

White Paper

APTARE Enabled Intelligent Storage Provisioning

One of the most difficult aspects of a storage administrator's job is to provision storage without having all the necessary data. Making sure the storage amount and tier is provisioned appropriately based on actual usage, dramatically reduces both the cost and growth of storage.

Some of the data points that are missing revolve around these questions:

- Are we over-allocating to avoid future requests?
- Has the requestor used all of the LUNs already allocated?
- Does the requestor already have unused storage on their server(s) or ESX host?
 - Free Volume Group Capacity?
 - Excess File System Capacity?
 - Decommissioned servers that still have allocated storage?
- What tier of storage is the requestor currently using for this particular application?
- What are the backup/replication requirements for the request?
- Based on growth projections, which array/pool makes the most sense to use for the allocation?
- Is there storage already reserved for other projects?
- What does the existing I/O performance look like?
- Do we have enough of the requested storage tier?
- Are we creating thin-provisioned storage to thin-provisioned Virtual Guests?

APTARE® has a unique integrated view of storage, SAN fabric, virtual and physical hosts, backup needs and applications provide storage administrators with the information needed to answer the tough questions about any allocation request. The single pane of glass provided by APTARE StorageConsole® platform not only makes it incredibly efficient to make the provisioning process more intelligent, it makes it possible for every storage allocation.

Here are the areas you should consider when making your provisioning process more intelligent:

- Host Views
- Existing Storage Utilization
- Host Mapping
- What Array/Tier Should I Use?
- Performance Profile
- Reserved Storage

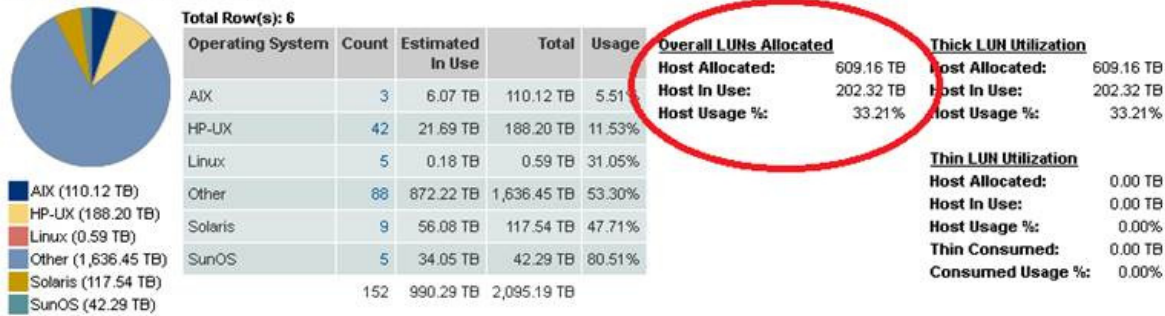
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- What Array/Tier Should I Use?
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- Reserved Storage

Host Views

APTARE consolidates all the information from the hosts in the environment to show not only an allocated view, but a utilized view of the storage. This higher level view allows for an enterprise-wide perspective of host utilization as shown below.

Executive Summary



When a storage allocation is requested, APTARE allows the storage administrator to understand the host requesting the storage, whether it is a physical host or a virtual host. APTARE has a unique agent-less data collection provides detailed information that is not provided by any other solution on the market. Here is the level of detail collected:

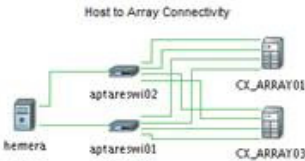
- Fibre Channel host connections
- Clustered host information
- HBA make, model, firmware, etc
- Volume manager disk usage and mapping including versions
- File system and volume usage
- Host OS, version, make and model
- Multi pathing software, version and connections
- CPU, Memory and IP Network performance
- Oracle ASM mapping and usage
- Oracle, SQL Server and Exchange allocation and utilization metrics

As you can see from the examples below, APTARE provides detailed information about basic host information, topology through the SAN and storage, any related hosts that are utilizing the same LUNs (like in a cluster), the mounted volumes and any NAS shares present.

hemera Utilization Detail

| Mar 12, 2013 03:17:27PM

Hostname: hemera **Display Name:** hemera **IP Address:** 172.28.105.38 **Type:** Client
Location: **Make:** **Model:** x86_64 **Operating System:** Linux 2.6.9-42.0.10.EL.smp
Last Poll Date: 2010-08-09 90 days forecast



Related Hosts Total Row(s): 1

Host	IP Address
heracles	172.28.105.39

- 5 Volume(s)

Total Row(s): 5

Mount Point	Raw Filesystem	Filesystem Type	Storage Type	Volume Group	Capacity	Used	% Available	90 Days Min Used	90 Days Avg Used	90 Days Max Used
/	/dev/mapper/vg_os-lv_root	ext3	DAS	vg_os	29.90 GB	11.97 GB	59.95%	N/A	N/A	N/A
/boot	/dev/cciss/c0d0p1	ext3	DAS		0.11 GB	0.02 GB	82.54%	N/A	N/A	N/A
/db	/dev/mapper/vg_os-lv_db	ext3	DAS	vg_os	14.01 GB	0.07 GB	99.52%	N/A	N/A	N/A
/db/app	/deviemcpowerc1	ocfs2	SAN		24.00 GB	15.67 GB	33.89%	N/A	N/A	N/A
/db/cra	/deviemcpowerf1	ocfs2	SAN		2.00 GB	0.34 GB	82.92%	N/A	N/A	N/A
					70.02 GB	28.27 GB		0.00 GB	0.00 GB	0.00 GB

