



SAP on Azure Enablement

Tuesday, Oct 27, 2020

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APAC, Singapore

Module Two – Week Three

Day 2 – Tuesday, Oct 27, 2020

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Module Two – Week Three

Day 2 – Building High Availability Systems on Azure



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Check-in

We are happy to host you 😊

<https://aka.ms/apac-enablement-check-in>

<https://aka.ms/SAPAPAC-POE-FEEDBACK>

Feedback for previous session



Check-In Form



Feedback Form

Agenda

- Resiliency on Azure
- HA/DR for DB in Azure VM
 - HANA DB
 - MS SQL DB
 - ASE DB
 - DB2 DB
 - Oracle DB
 - MaxDB (for Content Server)
 - Azure SQL DB (for BO)
- HA/DR for SAP Application
 - Windows based
 - Linux based
 - Multi-SID
- HA/DR for HLI
- DEMO

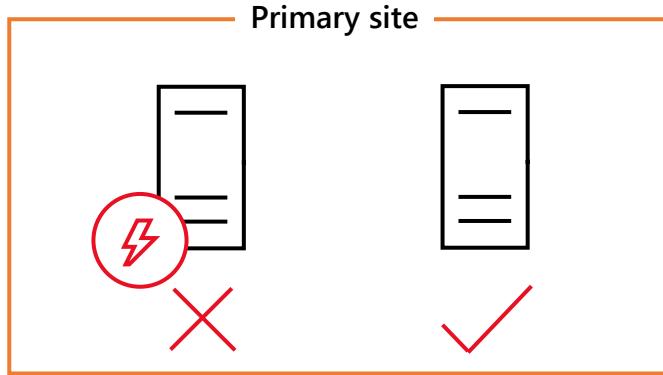


Resiliency on Azure

- Concepts
- Design considerations
- Sample architecture

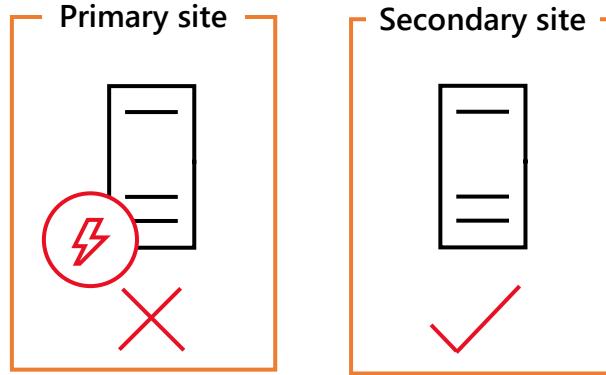
What is Resiliency?

- Not about avoiding failures, but responding to failures



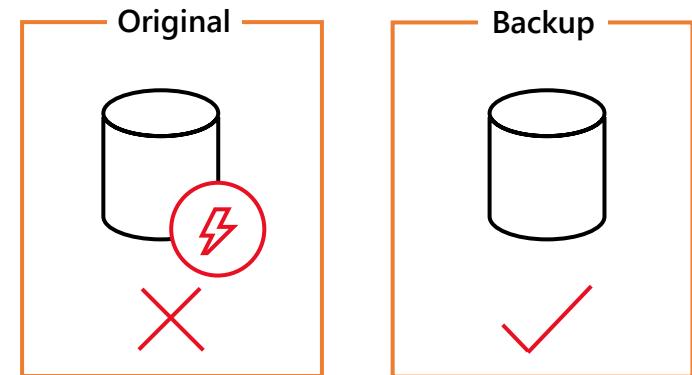
High availability

When your applications have a catastrophic failure, run a second instance



Disaster recovery

When your applications have a catastrophic failure, run them in Azure or a secondary datacenter



Backup

When your data is corrupted, deleted or lost, you can restore it

Key Design Considerations

Business drivers/Compelling Events

- Datacenter Transformation, End-of-Life Hardware, Cloud First Strategies

Quality Attributes

- Scalability - know your customer's performance objectives
- Availability - know your customer's SLA, RPO/RTO (3x9s, 4x9s)

1928533 - SAP Applications on Azure: Supported Products and Azure VM types)

- The SAP supported VM types of Azure & SAPS throughput of each SKU
- The SAP supported products/releases on Azure
- The supported OS and DBMS releases for the specific SAP releases in Azure

201553 – SAP on Microsoft Azure: Support prerequisites

- Professional Direct or Microsoft Premier Support contract required
- To log a support call, - component BC-OP-NT-AZR (Windows) or BC-OP-LNX-AZR (Linux)

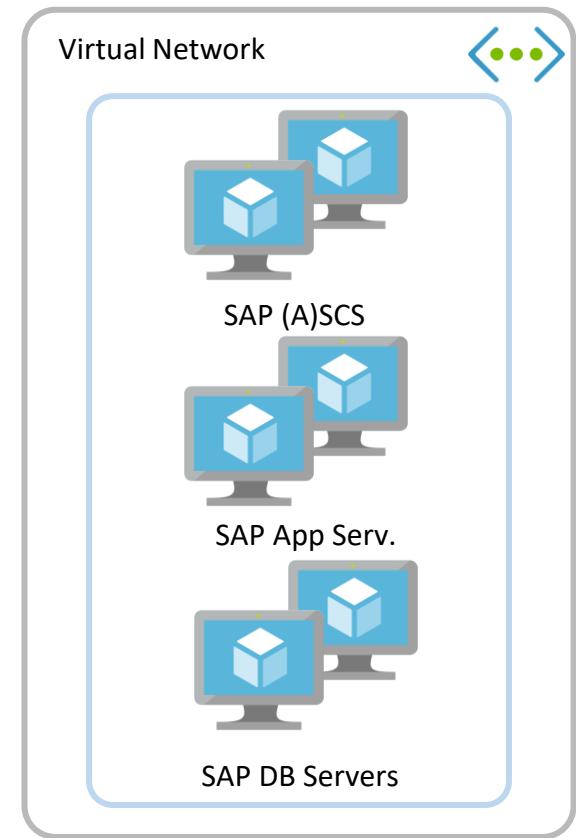
SAP Architecture

- **3-tier (*)**

- Presentation tier (SAP GUI, Fiori UX, Web Dynpro)
- Application tier
 - SAP (A)SCS – SAP Central Services instance
 - ABAP/Java stack
 - Application servers – Primary (PAS) and Additional (AAS) instances
- Database tier
 - DBMS (HANA, SQL Server, Oracle, SAP ASE, IBM DB2, MaxDB)

- **2-tier**

- Presentation tier (SAP GUI, Fiori UX, Web Dynpro)
- Application + Database tier – (A)SCS, PAS, AAS, DBMS



Azure SAP deployment

(*) 3-tier architecture is required for SAP High Availability

SAP – Single Points of Failure (SPoF)

Web Dispatcher :

- Load-balancing of HTTP requests

Message Server (stateless) :

