

QNAP

QNAP Technical White Paper

**QNAP Storage
Quality-of-Service**

QoS

Table of Contents

	ITEM	PAGE
1	Summary	02
2	Challenges	02
3	About Storage QoS	02
4	QNAP Storage QoS	03
5	Application Scenarios	04
	· Veeam Backup	04
	· File Server	05
6	Other Scenarios	06
	· When Network Capacity is Insufficient	06
	· Reserved Pool I/O Capacity	06
7	Conclusion	07

1

Summary

This white paper introduces QNAP Storage QoS, a technology that assists in providing applications with greater stability in enterprise IT environments. The white paper also simulates and verifies some application scenarios using QNAP Storage QoS. Administrators can deploy applications and appropriate QoS policies in their storage environments with reference to some use cases in this white paper.

QoS

**QNAP Storage
Quality-of-Service**

2

Challenges

As storage drives continue to drop in price, storage capacity is no longer the top concern for Enterprise IT users. Instead, driven by the increasing demands of various business applications, one of the most frequently-asked questions becomes "How do I sustain sufficient performance for each application?" This is especially true in environments where storage I/O is distributed to multiple applications concurrently.

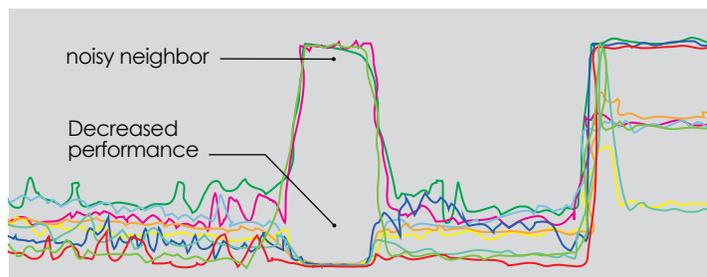


Figure 1: Noisy Neighbor Problem

The term "Noisy Neighbor" is used when one application delivers many I/O requests which then impacts the performance capacity of other applications using the same device. While a high-performance storage deployment (all-flash storage) may help increase the total performance capacity, this alone will not be enough to ensure that multiple services run concurrently with stability.

Another issue for Enterprise IT is the rigid bind between capacity and performance. This bind can force Enterprise IT to buy additional storage systems/capacity, resulting in unnecessary expenditure trying to achieve stable performance for all applications.

3

About Storage QoS

Quality-of-Service (QoS) primarily aims to avoid the "Noisy Neighbor" problem by adequately controlling I/O resources and providing applications with a certain performance level, which is usually measured by IOPS (Input/Output Operations Per Second) or throughput (MB/s).

As QoS is ubiquitous in the domain of network devices, we will clarify the difference between Network QoS and Storage QoS. Network QoS refers to the QoS for transferring data between source and destination devices over a network, while Storage QoS refers to the QoS for storing data on a specific storage device. This article focuses on Storage QoS.

Storage QoS also varies in the level of its ability and versatility to allocate and control I/O resources. One of the most common approaches applied by storage firms is to set a hard limit of IOPS or throughput on each volume. To get a higher limit, users must also pay a higher price. Another common approach is to allow simple prioritization on each volume, with higher-priority applications having a higher share of I/O resources.

These two common approaches may help alleviate noisy neighbor problems to some extent. However, they will not ensure that every volume receives the actual performance required.

QNAP Storage QoS

QNAP has developed a cutting-edge, flexible and powerful Storage QoS technology, which not only solves noisy neighbor problems, but also breaks through the rigid bind between performance and capacity by provisioning them separately out of a single pool.

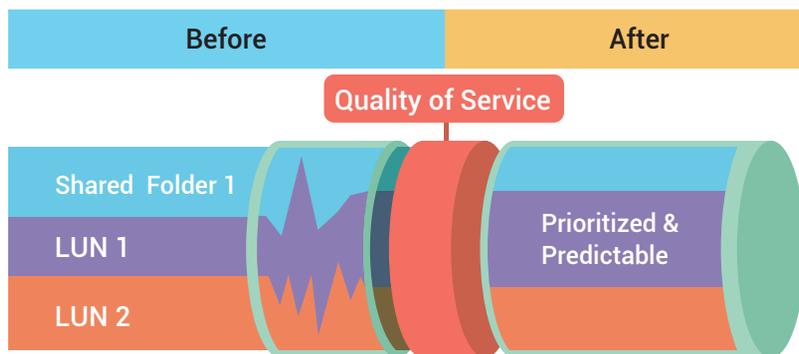


Figure 2: Concept of QNAP Storage QoS

Figure 2 illustrates the concept of QNAP Storage QoS. Applications are sharing the same storage device and the same system with limited performance capacity. The left side of the figure visualizes the unstable and unpredictable performance of applications without QNAP Storage QoS. The right part of the figure visualizes the stable and predictable performance when QNAP Storage QoS is enabled.

