

# iSCSI Performance Tuning

## Best Practice Guide

Version 1.0

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## Announcement

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### **Edition 1.0 (JAN. 2020)**

This edition applies to QSAN XCubeSAN SAN storage systems. QSAN believes the information in this publication is accurate as of its publication date. The information is subject to change without notice.

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Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products.

All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

## Preface

### About This Guide

This performance tuning guide provides technical guidance for adjusting/increasing the performance when testing QSAN products which provides iSCSI service, and it is intended for use by system administrators, SAN/NAS designers, storage consultants, or anyone who has purchased these products and is familiar with server and computer network, network administration, storage system installation and configuration, network attached storage management, and relevant protocols.



#### **CAUTION:**

Do NOT attempt to service, change, disassemble or upgrade the equipment's components by yourself. Doing so may violate your warranty and expose you to electric shock. Refer all servicing to authorized service personnel. Please always follow the instructions in this owner's manual.

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### Technical Support

Do you have any questions or need help troubleshooting a problem? Please contact QSAN Support, we will reply to you as soon as possible.

- Via the Web: [http://www.qsan.com/en/contact\\_support.php](http://www.qsan.com/en/contact_support.php)
- Via Telephone: +886-2-7720-6355
- (Service hours: 09:30 - 18:00, Monday - Friday, UTC+8)
- Via Skype Chat, Skype ID: qsan.support
- (Service hours: 09:30 - 02:00, Monday - Friday, UTC+8, Summertime: 09:30 - 01:00)
- Via Email: [support@qsan.com](mailto:support@qsan.com)

## Information, Tip and Caution

This manual uses the following symbols to draw attention to important safety and operational information.



**INFORMATION:**

INFORMATION provides useful knowledge, definition, or terminology for reference.



**TIP:**

TIP provides helpful suggestions for performing tasks more effectively.



**CAUTION:**

CAUTION indicates that failure to take a specified action could result in damage to the system.

---

# 1. Overview

## 1.1 Audience

This document is applicable for those technical members who are familiar with QSAN products, and for those who are good at network trouble shooting, Windows Server and Unix-Like OS operations, and basic hardware installations.

Please read this document carefully before trying to adjust any parameter on server side. Doing an adjustment with wrong understanding may lead you to get a worse performance experience than ever. If you have any questions about the adjustment, please consult QSAN Technical Support for further assistance.

## 2. Storage Best Configuration

### 2.1. Network Configuration

Please make sure the followings are configured properly based on user's environment, you don't need to set each setting to be exactly the same, please try to adjust and find the best ones for user:

- Make certain that each network port has been used for I/O transferring, you may check from Performance Monitor page on web UI for reference
- If you have enabled Jumbo Frame from controller side, make sure all ports (including switch) have enabled Jumbo Frame (also called as MTU) with the same size as controller ports'.
- If you have enabled Trunking/LACP on controller side, please be sure that the switch has been configured with the same setting to meet the usage, all connected ports on the switch side need to be in the same Trunking/LACP port group.
- Make sure you have enough clients to request high performance as many as controller's ports. E.g., if you have 10GbE port \* 4 from controller side, you must to prepare at least 4 10GbE ports from client side, using one 10GbE port could only get maximum performance around 1000MB/s.
- Make sure each NIC port is running at the expected link speed.

## 2.2. RAID Configuration

By default, QSAN provides the best configuration when creating a RAID pool for trying to gain the best performance, if you have no special demand, please do not modify any parameters as listed below:

- Use Thick Provisioning, Thin Provisioning provides a bit lower performance than Thick due to its algorithm, but if user needs to use it, that's no problem to use Thin Provisioning, just be sure you have read the policy of Thin Provisioning feature thoroughly, otherwise a data inconsistency situation may occur.
- Make sure all the below items (excepting Standby) are checked.