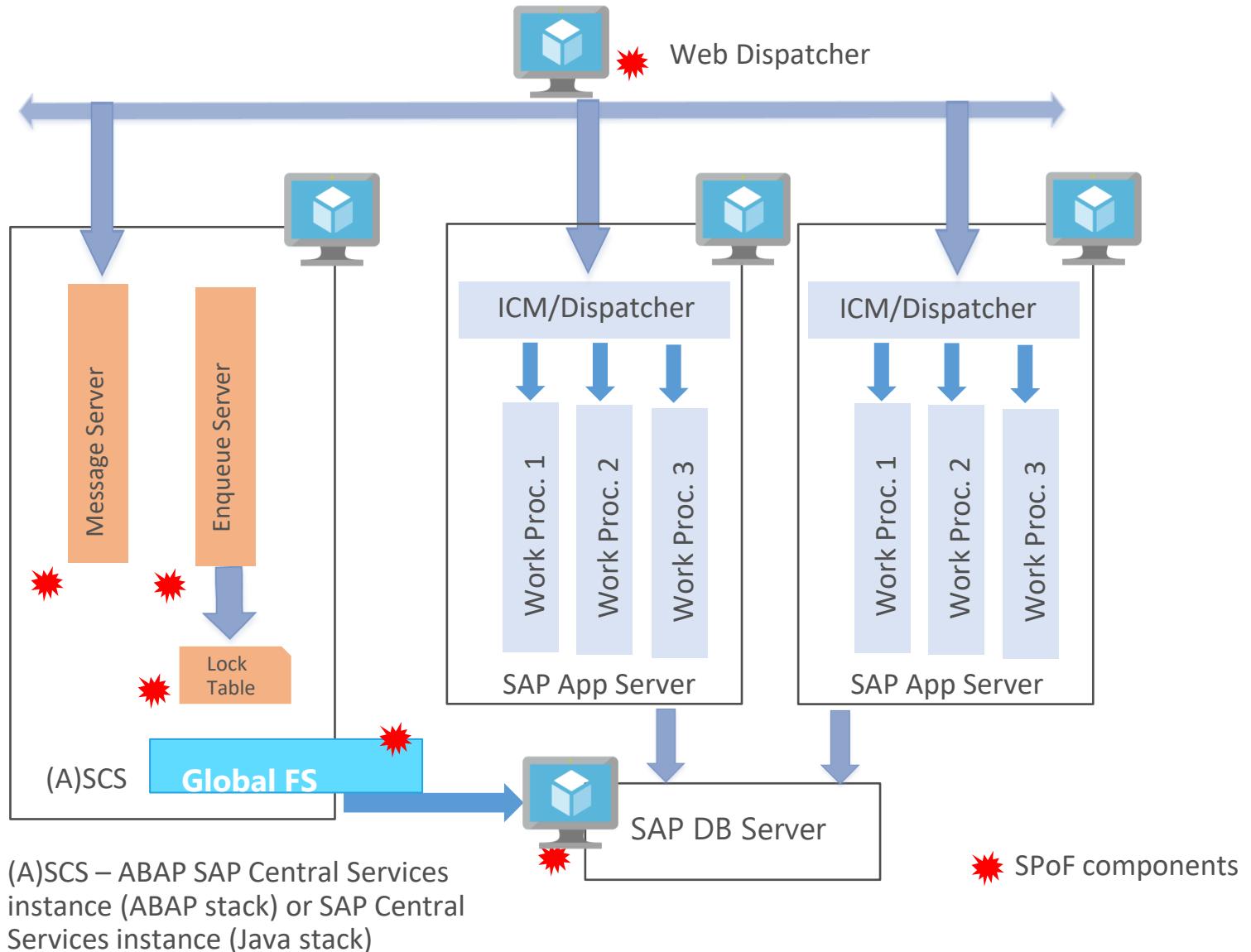
- Internal communication
- Communication with Dispatchers
- Maintains the list of app servers
- Allows for load balancing of application servers

Enqueue Server (stateful) :

- Keeps track of logical database locks (lock table)
- Coordinates DB access

Global File System :

- An SMB share (Windows) or an NFS mount (Linux)
- Contains globally shared data, profiles, kernel and JVM binaries



Relevant Documentation

1928533 - SAP Applications on Azure: Supported Products and Azure VM types

2015553 - SAP on Microsoft Azure: Support prerequisites

2316233 - SAP HANA on Microsoft Azure (Large Instances)

2191498 - SAP on Linux with Azure: Enhanced Monitoring

2367194 - Use of Azure Premium SSD Storage for SAP DBMS Instance

2178632 - Key Monitoring Metrics for SAP on Microsoft Azure

(...)

SAP HANA Hardware directory

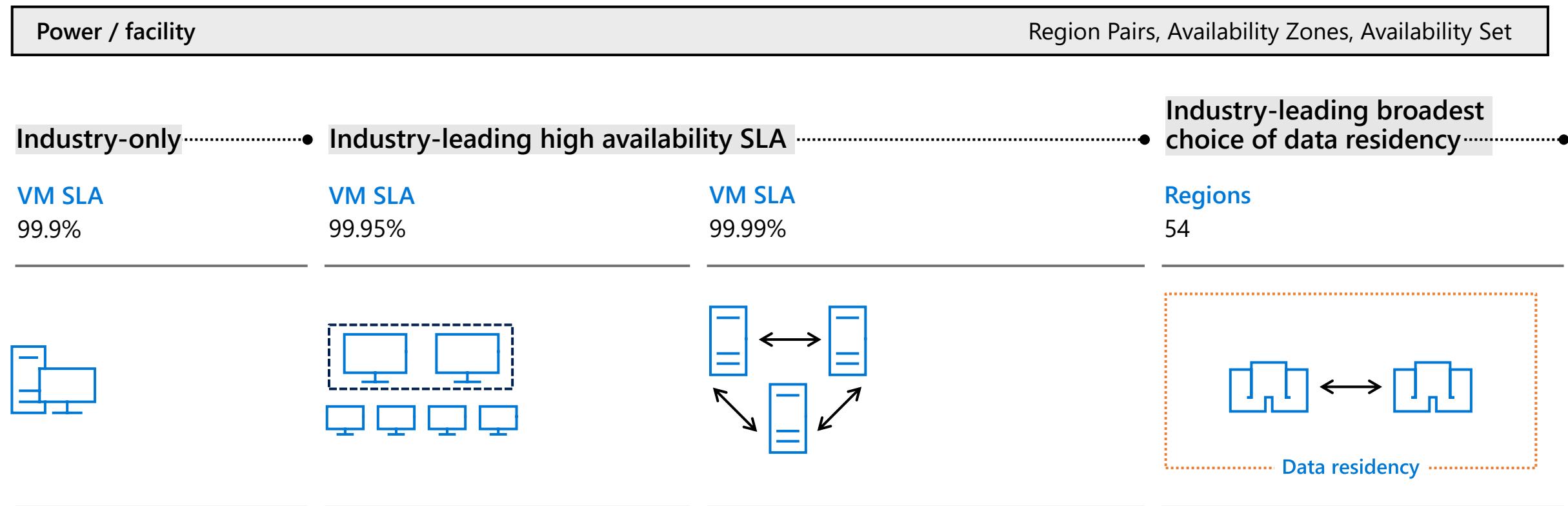
<https://www.sap.com/dmc/exp/2014-09-02-hana-hardware/enEN/index.html>

