



# **Improve client response time by providing SMB automatic node referrals with Auto Location**

**ONTAP 9**

NetApp  
March 11, 2023

# Table of Contents

- Improve client response time by providing SMB automatic node referrals with Auto Location ..... 1
  - Improve client response time by providing SMB automatic node referrals with Auto Location overview. .... 1
  - Requirements and guidelines for using automatic node referrals ..... 2
  - Support for SMB automatic node referrals. .... 4
  - Enable or disable SMB automatic node referrals. .... 4
  - Use statistics to monitor automatic node referral activity. .... 5
  - Monitor client-side SMB automatic node referral information using a Windows client. .... 7

# Improve client response time by providing SMB automatic node referrals with Auto Location

## Improve client response time by providing SMB automatic node referrals with Auto Location overview

Auto Location uses SMB automatic node referrals to increase SMB client performance on storage virtual machines (SVMs). Automatic node referrals automatically redirect the requesting client to a LIF on the node SVM that is hosting the volume in which the data resides, which can lead to improved client response times.

When an SMB client connects to an SMB share hosted on the SVM, it might connect using a LIF that is on a node that does not own the requested data. The node to which the client is connected accesses data owned by another node by using the cluster network. The client can experience faster response times if the SMB connection uses a LIF located on the node containing the requested data:

- ONTAP provides this functionality by using Microsoft DFS referrals to inform SMB clients that a requested file or folder in the namespace is hosted somewhere else.

A node makes a referral when it determines that there is an SVM LIF on the node containing the data.

- Automatic node referrals are supported for IPv4 and IPv6 LIF IP addresses.
- Referrals are made based on the location of the root of the share through which the client is connected.
- The referral occurs during SMB negotiation.

The referral is made before the connection is established. After ONTAP refers the SMB client to the target node, the connection is made, and the client accesses data through the referred LIF path from that point on. This allows the clients faster access to the data and avoids extra cluster communication.



If a share spans multiple junction points and some of the junctions are to volumes contained on other nodes, data within the share is spread across multiple nodes. Because ONTAP provides referrals that are local to the root of the share, ONTAP must use the cluster network to retrieve the data contained within these non-local volumes. With this type of namespace architecture, automatic node referrals might not provide significant performance benefits.

If the node hosting the data does not have an available LIF, ONTAP establishes the connection using the LIF chosen by the client. After a file is opened by an SMB client, it continues to access the file through the same referred connection.

If, for any reason, the CIFS server cannot make a referral, there is no disruption to SMB service. The SMB connection is established as if automatic node referrals were not enabled.

### Related information

[Improving Microsoft remote copy performance](#)

# Requirements and guidelines for using automatic node referrals

Before you can use SMB automatic node referrals, also known as *autolocation*, you need to be aware of certain requirements, including which versions of ONTAP support the feature. You also need to know about supported SMB protocol versions and certain other special guidelines.

## ONTAP version and license requirements

- All nodes in the cluster must be running a version of ONTAP that supports automatic node referrals.
- Widelinks must be enabled on a SMB share to use autolocation.
- CIFS must be licensed, and an SMB server must exist on the SVMs.

## SMB protocol version requirements

- For SVMs, ONTAP supports automatic node referrals on all versions of SMB.

## SMB client requirements

All Microsoft clients supported by ONTAP support SMB automatic node referrals.

The Interoperability Matrix contains the latest information about which Windows clients ONTAP supports.

[NetApp Interoperability Matrix Tool](#)

## Data LIF requirements

If you want to use a data LIF as a potential referral for SMB clients, you must create data LIFs with both NFS and CIFS enabled.

Automatic node referrals can fail to work if the target node contains data LIFs that are enabled only for the NFS protocol, or enabled only for the SMB protocol.

If this requirement is not met, data access is not affected. The SMB client maps the share using the original LIF that the client used to connect to the SVM.

## NTLM authentication requirements when making a referred SMB connection

NTLM authentication must be allowed on the domain containing the CIFS server and on the domains containing clients that want to use automatic node referrals.

When making a referral, the SMB server refers an IP address to the Windows client. Because NTLM authentication is used when making a connection using an IP address, Kerberos authentication is not performed for referred connections.

