Encrypt volume data with NVE or NAE

ONTAP 9

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Learn about encrypting ONTAP volume data with NVE

Beginning with ONTAP 9.7, aggregate and volume encryption is enabled by default when you have the VE license and onboard or external key management. For ONTAP 9.6 and earlier, you can enable encryption on a new volume or on an existing volume. You must have installed the VE license and enabled key management before you can enable volume encryption. NVE is FIPS-140-2 level 1 compliant.

Enable aggregate-level encryption with VE license in ONTAP

Beginning with ONTAP 9.7, newly created aggregates and volumes are encrypted by default when you have the VE license and onboard or external key management. Beginning with ONTAP 9.6, you can use aggregate-level encryption to assign keys to the containing aggregate for the volumes to be encrypted.

About this task

You must use aggregate-level encryption if you plan to perform inline or background aggregate-level deduplication. Aggregate-level deduplication is otherwise not supported by NVE.

An aggregate enabled for aggregate-level encryption is called an *NAE aggregate* (for NetApp Aggregate Encryption). All volumes in an NAE aggregate must be encrypted with NAE or NVE encryption. With aggregate-level encryption, volumes you create in the aggregate are encrypted with NAE encryption by default. You can override the default to use NVE encryption instead.

Plain text volumes are not supported in NAE aggregates.

Before you begin

You must be a cluster administrator to perform this task.

Steps

1. Enable or disable aggregate-level encryption:

To…	Use this command…
Create an NAE aggregate with ONTAP 9.7 or later	`storage aggregate create -aggregate` *`aggregate_name`* `-node` *`node_name`*
Create an NAE aggregate with ONTAP 9.6	`storage aggregate create -aggregate` *`aggregate_name`* `-node` *`node_name`* `-encrypt-with -aggr-key true`
Convert a non-NAE aggregate to an NAE aggregate	`storage aggregate modify -aggregate` *`aggregate_name`* `-node` *`node_name`* `-encrypt-with -aggr-key true`

Convert an NAE aggregate to a non-NAE aggregate	`storage aggregate modify -aggregate` *`aggregate_name`* `-node` *`node_name`* `-encrypt-with -aggr-key false`

Learn more about `storage aggregate modify` in the ONTAP command reference.

The following command enables aggregate-level encryption on `aggr1`:

- ONTAP 9.7 or later:

```
cluster1::> storage aggregate create -aggregate aggr1
```

- ONTAP 9.6 or earlier:

```
cluster1::> storage aggregate create -aggregate aggr1 -encrypt-with
-aggr-key true
```

Learn more about `storage aggregate create` in the ONTAP command reference.

2. Verify that the aggregate is enabled for encryption:

`storage aggregate show -fields encrypt-with-aggr-key`

The following command verifies that `aggr1` is enabled for encryption:

```
cluster1::> storage aggregate show -fields encrypt-with-aggr-key
aggregate            encrypt-aggr-key
-------------------- ----------------
aggr0_vsim4          false
aggr1                true
2 entries were displayed.
```

Learn more about `storage aggregate show` in the ONTAP command reference.

After you finish

Run the `volume create` command to create the encrypted volumes.

If you are using a KMIP server to store the encryption keys for a node, ONTAP automatically “pushes” an encryption key to the server when you encrypt a volume.

Enable encryption on a new volume in ONTAP

You can use the `volume create` command to enable encryption on a new volume.

About this task

You can encrypt volumes using NetApp Volume Encryption (NVE) and, beginning with ONTAP 9.6, NetApp Aggregate Encryption (NAE). To learn more about NAE and NVE, refer to the volume encryption overview.

Learn more about the commands described in this procedure in the ONTAP command reference.