SDN Wiki

<https://wiki.scn.sap.com/wiki/display/VIRTUALIZATION/SAP+on+Microsoft+Azure>

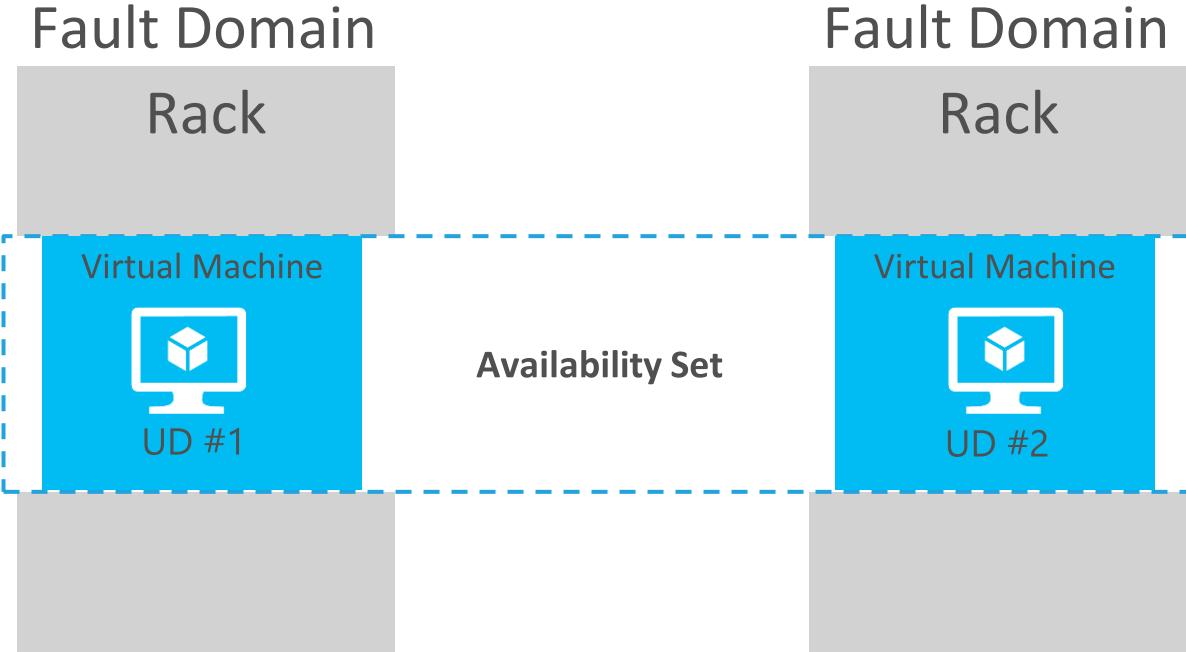
Azure resiliency as a platform

- Industry-leading high availability SLA

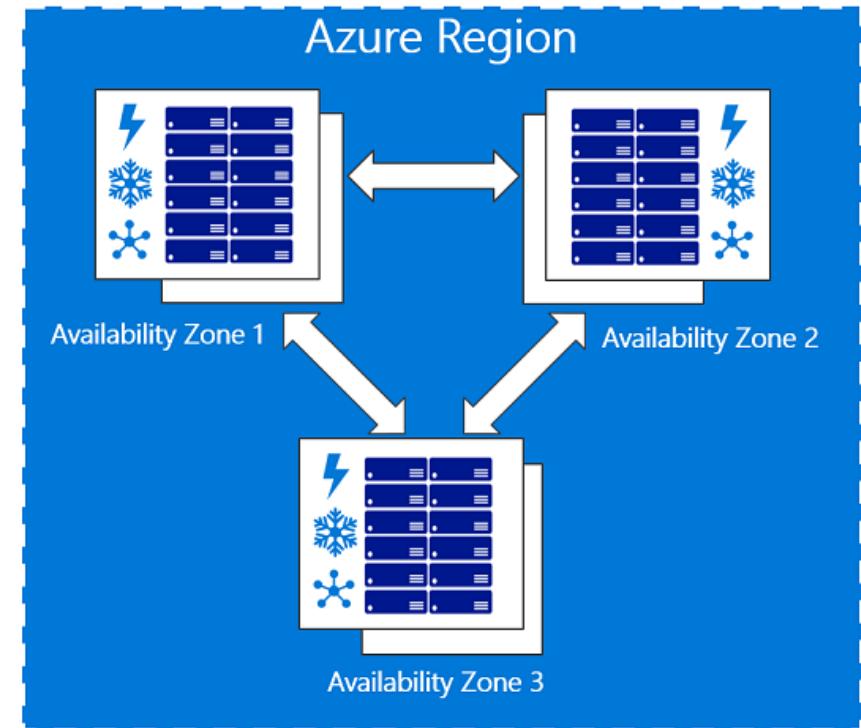


Availability Set & Availability Zones

Availability Set (99.95%)



Availability Zones (99.99%)



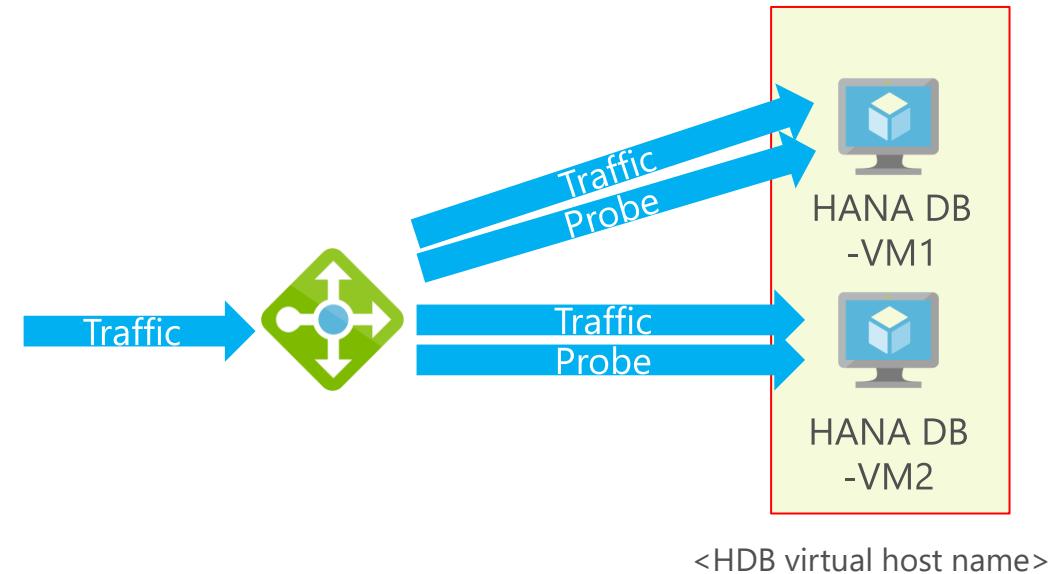


HA/DR for DB in Azure VMs

- HANA DB
- MS SQL DB
- ASE DB
- DB2 DB
- Oracle DB
- MaxDB (for Content Server)
- Azure SQL DB (for BO)

Azure Load Balancer Standard

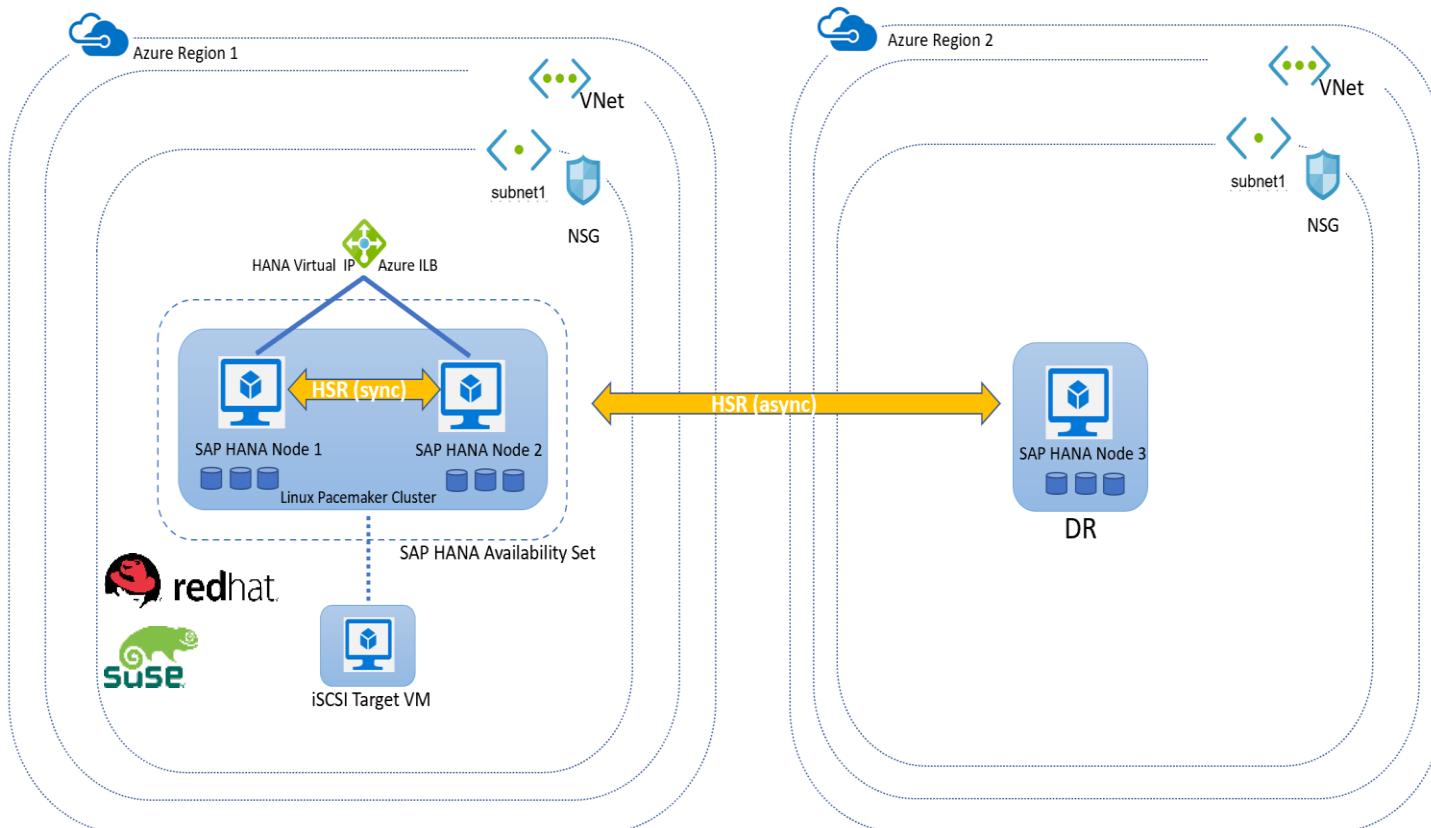
- On Azure, a load balancer is required to use a virtual IP address
- Supports Layer 4: TCP and HTTP health probes
- Balance traffic between on-premises computers and VMs in a VNet
- Required as part of HA solution for SAP A(SCS), DB Clusters (HANA, SQL) to use virtual hostnames & VIPs.



Sample Load Balancer Rules

- 32<nr> TCP
- 36<nr> TCP
- 39<nr> TCP
- 81<nr> TCP
- 3<nr>15 TCP

HA/DR for HANA DB



Database	Replication Method
Azure Disk (Premium, Ultra)	Hana System Replication (HSR)
ANF (Premium, Ultra)	Hana System Replication (HSR), Cross Region Replication (CRR)

Create VM either in **Av Set OR in AZ**, Azure Disk/ANF, File Systems

Azure load balancer used to setup virtual IP of HANA DB HA

Install HANA on All the DB Nodes and setup Hana System Replication.

