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SAN → Storage Area Network.

→ Types of Storage :-

① Direct Attached Storage [DAS]
② Network Attached Storage [NAS]
③ Storage Area Network. [SAN].

(i) ⇒ Direct Attached Storage (DAS):-

Advantage
- ✓ → Low cost Solution.

Adv
- ✓ → Simple to configure

Disadvantage
- ✗ → De-centralised storage

Disad
- ✗ → No storage consolidation

Disad
- ✗ → No High Availability.

(ii) ⇒ Network Attached Storage (NAS):-

- ✓ → Heterogeneous Environment
- ✓ → Centralised Storage.
- ✗ → Low Performance
- ✗ → Limited Scalability
- ✗ → Network congestion during backups & restore

(iii) ⇒ Storage Area Network (SAN):-

- ✓ → Heterogeneous environment
- ✓ → Centralised Storage Management
- ✓ → High Degree of Fault Tolerance
- ✓ → Best & Superior performance
- ✓ → Storage consolidation
- ✓ → Fast & efficient backups & restore
- ✓ → Dynamic Scalability.
- ✗ → Expensive solution for small setups.

✗ → disadvantage
✓ → advantage.

→ Defn:- DAS → Direct Attached Storage :-

It is a basic solution for storage which is a part of the host computer, and it is directly connected to the computer.
Eg:- Hard-drives, Pen drives, Tape drives, work station, etc.

→ Network Attached Storage (NAS):-
It provides file sharing or storage sharing through a network.
It provides a consolidated storage system having 1 centralised storage space.

→ Storage Area Network (SAN):-

It is a dedicated high performance storage system which transfers data b/w various servers and storage devices.
It is used in data centres, enterprises & various virtual environment.
→ SAN provides the speed of DAS with sharing, flexibility, availibility, & reliability of NAS.

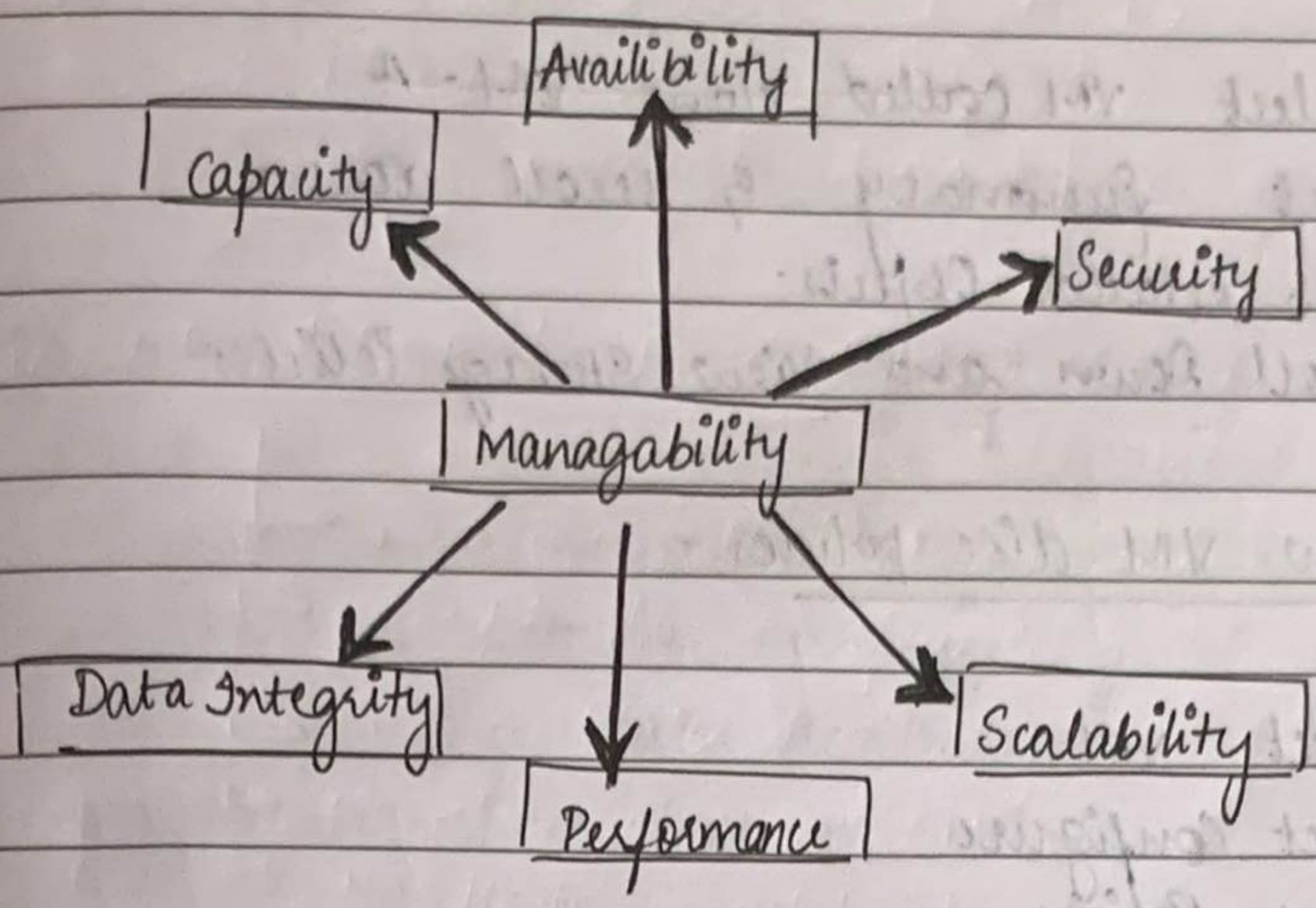
→ JBOD :- Just Bunch of Disks.

