Virtualization for Storage Efficiency and Centralized Management

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Agenda

Storage Virtualization

- what is it?

- who is it for and why?
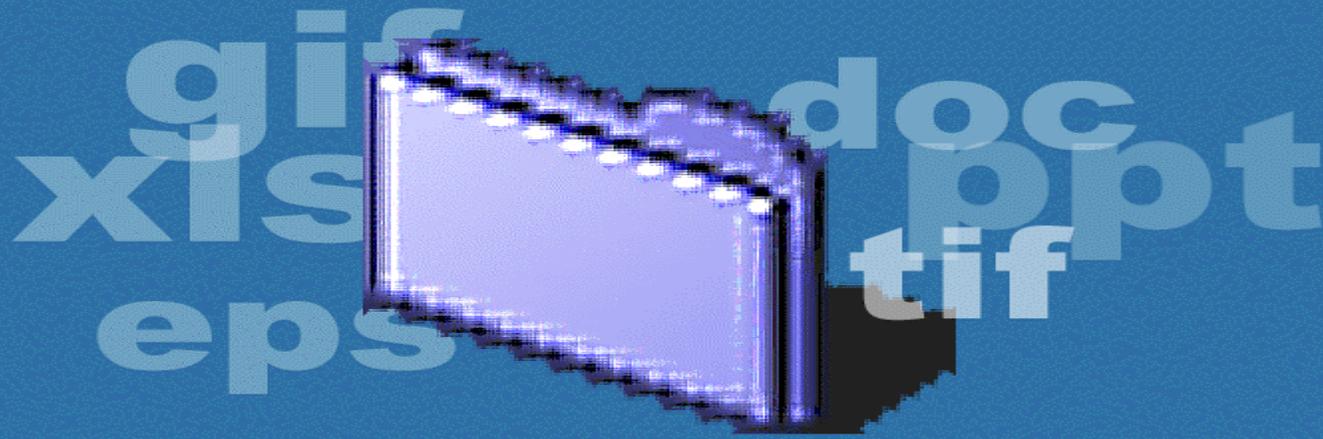
- how does it work?

- where's the value?

Agenda

Storage Virtualization

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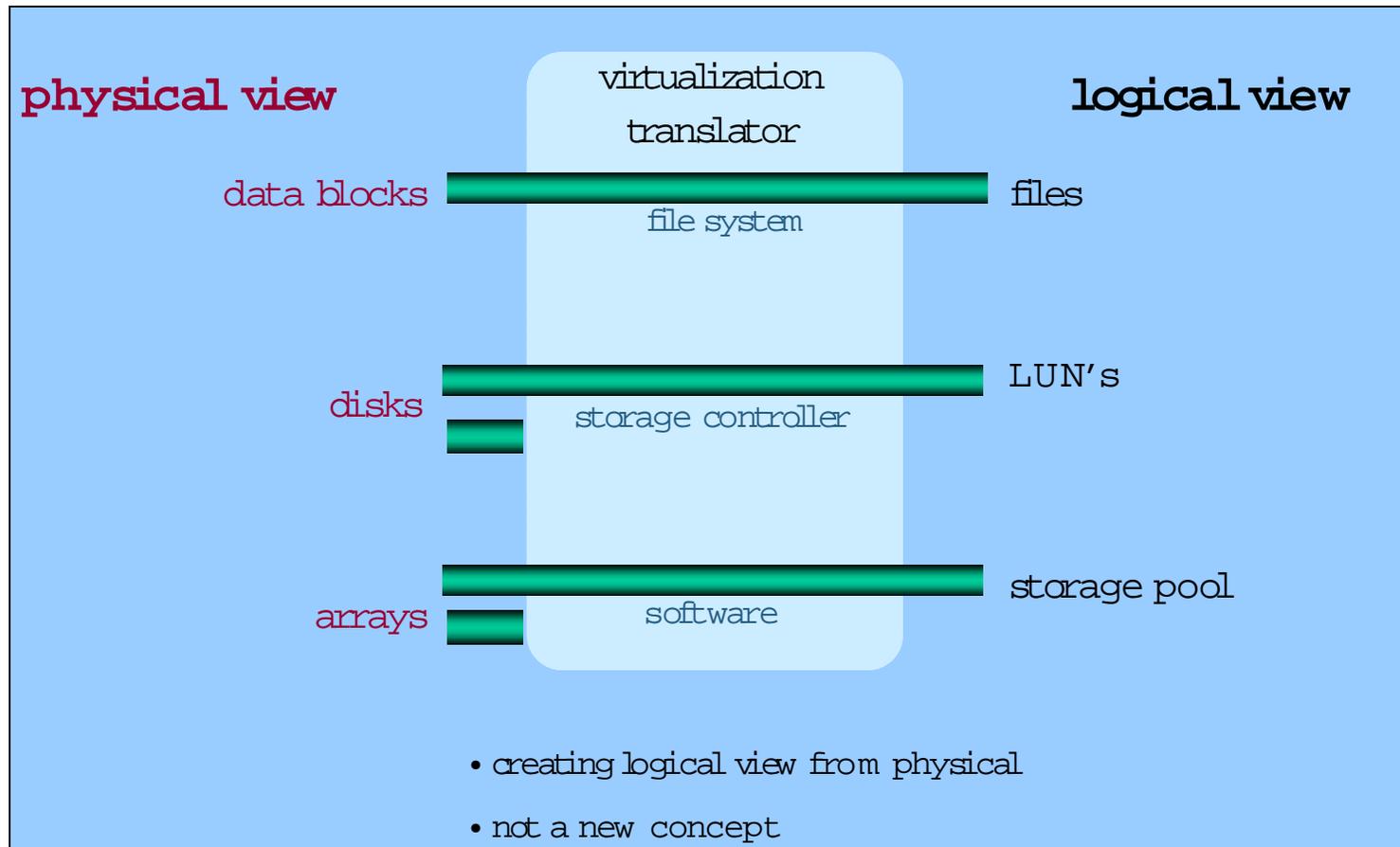
folders and files on your hard drive
virtualization example

folders and files are virtual representation of data blocks

gif xls eps doc ppt tif

storage virtualization

a translator

physical view

logical view

virtualization
translator

data blocks ━━━━━━━━━━━━━━━━━ files
file system

LUN's
disks ━━
storage controller

storage pool
arrays ━━
software

- creating logical view from physical

- not a new concept

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defining storage virtualization

Storage Networking Industry (SNIA):

The act of abstracting, hiding, or isolating the internal function of a storage (sub) system or service from applications, computer servers or general network resources for the purpose of enabling application and network independent management of storage or data.

storage virtualization is:

- a logical view of physical resources

- a logical view of other logical resources

- a method for creating a common pool of storage from different disks or arrays

- a way to reduce complexity for the end user, simplifying storage maintenance activities

- an enabler of additional storage services such as replication and migration

storage virtualization is not:

- a new concept, although some implementations are

- a single defined technology

- defined the same way by all vendors

- always implemented the same way, even when different vendors use the same terms

Agenda

Storage Virtualization

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why virtualization?

water example

water users care about:

capacity

- household requirements
- ability to use more/less water as needed

availability

- there on the turn of a knob

they don't care about:

capacity

- size of reservoir
- number of reservoirs

availability

- neighborhood pipe construction
- number of water pumps

why virtualization?

