



NETAPP TECHNICAL REPORT

Access to DataFabric Manager and Performance Advisor Data Using Database Access and Data Export

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July 2008 | TR 3690

ABSTRACT

Operations Manager provides a number of default reports and also allows creation of custom reports. However, storage administrators need to create reports with a combination of different data presented in a graphical way as per corporate guidelines. These usually require extracting the NetApp® DataFabric® Manager and Performance Advisor (PA) data and using their own tool or a third-party tool, which often proves to be cumbersome, time consuming and error prone.

To address this need, DataFabric Manager 3.7 introduces an access to database and data export feature. This technical report explains the feature in detail. It also lists a few use cases that help customers to use this feature.

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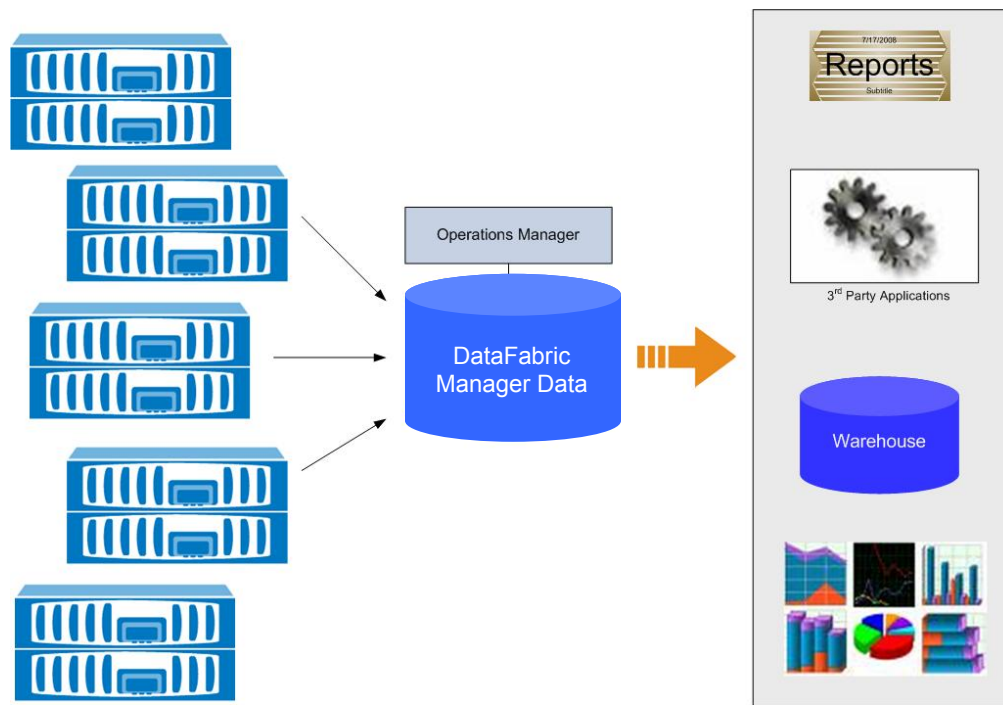
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1 INTRODUCTION

Operations Manager provides a variety of canned reports. Ability to customize reports was introduced in Operations Manager for DataFabric Manager server 3.2. Storage administrators can use these reports supported in various output formats, for example, Perl, CSV, Excel, and XML, to perform operations in third-party reporting engines such as Crystal Reports®. But, however comprehensive the canned and custom reports may be, they cannot provide all the functionality and flexibility that might be required. For example, you cannot combine the attributes of unrelated objects in a single report.

A method was required to allow users of Operations Manager flexible access to the underlying data so that third-party applications could pull data from the DataFabric Manager repository without understanding the underlying complex DataFabric Manager database schema or directly communicating with the storage subsystems in order to collect utilization, configuration, or performance statistics from Data ONTAP®. Providing such a mechanism would allow users to integrate with Operations Manager to create specific custom reports/applications that extend the Operations Manager core functionality:

- Custom forecasting and modeling for future capacity and bandwidth utilization
- Generating specific performance graphs
- Presenting monthly service-level agreement (SLA) reports
- Standardized reporting (using applications such as Crystal Reports, JReport®, any scripting languages such as Perl, and so on)
- Offloading the reporting functionality from the DataFabric Manager server to a secondary server (reducing the load on the primary DataFabric Manager server when large queries were run)
- Data warehouse/mining of the DataFabric Manager data
- Retaining granular samples of the DataFabric Manager data



Operations Manager for DataFabric Manager 3.7 introduces a new feature called the data export feature to address this concern. The feature exposes the DataFabric Manager data using database views and also allows you to export the DataFabric Manager data as well as Performance Advisor data to comma-separated value (CSV) or tab-separated text files.

Note: The term “DataFabric Manager Data” means data that is stored on the server related to Operations Manager, Protection Manager, Performance Advisor, and Provisioning Manager.

This technical report describes the data export feature and then provides some scenarios to implement the feature.

2 DATA EXPORT FEATURE OVERVIEW

The data export feature provides consistent access to the data held within the DataFabric Manager Server as follows:

- Provides database access to the historical data collected by the DataFabric Manager server
- Provides database access to the information provided by the custom report catalogs in the DataFabric Manager server
- Provides following SQL interfaces to the exposed DataFabric Manager views:
 - Open database connectivity (ODBC)
 - Java™ database connectivity
- Allows exporting PA and DataFabric Manager data to CSV and tab-separated text files. The exported data can be easily loaded to a database of user's choice
- Allows on-demand as well as scheduled data export
- Allows specifying the list of performance counters to be exported
- Allows customizing the rate at which the performance counter data is exported

The feature exposes consistent access to the following data:

- Nonhistorical DataFabric Manager data: This is the important data available in custom report catalogs in Operations Manager.
- Historical DataFabric Manager data: The DataFabric Manager server collects this data that is part of the capacity graphs for storage objects such as aggregates and volumes.
- Performance Advisor (PA) data: This data is collected over a period of time for different performance counters for each of the managed storage systems.

The feature provides access to the DataFabric Manager and PA data in the following ways:

2.1 DATABASE VIEWS

The database views provide access to nonhistorical and historical DataFabric Manager data. The embedded database of DataFabric Manager server defines and exposes the views. By default, access to the views is disabled. You can access the views by creating a database user and enabling access for this user. The database users are not the same as DataFabric Manager administrators.

A DataFabric Manager administrator must have core control capability (as shown in below figure) to create, delete, and control database access for the database users.

View Role Settings 10 Jul 14:02

Administrative Users Roles Details

View Role	
Role Name	Data_Export_Role
Description	Role to manage Database Users

Capabilities	
Resource	Operations
Global	DFM.Core.Control

Inherit Capabilities from other Roles

Roles

Back

Role with Core Control Capability

The database views do not expose PA data, because the embedded database does not store PA data.

Using a third-party reporting tool, a user can connect to the DataFabric Manager database to access views. Schema for the database views can be found in the Operations Manager online help. You can select and present the required objects and the metrics based on the database schema.

2.2 DATAFABRIC MANAGER DATA EXPORT

The data export feature exports the following two types of data:

DataFabric Manager data: The feature exports nonhistorical DataFabric Manager data only. The DataFabric Manager data export is enabled by setting the `dfmDataExportEnabled` option from the `dfm` command line using the `dfm options` command. By default, the `dfmDataExportEnabled` global option is set to No.

Performance Advisor data: The feature exports performance data collected by Performance Advisor, which is stored in the folder specified with the `perfArchiveDir` option. The Performance Advisor data export is controlled at the global level and at the host level through the `perfDataExportEnabled` option. By default, `perfDataExportEnabled` option is set to No. When enabled, the first PA data export run exports the counter data for the last seven days. You have the option to change the duration for which counter data is exported. For more information on the options to control the exported data, see note at the end of section 3.3.

You can customize the sampling rate for the counter data export at the global level. By default, one sample is exported at every 15 minutes. You can consolidate the sample values of the data export only if the sampling interval is greater than the interval with which the counter data is collected. Averaging is used as a default method to consolidate the sample values.

The data export feature exports DataFabric Manager and PA data to CSV or tab-separated text files. By exporting the DataFabric Manager and PA data, storage administrators can:

- Integrate Operations Manager data with centralized management framework such as HP OpenView in a data center environment
- Consolidate the DataFabric Manager and PA data in a third-party database such as Oracle® for centralized reporting of entire data center infrastructure
- Generate customized reports by using third-party reporting tools such as Crystal Reports from this consolidated data
- Move Operations Manager reporting function to a server other than DataFabric Manager to reduce the load on the DataFabric Manager server

The feature always performs a full data export of DataFabric Manager data. PA data is exported only for specified history period in the first scheduled run. For subsequent PA data exports, data is exported for incremental duration after considering the difference of times between the last successful scheduled run and the current time.

