



# **Encrypt volume data with NVE**

## **ONTAP 9**

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# Encrypt volume data with NVE

## Encrypt volume data with NVE overview

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

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	<pre>storage aggregate create -aggregate aggregate_name -node node_name</pre>
Create an NAE aggregate with ONTAP 9.6	<pre>storage aggregate create -aggregate aggregate_name -node node_name -encrypt-with -aggr-key true</pre>
Convert a non-NAE aggregate to an NAE aggregate	<pre>storage aggregate modify -aggregate aggregate_name -node node_name -encrypt-with -aggr-key true</pre>

Convert an NAE aggregate to a non-NAE aggregate

```
storage aggregate modify -aggregate  
aggregate_name -node node_name -encrypt-with  
-aggr-key false
```

For complete command syntax, see the man pages.

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
```

## 2. Verify that the aggregate is enabled for encryption:

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

For complete command syntax, see the man page.

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.
```

### 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

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](#).

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	<pre>volume create -vserver SVM_name -volume volume_name -aggregate aggregate_name</pre>
An NVE volume	<pre>volume create -vserver SVM_name -volume volume_name -aggregate aggregate_name -encrypt true</pre> <div><p>In ONTAP 9.6 and earlier where NAE is not supported, <code>-encrypt true</code> specifies that the volume should be encrypted with NVE. In ONTAP 9.7 and later where volumes are created in NAE aggregates, <code>-encrypt true</code> overrides the default encryption type of NAE to create an NVE volume instead.</p></div>
A plain text volume	<pre>volume create -vserver SVM_name -volume volume_name -aggregate aggregate_name -encrypt false</pre>

For complete command syntax, refer to the command reference page for `volume create`.

2. Verify that volumes are enabled for encryption:

```
volume show -is-encrypted true
```

For complete command syntax, see the [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 encryption on an existing 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

- Beginning with ONTAP 9.3, 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.
- For ONTAP 9.2 and earlier, you can use only the `volume move start` command to enable encryption by moving an existing volume.

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

Beginning with ONTAP 9.3, 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
```

For the entire command syntax, see the man page for the command.

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
```

For the entire command syntax, see the man page for the command.

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
```

For the entire command syntax, see the man page for the command.

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 must use `volume move start` in ONTAP 9.2 and earlier. 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	<code>volume move start -vserver <i>SVM_name</i> -volume <i>volume_name</i> -destination-aggregate <i>aggregate_name</i> -encrypt-destination true</code>
An NVE or plaintext volume to an NAE volume (assuming aggregate-level encryption is enabled on the destination)	<code>volume move start -vserver <i>SVM_name</i> -volume <i>volume_name</i> -destination-aggregate <i>aggregate_name</i> -encrypt-with-aggr-key true</code>
An NAE volume to an NVE volume	<code>volume move start -vserver <i>SVM_name</i> -volume <i>volume_name</i> -destination-aggregate <i>aggregate_name</i> -encrypt-with-aggr-key false</code>
An NAE volume to a plaintext volume	<code>volume move start -vserver <i>SVM_name</i> -volume <i>volume_name</i> -destination-aggregate <i>aggregate_name</i> -encrypt-destination false -encrypt-with-aggr-key false</code>
An NVE volume to a plaintext volume	<code>volume move start -vserver <i>SVM_name</i> -volume <i>volume_name</i> -destination-aggregate <i>aggregate_name</i> -encrypt-destination false</code>

For the entire command syntax, see the man page for the command.

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.

For the entire command syntax, see the man page for the command.

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
```

For the entire command syntax, see the man page for the command.

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 NetApp Volume Encryption on an 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
```

For more information about `volume move`, see [Move a volume](#).

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**.

# Enable node root volume encryption

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.

Root volume encryption is not supported on single node configurations.

- 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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