The procedure to enable encryption on a new volume in ONTAP varies based on the version of ONTAP you are using and your specific configuration:

- Beginning with ONTAP 9.4, if you enable `cc-mode` when you set up the Onboard Key Manager, volumes you create with the `volume create` command are automatically encrypted, whether or not you specify `-encrypt true`.
- In ONTAP 9.6 and earlier releases, you must use `-encrypt true` with `volume create` commands to enable encryption (provided you did not enable `cc-mode`).
- If you want to create an NAE volume in ONTAP 9.6, you must enable NAE at the aggregate level. Refer to Enable aggregate-level encryption with the VE license for more details on this task.
- Beginning with ONTAP 9.7, newly created volumes are encrypted by default when you have the VE license and onboard or external key management. By default, new volumes created in an NAE aggregate will be of type NAE rather than NVE.
  - In ONTAP 9.7 and later releases, if you add `-encrypt true` to the `volume create` command to create a volume in an NAE aggregate, the volume will have NVE encryption instead of NAE. All volumes in an NAE aggregate must be encrypted with either NVE or NAE.

Plaintext volumes are not supported in NAE aggregates.

Steps

1. Create a new volume and specify whether encryption is enabled on the volume. If the new volume is in an NAE aggregate, by default the volume will be an NAE volume:

To create…	Use this command…
An NAE volume	`volume create -vserver` *`SVM_name`* `-volume` *`volume_name`* `-aggregate` *`aggregate_name`*
An NVE volume	`volume create -vserver` *`SVM_name`* `-volume` *`volume_name`* `-aggregate` *`aggregate_name`* `-encrypt true` In ONTAP 9.6 and earlier where NAE is not supported, `-encrypt true` specifies that the volume should be encrypted with NVE. In ONTAP 9.7 and later where volumes are created in NAE aggregates, `-encrypt true` overrides the default encryption type of NAE to create an NVE volume instead.
A plain text volume	`volume create -vserver` *`SVM_name`* `-volume` *`volume_name`* `-aggregate` *`aggregate_name`* `-encrypt false`

Learn more about `volume create` in the ONTAP command reference.

2. Verify that volumes are enabled for encryption:

   `volume show -is-encrypted true`

   Learn more about `volume show` in the ONTAP command reference.

Result

If you are using a KMIP server to store the encryption keys for a node, ONTAP automatically "pushes" an encryption key to the server when you encrypt a volume.

Enable NAE or NVE on an existing ONTAP volume

You can use either the `volume move start` or the `volume encryption conversion start` command to enable encryption on an existing volume.

About this task

You can use the `volume encryption conversion start` command to enable encryption of an existing volume "in place," without having to move the volume to a different location. Alternatively, you can use the `volume move start` command.

Enable encryption on an existing volume with the volume encryption conversion start command

You can use the `volume encryption conversion start` command to enable encryption of an existing volume "in place," without having to move the volume to a different location.

After you start a conversion operation, it must be completed. If you encounter a performance issue during the operation, you can run the `volume encryption conversion pause` command to pause the operation, and the `volume encryption conversion resume` command to resume the operation.

You cannot use `volume encryption conversion start` to convert a SnapLock volume.

Steps

1. Enable encryption on an existing volume:

   `volume encryption conversion start -vserver SVM_name -volume volume_name`

   Learn more about `volume encryption conversion start` in the ONTAP command reference.

   The following command enables encryption on existing volume `vol1`:

   ```
   cluster1::> volume encryption conversion start -vserver vs1 -volume vol1
   ```

   The system creates an encryption key for the volume. The data on the volume is encrypted.

2. Verify the status of the conversion operation:

   `volume encryption conversion show`

Learn more about `volume encryption conversion show` in the ONTAP command reference.

The following command displays the status of the conversion operation:

```
cluster1::> volume encryption conversion show

Vserver   Volume   Start Time           Status
-------   ------   ------------------   ---------------------------
vs1       vol1     9/18/2017 17:51:41   Phase 2 of 2 is in progress.
```

3. When the conversion operation is completed, verify that the volume is enabled for encryption:

   `volume show -is-encrypted true`

   Learn more about `volume show` in the ONTAP command reference.

   The following command displays the encrypted volumes on `cluster1`:

```
cluster1::> volume show -is-encrypted true

Vserver  Volume  Aggregate  State  Type  Size  Available  Used
-------  ------  ---------  -----  ----  -----  ---------  ----
vs1      vol1    aggr2     online    RW  200GB    160.0GB  20%
```

Result

If you are using a KMIP server to store the encryption keys for a node, ONTAP automatically “pushes” an encryption key to the server when you encrypt a volume.