SYNC mode replication for HA and ASYNC Mode for DR. Operation Mode “Logreplay” is generally recommended.

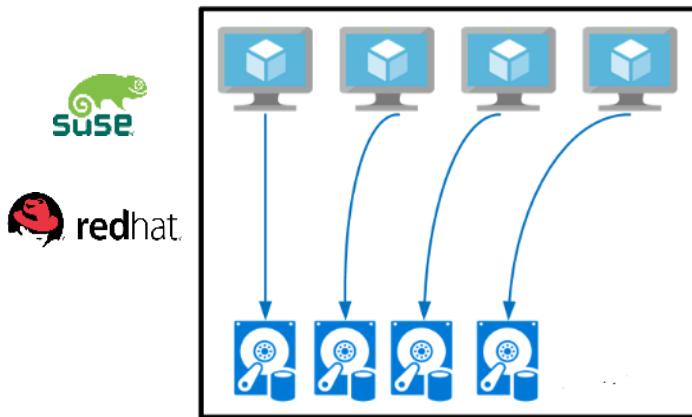
Setup Pacemaker Cluster. Use SBD device **or** Azure Fencing Agent.

Perform Failover Cluster Testing

SAP HANA Scale-Out Options on VM

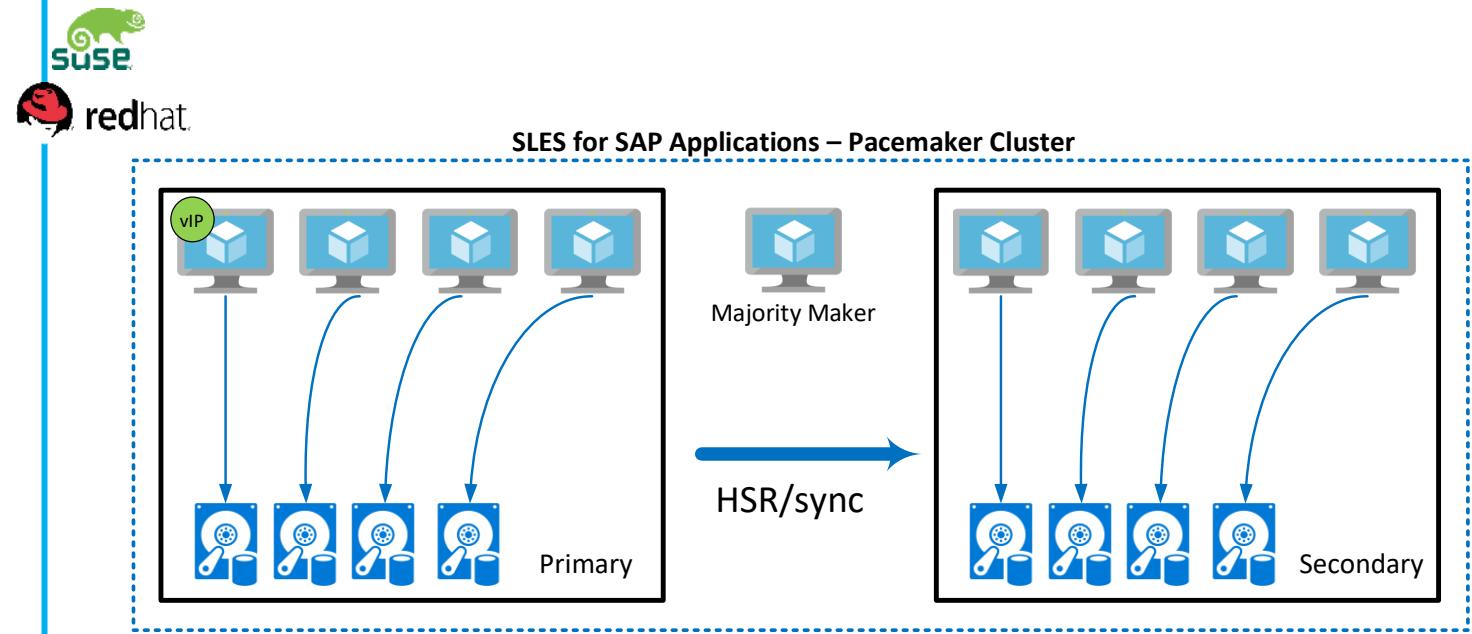
Option 1 – Azure Service Healing

- Simplified, cost efficient scale-out
- Each node single instance SLA of 99.9% ($4 \text{ nodes} = 99.9^4 = 99.6\%$)
- Higher RTO, failure of VM results in VM restart and reload of data into memory (~600MB/s); 2 TB per hour)



Option 2 – Scale-Out HSR Pacemaker Cluster

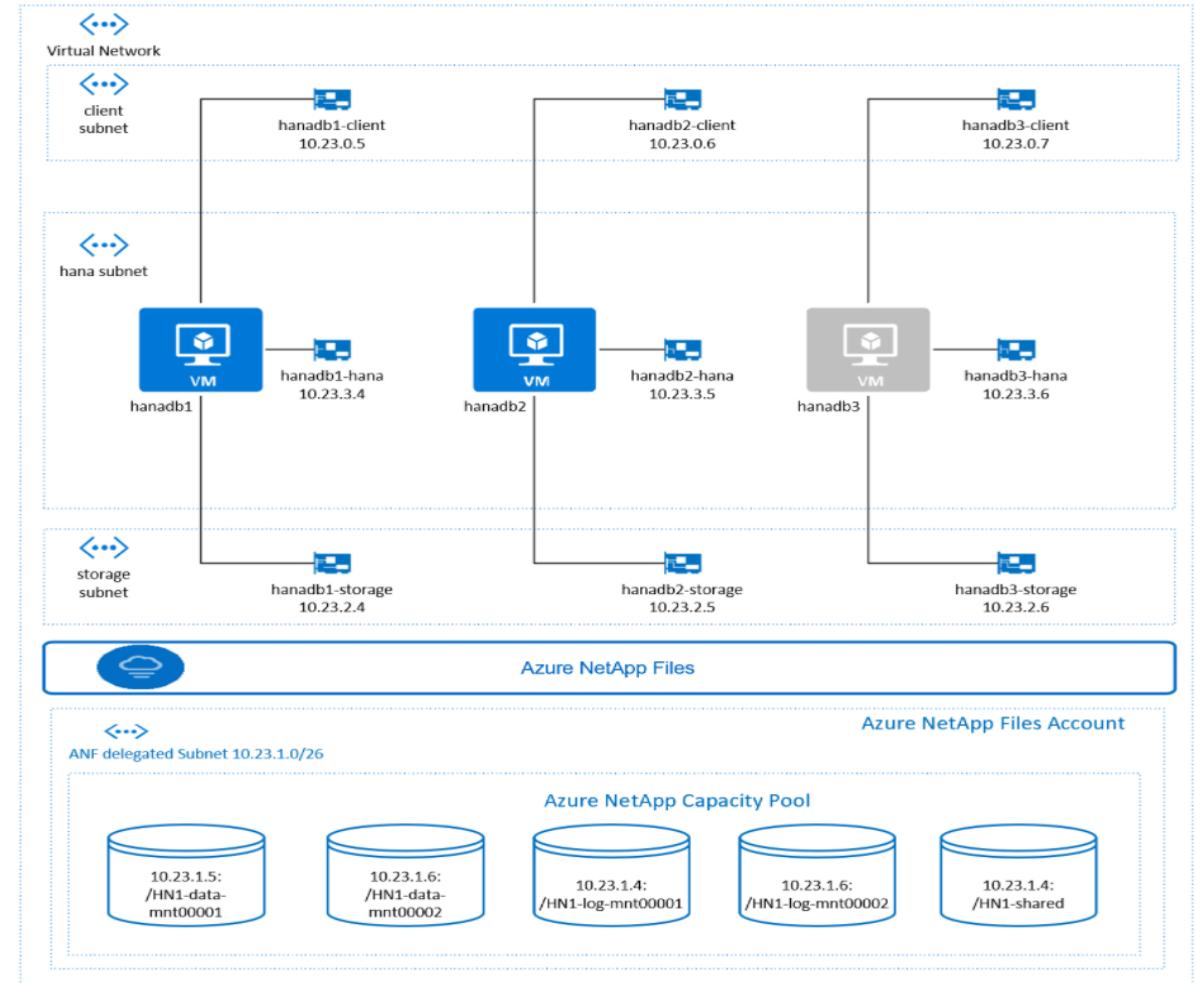
- SAPHanaSR-ScaleOut created by SUSE automates the takeover in SAP HANA system replication setups in scale-out
- Lowest RTO (Performance Optimized scenario)
- AvSet Deployment or AvZone Deployment
- More expensive, 2 x infrastructure



