



Improve Microsoft remote copy performance

ONTAP 9

NetApp
March 21, 2023

Table of Contents

- Improve Microsoft remote copy performance 1
 - Improve Microsoft remote copy performance overview 1
 - How ODX works 1
 - Requirements for using ODX 3
 - Guidelines for using ODX 3
 - Use cases for ODX 5
 - Enable or disable ODX 6

Improve Microsoft remote copy performance

Improve Microsoft remote copy performance overview

Microsoft Offloaded Data Transfer (ODX), also known as *copy offload*, enables direct data transfers within or between compatible storage devices without transferring the data through the host computer.

ONTAP supports ODX for both the SMB and SAN protocols. The source can be either a CIFS server or LUN, and the destination can be either a CIFS server or LUN.

In non-ODX file transfers, the data is read from the source and is transferred across the network to the client computer. The client computer transfers the data back over the network to the destination. In summary, the client computer reads the data from the source and writes it to the destination. With ODX file transfers, data is copied directly from the source to the destination.

Because ODX offloaded copies are performed directly between the source and destination storage, there are significant performance benefits. The performance benefits realized include faster copy time between source and destination, reduced resource utilization (CPU, memory) on the client, and reduced network I/O bandwidth utilization.

For SMB environments, this functionality is only available when both the client and the storage server support SMB 3.0 and the ODX feature. For SAN environments, this functionality is only available when both the client and the storage server support the ODX feature. Client computers that support ODX and have ODX enabled automatically and transparently use offloaded file transfer when moving or copying files. ODX is used irrespective of whether you drag-and-drop files through Windows Explorer or use command-line file copy commands, or whether a client application initiates file copy requests.

Related information

[Improving client response time by providing SMB automatic node referrals with Auto Location](#)

[SMB configuration for Microsoft Hyper-V and SQL Server](#)

How ODX works

ODX copy offload uses a token-based mechanism for reading and writing data within or between ODX-enabled CIFS servers. Instead of routing the data through the host, the CIFS server sends a small token, which represents the data, to the client. The ODX client presents that token to the destination server, which then can transfer the data represented by that token from the source to the destination.

When an ODX client learns that the CIFS server is ODX-capable, it opens the source file and requests a token from the CIFS server. After opening the destination file, the client uses the token to instruct the server to copy the data directly from the source to the destination.



The source and destination can be on the same storage virtual machine (SVM) or on different SVMs, depending on the scope of the copy operation.

The token serves as a point-in-time representation of the data. As an example, when you copy data between storage locations, a token representing a data segment is returned to the requesting client, which the client

copies to the destination, thereby removing the need to copy the underlying data through the client.

ONTAP supports tokens that represent 8 MB of data. ODX copies of greater than 8 MB are performed by using multiple tokens, with each token representing 8 MB of data.

The following figure explains the steps that are involved with an ODX copy operation:



1. A user copies or moves a file by using Windows Explorer, a command-line interface, or as part of a virtual machine migration, or an application initiates file copies or moves.
2. The ODX-capable client automatically translates this transfer request into an ODX request.

The ODX request that is sent to the CIFS server contains a request for a token.

3. If ODX is enabled on the CIFS server and the connection is over SMB 3.0, the CIFS server generates a token, which is a logical representation of the data on the source.
4. The client receives a token that represents the data and sends it with the write request to the destination CIFS server.

This is the only data that is copied over the network from the source to the client and then from the client to the destination.

5. The token is delivered to the storage subsystem.

6. The SVM internally performs the copy or move.

If the file that is copied or moved is larger than 8 MB, multiple tokens are needed to perform the copy. Steps 2 through 6 as performed as needed to complete the copy.



If there is a failure with the ODX offloaded copy, the copy or move operation falls back to traditional reads and writes for the copy or move operation. Similarly, if the destination CIFS server does not support ODX or ODX is disabled, the copy or move operation falls back to traditional reads and writes for the copy or move operation.

Requirements for using ODX

Before you can use ODX for copy offloads with your storage virtual machine (SVM), you need to be aware of certain requirements.

ONTAP version requirements

ONTAP releases support ODX for copy offloads.

SMB version requirements

- ONTAP supports ODX with SMB 3.0 and later.
- SMB 3.0 must be enabled on the CIFS server before ODX can be enabled:
 - Enabling ODX also enables SMB 3.0, if it is not already enabled.
 - Disabling SMB 3.0 also disables ODX.

Windows server and client requirements

Before you can use ODX for copy offloads, the Windows client must support the feature. Support for ODX starts with Windows 2012 Server and Windows 8.

The Interoperability Matrix contains the latest information about supported Windows clients.

[NetApp Interoperability Matrix Tool](#)

Volume requirements

- Source volumes must be a minimum of 1.25 GB.
- Deduplication must be enabled on volumes used with copy offload.
- If you use compressed volumes, the compression type must be adaptive and only compression group size 8K is supported.

Secondary compression type is not supported.

Guidelines for using ODX

Before you can use ODX for copy offload, you need to be aware of the guidelines. For example, you need to know on which types of volumes you can use ODX and you need

to understand the intra-cluster and inter-cluster ODX considerations.

Volume guidelines

- You cannot use ODX for copy offload with the following volume configurations:

- Source volume size is less than 1.25 GB

The volume size must be 1.25 GB or larger to use ODX.

- Read-only volumes

ODX is not used for files and folders residing in load-sharing mirrors or in SnapMirror or SnapVault destination volumes.

- If the source volume is not deduplicated

- ODX copies are supported only for intra-cluster copies.

You cannot use ODX to copy files or folders to a volume in another cluster.

