Configuring Resources and Settings with the Domain Manager

actifio

Actifio 9.0

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Preface

This guide provides step-by-step instructions on how to configure resources and settings with the Actifio Domain Manager. It assumes you have read ***Getting Started with Actifio Copy Data Management***, are familiar with the components of the Actifio Desktop, and have a grasp of the basic concepts associated with an Actifio appliance.

Your Actifio appliance's Documentation Library contains detailed, step-by-step, application-specific instructions on how to protect and access your data. Each guide is in PDF format and may be viewed online or downloaded. The following guides will be of particular interest:

- ***Setting Up Users and Roles With the Domain Manager***
- ***Connecting Hosts to Actifio Appliances***
- ***Planning and Developing Service Level Agreements***
- ***Virtualizing and Protecting Copy Data with the Application Manager***
- ***Accessing and Recovering Copy Data with the Application Manager***
- ***Replicating Data Using Actifio Appliances***

Actifio Appliances

Unless otherwise specified, all features and functions described in this document apply to all Actifio appliances.

The ActifioNOW Customer Portal

During the configuration and initialization of your Actifio appliance your Actifio representative provided you with a user name and password for the ActifioNOW customer portal.

From the ActifioNOW customer portal you can obtain detailed reports about your Actifio appliance, access the Actifio product documentation, including release notes, and search the knowledge base for answers to specific questions.

To log into the ActifioNOW customer portal:

1. Go to: **https://now.actifio.com**.
2. When prompted, enter the user name and password provided by your Actifio representative.

Actifio Support Centers

To contact an Actifio support representative, you can:

- Send email to: support@actifio.com
- Call:
  From anywhere: +1.315.261.7501
  US Toll-Free: +1.855.392.6810
  Australia: 0011 800-16165656
  Germany: 00 800-16165656
  New Zealand: 00 800-16165656
  UK: 0 800-0155019

1 Introduction to the System Functions of the Domain Manager

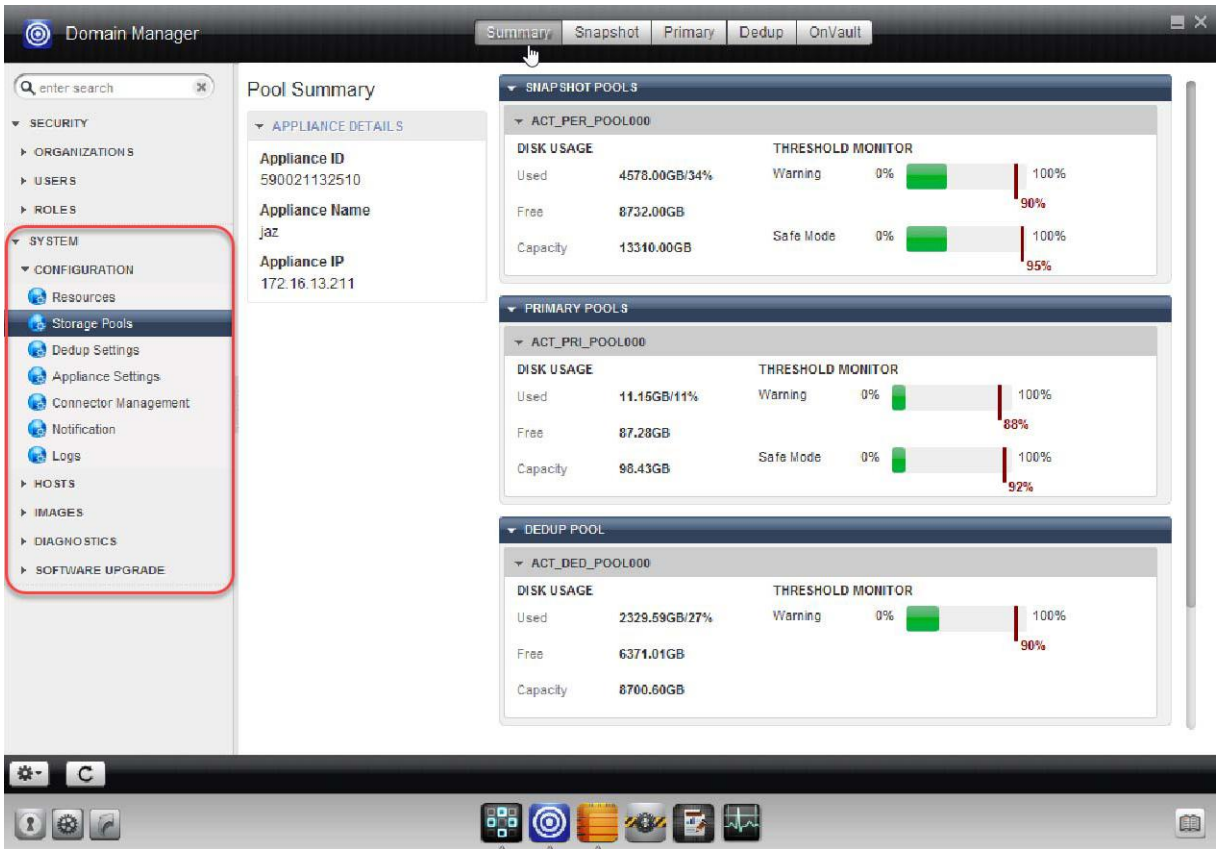
Note: *References in this document to the Actifio appliance apply to all Actifio appliance types. Information that pertains only to a specific appliance is clearly called out when the information is presented.*

The Actifio Desktop Domain Manager service is your primary tool for configuring and managing relationships among all resources protected by an Actifio appliance. The **System** function is where you configure the hosts and appliances on which copy data resides. These functions are detailed in the following chapters.

This introduction describes:

Functions of the Domain Manager System Service on page 2

The Domain Manager Service Menu on page 3



The System Functions of the Actifio Desktop Domain Manager

The Domain Manager also includes a Security section, used for configuring users, roles, and organizations. These functions are detailed in ***Setting Up Users and Roles with the Domain Manager***.

Functions of the Domain Manager System Service

The System service of the Domain Manager provides these tools:

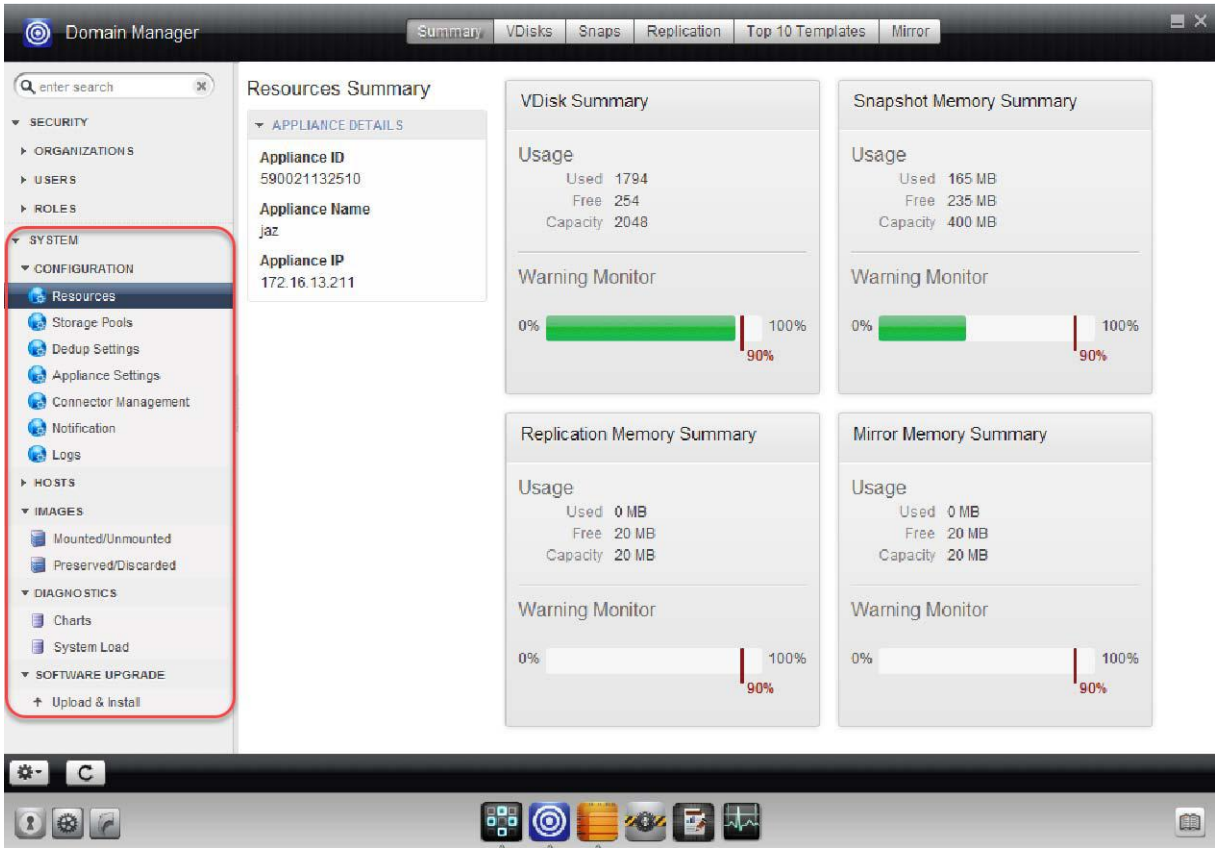
Configuration: A suite of tools for configuring and monitoring your Actifio appliance resources. This suite of tools is introduced in Chapter 2, Overview of Configuration Tools and detailed in subsequent chapters.

Hosts: For configuring and managing hosts protected by an Actifio appliance. Tools for host management are described in the ***Connecting Hosts to Actifio Appliances*** guide included in the Actifio Documentation Library.

Images: For displaying a list of preserved and discarded images and for managing backup images that have been mounted to hosts. The Mounted/Unmounted Images tools are described in Chapter 14, Working with Active Images and the Preserved/Discarded Images tools are described in Chapter 15, Working with Preserved Snapshot and Dedup Images.

Diagnostics: Three sets of diagnostic tools that include: a suite of diagnostic charts, statistics related to the system-related load on the dedup engine, and SSD drive status monitoring. These diagnostic tools are described in Chapter 16, Using Diagnostic Tools.

Software Upgrade: Upload a service pack to this Actifio appliance. This is visible only to the admin role. Use this feature only under the direction of Actifio Support



The Four Functions of the Domain Manager's System Service

The Domain Manager Service Menu

The Domain Manager's service menu includes functions for Security functions and System functions as outlined in the table below.

Domain Manager Service Menu Items

Command Name	Task
Security Functions Service Menus (see *Setting Up Users and Roles With the Domain Manager*)	
New Organization...	Create a new organization and assign resources.
New User...	Create a new user and assign roles to the user.
New Role...	Create a new role.
System Functions Service Menus (this Book)	
New Host...	Configure a new host.
Add New NAS Server	Add a NAS Server to an Actifio CDS appliance, specify its ports and virtual disks. ***Note:*** *See* ***Configuring Actifio Big Data Director (BDD)*** *for instructions on how to configure and use Actifio's Big Data Director (BDD).*
Join Appliance	Joins two Actifio appliances for copy data replication.
Certificate Exchange	Exchange security certificates between two Actifio appliances. This enables you to replicate data between the appliances.
Upload Certificate...	Upload the security certificate of a remote Actifio appliance to the Actifio appliance that Actifio Desktop is connected to.
Download Certificate...	Download the security certificate of the Actifio appliance that Actifio Desktop is connected to a local folder.
Archive Job History...	Archive a record of jobs executed using the Actifio Desktop.
Add CLI Access	Add an SSH public key to enable Command Line Interface (CLI) access for a user.
Remove CLI Access	Disable CLI access to a user.
Delete	Delete a user, role, organization, or host.

2 Overview of Configuration Tools

Configuration tools in the System service of the Domain Manager include:

Domain Manager Resources on page 6

Domain Manager Storage Pools on page 7

Domain Manager Dedup Settings on page 8

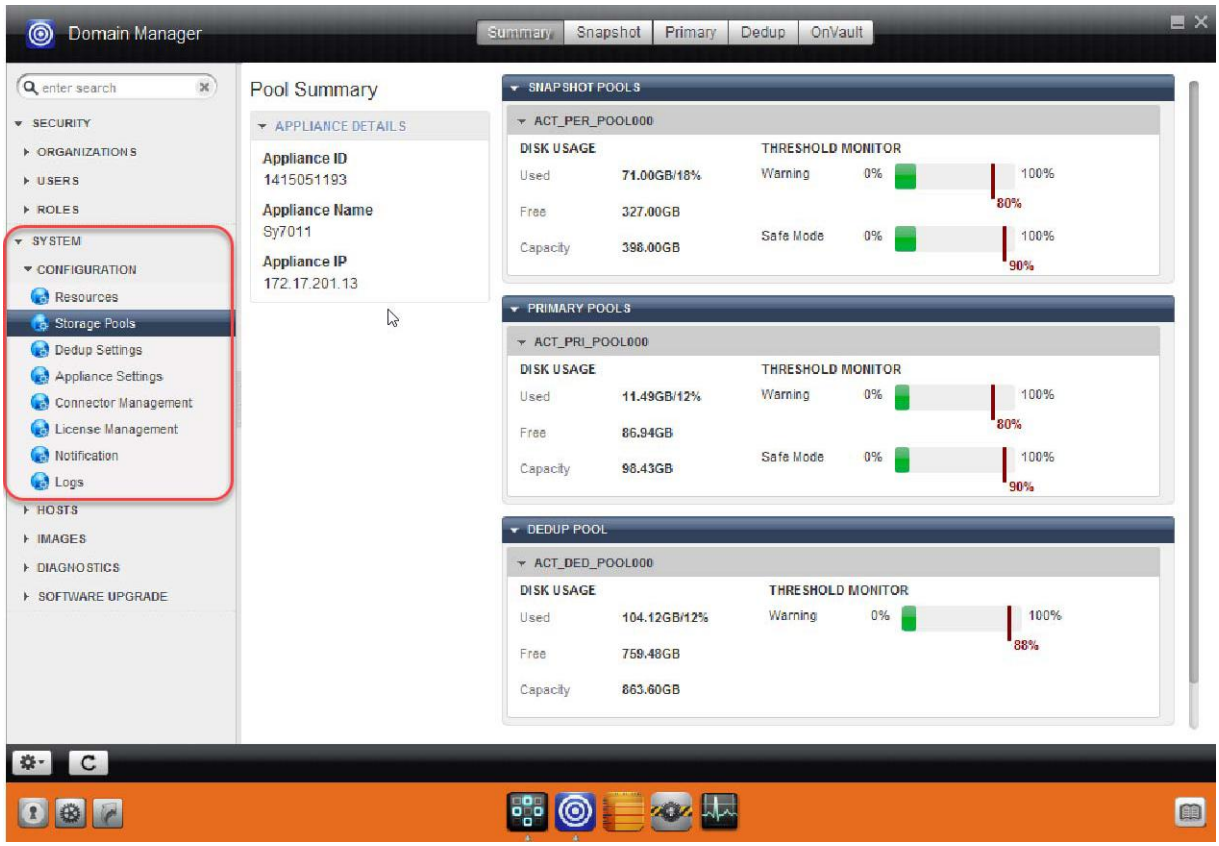
Domain Manager Appliance Settings on page 9

Domain Manager Connector Management on page 10

Domain Manager License Management (Actifio Sky Appliance only) on page 11

Domain Manager Notification on page 12

Domain Manager Logs on page 13

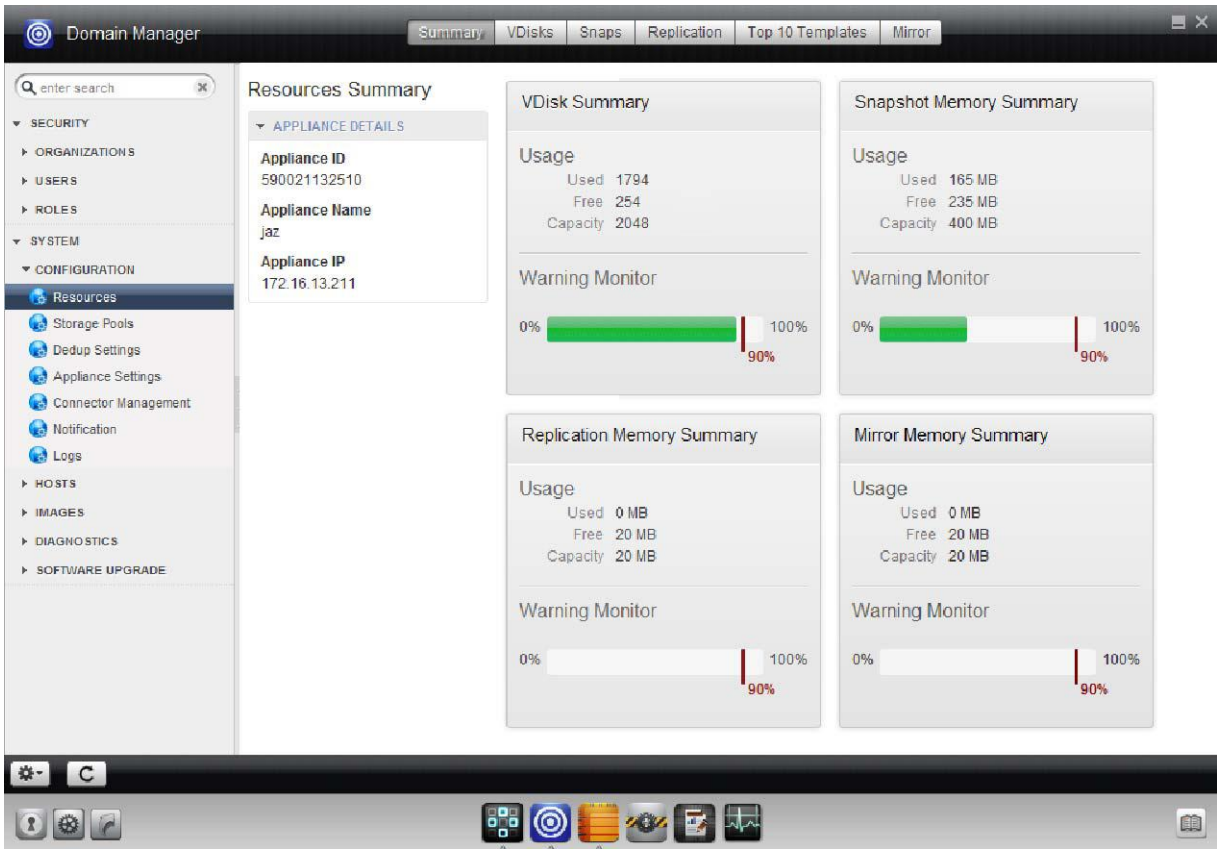


Configuration Section of Domain Manager System Service (Shown for Actifio Sky Appliance)

Domain Manager Resources

Use the Resources tools to view storage resources and to set resource limits, and warning thresholds.

Resources tools are detailed in Chapter 3, Monitoring Resource Usage.



The Resources Summary of the Domain Manager

Domain Manager Storage Pools

Use the Storage Pools tools to view the storage pools and to set resource limits and warning thresholds.

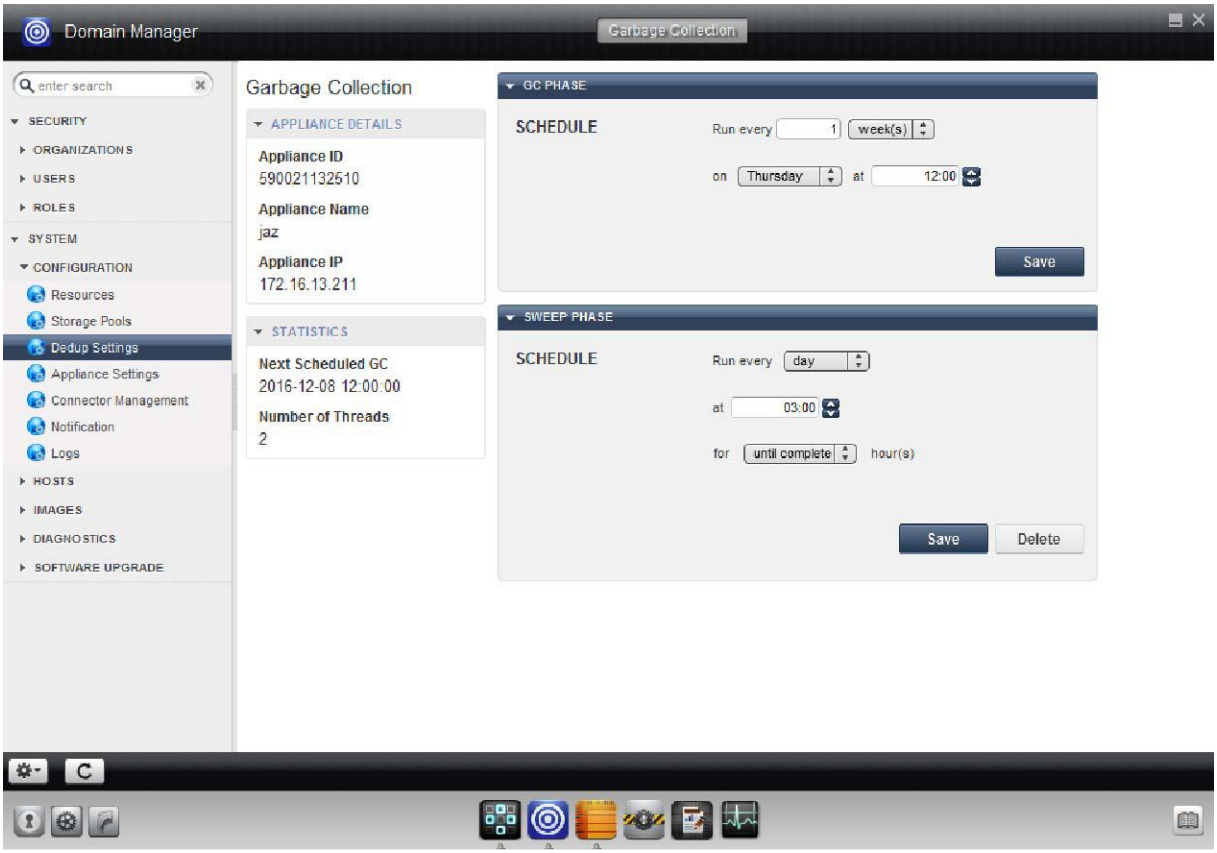
Storage pools are detailed in Chapter 6, Configuring Storage Pools.

The Storage Pools Summary of the Domain Manager

Domain Manager Dedup Settings

The amount of storage consumed by the dedup store grows over time, depending on the amount of unique data added with each new image that is ingested. As each image is expired, the space occupied by the unique data that was represented by that image is not immediately reclaimed. The garbage collection process identifies (and later reclaims) space occupied by this no-longer-needed data. The Dedup Settings page is where you configure Garbage Collection.

The Dedup pool and dedup garbage collection are detailed in Chapter 7, Managing the Dedup Pool.



The Dedup Storage Summary of the Domain Manager

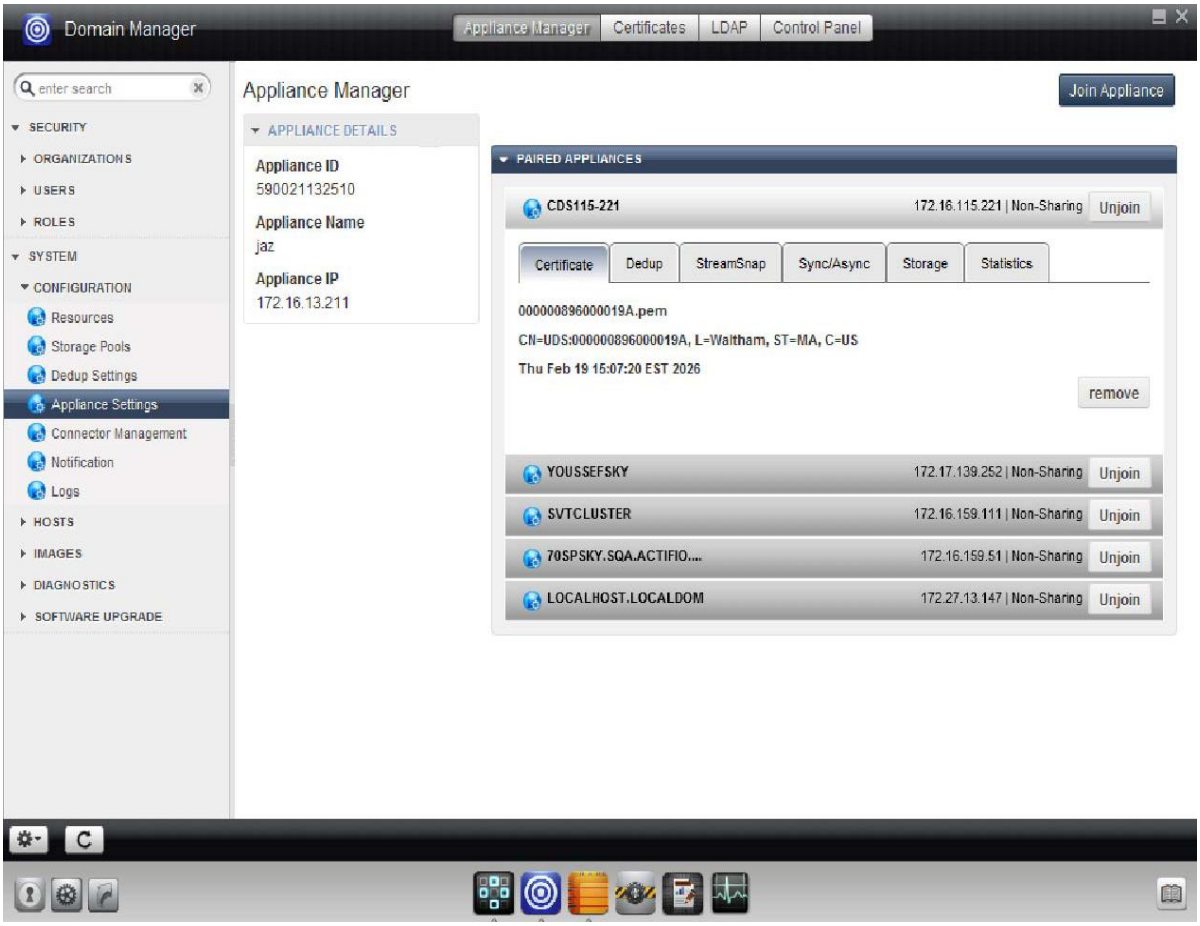
Domain Manager Appliance Settings

Use the Appliance Settings tools to add appliances, join appliances, change global Actifio appliance settings, and perform other configuration and maintenance tasks on your Actifio appliances.

The tools for managing multiple appliances are described in Chapter 9, Configuring Shared Appliances and communications management between Actifio appliances is detailed in Chapter 10, Managing Communication Between Actifio Appliances.

The configuration of an LDAP server for Actifio Desktop user authentication and mapping LDAP groups to Actifio appliance roles is detailed in Chapter 11, Configuring LDAP Settings and Group Mapping.

The use of the Control Panel for operations such as appliance shutdown, setting priorities for the first ingestion of new applications, and configuring image preservation priorities for snapshot and dedup images is detailed in Chapter 12, Configuring Control Panel Operations.

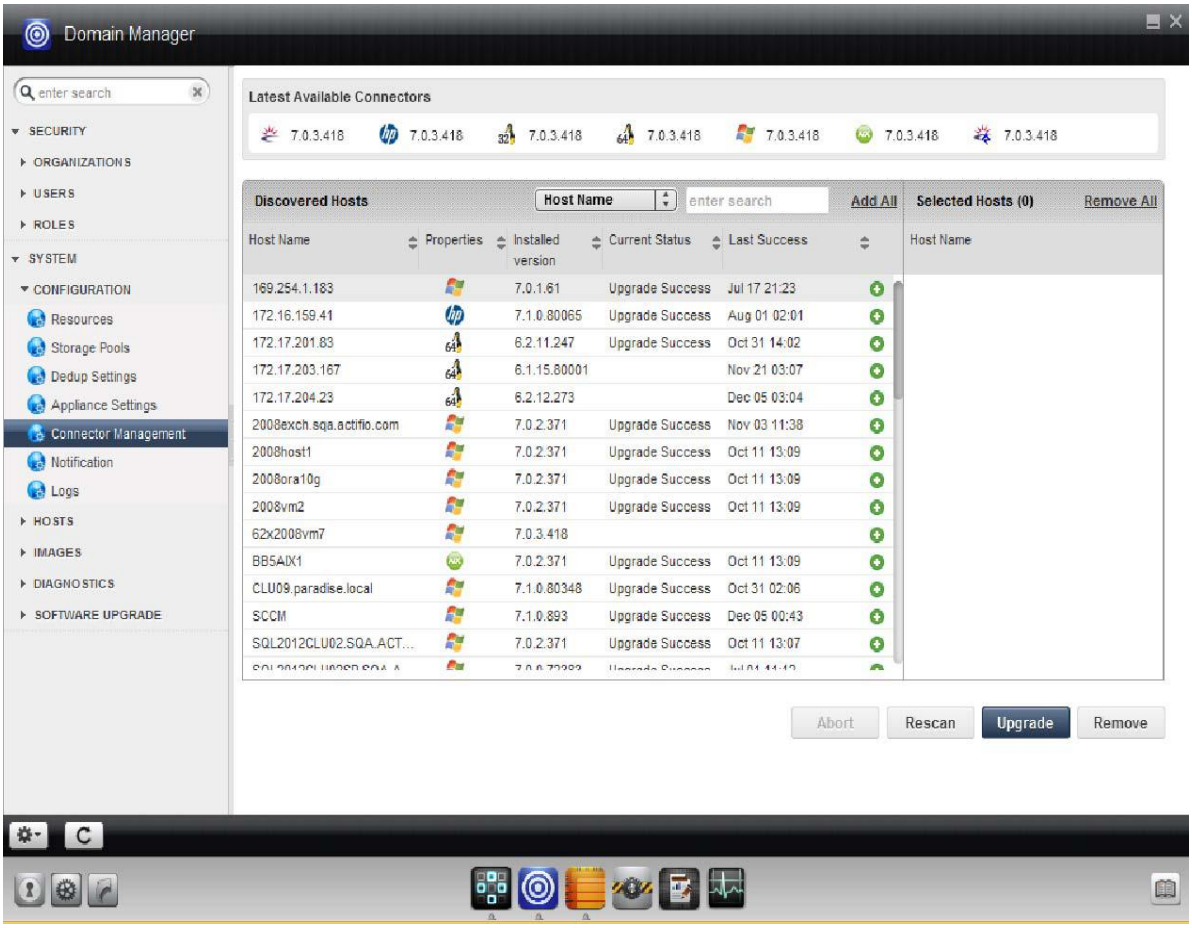


The Appliance Settings Summary of the Domain Manager

Domain Manager Connector Management

Use the Connector Management tool to upgrade the Actifio Connector on your hosts.

Connector management is detailed in ***Connecting Hosts to Actifio Appliances*** in the Actifio Documentation Library.



The Actifio Connector Manager

Domain Manager License Management (Actifio Sky Appliance only)

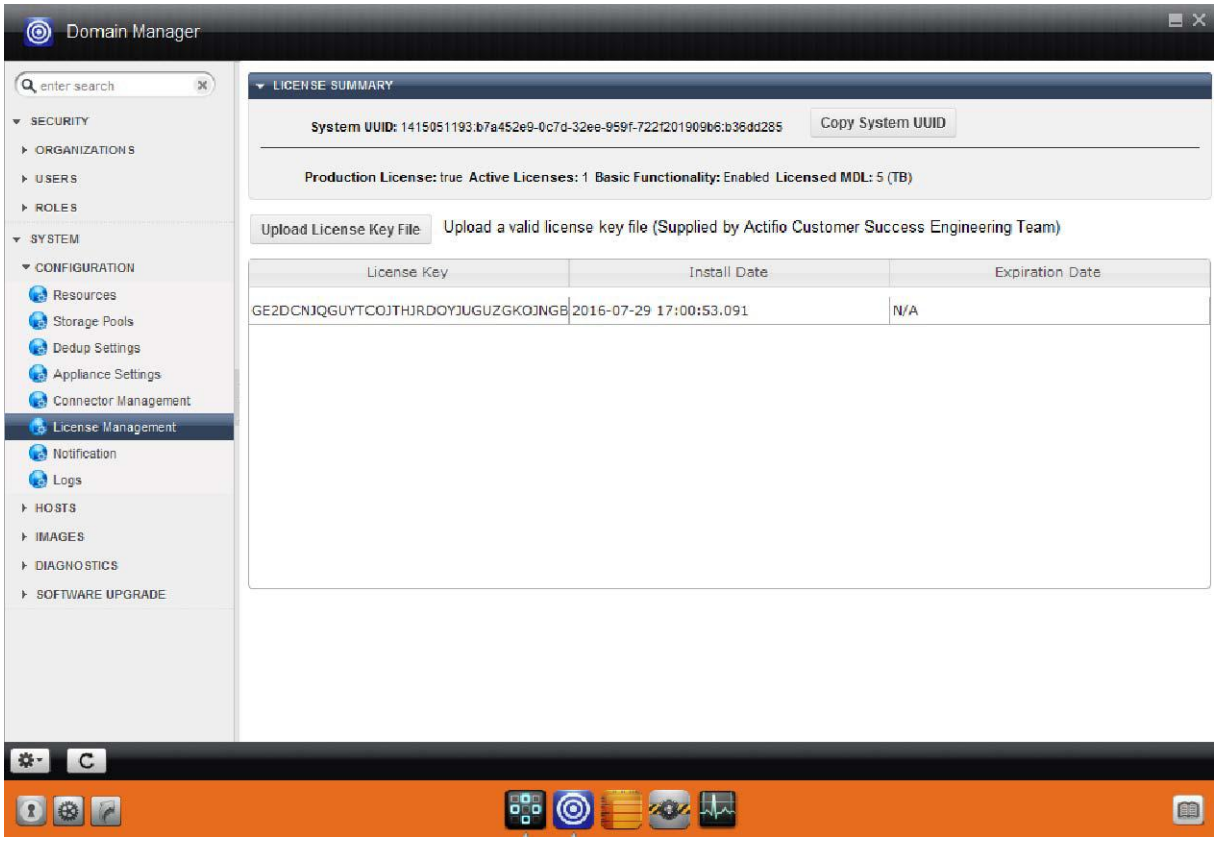
Use the License Management tool to manage your Actifio Sky appliance licenses.

> ***Note:*** *Licensing is not applicable to Actifio CDS appliances.*

Use the License Manager to upload:

- An evaluation-to-production license key if you intend to upgrade from the 30-day full-feature evaluation version of the base Actifio appliance software to the production version.
- An add-on functionality license key (for example, to add support for protecting Oracle databases).

Actifio Sky appliance license management is detailed in Chapter 13, Managing Licenses for an Actifio Sky Appliance.

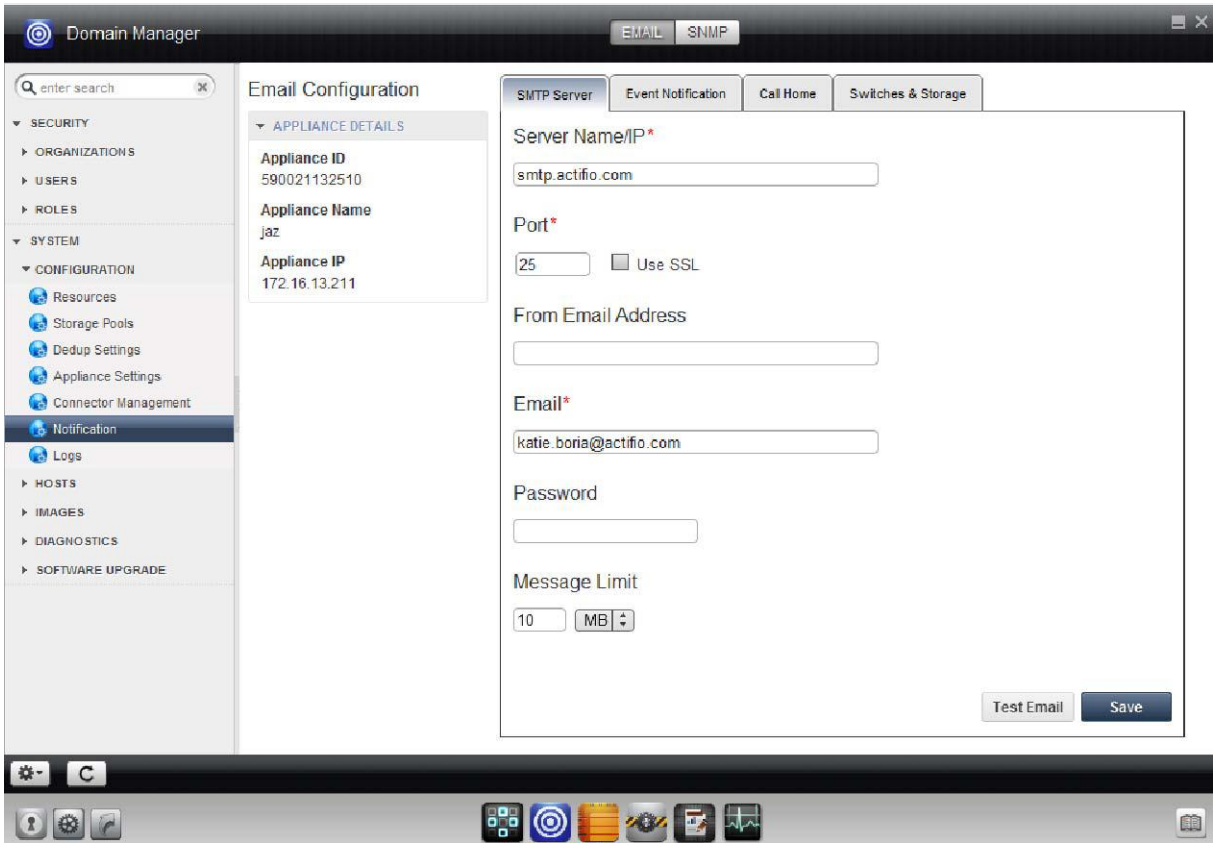


The License Manager on an Actifio Sky Appliance

Domain Manager Notification

Use the Notifications tools to configure an SNMP (Simple Network Management Protocol) trap receiver as the target of SNMP traps generated by the Actifio CDS or Sky appliance. You can also configure email notification to inform administrators when events of selected severity occur.

Notifications are detailed in ***Configuring Actifio Event Alerting*** in the Actifo Documentation Library.

