

# EMC AVAMAR 7.3: NEW BACKUP FORMAT FOR VMWARE VIRTUAL MACHINES

Improve replication time and reduce network traffic by using the OPTIMIZED FOR PERFORMANCE format

## ABSTRACT

This technical note describes the new Optimized for Performance backup format for the release of EMC® Avamar® 7.3. It details how the new backup format can improve performance, information that Avamar administrators should consider, and instructions on how to transition to the new backup format.

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## EXECUTIVE SUMMARY

Avamar 7.3 implements a new backup format, called Optimized for Performance, which provides improvements when you back up VMware virtual machines by using Changed Block Tracking (CBT) and replicate data to an EMC Data Domain® system. Administrators should see a reduction in replication time and network traffic at the expense of additional storage consumption. Depending on the environment, reductions in Data Domain CPU and I/O utilization can lead to improvements in backup times and the number of available Data Domain system streams.

New Avamar deployments use the Optimized for Performance backup format by default. Existing deployments will continue to use the current backup format, now called Optimized for Capacity. Avamar 7.3 defaults to the Optimized for Performance backup format to align with the data protection performance needs required by enterprise customers. While this data format results in a small increase in storage capacity usage, the resulting performance gains for backup, restore, and replication operations outweigh the cost.

Administrators interested in using the new backup format will need to manually transition virtual machines to the new backup format by using the procedures in this technical note. Both backup formats can coexist on the same server when backing up different virtual machines.

## AUDIENCE

This technical note is intended for backup administrators or technical staff seeking a more in-depth look at the Optimized for Performance backup format or how to enable backups using the new backup format. The paper assumes that the reader has a general understanding of Avamar, the Avamar management console, Data Domain, and VMWare.

## INTRODUCTION

With the release of Avamar 7.3, Avamar administrators have the option to move existing deployments to the new Optimized for Performance backup format. This technical note explains the advantages of using the new backup format, provides important considerations for administrators, provides instructions that describe how to enable the new backup format, and provides information on changing the global default backup format for the entire system. Note that Optimized for Performance requires DDOS 5.7 or later and DDBOOST 3.2 or later.

EMC recommends that you use Optimized for Performance for new deployments and new virtual machines. This provides significant performance gains for an additional storage cost. Both backup formats may coexist on a single Data Domain and the backup format may be chosen system-wide or individually for each virtual machine.

All existing deployments have backups that were created by using the Optimized for Capacity backup format. Customers must make the decision to switch to the Optimized for Performance backup format based on their individual environments, utilization, and other factors. Once you choose the backup format for a virtual machine, changing formats requires consideration described below.

## OPTIMIZED FOR CAPACITY

Typically, the Avamar algorithm eliminates redundancy by filtering backup data into variable-length sub-file data segments. The algorithm analyzes the backup data to find natural markers and then computes the ideal segment boundaries before determining if the data segment should be sent across the network to the Data Domain server.

This process provides for efficient deduplication even when data shifts within or across virtual machines. It can also recognize commonality between data stored on different virtual machines. VMware's native CBT blocking may not align well with the variable segments used by this backup format.

When Avamar replicates the backup data between a source Data Domain and a target Data Domain, the source sends the target a set of fingerprints that uniquely identify each data segment. The target uses the fingerprints to determine if the data segments already exist or if the source should supply them over the network. Avamar performs these operations for each data segment and synthesizes a virtual full backup from each incremental backup.

## OPTIMIZED FOR PERFORMANCE

Changing a virtual machine to the Optimized for Performance backup format begins with making a new full level-zero backup to serve as the starting point for subsequent backups. At first replication, the source transfers this initial backup to the target and both systems now have a common base. When the next backup of that virtual machine begins, the source creates a fastcopy of the previous backup. The source uses CBT to process new data from the virtual machine and then overwrites the appropriate data segments in the fastcopy in order to create a current backup. The source now has two stored backups.

During the next replication, the source ensures that the target has the same previous backup and then performs a fast comparison between the current and previous backups to identify all changed data segments. If any changes are detected, the source consults the target to see if it has a local copy of any changed data segment (for example, after backing up another virtual machine). The changed data segment is copied to the target if it does not already exist.