virtualization enables storage to become more like a utility

storage users care about:

capacity

- application requirements
- ability to use more space

availability

- failure resistance
- recovery time

they don't care about:

capacity

- disk size
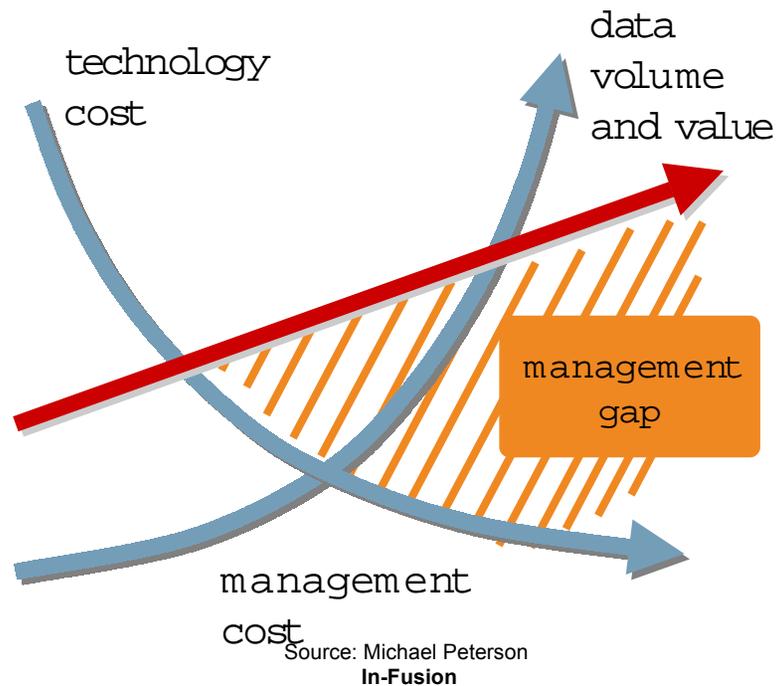- number of disks in array

availability

- mean time between failures (MTBF)
- path redundancy

storage virtualization – who is it for?

- storage networks with low storage utilization rates

- IT administrators spending too much time on disk management

- CxO's with imploding IT budgets

- applications with unpredictable storage demands

- heterogeneous environments that need data replication

What are their challenges?

technology
cost

data
volume
and value

management
gap

management
cost

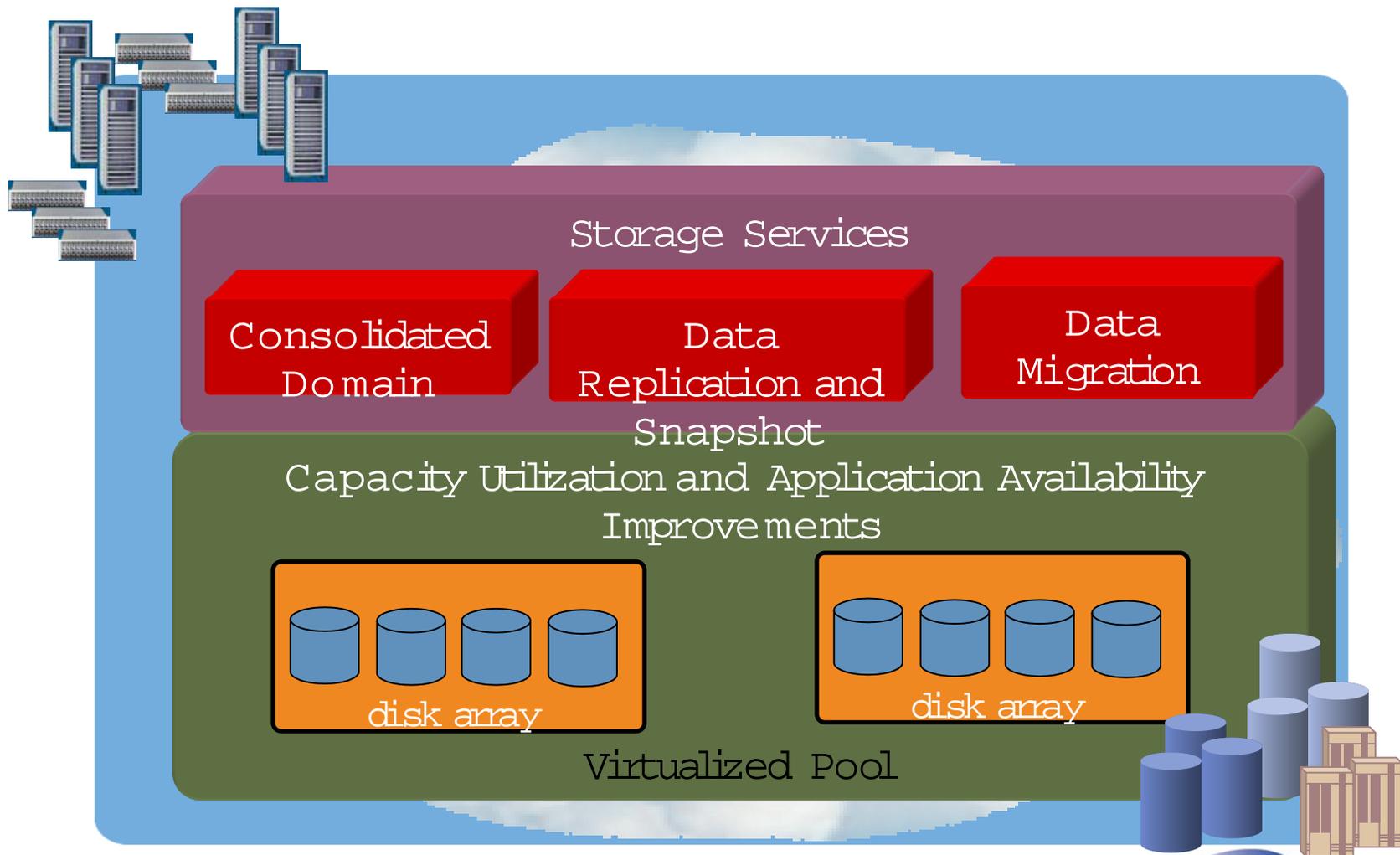Source: Michael Peterson
In-Fusion

- business increasingly demands more data
  - demands better access
  - greater resource sharing
  - higher performance
  - less application downtime
- business reality requires greater efficiencies
  - capacity utilization
  - improved management
- **storage virtualization helps close the management gap**
  - storage virtualization
    - advanced storage services

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Greater Efficiencies with Storage Virtualization

- Increased utilization of storage assets
    - Pooling of assets eliminates stranded capacity
- Reduced/Eliminated application downtime resulting from storage maintenance activities
    - Storage administrators quickly perform storage maintenance activities without disrupting business applications
- Advanced storage services enabled across heterogeneous components
    - Data replication and data migration services are performed across and between unlike storage devices from multiple vendors
- Consolidated domain for centralized management
    - Management functions can be performed across the heterogeneous storage pool
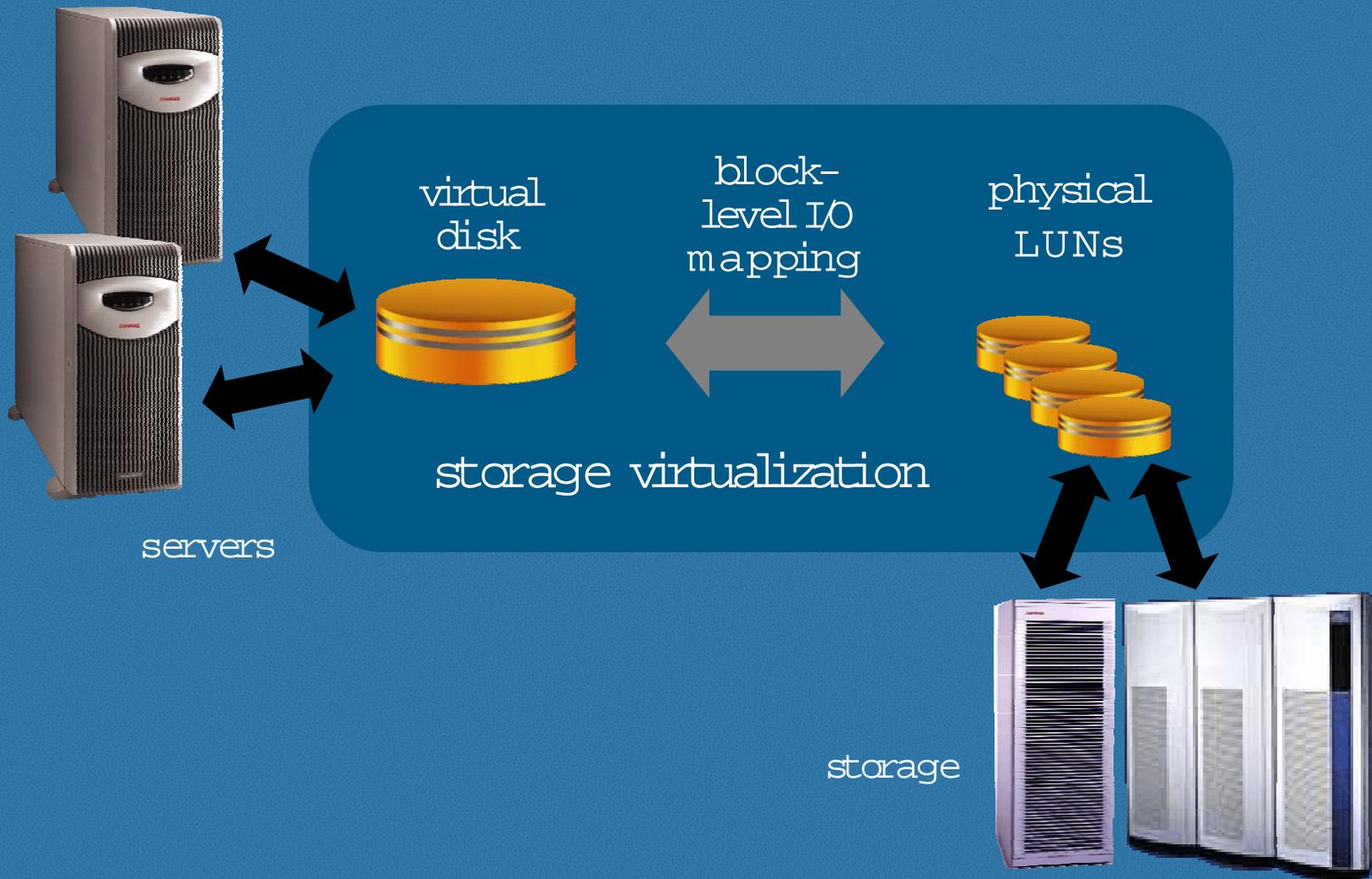
Benefits of Virtualization