→ RAID :-

→ IP SAN:- Internet Protocol SAN.

→ SDDC → Software Defined Data centre

→ Key elements for Data Centre Elements:-



Exp - ①:- Examine the Default Storage Policy.

① From Menu page of vSphere client, select policies and profile.
② Select VM storage policies
③ Select VM storage policy called vSAN Default Storage Policy. → Select rules.
④ Select storage compatibility.

→ ~~Exp~~ ②:- Deploy VM with Default policies.

① Create a VM.
② ↳ Select storage → select vSAN data store
③ For VM Storage Policy dropdown, select vSAN Default Storage Policy.
④. Check recent tasks
⑤.

→ Verify the VM Default Storage Policy:-

1. Select VM (called clone VM-A)
2. Select Summary & scroll down
3. View Related Objects.
4. Scroll Down and View Storage Policies.

→ View VM disc policies:-

1. Select VM
2. Select Configure
3. Select Policies.
4. Select Hard Disk 1

→ 1. Select ~~Reg~~ Region A01-comp01.
2. Select Monitor
3. Select vSAN > Virtual Objects
4. Select ~~Clone~~ VM-01 > Hard Disk 1.
5. Click View Placement details.

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→ **Storage:-** A storage device uses magnetic, optic or solid state media.

- → Disks, tapes
- → CD/DVD.
- → Removable Flash memory or flash drives.

(*) **RAID** → Redundant Array of Independent Disks.

→ RAID is a data storage virtualization technology that combines multiple physical disk drive components into one or more logical units for the purposes of data redundancy, performance improvement or both.

→ **RAID Implementation methods:-**

- → ① Software RAID
- → ② Hardware RAID.

→ **RAID techniques:-**

- → ① Striping
- → ② Mirroring.
- → ③ Parity :- form the basis for defining various RAID levels.

① → (*) **Striping** :- It is a technique used to spread data across multiple drives (mor than one) to use the drives in parallel.

(*). **Stripe:-** Set of aligned strips that span across all the disks within the RAID set is called a stripe

(*) **Strip** :- within each disk in a RAID set, a predefined no. of contiguously addressable disk blocks are defined as a strip.

② ⇒ **Mirroring:-** Technique whereby the same data is stored on 2 different disk drives.
It enables fast recovery from disk failures.

(10) **Drawbacks:-**
- ① Twice Storage capacity
- ② Expensive

③ ⇒ **Parity:-** Method to protect striped data from disk drive failure without the cost of mirroring.
An additional disk drive is added to hold parity, using which recreation of missing data will happen.