The primary advantage of using the new backup format is increased replication performance. Using fastcopy places a smaller load on the source Data Domain, reduces replication time, and produces less network traffic during replication. VMWare's native CBT blocking aligns well with the Data Domain segmentation mode selected for the Optimized for Performance backup format.

Customers may also see a reduction in the time required to complete a backup, provided that there are no bottlenecks in reading changes from storage. Lower Data Domain CPU and I/O utilization on the source and target may also enable the use of more streams in cases where the system was becoming saturated, though the overall stream limit remains unchanged.

The practical impact to the system will depend on the type of data stored on your virtual machines, but in general, the Optimized for Capacity backup format provides better deduplication than Optimized for Performance. EMC expects the additional storage utilization on the Data Domain server to be approximately 10% when averaged over a large number of virtual machines, with datasets for various use cases. The impact for any particular virtual machine may be much lower or higher than the average.

## PLANNING FOR THE TRANSITION

If you are satisfied with the current performance of your environment, you can continue to operate using the Optimized for Capacity backup format.

Your environment may be a good candidate to make the transition to the new backup format if you understand the storage impact described later and any of the following cases are true:

- You do not replicate backups to another Data Domain system, but encounter issues such as workloads exceeding the backup window, and wish to gain a small increase in performance,
- You replicate backups across a slow network link, are unhappy with performance or cannot complete the replication in the available time, and cannot acquire a faster link,
- You are unhappy with current replication performance or are in a less than optimal mode,
- You replicate backups to another Data Domain system, have a reasonable amount of available storage, and wish to slowly transition to the new backup format, or
- Your site retains backups for a short period, such as 15 or 30 days.

If you retain backups of some virtual machines for long or indefinite periods, such as more than one year, those virtual machines are not good candidates for transition. However, you may still have other virtual machines that are good candidates for the new backup format.

## BEFORE THE TRANSITION

Performance improvements with the new backup format will depend on the backup data change rate and change distribution, as well as the ability of the storage system to read changed data at a faster rate. Note that proxy client CPU usage increases proportionally with the reduction in backup completion time.

Deduplication is not possible between the different backup formats for the same virtual machine. Backups will consume twice the usual storage until the last Optimized for Capacity backup expires, as defined by the retention period, because backups for each format must coexist during this time. After this time, storage consumption will return to normal.

Administrators should ensure that sufficient storage capacity exists to support an incremental transition over the length of the retention period. Careful monitoring of the available capacity on both the source and target during the transition is essential. If the

retention periods on the source and target differ, then all Optimized for Capacity backups on the source might expire before those on the target or vice-versa.

If Optimized for Performance backups are performed on a virtual machine at both the image level and the file system level, deduplication between the two is not expected and the backups may consume double the expected amount of storage. This is a rare case and such deployments should continue to use the Optimized for Capacity backup format instead.

Making the transition is a tradeoff between performance and storage efficiency. There are circumstances where the new backup format makes less efficient use of available storage than previous backups. For example, if a virtual machine contains two large and nearly-identical documents, Optimized for Capacity provides deduplication between these documents while Optimized for Performance might not.

## MAKING THE TRANSITION

EMC recommends that you plan the transition to the new backup format over a period of six months to one year. Administrators should monitor the available storage on both the source and target Data Domain systems as the transition progresses. EMC recommends that you transition no more than 0.5% of your virtual machines each day in order to make the most efficient use of resources.

This number is a guideline that you should adjust by accounting for the footprint of your virtual machines, the available backup window, and any observed patterns of increased resource and storage consumption. After making the transition for a particularly large virtual machine, administrators should determine the effect on system resources before proceeding.

Remember that the first Optimized for Performance backup of each virtual machine is a full level-zero backup. The backup will take longer to complete than the previous incremental Optimized for Capacity backups. The first replication will also take longer for the same reason. After the first backup and replication have completed, subsequent backups and replications will proceed at a normal rate.

During the initial full backups, all data must be reread from each virtual machine. This may temporarily affect the performance of a virtual machine or the virtual machine host, especially during the transition of large virtual machines. EMC recommends a slow and incremental transition of virtual machines.