Storage Services

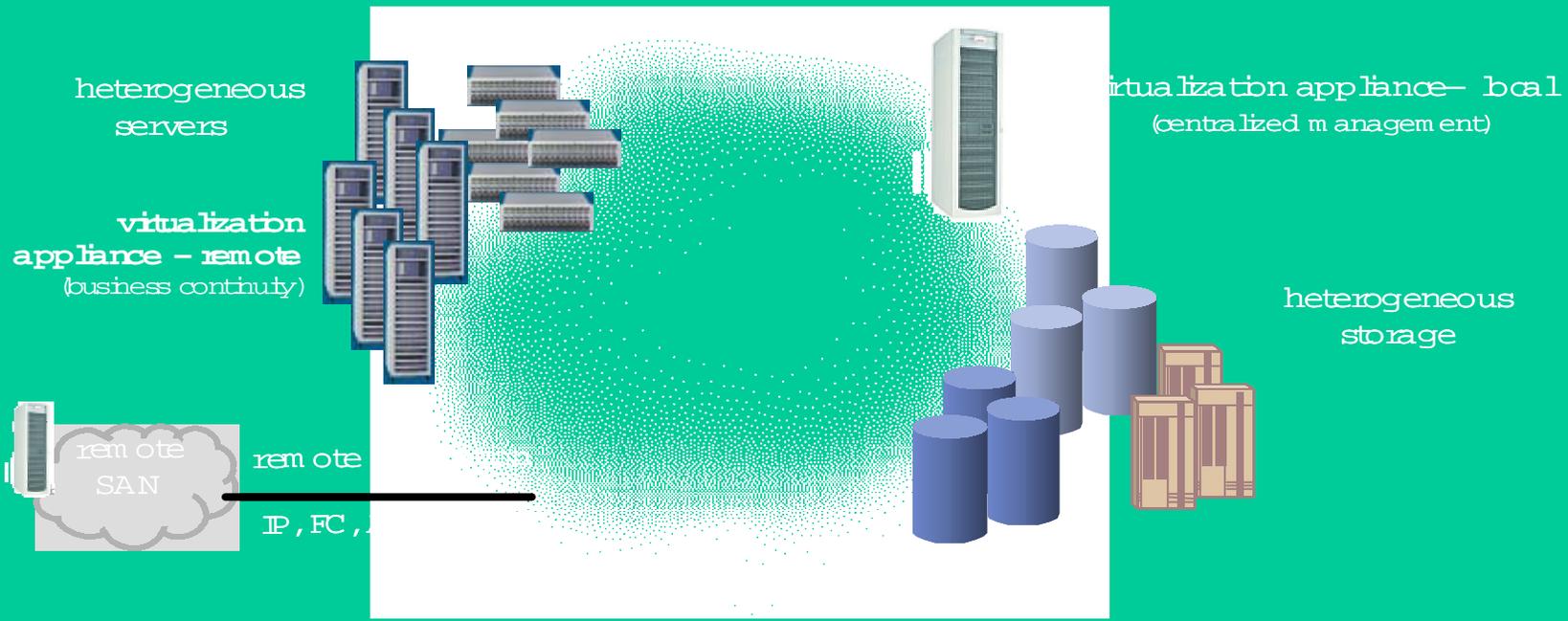Consolidated Domain

Data Replication and Snapshot

Data Migration

Capacity Utilization and Application Availability Improvements

disk array

disk array

Virtualized Pool

Agenda

Storage Virtualization

- what is it?

- who is it for and why?

- **how does it work?**

- where's the value?

how it works

servers

virtual
disk

block-
level I/O
mapping

physical
LUNs

storage virtualization

storage

virtualization solutions span many levels of IT

heterogeneous
servers

**virtualization
appliance – remote**
(business continuty)

virtualization appliance– local
(centralized management)