- 2 Network Attached Storage Shares

Total Row(s): 2

Mount Point	Raw Filesystem	Capacity	Used	% Available	90 Days Min Used	90 Days Avg Used	90 Days Max Used
/nfs/dbstorage	aptarenasf01:/rac_dump	348.33 GB	94.80 GB	72.78%	N/A	N/A	N/A
/nfs/purge	aptarenasf01:/tat_purge	49.24 GB	31.42 GB	36.19%	N/A	N/A	N/A
					0.00 GB	0.00 GB	0.00 GB

For virtual hosts, APTARE also provides detailed information about the VM guest includes OS, VM Path, volumes including utilization metrics and disks provided to the VM (whether raw mapped or through a data store)

VM Detail

| Mar 12, 2013 03:22:13PM

Name: Centos5-TSM62 **VMware Tools:** toolsOld **Boot Time:** Wed Feb 09 00:20:35 PST 2011
Host Name: apttsm6 **Tools Version:** 8194 **Suspend Time:**
IP Address: 172.16.1.120 **Connection State:** **Datastore:** aptesx04_raid1_datastore
VM Server: aptesx04.corp **Power State:** **Resource Pool:** resgroup-1689
VM Size: 143.29 GB **Status:** **Last Updated:** Feb 24, 2011 12:00:59PM PST

Current Snapshot: Configured TSM some more

VM Path Name: [ptesx04_raid1_datastore] RHS_TSM_6.2/RHS_TSM_6.2.vmx

System OS: Other 2.6x Linux (64-bit)

Notes: Laurent: This VM is our TSM 6.2 lab machine. It runs a TSM 6.2.1 instance.

Volumes:

Total Row(s): 4

Disk Path	VM Name	Total Capacity	Used	Free	Usage
/	Centos5-TSM62	96.02 GB	48.24 GB	47.78 GB	
/boot	Centos5-TSM62	0.10 GB	0.01 GB	0.08 GB	
/tsm_storage/001	Centos5-TSM62	0.97 GB	0.90 GB	0.08 GB	
/tsm_storage/002	Centos5-TSM62	0.98 GB	0.90 GB	0.08 GB	
		98.07 GB	50.04 GB	48.03 GB	

Disks:

Total Row(s): 3

Disk Label	Disk Type	Capacity	Datastore	LUN	Array	Mode
Hard disk 1	Virtual Disk	100.00 GB	ptesx04_raid1_datastore			
Hard disk 2	Virtual Disk	1.00 GB	ptesx04_raid1_datastore			
Hard disk 3	Virtual Disk	1.00 GB	ptesx04_raid1_datastore			

102.00 GB

Existing Storage Utilization

APTARE has been specifically designed to provide the information to necessary to support the provisioning process. Once you have visibility into the host details, you can further examine the need for additional capacity by validating unused or underutilized storage already allocated to the host. With a few clicks, storage administrators can easily validate the host's current utilization in any of the following areas:

- Unbound / Orphaned LUNs
- Excess Capacity at the Volume Manager level
- Unused space inside a VMware® datastore
- Current File System Utilization Rates
- Excess Capacity at the application/database

Often the largest source of excess capacity and easy reclamation opportunities are unused or orphaned LUNs. Typically, once the LUN has been allocated the storage administrator no longer has visibility to the utilization of the storage. The APTARE host view can quickly show LUNs that are allocated but not used by a host.

Host	# of Allocated LUNs	Allocated Capacity	# of Used LUNs	Seen by Host	# of Arrays	Related Host	# of Volumes			Volume Capacity				
							SAN/DAS	NAS	At Risk	Shared	Unshared	Total DAS/SAN	DAS/SAN	NAS
aptare1	526	27,899.46 GB	480	25,415.46 GB	3	aptare2	10	6	0	27,846.49 GB	0.00 GB	27,846.49 GB	27,846.49 GB	67.9 GB
aptare2	526	27,899.46 GB	480	25,415.46 GB	3	aptare1	10	7	0	27,846.49 GB	0.00 GB	27,846.49 GB	0.00 GB	70.8 GB
hds_sun1	19	23.00 GB	0	0.00 GB	1		8		3	0.00 GB	69.51 GB	69.51 GB	69.51 GB	N/A
hds_axc	5	647.60 GB	5	647.60 GB	5		7		3	0.00 GB	25.19 GB	25.19 GB	25.19 GB	N/A
hds_hpux	5	482.60 GB	5	482.60 GB	5		8		2	0.00 GB	11.37 GB	11.37 GB	11.37 GB	N/A
hds_linux	5	482.60 GB	1	401.67 GB	5		3		0	0.00 GB	39.16 GB	39.16 GB	39.16 GB	N/A
hds_win1	5	482.60 GB	5	482.60 GB	5		2		0	0.00 GB	34.87 GB	34.87 GB	34.87 GB	N/A
hds_win2	5	482.60 GB	5	482.60 GB	5		4		0	0.00 GB	128.71 GB	128.71 GB	128.71 GB	N/A

A detailed view of the LUNs is also available by drilling-down from any the links on the screenshot above.