Before using QNAP Storage QoS, you must know how applications work and what values of performance should be provisioned in the system to stabilize those applications. Here we list several factors needed to consider before configuring QoS:

- Desired level of performance
- Consistency of desired performance
- Tolerance of variable performance
- Value of providing this level of performance

After determining the above factors, you can start setting QoS in QES. You can create many storage groups (a group of shared folders and LUNs with a policy applied to it). A policy is a set of I/O parameters which are applied to each storage group member (a shared folder or a LUN) individually. To provide well-rounded controllability over all the I/O resources allocated to shared folders and LUNs, QES allows administrators to set the following four parameters. These parameters can be set dynamically.

- Max IOPS or MB/s: The maximum I/O that a storage group member is allowed to perform over an extended period of time. This value prevents shared folders or LUNs from negatively affecting other services.
- Min IOPS or MB/s: The minimum I/O required by this storage group member. QES tries to maintain this value for all storage group members. When all members meet their minimum requirement, QES scales up the I/O for each member towards its Maximum value based on its priority settings (Lowest, Low, Medium, High, and Highest). This value guarantee that each shared folder or LUN receives a sufficient share of performance, as long as the total I/O capacity of the storage pool is sufficient as well.
- Burst IOPS or MB/s: The maximum amount of I/O that a storage group member is allowed to process over a short period of time. This value is particularly effective for heavy workloads that need to be completed within a short period. Burst requests are only processed when the storage pool has sufficient spare I/O capacity, and the storage group member has had no I/O requests for a certain amount of time (see Burst Time).
- Burst time: If a storage group member has no I/O requests for the specified amount of time, then when it starts I/O again it can perform burst I/O for an equal amount of time.

Application Scenarios

Veeam Backup

QNAP NAS as Veeam Backup & Replication repositories for backup System architecture is shown in Figure 3.

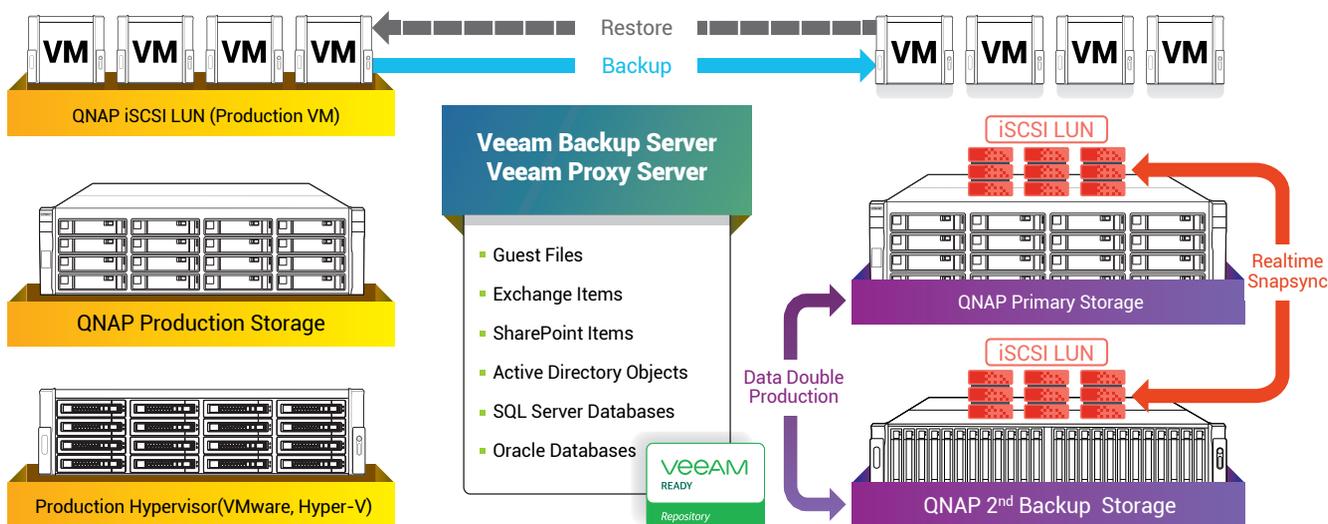


Figure 3: QNAP NAS as Veeam Backup & Replication repositories for backup System architecture