You can export the DataFabric Manager and PA data in following ways:

- **Scheduled data export:** The feature allows storage administrators to schedule a data export on hourly, daily, weekly, and monthly basis. Scheduling data export helps storage administrators in configuring periodic export of DataFabric Manager and PA data and loading it to third-party databases. Case B under section 3.5 describes how to schedule data export.
- **On-demand data export:** On-demand data export provides a manual method of exporting DataFabric Manager and PA data using command line interface. Section 3.2 and 3.3 describes how to perform an on-demand export

To export the data, the DataFabric Manager administrator must have the core control capability. Two new events have been introduced to indicate success and failure of data export: `data-export: ok` and `data-export: failed`.

The following table summarizes which method can be used to access the DataFabric Manager and PA data:

	Accessible Through Database Views	Exported to CSV or Tab-Separated Text Files
Historical DataFabric Manager Data	√	×
Nonhistorical DataFabric Manager Data	√	√
Performance Advisor Data	×	√

2.3 FILES AND FORMATS FOR STORING EXPORTED DATA

The exported DataFabric Manager and PA data is stored in the `export_<timestamp>` directory under the top-level folder specified by the global option `dataExportDir`. The files containing exported DataFabric Manager data use the same name as database view. For example, we store the LUN-related information in the `lunView` file. The fields on each line of the file correspond to the columns in `lunView` present in the database. The exported file `lunView` would look like the following:

lunId	lunHostId	lunSize	lunDescription
'121'	'25'	'10988974080'	"
'122'	'25'	'717737932800'	"

The following types of files store exported PA data:

- `perfHosts`: Contains information about the storage systems from which the counter data is collected.
- `perfCounters`: Contains information about the various PA counters.
- `perfObjInstances`: Contains information about the performance object instances on storage systems for which the data counter data is collected.
- `samples_<objectType>_<hostId>`: This is a per-host and per-object type table, which contains the sample values collected at various time stamps for different counters and object instances.

The format of each of the above mentioned files is as follows:

File name: <code>perfHosts</code>				
Contents:				
host-id	host-name			
.				
.				
File name: <code>perfCounters</code>				
Contents:				
counter-id	counter-name	description	obj-type	counter-unit
.				

```

.
.
File name: perfObjInstances
Contents:
instance-id      instance-name    host-id    obj-type    obj-id
.
.
.

File name: samples_<objType>_<hostId>
Contents:
instance-id      counter-id    sample-time    sample-value
.
.
.

```

The last updated time stamp for both DataFabric Manager and PA data export is stored in a conf file named `export.conf` under the `dataExport` directory. The format of the file is as follows:

```

Database Format Version: 1.0
Export Type: [Scheduled | On-demand]
Export Status: [Success | Failed | Canceled | Running]

Delimiter: [tab | comma]
Sampling Interval: <secs>
Consolidation Method: [average | min | max | last]
History: <secs>

DataFabric Manager Data Export Completion Timestamp: <timestamp>

Last PA data Export for following hosts at time <timestamp>
-----<host-name>-----
-----<host-name>-----

```

3 USE CASES

The feature can be used to address the following use cases:

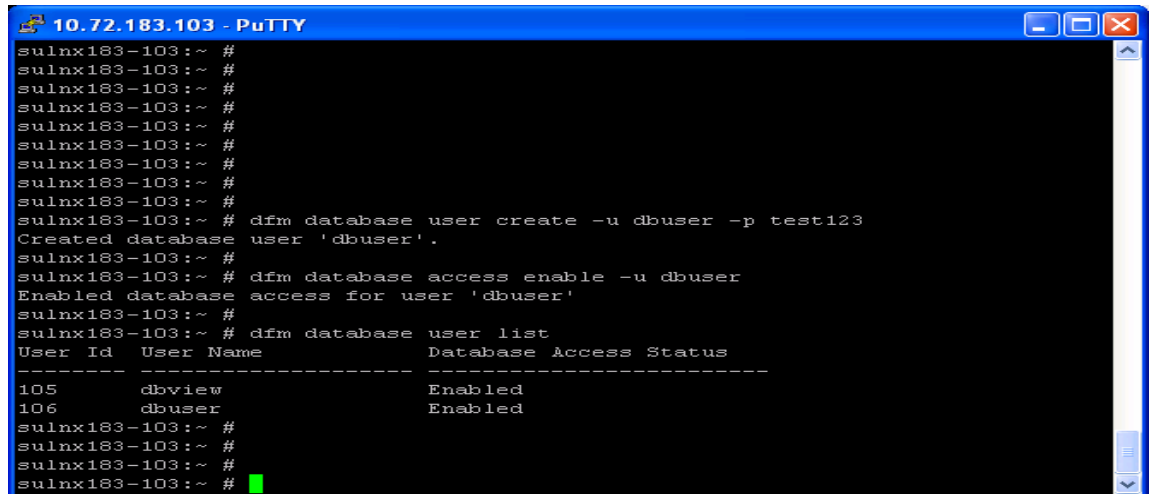
3.1 SCENARIO 1: ACCESSING DATABASE VIEWS THROUGH DATAFABRIC MANAGER'S COMMAND LINE INTERFACE (CLI)

Storage administrator wants to access the DataFabric Manager database to verify LUN-related information.

To access the embedded DataFabric Manager database for information rather than using the DataFabric Manager canned reports:

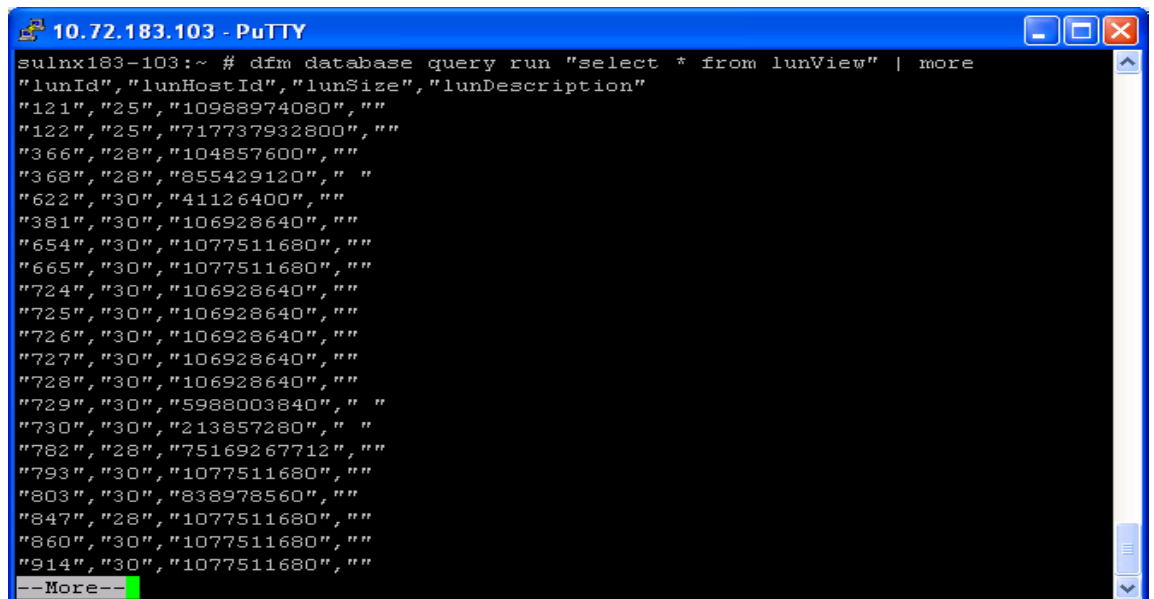
- Create a database user using the command `dfm database user create`.
- Enable access for the user created above
- Run the desired SQL query for getting the LUN information using the command `dfm database query run <SQL-Query>`.

Figure 1 and 2 capture the steps mentioned above



```
10.72.183.103 - PuTTY
sulnx183-103:~ #
sulnx183-103:~ #
sulnx183-103:~ #
sulnx183-103:~ #
sulnx183-103:~ #
sulnx183-103:~ #
sulnx183-103:~ #
sulnx183-103:~ #
sulnx183-103:~ # dfm database user create -u dbuser -p test123
Created database user 'dbuser'.
sulnx183-103:~ #
sulnx183-103:~ # dfm database access enable -u dbuser
Enabled database access for user 'dbuser'
sulnx183-103:~ #
sulnx183-103:~ # dfm database user list
User Id  User Name      Database Access Status
-----
105      dbview          Enabled
106      dbuser          Enabled
sulnx183-103:~ #
sulnx183-103:~ #
sulnx183-103:~ #
sulnx183-103:~ #
```

Figure 1



```
10.72.183.103 - PuTTY
sulnx183-103:~ # dfm database query run "select * from lunView" | more
"lunId","lunHostId","lunSize","lunDescription"
"121","25","10988974080",""
"122","25","717737932800",""
"366","28","104857600",""
"368","28","855429120"," "
"622","30","41126400",""
"381","30","106928640",""
"654","30","1077511680",""
"665","30","1077511680",""
"724","30","106928640",""
"725","30","106928640",""
"726","30","106928640",""
"727","30","106928640",""
"728","30","106928640",""
"729","30","5988003840"," "
"730","30","213857280"," "
"782","28","75169267712",""
"793","30","1077511680",""
"803","30","838978560",""
"847","28","1077511680",""
"860","30","1077511680",""
"914","30","1077511680",""
--More--
```