Allocated and Unused LUNs Total Row(s): 4

Name	RAID Type	Storage Array	Array Group	Product	Capacity	Host
3	RAID5	AMS500	100522,0	DF700M	10.00 GB	hds_linux
22	RAID5	HDS9570V	100523,0	DF600	10.00 GB	hds_linux
6	RAID5(3D+1P)	HDS9970V	100528,1-2-1	RAID451	50.93 GB	hds_linux
7	RAID5(3D+1P)	USP	100586,1-1-1	RAID500	10.00 GB	hds_linux



80.93 GB

APTARE can look inside the host's volume manager to see how the space has been allocated to volume groups and how that storage is being utilized. In the next example we see two LUNs that have not been used by the volume manager. This represents almost 1TB of free capacity that can be leveraged to satisfy capacity requirements.

Total Row(s): 1					Total Row(s): 1	
Type	Name	Array	Physical Disk Name	Size	Logical Volume	Size
LUN	0001	j0923	0001	naa.60000970001	Un-Allocated	480.01 GB
						480.01 GB

Total Row(s): 1					Total Row(s): 1	
Type	Name	Array	Physical Disk Name	Size	Logical Volume	Size
LUN	0001	j0925	0001	naa.60000970000	Un-Allocated	480.01 GB
						480.01 GB

When a request is made for more space to an ESX host for a VM Guest, in addition to making sure there are not any LUNs not being used at the physical machine level, Storage Administrators also need to verify the utilization of the datastores available in the ESX cluster. It is also helpful to check for VMs not in inventory – notice the 90GB of space taken by VMs no longer available.

Name	Total Capacity	Used	Free	Usage	Total VM Used	VMDK Used	VM Disk Capacity	VM Not In Inventory	# Sharing VM Servers	# VMs	# Extents	# Disks	# Arrays
datastore1 (1)	200.25 GB	175.20 GB	25.05 GB		174.44 GB	159.53 GB	90.00 GB	0.20 GB	1	4	1	1	0
storage1	557.50 GB	534.14 GB	23.36 GB		534.00 GB	414.64 GB	311.49 GB	91.05 GB	1	19	1	1	0

It is possible that all the allocated space has been used by the host and given to file systems/volumes on the host. APTARE can also show if these file systems are being utilized effectively. The report example below indicates a file system with over 2TB of free capacity available. Depending upon the nature of the provisioning request, this information could serve as a justification of denial.

- 11 Volume(s)

Total Row(s): 11

Mount Point	Raw Filesystem	Filesystem Type	Storage Type	Volume Group	Capacity	Used	% Available
/ggs	/dev/vx/dsk/ggatedg/ggs	vxfs	SAN	ggatedg	3.00 TB	0.52 TB	82.73%
/ora/staging	/dev/vx/dsk/stagingdg/ora_staging	vxfs	SAN	stagingdg	0.76 TB	0.35 TB	54.81%
/ora	/dev/vx/dsk/localdg/ora	vxfs	SAN	localdg	0.10 TB	0.05 TB	52.55%

In addition to having visibility into the file system and volume manager efficiency, APTARE also provides utilization statistics for database applications. Database applications are some of the biggest consumers of capacity and can represent a significant source of wasted space. Having the ability to evaluate utilization within the database is a powerful tool in evaluating provisioning requests. The following report shows excess capacity in Oracle table spaces and data files.

Application Storage Dashboard

Total Row(s): 2

Application	Host	Application Storage			Filesystem Storage			Array Storage			Arrays	LUNs
		Total	Free	Used	Total	Free	Used	Total	Free	Used		
* ORACLE	40 Host(s)	66,178.90 GB	7,848.60 GB	58,330.30 GB	50,300.04 GB	4,608.36 GB	45,691.68 GB	284,790.83 GB	23,730.46 GB	261,060.38 GB		
* COT(COT)	hal	126.85 GB	79.55 GB	47.30 GB	196.00 GB	65.59 GB	130.41 GB	164,854.31 GB	6,176.27 GB	58,678.04 GB		
* IDB(IDB)	hal	56.11 GB	21.75 GB	34.35 GB	60.00 GB	4.86 GB	55.14 GB	284,790.83 GB	23,730.46 GB	261,060.38 GB		
* FNSYS_TS		38.09 GB	12.48 GB	25.61 GB	60.00 GB	4.86 GB	55.14 GB	119,936.52 GB	17,554.18 GB	102,382.34 GB		
/oracle/IDB/tdbdata1/fnsys01.dbf		29.30 GB	6.25 GB	23.04 GB	60.00 GB	4.86 GB	55.14 GB	119,936.52 GB	17,554.18 GB	102,382.34 GB	109	090534 090535 090536 090537 090538
/oracle/IDB/tdbdata1/fnsys02.dbf		8.79 GB	6.22 GB	2.56 GB	60.00 GB	4.86 GB	55.14 GB	119,936.52 GB	17,554.18 GB	102,382.34 GB	09	090534 090535 090536 090537 090538

Host Mapping

It is necessary to understand the place of the host in the overall storage environment. In other words, how is it connected through the SAN backbone to the storage arrays? Will I need to create new masking or connections?

