Secure file access by using Storage-Level Access Guard

ONTAP 9

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Learn about secure ONTAP SMB file access by using Storage-Level Access Guard

In addition to securing access by using native file-level and export and share security, you can configure Storage-Level Access Guard, a third layer of security applied by ONTAP at the volume level. Storage-Level Access Guard applies to access from all NAS protocols to the storage object to which it is applied.

Only NTFS access permissions are supported. For ONTAP to perform security checks on UNIX users for access to data on volumes for which Storage-Level Access Guard has been applied, the UNIX user must map to a Windows user on the SVM that owns the volume.

Storage-Level Access Guard behavior

- Storage-Level Access Guard applies to all the files or all the directories in a storage object.

  Because all files or directories in a volume are subject to Storage-Level Access Guard settings, inheritance through propagation is not required.

- You can configure Storage-Level Access Guard to apply to files only, to directories only, or to both files and directories within a volume.
  - File and directory security

    Applies to every directory and file within the storage object. This is the default setting.

  - File security

    Applies to every file within the storage object. Applying this security does not affect access to, or auditing of, directories.

  - Directory security

    Applies to every directory within the storage object. Applying this security does not affect access to, or auditing of, files.

- Storage-Level Access Guard is used to restrict permissions.

  It will never give extra access permissions.

- If you view the security settings on a file or directory from an NFS or SMB client, you do not see the Storage-Level Access Guard security.

  It’s applied at the storage object level and stored in the metadata used to determine the effective permissions.

- Storage-level security cannot be revoked from a client, even by a system (Windows or UNIX) administrator.

  It is designed to be modified by storage administrators only.

- You can apply Storage-Level Access Guard to volumes with NTFS or mixed security style.
- You can apply Storage-Level Access Guard to volumes with UNIX security style as long as the SVM containing the volume has a CIFS server configured.
- When volumes are mounted under a volume junction path and if Storage-Level Access Guard is present on that path, it will not be propagated to volumes mounted under it.
- The Storage-Level Access Guard security descriptor is replicated with SnapMirror data replication and with SVM replication.
- There is special dispensation for virus scanners.

  Exceptional access is allowed to these servers to screen files and directories, even if Storage-Level Access Guard denies access to the object.

- FPolicy notifications are not sent if access is denied because of Storage-Level Access Guard.

Order of access checks

Access to a file or directory is determined by the combined effect of the export or share permissions, the Storage-Level Access Guard permissions set on volumes, and the native file permissions applied to files and/or directories. All levels of security are evaluated to determine what the effective permissions a file or directory has. The security access checks are performed in the following order:

1. SMB share or NFS export-level permissions
2. Storage-Level Access Guard
3. NTFS file/folder access control lists (ACLs), NFSv4 ACLs, or UNIX mode bits