SAP HANA Scale-Out Options on VM

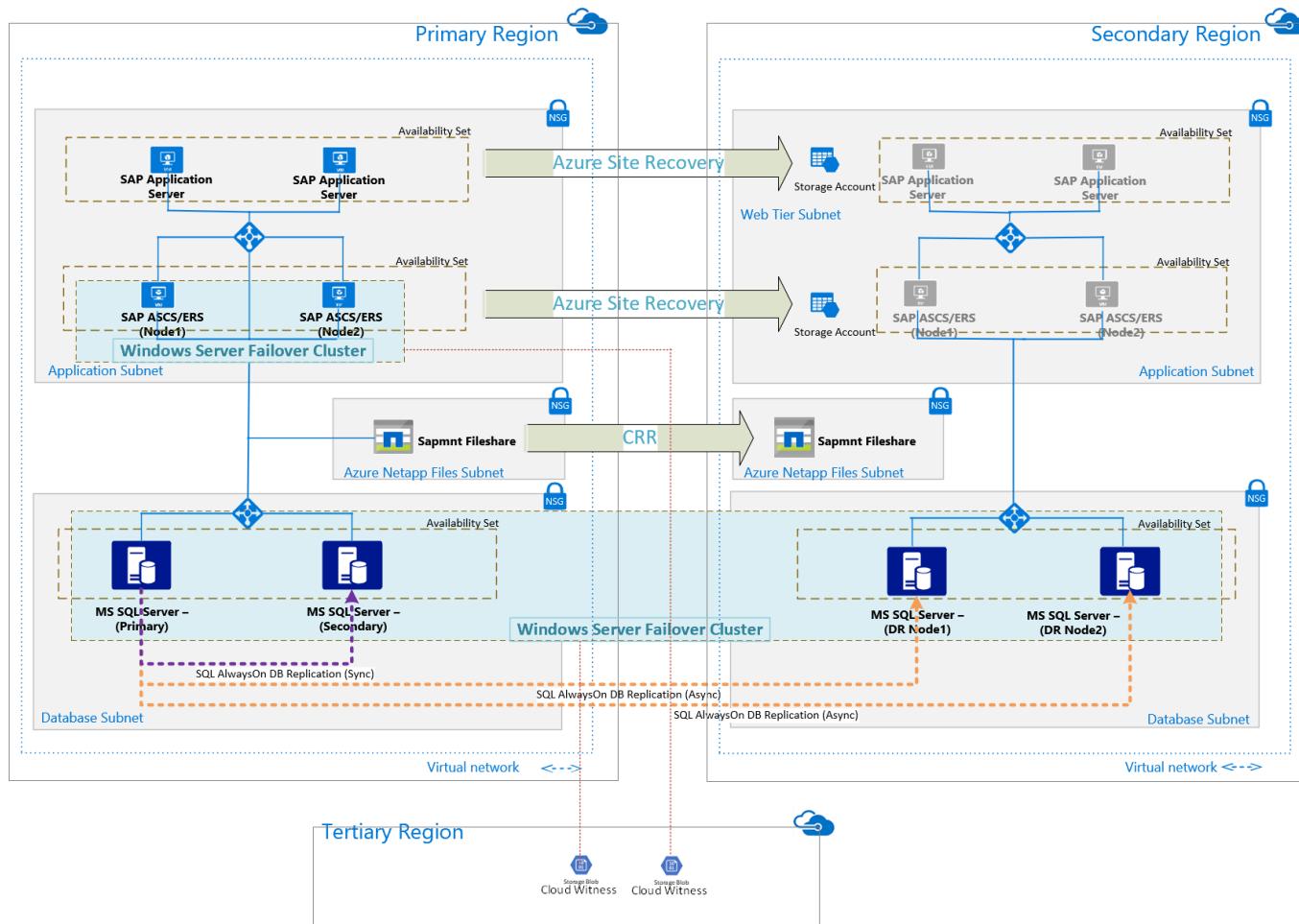
Option 3 – Scale-Out HSR Pacemaker Cluster

- ANF Storage is must.
- VM SKU Supported –
 - M128s (2TB)
 - M416s (6TB)
 - M416ms (12TB)
- 16 Node Scale-out certification
- 1 Master Node + 15 Workers Nodes
- Supported with NFS v4.1 for /hana/data and /hana/log
- Need to perform storage pinning with VMs
- Cross Region Replication (CRR) for DR



HA/DR for MS SQL DB

SAP Netweaver with MS SQL Server HA/DR



AlwaysOn Availability group for HA/DR

Windows Server Failover Cluster for HA and DR and configure Listener to connect from App Layer.

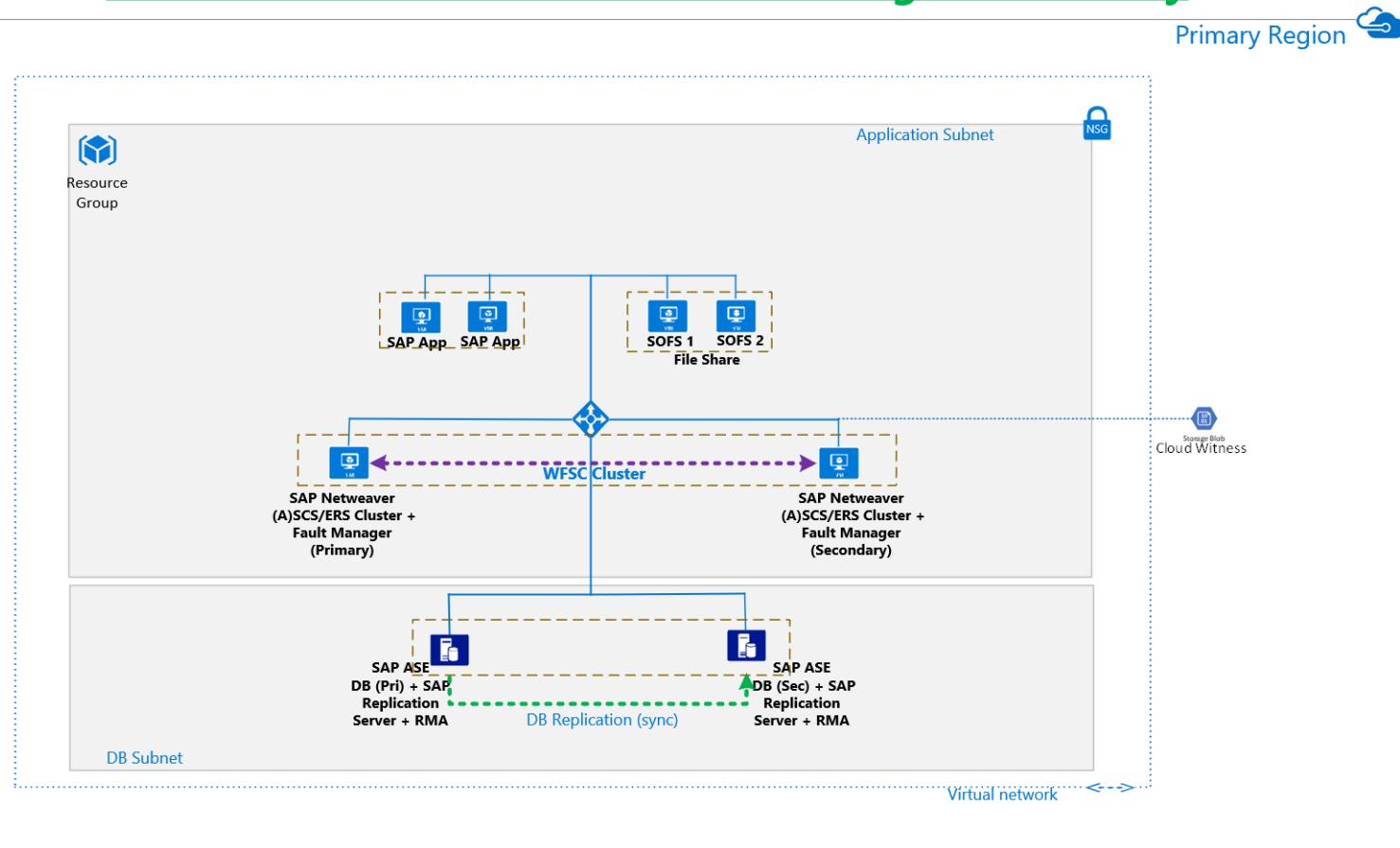
SYNC mode replication for HA and ASYNC Mode for DR. Automatic failover for HA Nodes and Manual failover for DR Nodes.

Cloud Witness is recommended in third zone or region.

Perform Failover Cluster Testing for HA and DR environment.