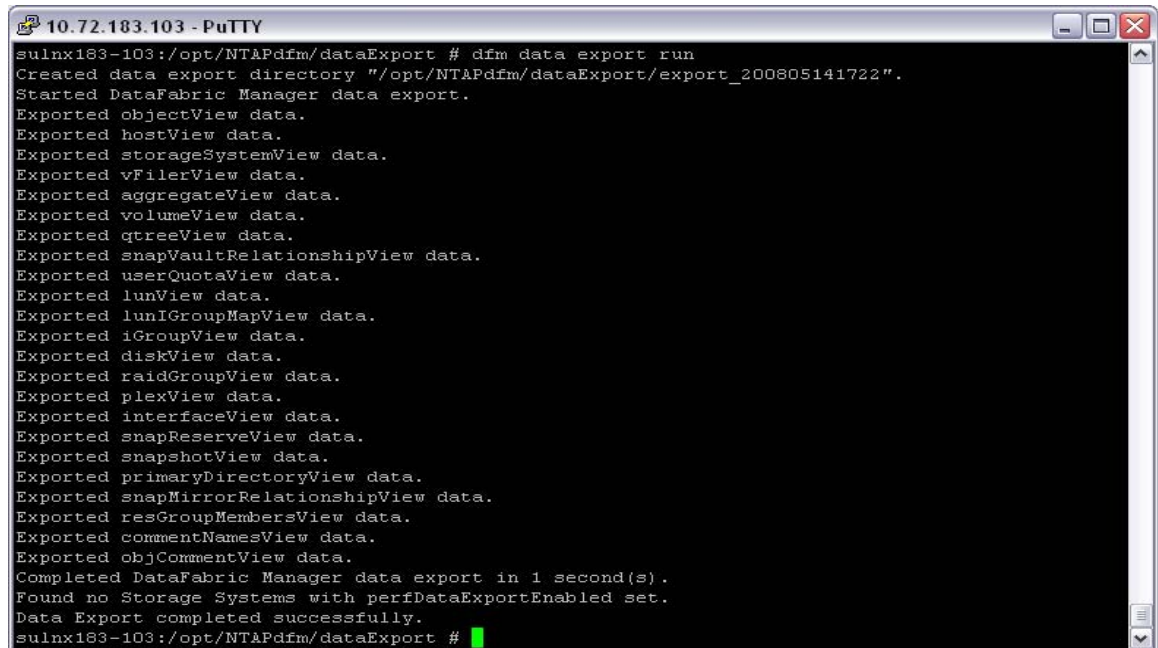
Figure 2

3.2 SCENARIO 2: EXPORTING DATAFABRIC MANAGER DATA TO CSV OR TAB-SEPARATED TEXT FILES

Storage administrator wants to do an on-demand data export of nonhistorical DataFabric Manager data to CSV or tab-separated text files.

To export the DataFabric Manager data to CSV or tab-separated text files:

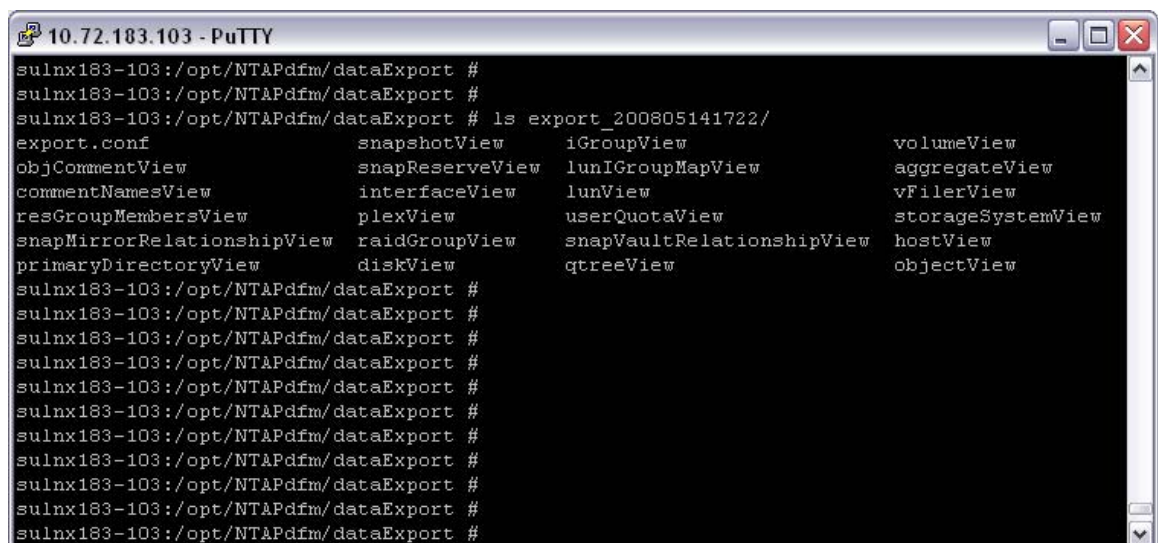
- Enable global option dfmDataExportEnabled. Example: `$ dfm options set dfmDataExportEnabled=yes`.
- Execute the dfm command `dfm data export run` as shown in Figure 3. This does an on-demand full data export of DataFabric Manager data.



```
10.72.183.103 - PuTTY
sulnx183-103:/opt/NTAPdfm/dataExport # dfm data export run
Created data export directory "/opt/NTAPdfm/dataExport/export_200805141722".
Started DataFabric Manager data export.
Exported objectView data.
Exported hostView data.
Exported storageSystemView data.
Exported vFilerView data.
Exported aggregateView data.
Exported volumeView data.
Exported qtreeView data.
Exported snapVaultRelationshipView data.
Exported userQuotaView data.
Exported lunView data.
Exported lunIGroupMapView data.
Exported iGroupView data.
Exported diskView data.
Exported raidGroupView data.
Exported plexView data.
Exported interfaceView data.
Exported snapReserveView data.
Exported snapshotView data.
Exported primaryDirectoryView data.
Exported snapMirrorRelationshipView data.
Exported resGroupMembersView data.
Exported commentNamesView data.
Exported objCommentView data.
Completed DataFabric Manager data export in 1 second(s).
Found no Storage Systems with perfDataExportEnabled set.
Data Export completed successfully.
sulnx183-103:/opt/NTAPdfm/dataExport #
```

Figure 3

- The data exported will be present in the data export directory as shown in Figure 4



```
10.72.183.103 - PuTTY
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport # ls export_200805141722/
export.conf          snapshotView         iGroupView           volumeView
objCommentView       snapReserveView     lunIGroupMapView     aggregateView
commentNamesView     interfaceView        lunView              vFilerView
resGroupMembersView  plexView            userQuotaView         storageSystemView
snapMirrorRelationshipView  raidGroupView      snapVaultRelationshipView  hostView
primaryDirectoryView  diskView            qtreeView            objectView
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
```

Figure 4

Note: The location of the export directory can be controlled by setting the global option dataExportDir. The current location can be found by executing dfm options list dataExportDir command.

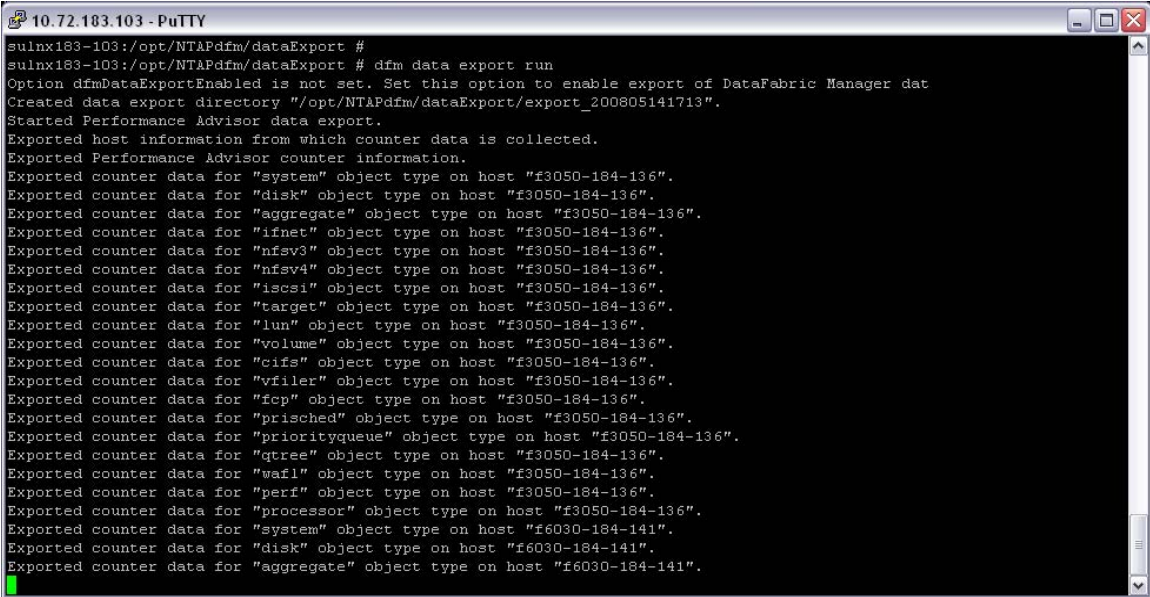
3.3 SCENARIO 3: EXPORTING PA DATA TO CSV OR TAB-SEPARATED TEXT FILES

Storage administrator wants to do an on-demand data export of performance counter information to a CSV or tab-separated text file and analyze the data.