Use cases for using Storage-Level Access Guard

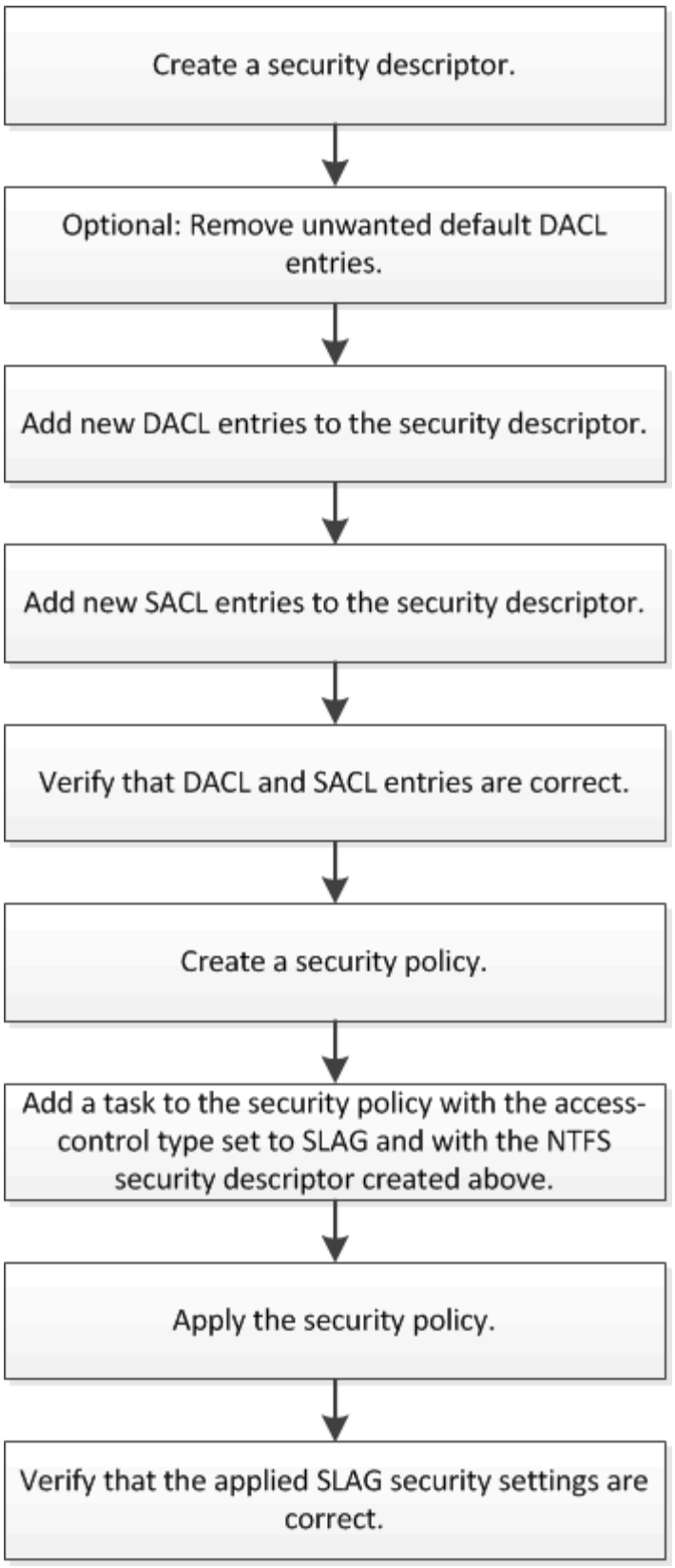
Storage-Level Access Guard provides additional security at the storage level, which is not visible from a client side; therefore, it cannot be revoked by any of the users or administrators from their desktops. There are certain use cases where the ability to control access at the storage level is beneficial.

Typical use cases for this feature include the following scenarios:

- Intellectual property protection by auditing and controlling all users' access at the storage level
- Storage for financial services companies, including banking and trading groups
- Government services with separate file storage for individual departments
- Universities protecting all student files

Configuration workflow for Storage-Level Access Guard on ONTAP SMB servers

The workflow to configure Storage-Level Access Guard (SLAG) uses the same ONTAP CLI commands that you use to configure NTFS file permissions and auditing policies. Instead of configuring file and directory access on a designated target, you configure SLAG on the designated storage virtual machine (SVM) volume.



Related information

Configure Storage-Level Access Guard on servers

Configure Storage-Level Access Guard on ONTAP SMB servers

There are a number of steps you need to follow to configure Storage-Level Access Guard on a volume or qtree. Storage-Level Access Guard provides a level of access security that is set at the storage level. It provides security that applies to all accesses from all NAS protocols to the storage object to which it has been applied.

Steps

1. Create a security descriptor by using the `vserver security file-directory ntfs create` command.

   `vserver security file-directory ntfs create -vserver vs1 -ntfs-sd sd1 vserver security file-directory ntfs show -vserver vs1`

   ```
   Vserver: vs1

      NTFS Security    Owner Name
      Descriptor Name
      ------------     --------------
      sd1              -
   ```

   A security descriptor is created with the following four default DACL access control entries (ACEs):

   ```
   Vserver: vs1
     NTFS Security Descriptor Name: sd1

       Account Name     Access   Access          Apply To
                        Type     Rights
       --------------   -------  -------         -----------
       BUILTIN\Administrators
                        allow    full-control   this-folder, sub-folders,
   files
       BUILTIN\Users    allow    full-control   this-folder, sub-folders,
   files
       CREATOR OWNER    allow    full-control   this-folder, sub-folders,
   files
       NT AUTHORITY\SYSTEM
                        allow    full-control   this-folder, sub-folders,
   files
   ```

   If you do not want to use the default entries when configuring Storage-Level Access Guard, you can remove them prior to creating and adding your own ACEs to the security descriptor.