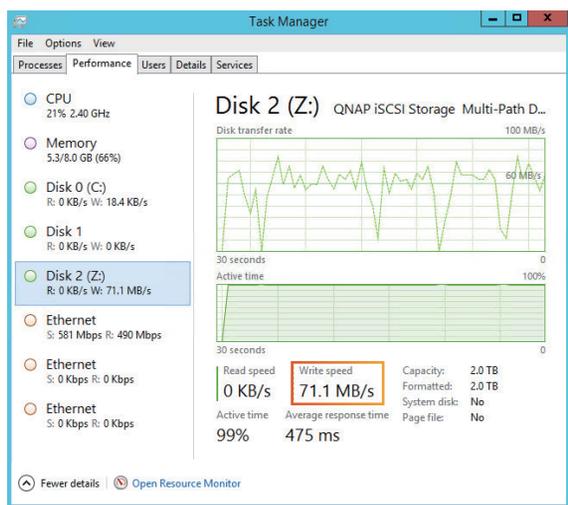


Figure 4: Veeam Backup performance with QNAP Storage QoS

In this case, we back up a large VM to verify QNAP Storage QoS. The maximum and minimum values have been set as 80MB/s and 10MB/s. Disk performance is monitored using Windows Task Manager. Figure 4 shows that the performance is around 60 MB/s to 80 MB/s most of the time. Occasional and instant fluctuations are restrained between 80MB/s and 10MB/s.



File Server

In this case, we simulate a situation where multiple users read/write large files simultaneously with a QoS policy applied on each iSCSI LUN to ensure all users get adequate performance values even if various tasks are processing. The maximum and minimum values have been set as 100MB/s and 40MB/s respectively. Figure 5 shows two users enjoying stable performance around 60MB/s. Occasional and instant fluctuations are restrained between 80MB/s and 40MB/s.

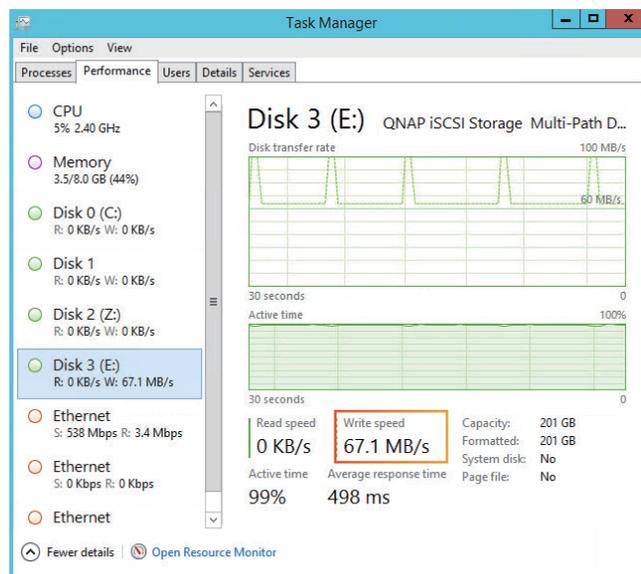
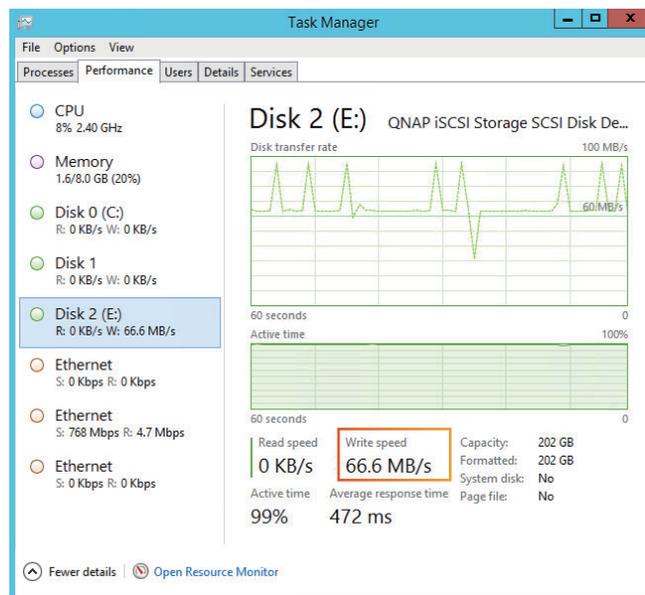


