Western Digital.
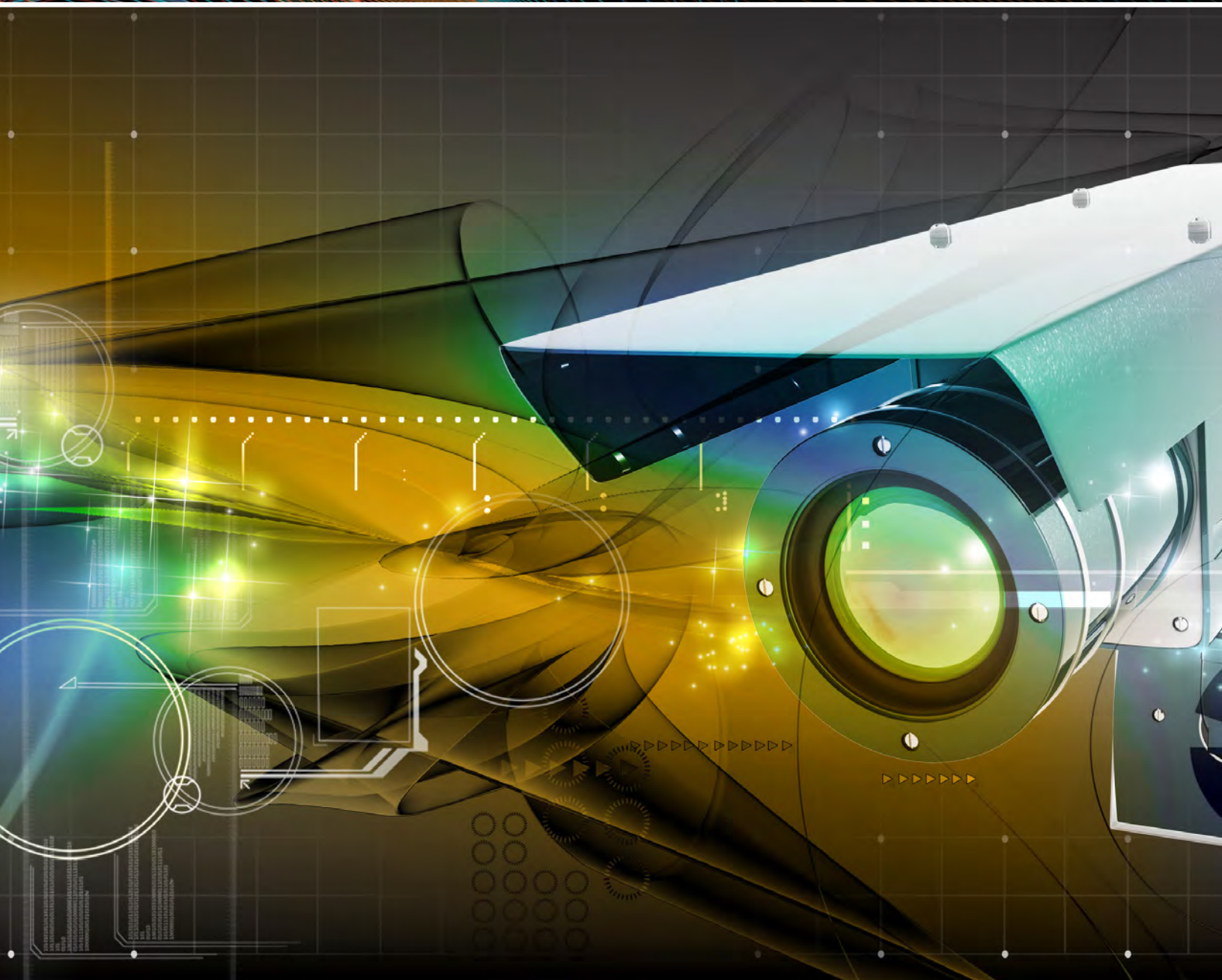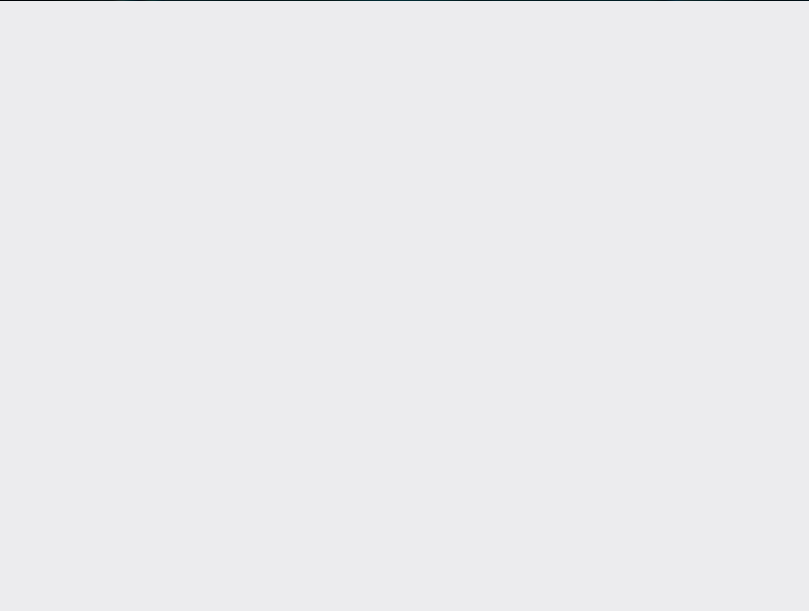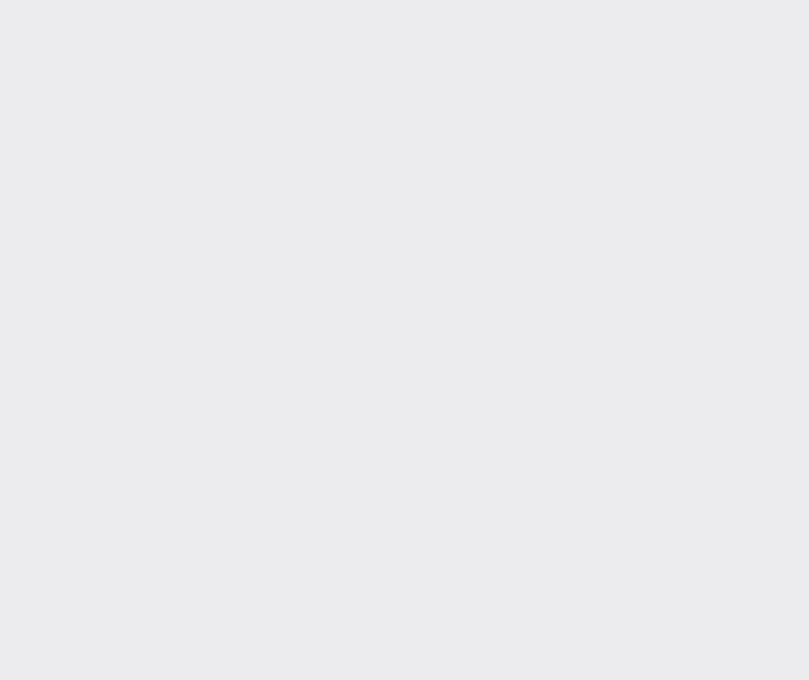
Endurance in Surveillance