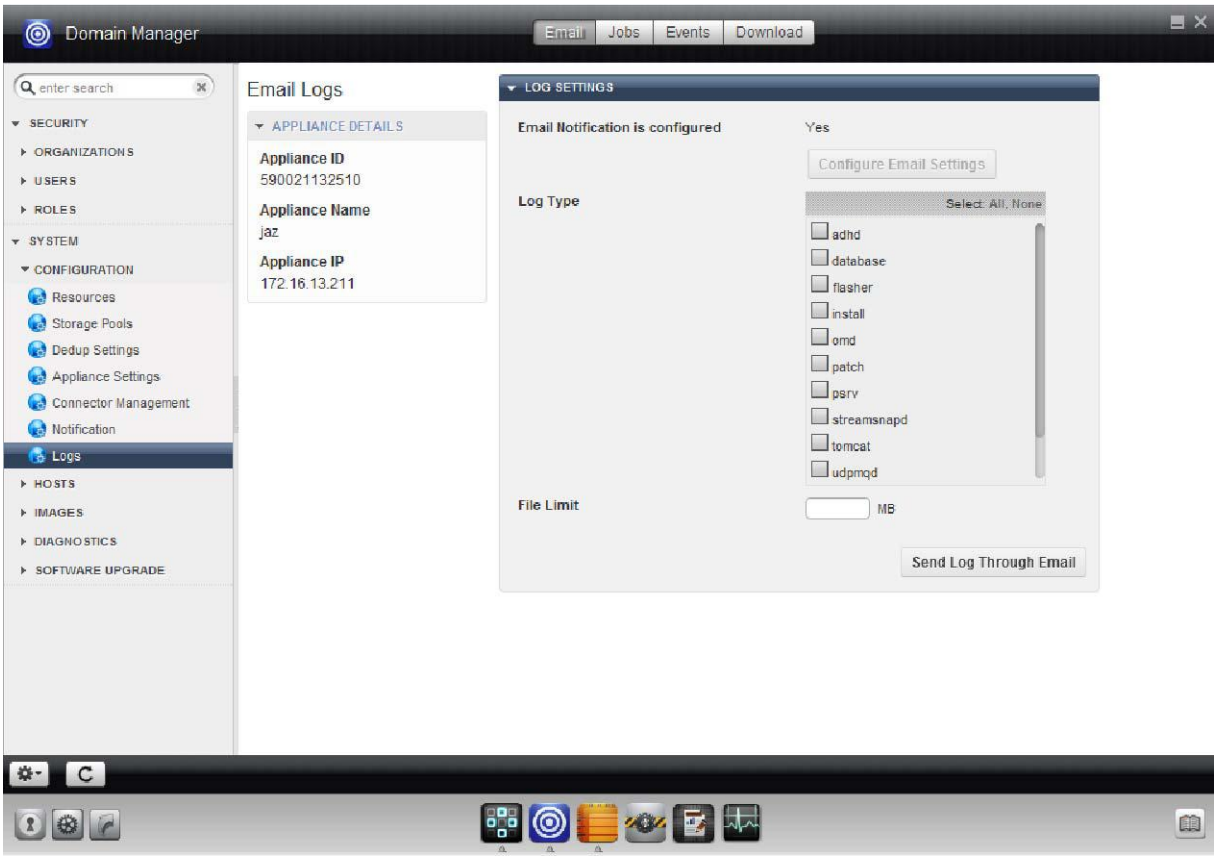


Domain Manager Notifications

Domain Manager Logs

Use the Logs tools to send Actifio appliance statistics and logs to the Actifio support team. You can also download selected logs to your computer from an Actifio CDS or Sky appliance.

Logs are detailed in ***Configuring Actifio Event Alerting*** in the Actifo Documentation Library.



The Domain Manager Logs Section

3 Monitoring Resource Usage

Resource usage includes:

Viewing the Resources Summary on page 16

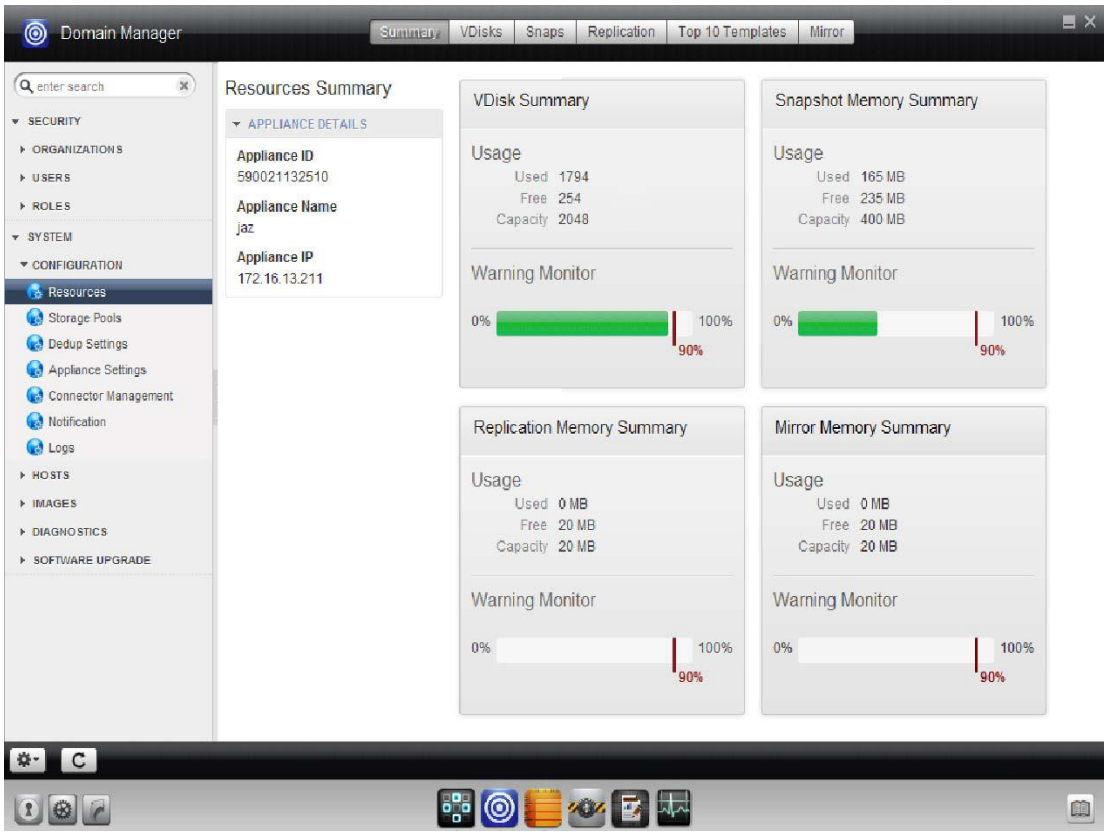
Viewing and Managing VDisk Usage on page 17

Viewing and Managing Snapshot Memory Usage on page 19

Viewing and Managing Replication Memory Usage on page 21

Viewing and Managing the Top 10 SLA Policy Templates on page 22

Viewing and Managing Mirror Memory Usage on page 23



The Resources Section of the Domain Manager Service

Viewing the Resources Summary

The Resources Summary page provides an at-a-glance view of the status of your Actifio appliance. It includes usage information and the warning threshold for VDisk (volume), snapshot memory, replication memory, and mirror memory.

To configure resource limits and warning thresholds for an Actifio appliance, you must access the following tools:

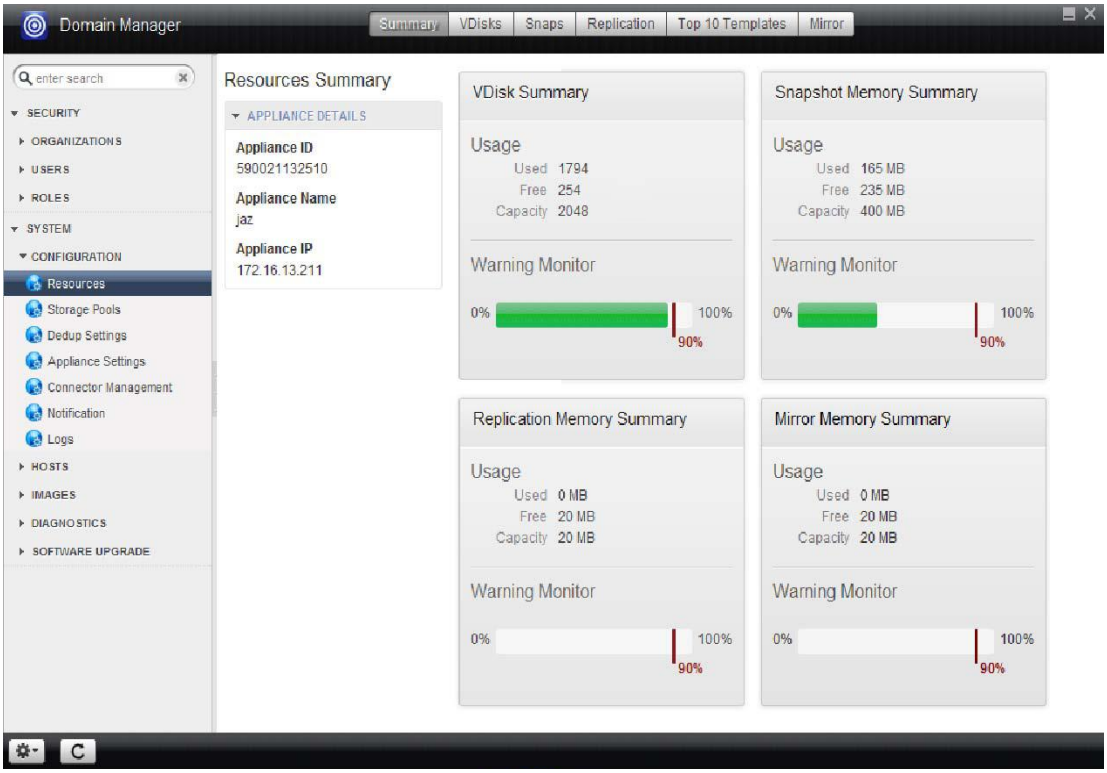
Viewing and Managing VDisk Usage on page 17

Viewing and Managing Snapshot Memory Usage on page 19

Viewing and Managing Replication Memory Usage on page 21

Viewing and Managing the Top 10 SLA Policy Templates on page 22

When usage of any of these resources reaches or exceeds the warning threshold, the Actifio appliance performance can suffer. Call Actifio Support for guidance and solutions.



The Domain Manager System Configuration Resources Summary

Viewing and Managing VDisk Usage

For details on VDisks, see: Chapter 5, About Storage Pools and VDisks.

A VDisk (volume) is a virtual disk on an Actifio appliance presented to a host as a unit of usable storage capacity. You use VDisks for each LUN, VMDK, VHD, database, or filesystem protected (unless protected direct-to-dedup), each volume comprising a snapshot of an application, and each LUN comprising a mount or clone of an application.

To monitor the number of virtual disks:

1. Open the **Domain Manager** to **System** > **Configuration** > **Resources**.
2. Select the **VDisks** tab.

Under VDisk Usage you see the number of VDisks in use and available. The VDisk limit for the Actifio CDS appliance is 2048 VDisks. For the Actifio Sky appliance the VDisk limit varies with the installed capacity license (1000, 3000, or 5000 VDisks).

Top 10 VDisks List

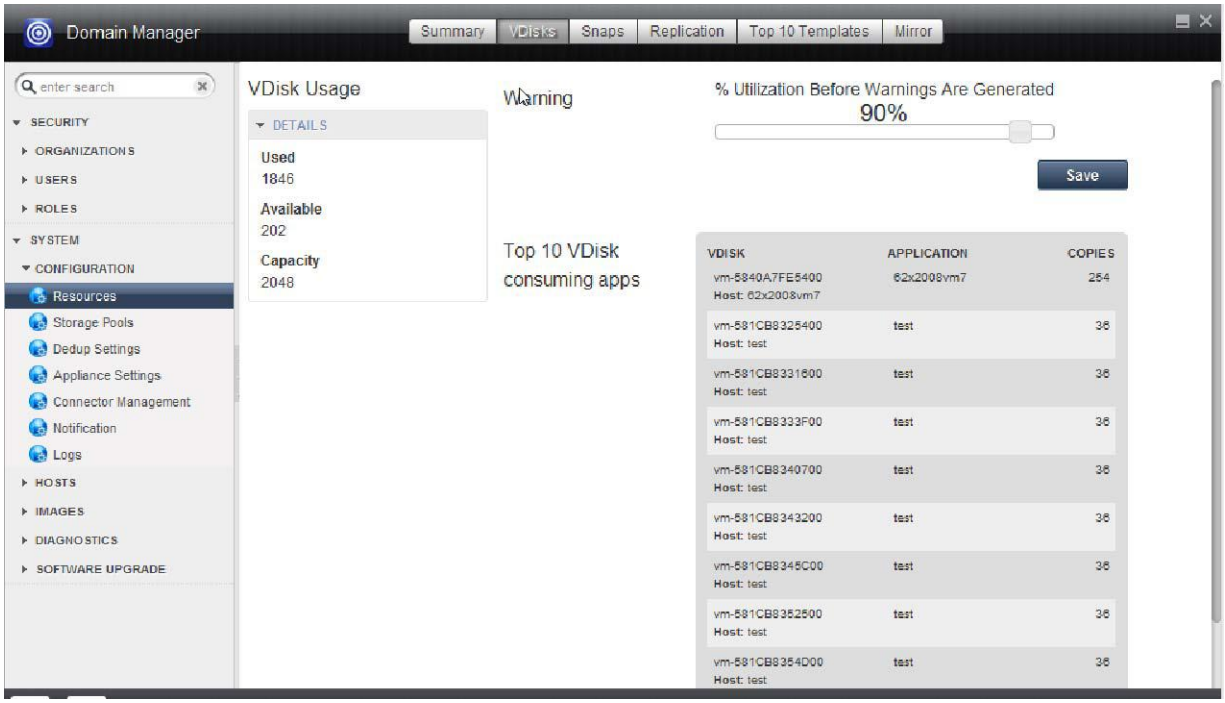
The Top Ten VDisks list shows the ten applications that have the maximum number of virtual disk copies. These are usually snapshots or mounts/clones.

Changing the Warning Threshold for VDisks

If the number of virtual disks created on an Actifio appliance exceeds the warning threshold, warnings are sent to the configured list of email recipients. See ***Configuring Actifio Event Alerting*** in the Actifio Documentation Library.

The default warning threshold for VDisks usage is 90%. To change the warning value, drag the threshold value to the desired value and click Save.

Note: *Do not change the warning threshold simply because your data exceeds the threshold. Change the warning threshold only if your usage requirements justify a different value. Actifio Support can help.*



Viewing VDisk Usage

Reducing VDisk Consumption

The following changes have an immediate affect on VDisk consumption:

- Move VMware VMs from a snapshot SLA to a Direct-to-Dedup SLA. You will need to expire all snaps to release the VDisks used by the staging disks and last snap. This action only works for VMware VMs, as other application types (including Hyper-V VMs) still use some VDisks when protected by a direct-to-dedup policy.
- Change VMware VMDKs that do not need to be protected to Independent Mode as these cannot be protected by VMware snapshots.
- Group SQL databases from a single host together into a consistency group. For example, if a single host has 9 SQL databases, create one Consistency Group for that host and include all 9 databases, then protect that group rather than the individual databases. In this example, VDisk consumption is reduced from 9 to 1.
- Reduce the number of snapshots kept for an application by changing the policy template used by an SLA. This action does not necessarily lead to a different RPO, as deduplicated images of each snap can be created before they are expired.
- Delete unneeded mounts, clones, and live-clones.

Actifio Appliance Reports Related to VDisks

The optional Actifio Report Manager includes several useful reports in the Utilization category:

- Application Contribution to Cumulative V-Disk Usage
- Application Contribution to Daily Storage Pool and V-Disk Usage
- Bandwidth Utilization History
- Daily Storage Pool and V-Disk Usage Trend by Appliance

These reports are detailed in ***Using the Report Manager*** included in the Actifio Documentation Library.

Viewing and Managing Snapshot Memory Usage

A snapshot is an image of an application or VM at a point in time.

To view the usage of the snapshot memory:

1. Open the **Domain Manager** to **System** > **Configuration** > **Resources**.
2. Select the **Snaps** tab.

Under Snapshot Memory you see the amount of memory taken by snapshots and how much is still available.

Snapshot Pool Exhaustion

When the Snapshot Pool reaches its Safe Limit, the Actifio appliance:

- Issues an alert that the stored data exceeds the configured warning limit.
- Stops running new jobs that will write to any Snapshot Pool.
- Cancels jobs that are still running if they will write to any Snapshot Pool.

Normal expiration should free up snapshot pool space progressively over time. This process can be accelerated by manually expiring snapshots. Contact Actifio support if the pool has reached 100% as snapshots may have been damaged (since the Actifio appliance will have nowhere to destage the changed data).

If Snapshot Memory Usage is Too High

When Snapshot Memory usage increases to and then exceeds the warning threshold, Actifio appliance performance can suffer. Solutions include:

- Review your SLAs and see if you can reduce the number of snapshots you are taking.
- Increase snapshot memory. It can be increased up to a maximum of 512MB, however the sum of replication + mirror + snapshot memory cannot exceed a combined maximum of 552MB.

Changing the Warning Threshold

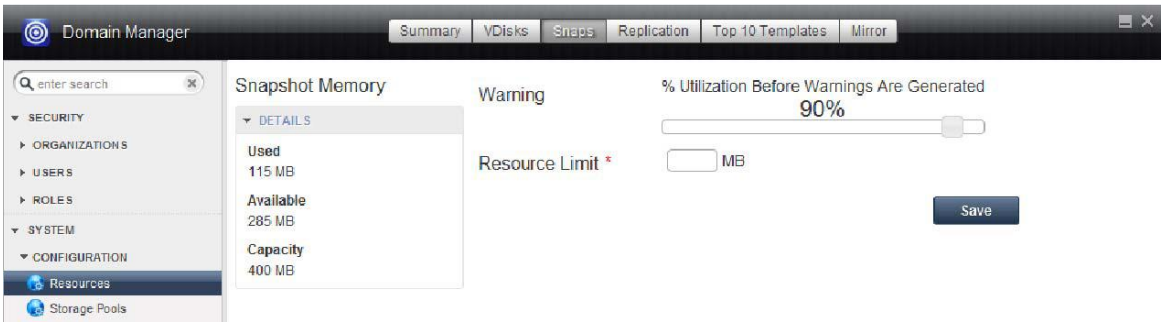
The default threshold for snapshot memory usage is 90%. To change the warning value, move the slider.

> ***Note:*** *Do not use this feature without the direction of Actifio Support.*

Changing the Resource Limit

The default snapshot memory capacity is 100 MB. You can change this value if you need more snapshot memory (see Chapter 6, Configuring Storage Pools).

Each snapshot, mount, or clone uses around a kilobyte of memory per gigabyte size of the target volume. With 100MB snapshot memory you can have snapshot of about 100TB of data. If you are protecting many large volumes and keeping multiple generations of snapshots, increase your snapshot memory.



Viewing Snapshot Memory Usage

Reducing Snapshot Pool Consumption

To reduce consumption of the snapshot pool:

- Move VMware VMs from a snapshot SLA to a Direct-to-Dedup SLA. You will need to expire all snapshots to release the space used by the staging disks and last snap. This action only works for VMware VMs; other application types still use some snapshot pool space if protected by a Direct-to-Dedup policy.
- Reduce the number of snaps being kept for an application by changing the policy template. Applications that have high change rates create larger snapshots, so this has the highest benefit for high change-rate applications. This does not necessarily lead to a different RPO, as deduplicated images of each snap can be created before they are expired.
- Delete mounts, clones, and live-clones if they are not needed
- Change applications from Out-of-Band to In-Band

Actifio Appliance Reports Related to Snapshot Pool Management

The Actifio Report Manager includes several useful reports relating to snapshot pool consumption:

- Application Contribution to Daily Snapshot Pool
- Application Contribution to Daily Storage Pool and V-Disk Usage
- Daily Snapshot Pool Utilization Summary
- Daily Storage Pool and V-Disk Usage Trend by Appliance
- Disk Pool Utilization History
- Snapshot Pool Utilization History by Application
- Storage Pool Usage by Organization
- Storage Resource Usage Summary

Reports are detailed in ***Using the Report Manager*** in the Actifio Documentation Library.

Viewing and Managing Replication Memory Usage

Replication memory buffers changes that are being written to a remote appliance using Sync or Async replication.

To view the usage of the replication memory:

1. Open the **Domain Manager** to **System** > **Configuration** > **Resources**.
2. Select the **Replication** tab.

Under Replication Memory you see the amount of memory already taken by replication and how much remains available.

If Replication Memory Usage is Too High

When replication memory usage exceeds the warning threshold, Actifio appliance performance can suffer. Solutions include:

- Review your SLAs and see if you can reduce the number or size of the VDisks that you are replicating.
- Increase memory pre-allocated for replication. It can be increased up to a maximum of 512MB, however the sum of replication + mirror + snapshot memory cannot exceed a combined maximum of 552MB.

Changing the Warning Threshold

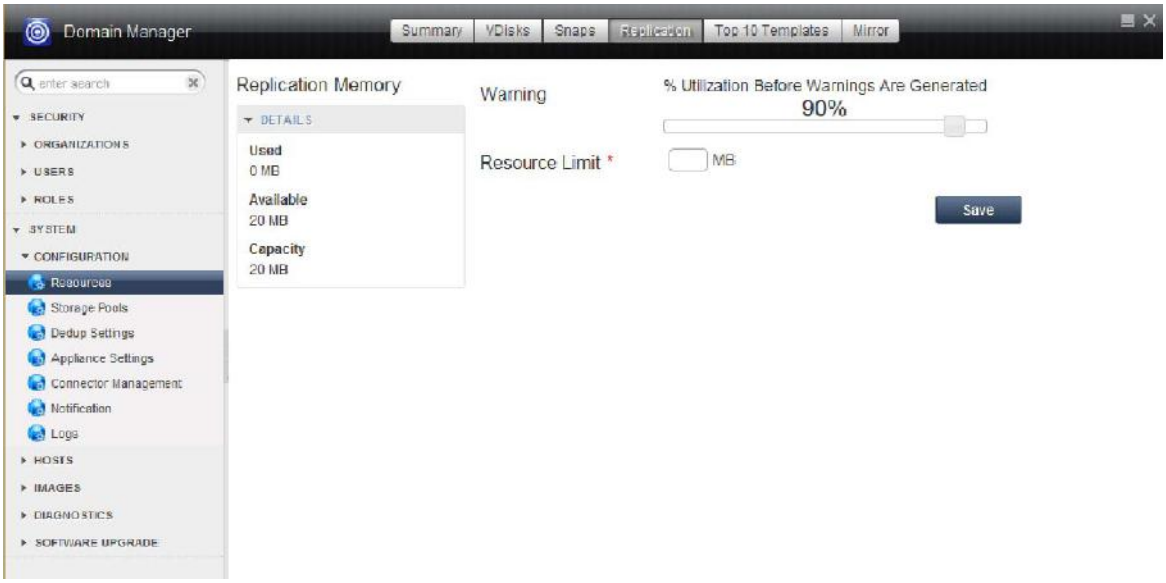
The default threshold for replication memory usage is 90%. To change the warning value, change the default warning threshold value.

Note: *Do not change the warning threshold simply because your data exceeds the threshold. Change the warning threshold only if your usage requirements justify a different value. Actifio Support can help.*

Changing the Resource Limit

The default replication memory capacity is 20 MB. Change this limit only with the assistance of Actifio Support.

If required, increase or decrease the Resource Limit and click **Save**.



Viewing Replication Memory Usage

Viewing and Managing the Top 10 SLA Policy Templates

For each Service Level Agreement (SLA), the top resources consumed by applications and VMs protected by the SLA policy templates appear in the **System > Configuration > Resources** section of the Domain Manager, in the Top 10 Templates tab. Policy templates are the rules that you create for the Actifio appliance to determine what type of protection to apply to your copy data, when to apply it, and where to store it. Each template policy defines how your applications and VMs are managed by the Actifio appliance. SLA operations have the potential of impacting the performance of the Actifio appliance by running out of critical resources as a result of a template policy.

To view the top 10 SLA policy templates:

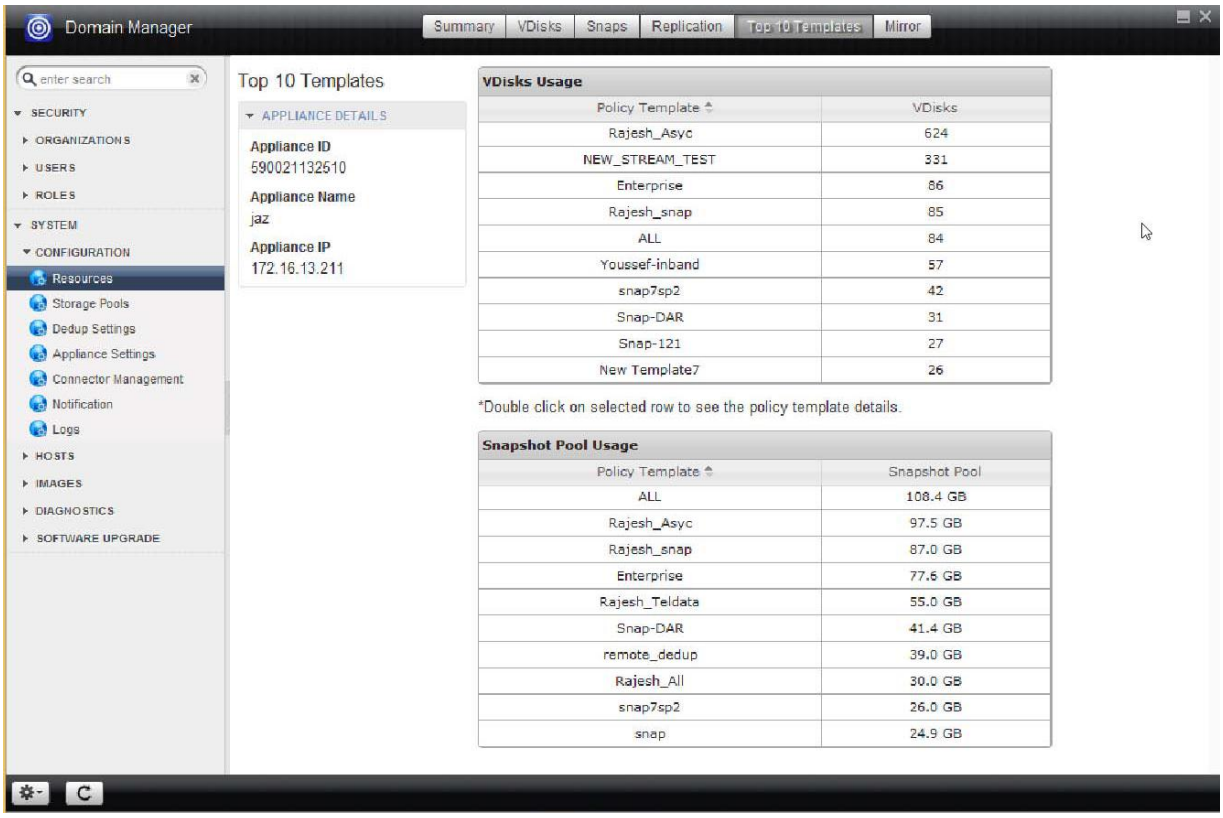
1. Open the **Domain Manager** to **System** > **Configuration** > **Resources**.
2. Select the **Top 10 Templates** tab.

Resource consumption information includes:

- Top 10 VDisk-consuming applications (with total number of VDisks used)
- Top 10 snapshot pool space usage applications (including total amount of storage used)

If you double-click a row in either the VDisk Usage or Snapshot Pool Usage table, this action brings you to the associated policy template in the SLA Architect.

For details on modifying a policy template to take into consideration how the frequency and retention settings for the various police templates can reduce VDisk and snapshot pool usage, see the ***Planning and Developing Service Level Agreements*** book in the Actifio Documentation Library.



Verifying Resources for SLA Templates

Viewing and Managing Mirror Memory Usage

When an Actifio appliance is protecting an in-band volume, it has the ability to create two identical copies of that volume that it keeps in sync. This function can be used to provide high availability or to facilitate migration of the volume from one storage controller to another. The Actifio appliance uses a memory bitmap to ensure that each copy of the volume is kept in sync.

Note: *In-Band is not applicable to Actifio Sky appliances.*

To view the usage of the mirror memory:

1. Open the **Domain Manager** to **System** > **Configuration** > **Resources**.
2. Select the **Mirror** tab. Under Mirror Memory you see the amount of memory already taken by mirroring and how much remains available.

If Mirror Memory Usage is Too High

When Mirror Memory usage increases to and then exceeds the warning threshold, Actifio appliance performance can suffer. Solutions include:

- Removing volume mirroring
- Increasing the size of the memory limit

Changing the Warning Threshold

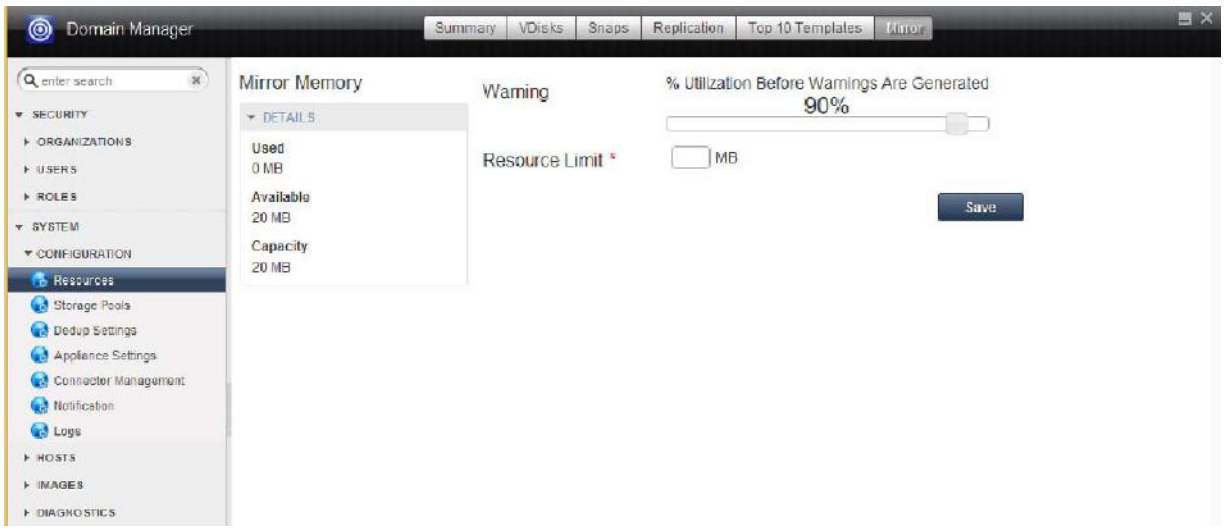
The default threshold for mirror memory usage is 90%. To change the warning value, change the default warning threshold value.

Note: *Do not change the warning threshold simply because your data exceeds the threshold. Change the warning threshold only if your usage requirements justify a different value. Actifio Support can help.*

Changing the Resource Limit

The default mirror memory capacity is 20MB, which supports 40TB of mirrored volumes.

Change this setting only with the assistance of Actifio Support. If required, increase or decrease the Resource Limit and click **Save**.



Viewing Mirror Memory Usage

4 Understanding Out-of-Band and In-Band Data Storage

In Actifio terms, production data is the data of your running applications and VMs, and copy data is all the backed-up data. In an Actifio appliance environment, your copy data is virtualized and managed in ways that greatly reduce storage requirements and increase the ease and reliability of recovery.

To store your copy data, an Actifio appliance must first capture it, and the incremental changes that occur to it per the SLAs assigned to each application or VM.

This chapter helps you understand the storage topology choices you can make and how these affect how an Actifio appliance will protect the copy data. The copy data is stored in VDisks in the Actifio appliance storage pools described in Configuring Storage Pools on page 35.

This section introduces:

The Actifio Connector on page 26

Out-of-Band Data and Staging Disks on page 27

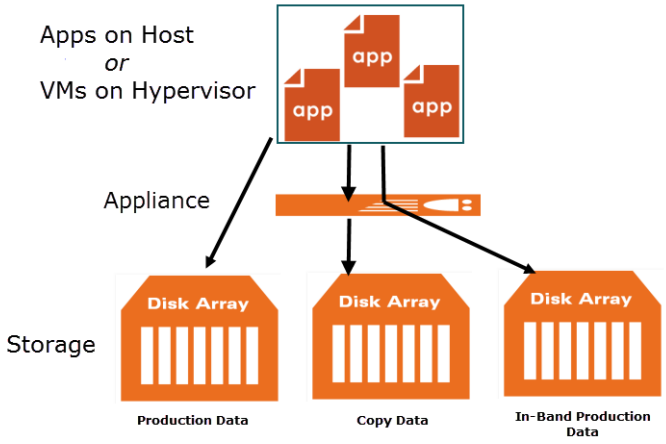
In-Band Data on page 29

Production data can be:

Out-of-Band: Production data storage is handled by a non-Actifio volume controller. Snapshots and changed-block tracking are handled by the Actifio Connector on physical hosts and Hyper-V VMs, and through VMware APIs for VMware VMs. Out-of-Band storage uses your existing storage arrays. Out-of-Band storage is described in Out-of-Band Data and Staging Disks on page 27.

In-Band: Production data storage is controlled by an Actifio CDS appliance. Snapshots and changed-block tracking are native to Actifio Sky appliance. In-Band storage is described in In-Band Data on page 29.

Note: *In-Band is provided only by Actifio CDS appliances.*



A Single Actifio CDS Appliance Can Protect Data In-Band and Out-of-Band

The Actifio Connector

The Actifio Connector is a small-footprint lightweight process installed on physical and virtual hosts to provide advanced data protection and restoration capabilities. Under normal conditions, the Actifio Connector requires less than 10 MB of memory and uses less than 0.5% of CPU time. Actifio Connector functions are described in ***Connecting Hosts to Actifio Appliances*** in the Actifio Documentation Library.

> ***Note:*** *Protecting an entire VMware VM does not require the use of the Actifio Connector. To protect an entire VMware VM an Actifio appliance makes calls to VMware APIs. To protect an entire Hyper-V VM, you must install the Actifio Connector on the VM's Hyper-V Server.*

The Actifio Connector:

- Enables an Actifio appliance to discover supported applications on out-of-band host machines.
- Truncates the logs of an application on application hosts after a backup.
- Quiesces an application on a host machine or in a host VM before backing up the production data. This process ensures an application-consistent backup for applications that support it.

To protect out-of-band applications, install the Actifio Connector on the server(s) that host those applications. After the first full backup, the Actifio appliance performs incremental backups.

Out-of-Band Data and Staging Disks

When the Actifio appliance is not in the data path, it protects copy data by presenting a staging disk to the host. This staging disk maintains a golden copy of the application data that is protected using Actifio appliance snapshots. On Windows, application-consistent backups are made via VSS. Oracle backups on all platforms are application consistent via RMAN interfaces. Whole VM backups are application-consistent if they are configured with vmtools.

Whenever possible, change block tracking is used to minimize backup data movement. Tracking is accomplished with VSS snapshots, Oracle RMAN, and the Actifio Connector.

This section describes:

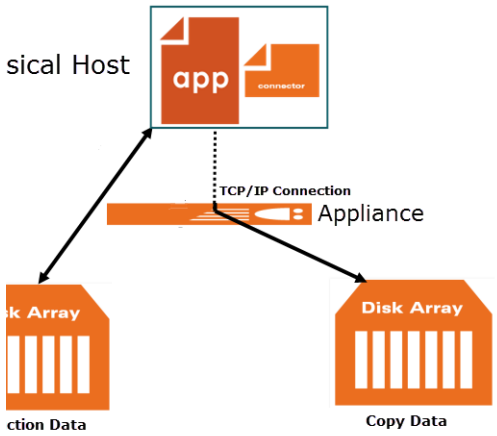
Protecting Physical Hosts Out-of-Band on page 27

Protecting Entire VMware and Hyper-V VMs Out-of-Band on page 28

Protecting Individual Applications on a VMware or Hyper-V VM Out-of-Band on page 28

Protecting Physical Hosts Out-of-Band

Applications on physical hosts are backed up with the Actifio Connector by reading data from the production data and sending this data to the snapshot pool or directly to the dedup pool. Most Windows backups are made in an application-consistent way via VSS, and database backups are application-consistent through database-specific APIs. Change block tracking is typically used to accelerate the process. Applications on non-Windows hosts are low-splash.

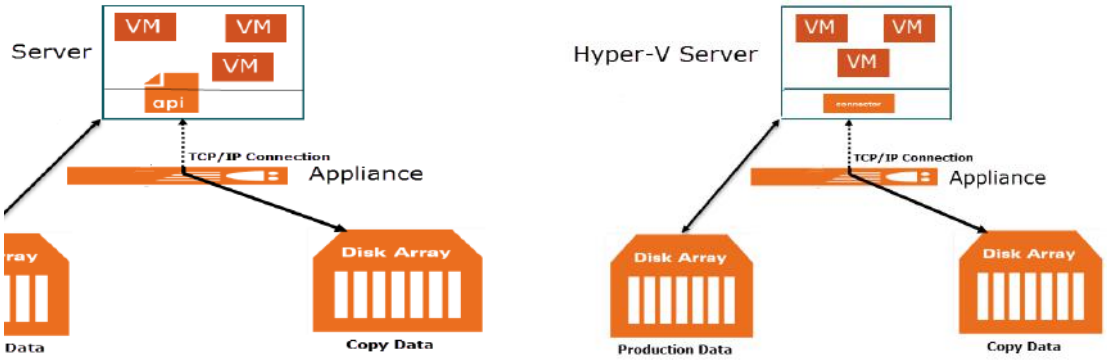


Protecting Applications on Physical Hosts Out-of-Band

Protecting Entire VMware and Hyper-V VMs Out-of-Band

An Actifio appliance can protect entire VMware and Hyper-V VMs Out-of-Band.

To protect entire VMware VMs, the Actifio appliance takes advantage of VMware APIs. To protect entire Hyper-V VMs, the Actifio Connector is installed on the Hyper-V server.

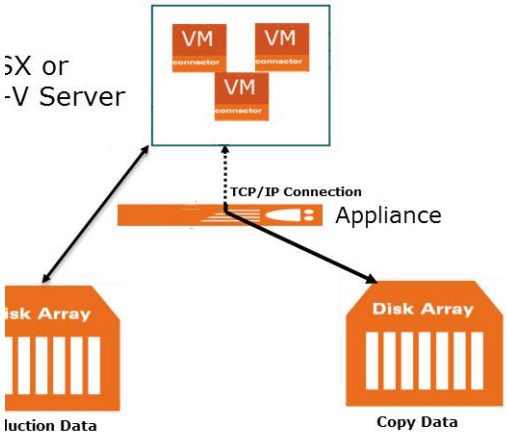


Protecting Entire VMs Out-of-Band

> ***Note:*** *An Actifio Sky appliance is a VMware VM and can be on the same ESX server as VMs it protects.*

Protecting Individual Applications on a VMware or Hyper-V VM Out-of-Band

The Actifio Connector is used to protect individual applications on a VM. Once the Actifio Connector is installed on a VM, you can create policies to protect sets of applications on the VM.



Protecting Applications on a VM Out-of-Band

> ***Note:*** *An Actifio Sky appliance is a VMware VM and can be on the same ESX server as VMs it protects.*

In-Band Data

In addition to the storage pools for copy data, the Actifio Sky appliance can also have additional storage for your applications. Actifio Optimized Storage (AOS) is controlled by the Actifio Sky appliance volume controller.

> ***Note:*** *In-Band is not applicable to Actifio Sky appliances.*

The Actifio Sky appliance can protect a Fibre Channel presented volume using storage virtualization. In-Band means that the Fibre Channel attached back-end storage device presents volumes to the Actifio Sky appliance (using SAN LUN masking) which the Actifio Sky appliance then presents to the host over Fibre Channel or iSCSI. This storage method allows the Actifio Sky appliance to track every block of the volume and determine which blocks change over time.

When the SLA driven scheduler determines a production snapshot is required, the Actifio Sky appliance makes a copy-on-write snapshot. This action allows the Actifio Sky appliance to save space in the snapshot pool by storing only the changed blocks. These snapshots can then be used for:

- **"Instant-Backup" -** Because each snapshot does not in itself move data, copy on first write only occurs when blocks change.
- **"Instant-Restore" -** Because the Actifio Sky appliance is presenting the storage, it can simply present a previous point-in-time to the host. Any data movement needed to complete the restore is done in the background without any further host downtime.