2. Remove any of the default DACL ACEs from the security descriptor that you do not want configured with

Storage-Level Access Guard security:

a. Remove any unwanted DACL ACEs by using the `vserver security file-directory ntfs dacl remove` command.

   In this example, three default DACL ACEs are removed from the security descriptor: BUILTIN\Administrators, BUILTIN\Users, and CREATOR OWNER.

   ```
   vserver security file-directory ntfs dacl remove -vserver vs1 -ntfs-sd sd1
   -access-type allow -account builtin\users vserver security file-directory
   ntfs dacl remove -vserver vs1 -ntfs-sd sd1 -access-type allow -account
   builtin\administrators vserver security file-directory ntfs dacl remove
   -vserver vs1 -ntfs-sd sd1 -access-type allow -account "creator owner"
   ```

b. Verify that the DACL ACEs you do not want to use for Storage-Level Access Guard security are removed from the security descriptor by using the `vserver security file-directory ntfs dacl show` command.

   In this example, the output from the command verifies that three default DACL ACEs have been removed from the security descriptor, leaving only the NT AUTHORITY\SYSTEM default DACL ACE entry:

   ```
   vserver security file-directory ntfs dacl show -vserver vs1
   ```

   ```
   Vserver: vs1
     NTFS Security Descriptor Name: sd1

       Account Name     Access   Access          Apply To
                        Type     Rights
       --------------   -------  -------         -----------
       NT AUTHORITY\SYSTEM
                        allow    full-control   this-folder, sub-
   folders, files
   ```

3. Add one or more DACL entries to a security descriptor by using the `vserver security file-directory ntfs dacl add` command.

   In this example, two DACL ACEs are added to the security descriptor:

   ```
   vserver security file-directory ntfs dacl add -vserver vs1 -ntfs-sd sd1
   -access-type allow -account example\engineering -rights full-control -apply-to
   this-folder,sub-folders,files vserver security file-directory ntfs dacl add
   -vserver vs1 -ntfs-sd sd1 -access-type allow -account "example\Domain Users"
   -rights read -apply-to this-folder,sub-folders,files
   ```

4. Add one or more SACL entries to a security descriptor by using the `vserver security file-directory ntfs sacl add` command.

   In this example, two SACL ACEs are added to the security descriptor:

   ```
   vserver security file-directory ntfs sacl add -vserver vs1 -ntfs-sd sd1
   ```

```
-access-type failure -account "example\Domain Users" -rights read -apply-to
this-folder,sub-folders,files vserver security file-directory ntfs sacl add
-vserver vs1 -ntfs-sd sd1 -access-type success -account example\engineering
-rights full-control -apply-to this-folder,sub-folders,files
```

5. Verify that the DACL and SACL ACEs are configured correctly by using the `vserver security file-directory ntfs dacl show` and `vserver security file-directory ntfs sacl show` commands, respectively.

   In this example, the following command displays information about DACL entries for security descriptor “sd1”:

   ```
   vserver security file-directory ntfs dacl show -vserver vs1 -ntfs-sd sd1
   ```

   ```
   Vserver: vs1
     NTFS Security Descriptor Name: sd1

       Account Name     Access   Access          Apply To
                        Type     Rights
       --------------   -------  -------         -----------
       EXAMPLE\Domain Users
                        allow    read           this-folder, sub-folders,
   files
       EXAMPLE\engineering
                        allow    full-control   this-folder, sub-folders,
   files
       NT AUTHORITY\SYSTEM
                        allow    full-control   this-folder, sub-folders,
   files
   ```

   In this example, the following command displays information about SACL entries for security descriptor “sd1”:

   ```
   vserver security file-directory ntfs sacl show -vserver vs1 -ntfs-sd sd1
   ```

```
Vserver: vs1
  NTFS Security Descriptor Name: sd1

    Account Name     Access   Access          Apply To
                     Type     Rights
    --------------   -------  -------         -----------
    EXAMPLE\Domain Users
                     failure  read           this-folder, sub-folders,
files
    EXAMPLE\engineering
                     success  full-control   this-folder, sub-folders,
files
```

6. Create a security policy by using the `vserver security file-directory policy create` command.

   The following example creates a policy named “policy1”:

   ```
   vserver security file-directory policy create -vserver vs1 -policy-name
   policy1
   ```

7. Verify that the policy is correctly configured by using the `vserver security file-directory policy show` command.

   ```
   vserver security file-directory policy show
   ```

   ```
   Vserver          Policy Name
   ------------     --------------
   vs1              policy1
   ```

8. Add a task with an associated security descriptor to the security policy by using the `vserver security file-directory policy task add` command with the `-access-control` parameter set to `slag`.