In the below example, we have a storage request from the host Hemera. APTARE provides the detailed topology map along with any connections to the storage and any zones for that host.

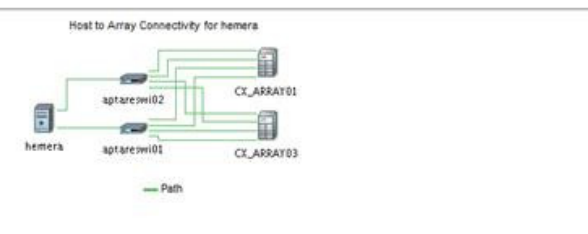
Host to Storage Dashboard

Fabrics=All SAN Fabrics | Mar 12, 2013 04:00:18PM

Customize Save Email Export Help

Total Path(s): 9

Host	Arrays	LUNs	Capacity	Host Ports	Zones	Hops
aeolus	1	11	850.00 GB	2	2	2
athena	1	1	22.00 GB	2	2	2
erebus	1	7	409.44 GB	4	2	2
hebe	1	7	409.44 GB	2	2	2
hemera	2	16	2,946.00 GB	4	4	2
heracles	2	16	2,946.00 GB	2	4	2
iris	1	16	2,000.00 GB	4	2	2
nike	1	5	1,230.00 GB	4	2	2



Host to Array Connectivity for hemera

Total Connections for hemera: 10

Status	Connected From			Connected To		
	Device	Port #	Gb/sec	Device	Port #	Gb/sec
●	Host: hemera			Switch: aptaresw01	06	2
●	Host: hemera			Switch: aptaresw02	06	2
●	Switch: aptaresw02	36	2	Array: CX_ARRAY01		
●	Switch: aptaresw01	60	4	Array: CX_ARRAY03		
●	Switch: aptaresw02	52	4	Array: CX_ARRAY03		
●	Switch: aptaresw02	44	2	Array: CX_ARRAY01		
●	Switch: aptaresw02	60	4	Array: CX_ARRAY03		
●	Switch: aptaresw01	36	2	Array: CX_ARRAY01		
●	Switch: aptaresw01	44	2	Array: CX_ARRAY01		
●	Switch: aptaresw01	52	4	Array: CX_ARRAY03		

Total Zone(s) for hemera: 4

Zone Name	Zone Set	Members	Initiators	Targets
hemera_01p06_cx1263_spA1_B1	aptare_zoneset_sw01	3	1	1
hemera_01p06_cx2181_spA0_B0	aptare_zoneset_sw01	3	1	1
hemera_02p06_cx1263_spA0_B0	aptare_zoneset_sw02	3	1	1
hemera_02p06_cx2181_spA1_B1	aptare_zoneset_sw02	3	1	1

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Likewise in the virtual environment, storage administrators want to know how a VM Guest is mapped to the storage they are providing.

VM Guest End To End LUN Mapping

Server Group=APTARE | Apr 14, 2012 12:00:00AM - Jun 12, 2012 07:35:59PM

Total Row(s): 8

VM Guest	Host Name	VM Server	Status	Datastore	File Name	Path	Type	Size(GB)	Array	LUN	Last Updated
ora4_vm98	ora2.aptare.com	vmora1217.aptare.com	●	vmdmz21	ora4_vm98.vmdk	ora4_vm98	VmDisk	60.00	fas1	/vol/vmdmz21/lun1	May 18, 2012 01:16:58AM
NS2	ns2.aptare.com	vmora1217.aptare.com	●	vmdmz22	NS2.vmdk	NS2	VmDisk	9.00	fas1	/vol/vmdmz22/lun0	May 20, 2012 12:31:55AM
NS1	ns1.aptare.com	vmora1217.aptare.com	●	vmdmz21	NS1.vmdk	NS1	VmDisk	9.00	fas1	/vol/vmdmz21/lun1	Apr 23, 2012 06:06:59AM
yourich	ora4.aptare.com	vmora1217.aptare.com	●	vmdmz23	yourich_1.vmdk	yourich	VmDisk	3.55	fas1	/vol/vmdmz23/lun0	May 08, 2012 07:48:28AM
yourich	ora4.aptare.com	vmora1217.aptare.com	●	vmdmz23	yourich.vmdk	yourich	VmDisk	18.46	fas1	/vol/vmdmz23/lun0	May 08, 2012 07:49:53AM
ora4_vm82	ora7.aptare.com	vmora1217.aptare.com	●	vmdmz21	ora4_vm82.vmdk	ora4_vm82	VmDisk	40.02	fas1	/vol/vmdmz21/lun1	Jun 10, 2012 01:17:12AM
boxter	ora3.aptare.com	vmora1217.aptare.com	●	vmraw20	Boxter.vmdk	Boxter	VmDisk	20.00	fas1	/vol/vmraw20/lun0	Jun 02, 2012 01:50:37PM
boxter	ora3.aptare.com	vmora1217.aptare.com	●	vmraw20	Boxter_1.vmdk	Boxter	VmDisk	40.00	fas1	/vol/vmraw20/lun0	Jun 02, 2012 01:50:37PM

200.04

What Array/Tier Should I Use?