heterogeneous
storage

remote
SAN

remote

IP, FC,

hostbased

Single host/cluster
connected to many arrays

array based

SAN s with many,
heterogeneous hosts
connected to a single
storage device

network based

Many hosts connected
to many arrays

server-based virtualization
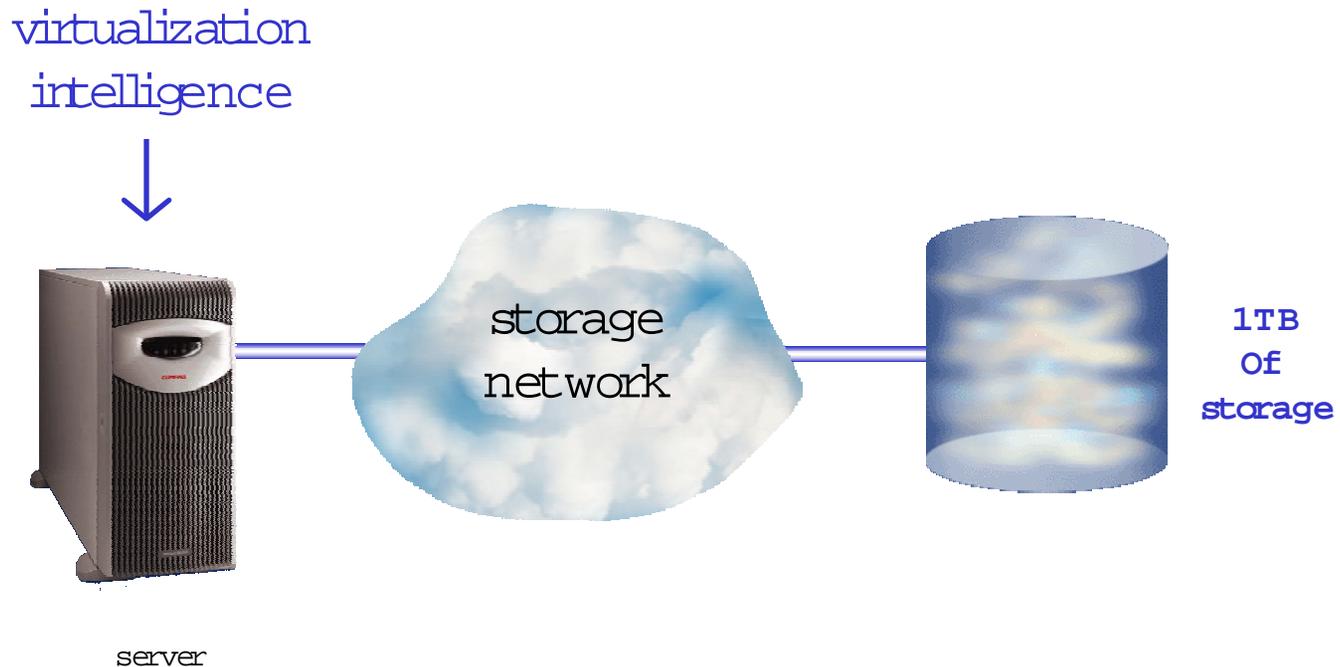
virtualization
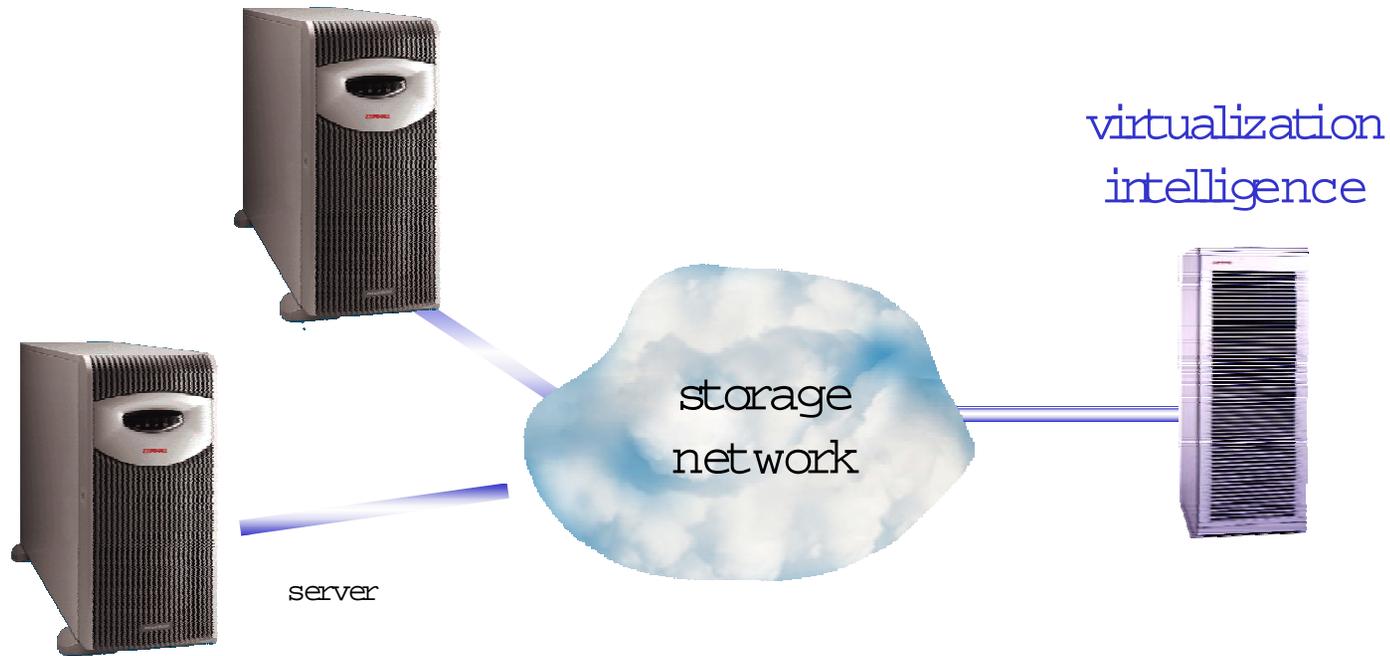intelligence

