



# 使用Trident Protect保护VM的数据

## NetApp Solutions

NetApp  
December 19, 2024

# 目录

使用Trident Protect保护VM的数据 .....	1
使用Trident Protect在OpenShift虚拟化中为VM实施故障转移和故障恢复 .....	1

# 使用Trident Protect保护VM的数据

## 使用Trident Protect在OpenShift虚拟化中为VM实施故障转移和故障恢复

### 概述

本节详细介绍了如何使用Trident Protect在OpenShift虚拟化中实施虚拟机故障转移和故障恢复。无论VM是内部OpenShift集群还是ROSA集群、这些过程都是相同的。本节介绍了创建ONTAP S3对象存储以用作Trident Protect的应用存储以及为应用程序镜像创建计划的过程。之后、将介绍如何创建应用程序镜像关系。最后、本指南将介绍如何更改应用程序镜像关系的状态以执行故障转移和故障恢复。

### 前提条件

- 必须安装Trident。在使用OpenShift虚拟化运算符在集群上安装OpenShift虚拟化之前、必须先创建后端和存储类。
- 要对OpenShift VM实施故障转移和故障恢复操作、必须安装Trident Protect。请参阅此处的说明["安装Trident Protect"](#)

```
[root@localhost SnapMirror]# oc get pods -n trident-protect
NAME                                     READY   STATUS    RESTARTS   AGE
autosupportbundle-e9252a48-34a9-4b40-99c2-c00876d962ee-bk2vx  1/1     Running   0           16h
trident-protect-controller-manager-7b76c8b59f-2rmh2           2/2     Running   0           22h
[root@localhost SnapMirror]#
```

VM必须在OpenShift虚拟化中可用。有关部署新VM或将现有VM迁移到OpenShift虚拟化的详细信息、请参见文档中相应的章节。

```
[root@localhost SnapMirror]# oc get pods -n source-ns
NAME                                     READY   STATUS    RESTARTS   AGE
virt-launcher-fedora-amethyst-silverfish-49-qpqs  1/1     Running   0           23h
[root@localhost SnapMirror]# oc get pvc -n source-ns
NAME                                     STATUS   VOLUME                                     CAPACITY   ACCESS MODES   STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
fedora-amethyst-silverfish-49          Bound    pvc-4c2b2407-3741-4fa9-95d5-9f9cf6cbaf0b  34087042032  RWX            ontap-nas      <unset>                  23h
[root@localhost SnapMirror]#
```

### 使用ONTAP S3创建应用存储

本节介绍如何使用ONTAP S3对象存储在Trident Protect中设置应用程序存储。

使用oc命令和下面显示的yaml文件为ONTAP S3创建密钥和appvaults自定义资源。请确保在Trident Protect命名空间中创建它们。

```
oc create -f app-vault-secret.yaml -n trident-protect
oc create -f app-vault.yaml -n trident-protect
```

```

apiVersion: v1
# You can provide the keys either as stringData or base 64 encoded data
stringData:
  accessKeyID: "<access key id as obtained from ONTAP>"
  secretAccessKey: "<secret access key as obtained from ONTAP>"
#data:
  #accessKeyID: <base 64 encoded value of access key>
  #secretAccessKey: <base 64 encoded value of secret access key>
kind: Secret
metadata:
  name: appvault-secret
  namespace: trident-protect
type: Opaque

```

```

apiVersion: protect.trident.netapp.io/v1
kind: AppVault
metadata:
  name: ontap-s3-appvault
  namespace: trident-protect
spec:
  providerConfig:
    azure:
      accountName: ""
      bucketName: ""
      endpoint: ""
    gcp:
      bucketName: ""
      projectID: ""
    s3:
      bucketName: trident-protect
      endpoint: <data lif to use to access S3>
      secure: "false"
      skipCertValidation: "true"
  providerCredentials:
    accessKeyID:
      valueFromSecret:
        key: accessKeyID
        name: appvault-secret
    secretAccessKey:
      valueFromSecret:
        key: secretAccessKey
        name: appvault-secret
  providerType: OntapS3

```

确保已创建ONTAP S3存储并处于可用状态

```
[root@localhost SnapMirror]# tridentctl-protect get vault -n trident-protect
+-----+-----+-----+-----+-----+
|      NAME      | PROVIDER | STATE  | AGE   | ERROR |
+-----+-----+-----+-----+-----+
| ontap-s3-appvault | OntapS3  | Available | 6d22h |      |
+-----+-----+-----+-----+-----+
```