APTARE provides numerous views to determine which storage array and/or storage tier makes the most sense to use in order allocate storage to the requesting business unit. Thin provisioned storage pools and array virtualization is fully supported by APTARE.

It is helpful to start with a wide angled view of the enterprise. The example below displays all storage in the environment by vendor.

Array Executive Summary

Arrays=All Storage Arrays | Mar 12, 2013 04:16:00PM

Total Row(s): 5

Vendor Name	Raw	Usage			Protection			Efficiency			Tier		
	Capacity	Frames	Total Usable	Used	Available	Primary	Replica	Thick	Thin	Overprov	Tier 1	Platinum	Platinum
EMC	802.37 TB	10	531.06 TB		248.08 TB	409.58 TB	121.48 TB	531.06 TB	0.00 TB	0.00%	0.00 TB	0.16 TB	0.00 TB
HDS	8,254.74 TB	48	641.18 TB		1,688.07 TB	N/A	1,215.61 TB	N/A	3,464.45 TB	89.90%	5.09 TB	0.00 TB	3,159.19 TB
HP	301.33 TB	4	167.54 TB		50.56 TB	167.54 TB	0.00 TB	167.54 TB	0.00 TB	0.00%	0.00 TB	0.00 TB	0.00 TB
IBM	239.49 TB	3	110.40 TB		22.31 TB	110.40 TB	0.00 TB	110.40 TB	0.00 TB	0.00%	0.00 TB	0.00 TB	0.00 TB
NetApp	511.02 TB	17	0.03 TB		0.02 TB	0.03 TB	0.00 TB	0.03 TB	0.00 TB	0.00%	0.00 TB	0.00 TB	0.00 TB
	10,108.94 TB	82	1,450.22 TB		2,009.04 TB	113.12 TB	1,337.10 TB	N/A	3,464.45 TB		5.09 TB	0.16 TB	3,159.19 TB

Usually, it is more helpful to start with an overall view by tier in order to satisfy the performance and/or data protection requirements of the application requesting storage. The report below shows each of the defined tiers of storage and identifies the unallocated capacity that's available to satisfy a provisioning request

Policy	Cost Per GB	Total Capacity	Virtual Capacity	RAID			LUNs			Thin Provisioned		
				Local Capacity	Used	Available	Total	Allocated	UnAllocated	Total	Used	Pool Available
Blended (Raid5 + 10)	\$ 84.00	148,140.06 GB	0.00 GB	148,140.06 GB	127,809.84 GB	20,330.42 GB	53,984.00 GB	41,098.39 GB	13,885.61 GB	0.00 GB	0.00 GB	0.00 GB
FC	\$ 0.00	75,153.13 GB	0.00 GB	75,153.13 GB	N/A	179,281.84 GB	2,749,053.50 GB	2,356,854.83 GB	392,398.87 GB	890,997.80 GB	796,452.34 GB	94,545.25 GB
Gold	\$ 56.00	2,083,117.69 GB	0.00 GB	2,083,117.69 GB	1,948,399.24 GB	134,718.45 GB	1,894,822.70 GB	1,485,156.11 GB	409,666.59 GB	37,729.00 GB	19,658.90 GB	18,070.10 GB
Performance (Raid 10)	\$ 106.00	2,947.22 GB	0.00 GB	2,947.22 GB	2,788.07 GB	159.15 GB	1,314.23 GB	1,314.23 GB	0.00 GB	0.00 GB	0.00 GB	0.00 GB
Raid 5	\$ 53.00	135,853.08 GB	0.00 GB	135,853.08 GB	106,815.82 GB	28,837.26 GB	83,450.19 GB	70,337.00 GB	23,113.19 GB	0.00 GB	0.00 GB	0.00 GB
SAN_Tier2	\$ 5.96	0.00 GB	0.00 GB	0.00 GB	0.00 GB	0.00 GB	15.01 GB	15.01 GB	0.00 GB	0.00 GB	0.00 GB	0.00 GB
SAS	\$ 0.00	139,411.34 GB	0.00 GB	139,411.34 GB	137,692.84 GB	1,718.50 GB	249,754.82 GB	219,142.18 GB	30,612.64 GB	192,963.50 GB	24,093.01 GB	168,870.49 GB
SATA	\$ 0.00	198,106.42 GB	0.00 GB	198,106.42 GB	18,559.03 GB	179,547.39 GB	1,166,744.32 GB	941,478.19 GB	225,266.13 GB	167,211.68 GB	N/A	167,961.76 GB
Tier 1	\$ 2.00	75,153.13 GB	0.00 GB	75,153.13 GB	N/A	179,281.84 GB	2,749,053.50 GB	2,356,854.83 GB	392,398.87 GB	890,997.80 GB	796,452.34 GB	94,545.25 GB
Tier 2	\$ 1.00	198,106.42 GB	0.00 GB	198,106.42 GB	18,559.03 GB	179,547.39 GB	1,166,744.32 GB	941,478.19 GB	225,266.13 GB	167,211.68 GB	N/A	167,961.76 GB
Tier 2	\$ 9.28	2,083,117.69 GB	0.00 GB	2,083,117.69 GB	1,948,399.24 GB	134,718.45 GB	1,894,822.70 GB	1,485,156.11 GB	409,666.59 GB	37,729.00 GB	19,658.90 GB	18,070.10 GB
Tier1	\$ 17.58	163,198.27 GB	0.00 GB	163,198.27 GB	161,900.97 GB	1,217.31 GB	394,031.05 GB	201,101.96 GB	192,929.09 GB	0.00 GB	0.00 GB	0.00 GB
		5,302,104.46 GB	0.00 GB	5,302,104.46 GB	4,262,746.86 GB	1,039,357.60 GB	12,013,790.34 GB	10,099,586.63 GB	1,914,203.71 GB	2,394,840.06 GB	1,654,815.34 GB	730,024.72 GB