The screenshot shows the 'Create Pool' configuration interface. On the left, a sidebar lists 'General', 'Disk Selection', 'RAID Configuration', 'Disk Properties', and 'Summary'. The main area is divided into two sections: 'Pool Type' and 'Pool Properties'. Under 'Pool Type', there are three radio buttons: 'Thick Provisioning' (selected), 'Thin Provisioning', and 'Auto Tiering (Thin Provisioning Enabled)'. Under 'Pool Properties', there is a text input for 'Pool Name' with the value 'Test' and a dropdown for 'Preferred Controller' set to 'Controller 1'. A note at the bottom states: 'The I/O resources will be managed by the preferred controller which you specified.'

- Make sure all the below items (excepting Standby) are checked.

The screenshot shows the 'Create Pool' configuration interface, specifically the 'Disk Properties' section. The sidebar on the left highlights 'Disk Properties'. The main area contains the following settings:
 

- Enable Disk Write Cache:** Checked. Description: 'Enabling disk write cache will improve write I/O performance but...'.
- Enable Disk Read-ahead:** Checked. Description: 'System will preload data to disk buffer based on previously retrieved sequential data retrieved.'
- Enable Disk Command Queuing:** Checked. Description: 'Send multiple commands to a disk at once to improve performance.'
- Enable Disk Standby:** Unchecked. Description: 'The disks will spin down for power saving when they are idle for...'.
- Disk Standby:** A dropdown menu set to '30 seconds'.



- Don't change anything when creating a volume, you may need to enable Video Editing Mode if user's environment needs a more stable performance.

**Create Volume**

**Volume Advanced Settings**

Please configure the volume advanced settings.

Block Size : 512 Byte

Priority : High

The priority is the comparison with the other volumes.

Background I/O Priority : High

Background I/O priority will influence volume initialization, rebuild, and migration.

Erase Volume Data : Fast Erase

Enable Cache Mode (Write-back Cache)  
Write back optimizes the system speed but comes with the risk which the data may be inconsistent be short time interval.

Enable Video Editing Mode  
Please enable it when the application is in the video editing environment. It sacrifices a bit of performance.

Enable Read-ahead  
The system will identify what is needed next, based on the content just retrieved from the disk, and the buffer. When the data to be transmitted is continuous, this feature will improve performance.

- The overall performance would be a bit lower if Video Editing Mode or Fast Rebuild is enabled, but it won't be a problem to use if user needs it.
- (Optional) This is an optional configuration, but it is important to realize, if overall performance (theory) from disk drives exceeds below thresholds:
- Don't enable/take snapshot on the volume that you would like to verify performance, QSAN's Snapshot mechanism uses differential copy (on write), write performance will be low when testing write performance on a volume which has taken a snapshot.
- (Optional) This is an optional configuration, but it is important to realize, if overall performance (theory) from disk drives exceeds below thresholds:
  - 6400MB/s for read (Sequential)
  - 2500MB/s for write (Sequential)
  - 600000 IOPS for read (Sequential)
  - 300000 IOPS for write (Sequential)
  - 300000 IOPS for read (Random)
  - 100000 IOPS for write (Random)

Please try to divide disk drives to two parts with the same quantity, and create two RAID pools, then assign to controller1 and controller2 separately.

## 3. Server Configuration

### 3.1. Network Configuration

Nowadays, those mainstream OSes contain the driver by default for most popular HBA cards, but it is still recommended to update the driver version to the latest one for the installed HBA on the server side, in case of any incompatibility between the OS and HBA card.

- Make certain that each network port has been used for I/O transferring, you may check from Task Manager from Windows Server.
- You may specify source IP address when logging in iSCSI target from Windows Server iSCSI Initiator, to ensure that each NIC port on server side will be used.
- Unix-Like OS may not support to specify a source IP address when logging in a iSCSI target, so you may need to configure different network segments for each NIC port on server side.
- Make sure a proper network cable with correct link speed is used for each NIC port.

**TIP:**

If you have a switch connected between server and storage, make sure the Flow Control on the switch side is ON, and be sure the other settings are the same as server's NIC.