HA/DR for SAP ASE DB

SAP Netweaver with ASE 1603 DB – High Availability



Install Data Movement agent, SAP Replication Server, Sap HostAgent on DB Nodes

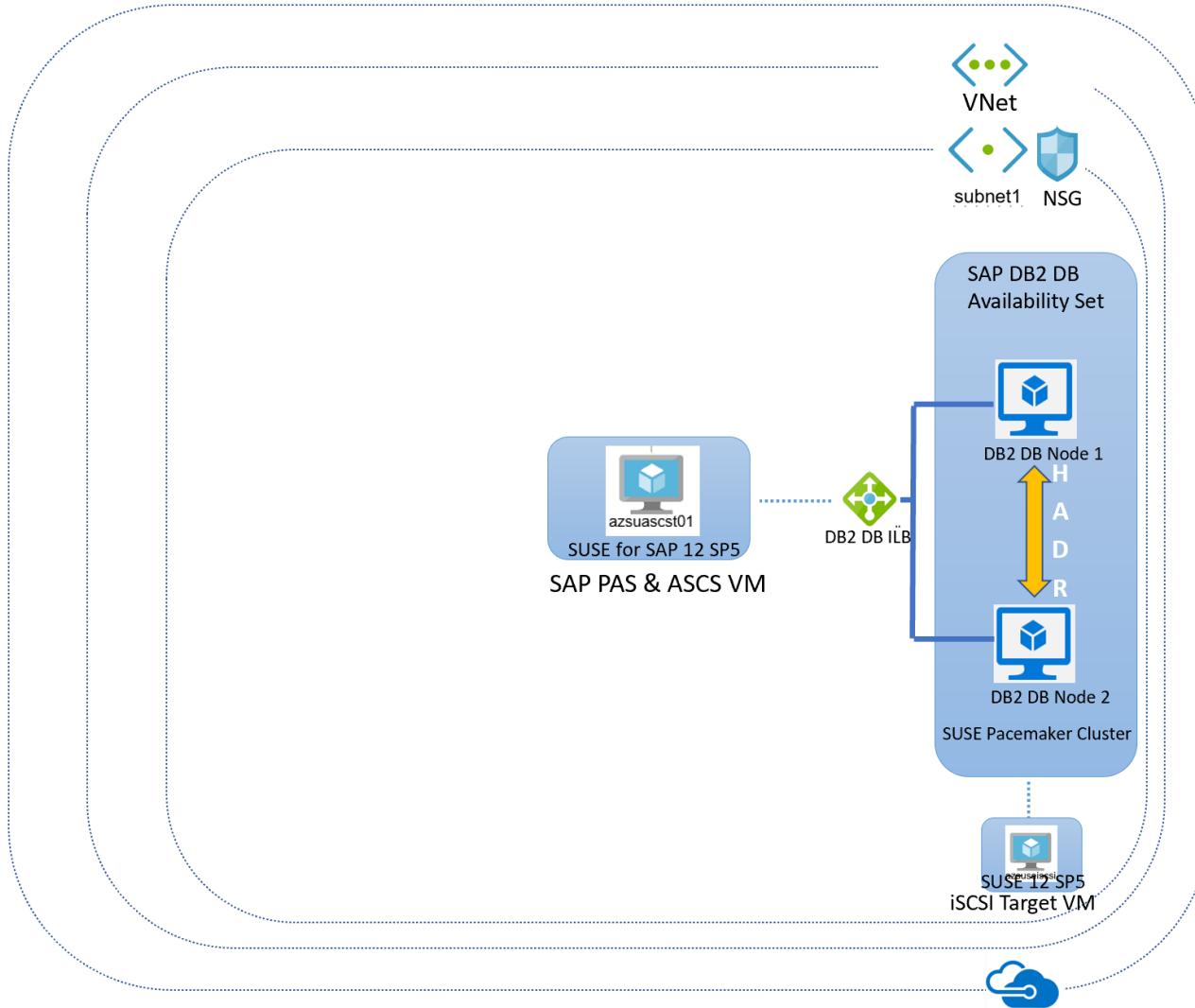
Install Fault Manager on ASCS Instance. FM manages DB failover.

Update env parameters in appl servers with Hostnames of Primary & Standby DB. It will auto connect to standby DB after failover.

No OS Clustering required.

Perform Failover Testing for HA and DR environment.

HA/DR for IBM DB2 DB



Perform system copy from DB Node1 to Node2 without Rollforward.

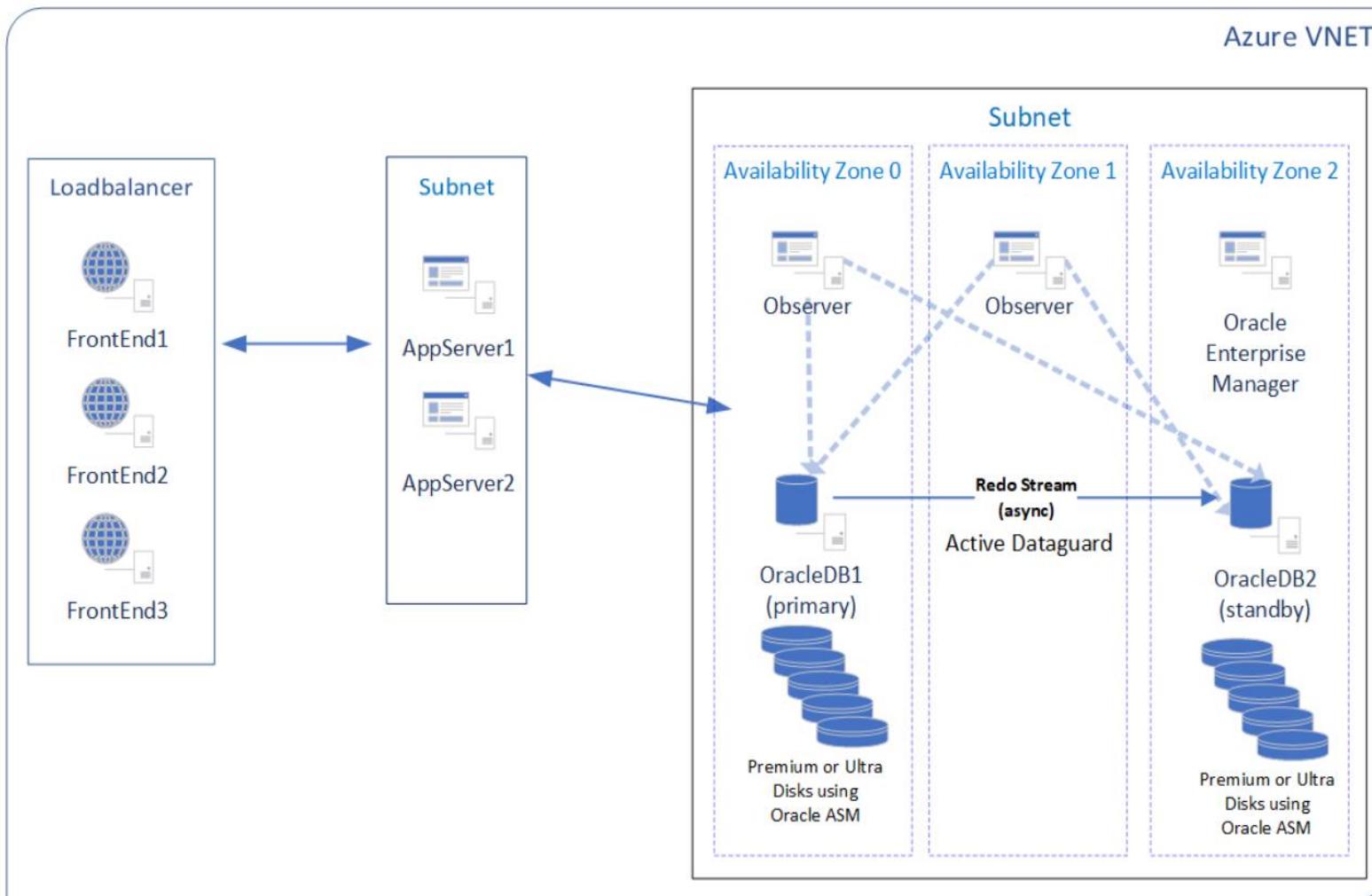
Configure DB2 HADR Replication

Setup Pacemaker Cluster with SBD device or Azure Fencing Agent

Create DB2 cluster resources. Test Auto Failover.

No integration with WSFC Cluster on windows. HADR setup will have manual failover.