## 为虚拟机创建Trident Protect应用程序

在VM所在的命名空间中创建应用程序自定义资源。

```
[root@localhost SnapMirror]# tridentctl-protect create app source-vm -n source-ns --namespaces source-ns
Application "source-vm" created.
[root@localhost SnapMirror]# tridentctl-protect get app -n source-ns
+-----+-----+-----+-----+
| NAME | NAMESPACES | STATE | AGE |
+-----+-----+-----+-----+
| source-vm | source-ns | Ready | 11s |
+-----+-----+-----+-----+
```

```
tridentctl-protect create app source-vm -n source-ns --namespaces source-ns
```

```
[root@localhost SnapMirror]# tridentctl-protect create app source-vm -n source-ns --namespaces source-ns
Application "source-vm" created.
[root@localhost SnapMirror]# tridentctl-protect get app -n source-ns
+-----+-----+-----+-----+
| NAME | NAMESPACES | STATE | AGE |
+-----+-----+-----+-----+
| source-vm | source-ns | Ready | 11s |
+-----+-----+-----+-----+
```

## 在新命名空间中为灾难恢复虚拟机创建Trident Protect应用程序

```
oc create ns dr-ns
tridentctl-protect create app dr-vm -n dr-ns --namespaces dr-ns
```

```
[root@localhost SnapMirror]# oc create ns dr-ns
namespace/dr-ns created
[root@localhost SnapMirror]# tridentctl-protect create app dr-vm -n dr-ns --namespaces dr-ns
Application "dr-vm" created.
[root@localhost SnapMirror]# oc get pods -n dr-ns
No resources found in dr-ns namespace.
[root@localhost SnapMirror]# tridentctl-protect get app -n dr-ns
+-----+-----+-----+-----+
| NAME | NAMESPACES | STATE | AGE |
+-----+-----+-----+-----+
| dr-vm | dr-ns      | Ready | 24s |
+-----+-----+-----+-----+
[root@localhost SnapMirror]#
```

## 在源命名空间中创建AppMirror计划

使用YAML为AppMirror创建计划、如图所示。此操作将使用计划创建快照(每5分钟创建一次)并保留2个快照

```
oc create -f appmirror-schedule.yaml -n source-ns
```

```
apiVersion: protect.trident.netapp.io/v1
kind: Schedule
metadata:
  name: appmirror-sched1
spec:
  appVaultRef: ontap-s3-appvault
  applicationRef: source-vm
  backupRetention: "0"
  enabled: true
  granularity: Custom
  recurrenceRule: |-
    DTSTART:20240901T000200Z
    RRULE:FREQ=MINUTELY;INTERVAL=5
  snapshotRetention: "2"
```

```
[root@localhost SnapMirror]# tridentctl-protect get schedule -n source-ns
```

NAME	APP	SCHEDULE	ENABLED	STATE	AGE	ERROR
appmirror-sched1	source-vm	DTSTART:20240901T000200Z RRULE:FREQ=MINUTELY;INTERVAL=5	true		42s	

```
[root@localhost SnapMirror]# tridentctl-protect get snapshots -n source-ns
```

NAME	APP REF	STATE	AGE	ERROR
custom-81db9-20241119190200	source-vm	Completed	58s	

## 在DR命名空间中创建appMirror关系

在Disaster Recovery命名空间中创建AppMirror关系。将此希望状态设置为已建立。

```

apiVersion: protect.trident.netapp.io/v1
kind: AppMirrorRelationship
metadata:
  name: amr1
spec:
  desiredState: Established
  destinationAppVaultRef: ontap-s3-appvault
  destinationApplicationRef: dr-vm
  namespaceMapping:
  - destination: dr-ns
    source: source-ns
  recurrenceRule: |-
    DTSTART:20240901T000200Z
    RRULE:FREQ=MINUTELY;INTERVAL=5
  sourceAppVaultRef: ontap-s3-appvault
  sourceApplicationName: source-vm
  sourceApplicationUID: "<application UID of the source VM>"
  storageClassName: "ontap-nas"

```



您可以从源应用程序的json输出中获取源VM的应用程序UID、如下所示

```

[root@localhost SnapMirror]# tridentctl-protect get app -n source-ns -o json
{
  "metadata": {
    "resourceVersion": "7281858"
  },
  "items": [
    {
      "kind": "Application",
      "apiVersion": "protect.trident.netapp.io/v1",
      "metadata": {
        "name": "source-vm",
        "namespace": "source-ns",
        "uid": "2a4e4911-9838-4d02-8f0f-aa30a3d07eab",
        "resourceVersion": "7268998",
        "generation": 1,
        "creationTimestamp": "2024-11-19T18:30:54Z",
        "finalizers": [
          "protect.trident.netapp.io/finalizer"
        ]
      },

```

```

[root@localhost SnapMirror]# oc create -f appmirror-relationship-original.yaml -n dr-ns
appmirrorrelationship.protect.trident.netapp.io/amr1 created

```

建立AppMirror关系后、最新的快照将传输到目标命名空间。已在DR命名空间中为VM创建PVC、但尚未在DR命名空间中创建VM Pod。

```
[root@localhost SnapMirror]#
[root@localhost SnapMirror]# tridentctl-protect get amr -n dr-ns
```