→ **RAID Levels:-**

RAID → capital letter

- **Raid 0:-** Striped set with no fault tolerance
- **Raid 1:-** Disk mirroring.
- **Raid 2:-** Nested combinations of RAID levels.
  Eg: RAID 1 + RAID 0.
- **Raid 3:-** Striped set with parallel access and dedicated parity disk.
- **Raid 4:-** Striped set with independent disk access and a dedicated parity disk.
- **Raid 5:-** Striped set with independent disk access and distributed parity.
- **RAID 6:-** Striped set with independent disk access and dual distributed parity.

used in VSAN

→ Experiment - 02 :-

Scaling out the vSAN Environment :-

(I) Lab Environment Review - Compute :-

① Select Esxi host → esx 04a.corp.local
② Select configure
③ Select storage → Storage devices.

(II) Add additional nodes to cluster :-

① Drag & drop esx-04a.corp.local into Region A01-COMP-01
(*) If it doesn't work :-

② Right click on Esxi-04.a.corp.local and select move to & Select cluster called Region A01-COMP01.

(III) Move host to cluster :-

① Select "put all of this host's VM in the cluster's root resource pool. Resource pools currently present on the host will be deleted
② click OK.

(IV) Move out of Maintenence mode :-

① Right click on esx 04a → Maintainace mode
→ Exit maintainence mode.

(V) (A) Configure vSAN Networking :-

① Select esx-04a.corp.local
② Select summary.

(A) (B) (1) Select esx-04a.corp.local
(2) Select Configure
(3) Select Networking → VMkernel adapters.
(4) Select Add Networking

Step (1) (C) (1) Select VMkernel Network Adapter
(2) Click Next.

Step (2) :- Target Device
(1) Click Browse Button
(2) Click VMkernel adapter called vSAN-Region A01-VDS-COMP
(3) Click OK → Next

Step (3) :- Port properties
(1) Enable vSAN service
(2) Click Next.

Step (4) :- IPv4 settings
(1) Select Use static IPv4 settings
(2) Enter the foll info.

IPv4 address :- 192.168.130.54
Subnet mask :- 255.255.255.0
Override default gateway for this adapter :- Enabled
Default gateway :- 192.168.130.1
DNS server address :- 192.168.110.10.
(3) Click Next.

Step (5) :- Ready to complete
(1) Click FINISH.

(VI) Verify VSAN Networking:-

① Select VSAN Region A01-VDS-COMP
② Review the properties of the VMkernel adapter. Verify that the VSAN Service is enabled

(*) Note: After a while the Alarms should disappear from the host.

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(XIII). (VII). Create Disk Group on new Host:-

①. Select vSAN cluster called Region A01-COMP 01
② Select Configure
③ Select vSAN > Disk Management.
④ Select esx 04 a-corp-local
⑤ Click on Create Disk Group. (on top)
⑥ Select one 6GB flash drive (cache) & two 12GB (capacity tier)
⑦ Click on create.

VIII Verify the Health Status:- vSAN is Not healthy, lets remediate it-

①. Select vSAN cluster, Region A01-comp01.
② ~~Select Monitor / configure~~
③ ~~Select~~
→ ② Select Monitor, Selet vSAN > Skyline Health.
③ Select Retest.

PFTT → Policy Fault to Tolerance.

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Experiment - ③ :- Creation of new VM storage policy. RAID 5 & Assign to VM

(I). New VM Storage Policy (RAID-5).

①. From Menu Page → Select Policies & Profiles.
②. Select VM Storage Policies
③ Click on create.
④. Give Name → PFTT=1 - Raid5, Next
Policy Struct ⑤. Enable rules for vSAN storage ☑, Next
vSAN ⑥ under availibility, ① Site disaster tolerance
⇒ Non-standard cluster.
② Failures to tolerate ⇒ 1 failure - RAID5 (Erasure Coding)
↳ changes acc to question

⑦. Click on Advanced Policy Rules, Next.
(No. of diskstripes per object depends ~~from~~ on question)

⑧. Storage compatibility → Select vSAN Datastore & select Next.

⑨. Review & finish → finish.

(II). Assign VM storage Policy to new VM

(A) ①. Select Host & Clusters → create new VM.
In storage compatibility → select PFTT-1, Next.
② Select the created VM, select configure & select policies.
③ [Here we can see the vSAN Default Storage Policy → PFTT-1 assigned to this VM.]

③. Select on Edit VM storage Policies.
VM storage policy :- PFTT-1-Raid 5

④ Click on Ok.