microSD Cards –
Marvels of Technology

NAND flash is being adopted at an increasing rate as a primary storage medium. With capacities up to 512GB and a package size 15mm long and 1.2mm thick, microSD cards are valued for small host devices that need sizable data storage space yet are highly constrained by physical size. As a removable device, microSD cards also have the flexibility to be easily serviced, exchanged, or replaced, providing high data portability if needed. microSD cards have all the advantages of flash storage: there are no moving parts, and they can withstand higher vibration, temperature swings, and humidity than legacy hard disk drives. With advantages in size, flexibility and serviceability, microSD cards are used in both consumer and commercial applications, from mobile phones to industrial and professional surveillance applications.

Use Cases for microSD Cards

Multiple use cases for microSD cards exist, and each use case has varying degrees of performance, handling and workload needs. Multiple types and classes of microSD cards are available in the market to address those needs; however, not all cards are capable of meeting all needs. It is important to under-stand the requirements of the application and then select cards that have the necessary attributes to fit the application. There are different types of microSD cards. Some cards are more cost effective, but do not excel at performance or robustness. Some cards are designed for higher performance yet cost a little more. And there are those cards that are designed to handle more workload, or writes, and last longer for applications that require it.

Cost Efficiency

Endurance

Performance

Low cost cards are designed for basic use in some mobile phones, small cameras, and action cameras to store still pictures and video. Once a user fills the card with images and video, the card must be purged of its data before it can be used again. Some mobile phones support wireless data transfer, but in the case of digital cameras, the user can easily remove the card from the device and download the files onto a laptop or other PC. The user then erases the card and reinserts it in the device for reuse. The card may stop work-ing at some point, but users typically do not believe this to be a critical issue and will just replace the card.