NAME	SOURCE APP	DESTINATION APP	DESIRED STATE	STATE	AGE	ERROR
amr1	ontap-s3-appvault	ontap-s3-appvault	Established	Established	3m51s	

```
Status:
Conditions:
  Last Transition Time:      2024-11-19T19:48:47Z
  Message:                  The relationship is established
  Reason:                   Established
  Status:                   True
  Type:                     Established
  Last Transition Time:      2024-11-19T19:47:08Z
  Message:                  Application CR was created successfully
  Reason:                   ApplicationCRCreatedSuccessfully
  Status:                   True
  Type:                     ApplicationCRCreated
  Last Transition Time:      2024-11-19T19:52:50Z
  Message:                  Next transfer at 2024-11-19T19:57:00Z
  Reason:                   Idle
  Status:                   False
  Type:                     Transferring
  Last Transition Time:      2024-11-19T19:48:47Z
  Message:                  Last transfer succeeded at 2024-11-19T19:52:50Z
  Reason:                   TransferSucceeded
  Status:                   True
  Type:                     LastTransferSucceeded
  Last Transition Time:      2024-11-19T19:47:08Z
  Message:                  Desired state is not Promoted
  Reason:                   DesiredStateNotPromoted
  Status:                   False
  Type:                     Promoted
  Last Transition Time:      2024-11-19T19:52:50Z
  Message:                  The latest transferred snapshot is sufficiently recent
  Reason:                   SnapshotSufficientlyRecent
  Status:                   True
  Type:                     RecurrenceRuleCompliant
Destination Application Ref: source-vm
Last Transfer:
  Completion Timestamp:     2024-11-19T19:52:50Z
  Start Timestamp:          2024-11-19T19:52:40Z
Last Transferred Snapshot:
  Completion Timestamp:     2024-11-19T19:52:15Z
  Name:                     custom-81db9-20241119195200
  State:                    Established
Events:                     <none>
```

```
[root@localhost SnapMirror]# oc get pod,pvc -n dr-ns
```

NAME	STATUS	VOLUME	CAPACITY	ACCESS MODES	STORAGECLASS	VOLUMEATT
persistentvolumeclaim/fedora-amethyst-silverfish-49	Bound	pvc-b3c8745d-55d0-4075-90f4-e2fc5f6d7243	34087042032	RWX	ontap-nas	<unset>

## 将关系提升为故障转移

将关系的所需状态更改为"promoted"、以便在DR命名空间中创建VM。虚拟机仍在源命名空间中运行。



```
oc patch amr amr1 -n dr-ns --type=merge -p
 '{"spec":{"desiredState":"Promoted"}}'
```

```
[root@localhost SnapMirror]#
[root@localhost SnapMirror]# oc patch amr amr1 -n dr-ns --type=merge -p '{"spec":{"desiredState":"Promoted"}}'
appmirrorrelationship.protect.trident.netapp.io/amr1 patched
```

```
[root@localhost SnapMirror]#
[root@localhost SnapMirror]# tridentctl-protect get amr -n dr-ns
```

NAME	SOURCE APP	DESTINATION APP	DESIRED STATE	STATE	AGE	ERROR
amr1	ontap-s3-appvault	ontap-s3-appvault	Promoted	Promoted	6m51s	

```
[root@localhost SnapMirror]# oc get pvc,pods -n dr-ns
```

NAME	STATUS	VOLUME	CAPACITY	ACCESS MODES	STORAGECLASS	VOLUMEATTRIBUTESCLASS	AGE
persistentvolumeclaim/fedora-chocolate-hare-37	Bound	pvc-eb2f98c1-4f80-44ad-a247-1e987109fe3b	34087042032	RWX	ontap-nas	<unset>	10m

Activate Windows  
Go to Settings to activate

NAME	READY	STATUS	RESTARTS	AGE
pod/virt-launcher-fedora-chocolate-hare-37-8jxlz	1/1	Running	0	5m53s

```
[root@localhost SnapMirror]#
```

```
[root@localhost SnapMirror]#
[root@localhost SnapMirror]# oc get pvc,pods -n source-ns
```

NAME	STATUS	VOLUME	CAPACITY	ACCESS MODES	STORAGECLASS	VOLUMEATTRIBUTESCLASS	AGE
persistentvolumeclaim/fedora-chocolate-hare-37	Bound	pvc-0fc204c5-c689-46ce-9a80-5498c2be59ab	34087042032	RWX	ontap-nas	<unset>	46m

Activate Window  
Go to Settings to activate

NAME	READY	STATUS	RESTARTS	AGE
pod/virt-launcher-fedora-chocolate-hare-37-kr86s	1/1	Running	0	46m

```
[root@localhost SnapMirror]#
```