This happens because the Windows client cannot craft the service principal name used by Kerberos (which is of the form `service/NetBIOS_name` and `service/FQDN`), which means that the client cannot request a Kerberos ticket to the service.

## Guidelines for using automatic node referrals with the home directory feature

When shares are configured with the home directory share property enabled, there can be one or more home directory search paths configured for a home directory configuration. The search paths can point to volumes contained on each node containing SVM volumes. Clients receive a referral and, if an active, local data LIF is available, connect through a referred LIF that is local to the home user's home directory.

There are guidelines when SMB 1.0 clients access dynamic home directories with automatic node referrals enabled. This is because SMB 1.0 clients require the automatic node referral before they have authenticated, which is before the SMB server has the user's name. However, SMB home directory access works correctly for SMB 1.0 clients if the following statements are true:

- SMB home directories are configured to use simple names, such as "%w" (Windows user name) or "%u" (mapped UNIX user name), and not domain-name style names, such as "%d\%w" (domain-name\user-name).
- When creating home directory shares, the CIFS home directory shares names are configured with variables ("%w" or "%u"), and not with static names, such as "HOME".

For SMB 2.x and SMB 3.0 clients, there are no special guidelines when accessing home directories using automatic node referrals.

## Guidelines for disabling automatic node referrals on CIFS servers with existing referred connections

If you disable automatic node referrals after the option has been enabled, clients currently connected to a referred LIF keep the referred connection. Because ONTAP uses DFS referrals as the mechanism for SMB automatic node referrals, clients can even reconnect to the referred LIF after you disable the option until the client's cached DFS referral for the referred connection times out. This is true even in the case of a revert to a version of ONTAP that does not support automatic node referrals. Clients continue to use referrals until the DFS referral times out from the client's cache.

Autolocation uses SMB automatic node referrals to increase SMB client performance by referring clients to the LIF on the node that owns the data volume of an SVM. When an SMB client connects to an SMB share hosted on an SVM, it might connect using a LIF on a node that does not own the requested data and uses cluster interconnect network to retrieve data. The client can experience faster response times if the SMB connection uses a LIF located on the node containing the requested data.

ONTAP provides this functionality by using Microsoft Distributed File System (DFS) referrals to inform SMB clients that a requested file or folder in the namespace is hosted somewhere else. A node makes a referral when it determines that there is an SVM LIF on the node containing the data. Referrals are made based on the location of the root of the share through which the client is connected.

The referral occurs during SMB negotiation. The referral is made before the connection is established. After ONTAP refers the SMB client to the target node, the connection is made, and the client accesses data through the referred LIF path from that point on. This allows the clients faster access to the data and avoids extra cluster communication.

## Guidelines for using automatic node referrals with Mac OS clients

Mac OS X clients do not support SMB automatic node referrals, even though the Mac OS supports Microsoft's Distributed File System (DFS). Windows clients make a DFS referral request before connecting to an SMB share. ONTAP provides a referral to a data LIF found on the same node that hosts the requested data, which leads to improved client response times. Although the Mac OS supports DFS, Mac OS clients do not behave exactly like Windows clients in this area.

## Related information

[How ONTAP enables dynamic home directories](#)

[Network management](#)

[NetApp Interoperability Matrix Tool](#)

# Support for SMB automatic node referrals

Before you enable SMB automatic node referrals, you should be aware that certain ONTAP functionality does not support referrals.

- The following types of volumes do not support SMB automatic node referrals:
  - Read-only members of a load-sharing mirror
  - Destination volume of a data-protection mirror
- Node referrals do not move alongside a LIF move.

If a client is using a referred connection over an SMB 2.x or SMB 3.0 connection and a data LIF moves nondisruptively, the client continues to use the same referred connection, even if the LIF is no longer local to the data.

- Node referrals do not move alongside a volume move.

If a client is using a referred connection over any SMB connection and a volume move occurs, the client continues to use the same referred connection, even if the volume is no longer located on the same node as the data LIF.

## Enable or disable SMB automatic node referrals

You can enable SMB automatic node referrals to increase SMB client access performance. You can disable automatic node referrals if you do not want ONTAP to make referrals to SMB clients.