   Even though a policy can contain more than one Storage-Level Access Guard task, you cannot configure a policy to contain both file-directory and Storage-Level Access Guard tasks. A policy must contain either all Storage-Level Access Guard tasks or all file-directory tasks.

   In this example, a task is added to the policy named “policy1”, which is assigned to security descriptor “sd1”. It is assigned to the `/datavol1` path with the access control type set to “slag”.

   ```
   vserver security file-directory policy task add -vserver vs1 -policy-name
   policy1 -path /datavol1 -access-control slag -security-type ntfs -ntfs-mode
   propagate -ntfs-sd sd1
   ```

9. Verify that the task is configured correctly by using the `vserver security file-directory policy task show` command.

   ```
   vserver security file-directory policy task show -vserver vs1 -policy-name
   ```

policy1

```
 Vserver: vs1
  Policy: policy1

   Index  File/Folder  Access           Security  NTFS       NTFS
Security
          Path         Control          Type      Mode       Descriptor
Name
   -----  -----------  ---------------  --------  ----------
---------------
   1      /datavol1    slag             ntfs      propagate  sd1
```

10. Apply the Storage-Level Access Guard security policy by using the `vserver security file-directory apply` command.

    ```
    vserver security file-directory apply -vserver vs1 -policy-name policy1
    ```

    The job to apply the security policy is scheduled.

11. Verify that the applied Storage-Level Access Guard security settings are correct by using the `vserver security file-directory show` command.

    In this example, the output from the command shows that Storage-Level Access Guard security has been applied to the NTFS volume `/datavol1`. Even though the default DACL allowing Full Control to Everyone remains, Storage-Level Access Guard security restricts (and audits) access to the groups defined in the Storage-Level Access Guard settings.

    ```
    vserver security file-directory show -vserver vs1 -path /datavol1
    ```

```
                Vserver: vs1
              File Path: /datavol1
      File Inode Number: 77
         Security Style: ntfs
        Effective Style: ntfs
         DOS Attributes: 10
 DOS Attributes in Text: ----D---
Expanded Dos Attributes: -
           Unix User Id: 0
          Unix Group Id: 0
         Unix Mode Bits: 777
 Unix Mode Bits in Text: rwxrwxrwx
                   ACLs: NTFS Security Descriptor
                         Control:0x8004
                         Owner:BUILTIN\Administrators
                         Group:BUILTIN\Administrators
                         DACL - ACEs
                           ALLOW-Everyone-0x1f01ff
                           ALLOW-Everyone-0x10000000-OI|CI|IO


                         Storage-Level Access Guard security
                         SACL (Applies to Directories):
                           AUDIT-EXAMPLE\Domain Users-0x120089-FA
                           AUDIT-EXAMPLE\engineering-0x1f01ff-SA
                         DACL (Applies to Directories):
                           ALLOW-EXAMPLE\Domain Users-0x120089
                           ALLOW-EXAMPLE\engineering-0x1f01ff
                           ALLOW-NT AUTHORITY\SYSTEM-0x1f01ff
                         SACL (Applies to Files):
                           AUDIT-EXAMPLE\Domain Users-0x120089-FA
                           AUDIT-EXAMPLE\engineering-0x1f01ff-SA
                         DACL (Applies to Files):
                           ALLOW-EXAMPLE\Domain Users-0x120089
                           ALLOW-EXAMPLE\engineering-0x1f01ff
                           ALLOW-NT AUTHORITY\SYSTEM-0x1f01ff
```

Related information

- Commands for managing NTFS file security, NTFS audit policies, and Storage-Level Access Guard
- Configuration workflow for Storage-Level Access Guard on servers
- Display information about Storage-Level Access Guard on servers
- Remove Storage-Level Access Guard on servers

Effective SLAG matrix on ONTAP SMB servers

You can configure SLAG on a volume or a qtree or both. The SLAG matrix defines on which volume or qtree is the SLAG configuration applicable under various scenarios listed in the table.