HA/DR for Oracle DB



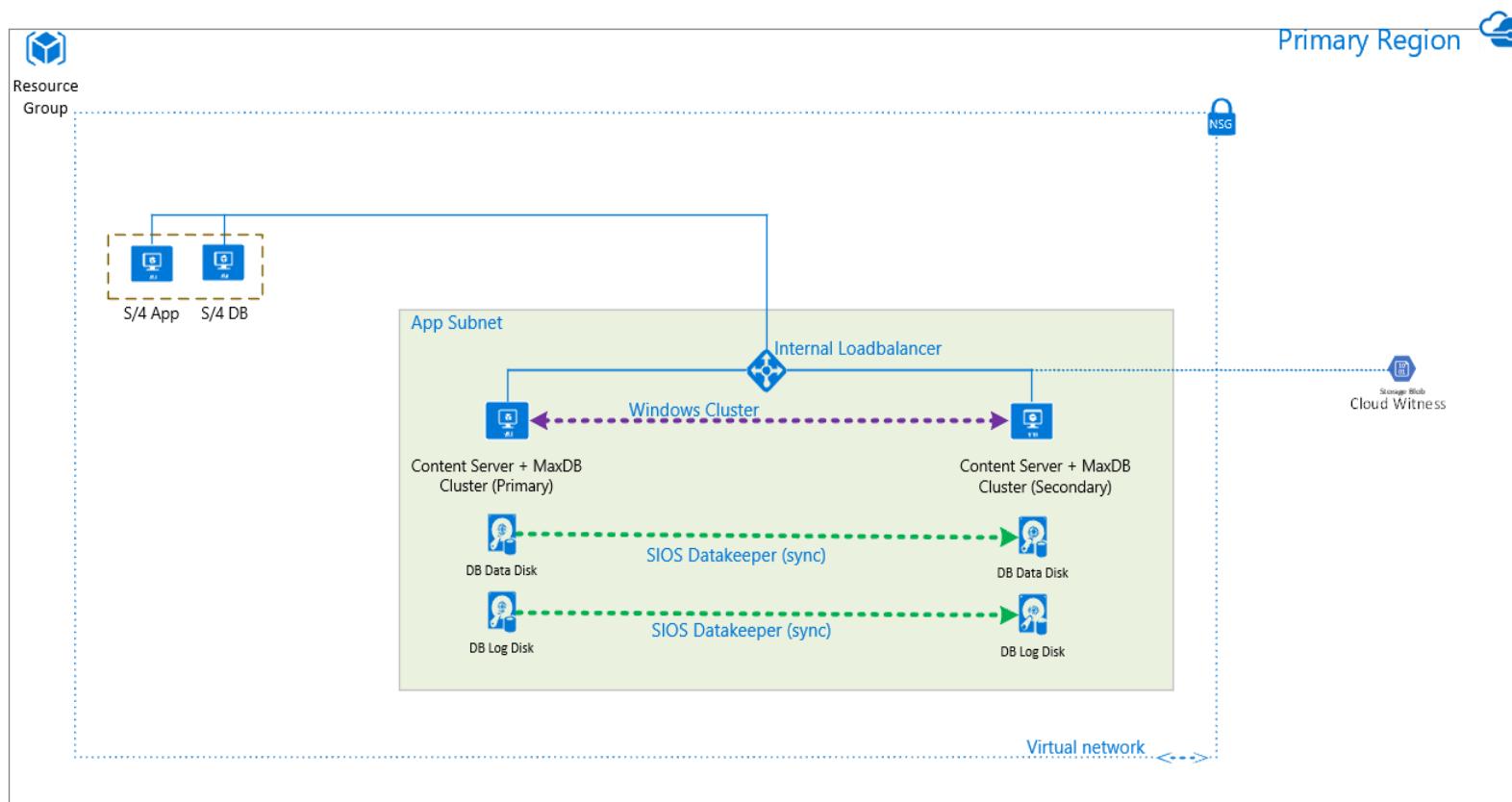
Oracle Dataguard for DB replication.

Fast Start Failover (FSFO) Observer for auto failover in case of unavailability of primary DB.

No need of OS Clustering.

For DR setup, third mode of DB in different region with Dataguard replication.

HA/DR for MaxDB for SAP Content Management System



Install MaxDB and Content Server on Node1 and 2.

Setup SIOS Datakeeper Disk Replication between both of the DB Nodes.

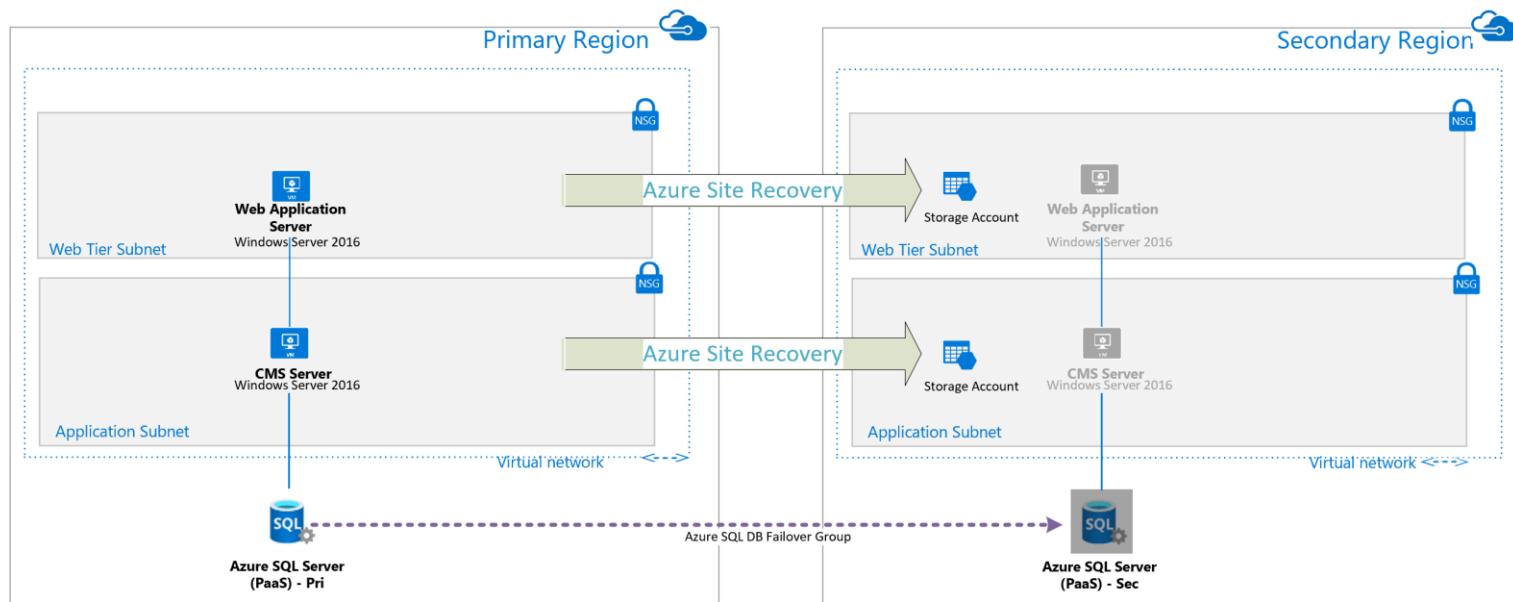
Windows Server Failover Clustering and ILB for auto failover for DB.

S/4 or ERP system will connect to ILB VIP/hostname.

Perform Failover Cluster Testing for HA and DR environment.

HA/DR for Azure SQL DB (PaaS)

SAP BO/BI Platform with Azure SQL DB (PaaS)



Azure SQL server/DB is supported from BO/BI version 4.2 SP8 onwards

Azure SQL DB is highly available by design. Provides 99.99% availability SLA.

Premium availability model is recommended for Prod env. AZ based setup is inbuilt in Business & Premium Tier.