Enable encryption on an existing volume with the volume move start command

You can use the `volume move start` command to enable encryption by moving an existing volume. You can use the same aggregate or a different aggregate.

About this task

- Beginning with ONTAP 9.8, you can use `volume move start` to enable encryption on a SnapLock or FlexGroup volume.
- Beginning with ONTAP 9.4, if you enable “cc-mode” when you set up the Onboard Key Manager, volumes you create with the `volume move start` command are automatically encrypted. You need not specify `-encrypt-destination true`.
- Beginning with ONTAP 9.6, you can use aggregate-level encryption to assign keys to the containing aggregate for the volumes to be moved. A volume encrypted with a unique key is called an *NVE volume* (meaning it uses NetApp Volume Encryption). A volume encrypted with an aggregate-level key is called an *NAE volume* (for NetApp Aggregate Encryption). Plaintext volumes are not supported in NAE aggregates.
- Beginning with ONTAP 9.14.1, you can encrypt an SVM root volume with NVE. For more information, see Configure NetApp Volume Encryption on an SVM root volume.

Before you begin

You must be a cluster administrator to perform this task, or an SVM administrator to whom the cluster administrator has delegated authority.

Delegating authority to run the volume move command

Steps

1. Move an existing volume and specify whether encryption is enabled on the volume:

To convert…	Use this command…
A plaintext volume to an NVE volume	`volume move start -vserver SVM_name -volume volume_name -destination-aggregate aggregate_name -encrypt-destination true`
An NVE or plaintext volume to an NAE volume (assuming aggregate-level encryption is enabled on the destination)	`volume move start -vserver SVM_name -volume volume_name -destination-aggregate aggregate_name -encrypt-with-aggr-key true`
An NAE volume to an NVE volume	`volume move start -vserver SVM_name -volume volume_name -destination-aggregate aggregate_name -encrypt-with-aggr-key false`
An NAE volume to a plaintext volume	`volume move start -vserver SVM_name -volume volume_name -destination-aggregate aggregate_name -encrypt-destination false -encrypt-with-aggr-key false`
An NVE volume to a plaintext volume	`volume move start -vserver SVM_name -volume volume_name -destination-aggregate aggregate_name -encrypt-destination false`

Learn more about `volume move start` in the ONTAP command reference.

The following command converts a plaintext volume named `vol1` to an NVE volume:

```
cluster1::> volume move start -vserver vs1 -volume vol1 -destination
-aggregate aggr2 -encrypt-destination true
```

Assuming aggregate-level encryption is enabled on the destination, the following command converts an NVE or plaintext volume named `vol1` to an NAE volume:

```
cluster1::> volume move start -vserver vs1 -volume vol1 -destination
-aggregate aggr2 -encrypt-with-aggr-key true
```

The following command converts an NAE volume named `vol2` to an NVE volume:

```
cluster1::> volume move start -vserver vs1 -volume vol2 -destination
-aggregate aggr2 -encrypt-with-aggr-key false
```

The following command converts an NAE volume named `vol2` to a plaintext volume:

```
cluster1::> volume move start -vserver vs1 -volume vol2 -destination
-aggregate aggr2 -encrypt-destination false -encrypt-with-aggr-key false
```

The following command converts an NVE volume named `vol2` to a plaintext volume:

```
cluster1::> volume move start -vserver vs1 -volume vol2 -destination
-aggregate aggr2 -encrypt-destination false
```

2. View the encryption type of cluster volumes:

   `volume show -fields encryption-type none|volume|aggregate`

   The `encryption-type` field is available in ONTAP 9.6 and later.

   Learn more about `volume show` in the ONTAP command reference.

   The following command displays the encryption type of volumes in `cluster2`:

```
cluster2::> volume show -fields encryption-type

vserver  volume  encryption-type
-------  ------  ---------------
vs1      vol1    none
vs2      vol2    volume
vs3      vol3    aggregate
```

3. Verify that volumes are enabled for encryption:

   `volume show -is-encrypted true`

   Learn more about `volume show` in the ONTAP command reference.