To export the PA data to CSV or tab-separated text files:

- Enable global option `perfDataExportEnabled`. Example: `$dfm options set perfDataExportEnabled=yes`.
- Execute the dfm command `dfm data export run`. This command does an on-demand PA data export for default history period. PA data can be exported either for a single host or for all the hosts.

Figure 5 captures performance data export for all managed hosts.



```
10.72.183.103 - PuTTY
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport # dfm data export run
Option dfmDataExportEnabled is not set. Set this option to enable export of DataFabric Manager dat
Created data export directory "/opt/NTAPdfm/dataExport/export_200805141713".
Started Performance Advisor data export.
Exported host information from which counter data is collected.
Exported Performance Advisor counter information.
Exported counter data for "system" object type on host "f3050-184-136".
Exported counter data for "disk" object type on host "f3050-184-136".
Exported counter data for "aggregate" object type on host "f3050-184-136".
Exported counter data for "ifnet" object type on host "f3050-184-136".
Exported counter data for "nfsv3" object type on host "f3050-184-136".
Exported counter data for "nfsv4" object type on host "f3050-184-136".
Exported counter data for "iscsi" object type on host "f3050-184-136".
Exported counter data for "target" object type on host "f3050-184-136".
Exported counter data for "lun" object type on host "f3050-184-136".
Exported counter data for "volume" object type on host "f3050-184-136".
Exported counter data for "cifs" object type on host "f3050-184-136".
Exported counter data for "vfiler" object type on host "f3050-184-136".
Exported counter data for "fcp" object type on host "f3050-184-136".
Exported counter data for "prischd" object type on host "f3050-184-136".
Exported counter data for "priorityqueue" object type on host "f3050-184-136".
Exported counter data for "qtree" object type on host "f3050-184-136".
Exported counter data for "waf1" object type on host "f3050-184-136".
Exported counter data for "perf" object type on host "f3050-184-136".
Exported counter data for "processor" object type on host "f3050-184-136".
Exported counter data for "system" object type on host "f6030-184-141".
Exported counter data for "disk" object type on host "f6030-184-141".
Exported counter data for "aggregate" object type on host "f6030-184-141".
```

Figure 5

To export PA data for a specific host, the administrator needs to execute the following command:

```
$dfm data export run [<hostname or host id> ...]
```

- The data exported for PA will be in text files named as `samples_<objType>_<hostId>` files under the data export directory, as shown in Figure 6.

```

10.72.183.103 - PuTTY
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport # ls export_200805141713/
export.conf          samples_system_25      samples_processor_28    samples_perf_30
samples_processor_25 samples_processor_26    samples_perf_28         samples_wafl_30
perfObjInstances     samples_perf_26        samples_wafl_28         samples_qtree_30
samples_perf_25      samples_wafl_26        samples_qtree_28        samples_priorityqueue_30
samples_wafl_25      samples_qtree_26       samples_priorityqueue_28 samples_prisched_30
samples_qtree_25     samples_priorityqueue_26 samples_prisched_28     samples_fcp_30
samples_priorityqueue_25 samples_prisched_26    samples_fcp_28         samples_vfiler_30
samples_prisched_25  samples_fcp_26        samples_vfiler_28      samples_cifs_30
samples_fcp_25       samples_vfiler_26     samples_cifs_28        samples_volume_30
samples_vfiler_25    samples_cifs_26       samples_volume_28      samples_lun_30
samples_cifs_25      samples_volume_26     samples_lun_28         samples_target_30
samples_volume_25    samples_lun_26        samples_target_28      samples_iscsi_30
samples_lun_25       samples_target_26     samples_iscsi_28       samples_nfsv4_30
samples_target_25    samples_iscsi_26      samples_nfsv4_28       samples_nfsv3_30
samples_iscsi_25     samples_nfsv4_26     samples_nfsv3_28       samples_ifnet_30
samples_nfsv4_25     samples_nfsv3_26     samples_ifnet_28       samples_aggregate_30
samples_nfsv3_25     samples_ifnet_26     samples_aggregate_28   samples_disk_30
samples_ifnet_25     samples_aggregate_26  samples_disk_28        samples_system_30
samples_aggregate_25 samples_disk_26        samples_system_28      perfCounters
samples_disk_25      samples_system_26     samples_processor_30    perfHosts
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #

```

Figure 6

- The information present in perfCounters and perfObjInstances files is shown in Figures 7 and 8.

```

10.72.183.103 - PuTTY
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport # cat export_200805141713/perfCounters | more
counter-id  counter-name  description  obj-type  counter-unit
17          cpu_busy     System CPU resource utilization system percent
1           nfs_ops     NFS operations per second system per_sec
7           net_data_rcv Network KB received per second system kb_per_sec
8           net_data_sent Network KB sent per second system kb_per_sec
9           disk_data_read Disk KB read per second system kb_per_sec
10          disk_data_written Disk KB written per second system kb_per_sec
20          total_transfers Total number of disk operations involving data transfer initiated per second disk per_s
46          disk_busy     Percentage of time there was at least one outstanding request to the disk disk perce
21          user_reads    Number of disk read operations initiated each second for retrieving data or metadata associat
ec
22          user_writes    Number of disk write operations initiated each second for storing data or metadata associated
ec
41          user_read_latency Average latency per block in microseconds for user read operations disk micro
42          user_write_latency Average latency per block in microseconds for user write operations disk micro
763         total_transfers Total number of transfers per second serviced by the aggregate aggregate per_sec
764         user_reads    Number of user reads per second to the aggregate aggregate per_sec
765         user_writes    Number of user writes per second to the aggregate aggregate per_sec
766         cp_reads      Number of reads per second done during a CP to the aggregate aggregate per_sec
767         user_read_blocks Number of blocks read per second on the aggregate aggregate per_sec
768         user_write_blocks Number of blocks written per second to the aggregate aggregate per_sec
769         cp_read_blocks Number of blocks read per second during a CP on the aggregate aggregate per_sec
63         rcv_data      Total bytes received per second ifnet b_per_sec
64         send_data     Total bytes sent per second ifnet b_per_sec
58         rcv_packets    Packets received per second ifnet per_sec
60         send_packets    Packets sent per second ifnet per_sec

```

Figure 7


```
10.72.183.103 - PuTTY
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport #
sulnx183-103:/opt/NTAPdfm/dataExport # cat export_200805141713/perfObjInstances | more
instance-id      instance-name      host-id obj-type      obj-id
478      system      30      system      30
487      20000014:C32B7A69:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      550
488      20000014:C32B75D0:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      551
483      20000014:C321F7F2:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      552
482      20000014:C321F7FC:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      553
480      20000014:C32B74C8:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      554
479      20000014:C321F3CC:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      555
484      20000014:C321FEB3:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      556
486      20000014:C321F7FD:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      557
485      20000014:C32B75D7:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      558
481      20000014:C321FBA1:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      559
489      20000014:C321F7F5:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      560
490      20000014:C321F7E3:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      561
492      20000014:C32B73D1:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      562
491      20000014:C321F7E1:00000000:00000000:00000000:00000000:00000000:00000000:00000000:00000000      30      disk      563
628      aggr0      30      aggregate      217
627      jag_Dont_Disturb      30      aggregate      215
629      Test      30      aggregate      219
630      NT_Test_Aggr      30      aggregate      221
498      e0a      30      ifnet      79
499      e0b      30      ifnet      80
500      e0c      30      ifnet      81
501      e0d      30      ifnet      82
502      e1a      30      ifnet      83
503      e1b      30      ifnet      84
504      nfs      30      nfsv3      30
```

Figure 8

- Tab-separated sample file containing exported PA data for an object of a host looks like as shown in Figure 9

```
10.72.183.103 - PuTTY
sulnx183-103:/opt/NTAPdfm/dataExport # cat export_200805141713/samples_system_30 | more
instance-id      counter-id      sample-time      sample-value
478      17      20080507174412      41.619999
478      17      20080507175912      40.168999
478      17      20080507181412      36.382000
478      17      20080507182912      38.736000
478      17      20080507184412      37.458000
478      17      20080507185912      38.985001
478      17      20080507191412      35.706001
478      17      20080507192912      38.456001
478      17      20080507194412      37.473000
478      17      20080507195912      37.812000
478      17      20080507201412      37.449001
478      17      20080507202912      38.023998
478      17      20080507204412      37.632999
478      17      20080507205912      37.980000
478      17      20080507211412      38.180000
478      17      20080507212912      37.335999
478      17      20080507214412      38.256001
478      17      20080507215912      36.944000
478      17      20080507221412      38.992001
478      17      20080507222912      36.576000
478      17      20080507224412      39.710999
478      17      20080507231412      36.337002
478      17      20080507232912      39.099998
478      17      20080507234412      36.396999
478      17      20080507235912      38.485001
478      17      20080508001412      36.495998
478      17      20080508002912      39.485001
--More--
```

Figure 9

Note: The dfm data export run CLI provides option to control the data exported.