Other guidelines

- In SMB environments, to use ODX for copy offload, the files must be 256 kb or larger.

Smaller files are transferred using a traditional copy operation.

- ODX copy offload uses deduplication as part of the copy process.

If you do not want deduplication to occur on SVM volumes when copying or moving data, you should disable ODX copy offload on that SVM.

- The application that performs the data transfer must be written to support ODX.

Application operations that support ODX include the following:

- Hyper-V management operations, such as creating and converting virtual hard disks (VHDs), managing Snapshot copies, and copying files between virtual machines
- Windows Explorer operations
- Windows PowerShell copy commands
- Windows command prompt copy commands

Robocopy at the Windows command prompt supports ODX.



The applications must be running on Windows servers or clients that support ODX.

For more information about supported ODX applications on Windows servers and clients, consult the Microsoft TechNet Library.

Related information

Microsoft TechNet Library: technet.microsoft.com/en-us/library/

Use cases for ODX

You should be aware of the use cases for using ODX on SVMs so that you can determine under what circumstances ODX provides you with performance benefits.

Windows servers and clients that support ODX use copy offload as the default way of copying data across remote servers. If the Windows server or client does not support ODX or the ODX copy offload fails at any point, the copy or move operation falls back to traditional reads and writes for the copy or move operation.

The following use cases support using ODX copies and moves:

- Intra-volume

The source and destination files or LUNs are within the same volume.

- Inter-volume, same node, same SVM

The source and destination files or LUNs are on different volumes that are located on the same node. The data is owned by the same SVM.

- Inter-volume, different nodes, same SVM

The source and destination files or LUNs are on different volumes that are located on different nodes. The data is owned by the same SVM.

- Inter-SVM, same node

The source and destination file or LUNs are on different volumes that are located on the same node. The data is owned by different SVMs.

- Inter-SVM, different nodes

The source and destination file or LUNs are on different volumes that are located on different nodes. The data is owned by different SVMs.

- Inter-cluster

The source and destination LUNs are on different volumes that are located on different nodes across clusters. This is only supported for SAN and does not work for CIFS.

There are some additional special use cases:

- With the ONTAP ODX implementation, you can use ODX to copy files between SMB shares and FC or iSCSI attached virtual drives.

You can use Windows Explorer, the Windows CLI or PowerShell, Hyper-V, or other applications that support ODX to copy or move files seamlessly using ODX copy offload between SMB shares and connected LUNs, provided that the SMB shares and LUNs are on the same cluster.

- Hyper-V provides some additional use cases for ODX copy offload:

- You can use ODX copy offload pass-through with Hyper-V to copy data within or across virtual hard disk (VHD) files or to copy data between mapped SMB shares and connected iSCSI LUNs within the same cluster.

This allows copies from guest operating systems to pass through to the underlying storage.

- When creating fixed-sized VHDs, ODX is used for initializing the disk with zeros, using a well-known zeroed token.
- ODX copy offload is used for virtual machine storage migration if the source and destination storage is on the same cluster.



To take advantage of the use cases for ODX copy offload pass-through with Hyper-V, the guest operating system must support ODX and the guest operating system's disks must be SCSI disks backed by storage (either SMB or SAN) that supports ODX. IDE disks on the guest operating system do not support ODX pass-through.

Enable or disable ODX

You can enable or disable ODX on storage virtual machines (SVMs). The default is to enable support for ODX copy offload if SMB 3.0 is also enabled.

Before you begin

SMB 3.0 must be enabled.

About this task

If you disable SMB 3.0, ONTAP also disables SMB ODX. If you reenables SMB 3.0, you must manually reenables SMB ODX.

Steps

1. Set the privilege level to advanced: `set -privilege advanced`
2. Perform one of the following actions:

If you want ODX copy offload to be...	Enter the command...
Enabled	<code>vserver cifs options modify -vserver vserver_name -copy-offload-enabled true</code>
Disabled	<code>vserver cifs options modify -vserver vserver_name -copy-offload-enabled false</code>

3. Return to the admin privilege level: `set -privilege admin`

Example

The following example enables ODX copy offload on SVM vs1:


```
cluster1::> set -privilege advanced
Warning: These advanced commands are potentially dangerous; use them
only when directed to do so by technical support personnel.
Do you wish to continue? (y or n): y

cluster1::*> vsserver cifs options modify -vsserver vs1 -copy-offload
-enabled true

cluster1::*> set -privilege admin
```

Related information

[Available SMB server options](#)

Copyright information

Copyright © 2023 NetApp, Inc. All Rights Reserved. Printed in the U.S. No part of this document covered by copyright may be reproduced in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system—without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP “AS IS” AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

LIMITED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (b)(3) of the Rights in Technical Data -Noncommercial Items at DFARS 252.227-7013 (FEB 2014) and FAR 52.227-19 (DEC 2007).

Data contained herein pertains to a commercial product and/or commercial service (as defined in FAR 2.101) and is proprietary to NetApp, Inc. All NetApp technical data and computer software provided under this Agreement is commercial in nature and developed solely at private expense. The U.S. Government has a non-exclusive, non-transferrable, nonsublicensable, worldwide, limited irrevocable license to use the Data only in connection with and in support of the U.S. Government contract under which the Data was delivered. Except as provided herein, the Data may not be used, disclosed, reproduced, modified, performed, or displayed without the prior written approval of NetApp, Inc. United States Government license rights for the Department of Defense are limited to those rights identified in DFARS clause 252.227-7015(b) (FEB 2014).

Trademark information

NETAPP, the NETAPP logo, and the marks listed at <http://www.netapp.com/TM> are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.