High performance cards are usually selected because the application has specific performance require-ments, such as a DSLR camera that has a high continuous shooting frame rate, or a video camera that records 1080p/4K video at a high frame rate. Performance oriented cards usually have speed ratings, like

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UHS Speed Class 3 (U3) or Video Speed Class 30 (V30) that are matched to the camera's performance requirements. Like low-cost cards, when a high performance card is filled to capacity with images or video, it must be purged to be used again. The cards can be easily removed to download images or video and then erased and reinserted. Many users of high performance cards also have multiple cards on hand. If at any point the card stops working, the user replaces it with a backup card or purchases a new card.

microSD Cards in Surveillance

Cards used in surveillance cameras help ensure uptime of the surveillance system. Potential outages in network connectivity would otherwise cripple a surveillance system, but a microSD provides on-camera storage for uninterrupted recording. In the case of multiple cameras connected to a single NVR through an IP network, any disruption of that network may result in loss of connectivity between the cameras and the NVR, causing a disruption in the recording of critical surveillance video and crippling the surveillance solution. A microSD card installed in each camera ensures uninterrupted recording; the camera can continue to record critical surveillance video until the camera-NVR connectivity is restored.

Surveillance solution architects and integrators are experts at implementing solutions for their customers, and want these systems to run as reliably as possible, with minimal disruption and servicing. They do not want their customers to experience any downtime and want as much uninterrupted video surveillance as possible. microSD cards used in surveillance cameras must be able to have the performance to record and the capacity to store surveillance video, often while operating under extreme environmental and other operational conditions that are unique to surveillance.

Key Considerations
for microSD Cards in Surveillance

There are three major aspects of surveillance camera recording that must be considered:

1. Surveillance cameras record 24 hours a day, 7 days a week. While some some cameras might be configured to record only upon the detection of motion activity, the storage device can expect continuous recording around the clock.

2. Users do not typically remove the cards to download the content, erase and then reuse the cards. Surveillance cameras are usually installed in inaccessible locations, such as the outside of buildings, in ceiling pods, or at the top of poles. The storage devices need to be designed to run for extended periods without removal, and be able to tolerate a wide range of environmental conditions.

3. If the card reaches its full capacity, the recording of the surveillance video wraps to the beginning of the card, erasing and overwriting the previously stored footage. Since the card must run for an extended time before replacement, the card should be able to handle many more writes over a particular span of time than it would for consumer applications.

Therefore, a card designed for consumer applications would prove inadequate given the aforementioned considerations. Surveillance cameras require cards that are designed for continuous 24/7 recording, can operate in a wide range of environmental conditions for an extended time, and do not have to be constantly removed. Surveillance cameras require a storage device that can undergo multiple and extensive write cycles, more so than consumer-grade cards. The cards must be engineered with high endurance.

DATA THAT NEVER LEAVES YOUR SIGHT

Endurance is key. Fine-tuned specifically for surveillance cameras, WD Purple™ microSD™ cards allow for continuous capture — even if the network goes down.

Endurance —
What is it and why is it important?

NAND flash devices can only sustain a limited number of writes and erasures, also known as program/erase cycles or P/E cycles, before the flash can no longer accept any more writes. The number of P/E cycles is known as endurance. Not all flash devices have the same endurance. Improvements in NAND flash design and flash management can provide some flash with higher endurance. This allows special flash storage devices to be designed with higher endurance flash for applications that require it, e.g., devices that undergo continuous writes.

High endurance cards are usually specified with the number of supported P/E cycles, such as 1,000 P/E cycles or 2,000 P/E cycles. Endurance can also be specified by the total amount of data that can be written to the device over its lifetime, usually in Terabytes Written, or TBW. TBW is calculated by multiplying the capacity of the card by the number of supported P/E cycles. For example, a 64GB card having an endurance of 1000 P/E cycles will have an equivalent endurance specification of 64 TBW (64GB x 1000 = 64 TBW).

One High-endurance
microSD Card

Multiple Low Cost
microSD Cards

Some cards on the market also specify endurance by the total number of hours of video that can be recorded over its lifetime; however, the calculated number of hours is based on an assumed video bit rate that may be inconsistent from manufacturer to manufacturer, and from use case to use case. A large number of recordable hours may prove deceptive if the hours were calculated using an unrealistic or inaccurate low bit rate. Specifying P/E cycles or TBW is less ambiguous and is a better measure of endurance. Cards that do not specify P/E cycles or TBW are likely not high endurance cards and cannot be trusted to deliver high endurance for applications that need it.

"HIGH-ENDURANCE"

Performance vs. Endurance vs. Cost —
Know the Difference

Low cost cards do not typically specify endurance because the endurance likely very low. A low cost card may only allow anywhere from 200 P/E cycles, to as low as 10 P/E cycles, before the card fails. This can prove risky if the card is used in applications that need high endurance. Yet low cost cards are fine for many consumer applications such as point-and-shoot and action cameras. How often does the storage used for such consumer products reach maximum capacity and subsequently require erasing and re-writing? For most casual users, this is not the case. High endurance is not needed in mainstream consumer applications because the cards rarely reach maximum capacity, and the low cost encourages having multiple cards on hand at any given time.