Once you have completed the transition of all virtual machines to the new backup format, you can change the global default backup format for the system. This ensures that all new policies that you create on the system will use the new backup format without further administrator action. Until you change the global default, any new policies that you create on the system will use the Optimized for Capacity backup format until you manually configure Avamar to use Optimized for Performance. It is very important that you do not change the global default until the transition completes.

## USING THE NEW BACKUP FORMAT

To minimize unwanted changes, you should verify which clients and groups are configured to use any applicable policies and datasets that you wish to use with the new backup format before making any modifications. For more information on setting plug-in options, refer to the Avamar Administration Guide.

## MOVING ALL VIRTUAL MACHINES ON A POLICY

Use this procedure when you need to transition a small number of virtual machines to the new backup format. If your policy contains many virtual machines, or virtual machines with a large resource footprint, use the procedure for MOVING A SUBSET OF VIRTUAL MACHINES ON A POLICY instead.

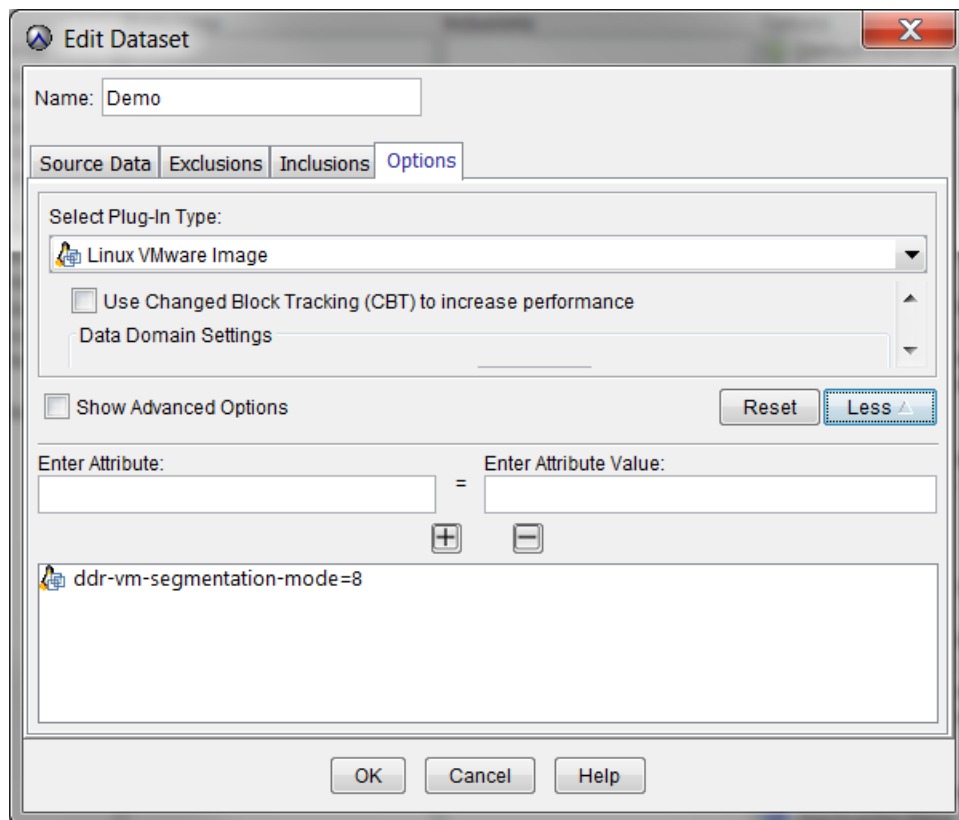
Perform these steps before the next scheduled start time of the policy:

1. In Avamar Administrator, check the available storage on the source and target data domains.
2. Locate and select the existing Optimized for Capacity dataset policy. Click Edit to open the Edit Dataset window, see Figure 1.
3. Select the **Options** tab.
4. Select the applicable plug-in type from the list.
5. Clear the **Use Changed Block Tracking (CBT) to increase performance** checkbox.