	Volume SLAG in an AFS	Volume SLAG in a snapshot	Qtree SLAG in an AFS	Qtree SLAG in a snapshot
Volume access in an Access File System (AFS)	YES	NO	N/A	N/A
Volume access in a snapshot	YES	NO	N/A	N/A
Qtree access in an AFS (when SLAG is present in the qtree)	NO	NO	YES	NO
Qtree access in an AFS (when SLAG is not present in qtree)	YES	NO	NO	NO
Qtree access in a snapshot (when SLAG is present in the qtree AFS)	NO	NO	YES	NO
Qtree access in a snapshot (when SLAG is not present in the qtree AFS)	YES	NO	NO	NO

Display information about Storage-Level Access Guard on ONTAP SMB servers

Storage-Level Access Guard is a third layer of security applied on a volume or qtree. Storage-Level Access Guard settings cannot be viewed by using the Windows Properties window. You must use the ONTAP CLI to view information about Storage-Level Access Guard security, which you can use to validate your configuration or to troubleshoot file access issues.

About this task

You must supply the name of the storage virtual machine (SVM) and the path to the volume or qtree whose Storage-Level Access Guard security information you want to display. You can display the output in summary form or as a detailed list.

Step

1. Display Storage-Level Access Guard security settings with the desired level of detail:

If you want to display information…	Enter the following command…
In summary form	`vserver security file-directory show -vserver` *`vserver_name`* `-path` *`path`*
With expanded detail	`vserver security file-directory show -vserver` *`vserver_name`* `-path` *`path`* `-expand-mask true`

Examples

The following example displays Storage-Level Access Guard security information for the NTFS security-style volume with the path `/datavol1` in SVM vs1:

```
cluster::> vserver security file-directory show -vserver vs1 -path
/datavol1

                Vserver: vs1
              File Path: /datavol1
      File Inode Number: 77
         Security Style: ntfs
        Effective Style: ntfs
         DOS Attributes: 10
 DOS Attributes in Text: ----D---
Expanded Dos Attributes: -
           Unix User Id: 0
          Unix Group Id: 0
         Unix Mode Bits: 777
 Unix Mode Bits in Text: rwxrwxrwx
                   ACLs: NTFS Security Descriptor
                         Control:0x8004
                         Owner:BUILTIN\Administrators
                         Group:BUILTIN\Administrators
                         DACL - ACEs
                           ALLOW-Everyone-0x1f01ff
                           ALLOW-Everyone-0x10000000-OI|CI|IO


                         Storage-Level Access Guard security
                         SACL (Applies to Directories):
                           AUDIT-EXAMPLE\Domain Users-0x120089-FA
                           AUDIT-EXAMPLE\engineering-0x1f01ff-SA
                         DACL (Applies to Directories):
                           ALLOW-EXAMPLE\Domain Users-0x120089
                           ALLOW-EXAMPLE\engineering-0x1f01ff
                           ALLOW-NT AUTHORITY\SYSTEM-0x1f01ff
                         SACL (Applies to Files):
                           AUDIT-EXAMPLE\Domain Users-0x120089-FA
                           AUDIT-EXAMPLE\engineering-0x1f01ff-SA
                         DACL (Applies to Files):
                           ALLOW-EXAMPLE\Domain Users-0x120089
                           ALLOW-EXAMPLE\engineering-0x1f01ff
                           ALLOW-NT AUTHORITY\SYSTEM-0x1f01ff
```

The following example displays the Storage-Level Access Guard information about the mixed security-style volume at the path `/datavol5` in SVM vs1. The top level of this volume has UNIX effective security. The volume has Storage-Level Access Guard security.

```
cluster1::> vserver security file-directory show -vserver vs1 -path
/datavol5
                Vserver: vs1
              File Path: /datavol5
      File Inode Number: 3374
         Security Style: mixed
        Effective Style: unix
         DOS Attributes: 10
 DOS Attributes in Text: ----D---
Expanded Dos Attributes: -
           Unix User Id: 0
          Unix Group Id: 0
         Unix Mode Bits: 755
 Unix Mode Bits in Text: rwxr-xr-x
                   ACLs: Storage-Level Access Guard security
                         SACL (Applies to Directories):
                           AUDIT-EXAMPLE\Domain Users-0x120089-FA
                           AUDIT-EXAMPLE\engineering-0x1f01ff-SA
                         DACL (Applies to Directories):
                           ALLOW-EXAMPLE\Domain Users-0x120089
                           ALLOW-EXAMPLE\engineering-0x1f01ff
                           ALLOW-NT AUTHORITY\SYSTEM-0x1f01ff
                         SACL (Applies to Files):
                           AUDIT-EXAMPLE\Domain Users-0x120089-FA
                           AUDIT-EXAMPLE\engineering-0x1f01ff-SA
                         DACL (Applies to Files):
                           ALLOW-EXAMPLE\Domain Users-0x120089
                           ALLOW-EXAMPLE\engineering-0x1f01ff
                           ALLOW-NT AUTHORITY\SYSTEM-0x1f01ff
```