---

### 3.2. Local Drive

If you are going to test the performance by copy and paste operation, please make sure that the local drive installed on your server possesses high performance, as a copy and paste operation relates to read and write performance from local drive as well. E.g., if local drive has only 100MB/s performance for read, while the RAID volume could deliver up to 1000MB/s performance for read and write, the test result by a copy and paste will be around 100MB/s when copying data from the local drive and pasting to the RAID volume, which means the bottleneck is on the local drive instead.

### 3.3. Windows Server OS

After the above configurations are confirmed, you may or may not encounter slow performance when testing read/write performance with through iSCSI connections, if you were suffering with slow performance, please try to adjust below parameters on server's HBA driver:

- Visit Device Manager, in Network adapters, right-click the NIC port you are using for performance testing, choose Properties, go to Advanced, find RSS Queue (different brands may have different terms), adjust the RSS Queue to 2 from 8.
- In the same location as above, find Receive Buffers, adjust the value to be maximum.

- In the same location as above, find Transmit Buffers, adjust the value to be maximum.
- In the same location as above, find Interrupt Moderation Rate, adjust the value to be Off.

If the above adjustments do not help, please go further for the below option:

- Open a Command Line, type “netsh int tcp set global autotuninglevel=restricted” or type “netsh int tcp set global autotuninglevel=highlyrestricted”.



#### **INFORMATION:**

It is necessary to re-log in the connected iSCSI session after the above parameters are made, a reboot of server may also be a must if it seems doesn't work after a re-login of iSCSI session.



#### **CAUTION:**

Please verify the performance right after one of adjustments above is made, to find out which one is suitable for user's environment, it is not necessary to adjust each item.

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### 3.4. Unix-Like OS

After the above configurations are confirmed, you may or may not encounter slow performance when testing read/write performance with through iSCSI connections, if you were suffering with slow performance, please try to adjust below parameters on server:

- Please firstly finish all the configurations mentioned in this [white paper](#).
- Adjust Read Ahead (RA) buffer for the RAID volume via blockdev command:

```
root@antony-virtual-machine:/home/antony# blockdev --report
RO   RA   SSZ   BSZ   StartSec           Size   Device
rw   256  2048  2048           0   1051721728 /dev/sr0
rw   256   512  4096           0   17179869184 /dev/sda
rw   256   512  4096         2048   16105078784 /dev/sda1
rw   256   512  1024    31459326         1024 /dev/sda2
rw   256   512  4096    31459328   1071644672 /dev/sda5
root@antony-virtual-machine:/home/antony# blockdev --setra 4096 /dev/sda
```

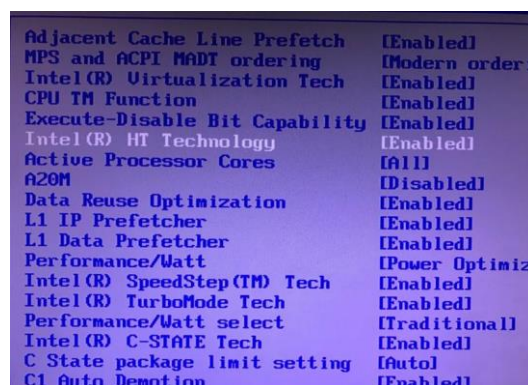
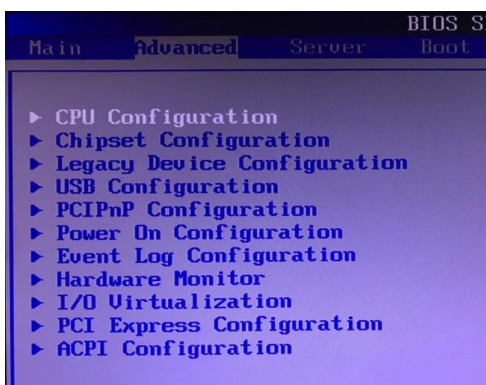
Set the RA value to be higher like 4096 or 8192 for each RAID volume, if the RAID volume is a multipath'ed device, please adjust the dm-x device.

