



For Data Centers

# Quality of Service (QoS)

Quality of Service to offer predictable response times

Application note

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# Quality of Service (QoS)

## 1. What is Quality of Service (QoS)?

Quality of Service (QoS) of SSD is the level of quality that provides steady and consistent performance given as a time taken to complete all requested processes within a specific time limit or with a fixed confidence level (threshold).

In server/data centers, it's important to provide secure, predictable, measurable and, sometimes, guaranteed service. QoS can be an indicator to estimate service time (response time) and is expected to provide a guaranteed service level agreement (SLA) through parallel processing performance and real-time processing.

Usually, QoS is given as a maximum response time under the certain confidence level of 99.9% or 99.9999%. For example, if the QoS of 845DC EVO 480GB in read operations is 0.6 msec with a 99.9% of confidence level, that means the 999th fastest response time out of 10,000 requests is about 0.6 msec.

## 2. Why is QoS important?

Offering predictable response-time performance is one of the most important factors or requirements in data centers since service providers want to manage and optimize the delay and its variations to offer a successful end-to-end business solution.

However, due to the characteristics of NAND flash-based SSDs, there are actions that host commands are unable to process promptly because of the SSD's internal operations, such as garbage collection (GC) and other background management tasks.

Figure 1(a) describes a use case scenario where multiple virtual machines share storage resources such as SSD. In this situation, each VM allocated to different customers with the same level of SLA expects the same Quality of Service in terms of the I/O performance. If some SSD specific behavior such as garbage collection or wear-leveling happens during a certain VM's access to SSD, it may see unexpected performance degradation (Figure 1(b)). Therefore for the sake of fair serviceability, consistent performance is considered a mandatory feature of data center SSDs.

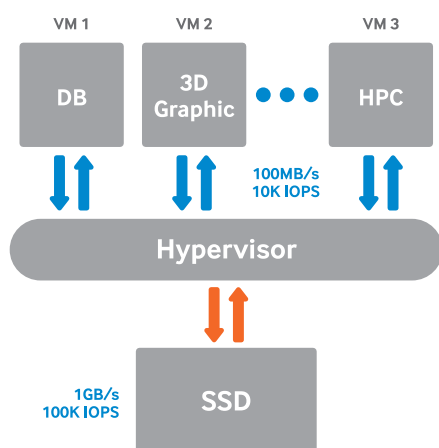


Figure.1(a)

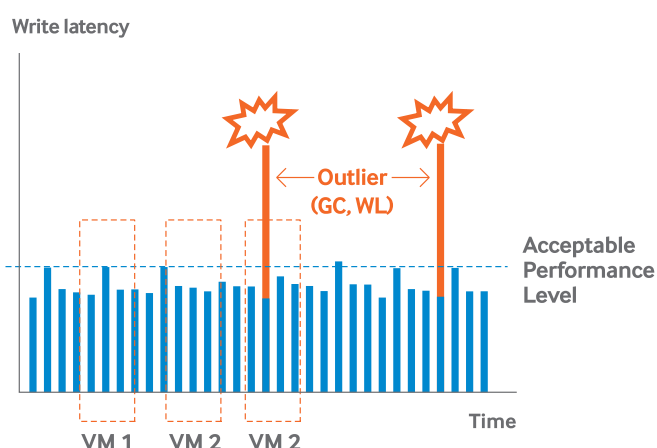


Figure.1(b)

Therefore, for better QoS, SSD manufacturers should focus on optimizing SSD resources and operations at the firmware level to reduce the response time.

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## Quality of Service (QoS)

### 3. Samsung SSDs for data centers

The table below shows the QoS for Samsung SSD 845DC EVO. The Samsung SSD 845DC EVO offers extremely low latency and a high level of Quality of Service (QoS), which are both essential for data center and cloud server applications.

QoS [msec] (4KB, Random)		240GB		480GB		960GB	
		Read	Write	Read	Write	Read	Write
QD 1	99.9.%	0.2	0.4	0.2	0.4	0.2	0.4
	Max (99.9999%)	1	1	1	1	1	1
QD 32	99.9.%	0.6	7	0.6	7	0.6	7
	Max (99.9999%)	3	8	3	8	3	8

※ Actual performance may vary depending on user conditions and system environment.

※ Test condition : Intel® Core i3-3240 3.40 GHz, 4 GB DDR3-1600, Intel C216 Chipset Family,  
RedHat Enterprise Linux® 6.4 with AHC (ver.9.3.0.1011).

※ Test program : FIO 2.1.3.

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