After each snapshot, the Actifio Sky appliance can create a deduplicated and compressed image of the snapshot that is stored in the Actifio dedup pool.

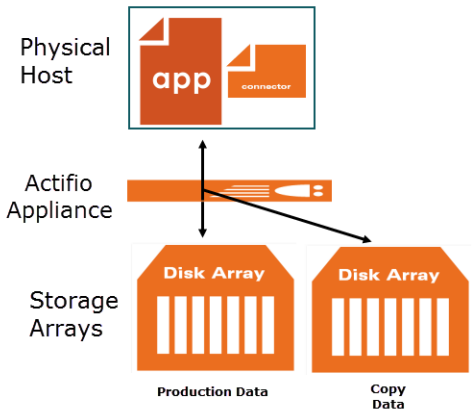
Both physical hosts and VMs can be protected in-band:

Protecting Physical Hosts In-Band on page 29

Protecting Entire VMs In-Band on page 30

Protecting Physical Hosts In-Band

The Actifio Connector is used to capture applications on physical servers. The Actifio Connector achieves application-consistent backups by enabling Microsoft VSS (Shadow Copy) snapshots, and database quiescing.

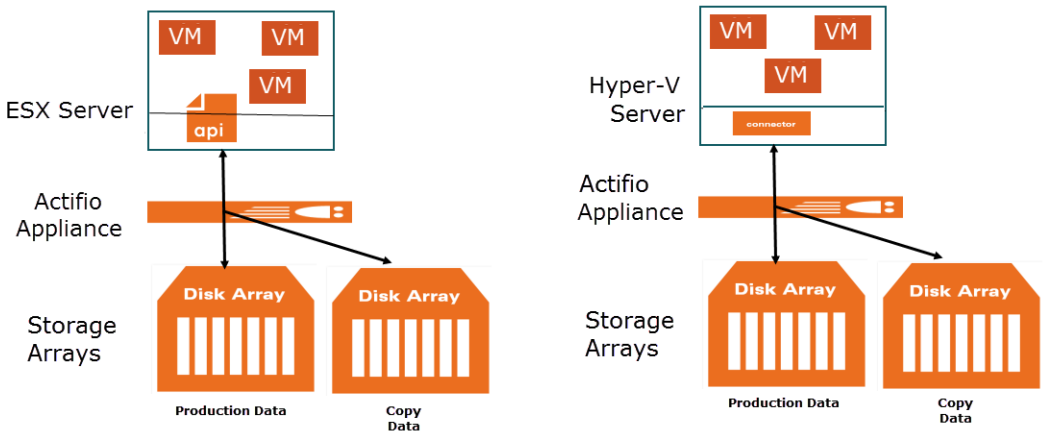


Protecting Physical Server In-Band

Protecting Entire VMs In-Band

An Actifio appliance can protect entire VMware and Hyper-V VMs.

- To protect entire VMware VMs, the Actifio appliance takes advantage of VMware APIs to quiesce applications and achieve application-consistent backups.
- To protect entire Hyper-V VMs, the Actifio Connector is installed on the Hyper-V server. The Actifio Connector achieves application-consistent backups by enabling Microsoft VSS (Shadow Copy) snapshots, and database quiescing.

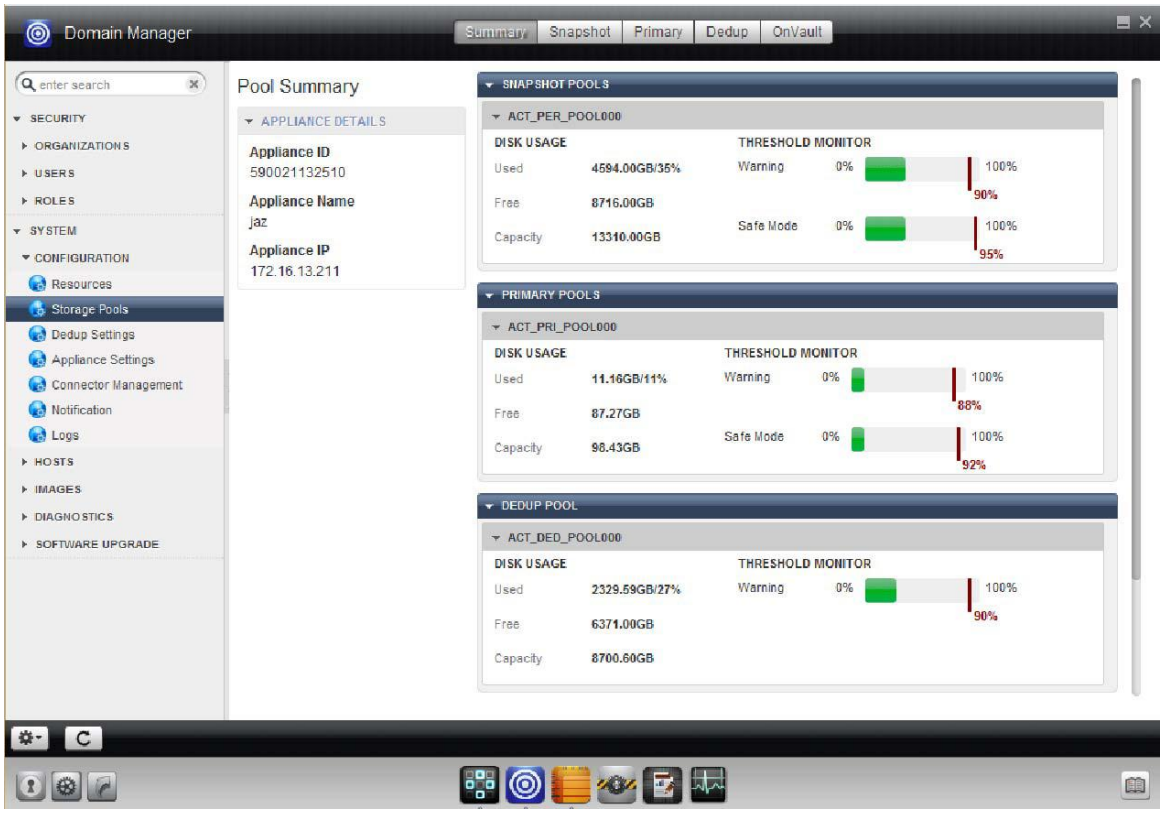


Protecting Entire VMware and Hyper-V VMs

5 About Storage Pools and VDisks

This chapter details:

- Storage Pools on page 32
- VDisks and VDisk Consumption on page 33



Storage Pools

Storage Pools

Actifio appliances provide three types of storage pools:

Snapshot storage pool: The Snapshot Pool (also called the Performance pool) is for the instant backup/restore pieces of the process. The snapshot pool often contains hundreds or even thousands of volumes (VDisks). Snapshots are good for instant access. Snapshot pool consumption is detailed in Viewing and Managing Snapshot Memory Usage on page 19. For more information on the Snapshot Pool, see Snapshot Pools on page 34.

Dedup storage pool: Dedup storage is for compact long-term retention. The Dedup pool consumption is detailed in Chapter 7, Managing the Dedup Pool.

OnVault storage pool: OnVault storage pools define storage for Actifio OnVault Policies. They are meant for long-term storage of data. Creation of a OnVault storage pool is described in Adding OnVault Pools on page 42.

Note: *The Primary Pool, act_pri_pool000, is for the Actifio appliance use. Do not change the Primary pool or add a second pool unless instructed by Actifio Support.*

Staging Disks for VMs and Out-of-Band Applications

When you protect a VM or an out-of-band application, copies of the selected image are put into a dedicated virtual staging disk in the Snapshot pool. The Actifio appliance creates a snapshot from the image on the staging disk, and stores the snapshot in the snapshot pool for the time specified in the SLA.

Staging disks for out-of-band backups are allocated from the snapshot pool. The VDisk is thin-provisioned so it does not consume all of its space right away. Each snapshot that is created of that staging disk also consumes some amount of snapshot pool space, depending on how many changes there are.

Staging disks are not created or used for In-Band VMware VMs and applications.

Growth of Applications

If an application grows from 1TB to 2TB, a new 2TB staging disk is created. The original 1TB disk is preserved until all snapshots that depend on it are expired.

Staging Disk Formatting

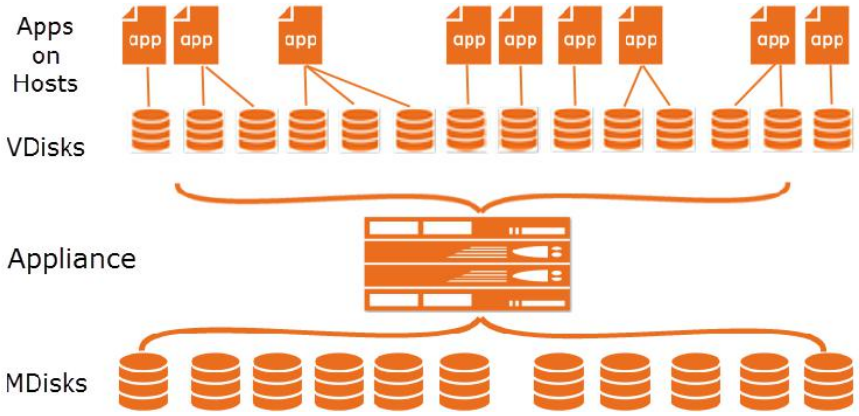
Windows staging disks up to 2 TB in size are MBR formatted. Those over 2TB are GPT formatted.

An Exception for Direct-to-Dedup Protection for VMware VMs

VMware VMs that are protected direct-to-dedup do not go through a staging disk because the Actifio appliance can get changed-block information directly from the VMware layer. Hyper-V VMs and all other applications get changed-block information either via Oracle RMAN or the Actifio Connector (using an Actifio staging disk), or via an in-band snapshot.

VDisks and VDisk Consumption

VDisks (virtual disks or volumes) are the primary tool of copy data management. Copy data from hosts and VMs is copied to VDisks in the Snapshot Pool. From the VDisks, the data can be deduplicated, cloned, mounted and recovered, presented for test and development work, and manipulated in other tasks. Actifio CDS and Sky appliances employ VDisks in slightly different ways, but the information in this section applies to both types of Actifio appliances.



Virtualized Applications on Managed Disks in Your Storage

How Many VDisks Do I Have?

An Actifio appliance creates VDisks as needed from pools of MDisks on the physical disk arrays in the Actifio appliance. The applications and hosts never see the MDisks.

The VDisk limit for the Actifio CDS appliance is 2048 VDisks, and for the Actifio Sky appliance the VDisk limit varies with the installed capacity license (1000, 3000, or 5000 VDisks). If you have enough VDisks for your needs, but they are growing too large for your existing storage, then you must add storage, as described in Modifying Existing Snapshot and Dedup Pools on page 38. If you need more VDisks, then you need another Actifio appliance as described in Chapter 9, Configuring Shared Appliances.

How Many VDisks Do I Need?

In general, each protected application or VM requires one or more VDisks for the staging disk plus the same number more VDisks per snapshot. In addition, note these rules:

- VM-level backups with a snapshot SLA consume one VDisk for each virtual disk in the VM.
- File system backups in a Windows environment consume one VDisk for each protected file system.
- File system backups in a Unix environment consume a VDisk for every 833GB protected times 1+(number of retained snapshots). You can adjust the 833GB value by changing Staging Disk Granularity in Application Advanced Settings, see ***Virtualizing and Protecting Copy Data with the Application Manager***.
- Mounts, LiveClones, and Clones of non-VM applications consume VDisks.
- On Linux and Solaris systems, filesystems and Oracle databases consume one VDisk plus another for every additional 2TB data is being protected.
- Exchange and SQL databases consume one VDisk for every volume that hosts the database.
- Each snapshot of a VDisk consumes one VDisk per snapshot per protected disk.
- Snapshots show peak usage, as new snapshots are created before old snapshots are expired.
- Each VDisk protected by Dedup-Async consumes one additional VDisk for the DAR snapshot and two VDisks on the target appliance.
- After failover and syncback, the failback operation cleans out all the syncback and failover VDisks.

VDisks are thin-provisioned, and can grow over time, as explained in Snapshot Pools on page 34.

Snapshot Pools

The Snapshot pool (sometimes referred to as the Performance Pool) holds "golden copies" of application data at the points in time specified by Service Level Agreement (SLA). Snapshot space is also used to rehydrate images from the deduplication pool. The amount of data consumed is determined by whether an existing snapshot can be used. VDisks are always thin-provisioned.

Snapshot Pool space is consumed by four different kinds of VDisk:

Staging disks: Staging disks are the Actifio golden copy of the application. Staging disks are retained for as long as an application is protected and at least one snapshot exists.

Snapshot disks: These are used to preserve the state of staging disks at specific points in time. Snapshots are retained until their expiry time, but the last snapshot will never expire unless the application is unprotected or it is explicitly expired.

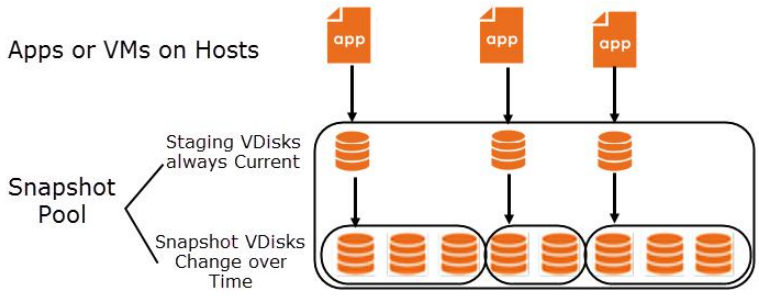
Mountable VDisk: Mountable VDisks are mountable images created at restore time from either a snapshot on a snapshot disk or a deduped image that has been rehydrated to a staging disk.

Clone disks: Clone disks are full copies of an application's production data. Clone disks are not automatically expired.

Staging Disks

A staging disk is a VDisk created when an application is first protected. It is a copy of the production data as of the last backup invoked by the application's SLA. Each staging disk is associated with a number of snapshots on their own snapshot VDisks. The number of snapshots for each application or VM is determined by the SLA frequency of snapshot and retention period.

Because a staging disk is a complete copy of the production application or VM, each staging disk requires as much storage space in the Snapshot Pool as the protected application or VM requires in its production storage. Snapshots made from the staging disk reference the data in the staging disk, so they are much smaller. As subsequent backups change blocks in the staging disk, the original blocks are "pushed" into the snapshot VDisks, so the snapshot appears to have constant content but contains more and more blocks over time.



Virtualized Copy Data on Staging VDisks and Snapshot VDisks in the Snapshot Pool

Snapshot Pool Storage Consumption

The Snapshot Pool contains both the staging disks and the snapshot disks for every protected application or VM, plus any clones and mount images that you make.

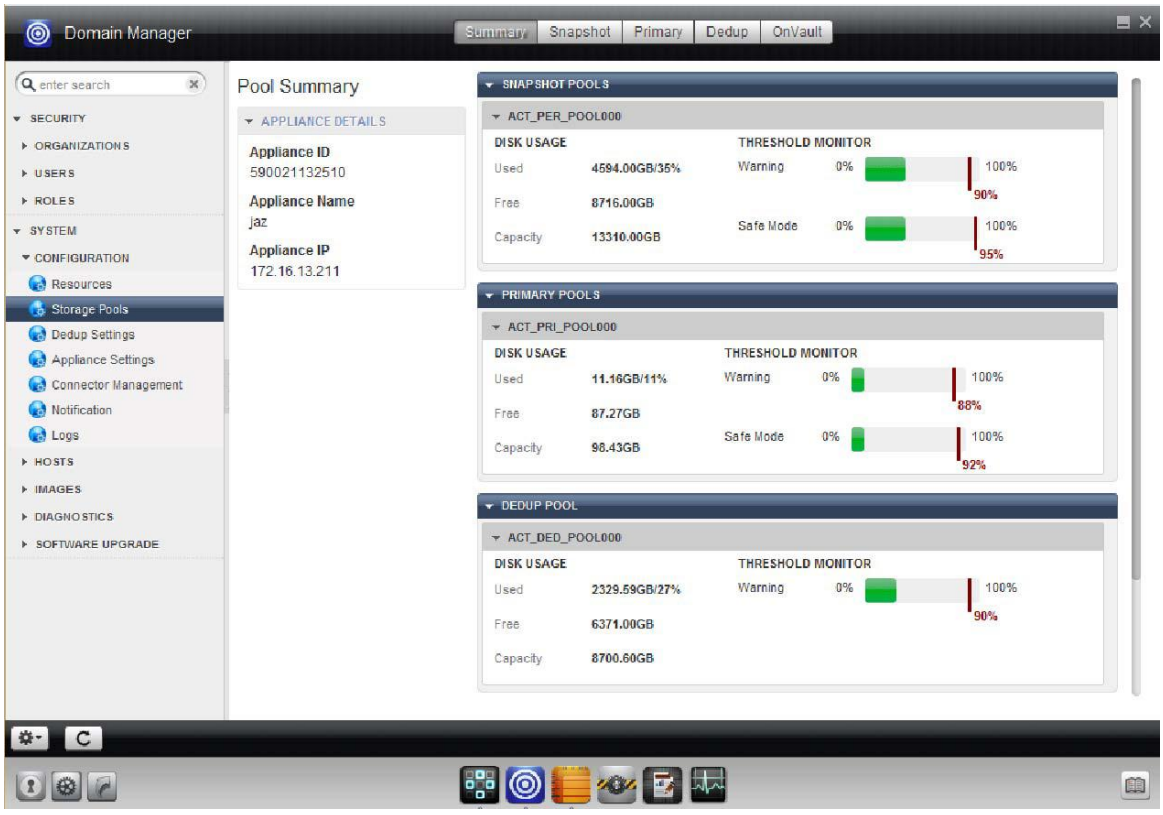
The storage space consumed in the Snapshot Pool depends upon whether the application and VM production data is in-band or out-of-band. For more on in-band and out-of-band storage, see Chapter 4, Understanding Out-of-Band and In-Band Data Storage.

- In-band applications have no staging disk, only incremental backups.
- Out-of-band applications have one staging disk which is the same size as the object being protected (for instance, a 100GB VM has a 100GB staging disk) then a series of snapshots (based on expiration policy) which take space directly proportional to the change rate of the application.

6 Configuring Storage Pools

This chapter details:

- Configuring the Alert Levels for Storage Pools and Resource Profiles on page 36
- Viewing Storage Pool Information on page 37
- Modifying Existing Snapshot and Dedup Pools on page 38
- Adding Snapshot Pools on page 40
- Adding OnVault Pools on page 42
- Deleting Pools on page 43



Storage Pools

Configuring the Alert Levels for Storage Pools and Resource Profiles

You can configure two usage alert levels, Warning and Safe Mode, for the Snapshot and the Dedup Pools.

> ***Note:*** *Do not change these settings unless advised by Actifio Support. If a snapshot pool fills to 100%, snapshots can be brought offline and become unrecoverable.*

When the Snapshot Pool reaches its Safe Limit, the Actifio appliance:

- Issues an alert that the stored data exceeds the configured warning limit.
- Stops running new jobs that will write to the Snapshot Pool.

When the Dedup Pool reaches its Safe Limit, the Actifio appliance:

- Issues an alert that the stored data exceeds the configured warning limit.
- Stops running new jobs that will write to the Snapshot Pool.
- Cancels jobs that are still running if they will write to the Dedup Pool.

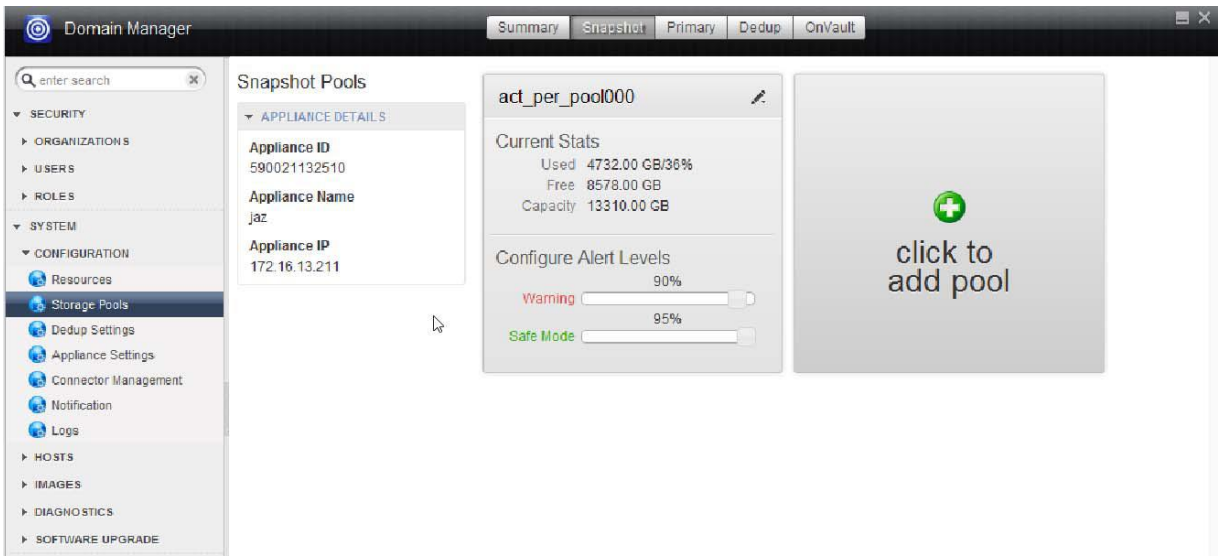
To configure the usage level:

> ***Note:*** *Do not change the default settings unless advised by Actifio Support.*

1. Open the **Domain Manager** to **System** >**Configuration** > **Storage Pools**.
2. Select the **Snapshot**, **Primary**, or **Dedup** tab.

   The default Warning level is 80% for the snapshot and primary pools and 75% for the deduplication pool. When this level is exceeded, you see warnings.
3. Set Safe Mode to an appropriate level of usage. The default value is 90% for the snapshot and primary pools. When this value is exceeded, the Actifio appliance stops writing to storage.

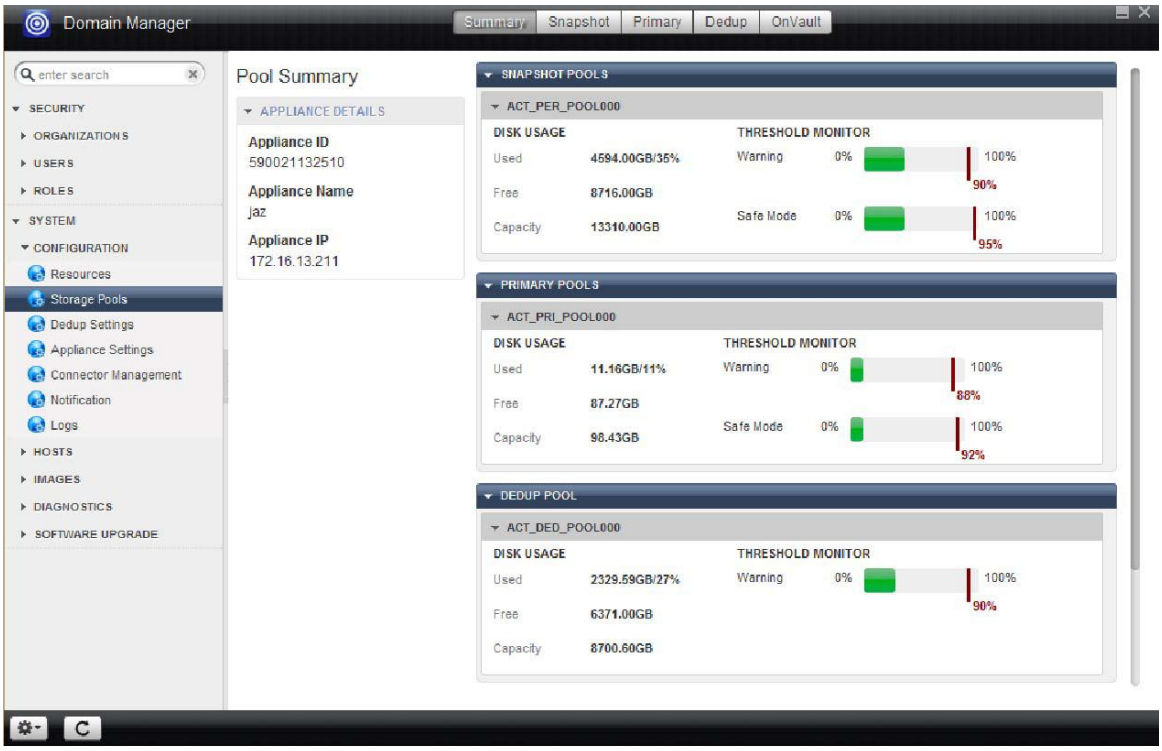
> ***Note:*** *The Safe Mode option is not available with deduplication.*



Alert Levels

Viewing Storage Pool Information

To view the existing storage pools information, open the **Domain Manager** to **System** > **Configuration** > **Storage Pools**. The pool summary page shows the disk usage (used, free, and total capacity) and alert level (Warning and Safe Mode) settings.



Viewing the Summary of the Storage Pools

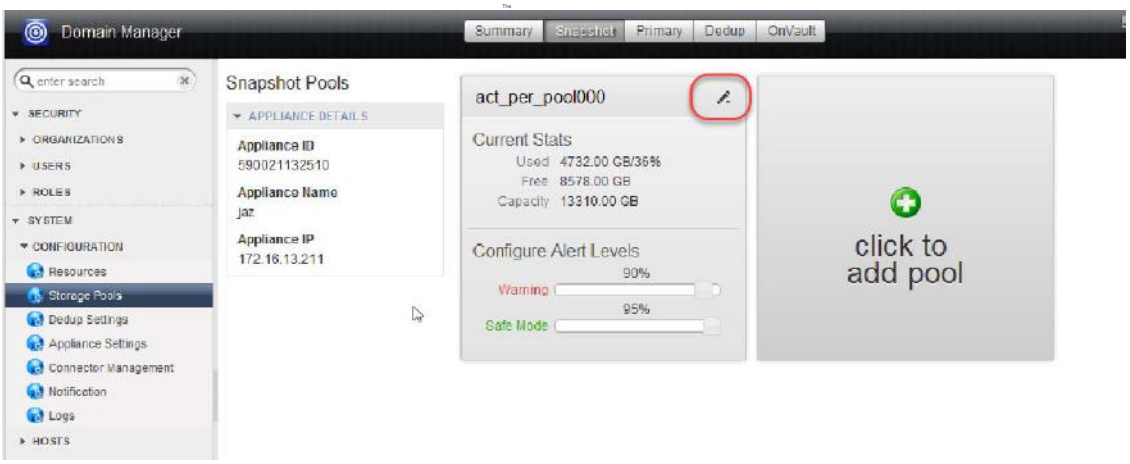
Modifying Existing Snapshot and Dedup Pools

You can modify the size and details of existing Snapshot and Dedup pools.

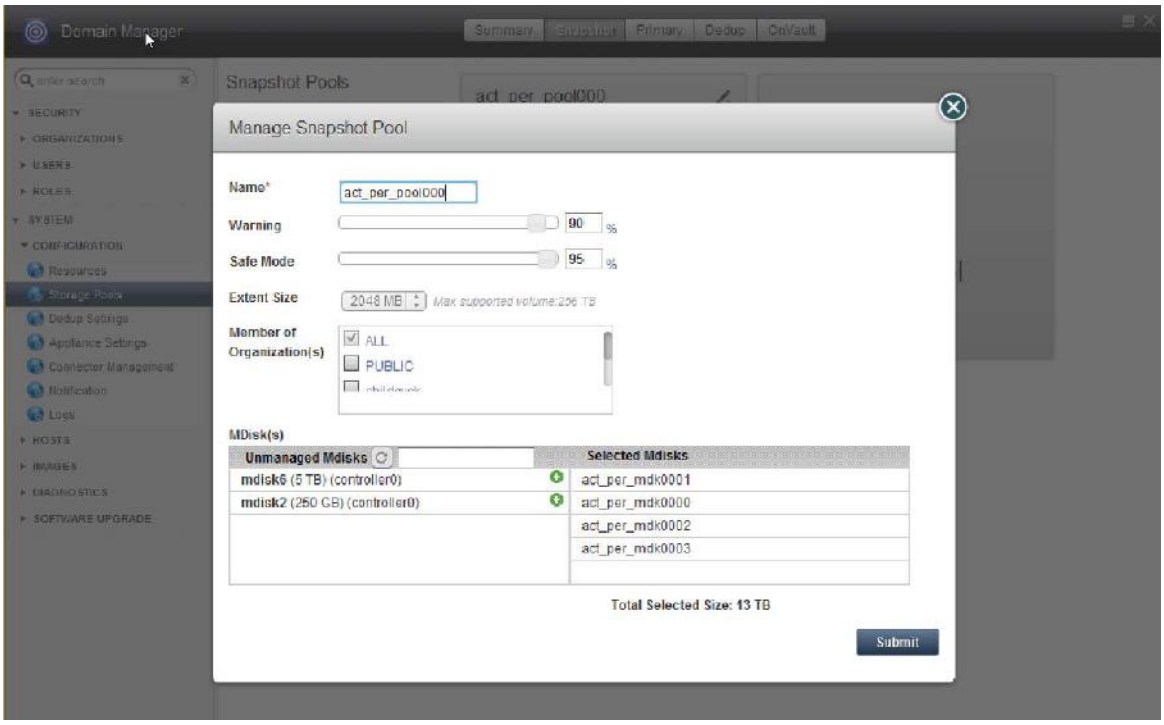
> ***Note:*** *You cannot add additional dedup pools, but you can extend their size.*

To modify a storage pool:

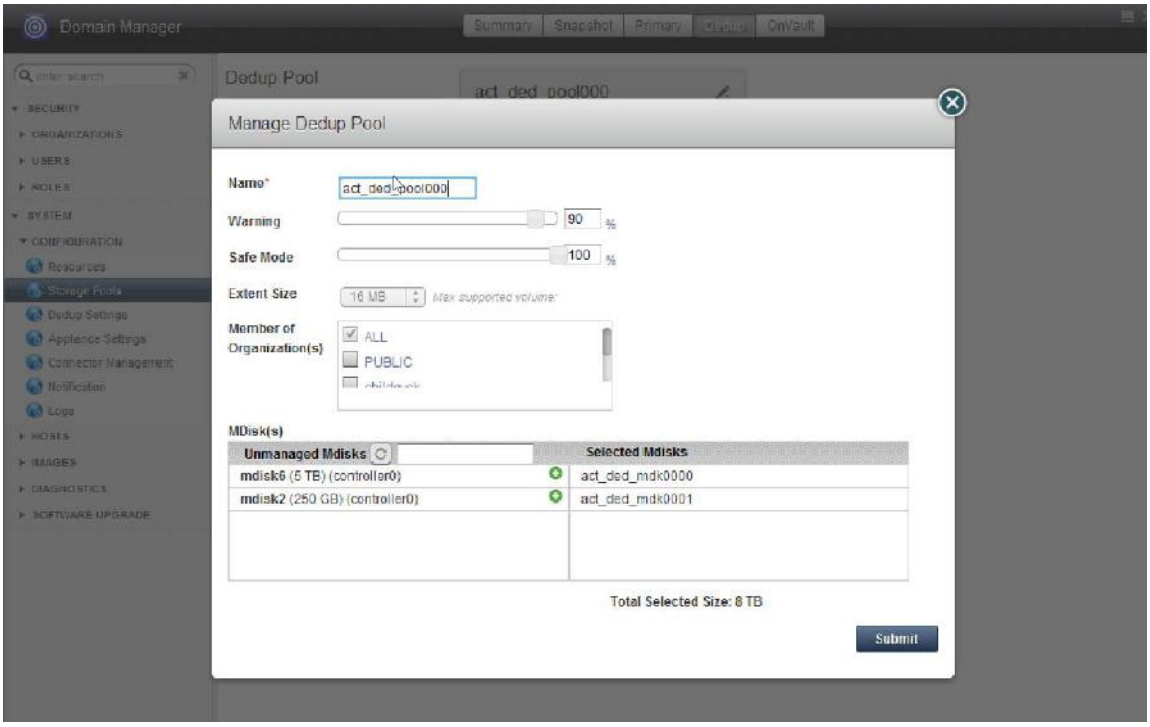
1. Open the **Domain Manager** to **System** > **Configuration** > **Storage Pools**.
2. Select the **Snapshot** or **Dedup** tab. The Snapshot Pools or Dedup Pool information page opens.
3. Click the pencil edit icon next to the storage pool name. The Manage Pool page appears.
4. Make the required modifications. Add additional unmanaged MDisk(s) to increase the size of the pool. Select one or more MDisk(s) from the list of unmanaged disks by clicking on the appropriate + symbol. Use the search option to find the required MDisk(s). Added MDisks appear in the right-hand panel.
5. Click **Submit**. A warning dialog appears. Type **PROCEED** in the text box to confirm.
6. You can verify the modified pool details under the corresponding snapshot, primary, or dedup pool information page.



Pool Edit Icon



Editing a Snapshot Pool



Editing a Dedup Pool

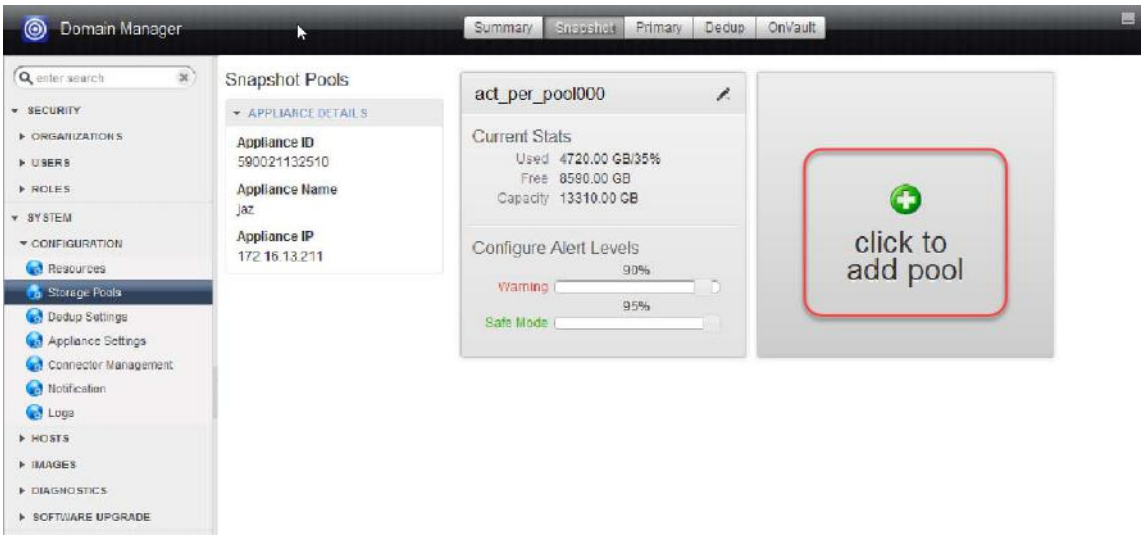
Adding Snapshot Pools

You can add additional storage pools for snapshot storage. You might do this to keep snapshot data from different groups or to keep systems separate from each other, or if you need to restore a large application from a dedup image.

> ***Note:*** *You cannot add additional dedup pools, but you can extend their size. See* Modifying Existing Snapshot and Dedup Pools *on page 38**.*

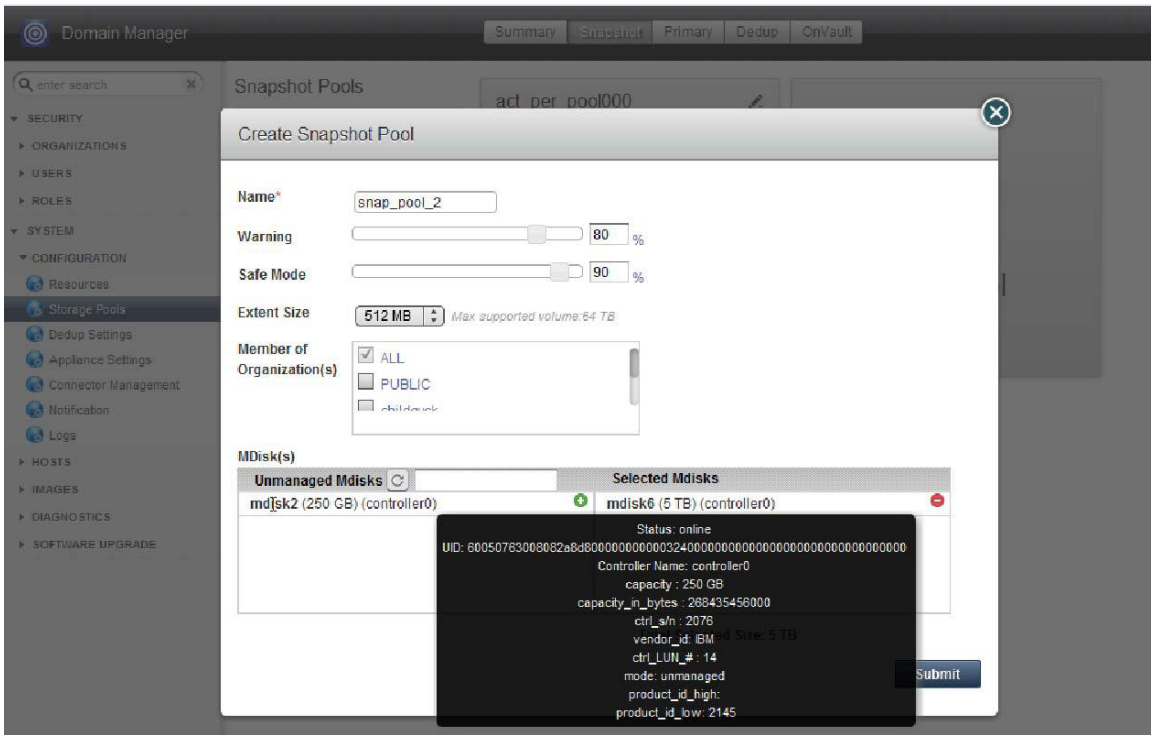
To create an additional snapshot pool:

1. Open the **Domain Manager** to **System** > **Configuration** > **Storage Pools**.
2. Select the **Snapshot** tab. The Snapshot Pools page opens.



Adding a Snapshot Pool

3. Click on **click to add pool**. The Create Pool page appears.
4. Enter a **Name** for the storage pool.
5. If required, modify the default **Warning** and **Safe Mode** limits.
6. **Extent Size**: Use this feature only under the guidance of Actifio Support.
7. Select the organizations that will have access to this pool.
8. Select the **MDisk(s)** to include in this pool from the list of unmanaged disks by clicking on the appropriate + symbol. Use the search option to find the required MDisk(s). Selected MDisks appear in the right-hand panel. You can hold the mouse cursor over an MDisk record to see its status, including UID, controller, capacity, etc.
9. Click **Submit**.
10. A warning dialog appears. Type **PROCEED** to confirm.
11. Click **Confirm**. The newly created pool is listed under the snapshot or primary pool page.



Viewing the Status of an MDisk to be Added to a New Snapshot Pool

Adding OnVault Pools

Storage is assigned to Actifio OnVault Pools. OnVault Pools are used in the creation of Resource Profiles. The Resource profile is used along with a Production Snapshot to OnVault Policy to send captured snapshot data to the assigned storage.