6. Click **More** to show the **Enter Attribute** and **Enter Attribute Value** fields.
7. In the **Enter Attribute** field, type `ddr-vm-segmentation-mode`.
8. In the **Enter Attribute Value** field, type `8`.
9. Click the **+** symbol to add the attribute and value to the policy.
10. Click **OK** to close the Edit Dataset window.
11. Select the policy and verify that the Options list includes "ddr-vm-segmentation-mode=8".
12. Complete a full level-zero Optimized for Performance backup for all virtual machines on this policy.
13. Open the policy.
14. On the **Options** tab, with the applicable plug-in type selected from the list, check the **Use Changed Block Tracking (CBT) to increase performance** checkbox.
15. Click **OK** to close the policy.
16. Monitor the available storage and system performance on the source and target data domains as clients complete backups using the new backup format.

It is important that you ensure that CBT is disabled before you perform the initial Optimized for Performance backup. Failure to do so causes subsequent backups to use the Optimized for Capacity backup format instead.

**Figure 1** The Edit Dataset window



## MOVING A SUBSET OF VIRTUAL MACHINES ON A POLICY

This procedure also applies to the transition of policies with a large number of virtual machines to the new backup format. You must create two new policies that duplicate the settings of the original. These policies will ensure that all required steps are completed.

The first policy is a placeholder that you will use to create the new level-zero backup. The CBT flag is off and the Optimized for Performance attribute is set. It is important that you ensure that CBT is disabled before you perform the initial backup. Failure to do so causes subsequent backups to use the Optimized for Capacity backup format instead.

The second policy is the new Optimized for Performance backup policy, which will ultimately replace the original Optimized for Capacity backup policy. The CBT flag and the Optimized for Performance attribute are both set. Virtual machines on this policy will create regular backups.

1. In Avamar Administrator, check the available storage on the source and target data domains.
2. Create two copies of the existing Optimized for Capacity dataset policy with appropriate names.

### CONFIGURING THE OPTIMIZED FOR PERFORMANCE LEVEL-ZERO BACKUP POLICY

3. Locate and select the first copy of the backup policy. Click **Edit** to open the Edit Dataset window, see Figure 1.
4. Select the **Options** tab and choose the applicable plug-in type from the list.
5. Clear the **Use Changed Block Tracking (CBT) to increase performance** checkbox.
6. Click **More** to show the **Enter Attribute** and **Enter Attribute Value** fields.
7. In the **Enter Attribute** field, type `ddr-vm-segmentation-mode`.
8. In the **Enter Attribute Value** field, type `8`.
9. Click the **+** symbol to add the attribute and value to the policy.
10. Click **OK** to close the Edit Dataset window.
11. Select the policy and verify that the Options list includes "`ddr-vm-segmentation-mode=8`".
12. Configure an appropriate schedule for virtual machines on this policy to complete full level-zero backups.

### CONFIGURING THE OPTIMIZED FOR PERFORMANCE REGULAR BACKUP POLICY

13. Locate and select the second copy of the backup policy. Click **Edit** to open the Edit Dataset window, see Figure 1.
14. On the **Options** tab, with the applicable plug-in type selected from the list, check the **Use Changed Block Tracking (CBT) to increase performance** checkbox.
15. Click **More** to show the **Enter Attribute** and **Enter Attribute Value** fields.
16. In the **Enter Attribute** field, type `ddr-vm-segmentation-mode`.
17. In the **Enter Attribute Value** field, type `8`.
18. Click the **+** symbol to add the attribute and value to the policy.
19. Click **OK** to close the Edit Dataset window.
20. Select the policy and verify that the Options list includes "`ddr-vm-segmentation-mode=8`".

### COMPLETING THE TRANSITION

21. Select an appropriate subset of virtual machines from the existing Optimized for Capacity policy and move them to the new Optimized for Performance level-zero backup policy.
22. Allow every virtual machine on the new policy to complete a full level-zero backup using the Optimized for Performance format.
23. Move all of the virtual machines on the new level-zero backup policy to the new Optimized for Performance regular backup policy.
24. Monitor the available storage and system performance on the source and target data domains as backups complete using the new backup format.