(B) ① Select Region A01 - COMP 01.
② Select Monitor
③ VSAN > Virtual Objects.
④ For the created VM, select Hard disk 1
⑤ Select View Placement Details.
Here we can see the new revised component layout for the VM with RAID 5 storage policy
⑥ Click CLOSE.

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Experiment - 04:- Edit VM Storage Policy.

✓ (A) Edit VM Storage Policy:-

1. Select Policies & Profiles from menu.
2. Select VM Storage Policies.
3. Select PFTT = 1 - Raid 5
4. Select Edit.
5. On Name & Description, click Next
6. On Policy Structure → Next.
7. Select Advanced Policy Rules
8. Modify no. of disk stripes per Objects to 2 → Next
9. On Storage compatibility, click next.
10. On Review and finish dialog, → FINISH.

B) Reapply to VM's:-

1. Select Manually Later → Yes.
2. Select VM compliance.
3. You will see that the Status has changed to OUT OF DATE
4. Click on Reapply.
5. Click on Show Predicted Storage Impact.
6. Click on CLOSE
7. Click on OK to reapply VM Storage Policy

C) Check:-

1. On VM compliance, if the VM does not show compliant, click on Check.
2. From vSphere client, select Menu
3. Select Host & clusters.
4. Select Region A01 COMP01.

5. Select Monitor
6. Select vSAN > Virtual Objects
7. For the created VM, select Hard disk - 1.
8. Select View Placement Details.
9. Click on close.

* Experiment - 4 :- Reserved capacity.

A. Configure Reserve capacity :-

1. Select Menu > Hosts & Clusters.
2. Select Region A01 COMP01 → Configure
3. Select vSAN > Services.
4. Under the Enable Capacity Reserve, click on Edit
5. Enable Operations reserve & Host Rebuild reserve
6. Click on Apply.

13/12/21 **Experiment :- 5 :- * vSAN file Services.**

1. Enabling file shares
2. Remediate file server.
3. Creating NFS file shares.
4. Mounting vSAN NFS file shares to other
5. Creating SMB file shares.

I. Enable file Services :- (Do Exp - 2) before doing this exp

1. Select vSAN cluster (Region A01 - COMP 01)
2. Select configure
3. vSAN > Services.
4. vSAN services : File service = Enabled.
5. Expand the file services, you can see the network details of the file services.

NFS → Network file ~~Share~~ System.

(II). Enable File Server :-

Shift esx04a to Region A01 COMP01.

1. Select vSAN Cluster, Region A01 - COMP01
2. Select Monitor.
3. Select vSAN > Skyline Health.
4. Select File Server Health.

(III). Remediate File Server :-

1. Select Infrastructure Health.
2. Click on Remediate file ~~Sh~~ Service.
3. Click Ok.

(IV). Creating NFS file Shares :-

(A). Create a file share :-

1. Select Region A01 COMP01
2. Select Configure
3. Select vSAN > File Shares
4. Click ADD.

(B). Create File share ... continued :-

Enter

(i) Name :- VMShares NFS.
(ii) Select versions :- NFS 4.1 & NFS 3
(iii) Storage Policy :- vSAN Default Storage Policy
(iv) Enter threshold and hard quota for the storage :- 5GB threshold & 10 GB for hard quota.
(v) Click Next
(vi) Select Allow access from any IP.
(vii) Click Next.
(viii) Click Finish.

(*) To view the list of vSAN file shares, navigate to the vSAN cluster → configure → vSAN → File Shares

(V). Mounting VSAN NFS file Shares to Other Systems:-

(A). Mount file Services Shares:-

① Check the box next to VMShareNFS.
② Select COPY URL, you can chose from NFSV3 or NFSV4.1.

NFS V3:- vsanfs-02.a.corp.local:/VMShareNFS
NFS V4.1:- vsanfs-01.a.corp.local:/vsanfs/VMShareNFS

③ Check the box next to VMShare NFS
④. Select COPY PATH, then select NFSV4.1.

(B). Power ON VM:-

①. Select VM:- photon-01a. → Power → Power ON.

(C). Launch PuTTy:-

①. Launch the PuTTy application from windows TaskBar.

(D). Choose Photon-01a:-

① Select the linux VM called photon-01.a.corp.local.
② Select Load
③ Select Open.