> ***Note:*** *OnVault can only be used on Actifio CDS systems capable of supporting 128TB dedup pools. Earlier generations of Actifio CDS hardware that were limited to 48TB or 64TB dedup pools cannot support OnVault.*

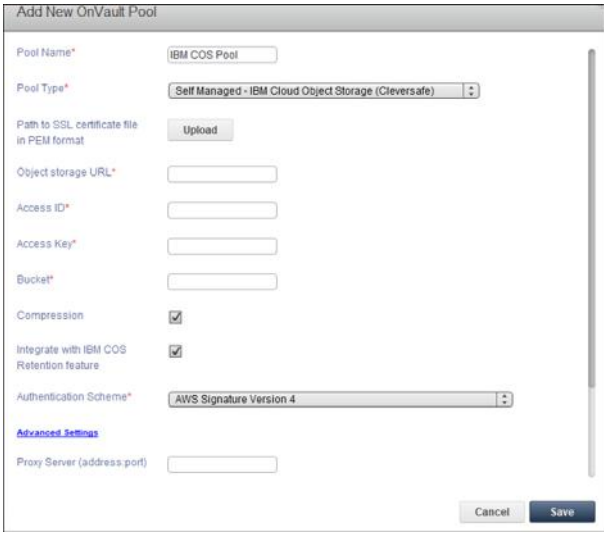
Actifio has created vendor-specific documents that provide detailed, step-by-step instructions on how to gather the information required to create an OnVault Pool:

- ***Configuring Amazon AWS and Actifio OnVault for Long-Term Data Retention***
- ***Configuring Generic Amazon AWS S3 Compatible Storage and Actifio OnVault for Long-Term Data Retention***
- ***Configuring Google Nearline Storage and Actifio OnVault for Long-Term Data Retention***
- ***Configuring Hitachi Content Platform and Actifio OnVault for Long-Term Data Retention***
- ***Configuring IBM Cloud Object Storage and Actifio OnVault for Long-Term Data Retention***
- ***Configuring Microsoft Azure and Actifio OnVault for Long-Term Data Retention***
- ***Configuring Scality S3 Server and Actifio OnVault for Long-Term Data Retention***

Configuring IBM Cloud Object Storage (COS) for Retention

During OnVault pool creation, for IBM Cloud Object Storage (Cleversafe) pool type you will see the option to Integrate with the IBM COS Feature. If selected, any policies that leverage Enforced Retention capability will extend that feature directly into the IBM COS. This means that images stored in IBM COS will be impossible to remove, even by an IBM COS administrator, until they are beyond their enforced retention date.

For more information on enforced retention feature, see the Enforced Retention Technical Bulletin and AGM Online Help.



Deleting Pools

You can delete Snapshot and OnVault pools. The dedup pool and the primary pool cannot be deleted.

> ***Note:*** *Before deleting a storage pool, expire all the backup data that in the pool.*

To delete a Snapshot or OnVault pool:

1. Open the **Domain Manager** to **System** > **Configuration** > **Storage Pools**.
2. Select the **Snapshot** or **OnVault** tab. The pool's information page opens.
3. Select the desired pool and then click on the delete icon next to the pool's name. The icon appears only if you have pools that can be deleted.
4. A warning dialog appears. Enter **DELETE** in the text box to confirm.
5. Click **Confirm** and the selected pool is deleted.

7 Managing the Dedup Pool

The local Dedup Pool is used to retain deduplicated copies of the snapshot data for quick access, and to facilitate low-bandwidth replication.

The Dedup Pool has a warning threshold at 80% of capacity. When this level has been exceeded, no new dedup related jobs can be run. The Actifio appliance sends a warning when dedup pool consumption exceeds the warning level.

> ***Note:*** *To configure notifications, see* ***Configuring Actifio Event Alerting*** *in the Actifio Documentation Library.*

A remote appliance will reject inbound replication jobs if its own Dedup Pool is above this threshold.

Under normal usage, deduplicated images accumulate over time, and are expired after a set retention period, having been replaced by newer images. The Garbage Collection (GC) feature identifies and reclaims the space used by the expired images. But over time, you may be capturing more or larger images, and the pool can fill up. Ultimately you may need to add more capacity, but before that becomes necessary, review this section carefully to be sure you are following best practices.

> ***Note:*** *Keep space for Dedup Pools on storage separate from space for Snapshot Pools. Dedup operations are I/O intensive. Keeping Dedup Pools on separate storage ensures that dedup operations will not impede the performance of the Snapshot Pools.*

This chapter includes:

Understanding Dedup Pool Consumption on page 46

How Dedup Pool Space is Consumed and Reclaimed on page 47

Configuring Dedup Garbage Collection on page 49

Monitoring Dedup Pool Space Consumption on page 52

Understanding Dedup Pool Consumption

The Dedup Pool becomes filled with both current and expired images. GC reclaims space by sweeping away the expired images. An expired snapshot image requires as much space as it did when it was current. In general terms, expired images accumulate in the Dedup Pool at a rate determined by:

Dedup Pool Consumption = Frequency of Snapshots x Snapshot Size

Snapshot Size = Proportion of Changed Blocks (change rate) x Application Size

A 10TB application with a 50% change rate actually generates snapshot images that are 5x bigger than a 100TB application with just a 1% change rate. But if it is protected 5x as often, then they consume the same amount of the Dedup Pool.

Example of Dedup Pool Consumption

Application RPO	Snapshot Size	SLA	Dedup Pool Consumption
Small, Dynamic, Non-Critical Application	50% x 10TB = 5TB	Weekly, Friday, 6pm	5TB/week
Large, Slow-Changing, Critical Application	1% x 100TB = 1TB	Monday, Tuesday, Wednesday, Thursday, and Friday, 6pm	5TB/week

Note: *This is an oversimplification of a complex subject, but the principles illustrated here can help you to understand how to keep your Dedup Pool at top performance.*

Image Retention and Garbage Collection

Those images add up. An application that contributes 30GB per day to the Dedup Pool produces after 30 days close to 1TB of net new data. If these images are retained for 12 months, then after that time it has consumed 12TB of Dedup Pool space. Long retention times can quickly fill the Dedup Pool.

Image retention indicates how long the image is considered current before it is expired. Expired images still consume Dedup Pool, so if those images are retained for only one month, but GC is never run, then the expired images still accumulate.

To reclaim that space, the unneeded images must be expired and then Garbage Collection (GC) must be run. Dedup Pool Consumption grows when the rate of incoming images exceeds the rate at which they are swept out by GC.

To reduce the amount of dedup pool space consumed:

- Retain images no longer than needed, and set GC accordingly as described in Configuring a GC Schedule on page 50.
- Use a mixed retention policy to decrease the number of unnecessary images. For example, retain daily images for one month, weekly images for three months, and monthly images for one year.
- Expiring images or reducing retention rates will not have an immediate affect on the dedup pool. You must run garbage collection and sweep to reclaim the space.
- Run Garbage Collection (GC) and sweep on a regular basis. Once per month is common. See Configuring Dedup Garbage Collection on page 49.

How Dedup Pool Space is Consumed and Reclaimed

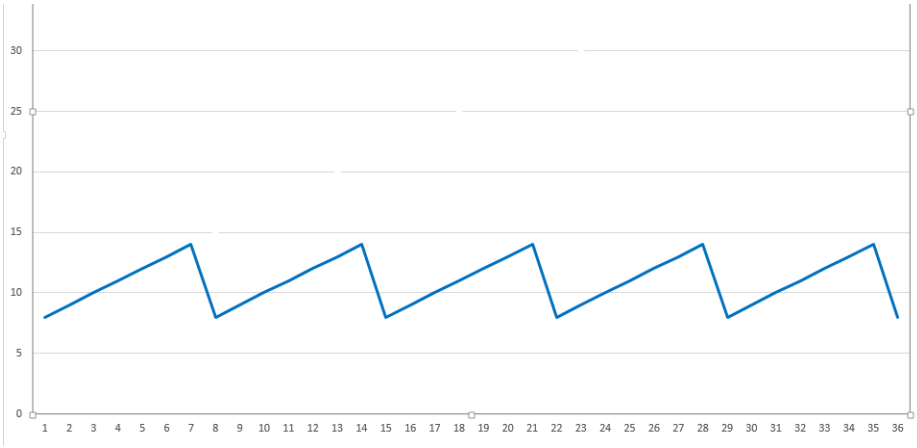
Space in the Dedup Pool is consumed and reclaimed over time. If the Dedup Pool becomes too full, then there is insufficient space to process new snapshots, and jobs start to fail. Knowing how and when to reclaim space is important for best operation. This section provides:

The Simple View

The Detailed View, for When Your Dedup Pool is Filling Up on page 48

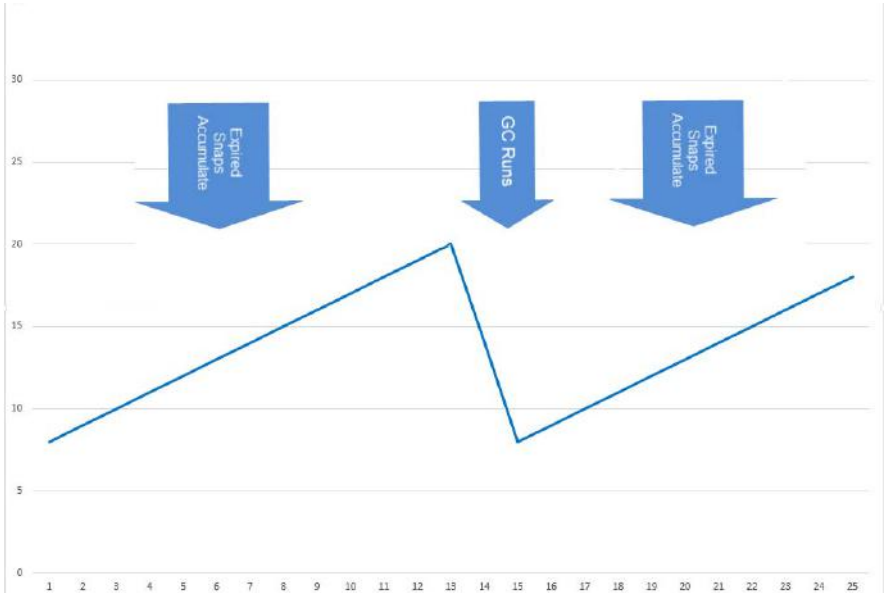
The Simple View

If you had an ideal system with snapshots all the same size being deduplicated and expired at even intervals, you might expect the Dedup Pool consumption over time to look like this:



An Oversimplified and Incorrect View of Dedup Pool Consumption: Snapshots and Expiry

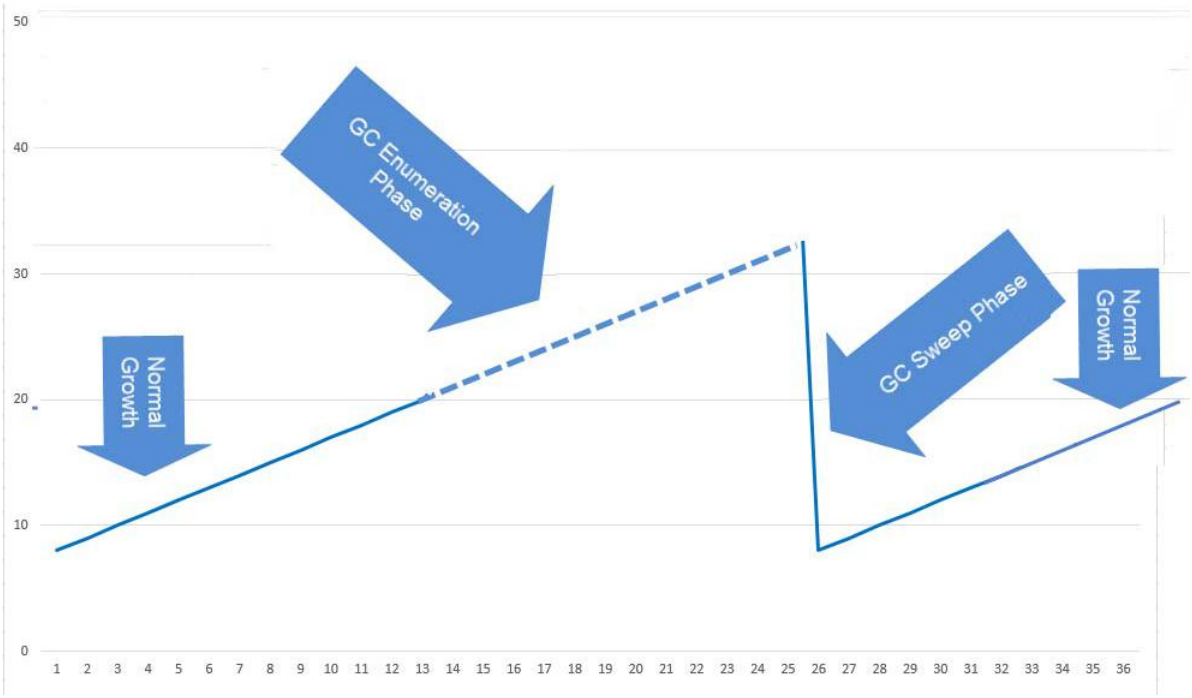
But expiring an image is not enough to reclaim the space. The space is only reclaimed after a Garbage Collection run has enumerated the blocks to keep and then reclaimed the remaining space. So the expired images accumulate until the GC finishes:



A Simplified, More Correct View of Dedup Pool Consumption: GC Reclaims Space

The Detailed View, for When Your Dedup Pool is Filling Up

When GC performs regularly and normally, the image above is enough to understand operations. But the process is a little more complex, and the difference is important when your Dedup Pool is approaching capacity. This is because GC has two phases, the GC Enumeration Phase and the GC Sweep Phase. These are detailed in Configuring Dedup Garbage Collection on page 49.



GC Increases Dedup Pool Consumption Before Reclaiming Space

With regard to keeping your Dedup Pool from filling up, you need to know these three things:

1. During the GC Enumeration Phase, Dedup Pool consumption continues to increase.
2. The GC Enumeration Phase can take a long time to run, even days, and it must not be interrupted. The Sweep Phase is usually faster, and you can set it to run at intervals such as overnight.
3. If necessary, the GC Enumeration Phase and the GC Sweep Phase can be run at different times.

If your Dedup Pool is approaching capacity, a GC run is very important, but the GC Enumeration Phase may temporarily increase your pool consumption to the point that jobs start to fail. It is important to monitor Dedup Pool consumption and to run GC monthly during times of low activity.

Garbage Collection is fully detailed in Configuring Dedup Garbage Collection on page 49.

Configuring Dedup Garbage Collection

The amount of storage consumed by the dedup store grows over time, depending on the amount of unique data added with each new image that is ingested. As each image is expired, the space occupied by the unique data that was represented by that image is not immediately reclaimed. The Garbage Collection (GC) process identifies (and later reclaims) space occupied by this no-longer-needed data.

GC consists of two phases:

The **enumeration** uses the current catalog of deduplicated images to decide what data needs to be kept in the system (and, by exclusion, which does not).

The **sweep** phase actually copies the useful data remaining in each region of the dedup store into new regions of the dedup store. The old regions are then freed. In this manner, only the still-relevant data in the dedup store is kept, and the rest has been "swept" away.

Note: *The enumeration phase must complete all at once for a subsequent sweep to happen. The sweep phase is most effective when done all at once, but it can be canceled and restarted if necessary.*

To configure GC, see Configuring a GC Schedule on page 50.

The Impact of Garbage Collection on Dedup Performance

GC is resource-intensive and time-consuming, sometimes taking days to complete. Initial ingests of new applications cannot run while GC is running.

GC consumes system resources. All jobs except initial ingests continue to run as scheduled, but some of them take longer to complete due to resource competition from GC. A long-running GC can result in a backlog of jobs and even SLA violations from jobs that do not complete within their scheduled time.

GC runs in the Dedup Pool, so Dedup, Direct-to-Dedup, and Remote Dedup jobs are heavily impacted. It is a good idea to reschedule these if a GC is planned, or is running overlong. Snapshot (protection) jobs are unaffected.

The GC Paradox

GC scheduling is important, but it can be confusing:

- Because GC reclaims valuable space in the Dedup Pool, you want to run it as often as needed.
- Because GC is resource-intensive, you want to run it as seldom as possible, and at "slow" times whenever possible.

A good rule of thumb is to identify the applications that require the most Dedup Pool consumption (see Understanding Dedup Pool Consumption on page 46), and then set GC to run at four times the retention of those images; for example if those applications are typically retained for one week, then run GC monthly.

Configuring a GC Schedule

Before setting a GC schedule, be sure you are familiar with the material in Understanding Dedup Pool Consumption on page 46 and How Dedup Pool Space is Consumed and Reclaimed on page 47.

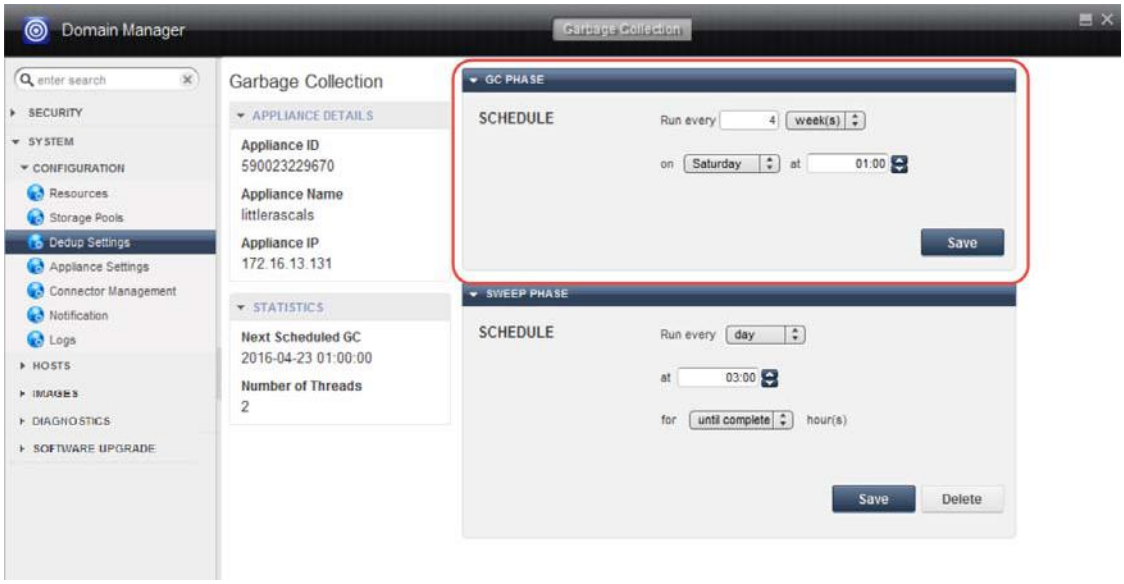
The GC schedule is managed in two phases: GC Phase and Sweep Phase.

GC Phase

In this phase, all data used by current (non-expired) images are identified and marked.

To configure the GC phase settings:

1. Open the **Domain Manager** to **System** > **Configuration** > **Dedup Settings.** This sequence opens the Full GC page.
2. Select the frequency of garbage collection from **SCHEDULE**. You can set this frequency value to run weekly or monthly.
3. Select the day and time values to perform the garbage collection.
4. Click **Save** to update the changes.



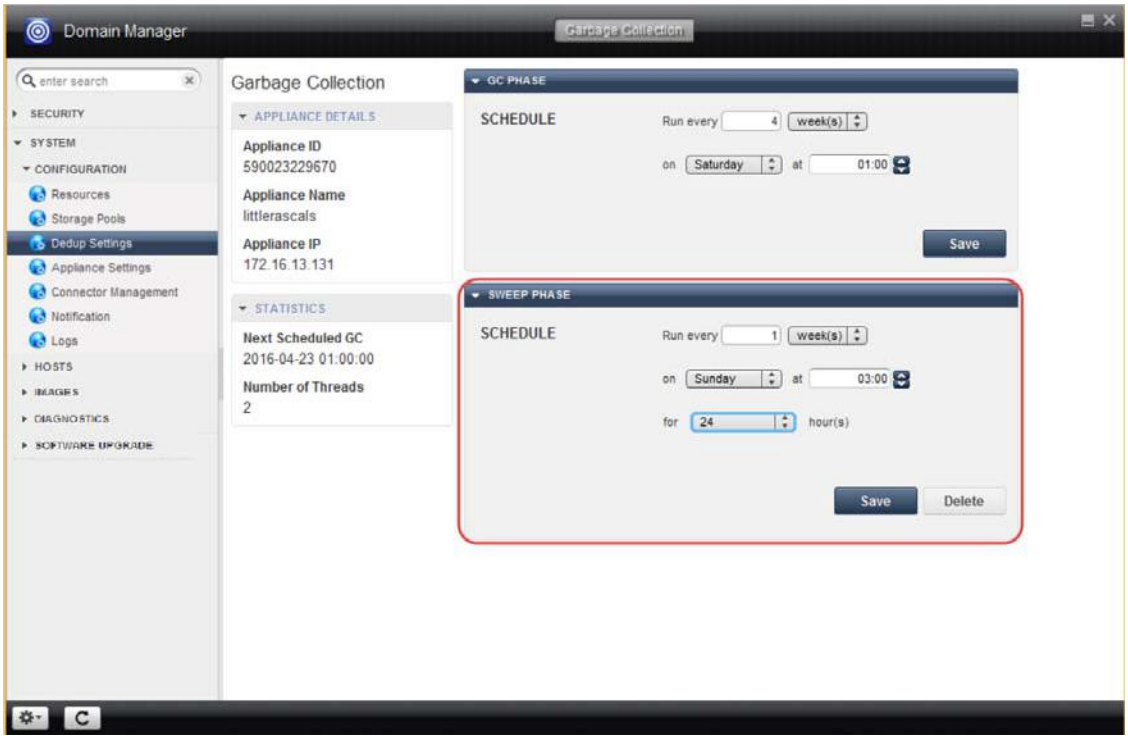
Configuring Garbage Collection (GC)

Sweep Phase

The sweep phase examines the marked objects, and frees storage space that has become unused. If no sweep schedule is enabled, then sweep runs immediately after every GC phase. This produces the best results. If necessary, you can schedule sweep separately if you want to have a sweep run for several hours every night (for example) until it is complete.

To schedule a recurring GC sweep:

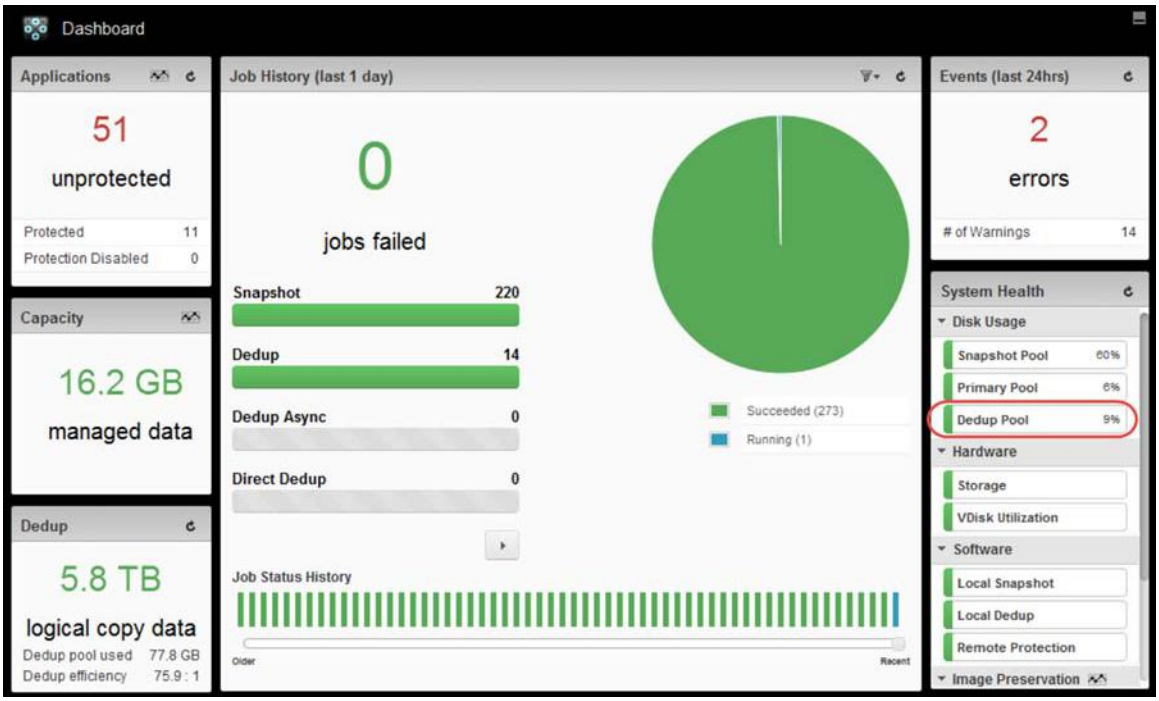
1. Open the **Domain Manager** to **System** > **Configuration** > **Dedup Settings**.
2. In **SWEEP PHASE**, select the frequency of garbage collection: **daily**, **weekly**, or **monthly**.
3. Select the day and time values to perform the sweep.
4. Define how long the schedule should run. You can set this value to until complete or specified hours using the drop-down.
5. Click **Save** to update the changes.



Configuring GC Sweep

Monitoring Dedup Pool Space Consumption

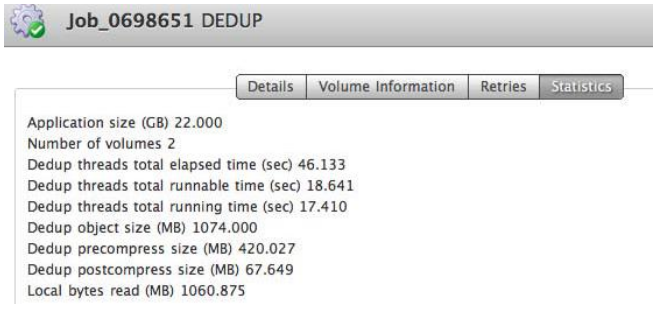
Dedup pool consumption for the Actifio appliance is shown on the Dashboard panel of the Actifio Desktop.



The Actifio Desktop Dashboard Shows Dedup Pool Consumption

Dedup pool space consumption is shown in the Domain Manager under **System > Configuration > Storage Pools**, as described in Viewing Storage Pool Information on page 37.

You can view the deduplication statistics for each dedup job from the Events tab of the System Monitor.



Actifio Appliance Reports Related to Dedup Pool Management

The Actifio Report Manager provides these reports from the Utilization category:

- Application Contribution to Daily Dedup Pool
- Application Contribution to Daily Storage Pool and V-Disk Usage
- Dedup Pool Utilization History by Application
- Disk Pool Utilization History
- Storage Pool Usage by Organization
- Storage Resource Usage Summary
- TOP - N Dedup Pool Users

Reports are detailed in ***Using the Report Manager*** in your Actifio Documentation Library.

8 Sharing Between Actifio Appliances

Appliance Sharing and Peer Relationships

The Actifio CDS or Sky appliance can support joining any number of appliances at any number of sites. Actifio appliances can be joined in sharing or non-sharing mode.

> ***Note:*** *Before proceeding to* Chapter 9, Configuring Shared Appliances*, be sure to read* Sharing Mode *on page 54 and* Non-Sharing Mode *on page 55 in this chapter.*

You can join Actifio appliances in two modes:

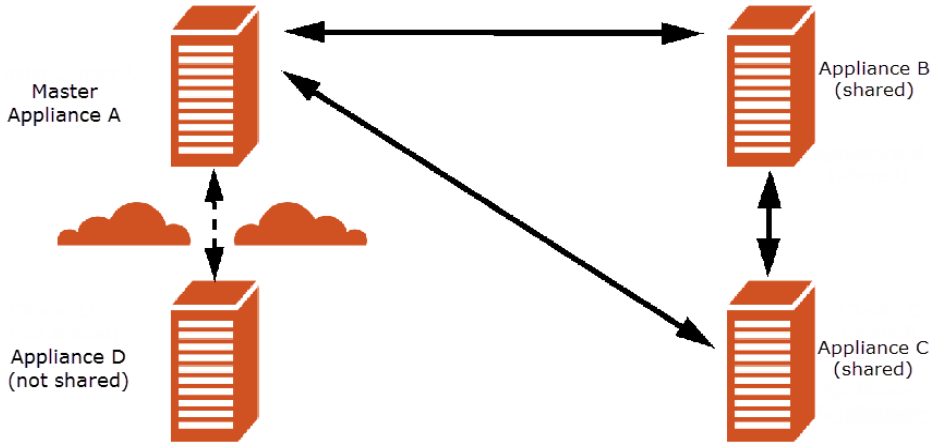
Sharing mode: Use this mode to share:

- Protected applications
- Security settings: Organizations, Users, and Roles
- Policy templates (but not resource profiles)

Sharing mode is described in Sharing Mode on page 54. The procedure for joining appliances in sharing mode can be found at Joining in Sharing Mode on page 60.

Non-sharing mode: Use this mode when you want appliances to perform remote backups for each other, for failover, and for dedup-async replication. Non-sharing mode is described in Non-Sharing Mode on page 55. The procedure for joining appliances in non-sharing mode are in Joining in Non-Sharing Mode on page 61.

You can use both types of relationships within your enterprise. For example, you might use three joined sharing-mode appliances for day-to-day data protection, and a non-shared appliance for off-site disaster recovery.

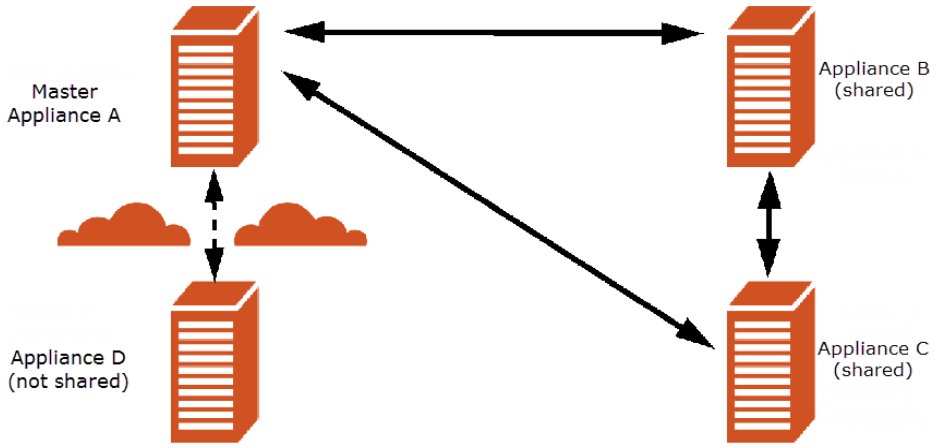


Appliances A, B, and C are Shared for Daily Operations; Remote Appliance D is for Disaster Recovery

Sharing Mode

When Actifio appliance B joins appliance A, the latter becomes the master and appliance B, the secondary.

- There can be only one master appliance in an Actifio appliance domain. There can be any number of secondary appliances.
- Masters are made, not born. The act of joining in shared mode creates the master-secondary relationship. Sharing mode makes a secondary of the appliance that joins. In the diagram above appliance B joined appliance A in sharing mode. At that moment appliance B became the secondary and appliance A became the master. The secondary joins the master.
- A master appliance, which is already in sharing mode (that's why it's a master) cannot join any other appliance, because it would become a secondary; once the master, always the master.
- All secondary appliances are peers to each other.
- An Actifio appliance can join any appliance in non-sharing mode. Non-shared appliances are peers to all appliances.
- An Actifio appliance cannot join a secondary appliance. In the diagram above appliance D cannot join appliance C or appliance B. Appliance D can join appliance A in the sharing or non-sharing mode.



Master Appliance A Shares Rules with Secondary Appliances B & C, but Not Remote Appliance D

When Actifio appliance B is joined to appliance A:

- If appliance B has no protected applications, and no users, roles, organizations, and policy templates defined, then appliance B gets users, roles, organizations, and policy templates shared from appliance A, but no applications.
- If appliance B has users, roles, policy templates, and organizations defined, they are deleted and replaced by those shared from appliance A.
- If appliance B has protected applications, they are preserved, but they are protected by the policy templates shared from appliance A.
- If appliances A and B both do not contain protected applications, users, roles, policy templates, and organizations, then when appliance B is joined to appliance A, no obvious changes occur. However, once you create users, roles, organizations, and policy templates on appliance A, they are shared with appliance B.

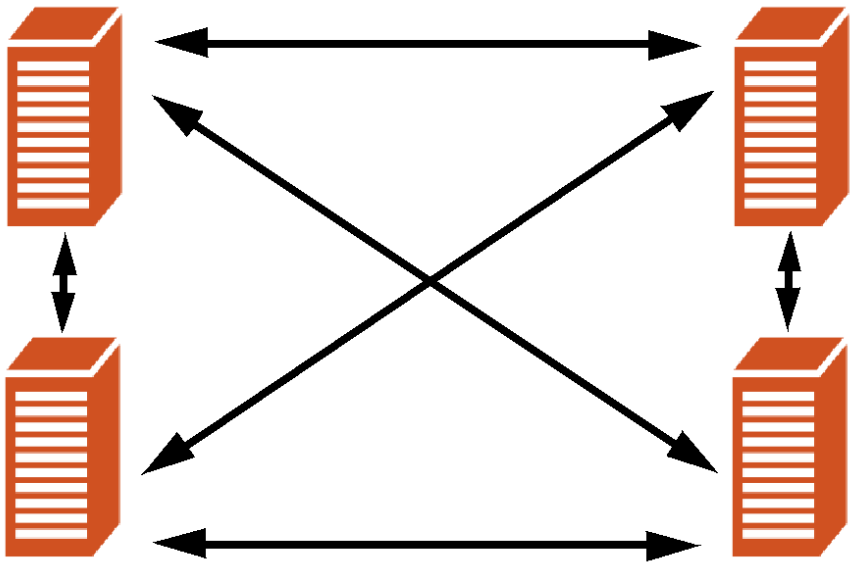
Non-Sharing Mode

Two Actifio appliances that belong to different Actifio appliance domains can be joined in non-sharing mode. You can join:

- One appliance with another appliance to enable replication from the former to the latter.
- One appliance with two appliances to enable different applications to replicate to separate appliances.
- Two appliances with one appliance to let the later act as a target for replication.

Non-sharing mode makes peers of the appliances that are joined. When two appliances join in the non-sharing mode, each appliance can be the destination for remote replication of data from the other appliance.

In the non-sharing mode, each appliance uses its own users, policies, templates, and organizations and protects only the applications assigned to it; peer appliances do not share users, policies, templates, and organizations.



The Master Appliance Shares Users and Policy Templates with Secondary Appliances

The types of replications supported by Actifio appliance are given below. All of these replications can use the appliance setup described above.

- Synchronous replication from the primary appliance to a remote appliance.
- Asynchronous replication from the primary appliance to a remote appliance.
- Asynchronous replication of deduped data from the primary appliance to a remote appliance.
- Remote deduplication replication from the dedup pool of the primary appliance to a remote appliance.
- StreamSnap replication from the primary appliance to a remote appliance.

For more information on Actifio replication, see ***Replicating Data Using Actifio Appliances***.

9 Configuring Shared Appliances

Actifio appliances can be joined to additional appliances for disaster recovery and business continuity purposes at the same site or at different sites. Actifio appliances can be joined in Sharing Mode and in Non-Sharing Mode.

> ***Note:*** *Before performing the joined and shared appliance procedures outlined in this chapter, be sure to read* Sharing Mode *on page 54 and* Non-Sharing Mode *on page 55 in* Chapter 8, Sharing Between Actifio Appliances.

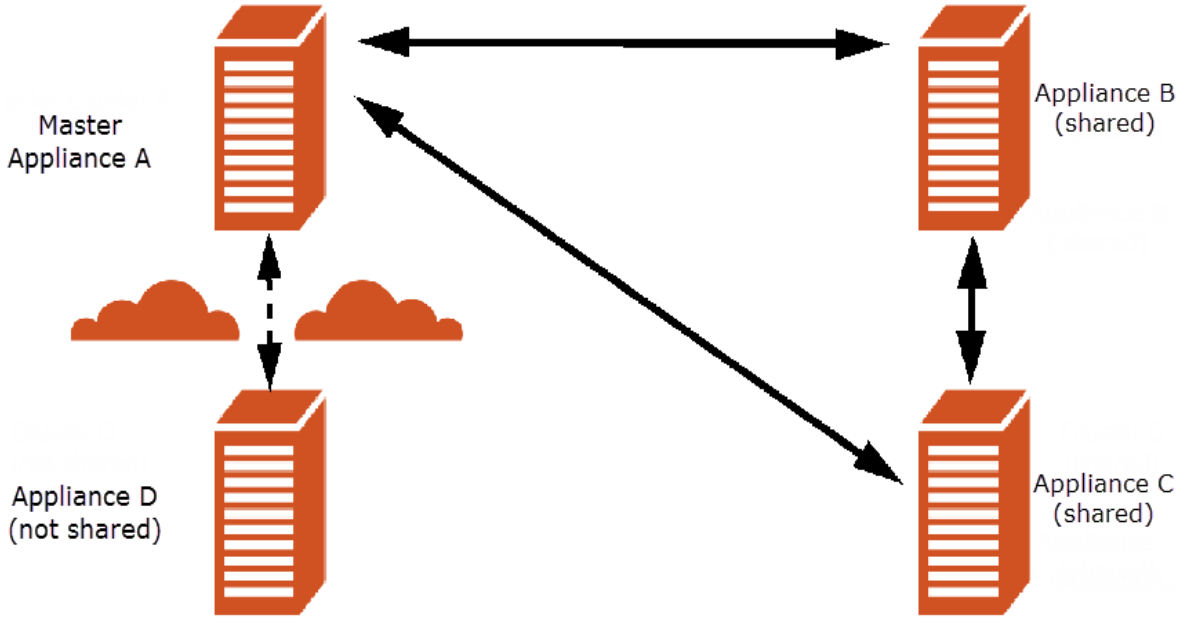
This chapter describes:

Viewing Details of Joined Appliances on page 58

Unjoining Appliances on page 59

Joining in Sharing Mode on page 60

Joining in Non-Sharing Mode on page 61

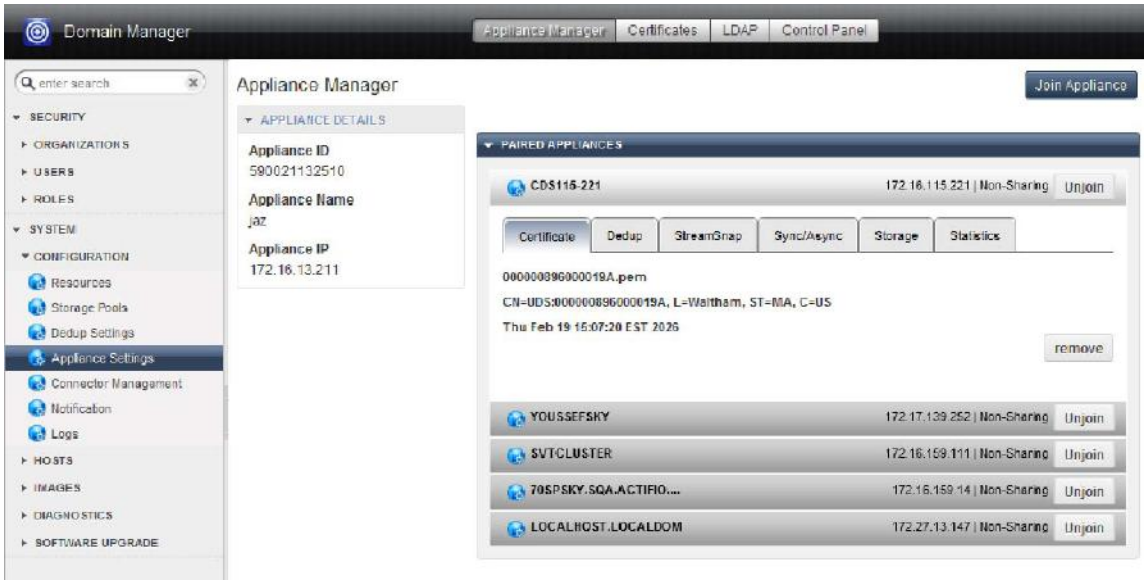


Example Appliance Topology

Viewing Details of Joined Appliances

To view the list of Actifio appliances and their details:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**. A list of Actifio appliances joined to the local appliance and their certificates is displayed. A master appliance has all the other appliances in the sharing mode.
2. If an Actifio appliance is the master of a domain, it is listed as Sharing.