Drill down on a tier of storage to provide a list of storage frames that have sufficient capacity to satisfy the request.

Name	Array	Policy	Cost Per GB	Total Capacity	Virtual Capacity	RAID			LUNs			Thin Provisioned		
						Local Capacity	Used	Available	Total	Allocated	UnAllocated	Total	Used	Pool Available
00		Tier 1	\$ 2.00	199,244.99 GB	0.00 GB	199,244.99 GB	133,071.97 GB	66,173.02 GB	125,740.23 GB	34,204.72 GB	91,535.51 GB	82,025.80 GB	91,287.99 GB	30,737.81 GB
000		Tier 1	\$ 2.00	315,974.82 GB	0.00 GB	315,974.82 GB	206,822.28 GB	29,152.34 GB	142,070.43 GB	135,894.16 GB	6,176.27 GB	141,945.45 GB	120,187.66 GB	21,757.79 GB

Storage Administrators can then drill-down further to the available thick or thin LUNs in the array or pool and choose the appropriate LUN for the allocation ticket.

LUN Utilization Summary - Unallocated

| Mar 12, 2013 09:54:49PM | Storage arrays: 00

Total Row(s): 956

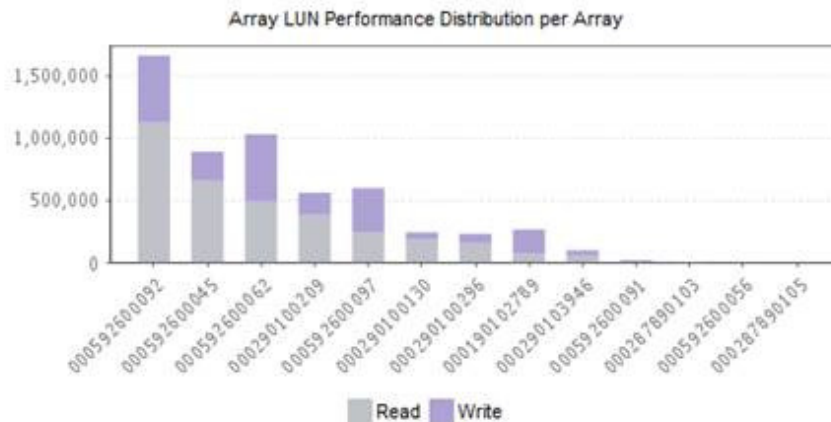
Name	RAID Type	Array Group	Storage Array	Capacity	Estimated Used	Estimated Available
00	113B TDEV (Meta Head)		00	1,200.07 GB	N/A	1,200.07 GB
0f	0BE0 TDEV (Meta Head)		00	1,024.10 GB	N/A	1,024.10 GB
00	0BF0 TDEV (Meta Head)		00	1,024.10 GB	N/A	1,024.10 GB

Performance also dictates which storage array makes the most sense to allocate a new request from for a particular host. The following section “Performance Profile” covers performance in more detail. A simple report over any user-specified time period, can give an idea of what arrays are not utilized as often and might be a better choice to use when satisfying an allocation request.

Array LUN Performance - RW Response

| Dec 05, 2012 01:12:00AM - Dec 07, 2012 01:11:59AM

Reporting on Array Vendor: EMC Symmetrix Metric: RW Response



Performance Profile

It is necessary to understand the current performance profile before suggesting a lower tier or higher tier of storage. APTARE creates a performance profile for each type of storage and compares the performance each host is getting against that profile. This provides the storage administrator with a quick view into the hosts to see if their current performance is working for their needs.

Storage Performance- Last 10-Days

Server Group=Global Storage Infrastructure | Mar 03, 2013 12:00:00AM - Mar 12, 2013 07:10:59PM
 ● Fast ● Normal ● Slow ○ No data collected false

Total host(s): 48

Host	LUNs	Mar 03	Mar 04	Mar 05	Mar 06	Mar 07	Mar 08	Mar 09	Mar 10	Mar 11	Mar 12
hds_hpux	1 LUN(s)	●	●	●	●	●	●	●	●	●	○
hds_axc	1 LUN(s)	●	●	●	●	●	●	●	●	●	○
hds_win1	LUN(s)	●	●	●	●	●	●	●	●	●	○
hds_win2	1 LUN(s)	●	●	●	●	●	●	●	●	●	○
hds_win3	1 LUN(s)	●	●	●	●	●	●	●	●	●	○
p57005	4 LUN(s)	○	○	○	○	○	○	○	○	○	○
ONEVH22	33 LUN(s)	●	●	●	●	●	●	●	●	●	○
ONEVH21	2 LUN(s)	●	●	●	●	●	●	●	●	●	○
ONEVH25	33 LUN(s)	●	●	●	●	●	●	●	●	●	○

APTARE also provides the detailed performance metrics by LUN and RAID Group as well as shown below.