Remove Storage-Level Access Guard on ONTAP SMB servers

You can remove Storage-Level Access Guard on a volume or qtree if you no longer want set access security at the storage level. Removing Storage-Level Access Guard does not modify or remove regular NTFS file and directory security.

Steps

1. Verify that the volume or qtree has Storage-Level Access Guard configured by using the `vserver security file-directory show` command.

   ```
   vserver security file-directory show -vserver vs1 -path /datavol2
   ```

```
                Vserver: vs1
              File Path: /datavol2
      File Inode Number: 99
         Security Style: ntfs
        Effective Style: ntfs
         DOS Attributes: 10
 DOS Attributes in Text: ----D---
Expanded Dos Attributes: -
           Unix User Id: 0
          Unix Group Id: 0
         Unix Mode Bits: 777
 Unix Mode Bits in Text: rwxrwxrwx
                   ACLs: NTFS Security Descriptor
                         Control:0xbf14
                         Owner:BUILTIN\Administrators
                         Group:BUILTIN\Administrators
                         SACL - ACEs
                           AUDIT-EXAMPLE\Domain Users-0xf01ff-OI|CI|FA
                         DACL - ACEs
                           ALLOW-EXAMPLE\Domain Admins-0x1f01ff-OI|CI
                           ALLOW-EXAMPLE\Domain Users-0x1301bf-OI|CI

                         Storage-Level Access Guard security
                         DACL (Applies to Directories):
                           ALLOW-BUILTIN\Administrators-0x1f01ff
                           ALLOW-CREATOR OWNER-0x1f01ff
                           ALLOW-EXAMPLE\Domain Admins-0x1f01ff
                           ALLOW-EXAMPLE\Domain Users-0x120089
                           ALLOW-NT AUTHORITY\SYSTEM-0x1f01ff
                         DACL (Applies to Files):
                           ALLOW-BUILTIN\Administrators-0x1f01ff
                           ALLOW-CREATOR OWNER-0x1f01ff
                           ALLOW-EXAMPLE\Domain Admins-0x1f01ff
                           ALLOW-EXAMPLE\Domain Users-0x120089
                           ALLOW-NT AUTHORITY\SYSTEM-0x1f01ff
```

2. Remove Storage-Level Access Guard by using the `vserver security file-directory remove-slag` command.

   ```
   vserver security file-directory remove-slag -vserver vs1 -path /datavol2
   ```

3. Verify that Storage-Level Access Guard has been removed from the volume or qtree by using the `vserver security file-directory show` command.

   ```
   vserver security file-directory show -vserver vs1 -path /datavol2
   ```

```
               Vserver: vs1
             File Path: /datavol2
      File Inode Number: 99
         Security Style: ntfs
        Effective Style: ntfs
         DOS Attributes: 10
 DOS Attributes in Text: ----D---
Expanded Dos Attributes: -
           Unix User Id: 0
          Unix Group Id: 0
         Unix Mode Bits: 777
 Unix Mode Bits in Text: rwxrwxrwx
                   ACLs: NTFS Security Descriptor
                         Control:0xbf14
                         Owner:BUILTIN\Administrators
                         Group:BUILTIN\Administrators
                         SACL - ACEs
                           AUDIT-EXAMPLE\Domain Users-0xf01ff-OI|CI|FA
                         DACL - ACEs
                           ALLOW-EXAMPLE\Domain Admins-0x1f01ff-OI|CI
                           ALLOW-EXAMPLE\Domain Users-0x1301bf-OI|CI
```

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