- Adjust the Receive Buffer for TCP/IP:

```
root@antony-virtual-machine:/home/antony# sysctl -w net.core.rmem_max=524284
net.core.rmem_max = 524284
root@antony-virtual-machine:/home/antony#
```

Set the receive buffer to be 524284 or higher (twice the value).

- Disable HT (Hyper Threading in BIOS of server):





**INFORMATION:**

It is necessary to re-log in the connected iSCSI session after the above parameters are made.



**CAUTION:**

Please verify the performance right after one of adjustments above is made, to find out which one is suitable for user's environment, it is not necessary to adjust each item.

---

## 4. Support and Other Resources

### 4.1. Getting Technical Support

After installing your device, locate the serial number on the sticker located on the side of the chassis or register your product at [partner.qsan.com/](http://partner.qsan.com/) (End-User Registration). We recommend registering your product in QSAN partner website for firmware updates, document download, and latest news in e-blast. To contact QSAN Support, please use the following information.

1. Via the Web: [http://www.qsan.com/en/contact\\_support.php](http://www.qsan.com/en/contact_support.php)
2. Via Telephone: +886-2-7720-6355  
(Service hours: 09:30 - 18:00, Monday - Friday, UTC+8)
3. Via Skype Chat, Skype ID: qsan.support  
(Service hours: 09:30 - 02:00, Monday - Friday, UTC+8, Summer time: 09:30 - 01:00)
4. Via Email: [support@qsan.com](mailto:support@qsan.com)

#### Information to collect

1. Product name, model or version, and serial number
2. Firmware version
3. Error messages or screenshot images
4. Product-specific reports and logs
5. Add-on products or components installed
6. Third-party products or components installed

#### Information for Technical Support

The following system information is necessary for technical support; please refer to following for what and where to get the information of your XCubeSAN model.

If the technical support requests you to download the service log/debug info, please navigate on the **SANOS UI → System Settings → Maintenance → System Information**, then click on the **“Download Service Package”** button for download.

The screenshot displays the QSAN SANOS 4.0 web interface. The left sidebar contains a navigation menu with categories: DASHBOARD, SYSTEM SETTINGS, HOST CONNECTIVITY, STORAGE MANAGEMENT, DATA BACKUP, VIRTUALIZATION, and MONITORING. Under SYSTEM SETTINGS, the 'Maintenance' option is highlighted with a red box. The main content area shows the 'System Information' page, which includes tabs for 'System Information', 'Update', 'Firmware Synchronization', 'System Identification', and 'Reset'. The 'System Information' tab is active, displaying a table of system details for 'Controller 2'. Below this, there are sections for 'Backplane' and 'Licenses', each with their own tables. At the bottom of the page, a 'Download Service Package' button is highlighted with a red box.

Item	Information
Firmware Version	1.2.0 (build 201707171500)
SAS IOC Firmware Version	07.00.01.00
SAS Expander Firmware Version	1000

Item	Information
Controller Serial Number	
CPU	Intel(R) Processor D1500 2 Cores
Memory	8 GB
Host Card Slot 1	Empty
Host Card Slot 2	Empty
Firmware Version	1.2.0 (build 201707171500)
SAS IOC Firmware Version	07.00.01.00
SAS Expander Firmware Version	1000

Item	Information
Backplane Serial Number	
Backplane ID	QW424
MCU Version	1.2.0

Item	Information
SSD Cache	Enabled
Auto Tiering	Enabled

## 4.2. Documentation Feedback

QSAN is committed to providing documentation that meets and exceeds your expectations. To help us improve the documentation, email any errors, suggestions, or comments to [docsfeedback@qsan.com](mailto:docsfeedback@qsan.com).

When submitting your feedback, include the document title, part number, revision, and publication date located on the front cover of the document.

## Appendix

### End-User License Agreement (EULA)

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## Miscellaneous

- QSAN reserves the right to modify this EULA.
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