For Data Centers

Endurance of the SSD for data centers

The lifetime of the SSD for data centers and its recommended usage applications

Application note

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1. What is the endurance of the SSD?

NAND flash is largely categorized into a single-level cell (SLC) and a multi-level cell (MLC), depending on the number of bits stored per cell, and this criterion has a great effect on the endurance (lifetime), performance and price. The electrical activity of NAND flash memory wears out the physical structure of the cell over time, due to its characteristics and mechanism. Each cell has a finite lifetime, measured in terms of its program/erase (P/E) cycle. The endurance of an SSD refers to the maximum P/E cycle (lifespan) that its NAND flash can endure.

2. Why is SSD endurance especially important in data centers?

The data workload might vary, depending on a data center's usage applications. In most cases, the data workload in the server, cloud and data center is much heavier than that of client PC usage. Therefore, in a usage environment that requires a heavy workload, using an SSD that has a low-endurance NAND would cause endurance problems within the warranty period.

Therefore, data centers that use SSDs in their server systems need to correctly determine their average workload and the SSD's endurance, which is generally measured in terabytes written (TBW) or drive writes per day (DWPD), and find the most efficient solution based on the lifetime, performance and cost.

3. How do I determine the lifetime of an SSD?

There are largely three factors that affect the SSD lifespan : NAND flash endurance (maximum P/E cycle), Write Acceleration Index (WAI) and the physical capacity of the SSD. WAI is the multiplication ratio of the data size actually written to the physical NAND in comparison to the size of the data that is intended to be written by the host system, also referred to as the Write Amplification Factor (WAF). The WAI is due to the internal operation, such as garbage collection (GC) and the wear-leveling process, and depends on the data workload pattern and the over-provisioning (OP) ratio. Considering all three factors, the lifetime of SSD can be calculated on a TBW basis.

TBW = (SSD physical capacity X NAND endurance)/WAI

Also, by comparing the TBW of an SSD and the user's required data workload, the optimal SSD replacement period can be estimated. During SSD usage, users can simply check the current amount of data written by using S.M.A.R.T information.

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4. Samsung SSDs for data centers are

The endurance of Samsung SSDs for data centers is described in the table below on a TBW basis.

Endurance (TBW)	845DC EVO			845DC PRO	
	240 GB	480 GB	960 GB	400 GB	800 GB
Warranty condition	5-year limited warranty			5-year limited warranty	
	150	300	600	7,300 (10 DWPD)	14,600 (10 DWPD)
Recommended applications	**Read-centric applications** Read cache Embedded solutions Search/Indexing Web servers Content delivery Media streaming Cloud service File servers Workstation			**Mixed/Write-centric applications** Email Database/OLTP Cache accelerator (write) Data warehousing High-performance computing(HPC) Media editing Analytics Database logging	

845DC EVO, which is equipped with a 3-bit MLC, offers reinforced endurance by using top-quality NAND, advanced signal processing and best optimized firmware. 845DC EVO's superior performance, low latency and high efficiency from low power consumption is suitable for read-intensive applications, such as read cache, search/indexing, content delivery, workstation, and web server. Even though 845DC EVO is recommended for read-centric applications, 845DC EVO's guaranteed amount of data write is very competitive, offering a generous 5-year limited warranty period.

845DC PRO adopted the world's first V-NAND technology, which is highly innovative, cutting-edge technology and boasts 10 times higher endurance than the conventional NAND. 845DC PRO's superior performance and high endurance are suitable for the most demanding data center uses, especially write-intensive applications, such as write cache, database (online transaction processing [OLTP]), high-performance computing (HPC), media editing and database logging.

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