Storage
network

hp
500GB

Array 1

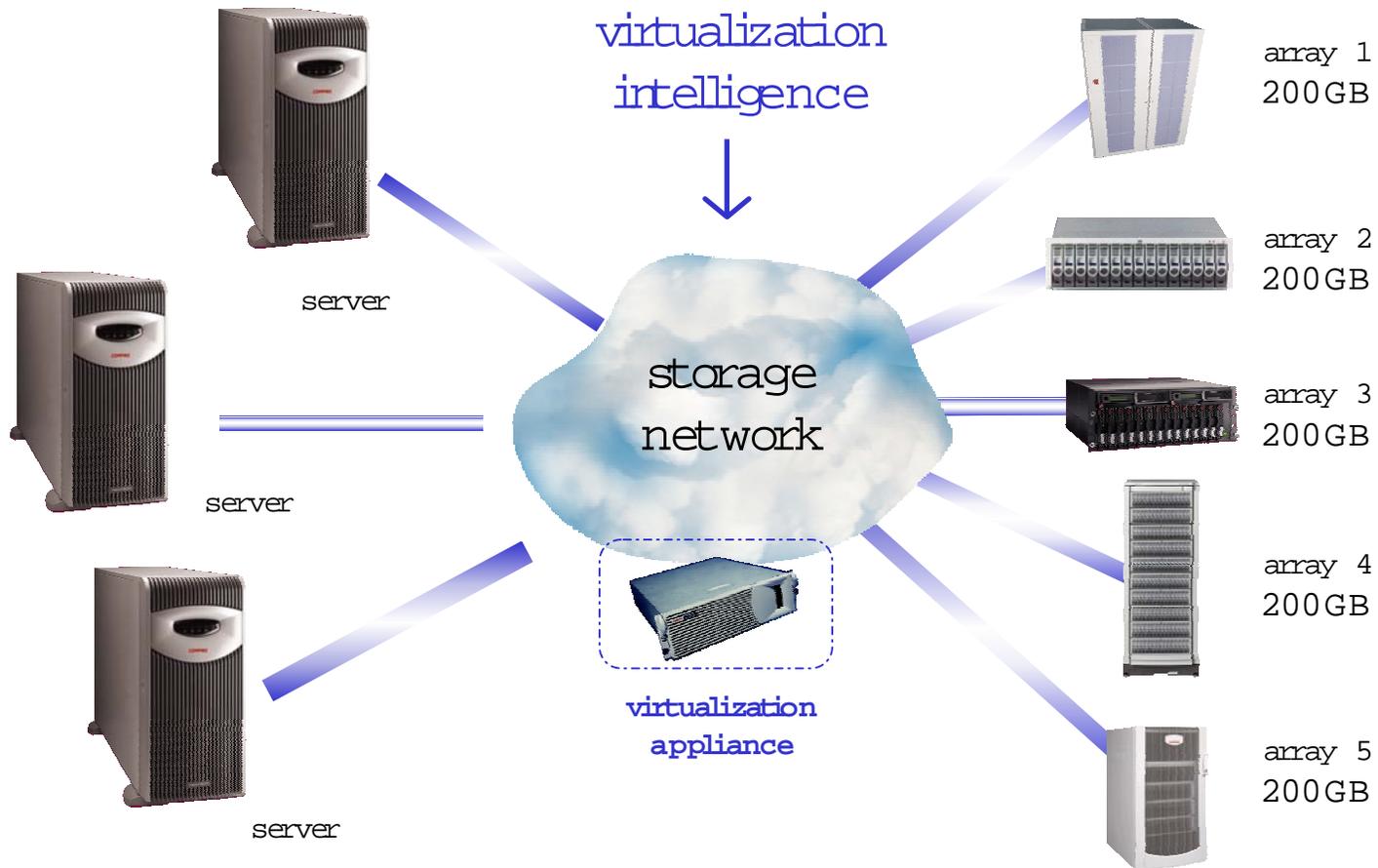Compaq
500GB

Array 2

server

server-based virtualization

virtualization
intelligence

↓

storage
network

1TB
Of
storage

server

server sees 1TB of storage as one logical unit of volume
through server-based software
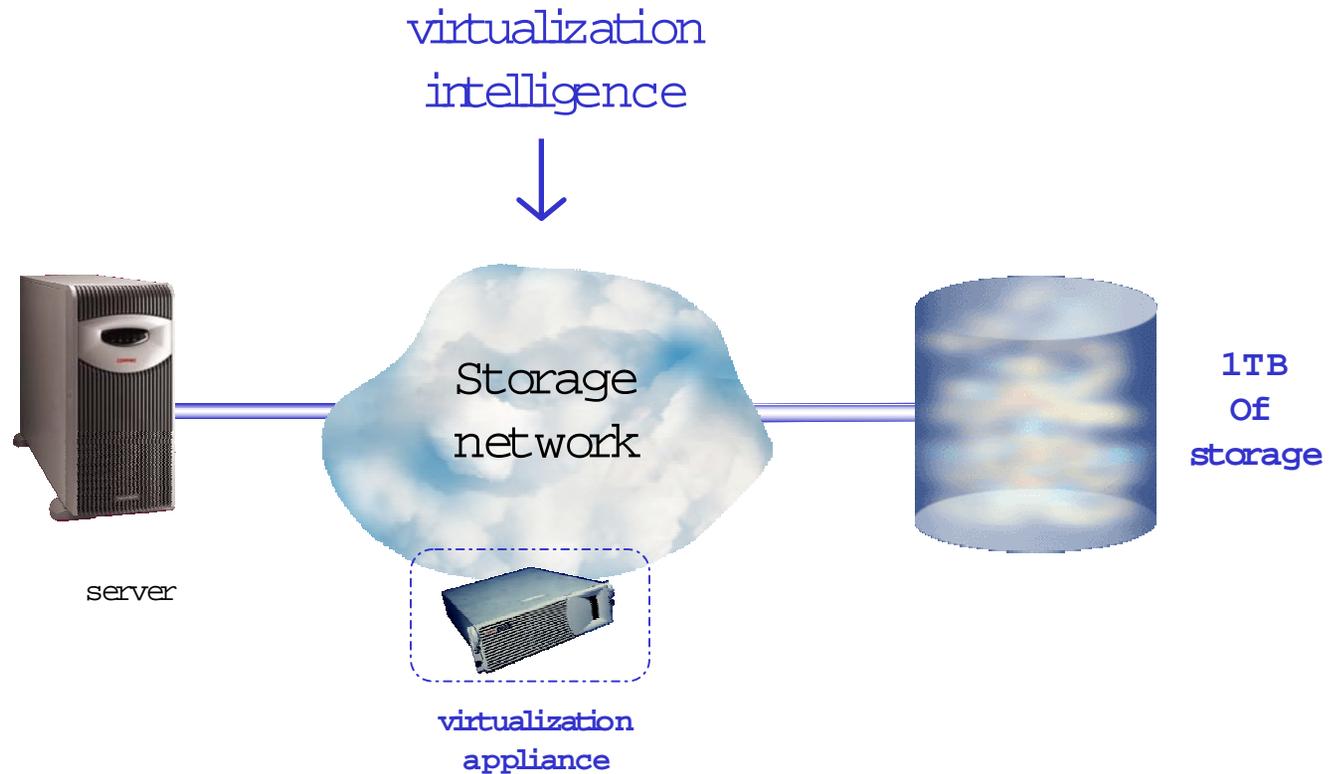
array-based virtualization

storage
network

server

array automatically stripes data across disks and tunes for
better performance and eliminate hot spots

network-based virtualization

virtualization
intelligence

array 1
200GB

server

array 2
200GB

storage
network

server

array 3
200GB

virtualization
appliance

array 4
200GB

server

array 5
200GB

network-based virtualization

virtualization
intelligence

↓

Storage
network

server

virtualization
appliance

1TB
Of
storage

server can see a 1TB LUN via network-virtualization appliance

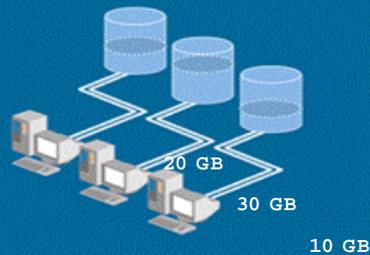HP WORLD 2002
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- **where's the value?**

value of virtualization
storage consolidation

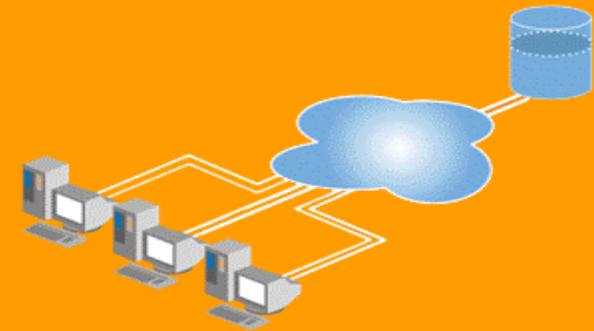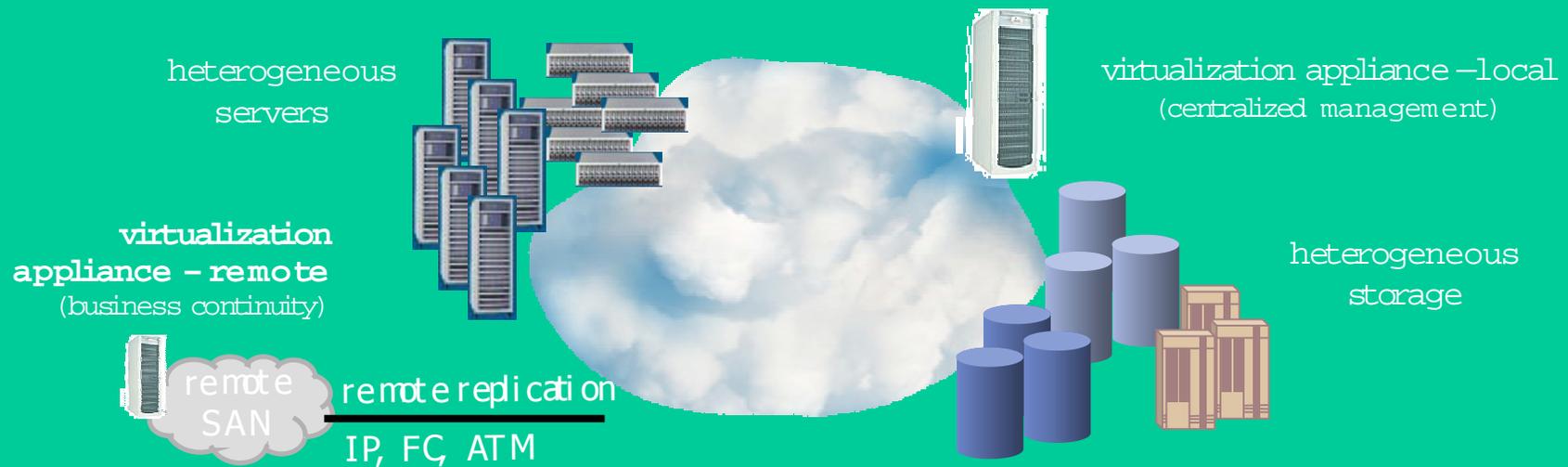increase storage utilization by creating virtual disks

bring arrays from different vendors into one manageable storage pool

lengthen useful life of older storage by spanning LUN's across arrays

traditional distributed storage
- difficult & expensive to manage
- 30-50% utilization

20 GB

30 GB

10 GB

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virtualization solutions improve capacity utilization

heterogeneous
servers

virtualization appliance —local
(centralized management)