You can use the `-d` option to export the DataFabric Manager and PA data to CSV or tab-separated text files. Default value is `Tab`. Apart from `-d` option, other options are applicable only for PA data export.

The `-t` option helps in consolidating multiple samples into one sample to achieve the desired resolution, using the specified consolidation method. Default sampling interval is 15 minutes.

The sampling interval defines the number of samples taken from the performance data collected by DataFabric Manager every minute. A sampling interval of 15 minutes for data export means that four sample values will be exported for a hour duration after applying the specified consolidation function using `-f` option.

The `-f` option is used to apply the function across the data to achieve the desired time resolution, if the requested sample rate is different from the actual sample rate of the data. The values can be `avg`, `min`, `max`, or `last`. The default value for this option is `last`.

The `-h` option specifies the number of weeks, days, hours, minutes, or seconds of history to export the PA data. Default unit is `seconds`. This means that if no unit is specified with the value, then unit taken will be in seconds. Default value for this option is `seven days`. This means that if no value is specified, then performance data will be exported for the previous seven days.

The value specified for this option is only used in the first scheduled run. For later scheduled runs, this value is calculated as the difference of times between the last successful scheduled run and the current time.

For example, consider a scenario where the DataFabric Manager server is collecting performance counter information from the managed storage system every minute. Storage administrator wants to do an on-demand export of the collected performance counter data to CSV text files for a sampling interval of 30 minutes with average consolidation method for a period of last 30 days.

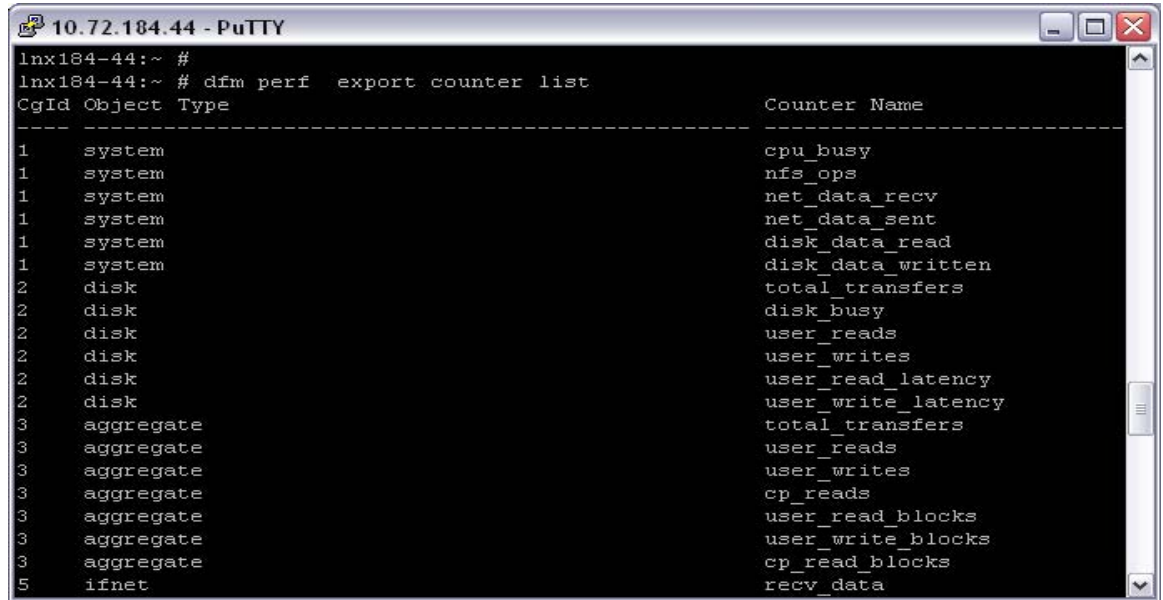
```
$ # dfm data export run -d comma -t "30 mins" -f avg -h "30 days"
```

3.4 SCENARIO 4: CONFIGURING PA COUNTERS FOR DATA EXPORT

Storage administrator wants to manage list of performance counters for which PA data is exported.

The feature provides CLI to manage the list of counters for which the PA data is exported.

By default, the feature exports PA data for a set of counters. To see the list of counters for which data is exported by default the command `dfm perf export counter list` needs to be executed as shown in Figure 10.



```
10.72.184.44 - PuTTY
lnx184-44:~ #
lnx184-44:~ # dfm perf export counter list
CgId Object Type Counter Name
-----
1 system cpu_busy
1 system nfs_ops
1 system net_data_rcv
1 system net_data_sent
1 system disk_data_read
1 system disk_data_written
2 disk total_transfers
2 disk disk_busy
2 disk user_reads
2 disk user_writes
2 disk user_read_latency
2 disk user_write_latency
3 aggregate total_transfers
3 aggregate user_reads
3 aggregate user_writes
3 aggregate cp_reads
3 aggregate user_read_blocks
3 aggregate user_write_blocks
3 aggregate cp_read_blocks
5 ifnet rcv_data
```

Figure 10

The list of counters that are not included in the default list can be viewed by using the command `dfm perf counter list -d`.

To see the list of all counters for which PA data can be exported, execute the command `dfm perf counter list -a`.

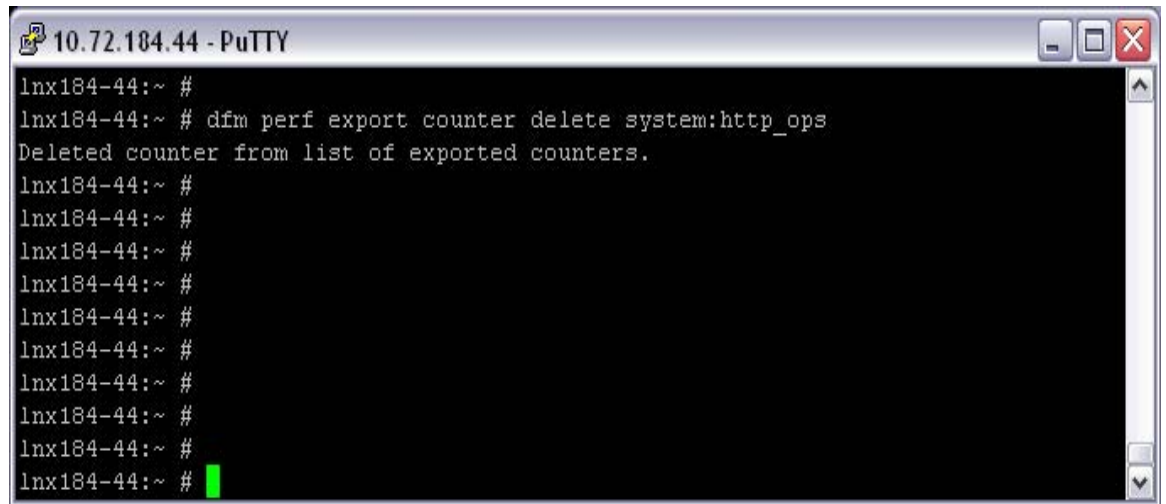
To export the PA data for a counter that is not part of default list, user needs to add the counter to the default list. This can be done by executing the command `dfm perf export counter add` as shown in Figure 11.



```
10.72.184.44 - PuTTY
lnx184-44:~ #
lnx184-44:~ # dfm perf export counter add system:http_ops
Added counter to list of exported counters.
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ # dfm perf export counter list | grep system | grep http_ops
1 system http_ops
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
```

Figure 11

To discard any counter data from being exported, we need to delete that counter from the default counter list by executing the command `dfm perf export counter delete system:http_ops` as shown in Figure 12.



```
10.72.184.44 - PuTTY
lnx184-44:~ #
lnx184-44:~ # dfm perf export counter delete system:http_ops
Deleted counter from list of exported counters.
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
lnx184-44:~ #
```

Figure 12

3.5 SCENARIO 5: ACCESSING DATAFABRIC MANAGER AND PA DATA THROUGH THIRD-PARTY REPORTING TOOLS

In two cases, the storage administrator likes an access to the DataFabric Manager and PA data through third-party reporting tools.

Case A: Storage administrator wants to access directly the DataFabric Manager database views from third-party reporting tools such as Crystal Report to generate customized storage capacity reports.

For illustration purpose, Crystal Report has been considered as the third-party reporting tool.

The steps required to connect from Crystal Report to DataFabric Manager database are documented below:

- Create database user using `dfm database user create` command.
- Enable the access for the user created above.
- Create a data source name (DSN) to connect to the embedded DataFabric Manager database. The DSN has to be created on the client machine where Crystal Report is installed.
- Connect to the embedded DataFabric Manager database from Crystal Report using the DSN created in the preceding step.
- Create required report from the exposed DataFabric Manager views.

The procedure to create a DSN for ODBC connection is described in section below.