### Before you begin

A CIFS server must be configured and running on the storage virtual machine (SVM).

### About this task

The SMB automatic node referrals functionality is disabled by default. You can enable or disable this functionality on each SVM as required.

This option is available at the advanced privilege level.

### Steps

1. Set the privilege level to advanced: `set -privilege advanced`
2. Enable or disable SMB automatic node referrals as required:

If you want SMB automatic node referrals to be...	Enter the following command...
Enabled	<pre>vserver cifs options modify -vserver vserver_name -is-referral-enabled true</pre>
Disabled	<pre>vserver cifs options modify -vserver vserver_name -is-referral-enabled false</pre>

The option setting takes effect for new SMB sessions. Clients with existing connection can utilize node referral only when their existing cache timeout expires.

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

### Related information

[Available SMB server options](#)

## Use statistics to monitor automatic node referral activity

To determine how many SMB connections are referred, you can monitor automatic node referral activity by using the `statistics` command. By monitoring referrals you can determine the extent to which automatic referrals are locating connections on nodes that host the shares and whether you should redistribute your data LIFs to provide better local access to shares on the CIFS server.

### About this task

The `cifs` object provides several counters at the advanced privilege level that are helpful when monitoring SMB automatic node referrals:

- `node_referral_issued`

Number of clients that have been issued a referral to the share root's node after the client connected using a LIF hosted by a node different from the share root's node.

- `node_referral_local`

Number of clients that connected using a LIF hosted by the same node that hosts the share root. Local access generally provides optimal performance.

- `node_referral_not_possible`

Number of clients that have not been issued a referral to the node hosting the share root after connecting using a LIF hosted by a node different from the share root's node. This is because an active data LIF for the share root's node was not found.

- `node_referral_remote`

Number of clients that connected using a LIF hosted by a node different from the node that hosts the share root. Remote access might result in degraded performance.

You can monitor automatic node referral statistics on your storage virtual machine (SVM) by collecting and viewing data for a specific time period (a sample). You can view data from the sample if you do not stop data collection. Stopping data collection gives you a fixed sample. Not stopping data collection gives you the ability to get updated data that you can use to compare against previous queries. The comparison can help you identify performance trends.



To evaluate and use the information you gather from the `statistics` command, you should understand the distribution of clients in your environments.

### Steps

1. Set the privilege level to advanced: `set -privilege advanced`
2. View automatic node referral statistics by using the `statistics` command.

This example views automatic node referral statistics by collecting and viewing data for a sampled time period:

- a. Start the collection: `statistics start -object cifs -instance vs1 -sample-id sample1`

```
Statistics collection is being started for Sample-id: sample1
```

- b. Wait for the desired collection time to elapse.
- c. Stop the collection: `statistics stop -sample-id sample1`

```
Statistics collection is being stopped for Sample-id: sample1
```

- d. View the automatic node referral statistics: `statistics show -sample-id sample1 -counter node`



```
Object: cifs
Instance: vs1
Start-time: 2/4/2013 19:27:02
End-time: 2/4/2013 19:30:11
Cluster: cluster1
```

Counter	Value
-----	
node_name	node1
node_referral_issued	0
node_referral_local	1
node_referral_not_possible	2
node_referral_remote	2
...	
node_name	node2
node_referral_issued	2
node_referral_local	1
node_referral_not_possible	0
node_referral_remote	2
...	

Output displays counters for all nodes participating in SVM vs1. For clarity, only output fields related to automatic node referral statistics are provided in the example.

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

#### Related information

[Displaying statistics](#)

[Performance monitoring setup](#)

## Monitor client-side SMB automatic node referral information using a Windows client

To determine what referrals are made from the client's perspective, you can use the Windows `dfsutil.exe` utility.

The Remote Server Administration Tools (RSAT) kit available with Windows 7 and later clients contains the `dfsutil.exe` utility. Using this utility, you can display information about the contents of the referral cache as well as view information about each referral that the client is currently using. You can also use the utility to clear the client's referral cache. For more information, consult the Microsoft TechNet Library.

#### Related information

[Microsoft TechNet Library: technet.microsoft.com/en-us/library/](http://technet.microsoft.com/en-us/library/)

## 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.