Use Kerberos with NFS for strong security

ONTAP 9

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Table of Contents

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Overview of using Kerberos with NFS for strong security

If Kerberos is used in your environment for strong authentication, you need to work with your Kerberos administrator to determine requirements and appropriate storage system configurations, and then enable the SVM as a Kerberos client.

Your environment should meet the following guidelines:

- Your site deployment should follow best practices for Kerberos server and client configuration before you configure Kerberos for ONTAP.
- If possible, use NFSv4 or later if Kerberos authentication is required.

  NFSv3 can be used with Kerberos. However, the full security benefits of Kerberos are only realized in ONTAP deployments of NFSv4 or later.
- To promote redundant server access, Kerberos should be enabled on several data LIFs on multiple nodes in the cluster using the same SPN.
- When Kerberos is enabled on the SVM, one of the following security methods must be specified in export rules for volumes or qtrees depending on your NFS client configuration.
  - `krb5` (Kerberos v5 protocol)
  - `krb5i` (Kerberos v5 protocol with integrity checking using checksums)
  - `krb5p` (Kerberos v5 protocol with privacy service)

In addition to the Kerberos server and clients, the following external services must be configured for ONTAP to support Kerberos:

- Directory service

  You should use a secure directory service in your environment, such as Active Directory or OpenLDAP, that is configured to use LDAP over SSL/TLS. Do not use NIS, whose requests are sent in clear text and are hence not secure.
- NTP

  You must have a working time server running NTP. This is necessary to prevent Kerberos authentication failure due to time skew.
- Domain name resolution (DNS)

  Each UNIX client and each SVM LIF must have a proper service record (SRV) registered with the KDC under forward and reverse lookup zones. All participants must be properly resolvable via DNS.

Verify permissions for Kerberos configuration

Kerberos requires that certain UNIX permissions be set for the SVM root volume and for local users and groups.

Steps

1. Display the relevant permissions on the SVM root volume:

   `volume show -volume root_vol_name-fields user,group,unix-permissions`

   The root volume of the SVM must have the following configuration:

Name…	Setting…
UID	root or ID 0
GID	root or ID 0
UNIX permissions	755

   If these values are not shown, use the `volume modify` command to update them.

2. Display the local UNIX users:

   `vserver services name-service unix-user show -vserver vserver_name`

   The SVM must have the following UNIX users configured:

User name	User ID	Primary group ID	Comment
nfs	500	0	Required for GSS INIT phase. The first component of the NFS client user SPN is used as the user. The nfs user is not required if a Kerberos-UNIX name mapping exists for the SPN of the NFS client user.
root	0	0	Required for mounting.

   If these values are not shown, you can use the `vserver services name-service unix-user modify` command to update them.

3. Display the local UNIX groups:

   `vserver services name-service unix-group show -vserver vserver _name`

   The SVM must have the following UNIX groups configured:

Group name	Group ID
daemon	1
root	0

If these values are not shown, you can use the `vserver services name-service unix-group modify` command to update them.

Create an NFS Kerberos realm configuration

If you want ONTAP to access external Kerberos servers in your environment, you must first configure the SVM to use an existing Kerberos realm. To do so, you need to gather configuration values for the Kerberos KDC server, and then use the `vserver nfs kerberos realm create` command to create the Kerberos realm configuration on an SVM.

What you'll need

The cluster administrator should have configured NTP on the storage system, client, and KDC server to avoid authentication issues. Time differences between a client and server (clock skew) are a common cause of authentication failures.

Steps

1. Consult with your Kerberos administrator to determine the appropriate configuration values to supply with the `vserver nfs kerberos realm create` command.
2. Create a Kerberos realm configuration on the SVM:

   `vserver nfs kerberos realm create -vserver` *`vserver_name`* `-realm` *`realm_name`* *`{AD_KDC_server_values |AD_KDC_server_values}`* `-comment "`*`text`*`"`

3. Verify that the Kerberos realm configuration was created successfully:

   `vserver nfs kerberos realm show`

Examples

The following command creates an NFS Kerberos realm configuration for the SVM vs1 that uses a Microsoft Active Directory server as the KDC server. The Kerberos realm is AUTH.EXAMPLE.COM. The Active Directory server is named ad-1 and its IP address is 10.10.8.14. The permitted clock skew is 300 seconds (the default). The IP address of the KDC server is 10.10.8.14, and its port number is 88 (the default). "Microsoft Kerberos config" is the comment.

```
vs1::> vserver nfs kerberos realm create -vserver vs1 -realm
AUTH.EXAMPLE.COM -adserver-name ad-1
-adserver-ip 10.10.8.14 -clock-skew 300 -kdc-ip 10.10.8.14 -kdc-port 88
-kdc-vendor Microsoft
-comment "Microsoft Kerberos config"
```