**virtualization
appliance – remote**
(business continuity)

heterogeneous
storage

remote
SAN

remote replication
IP, FC, ATM

host based

efficient storage
utilization of capacity
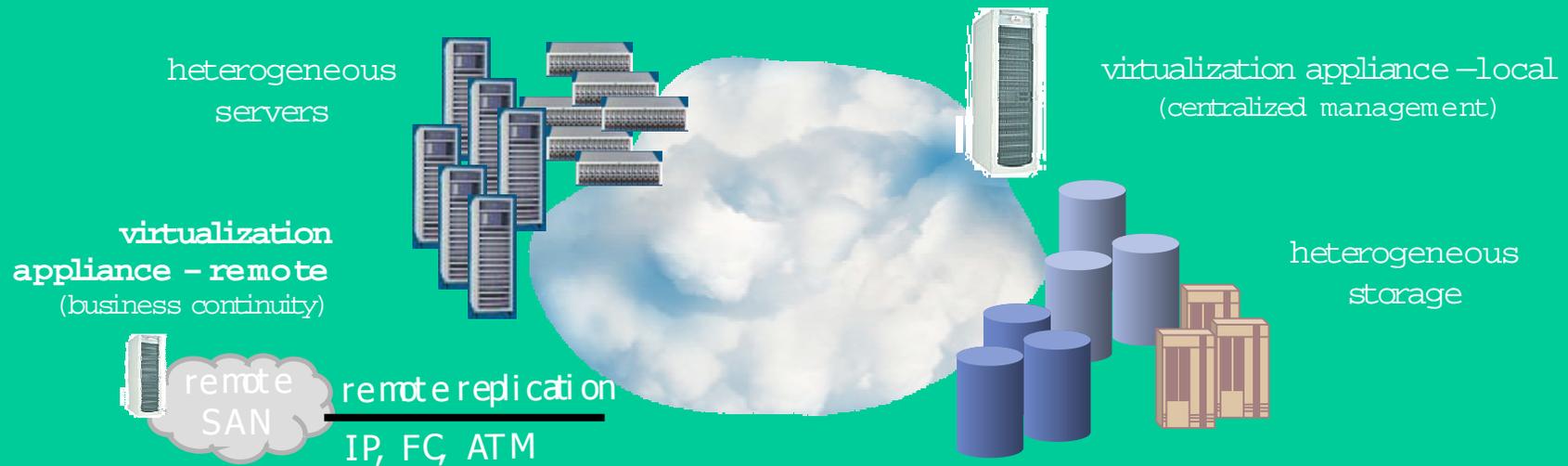attached to a single host
or cluster

array based

Optimized storage
utilization of capacity
attached to multiple
heterogeneous hosts
.

network based

Seamless SAN-wide
storage capacity
management
.

value of virtualization
business continuity
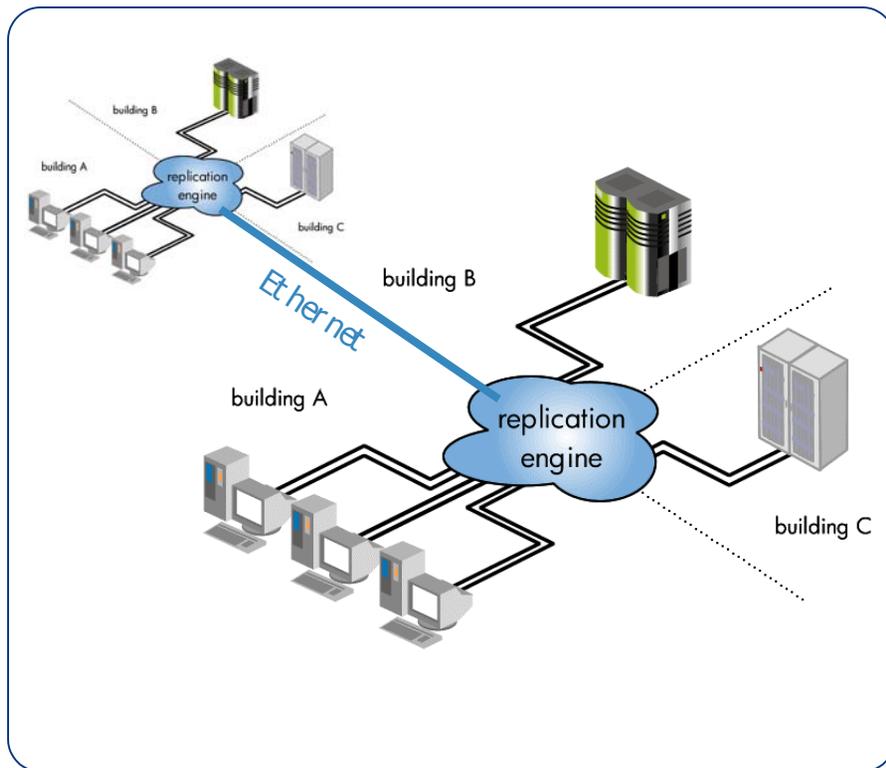
fibre channel mirroring

remote IP mirroring for DR

space-efficient snapshots

snapclones
redundant/cluster

data loss

snapshot

snapshot copies
of data protect
against human
error or recover
from attacks

computer
virus

human error

local copy allows
testing of software
before production

software
program
malfunction

32 %

14 %

7 %

3 %   site disaster

44 %

hardware or system
malfunction
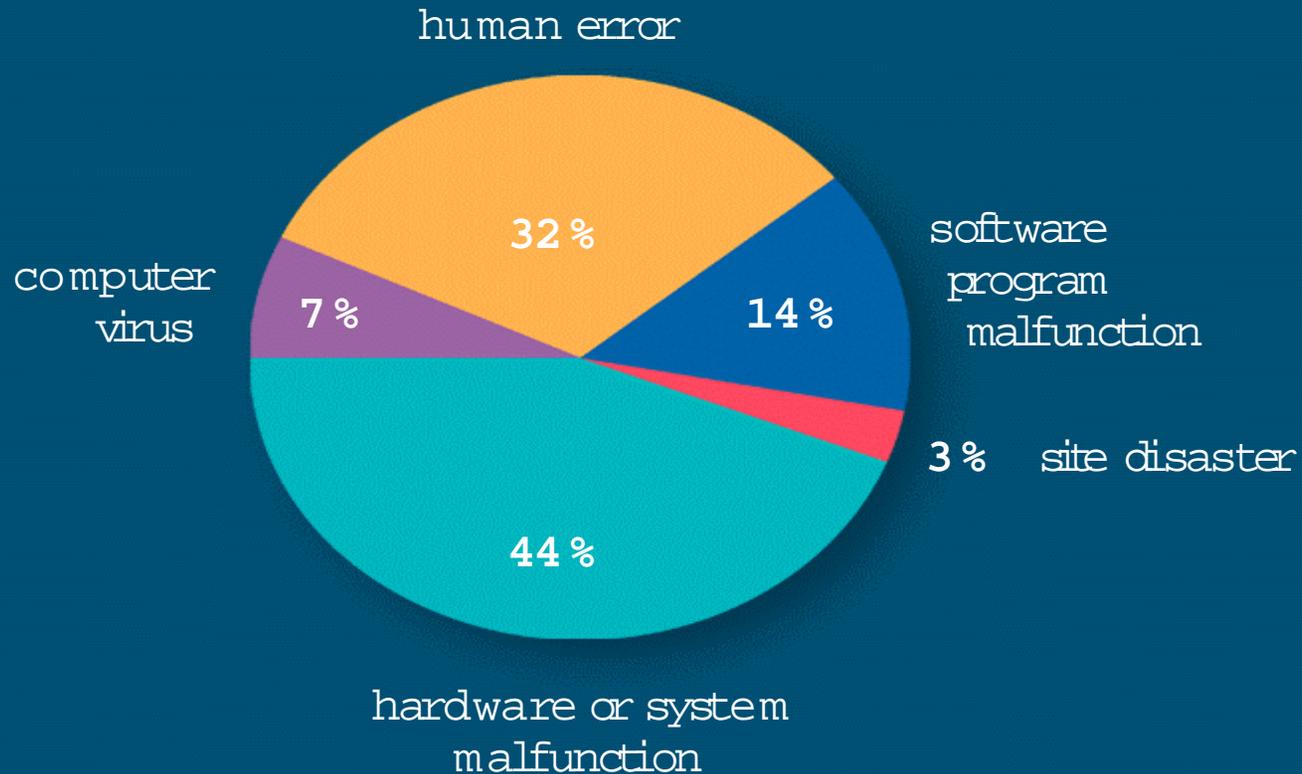
source: Ontrack, a data availability service provider

data loss

snapshot

snapshot copies of data protect against human error or recover from attacks

computer virus

mirroring

RAID, clustering, and local/remote mirroring protect against hardware failure or malfunction

human error

32 %

7 %

44 %

hardware or system malfunction

local copy allows testing of software before production

software program malfunction

14 %

3 %   site disaster

remote replication or offsite archiving is the only protection against a site or natural disaster