Viewing Details of Joined Appliances

Unjoining Appliances

Note: *Prior to deleting a joined appliance, ensure that running jobs are not using the remote appliance.*

When you delete a joined Actifio appliance:

- The certificates that were exchanged when joining the appliances are deleted.
- Jobs in progress change to Stalled status and the jobs are displayed as **Stalled** by the System Monitor.

To delete a joined appliance:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**. A list of joined appliances is displayed.
2. Click **Unjoin** against the appropriate appliance.

Note: *If an Actifio appliance is in use in any resource profile, then the unjoin process will fail.*

Joining in Sharing Mode

The following are step-by-step instructions for joining Actifio appliances in sharing mode. The local appliance shares the rules with the joined remote appliance. For details, see Sharing Mode on page 54.

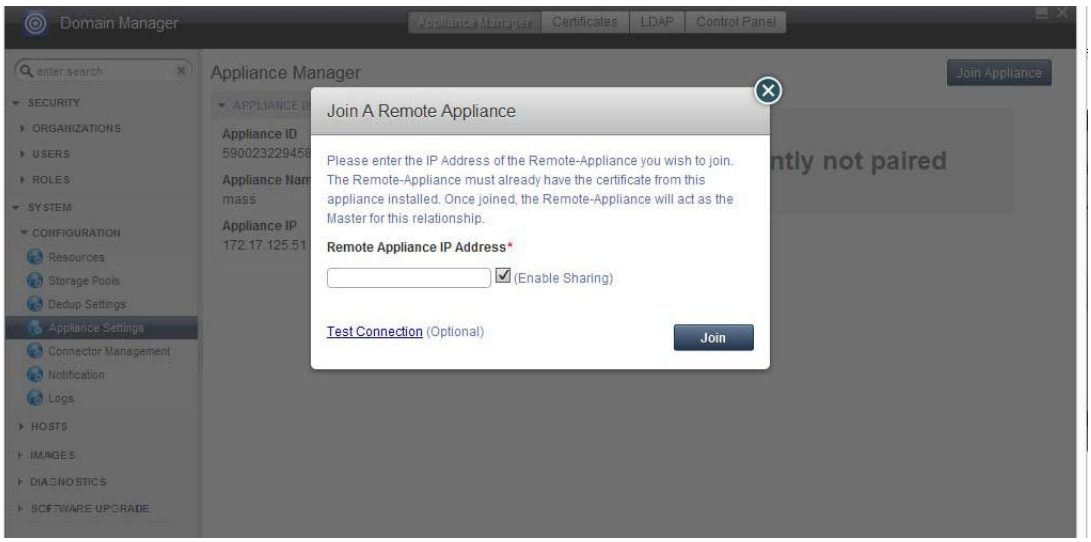
Note: *To join in Non-Sharing Mode, see* Joining in Non-Sharing Mode *on page 61*.

To join local appliance A to remote appliance B:

Note: *Before joining, ensure certificates have been exchanged between appliances. See* Exchanging Certificates *on page 66 for details*.

---

1. Open the **Actifio Desktop** on Actifio appliance B.
2. Open the **Domain Manager**.
3. On appliance B, click **Domain Manager** > **Appliance Settings** and click the **Join Appliance** button. The **Join a Remote Appliance** window appears.
4. Enter the IP address of Actifio appliance A in **Remote Appliance IP Address**.
5. Select **Enable Sharing** to use the remote appliance A as the master appliance. When you select this option, the remote appliance's users, roles, policy templates (but not resource profiles), and organizations replace those on appliance B.
6. Click **Join**. On successful configuration Actifio appliance B appears connected to the appliance A.
7. If you want to configure the bandwidth throttling used to replicate Dedup or StreamSnap image data from one Actifio appliance to another so that the two paired appliances can share bandwidth, see Managing Bandwidth Utilization on page 67.
8. If you have joined Actifio CDS appliances that are operating in either synchronous or asynchronous replication, set up partnerships between the local and the remote appliances as explained in Enabling/Disabling Sync/Async Replication on page 70.



Sharing Mode

Joining in Non-Sharing Mode

The following are step-by-step instructions for joining Actifio appliances in non-sharing mode. For details, see Non-Sharing Mode on page 55.

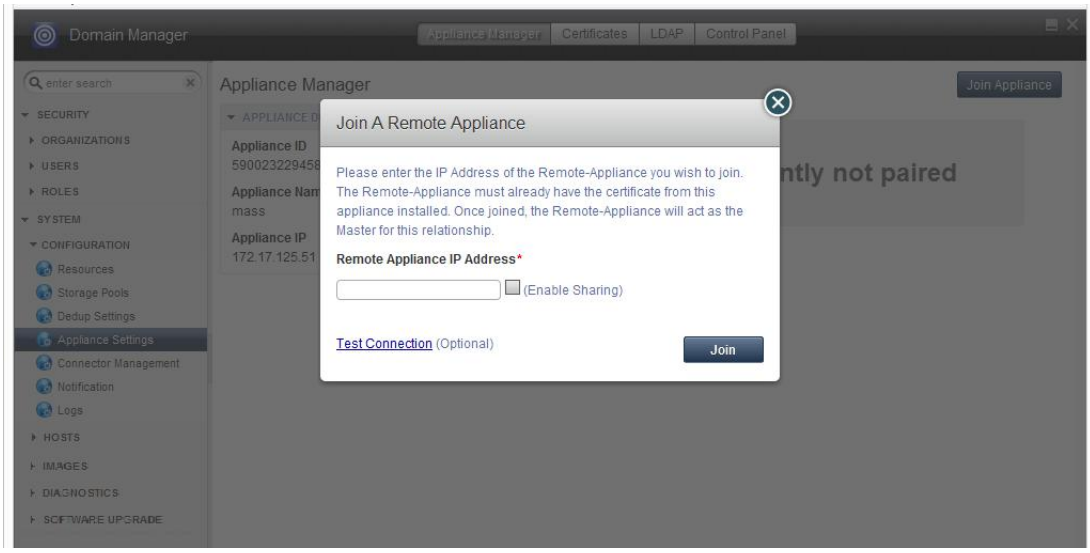
Note: *To join in Sharing Mode, see* Joining in Sharing Mode *on page 60*.

To join the local appliance A and the remote appliance B:

Note: *Before joining, ensure certificates have been exchanged between appliances. See* Exchanging Certificates *on page 66 for details*.

---

1. Open the **Actifio Desktop** on Actifio appliance A.
2. Open the **Domain Manager**.
3. Click **Domain Manager** > **Appliance Settings** > **Join Appliance**. The **Join a Remote Appliance** window appears.
4. Enter the IP address of the remote Actifio appliance B in **Remote Appliance IP Address**.
5. **Uncheck** Enable Sharing. The appliances will be joined for purposes of sharing protected applications, but each will use its own users, roles, and organizations and its own policy templates and resource profiles.
6. Click **Join**. On successful configuration appliance B appears connected to the appliance A.
7. If you want to configure the bandwidth throttling used to replicate Dedup or StreamSnap image data from one Actifio appliance to another so that the two paired appliances can share bandwidth, see Managing Bandwidth Utilization on page 67.
8. If you have joined Actifio CDS appliances that are operating in either synchronous or asynchronous replication, set up partnerships between the local and the remote appliances as explained in Enabling/Disabling Sync/Async Replication on page 70.



Non-Sharing Mode

10 Managing Communication Between Actifio Appliances

Communications management of an Actifio appliance from the Appliance Manager includes:

Managing Security Certificates on page 64

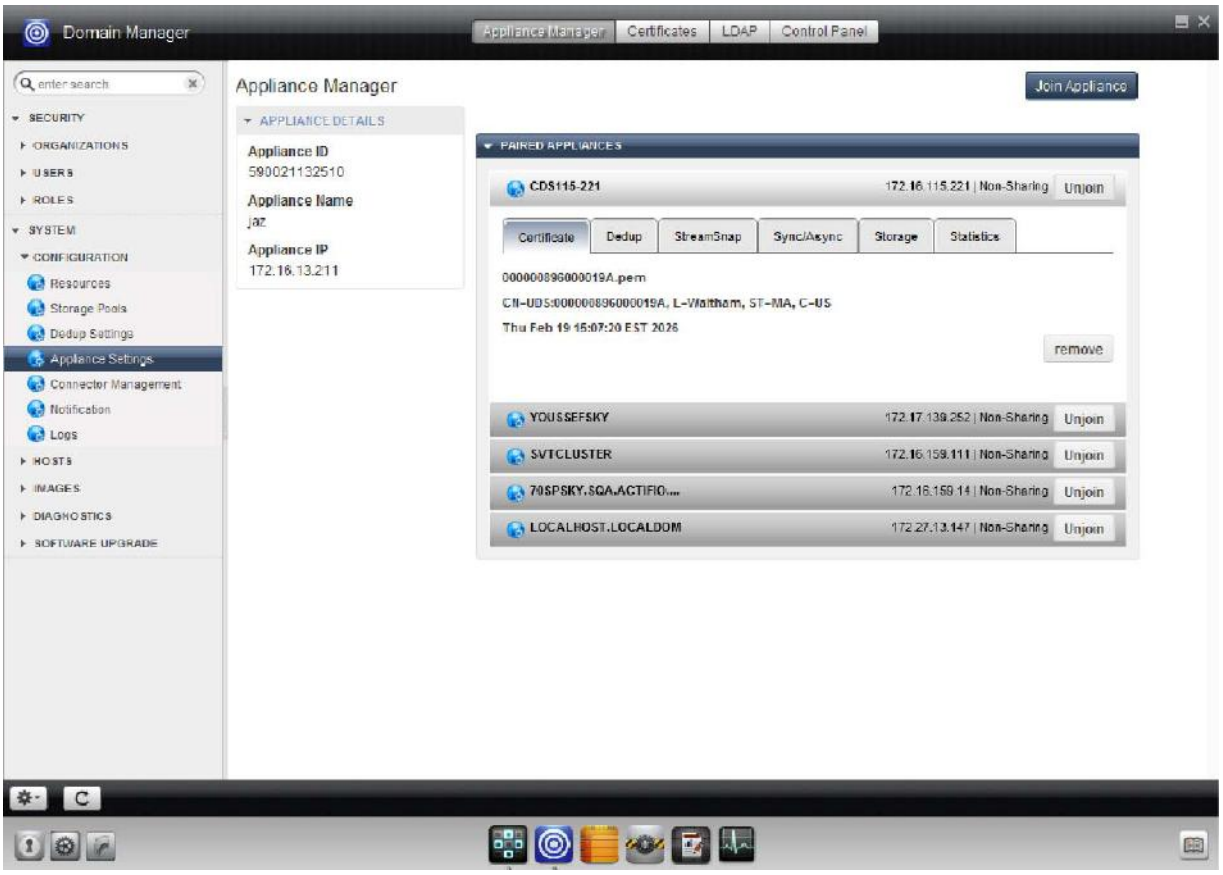
Managing Bandwidth Utilization on page 67

Enabling/Disabling Sync/Async Replication on page 70

Selecting a Storage Pool for Replicated Data on page 71

Viewing Bandwidth Usage Statistics on page 72

Note: *See* Chapter 8, Sharing Between Actifio Appliances *and* Chapter 9, Configuring Shared Appliances *for details on pairing two Actifio appliances for replication.*



The Appliance Manager Section of the Domain Manager

Managing Security Certificates

The Actifio appliance uses digital certificates to ensure secure communication between Actifio appliances. All entities in a configuration must have matching security certificates in order to establish a secured relationship.

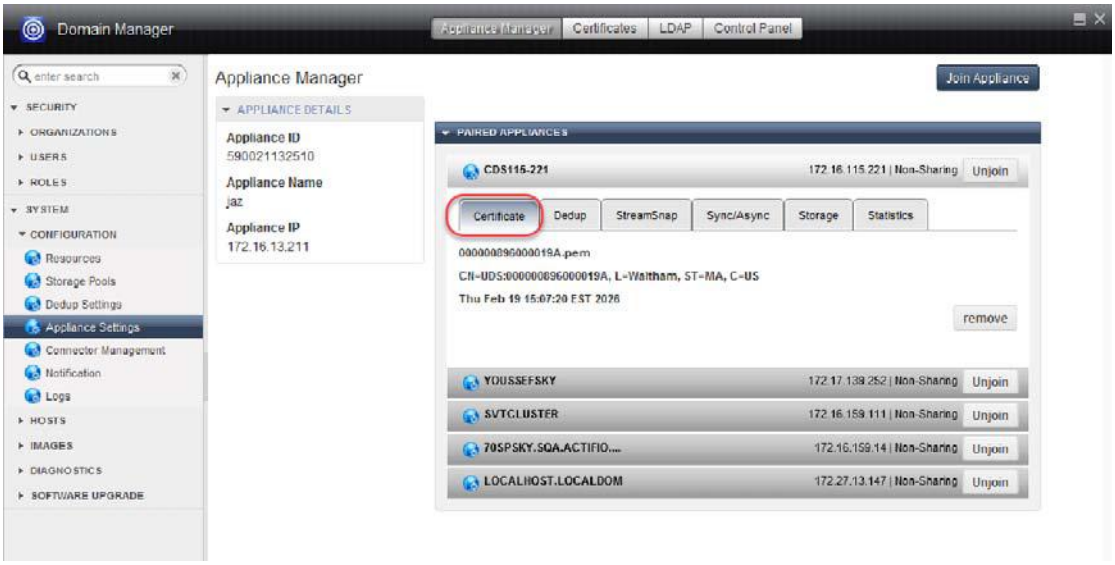
There are two methods to establish a secured relationship between entities:

- Exchange certificates between two entities, as detailed in Exchanging Certificates on page 66.
- Download a certificate from each appliance and then upload them to the other appliance, as detailed in Downloading a Certificate on page 65 and Uploading a Certificate on page 65.

Viewing Certificates

To view the certificate of all entities connected to the local appliance in the sharing or non-sharing mode:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**. This sequence opens the Appliance Manager page.
2. Click the **Appliance Manager** tab.
3. Click the **Certificate** subtab. A list of all appliances connected to the local appliance is displayed along with the corresponding certificates.



Viewing Security Certificates

Deleting a Certificate

You may need to delete an existing certificate:

- To disconnect the communication.
- When an existing certificate becomes invalid. In such cases, you may need to remove the old one and upload the new certificate.

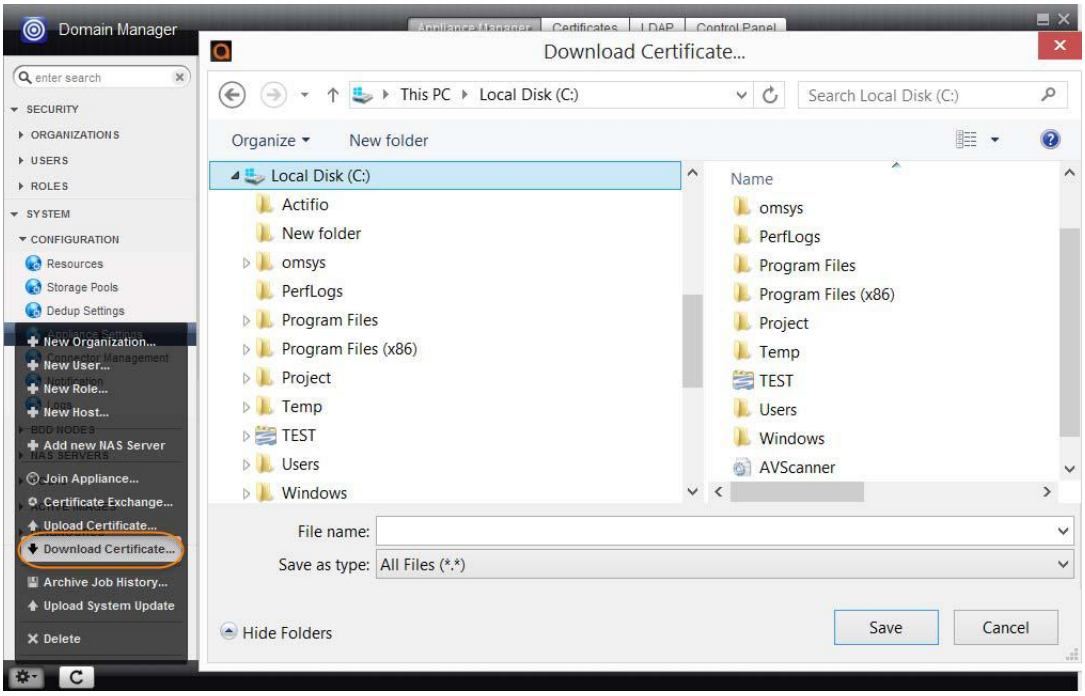
To delete a security certificate:

1. Follow the steps outlined above to view the certificate.
2. Select the certificate and click the **Remove** button.
3. Click **Yes** in the confirmation dialog.

Downloading a Certificate

To download a security certificate:

1. Open the **Domain Manager**.
2. Click **Download Certificates** from the service menu. The Download Certificate window opens:



Downloading a Security Certificate

3. Browse and choose the folder to save the certificate file, and then click **Save**. The certificate is saved in your local system.

Note: *To join this Actifio appliance to another, you will have to upload this certificate to the other appliance. Log on to the appliance and perform the steps described in* Uploading a Certificate *on page 65.*

Uploading a Certificate

To upload a security certificate:

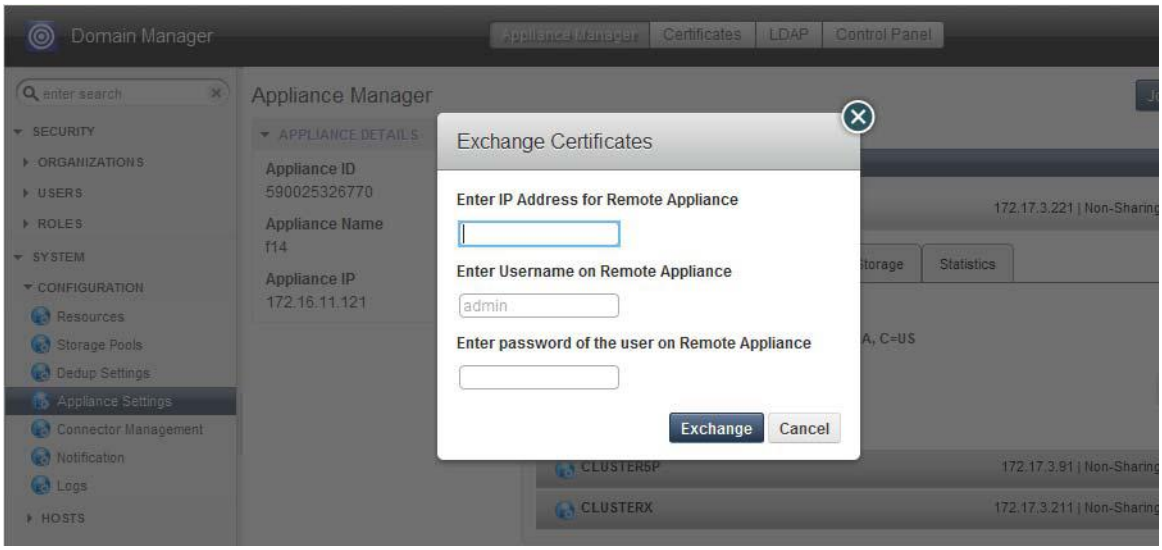
1. Open the **Domain Manager**.
2. Click **Upload Certificates** from the service menu. The **Choose a certificate to import** window opens.
3. Browse and select the certificate file and then click **Open**. The certificate is listed in the certificate store at **Domain Manager > System > Configuration > Appliance Settings > Certificates**.

Exchanging Certificates

Certificate exchange is a quick way to download certificates when you have secure administrative access to both appliances.

To exchange security certificates between two Actifio appliances:

1. Open the **Domain Manager**.
2. Click **Certificate Exchange**... from the service menu. The Exchange Certificates dialog appears.
3. Enter the IP address of the remote appliance.
4. In the space provided, enter the Admin password to access the remote appliance.
5. Click **Exchange**. The security certificates are exchanged between the local appliance and the remote appliance. Once certificates are exchanged, the local appliance can be joined with the remote appliance.



Exchanging a Security Certificate

Managing Bandwidth Utilization

You can configure the bandwidth used to replicate Dedup or StreamSnap image data from one Actifio appliance to another so that two appliances can share the bandwidth available to your organization with other organizational resources. Throttling determines the amount of bandwidth you want to dedicate to an Actifio appliance for your data replication.

When two Actifio appliances are paired for replication (see Chapter 8, Sharing Between Actifio Appliances), you can choose to set the maximum bandwidth used for this replication. The bandwidth setting is made from the point-of-view of the originating Actifio appliance, called the "A-side". When choosing this bandwidth setting, the bandwidth chosen represents the amount of traffic *originating from* this appliance to Actifio appliance B. If appliance A replicates to appliances B and C simultaneously, bandwidth throttling is set independently for Actifio appliance A to appliance B and Actifio appliance A to appliance C. For example, for paired Actifio appliances A and B bandwidth throttling can be 10Mb/s while paired Actifio appliances A and C can be 100Mb/s.

This section covers:

Configuring Bandwidth Throttling on page 67

Scheduling Bandwidth Throttling on page 69

Configuring Bandwidth Throttling

Use the Bandwidth Throttling feature to limit the bandwidth used by the replication process between Actifio appliances.

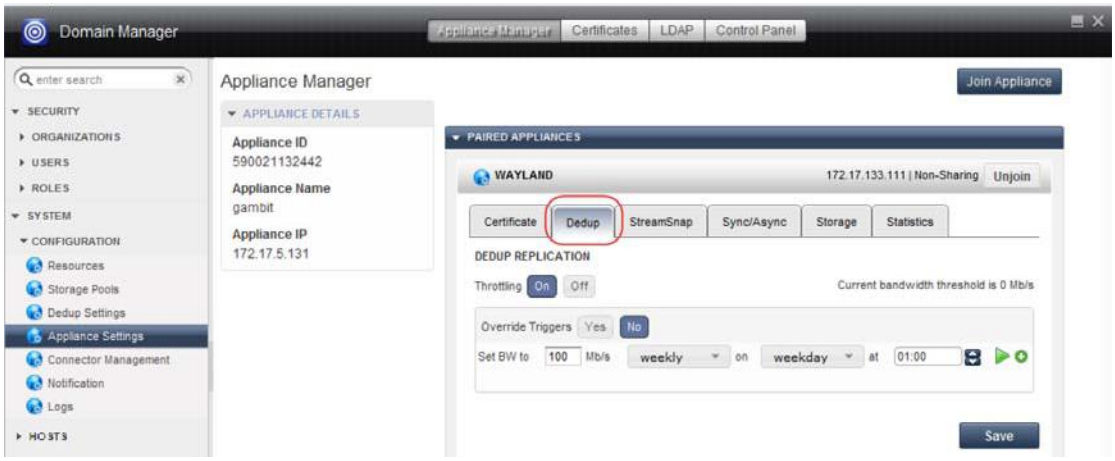
Enable Bandwidth Throttling: Set Throttling to **On** if you plan to limit the maximum amount of bandwidth available for Actifio appliance replication (Dedup and/or Steam Snap). You can restrict bandwidth usage by turning on bandwidth throttling and limiting the maximum amount of bandwidth that the Actifio appliance should not exceed for each type of replication.

Note: *Bandwidth Throttling for Dedup replication and StreamSnap replication can be set independent from each other.*

Disable Bandwidth Throttling: Set Throttling to **Off** if you do not want to restrict the amount of bandwidth used for Actifio appliance replication. This option allows you to use the maximum available bandwidth.

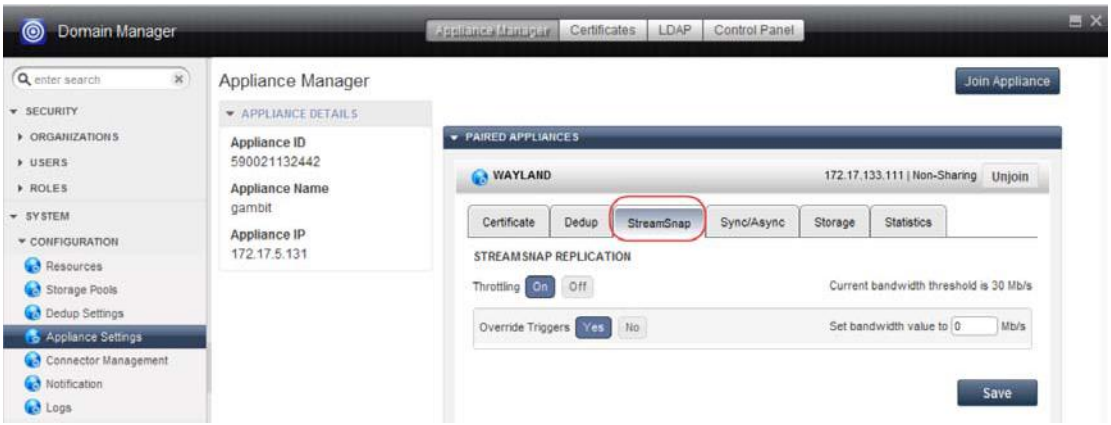
To turn bandwidth throttling on or off with a bandwidth limit:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**. The Appliance Manager page allows you to enable or disable the settings.
2. In the Appliance Manager, click one of the following:
   - The **Dedup** subtab if you wish to turn bandwidth throttling on or off for Dedup replication.



Accessing the Dedup Subtab

   - The **StreamSnap** subtab if you wish to turn bandwidth throttling on or off for StreamSnap replication.



Accessing the StreamSnap Subtab

3. To enable bandwidth throttling, click **On**.

> ***Note:*** *If you choose not to restrict the maximum amount of bandwidth used for Actifio appliance replication, click the* ***Off*** *button to disable bandwidth throttling.*

4. Click **Yes** to override existing triggers or to configure a constant bandwidth value.
5. Enter the desired bandwidth in **Set bandwidth value to**. A value of 0 means unlimited bandwidth.
6. Click **Save** to update the bandwidth configuration settings.

Scheduling Bandwidth Throttling

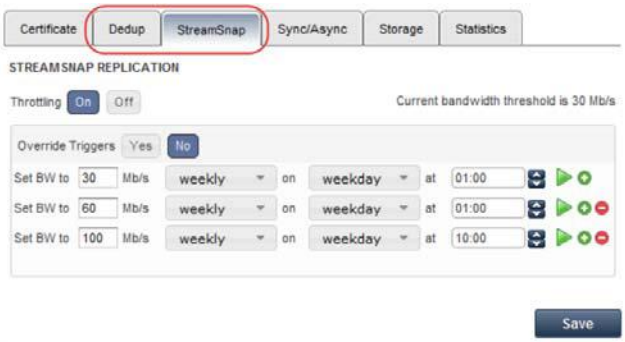
During various times of the day or week you may want an Actifio appliance to use less bandwidth so that other priority services can leverage this bandwidth. You can customize the bandwidth throttle so that it runs automatically based on pre-defined schedules (triggers).

This section describes how to schedule bandwidth throttles. Each schedule specifies the amount of bandwidth that you want to allocate during the interval and time. You can create separate schedules for weekdays and weekends.

Note: *You can create a maximum of 10 different bandwidth triggers.*

To create a custom schedule for bandwidth throttling:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**. The Appliance Manager page allows you to coordinate bandwidth throttling through the use of scheduled triggers.
2. In the Appliance Manager, click one of the following:
   - The **Dedup** subtab if you wish to schedule bandwidth throttling for Dedup replication.
   - The **StreamSnap** subtab if you wish to schedule bandwidth throttling for StreamSnap replication.



Configuring Bandwidth Schedules (Shown for StreamSnap Replication)

3. Click the **On** button next to Throttling to enable throttling.
4. Click the **No** button next to Override Triggers.
5. Click the **Add New Trigger (+)** button to add a new trigger schedule.
6. Enter the bandwidth value (in Mb/s), day, and time for the new schedule.
7. Click **Save** to update the changes.

Activating a Trigger Schedule

To activate a trigger schedule, select the schedule and click the **Set This Trigger (** ▶ **)** button.

Deleting a Trigger Schedule

To delete an existing trigger schedule, select the schedule and click the **Remove This Trigger (-)** button.

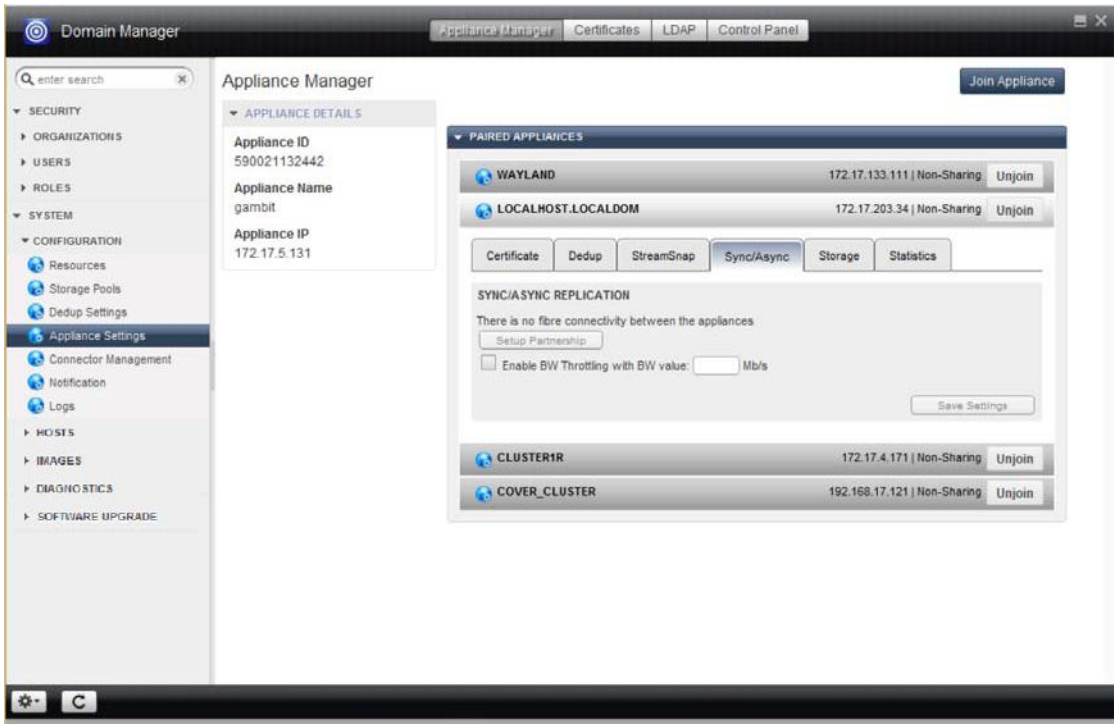
Enabling/Disabling Sync/Async Replication

Note: *Sync/Async Replication is supported only by the Actifio CDS appliance.*

A pair of joined Actifio CDS appliances requires partnership between the local and the joined appliance. Partnership is a pre-requisite for configuring synchronous or asynchronous replication over Fibre Channel. The appliances must be zoned together in the SAN.

To set up partnership between two appliances:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**.
2. In the Appliance Manager, click the **Sync/Async** subtab. The Sync/Async Replication page appears.
3. Click the **Setup Partnership** button from the Sync/Async tab. If partnership has been enabled, you can disable it from the Disable Partnership button that appears here.
4. (Optional) You can enable bandwidth throttling as described in Managing Bandwidth Utilization on page 67.
5. Click the gray **Save Settings** button.



Setting Up Partnership for Fibre Channel Support for Sync/Async Replication

Selecting a Storage Pool for Replicated Data

To select the destination storage pool to be used to store the incoming Dedup Async replication data:

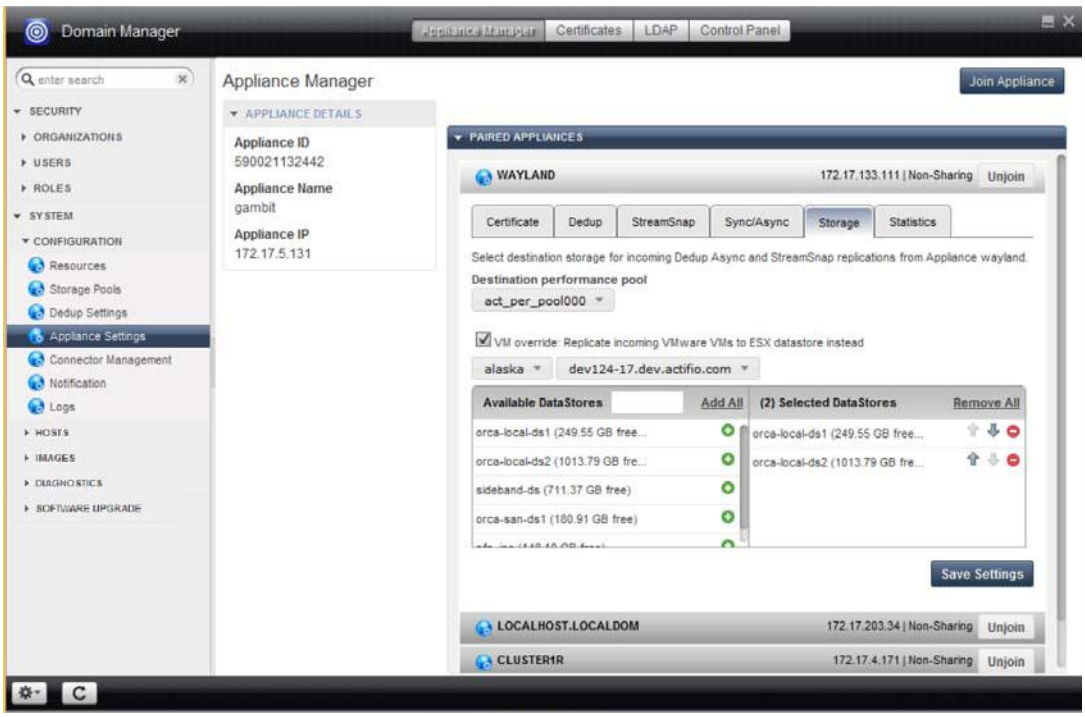
1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**.
2. In the Appliance Manager, click the **Storage** subtab. A drop down menu appears where you can select the destination performance pool for replicated data that comes to this Actifio appliance.
3. (Optional VMware only) You can override this setting for VMware VMs if you want them to go to an ESX datastore instead. Check the **VM override** box and make the following selections:
   - Select a vCenter to manage the operation. This vCenter should ideally be at the DR site.
   - Select an ESXi host to host the VMware VMs. This ESXi host should also be at the DR site and must be powered on and available at all times. You can only select one ESXi host.
   - Select the datastores to hold the DR data. The datastores must have space to hold the replicated VMDKs (Virtual Disks). If you select multiple datastores, the Actifio appliance will use each in turn.

   The Actifio appliance will create new VMs at the DR site using the name DR-<*original VM name*>. For example, if the source VM is called **testvm**, then the DR copy will be called **DR-testvm**. If the VM already exists and is powered off, the Actifio appliance will use it as the target for the replicated VMs.

Note: *When you configure VMware override, it affects the incoming Dedup-Async replication to the Actifio appliance you are currently logged onto. If you require the DR appliance to create its DR copy in a VMware datastore rather than the DR appliance's Snapshot pool, be sure to set the VMware override at the DR appliance site. VMware override does not apply to StreamSnap replication.*

Note: *This feature is referred to in the CLI as ReadyVM.*

4. Click the gray **Save Settings** button.



Viewing Destination Storage for Dedup Async or StreamSnap Replication

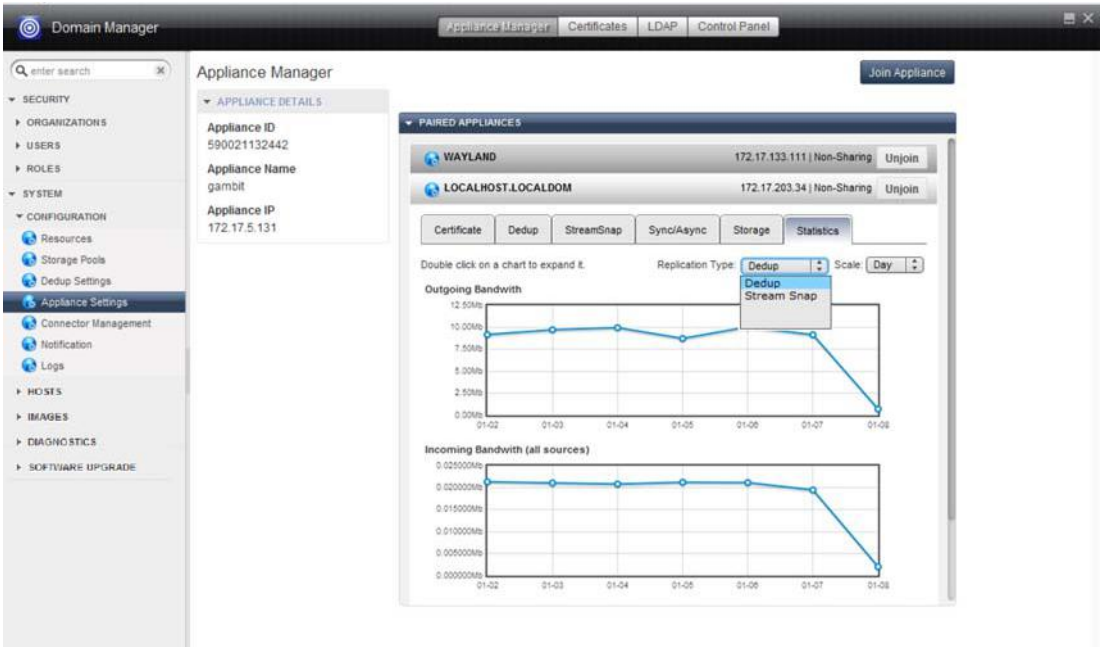
Viewing Bandwidth Usage Statistics

Use the Statistics tab to monitor bandwidth consumption for either Dedup Async or StreamSnap replication.

To view the bandwidth statistics for your Actifio appliances:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**.
2. Select an Actifio appliance from the Navigation pane.
3. In the Appliance Manager, click the **Statistics** subtab.
4. Select from the **Replication Type** drop-down list: Dedup or StreamSnap.
5. A pair of charts appears displaying outgoing and incoming bandwidth consumption statistics for the selected appliance on a time scale that you select.
    - The **Incoming Bandwidth (All Sources)** graph depicts the incoming traffic reaching the local appliance from all joined appliances.
    - The **Outgoing Bandwidth** graph depicts the outgoing traffic from the local appliance to the selected appliance.

    You can modify the scale by selecting a time unit, such as Day (bandwidth used during the last seven days), Hour (bandwidth used during the last 23 hours), and Minute (bandwidth used in the last 10 minutes). The bandwidth is measured in Mbps.