Creating DSN

The steps mentioned below help the administrator to create a DSN on a Windows® operating system.

- Go to Control Panel → Administrative Tools → Data Sources (ODBC) → System DSN tab
- To add a new DSN, click "Add" button. This opens "Create New Data Source" wizard.

- In the wizard, select Adaptive Server Anywhere (ASA) driver and click “Finish” button.

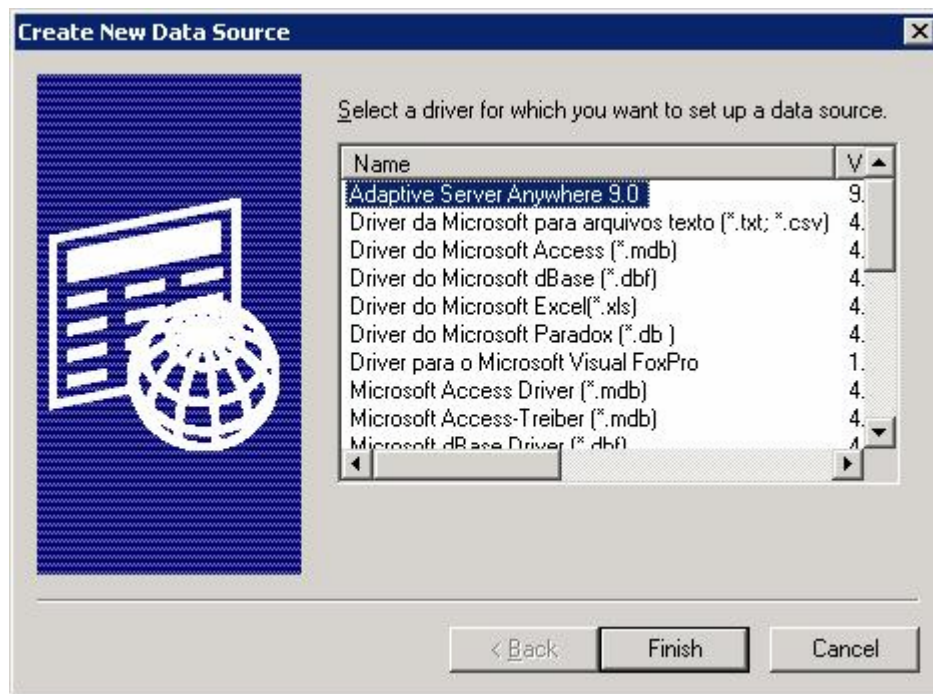


Figure 13

Note: Administrator needs to install the appropriate ASA driver on the Windows system where Crystal Report is installed.

- This opens “ODBC configuration for ASA” wizard.

In this wizard, configure the following fields with values mentioned below:

Data Source Name: <DSN Name>

Database name: monitordb

Server name: monitordb

User ID: <database user name>

Password: <database user password>

Hosts: <DataFabric Manager Server IP>

Port: 2638

dobroad: none

Links: tcpip

The following figures capture the required configuration steps.

- Specify a DSN in ODBC tab as shown in Figure 14.

The screenshot shows the 'ODBC Configuration for Adaptive Server Anywhere 9' dialog box with the 'ODBC' tab selected. The 'Data source name' field contains 'Any_DSN_Name'. The 'Description' field is empty. The 'Isolation level' field is empty. There are five unchecked checkboxes: 'Microsoft applications (Keys in SQLStatistics)', 'Delphi applications', 'Suppress fetch warnings', 'Prevent driver not capable errors', and 'Delay AutoCommit until statement close'. The 'Describe Cursor Behavior' section has three radio buttons: 'Never' (unchecked), 'If required' (checked), and 'Always' (unchecked). The 'Translator' field contains '<No Translator>'. There are 'Select Translator...' and 'Test Connection' buttons. At the bottom are 'OK', 'Cancel', and 'Help' buttons.

Figure 14

- Specify the credentials of the user created using the command `dfm database user create` as shown in Figure 15.

The screenshot shows the 'ODBC Configuration for Adaptive Server Anywhere 9' dialog box with the 'Login' tab selected. There are two radio buttons: 'Use integrated login' (unchecked) and 'Supply user ID and password' (checked). Under 'Supply user ID and password', the 'User ID' field contains 'dbuser' and the 'Password' field contains 'XXXXXX'. There is an unchecked checkbox for 'Encrypt password'. At the bottom are 'OK', 'Cancel', and 'Help' buttons.

Figure 15

- Specify the server name and database name as monitordb as shown in Figure 16.

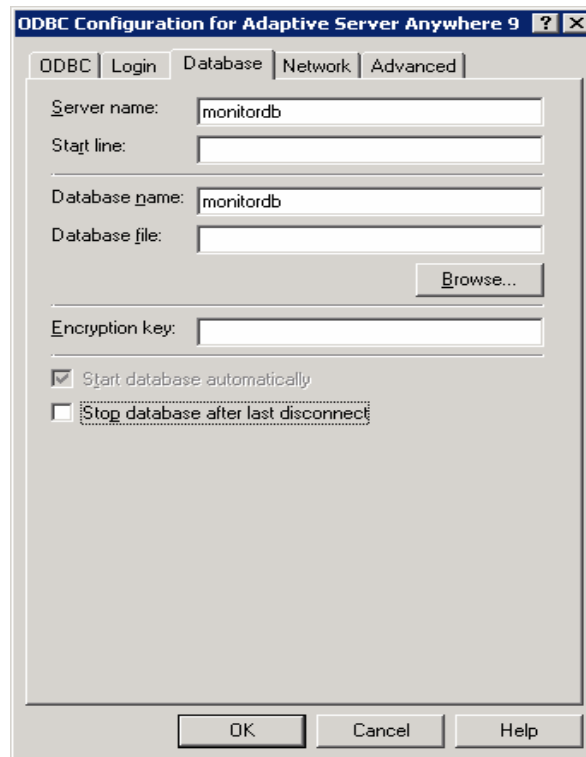


Figure 16

- Select the TCP/IP option and specify the host and port details as shown in Figure 17. Also specify `dobroad=none` along with host and port details.

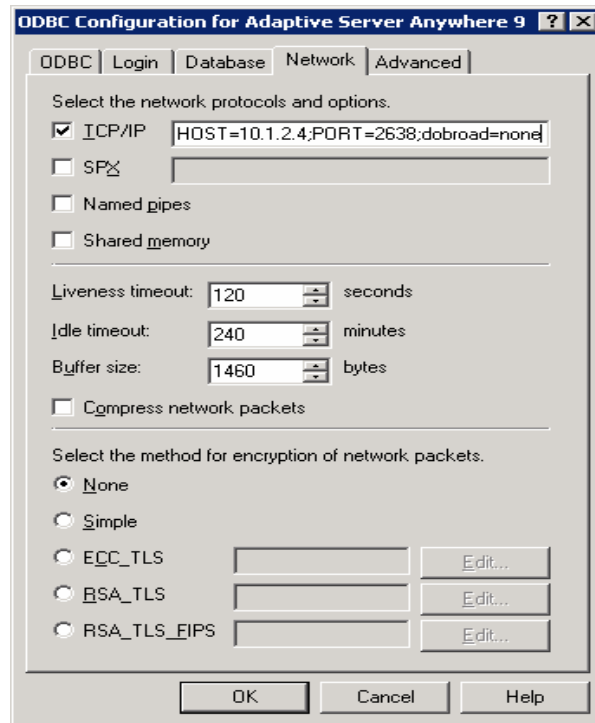


Figure 17

- Once the DSN is created successfully, administrator can connect to the embedded DataFabric Manager database using this DSN from Crystal Report.
- The database views for nonhistorical DataFabric Manager data will be listed under "DFMGROUP" node in the Standard Report Creation Wizard as shown in Figure 18.