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value of virtualization
Reduced Replication Costs

all copies of data should
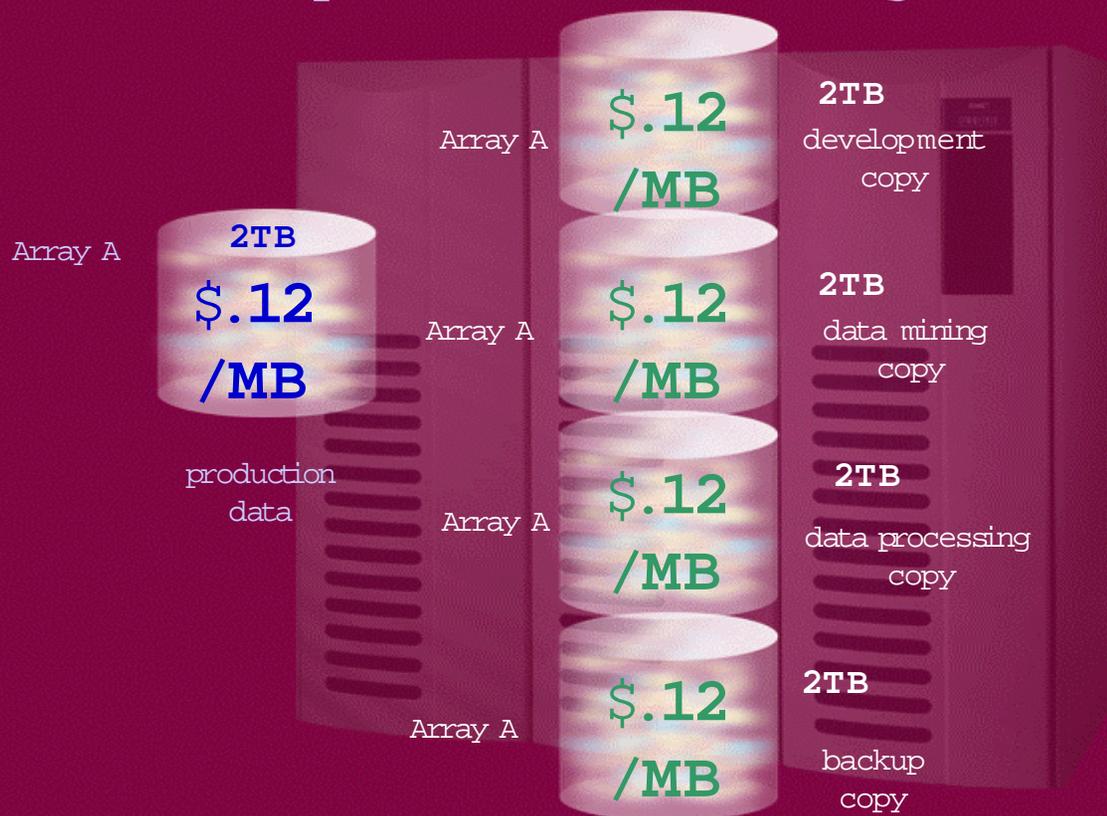NOT be treated equal!

- performance, scalability, and availability requirements are different for each copy

- cost per MB for copies should reflect copy requirements, not production requirements

- many customers pay for high cost copies only because they are locked into creating copies on the same platform

value of virtualization
copies via traditional homogeneous method

Array A
2TB
$.12
/MB

production
data

Array A $.12 /MB **2TB** development copy

Array A $.12 /MB **2TB** data mining copy

Array A $.12 /MB **2TB** data processing copy

Array A $.12 /MB **2TB** backup copy

$ 1.2 Million
for 10 TB

network-based heterogeneous virtualization

replication
intelligence

array 1
200GB

array 2
200GB

storage
network

array 3
200GB

array 4
200GB

server

virtualization
appliance

array 5
200GB
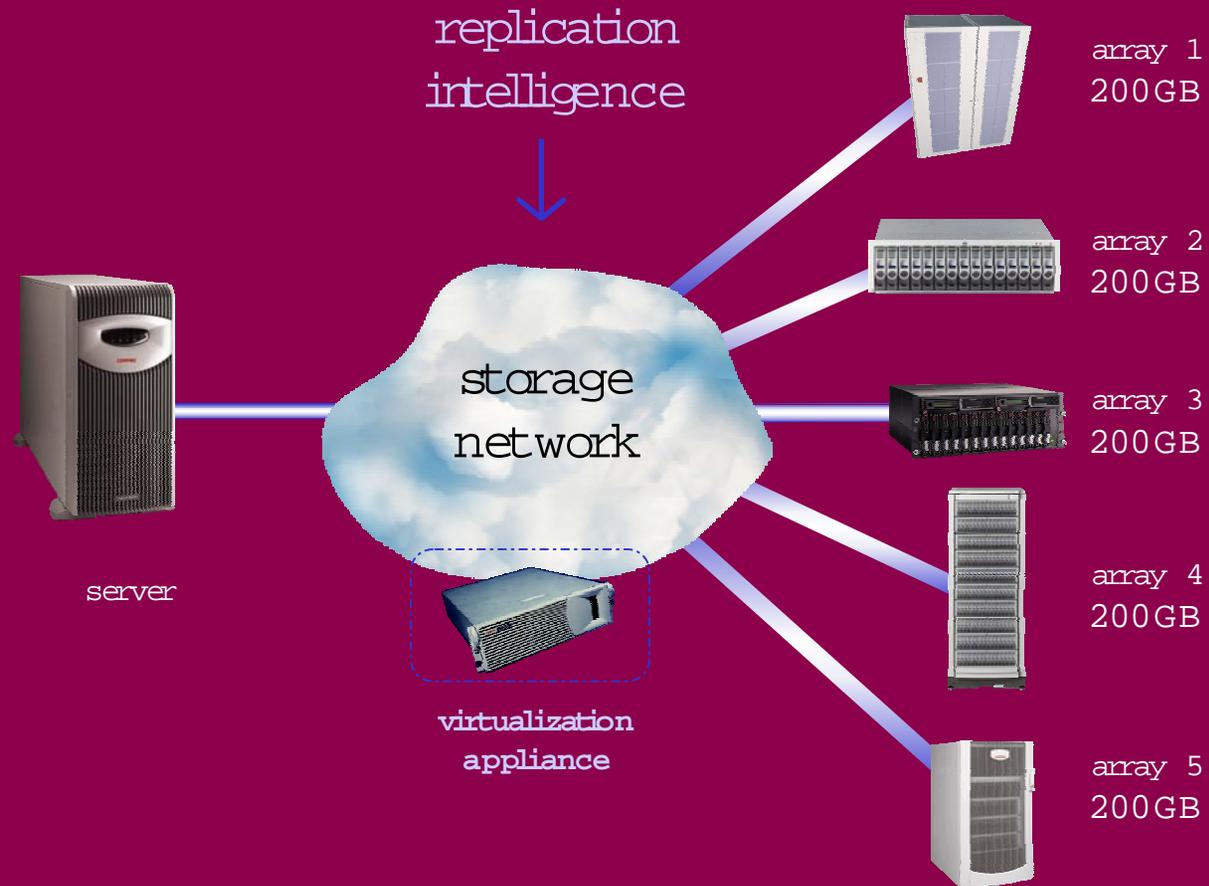
value of heterogeneous virtualization