If the available storage and system performance are acceptable, you may repeat the process with additional virtual machines. If significantly less storage is available, you should reduce the rate of virtual machines that you transition.

### CHANGING THE GLOBAL DEFAULT BACKUP FORMAT

The global default backup format should only be changed once you complete the transition. If you change the global default before the transition completes, a drastic increase in storage consumption or other unexpected results might occur. The Avamar Administration Guide provides details about how to log in to start and stop the Management Console Server (MCS).



To change the global default backup format, proceed as follows:

1. Open a command shell and log in to the server (for single-node servers) or the utility node (for multi-node servers) as admin.
2. Stop the MCS service.
3. Change the working directory by typing the following command:

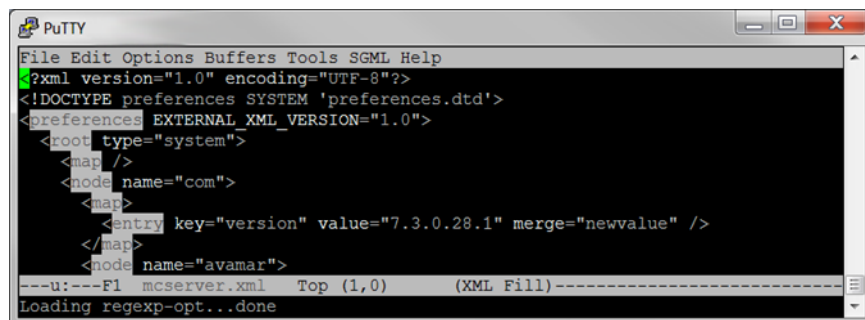
```
cd /usr/local/avamar/lib
```

4. Make a backup copy of mcserver.xml.
5. Open mcserver.xml in a text editor.
6. In the <node name="com"> node, locate the version key/value pair and increment the existing version number by 1. For example:

```
<entry key="version" value="7.3.0.28.0" merge="newvalue" />

<entry key="version" value="7.3.0.28.1" merge="newvalue" />
```

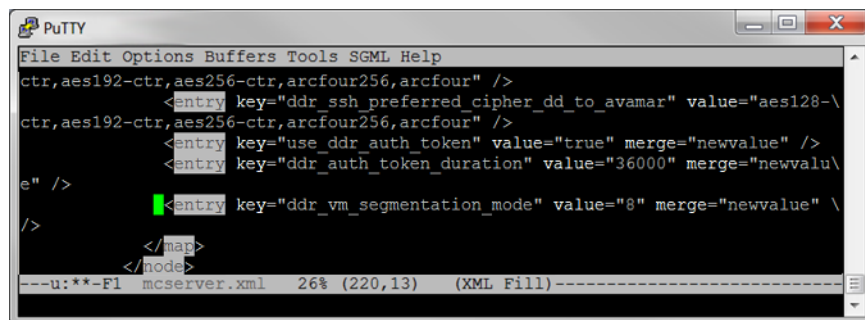
Figure 2 Editing mcserver.xml



7. In the <node name="datadomain"> node, add a new key/value pair:

```
<entry key="ddr_vm_segmentation_mode" value="8" merge="newvalue" />
```

Figure 3 Editing mcserver.xml



8. Save the changes and close the file.
  9. Start the MCS and scheduler services.
  10. Change the working directory by typing the following command:
- ```
cd /usr/local/avamar/var/mc/server_data/prefs
```
11. Open mcserver.xml in a text editor and verify that the datadomain node contains a new key/value pair:
- ```
<entry key="ddr_vm_segmentation_mode" value="8" />
```
12. Close the text editor without saving changes.
  13. Close the command shell.

During the MCS startup procedure, MCS will adjust the XML file in /usr/local/avamar/var/mc/server\_data/prefs. After this change, all new policies created on the system will use the new backup format without further administrator action.

## CONCLUSION

Avamar 7.3 provides customers with even more options and the flexibility to manage the challenges and complexity of today's backup environment, including the new Optimized for Performance backup format. When you use the Optimized for Performance format, Avamar administrators should see better replication times and lower network traffic, with corresponding improvements in Data Domain CPU and I/O usage.