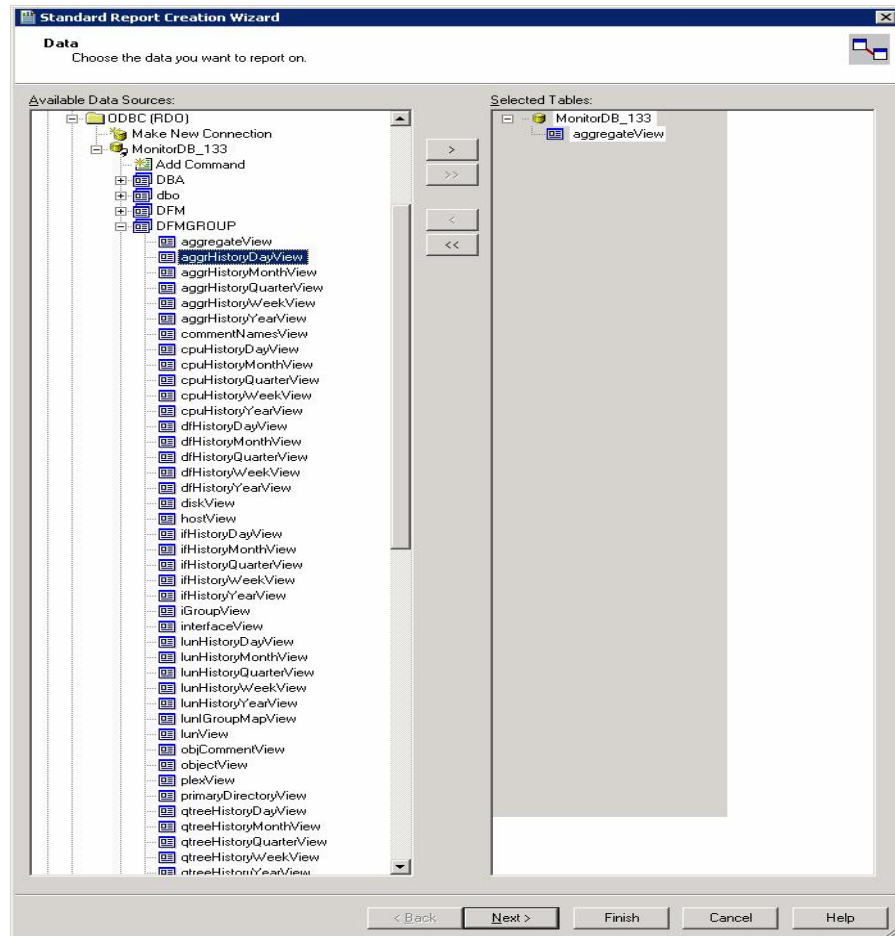


Figure 18

Using the Standard Report Creation Wizard, administrator can create custom reports as shown in Figure 19.

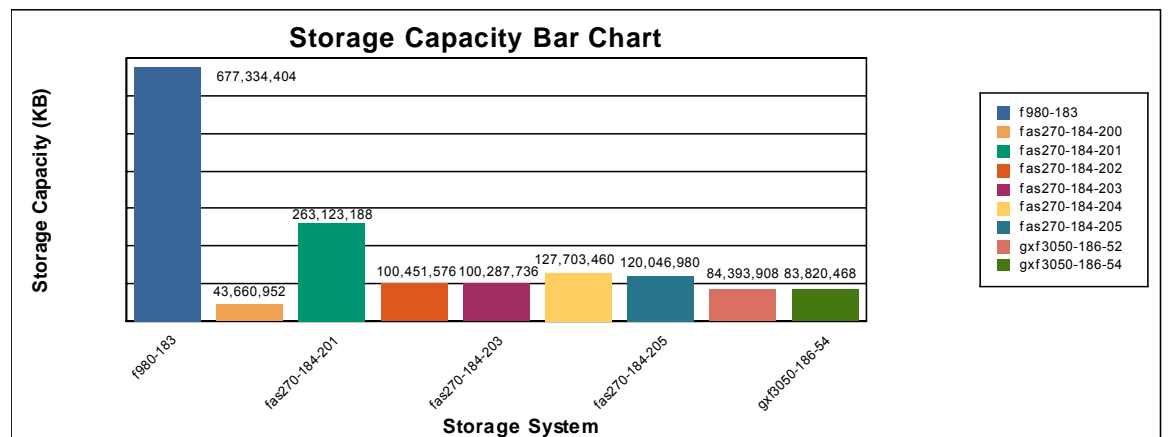


Figure 19

Note: Jar files required for iAnywhere Java database connectivity driver and jConnect Java database connectivity driver are packaged with Operations Manager and are available under `<dfm-install-dir>/misc/dbconn` folder. Procedure to create DSN for jdbc connection is same as shown in Figures 13 to 17.

Case B: Storage administrator wants to isolate/offload the reporting functions to a secondary server rather than have the Operations Manager server host all the workload. To achieve this, he needs to export both the DataFabric Manager as well as PA data to a third-party database on the secondary server and create his own customized reports based on this exported data.

For illustration purpose, let's consider Crystal Report as the third-party reporting tool and MySQL as third-party database. The data export can be done on-demand or on-schedule. In this case, it is recommended to use scheduled data export to avoid manual intervention and get the incremental data for the defined schedule each time the export runs.

The steps required are documented below:

- Enable global options `dfmDataExportEnabled` and `perfDataExportEnabled`.
- Create a schedule using the command `dfm schedule create`. We recommend having a daily schedule as shown below.

```
$ # dfm schedule create -D 00:00 Daily_Export_Schedule
Created daily schedule Daily_Export_Schedule (2351).
Will run every day at 0 hours 0 minutes.
```

- Assign this schedule to data export using the command `dfm data export schedule set`.

```
$ # dfm data export schedule set -d comma -t "30 mins" -f "avg" -h "10 days" Daily_Export_Schedule
Added data export schedule.
```

This adds a schedule for DataFabric Manager and PA data export.

Using `-d` option, one can specify whether the DataFabric Manager and PA data has to be exported to CSV or tab-separated text files. Apart from `-d` option, other options are applicable only for PA data export.

The `-t` option helps in consolidating multiple samples into one sample to achieve the desired resolution, using the specified consolidation method.

The `-f` option is used to apply the function across the data to achieve the desired time resolution, if the requested sample rate is different from the actual sample rate of the data. The values can be `avg`, `min`, `max`, or `last`. The default is `last`.

The `-h` option specifies the number of weeks, days, hours, minutes, or seconds of history to export the PA data. This is only used in the first scheduled run. For later scheduled runs, this value is calculated as the difference of times between the last successful scheduled run and the current time.

Note: To check the status of scheduled data export, administrator can use the command `dfm data export schedule status`. The log messages corresponding to data export are recorded in `<dfm-install-dir>/log/dataexport.log`.

- The administrator can load the data exported to MySQL database running on a secondary server. A sample reference script to load exported data to MySQL database is available in

“NetApp Technology Network” Web site titled “Operations Manager Server Data Export Tool.”
The URL is listed below:

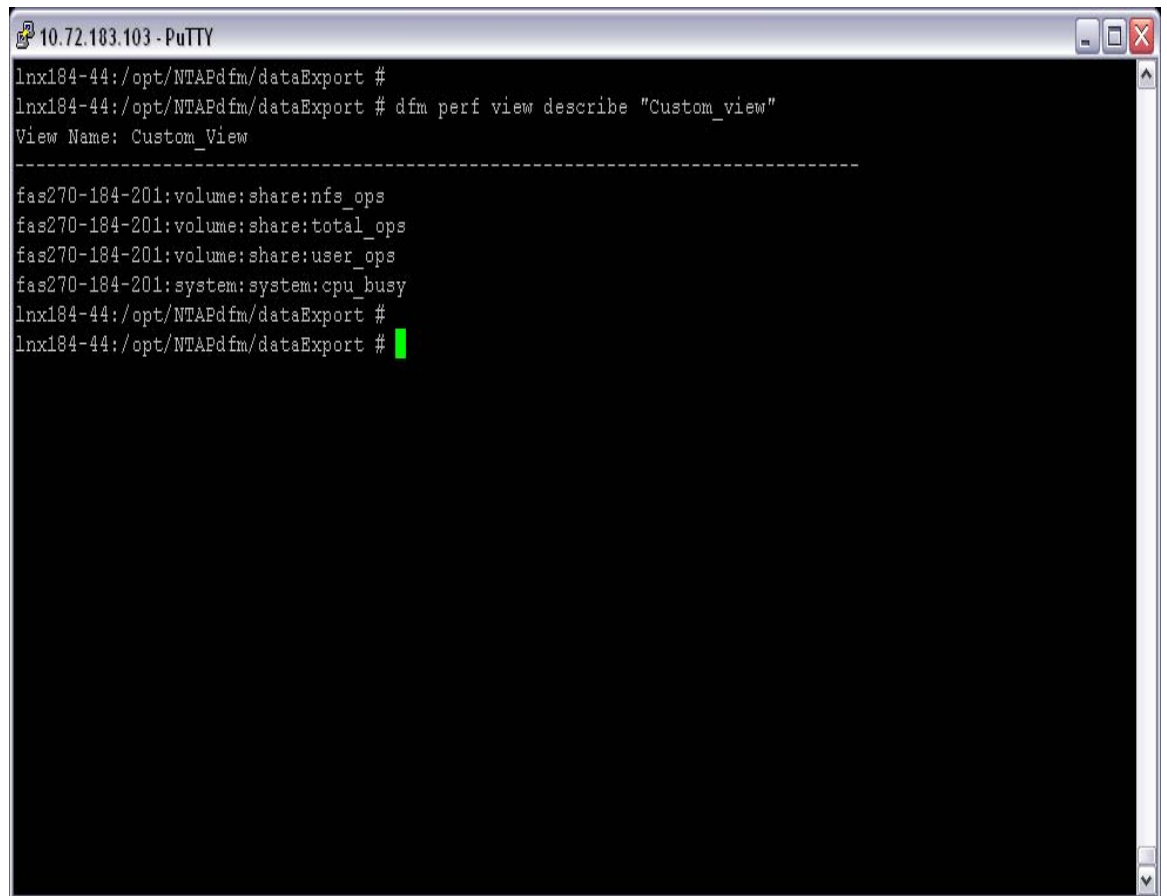
<http://communities.netapp.com/docs/DOC-1217>

- Once the exported data is loaded to MySQL, the administrator can connect to MySQL database from Crystal Report and create customized DataFabric Manager and PA reports.