Figure 5: File Server performance with QNAP Storage QoS

Other Scenarios

When Network Capacity is Insufficient

Throughput on an NIC provisioned for multiple shared folders that use the same policy. Two shared folders with this policy are in the same pool, and NIC bandwidth would be evenly distributed to folders by 500 MB/s for each. See the tables below for further information of pool performance and QoS policy.

NIC information: 1000 MB/s

Pool information:

Each SAS disk	Raid 5	Pool I/O Capacity
150 MB/s	150 MB/s * 5	750 MB/s

Policy information:

Min MB/s	Max MB/s
500 MB/s	Unlimited

In this case, pool I/O capacity (750MB/s) is not enough to sustain the minimum settings (500 MB/s *2) of both shared folders. Desired levels of performance will come to your attention if the Min MB/s setting cannot satisfy two shared folders at the same time. Each folder can take around 375 MB/s of performance but not the 500 MB/s, marked in the policy.

Network and pool performance are both important in this case to meet the levels of performance set in the policy. Before setting QoS, you should ensure that your network deployment can deliver the total performance demands.

Reserved Pool I/O Capacity

You can reserve a percentage of storage pool I/O capacity for shared folders and LUNs without a QoS minimum value applied to them. This ensures that all shared folders and LUNs in the pool always have sufficient I/O for normal operations.

For example, there are ten shared folders in a storage pool. Six of them have a minimum I/O capacity set by the QoS policy. If the Pool I/O Capacity is 1000 MB/s and we set a 20% Reserved Ratio for this pool, then the Reserved Pool I/O Capacity would be 200 MB/s.

Pool I/O Capacity	Reserved Ratio	Reserved Pool I/O Capacity
1000 MB/s	20%	200 MB/s

Reserved Pool I/O Capacity is allocated equally to the remaining four shared folders when they request I/O. If all four shared folders request I/O, each folder will get 50 MB/s of I/O capacity. If only two of the four folders request I/O, then the two folders will get 100 MB/s of I/O capacity each.

Conclusion

QNAP Storage QoS guarantees the undisturbed functioning of multiple workloads which share the same resources, and also maintains stable performance for other applications on the same system.

One of the significant advantages that QNAP Storage QoS renders is to consolidate multiple applications. For enterprise IT, the noisy neighbor problem will be resolved, and the performance obsession within a single storage system will be removed. Eventually, Enterprise IT can save operation costs by reducing the number of storage platforms needed to meet the performance requirements of their applications.

QNAP Storage QoS also breaks through the rigid bind between performance and capacity by provisioning them separately out of a single pool. This allows administrators to deploy less capacity and more efficient over-provisioning settings to meet the requirements for workloads.

QoS

**QNAP Storage
Quality-of-Service**



QNAP Storage Quality-of-Service

QoS

QNAP SYSTEMS, INC.

TEL : +886-2-2641-2000 FAX: +886-2-2641-0555 Email: qnap-sales@qnap.com

Address : 3F, No.22, Zhongxing Rd., Xizhi Dist., New Taipei City, 221, Taiwan

QNAP may make changes to specification and product descriptions at any time, without notice.

Copyright © 2019 QNAP Systems, Inc. All rights reserved.

QNAP® and other names of QNAP Products are proprietary marks or registered trademarks of QNAP Systems, Inc.

Other products and company names mentioned herein are trademarks of their respective holders.

Netherlands (Warehouse Services)

Email: nlsales@qnap.com
TEL: +31(0)107600830

China

Email: cnsales@qnap.com
TEL: +86-400-028-0079

Thailand

Email: thsales@qnap.com
TEL: +66-2-5415988

Japan

Email: jpsales@qnap.com
FAX: 03-6435-9686

US

Email: usasales@qnap.com
TEL: +1-909-595-2782

India

Email: indiasales@qnap.com

Germany

Email: desales@qnap.com

France

Email: frsales@qnap.com