   The following command displays the encrypted volumes on `cluster2`:

```
cluster2::> volume show -is-encrypted true

Vserver  Volume  Aggregate  State  Type  Size  Available  Used
-------  ------  ---------  -----  ----  -----  ---------  ----
vs1      vol1    aggr2     online    RW  200GB    160.0GB  20%
```

Result

If you are using a KMIP server to store the encryption keys for a node, ONTAP automatically pushes an encryption key to the server when you encrypt a volume.

Configure NVE on an ONTAP SVM root volume

Beginning with ONTAP 9.14.1, you can enable NetApp Volume Encryption (NVE) on a storage VM (SVM) root volume. With NVE, the root volume is encrypted with a unique key, enabling greater security on the SVM.

About this task

NVE on an SVM root volume can only be enabled after the SVM has been created.

Before you begin

- The SVM root volume must not be on an aggregate encrypted with NetApp Aggregate Encryption (NAE).
- You must have enabled encryption with the Onboard Key Manager or an external key manager.
- You must be running ONTAP 9.14.1 or later.
- To migrate an SVM containing a root volume encrypted with NVE, you must convert the SVM root volume to a plain text volume after the migration completes then re-encrypt the SVM root volume.
  - If the destination aggregate of the SVM migration uses NAE, the root volume inherits NAE by default.
- If the SVM is in an SVM disaster recovery relationship:
  - Encryption settings on a mirrored SVM are not copied to the destination. If you enable NVE on the source or destination, you must separately enable NVE on the mirrored SVM root volume.
  - If all aggregates in the destination cluster use NAE, the SVM root volume will use NAE.

Steps

You can enable NVE on an SVM root volume with the ONTAP CLI or System Manager.

CLI

You can enable NVE on the SVM root volume in-place or by moving the volume between aggregates.

Encrypt the root volume in place

1. Convert the root volume to an encrypted volume:

   ```
   volume encryption conversion start -vserver svm_name -volume volume
   ```

2. Confirm the encryption succeeded. The `volume show -encryption-type volume` displays a list of all volumes using NVE.

Encrypt the SVM root volume by moving it

1. Initiate a volume move:

   ```
   volume move start -vserver svm_name -volume volume -destination-aggregate
   aggregate -encrypt-with-aggr-key false -encrypt-destination true
   ```

   Learn more about `volume move` in the ONTAP command reference.

2. Confirm the `volume move` operation succeeded with the `volume move show` command. The `volume show -encryption-type volume` displays a list of all volumes using NVE.

System Manager

1. Navigate to **Storage** > **Volumes**.
2. Next to the name of the SVM root volume you want to encrypt, select ⋮ then **Edit**.
3. Under the **Storage and Optimization** heading, select **Enable encryption**.
4. Select **Save**.

Configure NVE on an ONTAP node root volume

Beginning with ONTAP 9.8, you can use NetApp Volume Encryption to protect the root volume of your node.

About this task

This procedure applies to the node root volume. It does not apply to SVM root volumes. SVM root volumes can be protected through aggregate-level encryption and, beginning with ONTAP 9.14.1, NVE.

Once root volume encryption begins, it must complete. You cannot pause the operation. Once encryption is complete, you cannot assign a new key to the root volume and you cannot perform a secure-purge operation.

Before you begin

- Your system must be using an HA configuration.
- Your node root volume must already be created.
- Your system must have an onboard key manager or an external key management server using the Key Management Interoperability Protocol (KMIP).

Steps

1. Encrypt the root volume:

   `volume encryption conversion start -vserver SVM_name -volume root_vol_name`

2. Verify the status of the conversion operation:

   `volume encryption conversion show`

3. When the conversion operation is complete, verify that the volume is encrypted:

   `volume show -fields`

   The following shows example output for an encrypted volume.

```
::> volume show -vserver xyz  -volume vol0 -fields is-encrypted
vserver    volume is-encrypted
---------- ------ ------------
xyz        vol0   true
```

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