Viewing Bandwidth Usage Statistics

11 Configuring LDAP Settings and Group Mapping

You can use a single existing LDAP server for Actifio Desktop user authentication and to map LDAP groups to Actifio appliance roles. Active Directory is a database-based system that provides authentication, directory, policy, and other services in a Windows environment, and LDAP is an application protocol for querying and modifying items in directory service providers such as Active Directory.

This chapter includes:

Considerations When an Actifio Appliance is Configured with LDAP on page 73

Configuring LDAP Settings on page 74

Mapping LDAP Groups to Roles on page 76

Considerations When an Actifio Appliance is Configured with LDAP

When the Actifio appliance connects to the LDAP server for authentication, the Actifio appliance updates users with credentials cached from the LDAP server.

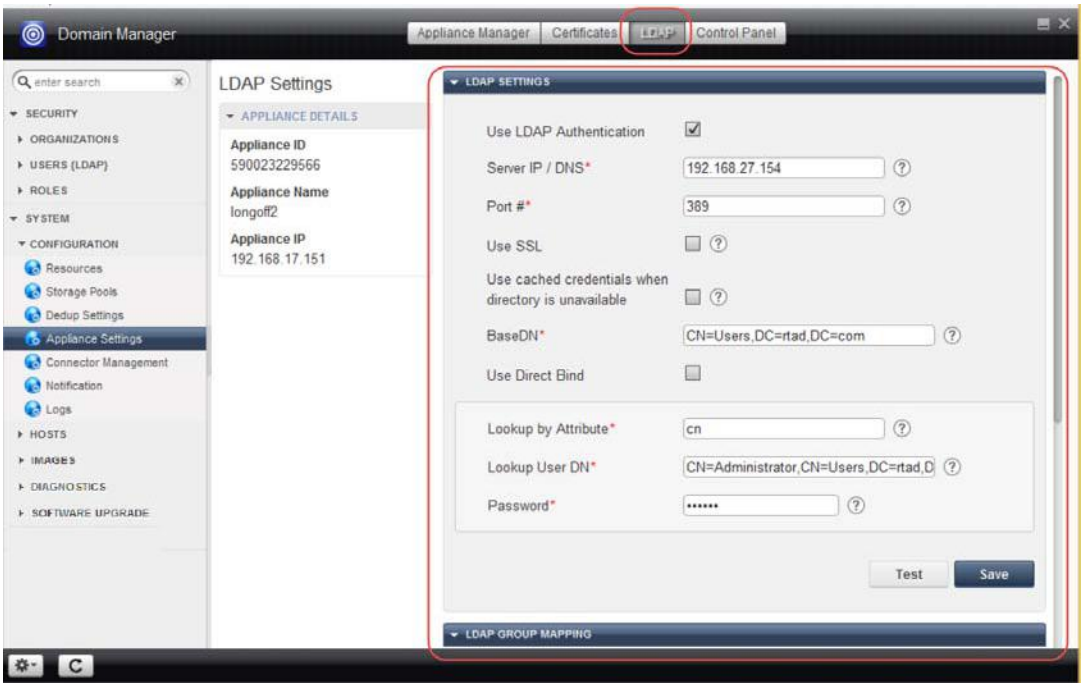
When Actifio appliances are configured with LDAP to authenticate users:

- LDAP users can also be created in an Actifio appliance by administrators. These new users can have their passwords left blank. User accounts with empty passwords will be "locked" until the user logs in with LDAP once to set their cached credential.
- The login process is transparent to users; username and password will be the same as their LDAP server username and password. Users receive no feedback on the reason for a failed login attempt. The reason is logged for administrative use but for security purposes the user is only informed that login failed. Users receive no information about which authentication method is in use.
- The hash value of each user credential is cached in the Actifio appliance database.
- If the Actifio appliance is not able to reach the LDAP server AND if the appliance is configured to use database fallback (not selected by default), then each user will be authenticated against their cached credential hash value stored in the Actifio appliance database.
- Cached credential hash values are refreshed upon establishing connection with configured LDAP servers.
- The default "admin" account will always be authenticated against internal credentials stored in the Actifio appliance database.
- When Actifio appliances are in Sharing Mode, the appliance configured to authenticate against LDAP will propagate only usernames to the shared appliance. User credentials are not propagated to a shared appliance.
- LDAP configuration is not shared between Actifio appliances. Each appliance must be configured to the LDAP server individually.
- LDAP users cannot be granted CLI access. Locally-created users can be granted CLI access.

Configuring LDAP Settings

To perform LDAP server authentication, configure the LDAP connection as follows:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**.
2. Click the **LDAP** tab. The LDAP Settings panel appears.



Entering LDAP Connection Information

3. Check **Use LDAP Authentication** to enable this feature. You can uncheck this at any time without losing the configuration information.

Note: *If you uncheck the* ***Use LDAP Authentication*** *check box, the Actifio appliance will no longer connect to the LDAP server for authentication. All local users and previously cached LDAP users can still use their credentials to access the Actifio appliance.*

---

4. Enter the following LDAP server settings:
   - **Server IP Address/DNS**: The server IP address or host name of the server where LDAP is hosted to authenticate device users. If you specify a host name, make sure that it can be resolved.
   - **Port #**: TCP/IP port number on which the server is processing LDAP requests. Leave this setting at the default of port 389. If you plan to use SSL for the connection, specify port 636.
   - **Use SSL**: Specifies that the connection uses SSL/TLS to connect with the LDAP server.

Note: *In the case of Microsoft Active Directory, for the SSL/TLS connection to properly connect to the LDAP server the server must have Certificate services installed on it so that it can answer on port 636. You can confirm that the connection is working properly by looking in the event viewer of the LDAPSERVER under* ***Windows Logs -> System****. Look for event 36886 by source* ***Schannel****. If your output shows a connection and no disconnect, then that means that LDAP is communicating properly.*

- **Use Cached Credentials When Directory is Unavail**: Specifies to use the cached credentials in the Actifio appliance database for verification when the LDAP server is offline or unavailable.
- **BaseDN**: The base/root distinguished name (DN) of the LDAP server and the sub-tree at which users are stored in the LDAP server. If using Direct Bind, only users at the BaseDN can log in; users in the sub-tree are restricted from logging in.
- **Use Direct Bind**: If checked, User Direct Bind instructs the Actifio appliance to use direct bind for users stored in the LDAP server.

5. If **Use Direct Bind** is unchecked, you can use the Group Mapping feature described in Mapping LDAP Groups to Roles on page 76.

   Enter the following settings for an LDAP user with rights to perform user lookups and mapping:

   - **Lookup by Attribute**: The LDAP attribute to use to match against the supplied login name.
   - **Lookup User: DN**: The full DN (distinguished name) of the user that is to perform user lookups in the LDAP server. This field creates the user within the Actifio appliance that matches the LDAP server account properties.
   - **Password**: Password for the lookup user.

6. Click **Save**. Optionally you can use the **Test** button to review whether the provided information is accurate.

Mapping LDAP Groups to Roles

After your LDAP settings are configured as described in Configuring LDAP Settings and Group Mapping on page 73, you can set up group mapping. You create a mapping by choosing an LDAP Group and associating it with a role.

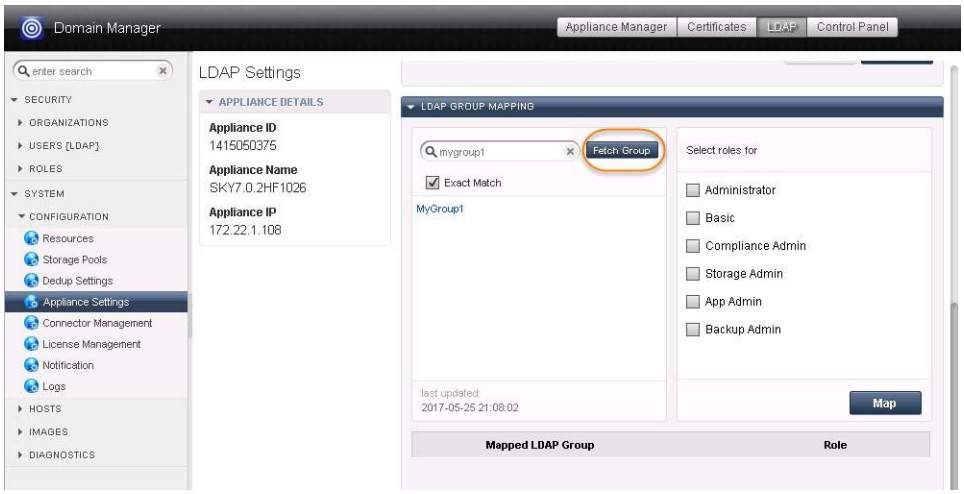
Note: *During LDAP user authentication, if the group mapping information is not found then the user is assigned with the previously assigned roles/organizations.*

Note: *For the LDAP server, the Domain Users group is not supported, and it will not appear in the list of mappings.*

To set up a group mapping:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**.
2. Click the **LDAP** tab. The LDAP Settings Panel appears.
3. Click the **LDAP Group Mapping** panel located below the LDAP Settings panel. The LDAP Group Mapping panel has two lists.
    - The left list contains the LDAP groups that appear after a query is performed
    - The right list contains the Actifio appliance roles.
4. Enter a group name in the **Search** field to lookup a specific group from the LDAP server.
    - Use the **Exact Match** check box (recommended) to return an exact match of what you entered in the search field.
    - Click **Fetch Group** to refresh the LDAP groups list.
5. Select the desired LDAP group from the left list and then select the roles in the right list to map the LDAP group to the role(s), then click **Map**. The mappings appear in a list at the bottom of the LDAP Group Mapping panel.
6. Repeat this process for each group that requires mapping.

Note: *Use the "x" icon in the bottom panel to remove mapping.*



LDAP Group Mapping

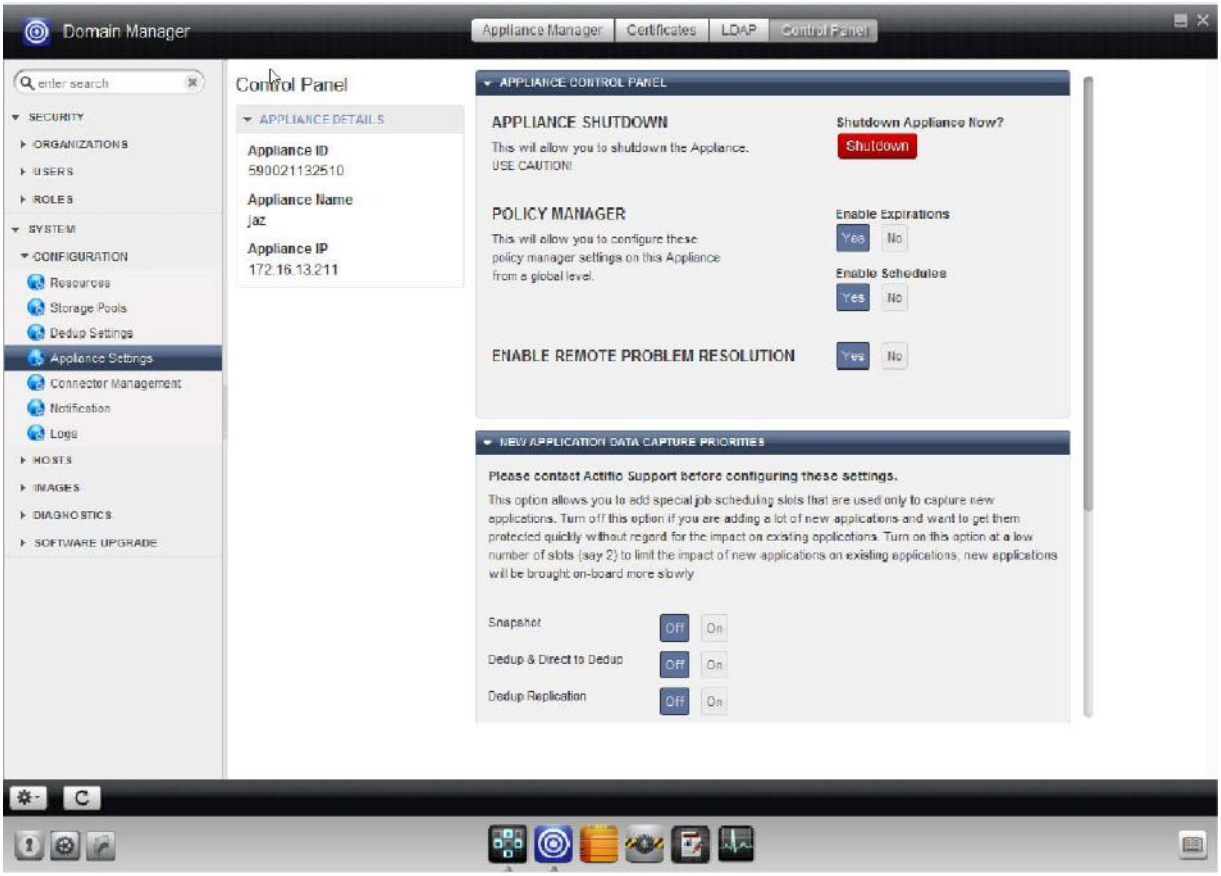
12 Configuring Control Panel Operations

This chapter describes the various operations supported by the Control Panel. It includes the following procedures:

Using the Appliance Control Panel on page 78

Setting Priorities for the First Ingestion of New Applications on page 81

Configuring Image Preservation Priority Setting for Snapshot and Dedup Images on page 82



The Control Panel

Using the Appliance Control Panel

This includes:

Shutting Down an Actifio Appliance on page 78

Disabling Expirations and Schedules on page 79

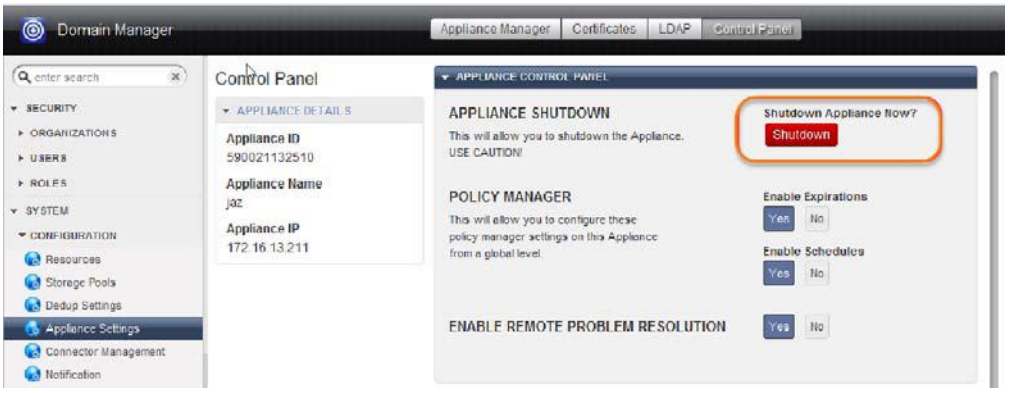
Enabling Remote Problem Resolution on page 80

Shutting Down an Actifio Appliance

Note: *Improperly shutting down an Actifio appliance can result in* ***data loss****. Shut down the appliance only under the guidance of Actifio Support.*

To shutdown the appliance in a controlled manner:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**.
2. Click the **Control Panel** tab. The Appliance Control Panel appears.
3. Click **Shutdown**. Complete shutdown takes 10 to 20 minutes.



Appliance Shutdown Procedure

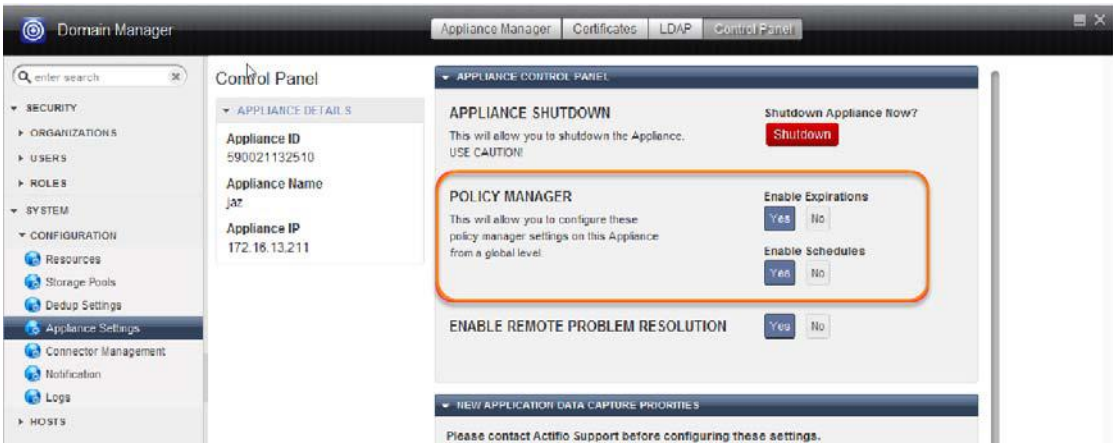
Disabling Expirations and Schedules

Expirations and schedules are not enabled by default; images (backup, dedup, remote-dedup, direct-to-dedup, StreamSnap) are expired depending on the policy configuration. Click **Yes** to enable expirations and schedules.

The global configuration set here takes precedence over the individual policy configuration in policy templates. For example, if you configure a policy to expire backup images and then set Enable Expirations to **No** using the Appliance Control Panel the backup images do not expire.

You can save storage by configuring image expiry globally on an Actifio appliance:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**.
2. Click the **Control Panel** tab. The Appliance Control Panel appears.



Expirations and Schedules Not Enabled

3. In the Policy Manager section under the Appliance Control Panel, click **Yes** to Enable Expirations and/or Enable Schedules.

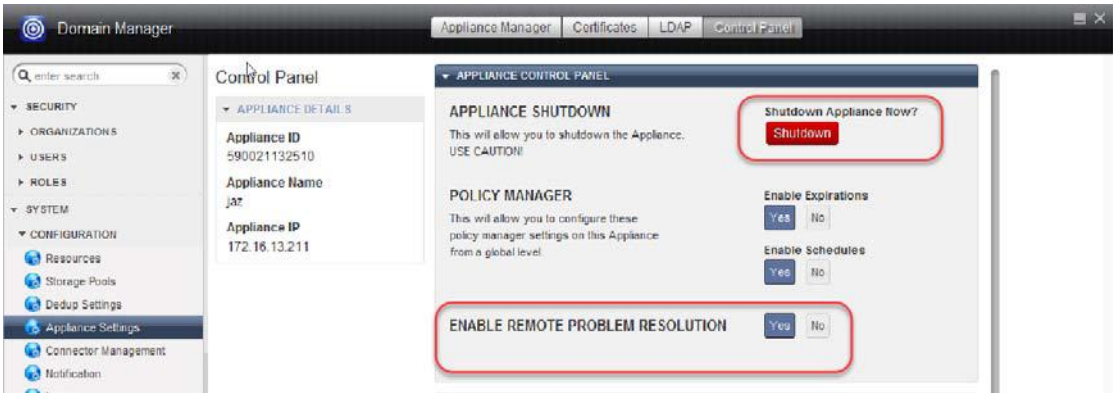
Enabling Remote Problem Resolution

Remote Problem Resolution is a feature of Actifio SecureConnect mode. Actifio SecureConnect mode allows Actifio Support to remotely troubleshoot problems through a VPN connection. Actifio SecureConnect enables the Actifio appliance's phone home capabilities. When this option is enabled, should your Actifio appliance encounter an issue Actifio Support will be notified and will immediately begin addressing the issue.

Note: *Use the System Settings tab to enable Actifio SecureConnect mode. See the* ***Actifio Remote Support Options Tech Brief*** *for background on enabling SecureConnect mode.*

To enable Remote Problem Resolution:

1. Make sure **SecureConnect** is enabled under **Software and Settings** > **System Settings**. You can access this function from the Software & Settings icon located at the lower left corner of the Actifio Desktop.
2. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**.
3. Click the **Control Panel** tab. The Appliance Control Panel appears.
4. Set **ENABLE REMOTE PROBLEM RESOLUTION** to **Yes**. A dialog opens to confirm the selection.



Enabling Remote Problem Resolution

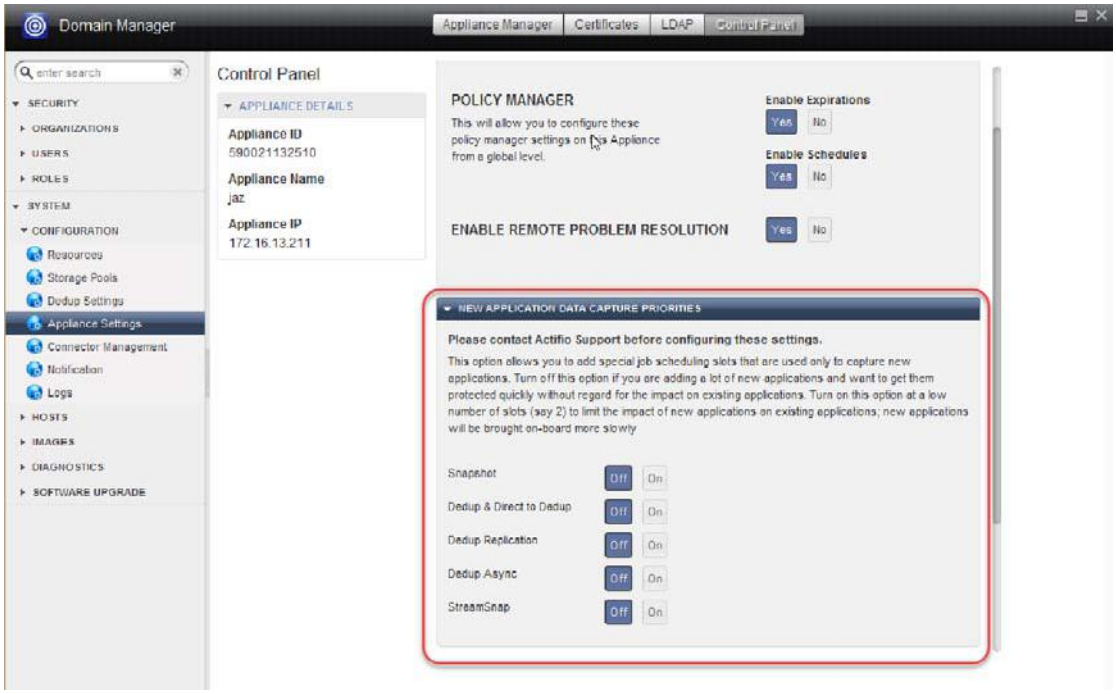
Note: *For more information on Actifio remote problem resolution, see* ***Configuring Actifio Event Alerting****.*

Setting Priorities for the First Ingestion of New Applications

This option allows you to add special job scheduling slots that are used only to capture the first ingest of a new application. Turn this option off if you are adding a lot of new applications and want to get them protected quickly without regard for the impact on existing applications. Turn on this option at a low number of slots (for example, 2 slots) to limit the impact of the ingestion of new applications on existing applications; new applications will be brought on-board more slowly.

To enable additional job slots for ingestion of new applications:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**.
2. Click the **Control Panel** tab. The Appliance Control Panel appears.



Setting Priorities for Capture of New Application Data

3. You can increase, decrease, or turn off slots dedicated to capturing new application data. You can select from 1 to 10 slots. However, there is a finite number of slots available, so slots assigned come at the expense of incremental job performance.

Note: *Do not change the slot assignment values except under the guidance of Actifio Support.*

Configuring Image Preservation Priority Setting for Snapshot and Dedup Images

Image Preservation will, when necessary, preserve snapshot and local dedup images beyond their expiration dates to ensure that those images are properly processed by the Actifio appliance. Image Preservation in the Control Panel allows you to modify or disable the application priority settings for preserved snapshots jobs and/or local dedup jobs.

This section includes the following topics on Image Preservation:

- Image Preservation Overview on page 82
- Modifying Image Preservation Priority Settings for Snapshot and Dedup Images on page 84

See Chapter 15, Working with Preserved Snapshot and Dedup Images for information on:

- Displaying a list of preserved/discarded snapshot and dedup images in the Images section of the Domain Manager.
- Viewing Image Preservation status for preserved snapshot and dedup images in the Dashboard.
- Viewing alerts and warnings specific to preserved snapshot and dedup images in the System Monitor.

Image Preservation Overview

Your Actifio CDS or Sky appliance may encounter resource challenges that result in snapshot or local dedup jobs failing to execute in a timely manner. To enhance the success rate in which the Actifio appliance is able to complete snapshot and local dedup jobs, the Actifio appliance operates in an Image Preservation mode. Image Preservation enhances the scheduling features of the Actifio SLA policy manager to be able to ride through periods of high change rates, reduced dedup or replication throughput, and other transient or abnormal situations. Image Preservation delays snapshot and local dedup expirations in order to catch up with the transient system resource constraints. Images due for expiration will be held until they have been processed by the Actifio appliance as long as there is capacity to do so by the appliance.

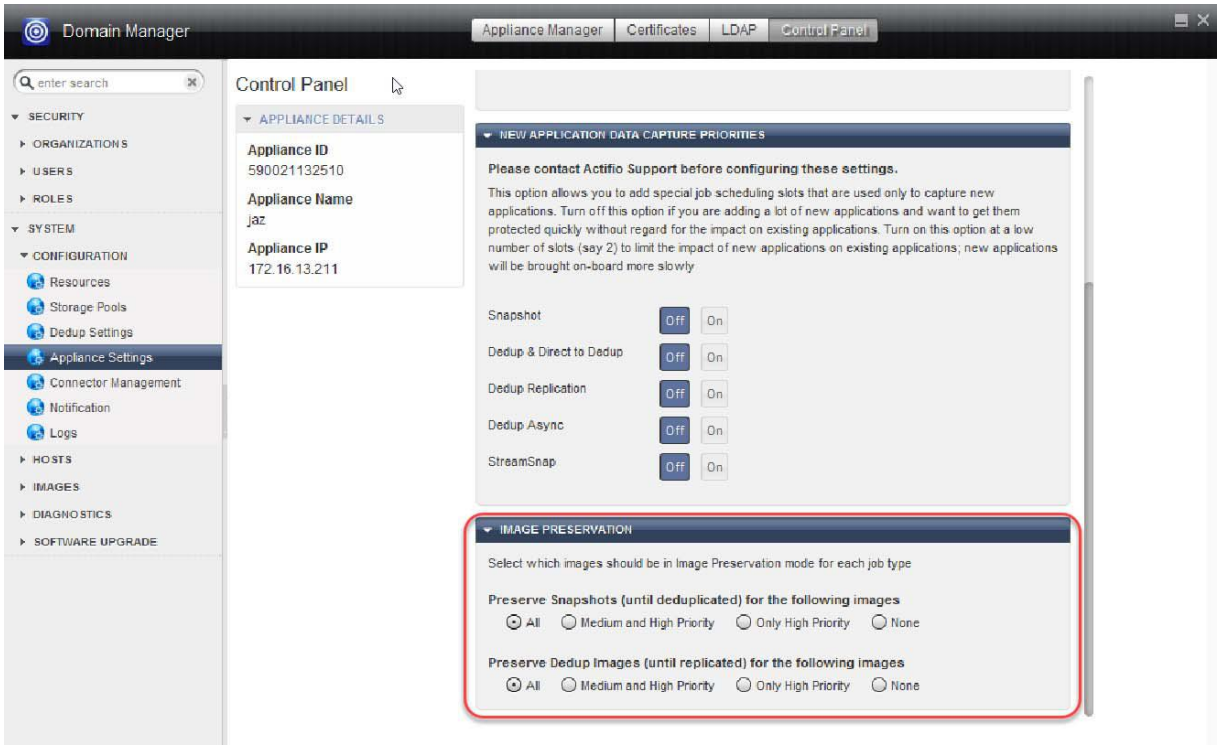


Image Preservation Settings for Snapshot and Local Dedup Images

Image Preservation operates on two types of images:

- **Preserve Snapshots**: When enabled, all dedupable snapshot images will be preserved until the local dedup system can process them. Older snapshot images will be processed first until images are caught up by the Actifio appliance. If VDisk counts or performance pool capacity thresholds are reached, then image expiration may occur prior to processing to ensure system stability.
- **Preserve Dedup Images**: When enabled, all local dedup images that are eligible for remote deduplication will be preserved until the remote deduplication system can process them. Older local dedup images will be processed first until images are caught up by the Actifio appliance. If capacity in the local dedup pool has reached the warning level, then image expiration may occur prior to processing to ensure system stability.

When the Actifio appliance attempts to preserve snapshot images or local dedup images, the Actifio appliance will run snapshot and local dedup jobs (images beyond their expiration date) continuously within the allowed window in an attempt to catchup on all image processing. In this case, the Actifio appliance will process the oldest unprocessed snapshot or local dedup images ahead of the latest images. Once a backlogged image is processed, the image is expired per the SLA schedule.

Preserved images will automatically be expired when pool space or VDisk count reaches the warning threshold levels set in the Domain Manager (see Chapter 3, Monitoring Resource Usage). When the Actifio appliance reaches a warning threshold level, images will be expired based on application priority and age. Images for applications with lower priority will be expired ahead of applications with higher priority. Within a priority level, older images will be expired before newer images. However, the last snapshot (or local dedup) image of any application will not be expired by this method. Rather than expiring the most recent snapshot (or local dedup) of any application, an older snapshot of a different application or a snapshot (or local dedup) of a higher priority application will be expired.

If you find that you need to limit the scope of image preservation to exclude lower priority applications, you can:

- Change preserved snapshot settings from the Control Panel in the Domain Manager as described in Modifying Preserve Snapshots Settings on page 84.
- Change preserved local dedup settings from the Control Panel in the Domain Manager as described in Modifying Preserve Dedup Images Settings on page 86.

In addition, if over a period of time you find that the Actifio appliance is unable to "catch-up" with backlogged local or remote dedup jobs, you can disable the ability to preserve snapshot and/or preserve local dedup images.

Modifying Image Preservation Priority Settings for Snapshot and Dedup Images

You can modify Image Preservation priority settings for preserved snapshots jobs and/or local dedup jobs from the Control Panel in the Domain Manager (**System** > **Configuration** > **Appliance Settings** > **Control Panel**). Modifying Image Preservation settings may be necessary when you need to:

- Change the global application priority of Preserve Snapshots or Preserve Dedup Images settings to limit the scope exclude applications of a certain priority setting. You can instruct the Actifio appliance to preserve images for only Medium and High Priority applications or to preserve images for only High Priority applications.
- Disable the Image Preservation function if the Actifio appliance is unable to "catch-up" with backlogged snapshot or local dedup images.

Note: *If necessary, for a specific application you can disable Image Preservation for a specific application using the* ***-flags ProcessLatestSnap*** *and* ***ProcessLatestDedup*** *options of the* ***udstask chsla*** *CLI command. When you enable a flag (set it to* ***true****), the Actifio appliance processes the most recent snapshot or dedup image for an application and allows the older images to expire. See the* ***Actifio CLI Reference*** *in the Actifio Documentation Library for details.*

This section includes the following procedures:

- Modifying Preserve Snapshots Settings on page 84
- Modifying Preserve Dedup Images Settings on page 86

Modifying Preserve Snapshots Settings

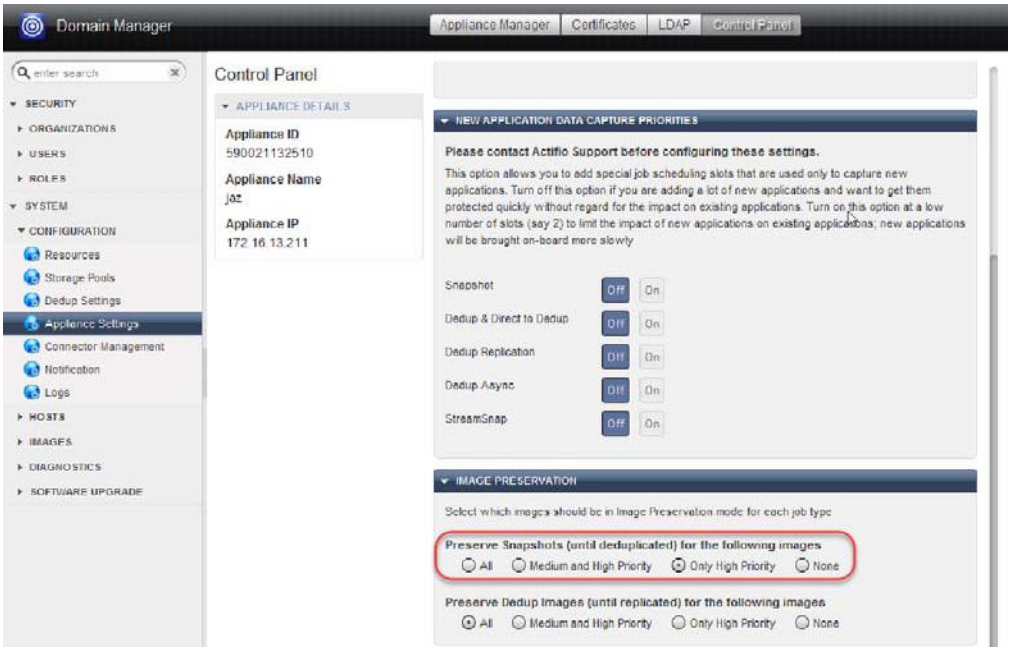
A dedupable snapshot is a snapshot image that would normally be deduped by the Actifio appliance based on the frequency, retention, start time, and end time specified in the policy template for an application. At times, the Actifio appliance may lag behind in the snapshot to dedup jobs due to resource constraints. When this lag occurs, the setting of the **Preserve Snapshots** parameter in the Image Preservation section of the Control Panel defines to the Actifio appliance how to preserve snapshot images that are due for expiration but not yet successfully deduped.

If necessary, you can change the application priority of Preserve Snapshots from **All** (the default setting) to **Medium and High Priority** applications or to **Only High Priority** applications. If you find that the Actifio appliance is unable to "catch-up" with backlogged local jobs, you can disable the Preserve Snapshots parameter by setting it to **None**.

Note: *See* ***Planning and Developing Service Level Agreements*** *in the Actifio Documentation Library for information on assigning job priority in a policy template.*

To modify the Image Preservation settings for preserved snapshot jobs:

4. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings**. This sequence opens the Appliance Manager page.
5. Click the **Control Panel** tab. The Appliance Control Panel appears.
6. Scroll to the bottom of the page to locate **Image Preservation**.



Modifying Preserve Snapshot Settings

7. Options for the **Preserve Snapshots** parameter include:
    - **All**: All applications (low, medium, and high priority) will have their snapshot images preserved. This is the default setting.
    - **Medium and High Priority**: High and medium priority applications will have their snapshot images preserved.
    - **Only High Priority**: Only high priority applications will have their snapshot images preserved.
    - **None**: No local snapshot images will be preserved even if the local dedup job has not run on those images. When the snapshot image reaches its expiration time, barring other dependencies, it will be expired.
8. A confirmation dialog appears instructing you that changing the priority of the **Preserve Snapshots** parameter may result in additional or fewer snapshot images being preserved beyond their expiration until those images are processed into the Snapshot pool. Click **OK** to proceed with the application priority change.

Modifying Preserve Dedup Images Settings

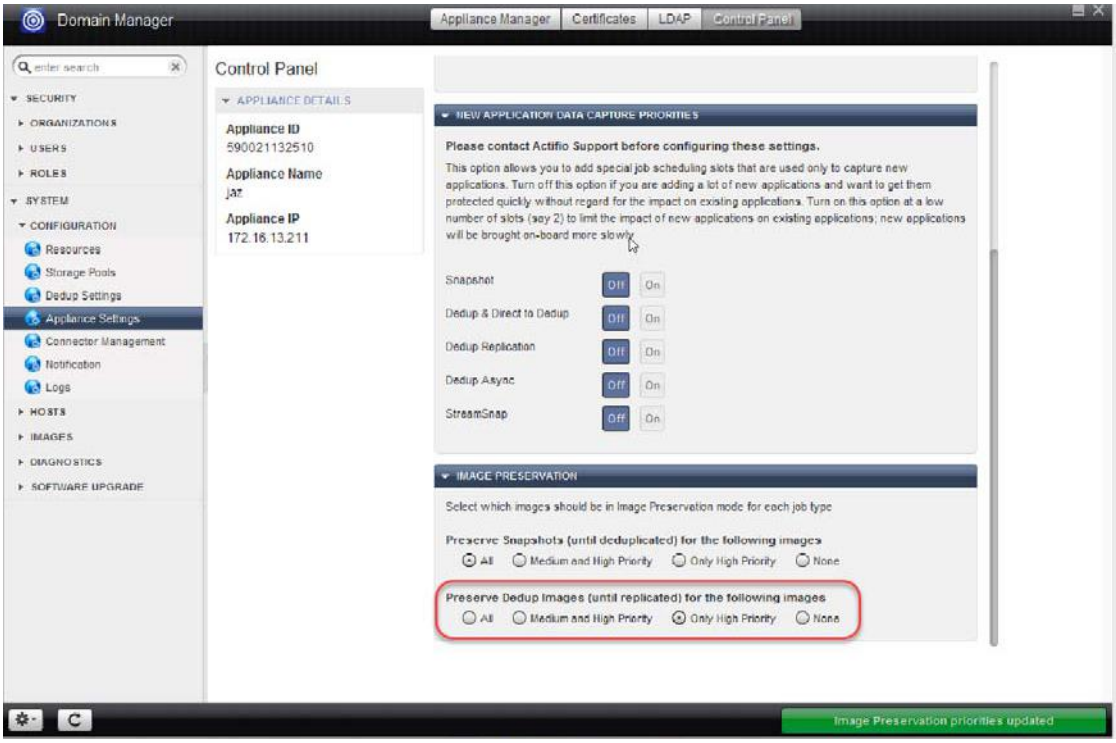
Similar to dedupable snapshots, there are local dedup images that are candidates for remote deduplication based on the remote dedup policy template. At times, the Actifio appliance may start to lag behind in the local to remote deduplication jobs due to resource constraints. When this lag occurs, the setting of the **Preserve Dedup Images** parameter in the Image Preservation section of the Control Panel defines to the Actifio appliance how to preserve local dedup images that are due for expiration but not yet successfully processed.

If necessary, you can change the application priority of Preserve Dedup Images from **All** to **Medium and High Priority** applications or to **Only High Priority** applications. If you find that the Actifio appliance is unable to "catch-up" with backlogged local jobs, you can disable the Preserve Dedup Images parameter by setting it to **None**.

Note: *See* ***Planning and Developing Service Level Agreements*** *in the Actifio Documentation Library for information on assigning job priority in a policy template.*

To modify the Image Preservation settings for preserved dedup image jobs:

1. Open the **Domain Manager** to **System** > **Configuration** > **Appliance Settings** > **Control Panel**.
2. Scroll to the bottom of the page to locate **Image Preservation**.



Modifying Preserve Dedup Images Mode

3. Options for the **Preserve Dedup Images** parameter include:
   - **All**: All applications (low, medium, and high priority) will have their local dedup images preserved. This is the default setting.
   - **Medium and High Priority**: High and medium priority applications will have their local dedup images preserved.
   - **Only High Priority**: High priority applications will have their local dedup images preserved.
   - **None**: No local dedup images will be preserved. When the local dedup image reaches its expiration time, barring other dependencies, it will be expired.
4. A confirmation dialog appears. Click **OK** to proceed with the application priority change.

13 Managing Licenses for an Actifio Sky Appliance

The Actifio License Manager is unique to Actifio Sky appliances. The Actifio CDS appliance does not use license management. During your initial software installation, a license is installed to register the Actifio Sky software. The registration of your Actifio Sky software is based on a unique 128-bit system UUID. After installation, you then use the License Manager when you need to upload:

- An evaluation-to-production license key if you intend to upgrade from the 30-day full-feature evaluation version of the base Actifio Sky software to the production version.
- An add-on functionality license key (for example, to add support for protecting Oracle databases).