3.6 SCENARIO 6: EXPORTING PERFORMANCE DATA FOR CUSTOM VIEW COUNTERS

Storage administrator wants to export performance data for counters that are part of a custom view.

For illustration purpose, let's assume that we have created a custom view `Custom_view` for a volume share. The counters added in the custom view are as shown in Figure 20.



```
10.72.183.103 - PuTTY
lnx184-44:/opt/NTAPdfm/dataExport #
lnx184-44:/opt/NTAPdfm/dataExport # dfm perf view describe "Custom_view"
View Name: Custom_View
-----
fas270-184-201:volume:share:nfs_ops
fas270-184-201:volume:share:total_ops
fas270-184-201:volume:share:user_ops
fas270-184-201:system:system:cpu_busy
lnx184-44:/opt/NTAPdfm/dataExport #
lnx184-44:/opt/NTAPdfm/dataExport #
```

Figure 20

The custom view counters needs to be added to the perf export counter list as shown in Figure 21.

```
10.72.183.103 - PuTTY
lnx184-44:/opt/NTAPdfm/dataExport # dfm perf export counter add -v Custom_view volume:nfs_ops
Added counter to list of exported counters.
lnx184-44:/opt/NTAPdfm/dataExport # dfm perf export counter add -v Custom_view volume:total_ops
Added counter to list of exported counters.
lnx184-44:/opt/NTAPdfm/dataExport # dfm perf export counter add -v Custom_view volume:user_ops
Added counter to list of exported counters.
lnx184-44:/opt/NTAPdfm/dataExport # dfm perf export counter add -v Custom_view system:cpu_busy
Added counter to list of exported counters.
lnx184-44:/opt/NTAPdfm/dataExport #
lnx184-44:/opt/NTAPdfm/dataExport #
```

Figure 21

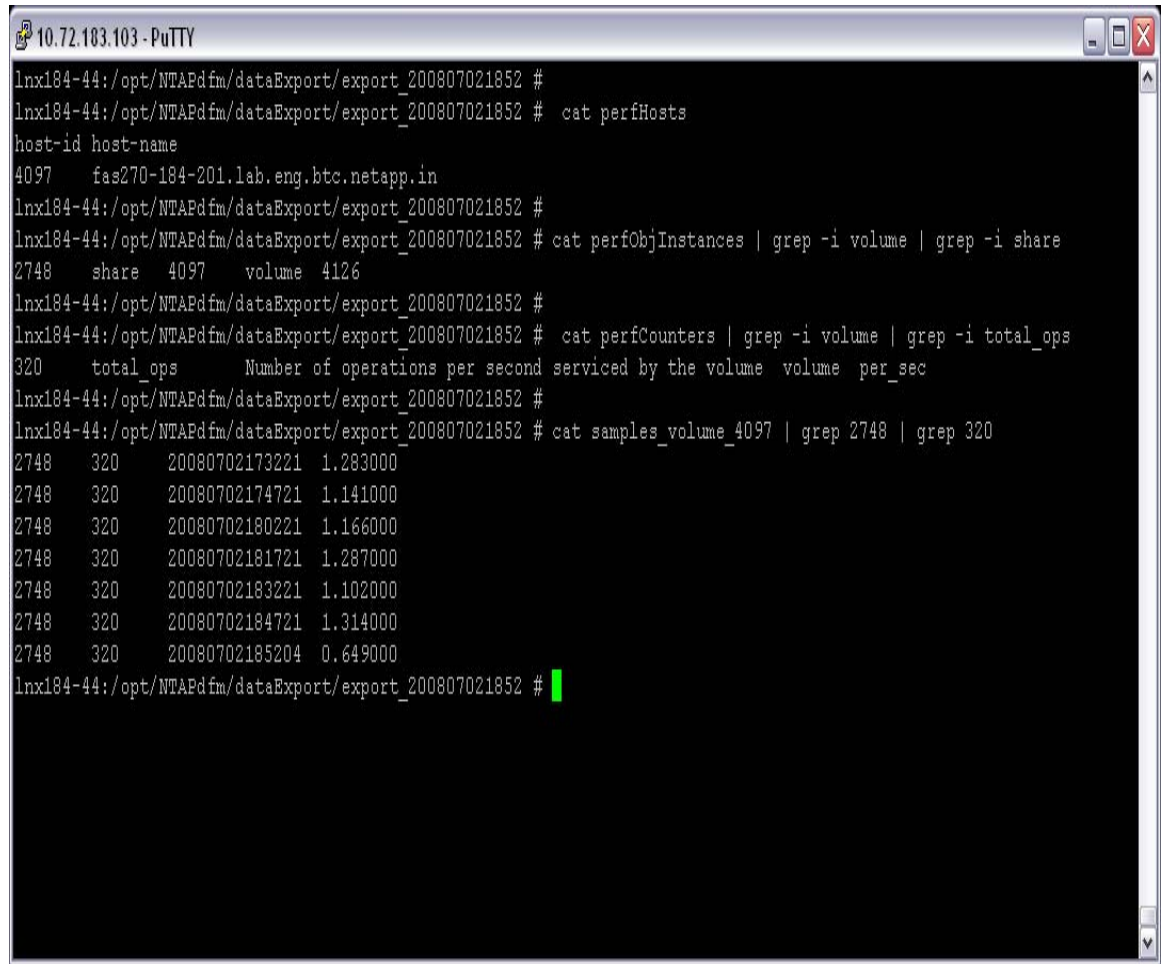
Perform a data export run as shown in Figure 22

```
10.72.183.103 - PuTTY
lnx184-44:/opt/NTAPdfm/dataExport #
lnx184-44:/opt/NTAPdfm/dataExport #
lnx184-44:/opt/NTAPdfm/dataExport # dfm data export run
Option dfmDataExportEnabled is not set. Set this option to enable export of DataFabric Manager data.
Created data export directory "/opt/NTAPdfm/dataExport/export_200807021852".
Started Performance Advisor data export.
Exported host information from which counter data is collected.
Exported Performance Advisor counter information.
Exported counter data for "volume" object type on host "fas270-184-201".
Exported "user_ops" counter data for "share" instance on host "fas270-184-201".
Exported "nfs_ops" counter data for "share" instance on host "fas270-184-201".
Exported "total_ops" counter data for "share" instance on host "fas270-184-201".
Exported counter data for "system" object type on host "fas270-184-201".
Exported "cpu_busy" counter data for "system" instance on host "fas270-184-201".
Exported counter data for "disk" object type on host "fas270-184-201".
Exported counter data for "aggregate" object type on host "fas270-184-201".
Exported counter data for "ifnet" object type on host "fas270-184-201".
Exported counter data for "nfsv3" object type on host "fas270-184-201".
Exported counter data for "nfsv4" object type on host "fas270-184-201".
Exported counter data for "iscsi" object type on host "fas270-184-201".
Exported counter data for "target" object type on host "fas270-184-201".
Exported counter data for "lun" object type on host "fas270-184-201".
Exported counter data for "cifs" object type on host "fas270-184-201".
Exported counter data for "vfiler" object type on host "fas270-184-201".
Exported counter data for "fc" object type on host "fas270-184-201".
Completed export of Performance Advisor data in less than a second.
Data Export completed successfully.
lnx184-44:/opt/NTAPdfm/dataExport #
```

Figure 22

The green colored arrows indicate the performance data exported for the counters belonging to the custom view.

The performance data exported for `total_ops` counter for the volume share is as shown in Figure 23



```
10.72.183.103 - PuTTY
lnx184-44:/opt/NTAPdfm/dataExport/export_200807021852 #
lnx184-44:/opt/NTAPdfm/dataExport/export_200807021852 # cat perfHosts
host-id host-name
4097 fas270-184-201.lab.eng.btc.netapp.in
lnx184-44:/opt/NTAPdfm/dataExport/export_200807021852 #
lnx184-44:/opt/NTAPdfm/dataExport/export_200807021852 # cat perfObjInstances | grep -i volume | grep -i share
2748 share 4097 volume 4126
lnx184-44:/opt/NTAPdfm/dataExport/export_200807021852 #
lnx184-44:/opt/NTAPdfm/dataExport/export_200807021852 # cat perfCounters | grep -i volume | grep -i total_ops
320 total_ops Number of operations per second serviced by the volume volume per_sec
lnx184-44:/opt/NTAPdfm/dataExport/export_200807021852 #
lnx184-44:/opt/NTAPdfm/dataExport/export_200807021852 # cat samples_volume_4097 | grep 2748 | grep 320
2748 320 20080702173221 1.283000
2748 320 20080702174721 1.141000
2748 320 20080702180221 1.166000
2748 320 20080702181721 1.287000
2748 320 20080702183221 1.102000
2748 320 20080702184721 1.314000
2748 320 20080702185204 0.649000
lnx184-44:/opt/NTAPdfm/dataExport/export_200807021852 #
```

Figure 23

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