance capabilities are driving transformation for organizations as they look to integrate existing and new systems and use them to drive efficiencies, improve revenue, or provide public safety oversight. This transformation is multifold. The four transformations in surveillance are described as follows (see Figure 2):

- **IT transformation:** With higher resolutions and longer retention times, surveillance data is placing increased demands on IT infrastructure, and organizations need to ensure they have enough network, compute, and storage resources to support increased demands.
- **Digital transformation:** Organizations continue to look for ways to use their video as a data source. They also are working to integrate artificial intelligence and computer vision aligned with their video surveillance strategy as this represents a key element of digital transformation.
- **Workforce transformation:** Jobs are also being transformed as the use of video provides additional inputs to decisions and augmentation of tasks because of visual data points.
- **Security transformation:** In the past, video cameras were standalone devices and largely unconnected. Many organizations are deploying hundreds, even thousands, of cameras to accomplish their surveillance goals, thus dramatically expanding the attack surface and providing a rich target for hackers who can have larger motivations to expose a vulnerability, such as political, for profit, or for hire.

FIGURE 2

Four Transformations in Surveillance



Source: Dell Technologies, 2018

Challenges of Existing Video Solutions

Yet with the transformation organizations are undergoing to respond to current video surveillance needs, there are several requirements that are not being met as they continue their migration. These requirements include:

- **Real-time video replay lag time.** In some cases, there is a need to record an event and replay the video (e.g., live view of playback) in real time. Solutions today struggle with providing minimal lag time. This is especially relevant in public safety instances where real-time video capture and replay can provide insight that could affect life or death situations.
- **Simplicity of deployment.** In many instances, cameras are of different types and in a myriad of locations, and finding a way to connect, secure, and monitor them proves more challenging than expected. Organizations are demanding a simplified, consistent deployment experience.
- **Validation of entire solution.** One pain point that is repeatedly raised by organizations investing in a video surveillance system is the need to adequately test and validate the entire solution before it is deployed. Having a key manufacturer(s) available to maintain validation labs and certifications globally can speed up deployments and ensure consistency across all of an organization's facilities.
- **Holistic security.** Because video cameras represent another endpoint on an organization's network, it needs to be secure, but the data that is transported on it must be protected from any malicious activity.
- **Ease of integration with other IoT endpoints.** Progressively, IT and operations technology are merging. With card readers, elevators, and other OT assets being connected to the network, organizations are eager to integrate these data feeds with video surveillance solutions.
- **Linking IT/OT assets.** Organizations are looking to manage all their endpoints seamlessly to help provide a linkage between IT and OT. They are looking to have other IoT endpoints work in concert with the video systems to provide a full picture of the IT/OT infrastructure. Organizations are looking for a solution that provides an architecture that is open and flexible enough to address their larger requirements.
- **Flexible storage solutions.** With more cameras and more high-bandwidth video content being created, organizations are still struggling to find solutions that provide a flexible and dynamic storage capability.
- **Price.** As with any capital investment, price is a major consideration. In many instances, organizations are struggling with finding an integrated architecture that integrates all the elements needed to meet their needs – at an affordable price point.
- **Scalability.** Organizations making the transition will not make a full cutover on day one. They are looking for solutions that allow them to scale their deployment over time yet give them a glimpse of what day two or day three will look like with a larger, integrated, and fully functional system.
- **Open architecture.** An open architecture allows the organization to develop and build custom applications that sit on top of the solution to meet specific business needs. Open source hooks allow integration into other systems.

Dell Technologies' Video Surveillance Solution

Dell Technologies offers a robust, secure, open, and scalable video surveillance solution – the IoT Solution for Surveillance powered by Intel. From the hardware and software necessary to build out the infrastructure components to the validation labs, Dell Technologies, in collaboration with Intel, is offering organizations a future-proofed end-to-end video solution. It includes the storage, security, network, and management and orchestration products required to build and deploy a fully integrated commercial-scale video surveillance system that meets the needs of both OT and IT.

Components of Dell Technologies' portfolio include:

- **An end-to-end product suite addressing the edge to core to cloud.** The elements of this product suite include:
 - Software-defined surveillance
 - Scalable tier 1 storage to 500TB
 - Scalable tier 2 storage to 50PB
 - Expandable to an effective tier 3 store in the cloud
 - Fully integrated and tested hardware and software stack
 - Management and monitoring solution
 - Tested and validated deployment scenarios
 - Designed-in security from camera to cloud that protects data with micro-segmentation and enables visibility of your surveillance devices
 - Latest technology from Intel used to power the solution
- **Dell EMC Surveillance Validation Labs.** The Labs' primary goal is to give customers the confidence that the platform they purchase will achieve the performance as advertised. Essentially, it is a tool to help derisk an organization's video surveillance investment. This lab was developed in conjunction with Intel to bring the latest technology into a comprehensive testing environment. Through comprehensive testing that ensures performance standards in real-world scenarios can be met, the Labs provide a tried and tested validation process to help:
 - Reduce deployment risks.
 - Increase system reliability, thereby reducing overall support costs.
 - Gain a proven, repeatable architecture.
 - Get benchmarking results using production workloads.
 - Test multiple ISV products simultaneously with Dell EMC's fault toleration and high availability options and validate virtual and non-virtual architectures.

Dell Technologies' video surveillance solution is differentiated in the market because of four key factors:

- **Try it before you deploy.** Within its validation labs, Dell Technologies has test plans that have been refined over the years and incorporates best practices along the way.
- **Optimized for surveillance.** Included at the core of the solution is Dell Technologies' high tier of storage. This provides flexibility for IT organizations to maintain storage on-premise or off-premise depending on the scenario and allows a truly hybrid cloud environment.
- **Purpose built for OT and IT.** IT organizations are increasingly building and managing these systems today. Dell Technologies is a familiar partner for IT departments and can help bridge the gap in terms of bringing this historically OT technology into the IT umbrella.
- **Dell Technologies' portfolio of solutions.** The video surveillance solution is based on a platform design leveraging all the best-of-breed elements from across Dell Technologies to provide a holistic solution for organizations looking for an end-to-end video surveillance solution including the compute, storage, and network.

CONCLUSION

The video surveillance market is undergoing a massive transformation. With the proliferation of IP-enabled cameras, organizations have been struggling to find ways to keep up with the pace at which video content is created and how they will manage, store, and secure it now that this video rides on local and wide area networks. From public safety situations to in-car video to physical security, the need for video capture and processing in real time, without replay time lags, that is of high resolution and is stored for long periods due to increasing regulatory and process oversight is only going to increase. It behooves IT (and OT) organizations to consider solutions that offer an open, integrated, and holistic platform approach to support their video surveillance initiatives. Dell Technologies has a robust road map to support video over the coming decade to support the needs of organizations as they continue to integrate video and computer vision capabilities into their IoT deployments.

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