This chapter describes:

Ordering a License on page 87

Uploading a License Key on page 88

Copying the System UUID Value on page 90

Ordering a License

To order a Actifio Sky license from an Actifio representative:

1. Contact your Actifio representative to order a Actifio Sky license.

   Note: *As part of the initial installation of Actifio Sky appliance, a unique 128-bit system UUID is generated for the host running the Actifio Sky software. This unique UUID will be required when you order a Actifio Sky license, and can be found on the License Manager (see Uploading a License Key on page 88).*

2. You will receive a license key email with an attached license file. Save the license key file in a location where it will be easy to locate and retrieve when uploading it to the Actifio Sky appliance. We also recommend that you save the original e-mail in a safe place in case you need it in the future.
3. Upload the license key as described in Uploading a License Key on page 88.

Uploading a License Key

After you receive the license key from your Actifio representative, upload it in the Domain Manager License Manager as described in this section.

1. Open the **Domain Manager** to **System** > **Configuration** > **License Management**.

Note: *This section appears only in Actifio Sky appliances. Actifio CDS appliances do not show this screen.*

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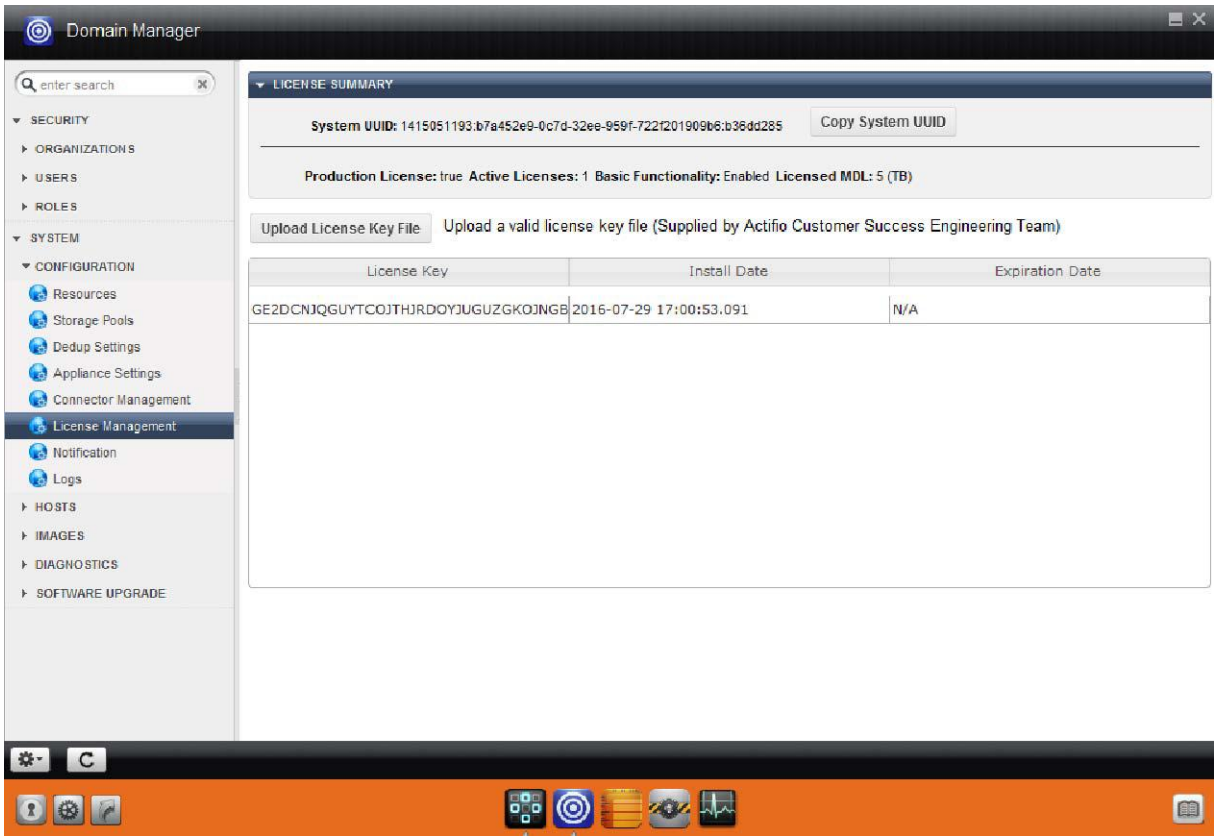
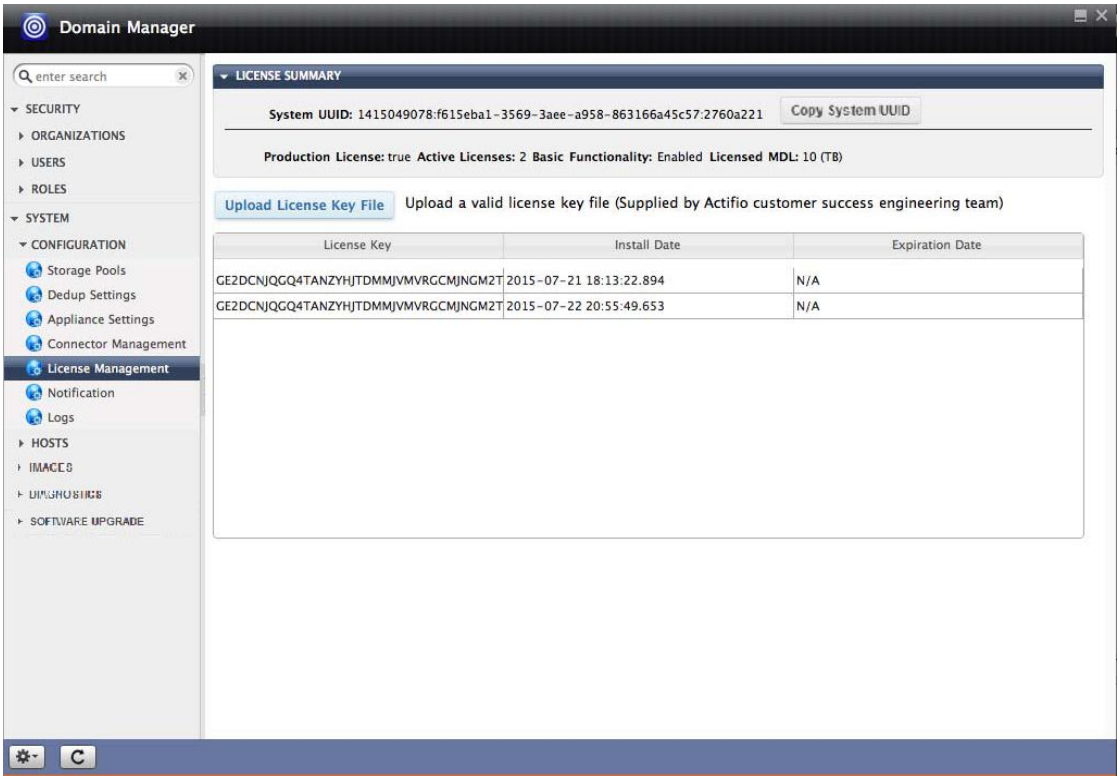
2. Click **Upload License Key File** to install the license key file. Navigate to the stored location of the license key, then click **Open**.



Accessing the License Manager

3. The license key uploads into the Actifio Sky appliance, and the License Manager updates with information about the newly installed license key (License Key, Install Date, and Expiration Date).

4. Once the license key upload process is complete you can use your add-on functionality (such as to protect Oracle databases).

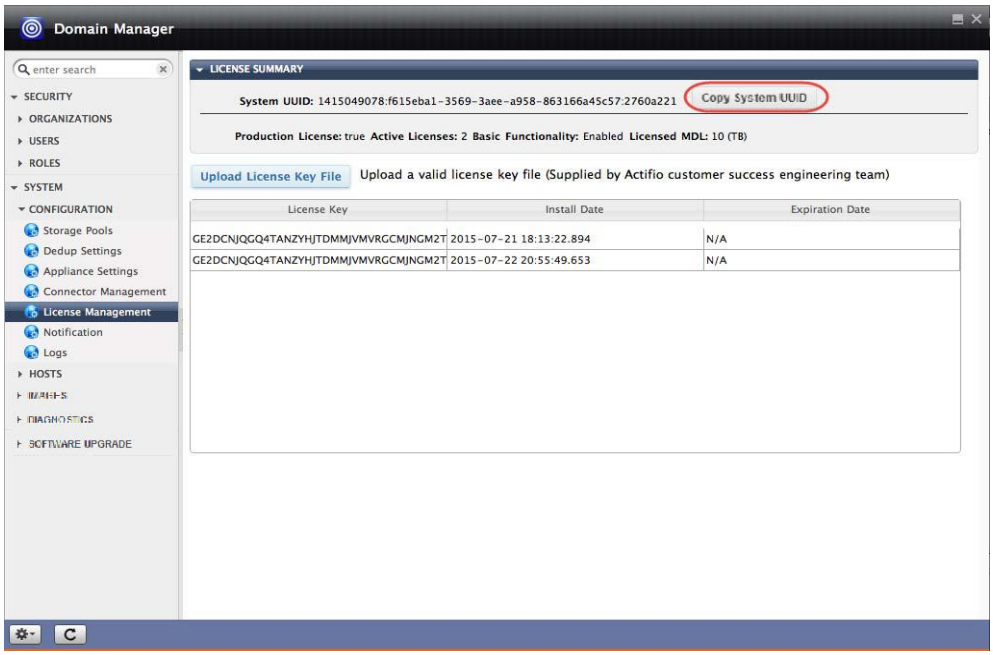


License Manager with Uploaded License Key

Copying the System UUID Value

If you wish to save the Actifio Sky system UUID value to reference for future service requests, you can use the Copy System UUID button as follows:

1. Open the **Domain Manager** to **System** > **Configuration** > **License Management**. This sequence opens the License Manager.
2. Click **Copy System UUID**.



License Manager with Uploaded License Key

3. Use the **CTRL+V** sequence to save the system UUID value to a text file or a document for future reference.
4. Save the file.

14 Working with Active Images

Active images are mounted copies of backup images. Mounting a backup image presents a copy of the image to a host. You can access the mounted and unmounted images under the Images > Mounted/Unmounted section of the Domain Manager. When you are finished with an active image, you can unmount the image, or you can unmount and delete the image.

This section details:

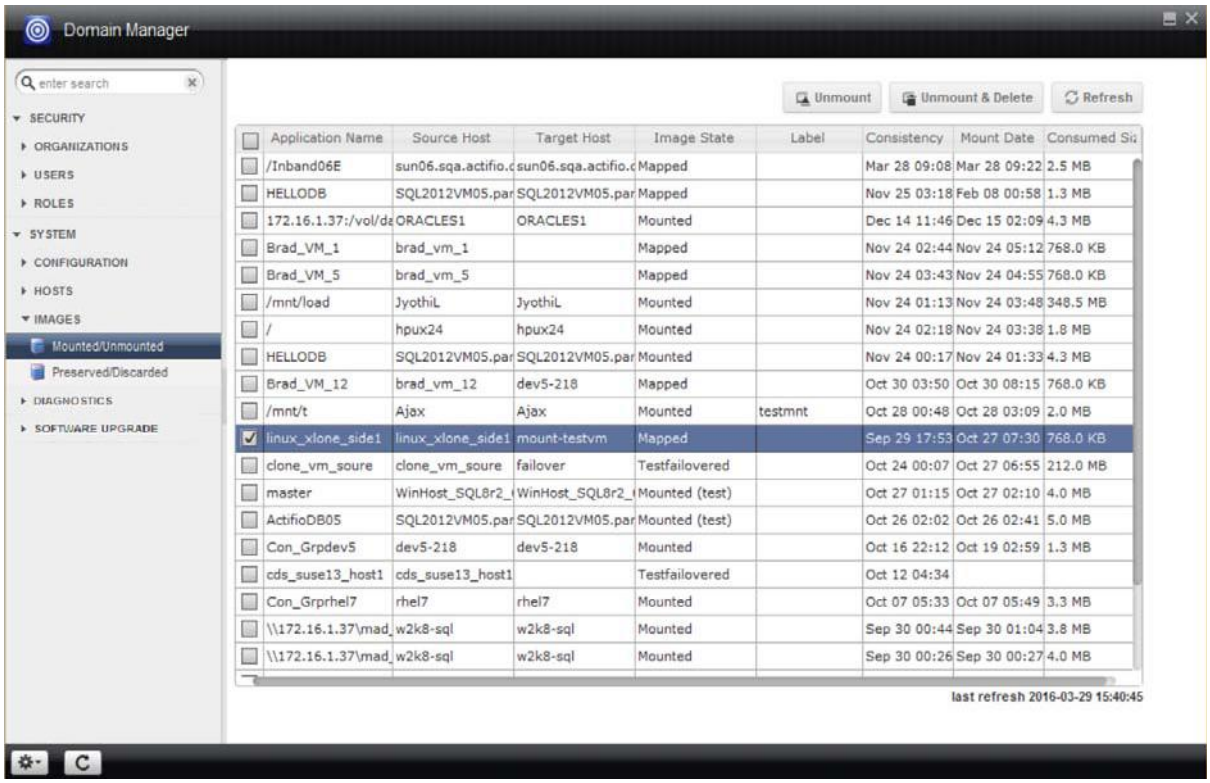
Unmounting an Image on page 92

Deleting an Unmounted Image on page 93

Unmounting and Deleting an Active Image on page 94

Unmount & Accept Changes or Reject Changes to Prep-Mounted LiveClones on page 95

Note: *Images are not mounted in the Mounted/Unmounted section of the Domain Manager; you mount images from the Application Manager Restore tab. See* ***Accessing and Recovering Copy Data with the Application Manager*** *in the Actifio Documentation Library.*

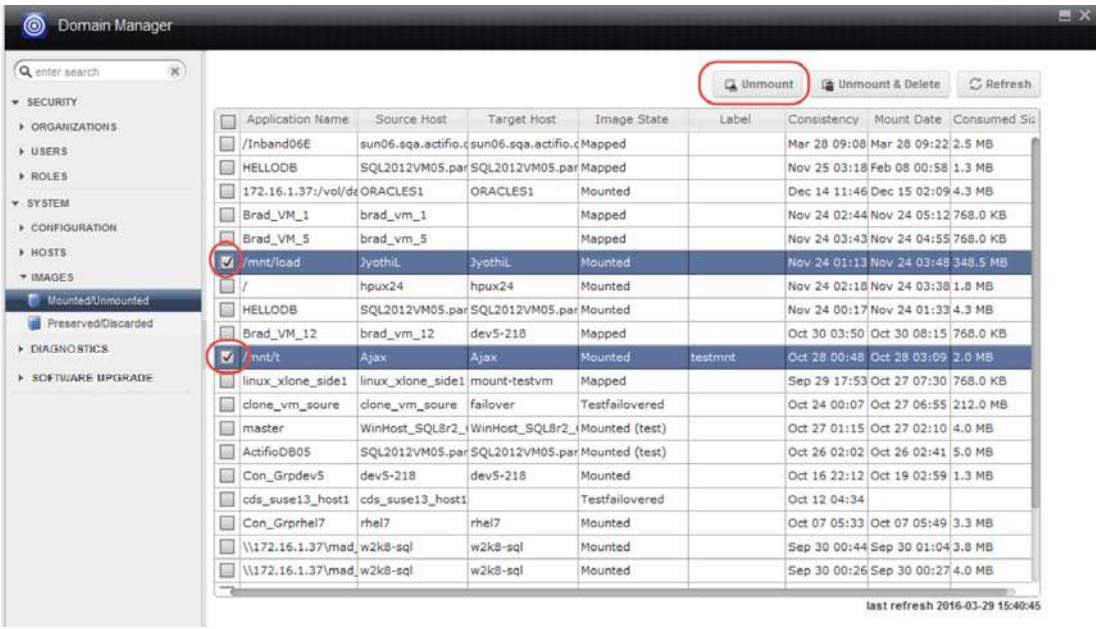


The Global List of Currently Mounted, Unmounted, and Mapped Images

Unmounting an Image

To unmount an image from a host:

1. Open the **Domain Manager** to **Images > Mounted/Unmounted** (in the navigation pane). All mounted and unmounted images are listed.
2. Select a single image or multiple images using the appropriate check boxes.
3. Click **Unmount**.
4. Click **Yes** in the confirmation dialog.
5. Click **Refresh** to refresh the images list.

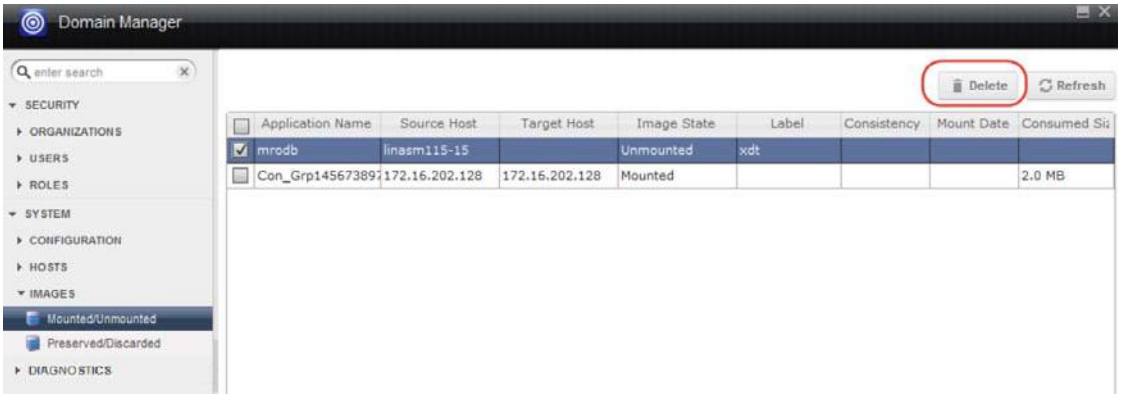


Unmounting an Active Image

Deleting an Unmounted Image

Images take up storage space, so it is a good idea to delete unneeded images. To remove an unmounted image:

1. Open Actifio Desktop to the **Domain Manager**.
2. Click **Images > Mounted/Unmounted** from the navigation pane. All mounted and unmounted images are listed in the right panel.
3. Select a single or multiple images using the appropriate check boxes.
4. Click **Delete**.
5. Click **Yes** in the confirmation dialog.
6. Click **Refresh** to refresh the images list.

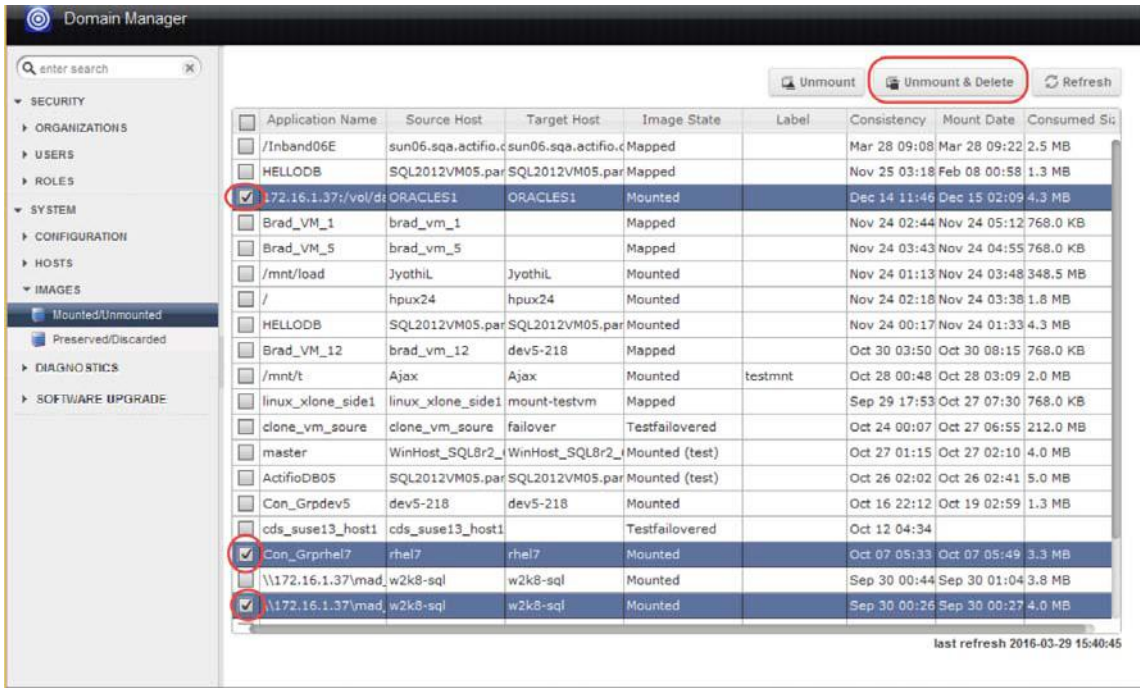


Deleting Unmounted Images

Unmounting and Deleting an Active Image

To unmount and delete a mounted image:

1. Open Actifio Desktop to the **Domain Manager**.
2. Click **Images > Mounted/Unmounted** from the navigation pane. All the Mounted and Unmounted images are listed in the right panel:
3. Select a single or multiple images using appropriate check boxes.
4. Click **Unmount & Delete**.
5. Click **Yes** in the confirmation dialog.
6. Click **Refresh** to refresh the images list.



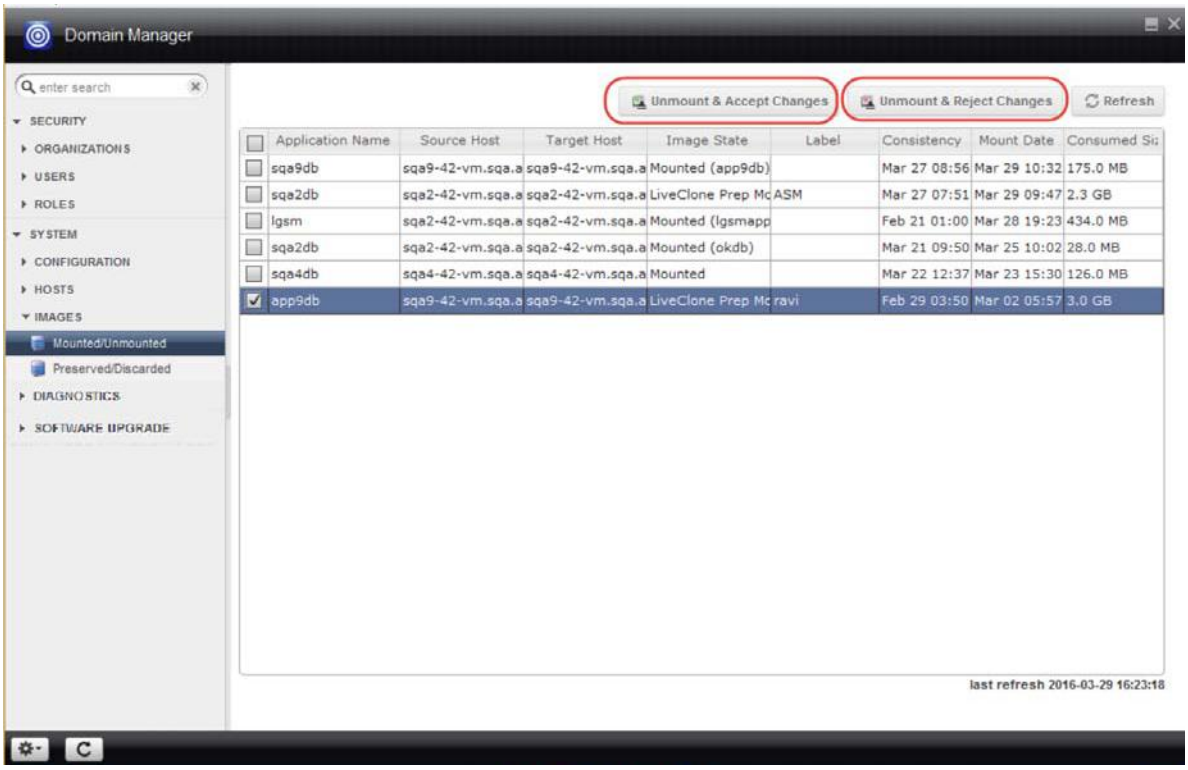
Unmounting and Deleting an Active Image in a Single Operation

Unmount & Accept Changes or Reject Changes to Prep-Mounted LiveClones

LiveClone images permit prep-mounting images for additional preparation work before presenting the prepped LiveClone image to a host.

When you are finished working on a prep-mounted LiveClone image, you can:

- Unmount & Accept Changes
- Unmount & Reject Changes



Unmount and Accept Changes or Reject Changes

15 Working with Preserved Snapshot and Dedup Images

You can display a list of preserved/discarded snapshot and dedup images in the Images section of the Domain Manager.

- From the Preserved Images window you can:
  - View a Preserved Images history to see how many snapshot and dedup images were preserved over a period of a week or a month.
  - Select a single snapshot or dedup image and access this image in the Restore window of the Application Manager.
  - Expire a single image or multiple preserved images.
- From the Discarded Images window you can see a summary of images that have been expired without processing over the past day, week, or month.

You can also monitor Image Preservation status for snapshot and dedup images:

- The Dashboard in the Actifio Desktop displays an Image Preservation status under the System Health widget to inform you of the general status of preserved snapshot images and dedup images.
- The System Monitor displays alerts and warnings specific to image preservation to inform you of different activities that can occur when the Actifio appliance attempts to preserve snapshot images or local dedup images.

This chapter includes the following topics:

- Viewing Preserved Images History on page 98
- Working with Preserved Snapshot and Dedup Images on page 99
- Viewing Discarded Images on page 101
- Monitoring Preserved Image Status in the Dashboard on page 102
- Alerts and Warnings for Image Preservation in System Monitor on page 103

For details on how to modify or disable the application priority settings for preserved snapshots jobs and/or local dedup jobs from the Control Panel in the Domain Manager, see Configuring Image Preservation Priority Setting for Snapshot and Dedup Images on page 82.

Viewing Preserved Images History

You can view a graph that shows how many images were in a preserved state on each day over a selected time period (which can be an interval of either Last Week or Last Month). Data is logged in the Preserved Images History graph on an hourly basis.

To view a history of preserved images:

1. Open the **Domain Manager** to **Images** > **Preserved** (in the navigation pane).
2. Click the **Preserved Images** tab.
3. Click the **Preserved Images History** button. The Preserved Images History graph appears displaying the number of images preserved over the specified time interval. You can:
    - Modify the time interval to Last Week or Last Month. The data will update in the history graph based in the interval selection.
    - Hover over a date in the graph to see the time stamp and number of images preserved on that date.

Preserved Images History Displayed for the Past Month

Working with Preserved Snapshot and Dedup Images

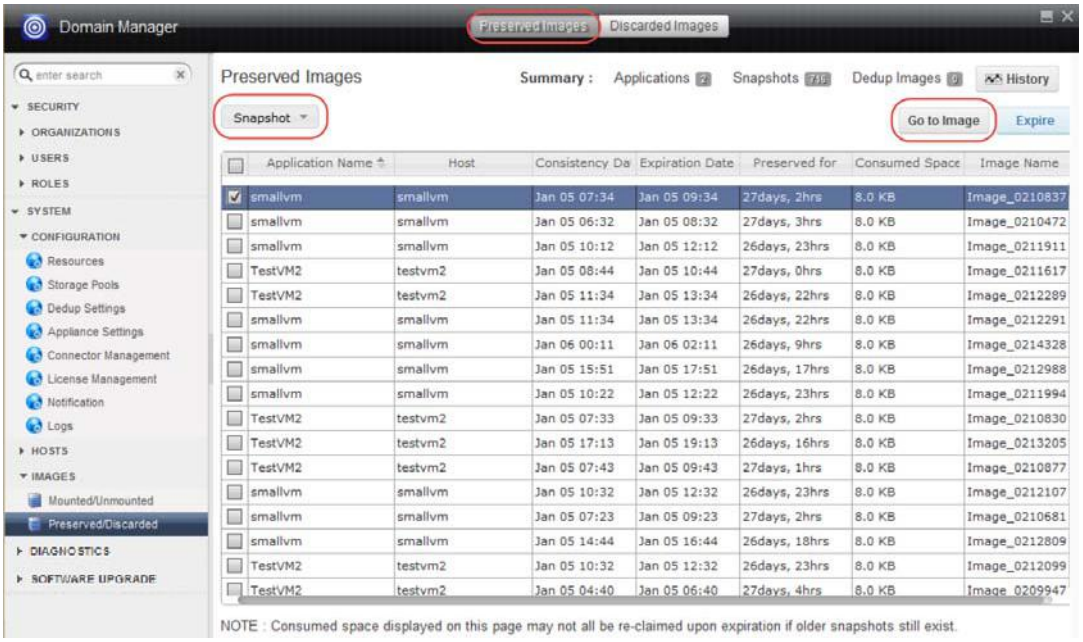
You can choose from the list of preserved snapshot and dedup images and perform the following actions on those images from the Domain Manager:

- Select from the list of preserved images and navigate to that image in the Application Manager.
- Expire one or more selected snapshot or dedup images.

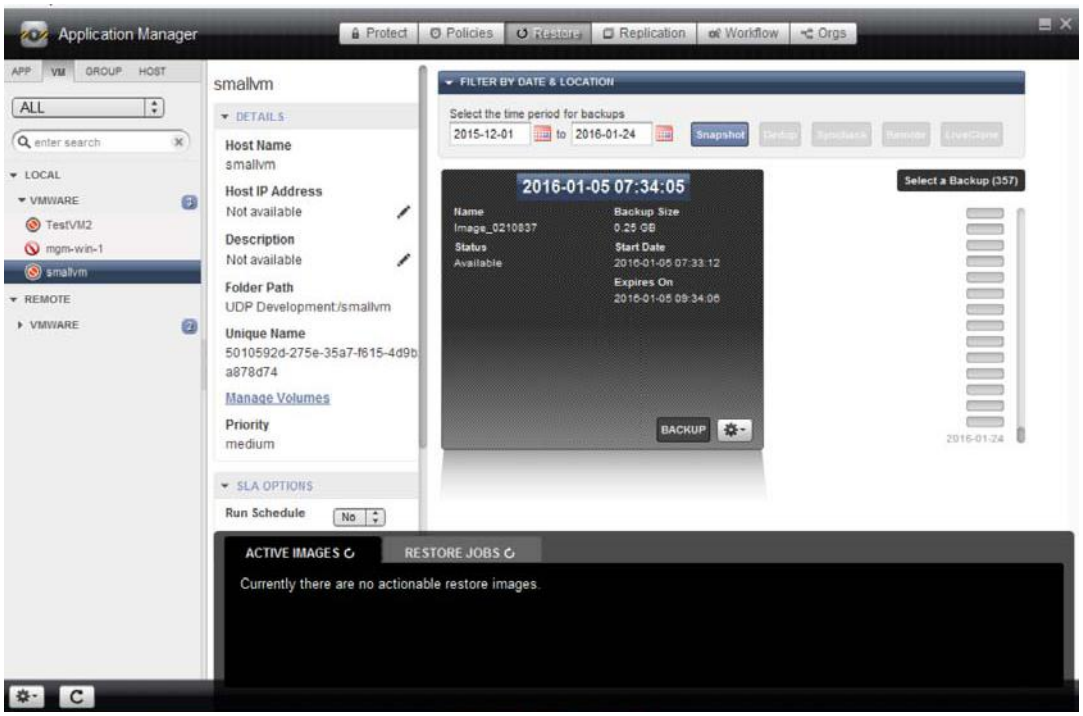
Note: *When expiring snapshots, the amount of space reclaimed may be less than the amount of space consumed by that snapshot. This is due to the common block reference between snapshots. To ensure maximum space reclamation, expire the oldest snapshot first.*

To view a list of all preserved snapshot and dedup images and perform an operation on an image:

1. Open the **Domain Manager** to **Images** > **Preserved** (in the navigation pane).
2. Click the **Preserved Images** tab.
3. Choose **Snapshot** or **Dedup** from the drop-down list in the Preserved Images window. Based on your selection, all preserved snapshot or dedup images are listed.
4. If you want to navigate to a preserved image in the Application Manager, select a single preserved image using the appropriate check box, then click **Go to Image**. The preserved image appears in the Restore window of the Application Manager.



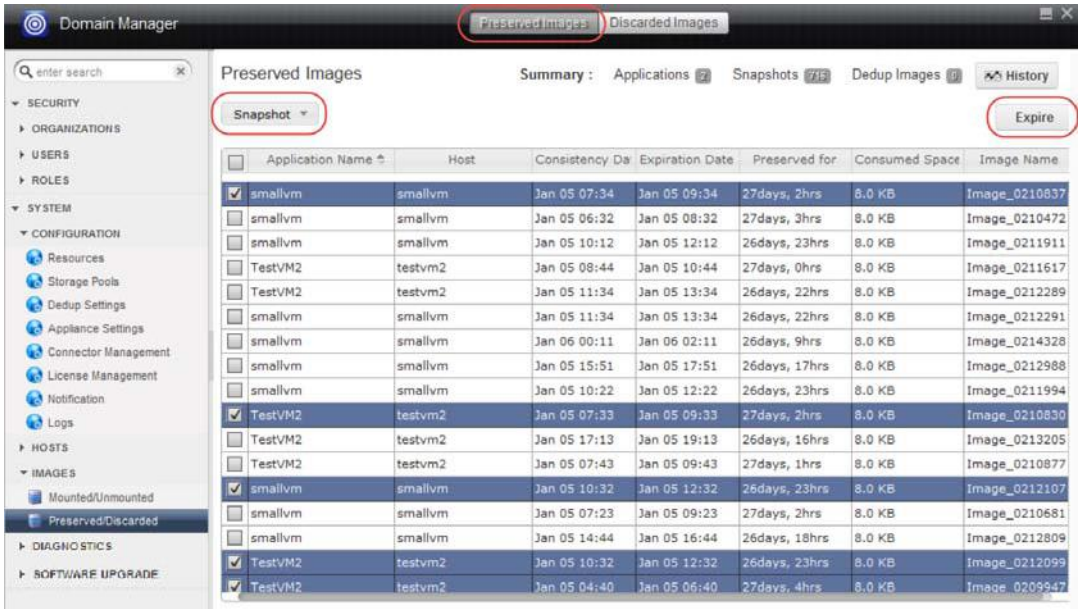
Selecting a Preserved Image to Open in the Restore Window



Displaying the Preserved Image in the Restore Window of the Application Manager

5. If you would like to manually expire one or more older preserved images, select a single image or multiple images using the appropriate check boxes, then slick **Expire**.

   A confirmation dialog appears instructing you that not all of the space consumed by this image will be reclaimed and that a best practice is to expire the oldest snapshot image first for maximum space reclamation. Click **OK** to proceed with the preserved image expiration.



Expiring Multiple Preserved Snapshot Images

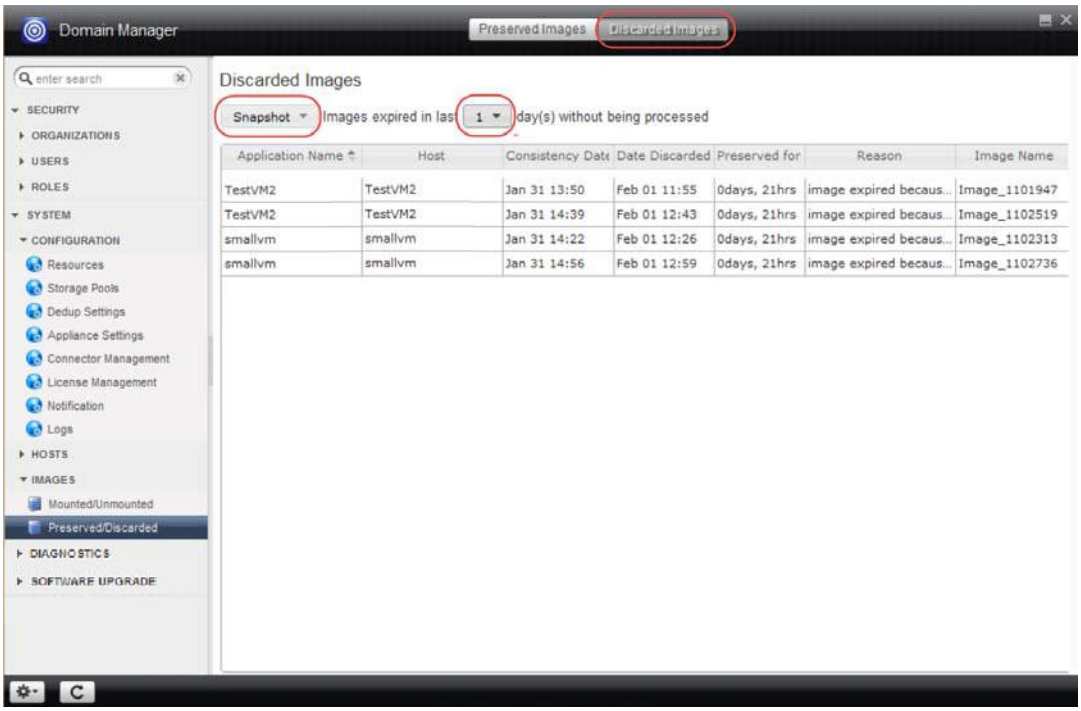
Viewing Discarded Images

Preserved images will automatically be expired and discarded when pool space or VDisk count reaches the warning threshold levels set in the Domain Manager. In this case, images are expired based on application priority and age. Images for applications with lower priority will be expired ahead of applications with higher priority. Within a priority level, older images will be expired before newer images.

From the Discarded Images window, you can see a summary of images that have been expired over the past day, week (7-day interval), or month (30-day interval) along with the reason for discarding the image. This window also includes images that have been manually expired prior to processing.

To view the images discarded without processing by the Actifio appliance as follows:

1. Open the **Domain Manager** to **Images** > **Preserved** (in the navigation pane).
2. Click the **Discarded Images** tab.
3. Choose **Snapshot** or **Dedup** from the drop-down list in the Discarded Images window. Based on your selection, all expired snapshot or dedup images are listed.
4. Change the time window of discarded images listed by making a selection from the drop-down list in the Discarded Images window. You can choose to view discarded images over the past 1 day, 7 day, or 30 day interval.