## 重新建立此关系以进行故障恢复

将关系的所需状态更改为"关系 已建立"。此时将在灾难恢复命名空间中删除此VM。此PVC仍存在于DR命名空间中。虚拟机仍在源命名空间中运行。此时将建立从源命名空间到灾难恢复ns的初始关系。

```
oc patch amr amr1 -n dr-ns --type=merge -p
 '{"spec":{"desiredState":"Established"}}'
```

```
[root@localhost SnapMirror]#
[root@localhost SnapMirror]# oc patch amr amr1 -n dr-ns --type=merge -p '{"spec":{"desiredState":"Established"}}'
appmirrorrelationship.protect.trident.netapp.io/amr1 patched
```

```
[root@localhost SnapMirror]#
[root@localhost SnapMirror]# tridentctl-protect get amr -n dr-ns
```

NAME	SOURCE APP	DESTINATION APP	DESIRED STATE	STATE	AGE	ERROR
amr1	ontap-s3-appvault	ontap-s3-appvault	Established	Established	1h22m	

```
[root@localhost SnapMirror]#
[root@localhost SnapMirror]# oc get pods,pvc -n dr-ns
```

NAME	STATUS	VOLUME	CAPACITY	ACCESS MODES	STORAGECLASS	VOLUMEATTRIBUTESCLASS	AGE
persistentvolumeclaim/fedora-chocolate-hare-37	Bound	pvc-023b66d9-8fe0-496c-88cd-b852a801111d	34087042032	RWX	ontap-nas	<unset>	17m

Activi  
(AGE) s

```
[root@localhost SnapMirror]#
```

```
[root@localhost SnapMirror]# oc get pods,pvc -n source-ns
```

NAME	READY	STATUS	RESTARTS	AGE
pod/virt-launcher-fedora-chocolate-hare-37-kr86s	1/1	Running	0	4h34m

  

NAME	STATUS	VOLUME	CAPACITY	ACCESS MODES	STORAGECLASS
persistentvolumeclaim/fedora-chocolate-hare-37	Bound	pvc-0fc204c5-c689-46ce-9a80-5498c2be59ab	34087042032	RWX	ontap-nas

```
[root@localhost SnapMirror]#
```

## 版权信息

版权所有 © 2024 NetApp, Inc.。保留所有权利。中国印刷。未经版权所有者事先书面许可，本档中受版权保护的任何部分不得以任何形式或通过任何手段（图片、电子或机械方式，包括影印、录音、录像或存储在电子检索系统中）进行复制。

从受版权保护的 NetApp 资料派生的软件受以下许可和免责声明的约束：

本软件由 NetApp 按“原样”提供，不含任何明示或暗示担保，包括但不限于适销性以及针对特定用途的适用性的隐含担保，特此声明不承担任何责任。在任何情况下，对于因使用本软件而以任何方式造成的任何直接性、间接性、偶然性、特殊性、惩罚性或后果性损失（包括但不限于购买替代商品或服务；使用、数据或利润方面的损失；或者业务中断），无论原因如何以及基于何种责任理论，无论出于合同、严格责任或侵权行为（包括疏忽或其他行为），NetApp 均不承担责任，即使已被告知存在上述损失的可能性。

NetApp 保留在不另行通知的情况下随时对本文档所述的任何产品进行更改的权利。除非 NetApp 以书面形式明确同意，否则 NetApp 不承担因使用本文档所述产品而产生的任何责任或义务。使用或购买本产品不表示获得 NetApp 的任何专利权、商标权或任何其他知识产权许可。

本手册中描述的产品可能受一项或多项美国专利、外国专利或正在申请的专利的保护。

有限权利说明：政府使用、复制或公开本文档受 DFARS 252.227-7013（2014 年 2 月）和 FAR 52.227-19（2007 年 12 月）中“技术数据权利 — 非商用”条款第 (b)(3) 条规定的限制条件的约束。

本文档中所含数据与商业产品和/或商业服务（定义见 FAR 2.101）相关，属于 NetApp, Inc. 的专有信息。根据本协议提供的所有 NetApp 技术数据和计算机软件具有商业性质，并完全由私人出资开发。美国政府对这些数据的使用权具有非排他性、全球性、受限且不可撤销的许可，该许可既不可转让，也不可再许可，但仅限在与交付数据所依据的美国政府合同有关且受合同支持的情况下使用。除本文档规定的情形外，未经 NetApp, Inc. 事先书面批准，不得使用、披露、复制、修改、操作或显示这些数据。美国政府对国防部的授权仅限于 DFARS 的第 252.227-7015(b)（2014 年 2 月）条款中明确的权利。

## 商标信息

NetApp、NetApp 标识和 <http://www.netapp.com/TM> 上所列的商标是 NetApp, Inc. 的商标。其他公司和产品名称可能是其各自所有者的商标。