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Video Surveillance

Reliable Storage Systems That Meet Expectations of High-Resolution Video Data Streams

Author: Irina Chan, Specialist Product Marketing Management, Storage Products Division, Toshiba Electronics Europe GmbH

Video surveillance systems are incorporating larger numbers of cameras, with higher resolutions. Consequently, the volumes of data being generated are growing all the time. This ongoing trend means that the storage media being used have to satisfy significantly increased demands. Not only is this true when it comes to storage capacity, but also in terms of providing around the clock reliability in what are often extremely tough working conditions.

The market for video surveillance is booming. In addition to the greater need for security among the population and businesses, there are also new applications emerging in the field of video analytics. For example, smart algorithms are capable of analysing video streams to count visitor numbers, identify vehicle number plates or detect the presence of smoke. The quantity of cameras deployed in the public domain and at company premises is therefore rising dramatically. According to a study conducted by Mordor Intelligence, the European video surveillance market is predicted to experience a compound annual growth rate (CAGR) of approximately 15.5% between now and 2027.

As already mentioned, along with the number of cameras, device resolutions are also increasing. Even the simplest models already offer full HD these days, with 4K and even 8K not being uncommon in the professional sector. Given that multiple cameras are typically used and these are in operation 24/7, the amounts of data involved can quickly build up. It is often the case that this data then has to be kept for a prolonged period without losing frames and also be readily available for review at any time. Such requirements pose particular challenges for storage systems and the media they rely on.

Conventional desktop hard disk drives (HDDs) are insufficient here - as they are only designed for operating times of between 8 and 16 hours a day, and for annual workloads of about 55 TB. In a video surveillance system they would generally exceed these values and wear out quickly, as the probability of faults or failures during the warranty period would increase considerably. Consequently, HDD manufacturers offer specialised models that are optimised for video surveillance and support non-stop operation. These drives are much more robust, enabling them to handle up to 180 TB of data per year.

Surveillance HDDs typically have a mean time to failure (MTTF) of 1 million hours, which equates to an annualised failure rate (AFR) of 0.88%. So, out of a thousand of these drives, about 9 would probably fail per year. By comparison, if placed into continuous operation, desktop HDDs with a MTTF of 600,000 hours have an AFR of 1.46% Therefore, out of a thousand of these drives, 15 would probably fail in any given year. Lower priced models would thus only save money in the short term, as in the longer term they would incur higher maintenance and servicing expenses, that will add to the total cost of ownership (TCO). In addition, surveillance HDDs will have a longer warranty period, usually covering a 3-year period.

Robust and reliable storage media

Given the large volumes of data involved in video surveillance activities, digital video recorders (DVR), network video recorders (NVR), video servers and video management systems must provide plenty of storage capacity. This is why they are often equipped with a number of HDDs. The problem with this is that, in conventional arrangements, their rotational vibrations reinforce each other. In extreme cases this can even result in damage being done to the drives. That is why special surveillance HDDs have sensors incorporated, so as to identify these vibrations. As soon as a situation occurs where the vibrations present are becoming a concern, the operating parameters can be adjusted by control mechanisms to safeguard against the HDDs suffering any adverse effects on their performance. Desktop HDDs, which are normally only installed on a standalone basis, can manage without such sensors and control mechanisms. However, their service life will be substantially reduced if used in the storage systems intended for video surveillance.

Unlike desktop HDDs, surveillance HDDs are put through comprehensive compatibility and function tests in various different types of video recording equipment. This enables hard drive manufacturers to ensure that their models work smoothly with such equipment and deliver optimum performance - which is not guaranteed in the case of desktop HDDs.

In addition, desktop HDDs are only designed for an operational temperature range of 0 to 60˚C. This can be insufficient for video surveillance, because the recorders are not always installed in air-conditioned server rooms or data centres, or even in normal office environments. In some cases, the systems are located in poorly ventilated storage rooms or within safety cabinets in production and storage areas, where they may be exposed to elevated temperatures. Surveillance HDDs are designed for higher temperatures, with 0 to 70˚C operation covered.

Boosting performance

To enable high-resolution video streams to be processed in parallel, surveillance HDDs have optimised firmware and will generally also feature a larger buffer memory than desktop HDDs of comparable capacity. This allows them to attend to up to 64 video streams - with the exact performance ulti- mately depending on the resolution, the video codec used and the captured video content. Take an example of a camera in an underground car park. This will generate smaller amounts of data than a street camera that is monitoring a constant flow of traffic.

Some surveillance HDDs operate at speeds of 5,400 or 5,700 revolutions per minute (rpm). This is enough for many applications, even if video material sometimes needs to be read out for review in parallel with the recording. The firmware ensures that the write operations are not slowed down and that all streams are reliably recorded. Low rotational speeds make drives very energy-efficient and helps companies using them to reduce their power consumption. Where higher performance is required, however, there are also surveillance HDDs supporting 7,200 rpm.

If there are frequent high read loads, it can make sense to use enterprise grade HDDs instead of surveillance HDDs. Not only do these provide higher data rates, they can also cope with bigger annual workloads of up to 550 TB. They are also equipped with vibration sensors and control mechanisms for vibration suppression, but are only designed for operating temperatures between 5 and 55˚C. Companies therefore need to make sure that they only put video storage systems equipped with enterprise grade HDDs in air-conditioned rooms. If this is done, then nothing stands in the way of downstream analysis of large video volumes, potentially using modern AI algorithms.

Conclusion

Through access to high-resolution video data, there are a plethora of exciting new use cases that can be explored. Analysis of such data will have huge worth as we move into a smart city future, allowing traffic congestion to be alleviated and the better assigning of resources to particular areas. In residential buildings and workplaces, captured occupancy data will help lower energy usage, as heating and lighting will only be activated in the places where they are needed. With an unprecedented quantity of acquired data needing to be stored, having fully optimised HDD solutions will be absolutely essential.

Toshiba Electronics Europe GmbH

Hansaallee 181
40549 Düsseldorf
Germany

info@toshiba-storage.com
toshiba-storage.com

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