Viewing All Discarded Snapshot Images Over the Past 1 Day Period

Monitoring Preserved Image Status in the Dashboard

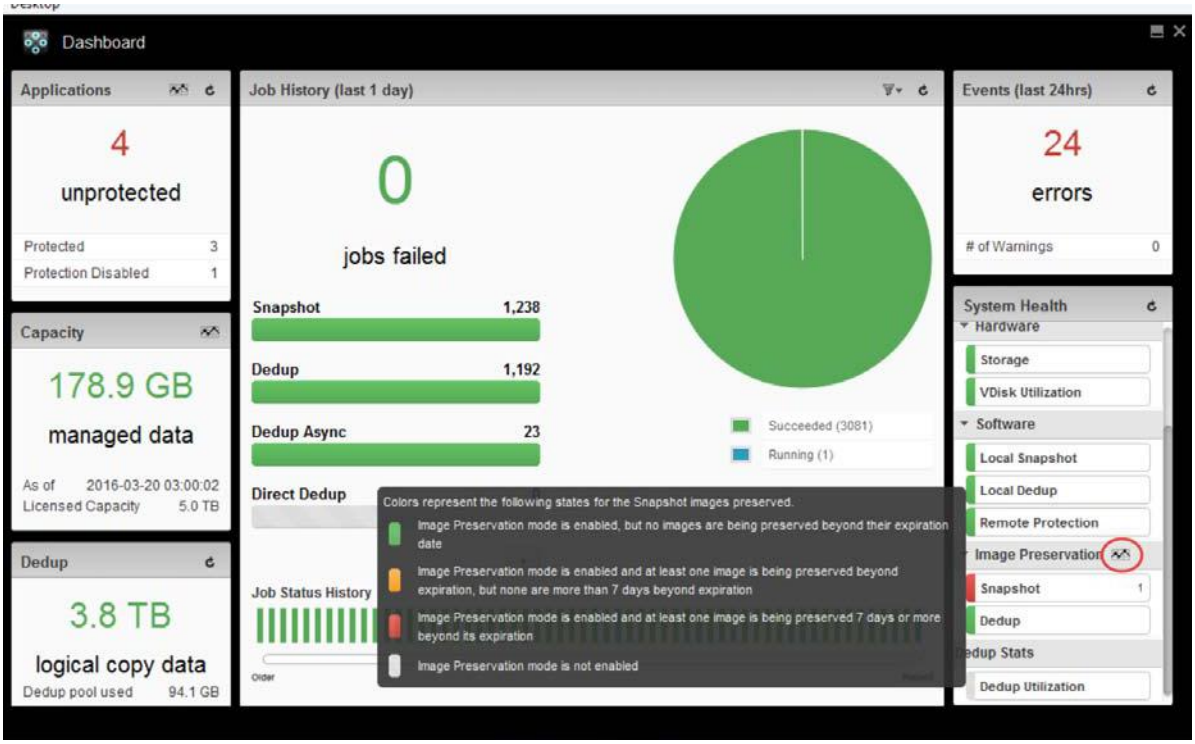
The Dashboard in the Actifio Desktop includes Image Preservation status under the System Health widget to inform you of the general status of preserved snapshot images and dedup images.

> ***Note:*** *See* ***Using The Actifio Dashboard*** *in the Actifio Documentation Library for additional details about the Actifio Dashboard and the System Health widget.*

Image Preservation states include:

- Image Preservation is enabled, and one of the following conditions exists:
  - Green = No images are being preserved beyond their expiration date.
  - Yellow = At least one image is being preserved beyond expiration but no images are more than 7 days beyond expiration (yellow).
  - Red = At least one image is being preserved beyond expiration and at least one image is more than 7 days beyond expiration (red).
- Image Preservation Mode is not enabled (gray).

The Image Preservation History button ( ) opens a chart that shows how many images were preserved on each day over the selected time period (which can be an interval of either Last Week or Last Month). This is the same chart that appears from the Preserved Images tab in the Domain Manager (see Viewing Preserved Images History on page 98)



Viewing Preserved Images Status in the Dashboard

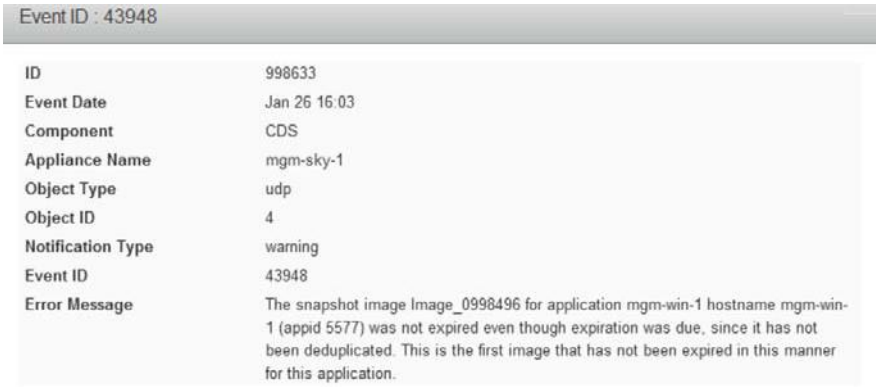
Alerts and Warnings for Image Preservation in System Monitor

This section outlines the various alerts and warnings related to image preservation.

Warning Level Alert: First Time the Snapshot Expiration Window is Reached

A Warning level alert is generated (and posted to the event log) the first time a snapshot that is eligible for expiration is held for pending processing. A similar Warning level Alert also occurs for remote deduplication of local dedup images.

This Warning level alert is generated for the first snapshot for each application that has its expiration deferred. When the count of deferred expirations for an application goes to zero, the Warning alert trigger is reset. The next time there is a dedupable snapshot image that is held by the Actifio appliance an alert will be posted again. An example of this particular Warning alert message is shown below:



Warning Level Alert: Snapshot Image Expired Because Threshold Limit Exceeded

When an application has preserved snapshots, and a dedupable snapshot is expired because the Actifio appliance has exceeded the threshold limits (such as VDisk count or pool capacity), a Warning level alert indicating this condition is posted. This warning will be logged only for the first snapshot expired due to this situation. The same requirement applies to local dedup images with regard to remote dedup replication.

Below is a summary of the Warning thresholds for VDisk and storage pools as specified in the Domain Manager:

- The Warning threshold for VDisks usage is 90%. The VDisk limit for the Actifio CDS appliance is 2048, and for the Actifio Sky appliance the VDisk limit varies with the installed capacity license (1000, 3000, or 5000 VDisks).
- The Warning level is 80% for the snapshot pool and 75% for the dedup pool. The default value is 90% for the snapshot and primary pools.

Daily Warning Level Event: Deferred Expirations for Snapshots

A daily warning level event is generated when there are deferred expirations for snapshots. This daily warning includes a count of images for which expiration was deferred because these images are all candidates for deduplication. An example of such an daily warning level event is shown below:

```
The number of images not expired awaiting further processing is 2 images (2 snapshots, 0 dedups)
from 1 unique applications. 2 snapshots and 0 dedups were added in the last period of 24 hours.
```

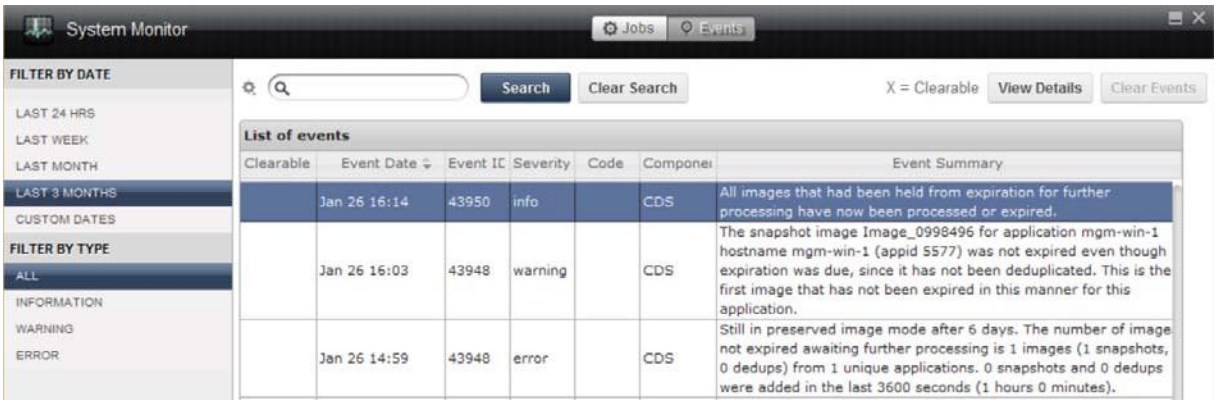
Daily Warning Level Event: Deferred Expirations Because Threshold Limit Exceeded

A daily warning level event is posted when a number of images that had deferred expirations were expired because the Actifio appliance has exceeded the threshold limits (such as VDisk count or pool capacity). The message includes a count of images expired in this fashion. An example of such an event is shown below:

```
The number of images awaiting further processing that had to be discarded is 5 images (3
snapshots, 2 dedups) from 3 unique applications in the last period of 24 hours.
```

Warning Level Alert: All Preserved Images Have Been Processed

When the number of preserved images drops to zero, the following alert is posted in the System Monitor:



System Monitor -- Event Page with All Preserved Images Have Been Processed Event

Weekly Error Level Event: Images Deduplicated or Remotely Replicated After 7 Days

When there are images that have not been deduplicated or remotely replicated for a period of 7 days, a weekly error level event of severity Error is raised. When the 7th day is reached an alert will be generated to inform you that the Actifio appliance has been in Preserve Image Mode for 7 days.

System Monitor -- Event Page with Alert That Appliance Has Been in Preserve Mode for x Days

16 Using Diagnostic Tools

The Actifio appliance provides three sets of diagnostic tools in the Diagnostics section of the Domain Manager:

Charts on page 105

System Load on page 116

SSD Device Status Monitoring on page 119

Charts

The Actifio appliance includes a suite of diagnostic charts to help you keep your Actifio appliance running efficiently. Information from the diagnostic charts can help you to plan changes to your Actifio appliance and to identify problems and potential problems with your appliance.

To display the diagnostic charts, open the **Domain Manager** to **Diagnostics** > **Charts**.

Dedup - Average Number of Jobs Graph in Charts Window, Shown for 7-Day Interval

Selecting a Graph

From the **Select a graph** drop-down list you can select from the following diagnostic information to display as a graph in the Charts window

This section describes the following graphs in the Charts window:

- Dedup - Ingested Data on page 106
- Dedup - Disk IOPS on page 107
- Dedup - Disk Throughput on page 108
- Dedup - Average Number of Jobs on page 109
- Dedup - System Load on page 110
- Snapshot - Disk IOPS on page 112
- Snapshot - Disk Throughput on page 112
- VDisk Count on page 113

Note: *The Dedup - Disk IOPS and Dedup - Disk Throughput graphs are only available for the Actifio CDS appliance.*

Dedup - Ingested Data

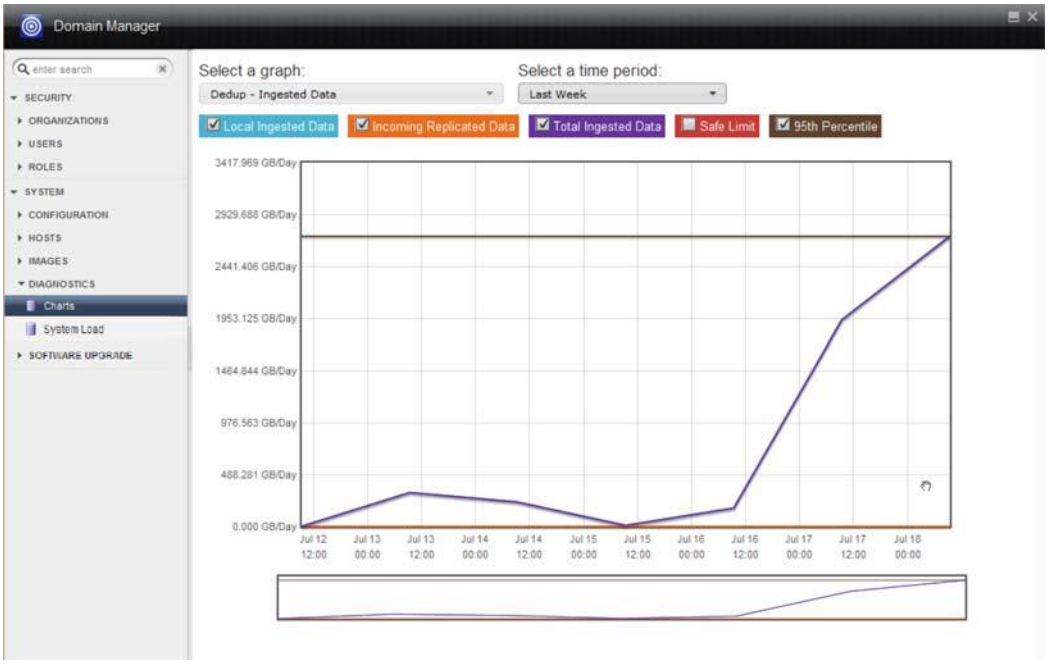
The dedup engine is capable of handling ~4TB of data daily, and the total of the local ingested data and the incoming replicated data is displayed in the Dedup - Ingested Data graph to track the ingest load on the dedup engine. The Actifio appliance queries the dedup engine every 15 minutes for the amount of data ingested (both local and incoming remote replication data), and the Actifio appliance maintains a month's worth of the ingested data.

You can display data in the graph by using the following selections:

- **Local Ingested Data TB/day** - Amount of local data ingested by the dedup engine, in TB/day.
- **Incoming Replicated Data TB/day** - Amount of incoming replicated data ingested by the dedup engine, in TB/day.
- **Total Ingested Data TB/day** - Total amount of data ingested, including the incoming local and remote replication data, in TB/day.
- **Safe Limit** - Typical value of the total ingest below which the Actifio appliance is expected to operate without SLA impact. For the Actifio CDS appliance, the safe limit is defined as 4TB/day. For the 30TB and 50TB models of Actifio Sky appliance, the safe limit is defined as 2TB/day. The Safe Limit is displayed for the past 7 and 30 days.

  Note: *This metric is not defined for the 1TB, 5TB, 10TB, and 20 TB models of Actifio Sky appliance.*

- **95th Percentile** - Calculated for the average daily ingested data for the past 7 and 30 days, where 95% of the data is below this value within the specified timeframe. A dataset is created with the average ingested data for the past *x* days.

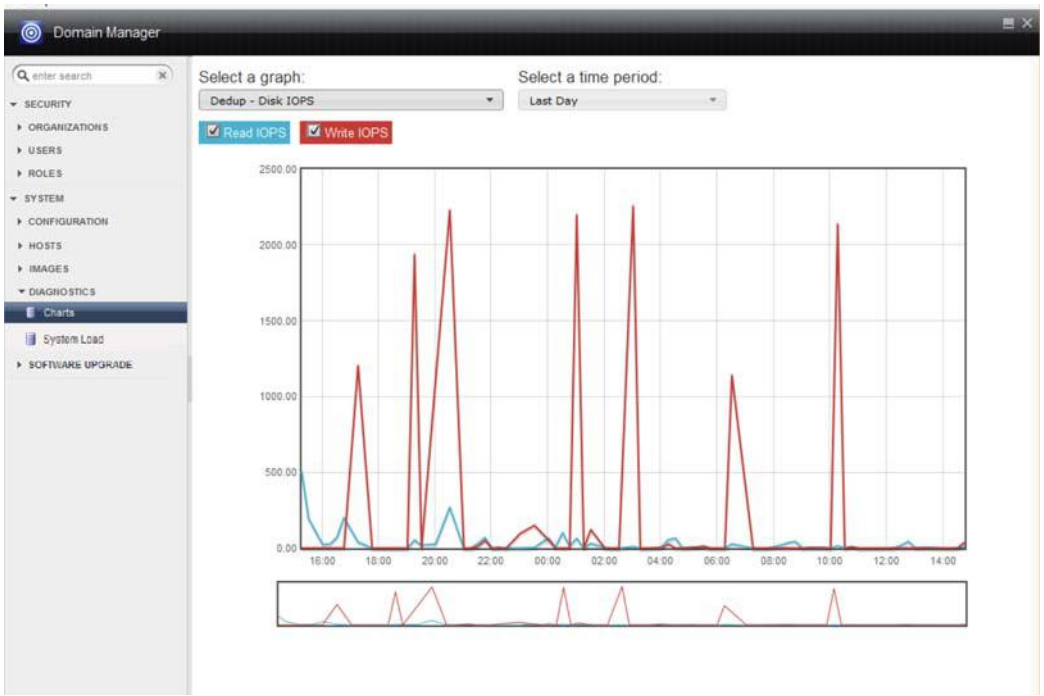


Dedup - Ingested Data Graph

Dedup - Disk IOPS

Note: *The Dedup - Disk IOPS graph is only available for the Actifio CDS appliance.*

The disk I/O per second required by the dedup engine (read and write activities). You can display data in the graph by Read IOPS, Write IOPS, or both selections.



Dedup - Disk IOPS Graph

Dedup - Disk Throughput

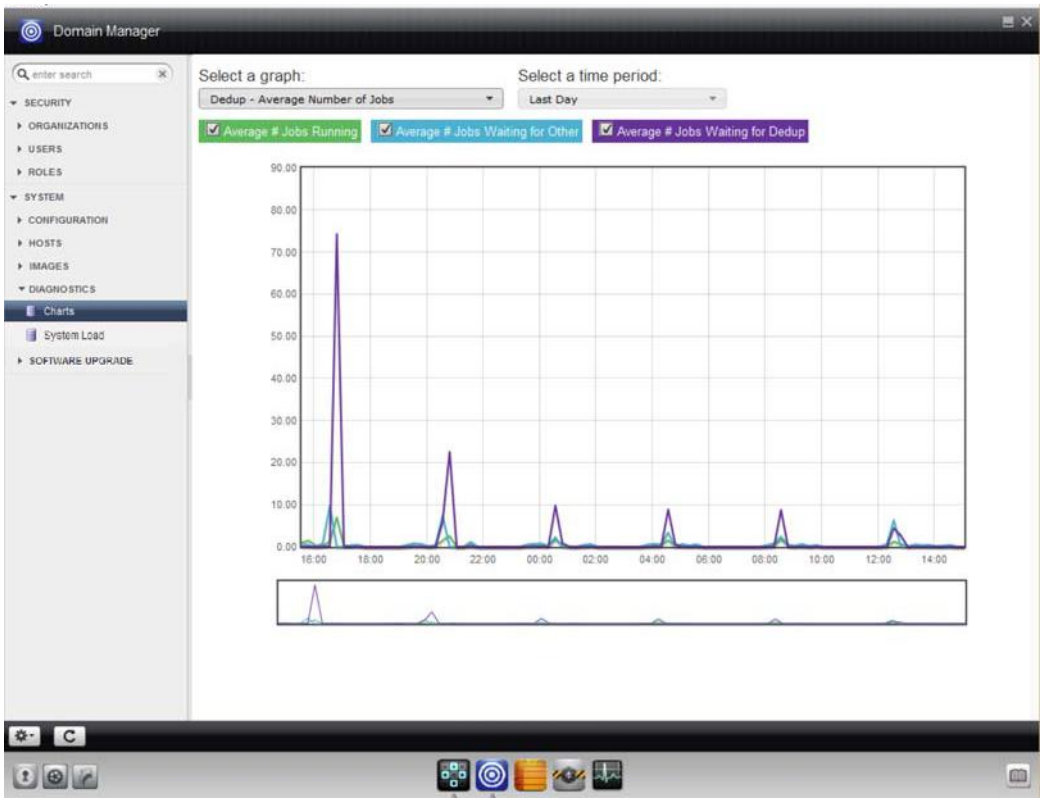
Note: *The Dedup - Disk Throughput graph is only available for the Actifio CDS appliance.*

The logical amount of data replicated by the dedup engine, in KB/sec. You can display data in the graph by Read KB/s, Write KB/s, or both selections.

Dedup - Disk Throughout Graph

Dedup - Average Number of Jobs

The jobs/sec relative to the capacity measured by the number of cores assigned in the dedup engine. You can display data in the graph by Average Number of Jobs Running, Average Number of Jobs Waiting for Other, Average Number of Jobs Waiting for Dedup, or all three selections.



Dedup - Average Number of Jobs Graph

Dedup - System Load

The dedup engine has its own scheduler, and jobs are issued to the dedup engine as subjobs (one subjob per volume). The dedup scheduler has a limit of the amount of subjobs that can run at one time, which is the dedup engine slot limit (one slot requires one subjob). Subjobs can be spawned to service data movement jobs (for example, dedup jobs, backup jobs, restore jobs, replication jobs, on-demand jobs, and so on) or background maintenance tasks (GC, sweep, and so on). The dedup scheduler prioritizes the allocation of slots to data movement jobs over background jobs.

The number of dedup engine slots controls the number of maximum parallel transactions (MPT) that can occur to the dedup engine at any given point in time. The Actifio CDS appliance and all models of Actifio Sky appliance (Sky-1, Sky-5, Sky-10, Sky-30, and Sky-50) support a maximum load of 16 dedup engine slots.

The Actifio appliance calculates system load as a means to help you determine the amount of load on the dedup engine and to assist you in better understanding when the dedup engine becomes overloaded. This information also helps you determine whether your Actifio appliance still has capacity for additional dedup throughput.

In the graph you can view system load data based on:

- Actifio appliance running data movement jobs: displayed as Data Movement Load in the graph.
- Dedup engine slots utilized by background system tasks: displayed as Background Load in the graph.

Note: *The Actifio appliance queries the dedup engine every 15 minutes for the system load metrics, and the appliance can maintain a month's worth of system load data based on the user jobs in the database.*

You can display data in the graph by using the following selections:

- **Data Movement Load** - The average of dedup engine load utilization samples due to user-initiated jobs (such as backup jobs, restore jobs, replication jobs, and on-demand jobs). Samples are collected every 15 minutes over a period of time to calculate the data movement load. For example, for a 24-hour time period, this would result in 96 average data points. For the operational management of an Actifio appliance, the best practice recommendation is for the Data Movement Load not to exceed the Safe Limit.

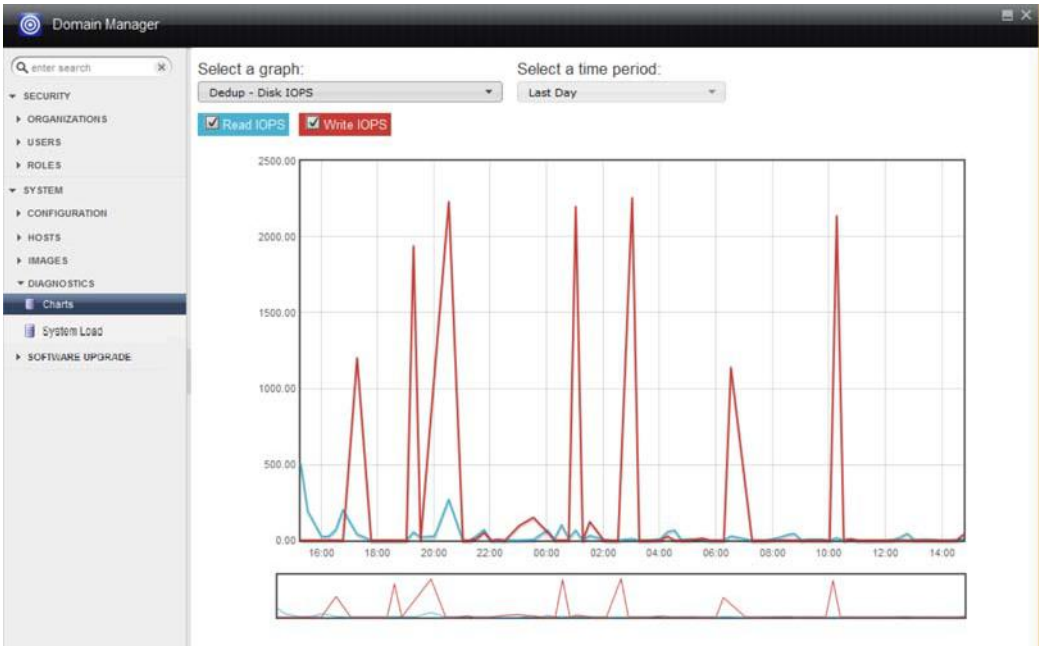
  Note: *The Data Movement Load and Background Load lines are overlayed in the Dedup - System Load graph.*

- **Background Load** - The average of background load utilization samples due to system tasks (such as GC, sweep, and so on). Samples are collected every 15 minutes over a period of time to calculate the background load. For example, for a 24-hour time period, this would result in 96 average data points.
- **Safe Limit** - The dedup engine utilization at which the Actifio appliance is expected to operate without SLA impact. The safe limit is less than or equal to 60 percent of the Dedup Max Load for an Actifio appliance. For example, for the Actifio CDS appliance, the safe limit would be 9.6, which is 60% of a Dedup Max Load of 16.
- **95th Percentile** - Calculated for the average daily ingested data for the past 7 and 30 days, where 95% of the data is below this value within the specified timeframe. The 95th Percentile applies only to user-initiated jobs (Data Movement Load).

Dedup - System Load Graph

Snapshot - Disk IOPS

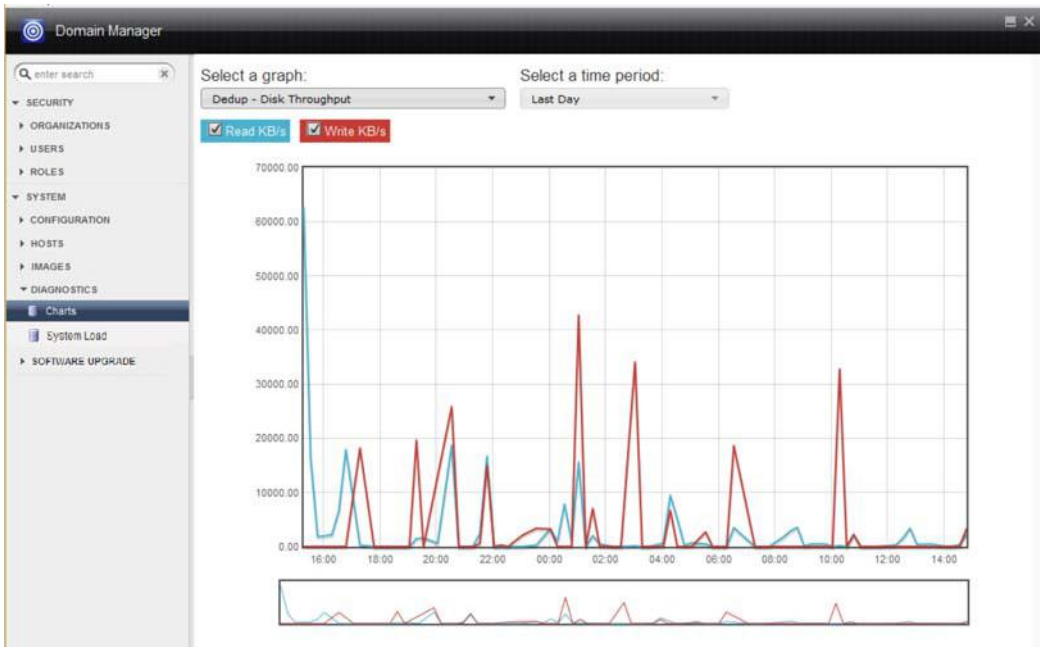
The disk I/O per second required by snapshots (read and write activities). You can display data in the graph by Read IOPS, Write IOPS, or both selections.



Snapshot - Disk IOPS Graph

Snapshot - Disk Throughput

The logical amount of data required for snapshots, in KB/sec. You can display data in the graph by Read KB/s, Write KB/s, or both selections.



Snapshot - Disk Throughout Graph

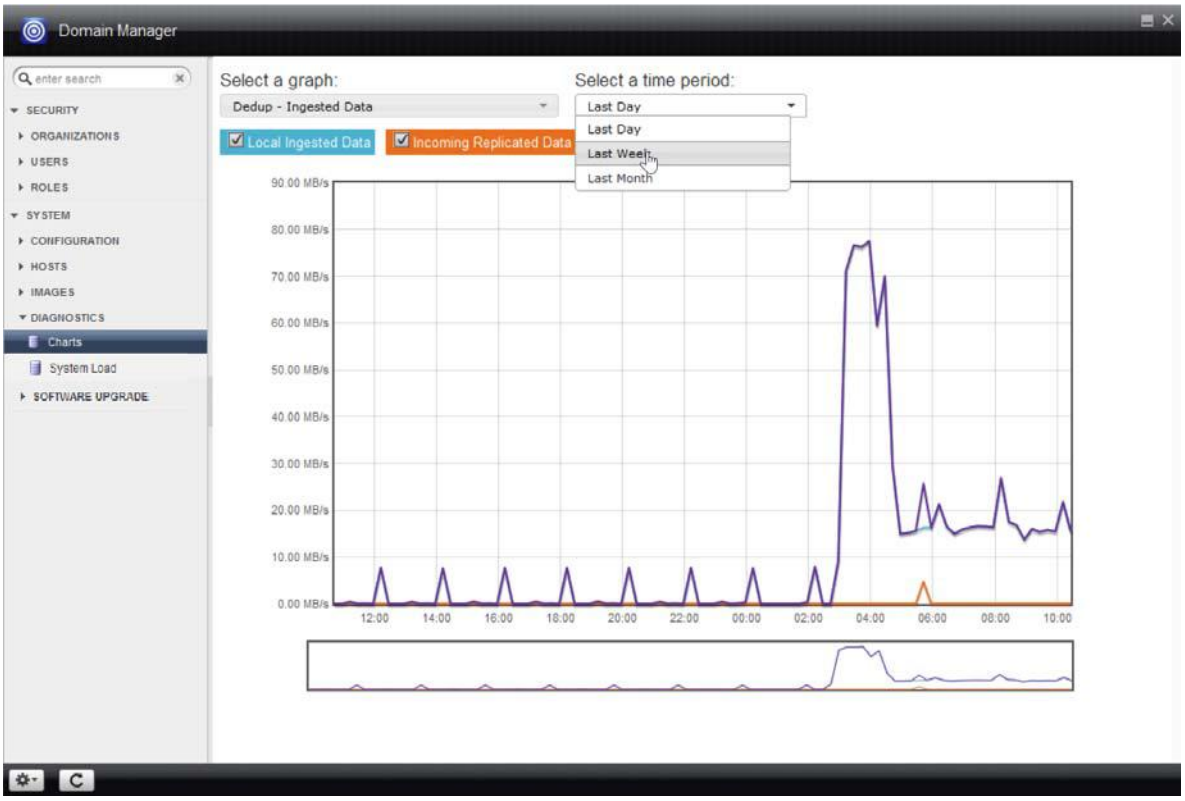
VDisk Count

A count of the SVC VDisks every 15 minutes.

VDisk Count Graph

Selecting a Time Period for the Graph

From the **Select a time period** drop-down list you can select the past day, week, or month to display the data in the associated graph.



Changing the Time Period for a Graph

Zooming an Area in the Graph

Use the zoom display below the selected graph to expand on a particular period of time. To zoom:

- Click-drag within a desired time period in the zoom display to select the view area. You can repeat this process for different time intervals in the display.
- To revert back to the normal chart display, click anywhere within the zoom display.

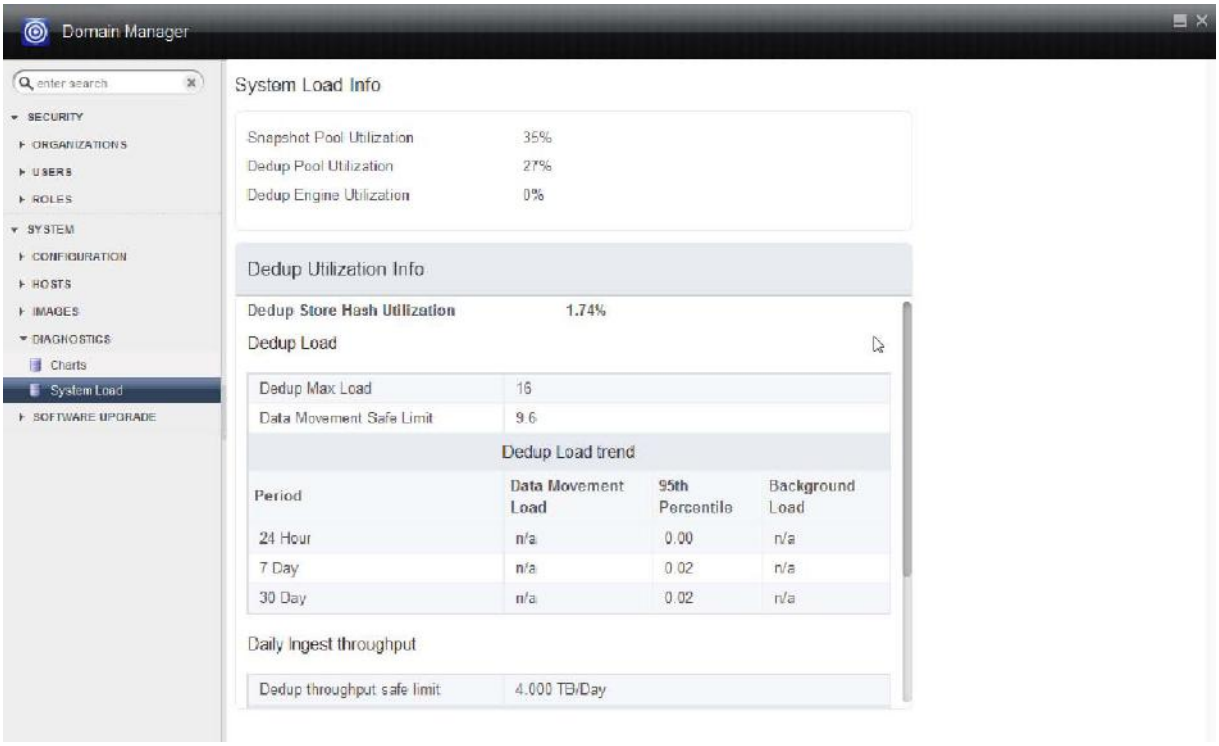
Selecting a View Area in a Diagnostics Graph

System Load

The System Load window displays statistics related to the system-related load on the dedup engine in your Actifio appliance. This information is intended to help you better determine the load on the Actifio appliance as well as the maximum dedup load demands on the dedup engine. System load statistics are intended to help you be able to make an informed decision on the amount of load on the dedup engine and whether you can continue to ingest additional applications based on the system load analysis.

To display the System Load window, open the **Domain Manager** to **Diagnostics** > **System Load**.

Note: *You can also retrieve dedup load statistics by using the following Actifio appliance CLI commands:* ***udsinfo getdedupstats****,* ***udsinfo getdedupsafelimits****, and* ***udsinfo lsdeduploadstat.*** *You can find this information in the* ***Actifio CLI Reference*** *included in the Actifio Documentation Library with this Actifio appliance.*



System Load Window and Associated Dedup Engine Statistics

System Load Statistic	Description
System Load Info	
Snapshot Pool Utilization	Capacity utilization of the Snapshot pool.
Dedup Pool Utilization	Capacity utilization of the Dedup pool.
Dedup Engine Utilization	Average value that indicates the level of dedup engine utilization by data movement job over a 30-day interval. This value is expressed as a percent of the Data Movement Safe Limit (see below).
Dedup Utilization Info	
Dedup Store Hash Utilization	The level of utilization of the dedup index (shown as a percentage) associated with the dedup engine. A high percentage indicates a heavily utilized dedup index which can impact system performance.
Dedup Load	Details on how the dedup engine is being utilized by the Actifio appliance.
Dedup Max Load	The maximum load that the dedup engine can support at a given point in time. The Actifio CDS appliance and all models of Actifio Sky appliance (Sky-1, Sky-5, Sky-10, Sky-30, and Sky-50) support a Dedup Max Load of 16.
Data Movement Safe Limit	The Data Movement Safe Limit is less than or equal to 60 percent of the Dedup Max Load for an Actifio appliance. For example, for the Actifio CDS appliance, the safe limit would be 9.6, which is 60% of a Dedup Max Load of 16. ***Note:*** *If the average slot utilization is greater than the safe limit for the Actifio appliance, then this is a good indicator that the Actifio appliance may be overloaded. An appliance with a dedup load that is consistently over the Data Movement Safe Limit is at a higher risk of experiencing SLA violations.*
Dedup Load Trend	Summary table of the dedup engine load over a period of time. Displays the Data Movement Load, 95th Percentile, and Background Load of Dedup Slot Utilization data for the past day (24-hour interval), week (7-day interval), and month (30-day interval). • **Data Movement Load** - The average of data movement slot utilization samples due to user-initiated jobs (such as backup jobs, restore jobs, replication jobs, and on-demand jobs). • **95th Percentile** - Calculated for the average daily ingested data for the past 7 and 30 days, where 95% of the data is below this value within the specified timeframe. The 95th Percentile applies only to user-initiated jobs (Data Movement Load). • **Background Load** - The average of background slot utilization samples due to system tasks (such as GC, sweep, and so on).

System Load Statistic	Description
Daily Ingest Throughput	
Dedup Throughput Safe Limit	The maximum dedup engine ingest rate (the daily ingest safe limit), which defines how much data is being ingested into the dedup pool. This is the typical value of the total ingest below which the Actifio appliance is expected to operate without SLA impact. For the Actifio CDS appliance, the safe limit is defined as 4TB/day. For the 30TB and 50TB models of Actifio Sky appliance, the safe limit is defined as 2TB/day. The Safe Limit is displayed for the past 7 and 30 days. ***Note:*** *This metric is not defined for the 1TB, 5TB, 10TB, and 20 TB models of Actifio Sky appliance.* If the average dedup ingest is greater than the safe limit for the Actifio appliance, this is a good indicator of the amount of load on the dedup engine. An appliance with a daily ingest rate that is consistently over the Dedup Throughput Safe Limit is at a higher risk of experiencing SLA violations.
Dedup Ingest Throughput Trend	Summary table of the daily dedup engine ingest throughout over a period of time. Displays the Moving Average and the 95th Percentile value of the Dedup Ingest data for the past day (24-hour interval), week (7-day interval), and month (30-day interval).

SSD Device Status Monitoring

The solid-state drive (SSD) memory in your Actifio CDS appliance improves dedup performance. SSD devices can degrade over time. The SSD window allows you to review the status and expected remaining life of the SSD drives in your Actifio appliance.

Note: *SSD Device Status is not applicable for the Actifio Sky appliances.*

The status of the SSD drives is color-coded:

Green: The SSD drive is in use.

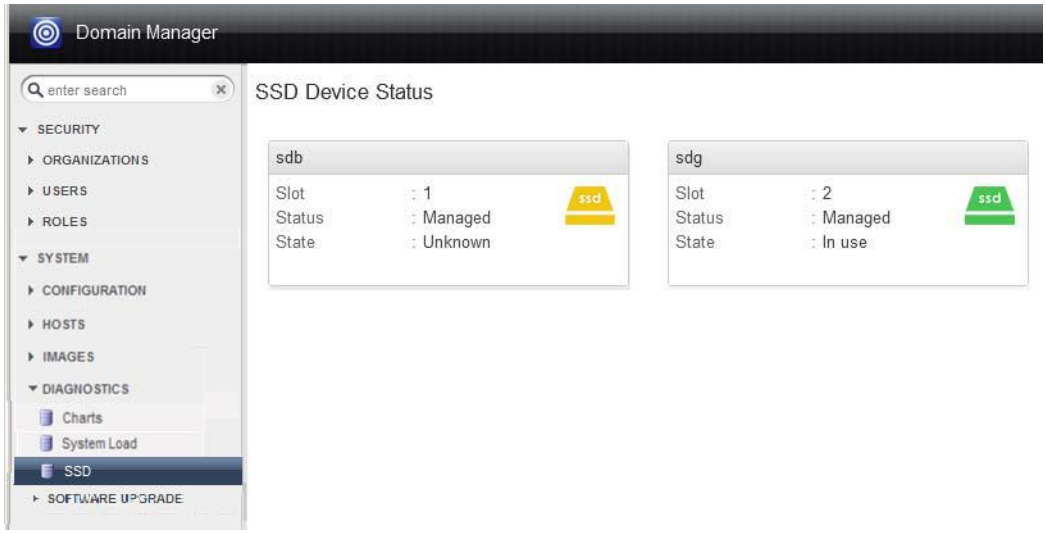
Yellow: The SSD drive is installed and pending activation by Actifio Support.

Blue: The SSD drive is not in use. The drive may be full.

Red: The SSD drive is installed, but errors exist.

Gray: The SSD drive is installed, but not managed by Actifio Sky appliance

Note: *If any SSD icon is not green, or if any SSD device has less than 50% remaining life, Contact Actifio Support.*



SSD Device Status

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