XIV Array Performance

Array Vendor=IBM XIV | Mar 06, 2013 12:00:00AM - Mar 12, 2013 07:12:39PM
 ● Fast ● Normal ● Slow ○ No data collected

Total Row(s): 13

Storage Array	RAID Group	Performance	RAID Type	# Drives	Drive Type	Drive Speed	Drive Form	# LUNs	Read Resp (ms)	Write Resp (ms)	Total IO/sec	Read IO/sec	Write IO/sec	Read MB/sec	Write MB/sec	Read Cache Hits/sec	Write Cache Hits/sec
ONEXV01	DUR-ONEVPS01-01	●	XIV	180	SATA	N/A	3.5	1	2	8	153	108	54	0	0	99	9
ONEXV01	FLS-ONEVPS01-01	●	XIV	180	SATA	N/A	3.5	24	25	12	506,688	170,226	336,462	2,751	6,741	111,636	209,013
ONEXV01	GOL-ONEVPS01-01	●	XIV	180	SATA	N/A	3.5	2	13	15	4,347	3,168	1,188	315	9	2,781	369
ONEXV01	GUR-ONEVPS01-01	●	XIV	180	SATA	N/A	3.5	8	34	16	30,627	14,418	16,209	873	702	5,733	10,233
ONEXV01	LAT-ONEVPS01-01	●	XIV	180	SATA	N/A	3.5	9	19	9	21,852	11,349	10,503	333	234	7,974	5,715
ONEXV01	LOU-ONEVH21-01	●	XIV	180	SATA	N/A	3.5	2	4	6	696	389	308	6	5	301	111
ONEXV01	ONE-ONEVPS01-01	●	XIV	180	SATA	N/A	3.5	5	25	21	126,405	3,537	122,868	90	1,719	2,997	100,755
ONEXV01	ONE-ONEVPS02-01	●	XIV	180	SATA	N/A	3.5	3	1	1	18	12	9	0	0	9	0
ONEXV01	PRO-ONEVPS01-01	●	XIV	180	SATA	N/A	3.5	1	6	11	711	72	639	9	9	36	360
ONEXV01	SPY-ONEVPS01-01	●	XIV	180	SATA	N/A	3.5	1	20	13	5,076	4,374	702	351	18	3,582	405
ONEXV01	SSN-ONEVPS01-01	●	XIV	180	SATA	N/A	3.5	1	1	43	2,709	27	2,682	0	54	18	2,115
ONEXV01	SUN-SUNESX-01	●	XIV	180	SATA	N/A	3.5	9	45	15	80,184	16,824	63,352	872	912	12,416	50,944
ONEXV01	TEA-ONEVPS01-01	●	XIV	180	SATA	N/A	3.5	5	20	12	11,493	6,858	4,644	153	63	4,833	2,619
									17	14	790,959	231,362	559,620	5,753	10,466	152,415	382,648

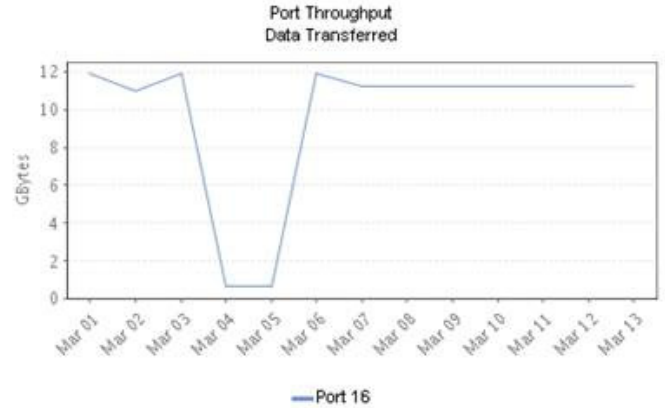
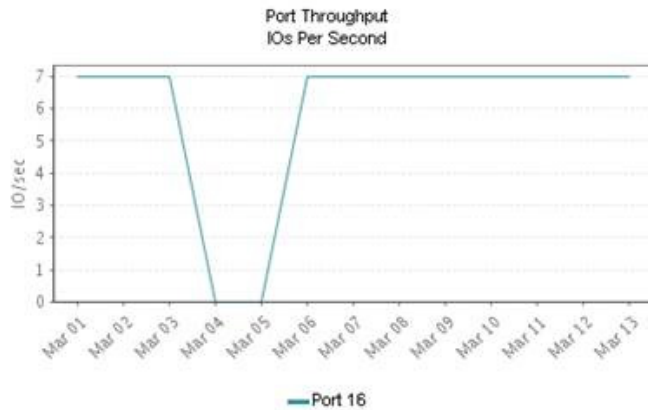
Properly distributing masked capacity across the storage array and fabric ports is essential in maintaining performance levels. APTARE provides performance metrics that can assist an administrator on determining which ports are least utilized.