Array A

2TB
$.12 /MB

production data

Array B — **2TB** development copy — $.04 /MB

Array C — **2TB** data mining copy — $.03 /MB

Array D — **2TB** data processing copy — $.05 /MB

Array E — **2TB** backup copy — $.04 /MB

save over

$ ½ million

with heterogeneous virtualization

$ 560 thousand
for 10 TB
heterogeneous storage

+

$ 125 thousand
for
virtualization appliance

$ 685 thousand
for 10 TB

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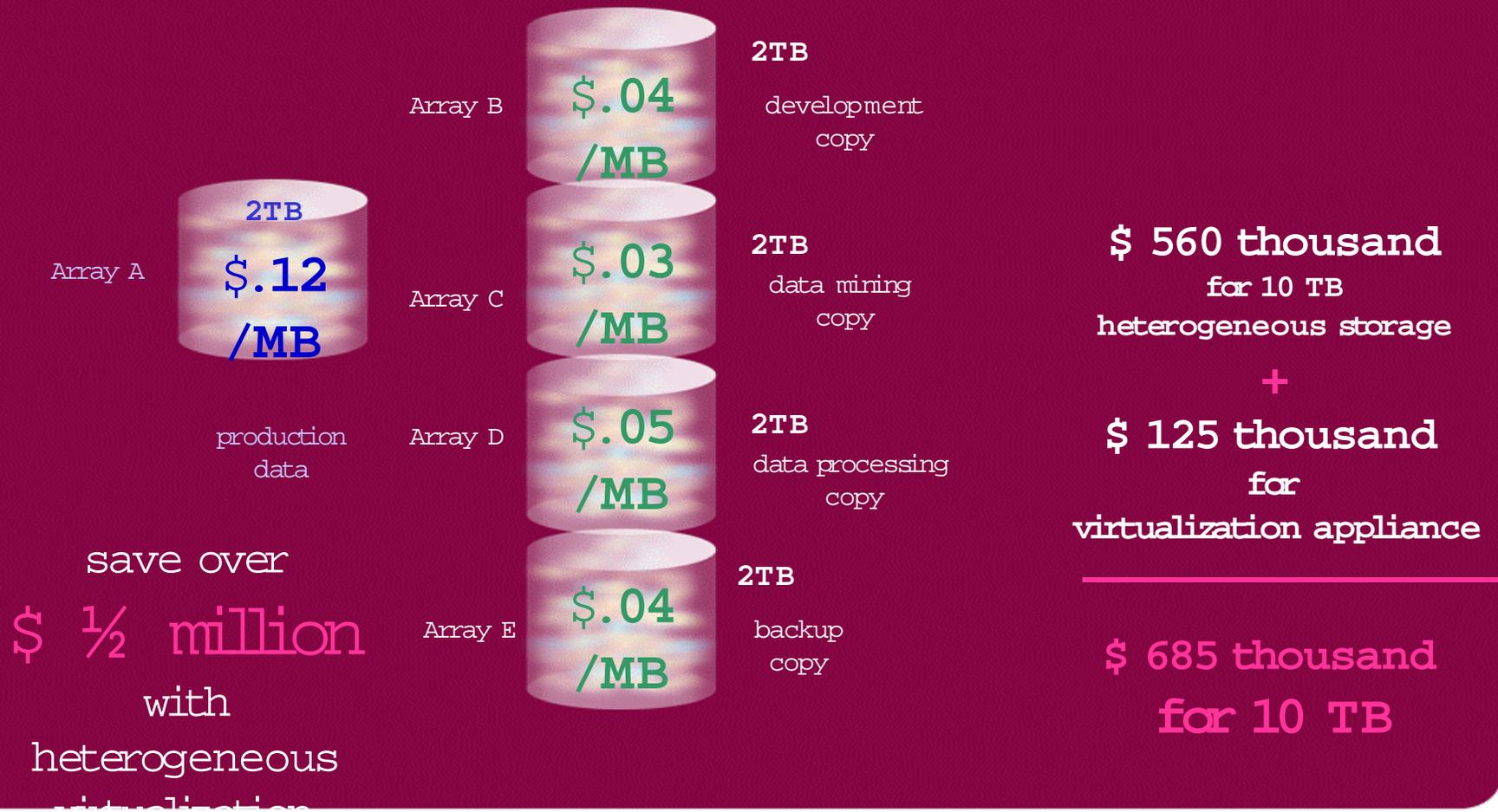
value of virtualization
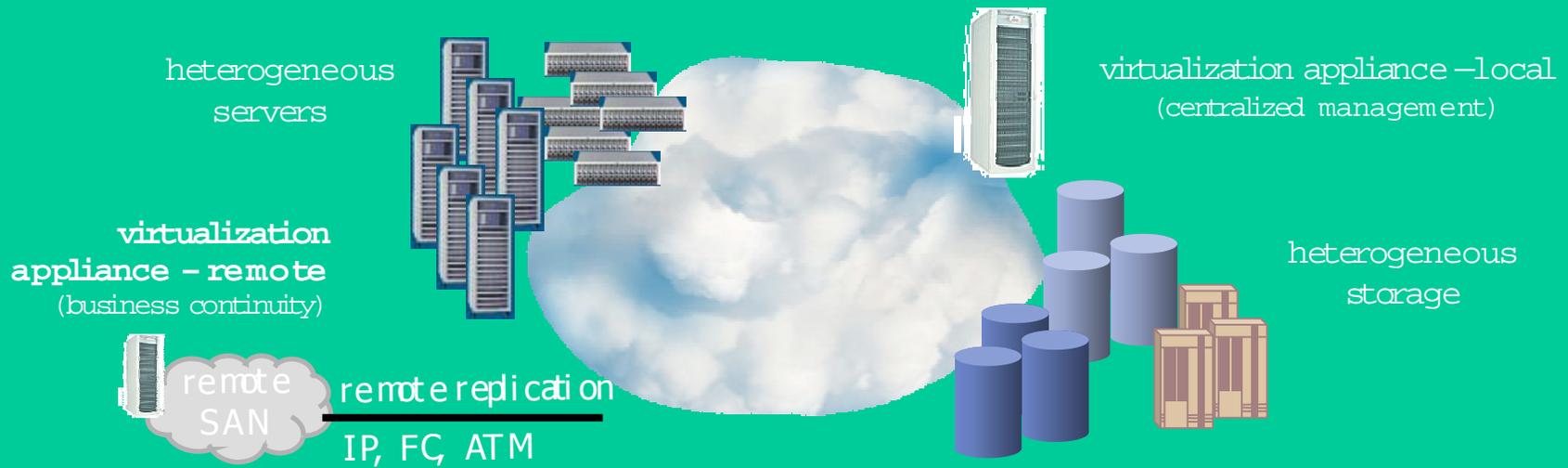## lower storage management costs

quickly allocate pooled storage to hosts from central console

on-the fly array tuning to eliminate hot spots

online LUN expansion

automatic RAID level migration

LOGOUT

home | node conf | snapshot | LUN Map | LUN resize | hosts | IP mirror | FCP mirror | targets | utils | LUNs

HP StorageApps SV3000

luns

→ lun info
→ lun stats
→ lun matrix

→ delete lun

→ rescan luns

view luns

	lun	size	scsi id	physical lun	hba	bus
info	0	13.57 GB	0	0	2	0
info	1	13.57 GB	2	2	6	0
info	2	13.57 GB	3	3	6	0
info	3	11.57 GB	4	4	6	0
info	4	2.88 GB	5	5	6	0
info	5	6.88 GB	6	6	6	0

lun 0

bytes read: 1683056223
bytes written: 384
i/o read: 112063
i/o written: 16
bytes mirrored : 1682964576
i/o mirrored: 111148

partition: no
partitioned: no
expanded: no
mapped: yes
snapshot source: no
snapshot target: no

fcp mirror source: no
fcp mirror target: no

back...

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a consolidated domain for centralized management

heterogeneous servers

virtualization appliance – local
(centralized management)

virtualization appliance – remote
(business continuity)

heterogeneous storage

remote SAN

remote replication
IP, FC, ATM

host based

array based

network based

management functions are performed on a single pool of capacity

value of virtualization
storage virtualization addresses your storage challenges

- explosive storage growth
- dynamically add capacity without downtime

- shortage of skilled IT staff
- storage growth/allocation tasks take less time to accomplish

- storage management complexity
- manage storage pools centrally from simple GUI

- manage technology lifecycle
- extend useful life of arrays by adding storage intelligence via hosts or network appliance

- keep business running while environment evolves
- make copies of data via server, network, or array virtualization

- total cost of ownership
- lower management costs and higher storage utilization rates