High performance cards do not necessarily have high endurance, as there are not many use cases that require both high performance and high endurance. Many cards that are designed for high performance, such as UHS Speed Class 3 (U3) or Video Speed Class 30 (V30) cards, are valued for their performance and therefore cost more. Consumers and Prosumers select these cards to work with their high-performance DSLRs and camcorders. High performance cards do not typically have high endurance because the card rarely becomes so completely full that it requires high endurance. Professional photographers will likely have multiple cards on hand so that once a card reaches its maximum capacity, it is swapped out with a blank card to continue recording.

High endurance cards are designed for applications that require continuous uninterrupted operation, especially applications that continuously write to the card. High endurance cards are particularly valuable in applications where the card is constantly rewritten, and where removal/replacement of the card incurs a substantial service cost. High endurance cards also typically have higher environmental robustness, such as wider temperature and humidity tolerance. Industrial applications and surveillance are typical use cases for high endurance cards, where such applications value longevity versus high performance. For example, surveillance video is typically not as bandwidth intensive as consumer video, which usually generates higher bit rates due to high resolution, high frame rates, stereo sound, and much higher scene activity; however, video surveillance cameras constantly write and rewrite cards, and surveillance cameras are not as accessible to replace the cards on a regular basis.

High Endurance microSD Cards Deliver Value in Surveillance

High endurance cards are highly recommended for use in all surveillance camera devices. Even though high endurance cards typically cost more than consumer or commercial cards, there are many factors that reduce the total cost of managing surveillance cameras through the use of high endurance cards:

1. Using lower-cost cards with lower endurance will require the use of more cards over the same amount of time as using one high-endurance card, thereby potentially increasing the total cost of storage needed.

2. The cost of servicing the surveillance cameras to replace the cards will rise because replacement must occur on a more frequent basis.

3. More frequent replacement of the cards increases downtime of cameras, thereby causing a higher potential for missing critical surveillance video recording.

Using high endurance cards in surveillance cameras reduces the need to constantly replace cards as they approach their end-of-life, thereby saving time and money in the servicing of surveillance systems. In addition, high-endurance cards provide peace of mind by running longer and more reliably. Card health monitors featured in some high-endurance cards allow even greater ability to monitor and proactively manage storage, and schedule maintenance when most convenient to the end customer.

Use Western Digital High-Endurance microSD Cards for Your Surveillance Solution

Western Digital's line of high-endurance WD Purple microSD cards are designed specifically for surveillance cameras. The cards feature an endurance rating of 1,000 P/E cycles, and are a best fit for surveillance cameras that are connected to NVRs; the cards can act as a short-term backup if connectivity is lost between the camera and the NVR. Video can still be recorded to the WD Purple microSD card until the connectivity is restored. This ensures minimal loss of the recording of important surveillance video.
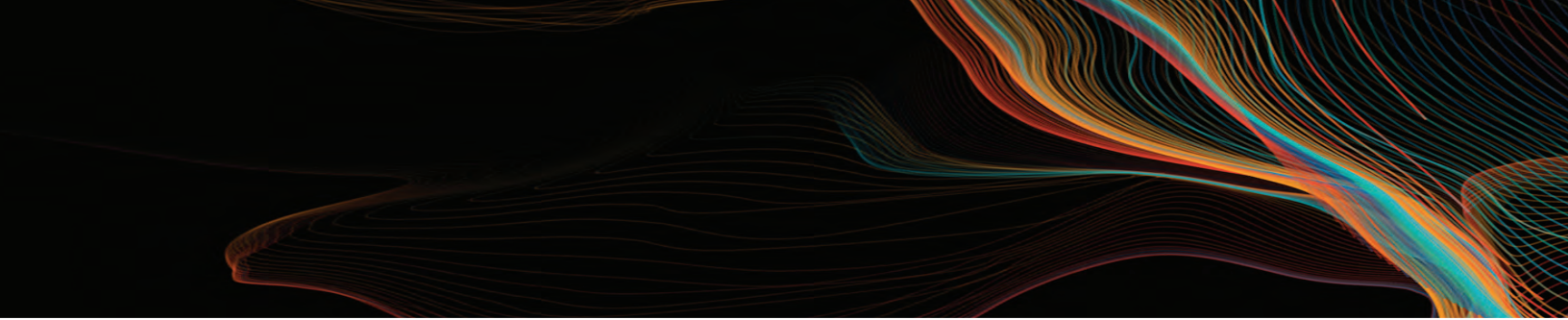
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