Refer All the CODES to be typed from PDF [Pg 81 to Pg 84]

By Typing:-

```
root@photon-01a [~]# mkdir /mnt/newfs.
root@photon-01a [~]# mount vsanfs-01a.corp.local
:/vsanfs/VMShareNFS /mnt/newfs.
root@photon-01a [~]# mount | grep /mnt/newfs.

root@photon-01a [~]# cd /mnt/newfs.
root@photon-01a [~]# echo "NFS 4 Share" >> newfs.txt
root@photon-01a [~]# cat newfs.txt.
```

mkdir → make directory
cd → change directory

→ Let us mount to NFS v3 :-

① Select COPY PATH, then select NFSv3

⊛ Switch back to the putty session for Photon-01a and run

```
root @ photon-01a [~] # cd /
root @ photon-01a [~] # umount /mnt/newfs.
root @ photon-01a [~] # mount -t nfs -o vers=3
vsanfs-02a.corp.local:/VM Shares NFS /mnt/
newfs.

root @ photon-01a [~] # cd /mnt/newfs
root @ photon-01a [~] # cat newfs.txt.
```

⊛ You should see "NFS 4 Share" as a return value
root @ photon-01a [~] # mount | grep /mnt/newfs

⊛ You can see the /mnt/newfs is now mounted via NFS v3.

AD → Active directory

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→ SMB file Shares :-

SMB - Server Message Block.
SMB protocol is a network file share protocol implemented in microsoft windows which allows applications on a computer to read & write to files and to request services in a computer network

→ Experiment - 06 :- Creating SMB file shares:-

(I). Enable AD Domain for file share:-

1. Select VSAN cluster Region A01- COMP01.
2. Select configure
3. VSAN → Services.
4. Click on EDIT in the file service.

(II). ~~Enable~~ Edit File Service - Domain:-

1. Directory (~~status~~) service → Enable ☑ Active Directory.
2. Enter AD Domain : corp.local
3. Enter AD username : Administrator
4. Enter password : VMware1 !
5. Click on Next.

(III) Edit File Service:- Networking:-

1. Click Next

(IV) Edit File Service - IP Pool:-

1. Enter IP Address : 192.168.130.104
2. Click on LOOKUP DNS.
3. Click Next.
4. Click on Finish.

(V) File Service - AD Domain enabled :-

1. Expand the File Services section.
2. You can see that the AD Domain & Username are a part of File service

(VI) Create SMB file share:-

1. Select VSAN → file shares.
2. Click ADD
3. Enter Name :- SMBShares
4. Select Protocol: SMB
5. Select Storage Policy: VSAN Default Storage Policy.
6. Enter threshold = 5GB ; Hard Quota = 10GB
7. Click on Next.
8. Click on FINISH.

(VII) View File Shares:-

1. Click on button next to SMBShares.

→ Client File Share Access:-

1. Launch file explorer on the taskbar.
2. Right click Network
3. Select Map Network drive
4. Enter the Drive : Z
5. Enter the folder : \\vsanfs-01a.corp.local\vsanfs\SMBShares
6. Click on finish.
7. You can see SMBShares is mapped from the file explorer

→ Create file shares via Microsoft Management Console (MMC):-

1. VSAN → File Shares
2. Check mark on SMB Shares.
3. Click on COPY MMC Command to view the command string & details.
4. Launch Start from task bar.
5. Enter the command :- fsmgmt.msc /computer: \\vsanfs-01a.corp.local.
6. Select shares.
7. You can see SMB shares called SMB Shares.

→ VSAN file services monitoring:-

1. Select Region A01-COMP01.
2. Select Monitor
3. VSAN > Virtual Objects.
4. Scroll down. , Check Mark VM Shares NFS
5. Select View Placement Details.
6. Click on Close.

→ Skyline Health :- Infrastructure health:-

1. VSAN > Skyline Health
2. Expand file services.
3. Click on Infrastructure health
4. Click on Remediate file service. → OK

(*) Everything should be healthy now.

→ Skyline Health → File Server Health:-

1. Click on file server health. You can see protocol service/ file server containers.
2. Click on Share health
3. Select the Host & Cluster icon on top

4. Select Region A01- COMP-01
5. Select Monitor
6. VSAN → Performance
7. Select file share
8. View Latency

→ Monitor Capacity:-

1. Select VSAN > Capacity
2. Select capacity Usage
3. Expand User Objects

You can see the file shares usage

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