The following command creates an NFS Kerberos realm configuration for the SVM vs1 that uses an MIT KDC. The Kerberos realm is SECURITY.EXAMPLE.COM. The permitted clock skew is 300 seconds. The IP address of the KDC server is 10.10.9.1, and its port number is 88. The KDC vendor is Other to indicate a UNIX vendor. The IP address of the administrative server is 10.10.9.1, and its port number is 749 (the default). The IP address of the password server is 10.10.9.1, and its port number is 464 (the default). "UNIX Kerberos config" is the comment.

```
vs1::> vserver nfs kerberos realm create -vserver vs1 -realm
SECURITY.EXAMPLE.COM. -clock-skew 300
-kdc-ip 10.10.9.1 -kdc-port 88 -kdc-vendor Other -adminserver-ip 10.10.9.1
-adminserver-port 749
-passwordserver-ip 10.10.9.1 -passwordserver-port 464 -comment "UNIX
Kerberos config"
```

Configure NFS Kerberos permitted encryption types

By default, ONTAP supports the following encryption types for NFS Kerberos: DES, 3DES, AES-128, and AES-256. You can configure the permitted encryption types for each SVM to suit the security requirements for your particular environment by using the `vserver nfs modify` command with the `-permitted-enc-types` parameter.

About this task

For greatest client compatibility, ONTAP supports both weak DES and strong AES encryption by default. This means, for example, that if you want to increase security and your environment supports it, you can use this procedure to disable DES and 3DES and require clients to use only AES encryption.

You should use the strongest encryption available. For ONTAP, that is AES-256. You should confirm with your KDC administrator that this encryption level is supported in your environment.

- Enabling or disabling AES entirely (both AES-128 and AES-256) on SVMs is disruptive because it destroys the original DES principal/keytab file, thereby requiring that the Kerberos configuration be disabled on all LIFs for the SVM.

  Before making this change, you should verify that NFS clients do not rely on AES encryption on the SVM.

- Enabling or disabling DES or 3DES does not require any changes to the Kerberos configuration on LIFs.

Step

1. Enable or disable the permitted encryption type you want:

If you want to enable or disable…	Follow these steps…
DES or 3DES	a. Configure the NFS Kerberos permitted encryption types of the SVM: `vserver nfs modify -vserver vserver_name -permitted-enc-types encryption_types` Separate multiple encryption types with a comma. b. Verify that the change was successful: `vserver nfs show -vserver vserver_name -fields permitted-enc-types`
AES-128 or AES-256	a. Identify on which SVM and LIF Kerberos is enabled: `vserver nfs kerberos interface show` b. Disable Kerberos on all LIFs on the SVM whose NFS Kerberos permitted encryption type you want to modify: `vserver nfs kerberos interface disable -lif lif_name` c. Configure the NFS Kerberos permitted encryption types of the SVM: `vserver nfs modify -vserver vserver_name -permitted-enc-types encryption_types` Separate multiple encryption types with a comma. d. Verify that the change was successful: `vserver nfs show -vserver vserver_name -fields permitted-enc-types` e. Reenable Kerberos on all LIFs on the SVM: `vserver nfs kerberos interface enable -lif lif_name -spn service_principal_name` f. Verify that Kerberos is enabled on all LIFs: `vserver nfs kerberos interface show`

Enable Kerberos on a data LIF

You can use the `vserver nfs kerberos interface enable` command to enable Kerberos on a data LIF. This enables the SVM to use Kerberos security services for NFS.

About this task

If you are using an Active Directory KDC, the first 15 characters of any SPNs used must be unique across SVMs within a realm or domain.

Steps

1. Create the NFS Kerberos configuration:

   ```
   vserver nfs kerberos interface enable -vserver vserver_name -lif
   logical_interface -spn service_principal_name
   ```

   ONTAP requires the secret key for the SPN from the KDC to enable the Kerberos interface.

   For Microsoft KDCs, the KDC is contacted and a user name and password prompt are issued at the CLI to obtain the secret key. If you need to create the SPN in a different OU of the Kerberos realm, you can specify the optional `-ou` parameter.

   For non-Microsoft KDCs, the secret key can be obtained using one of two methods:

If you…	You must also include the following parameter with the command…
Have the KDC administrator credentials to retrieve the key directly from the KDC	`-admin-username` *kdc_admin_username*
Do not have the KDC administrator credentials but have a keytab file from the KDC containing the key	`-keytab-uri` {ftp|http}://*uri*

2. Verify that Kerberos was enabled on the LIF:

   ```
   vserver nfs kerberos-config show
   ```

3. Repeat steps 1 and 2 to enable Kerberos on multiple LIFs.

Example

The following command creates and verifies an NFS Kerberos configuration for the SVM named vs1 on the logical interface ves03-d1, with the SPN nfs/ves03-d1.lab.example.com@TEST.LAB.EXAMPLE.COM in the OU lab2ou:

```
vs1::> vserver nfs kerberos interface enable -lif ves03-d1 -vserver vs2
-spn nfs/ves03-d1.lab.example.com@TEST.LAB.EXAMPLE.COM -ou "ou=lab2ou"

vs1::>vserver nfs kerberos-config show
        Logical
Vserver Interface Address       Kerberos  SPN
------- --------- -------       --------- --------------------------------
vs0     ves01-a1
                  10.10.10.30   disabled  -
vs2     ves01-d1
                  10.10.10.40   enabled   nfs/ves03-
d1.lab.example.com@TEST.LAB.EXAMPLE.COM
2 entries were displayed.
```