Storage Array	Port #	Role	Port Name	IO/Sec	IO %	MB Transferred	Transferred %
Hitachi TagmaStore AMS1000	0		CTL0-A	7	19.44%	6,088	19.21%
Hitachi TagmaStore AMS1000	2	Target	CTL0-C	0	0.00%	8	0.03%
Hitachi TagmaStore AMS1000	3	Target	CTL0-D	7	19.44%	6,494	20.49%
Hitachi TagmaStore AMS1000	16		CTL1-A	7	19.44%	6,143	19.39%
Hitachi TagmaStore AMS1000	17		CTL1-B	8	22.22%	6,630	20.92%
Hitachi TagmaStore AMS1000	18	Target	CTL1-C	7	19.44%	6,322	19.95%
Hitachi TagmaStore AMS1000	19	Target	CTL1-D	0	0.00%	1	0.00%

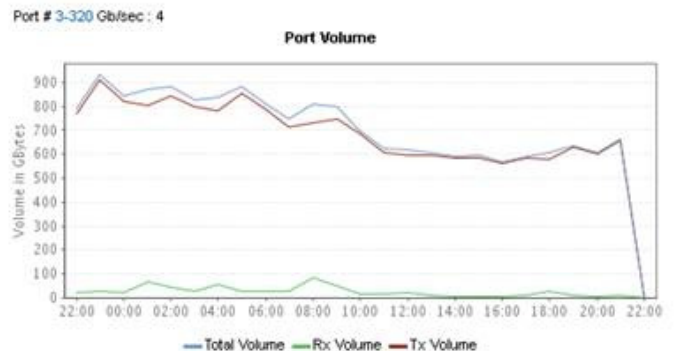
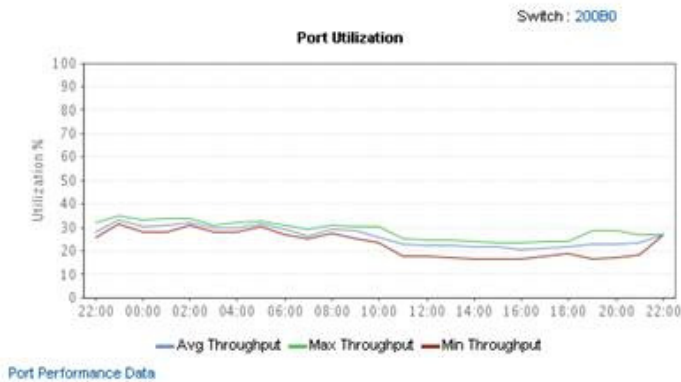
Port Throughput

| Mar 01, 2013 12:00:00AM - Mar 13, 2013 12:46:59AM

Array: Hitachi Thunder 9570V RD80



APTARE also provides full information from the FC switch perspective as shown in the Host Mapping section earlier in this document. The report below shows current port utilization from the host requesting new storage.



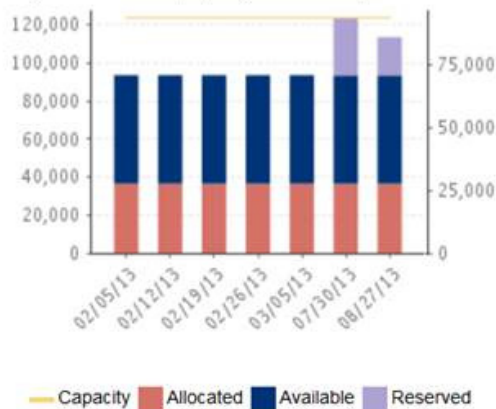
Reserved Storage

It is extremely useful to keep track of known future allocations of storage – storage that business units or applications know they will need in the near future. These storage reservations can easily be stored in the APTARE database and used with any projection of storage growth. Storage reservations can also track storage that is off lease or being removed from the environment.

As you can see from the below screenshots, APTARE can easily show your storage growth across individual arrays (or by any other business grouping necessary), the historical growth of storage (allocated and available) as well as any storage that will be coming on-line (or removed) in the future.

Array Allocated Capacity with Future Requested Storage

| Mar 09, 2012 12:00:00AM - Mar 08, 2013 08:25:10AM
 Array: DMX-3000-M2 (Capacity values in GB)



Reserved Storage

| Mar 08, 2013 08:09:03AM

Total Row(s): 3

Array	Reserved Capacity	Project	Description	Reserved for Date
DMX-3000-M2	30,000.00	VM Expansion	VMWare Expansion into UAT environment	Aug 01, 2013 12:00:00AM
DMX-3000-M2	20,000.00	SAP Addon	Add additional capacity to SAP in London Datacenter	Sep 01, 2013 12:00:00AM
APTLAB-CX4-5	10,000.00	DB Tablespace	Extend Tablespaces on all Prod Oracle where tablespaces at 90%	Sep 12, 2013 12:00:00AM