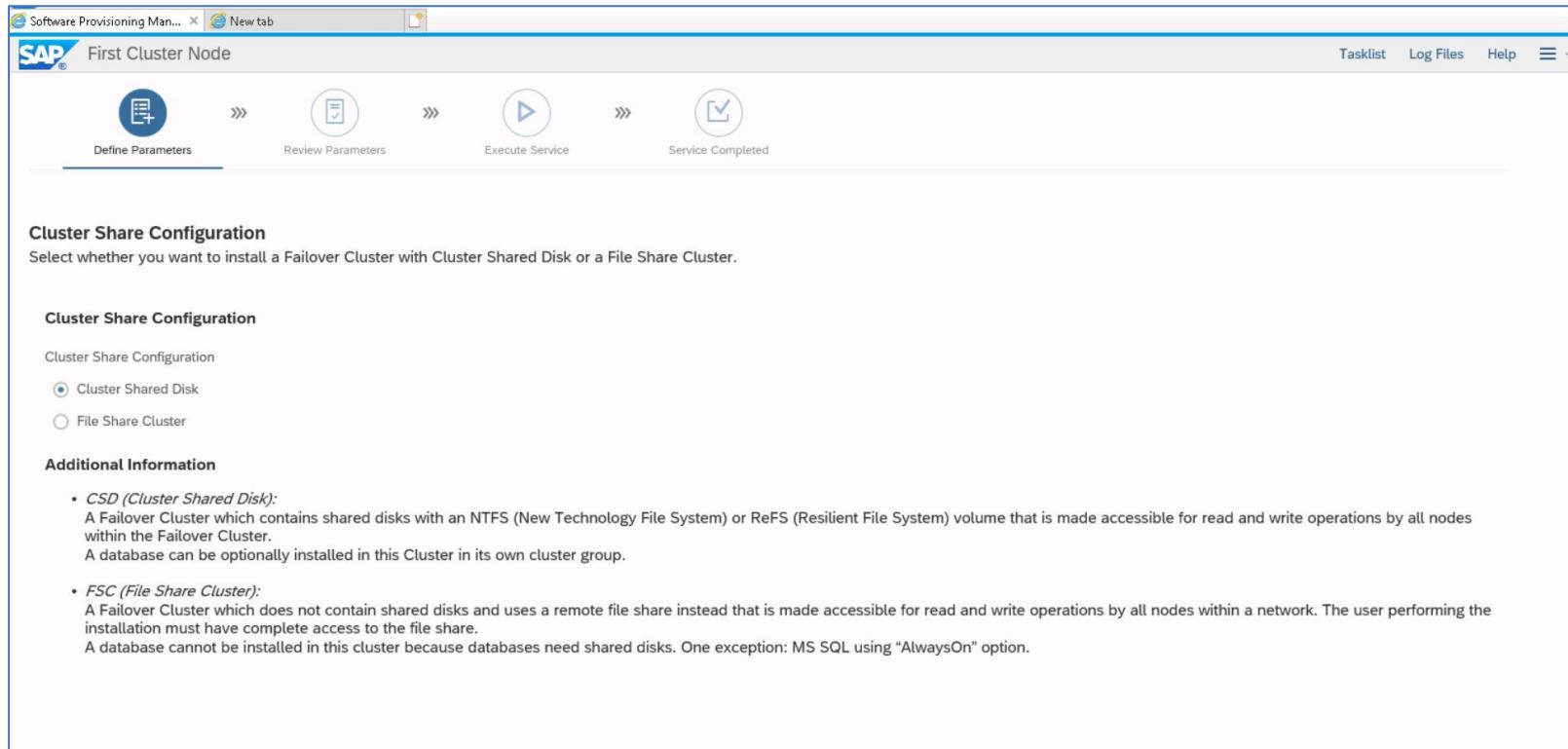
Azure SQL DB provide auto-failover group across region for DR setup. Traffic Manager based Listener setup.

HA/DR for SAP Application

- ASCS HA on Windows
 - Azure shared disk
 - SOFS
 - ANF
 - Third party / SIOS
- ASCS HA on Linux
- Multi-SID HA

SAP ASCS/SCS Windows Cluster

Method	Option to Choose
Azure Shared Disk	Cluster Shared Disk
SOFS	File Share Cluster
ANF	File Share Cluster
SIOS	Both Options Possible



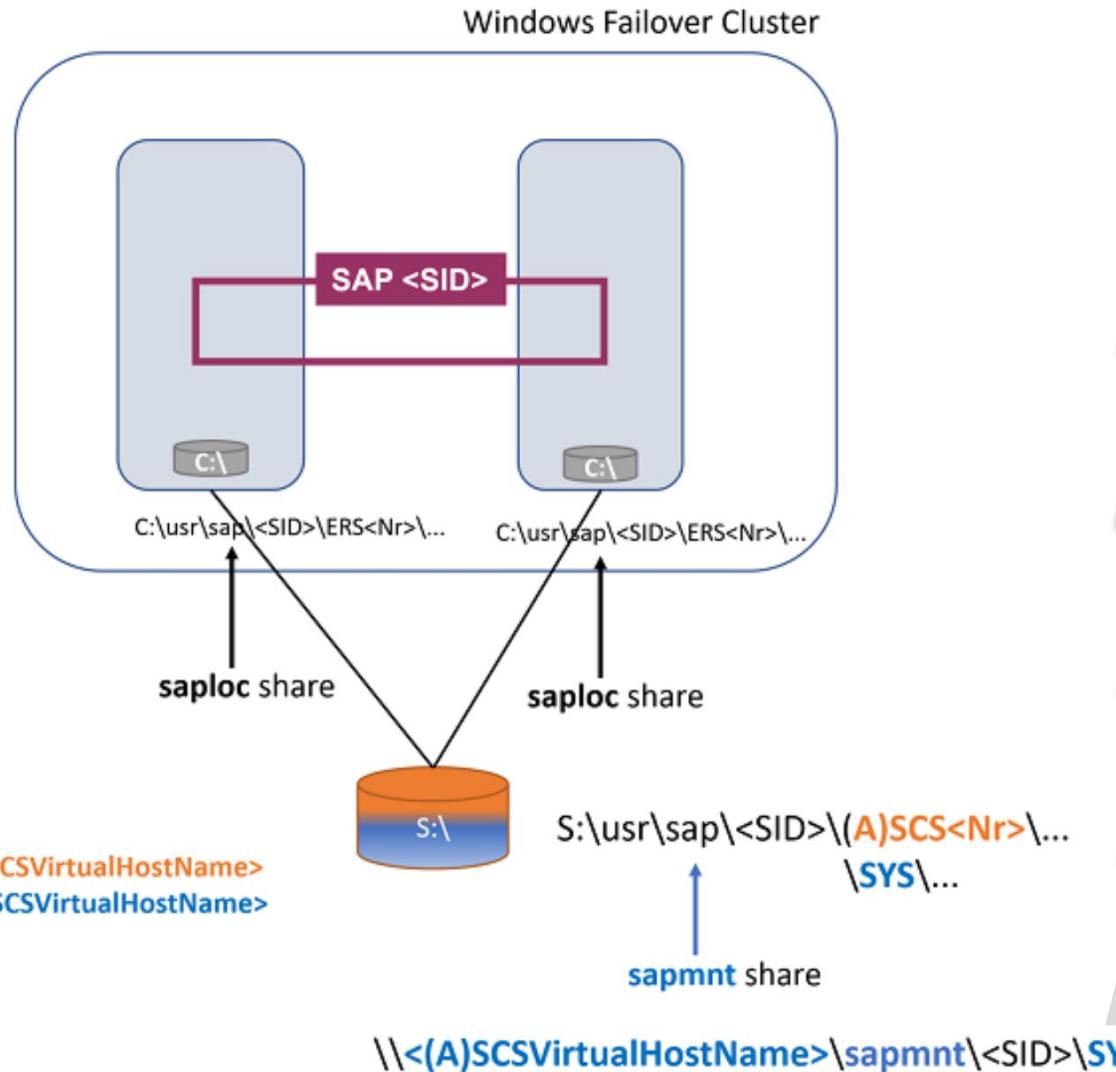
The screenshot shows the SAP Software Provisioning Manager interface for configuring a cluster. The top navigation bar includes 'Tasklist', 'Log Files', and 'Help'. Below the navigation is a progress bar with four steps: 'Define Parameters' (selected), 'Review Parameters', 'Execute Service', and 'Service Completed'. The main content area is titled 'Cluster Share Configuration' and describes the choice between a Failover Cluster with Cluster Shared Disk or a File Share Cluster. Under 'Cluster Share Configuration', 'Cluster Shared Disk' is selected. The 'Additional Information' section provides detailed descriptions of both options:

- CSD (Cluster Shared Disk):** A Failover Cluster which contains shared disks with an NTFS (New Technology File System) or ReFS (Resilient File System) volume that is made accessible for read and write operations by all nodes within the Failover Cluster. A database can be optionally installed in this Cluster in its own cluster group.
- FSC (File Share Cluster):** A Failover Cluster which does not contain shared disks and uses a remote file share instead that is made accessible for read and write operations by all nodes within a network. The user performing the installation must have complete access to the file share. A database cannot be installed in this cluster because databases need shared disks. One exception: MS SQL using "AlwaysOn" option.

SAP ASCS/SCS HA Architecture with Azure shared disk

Legend:

- Local Disk:
- Shared Disk:
- (A)SCS Components
- Global Host Components
- Infrastructure shared between (A)SCS and Global Host components



To be used in Windows cluster only and in Av Set. Not in AZ

No support for ASR and Azure backup.
Development In-progress.

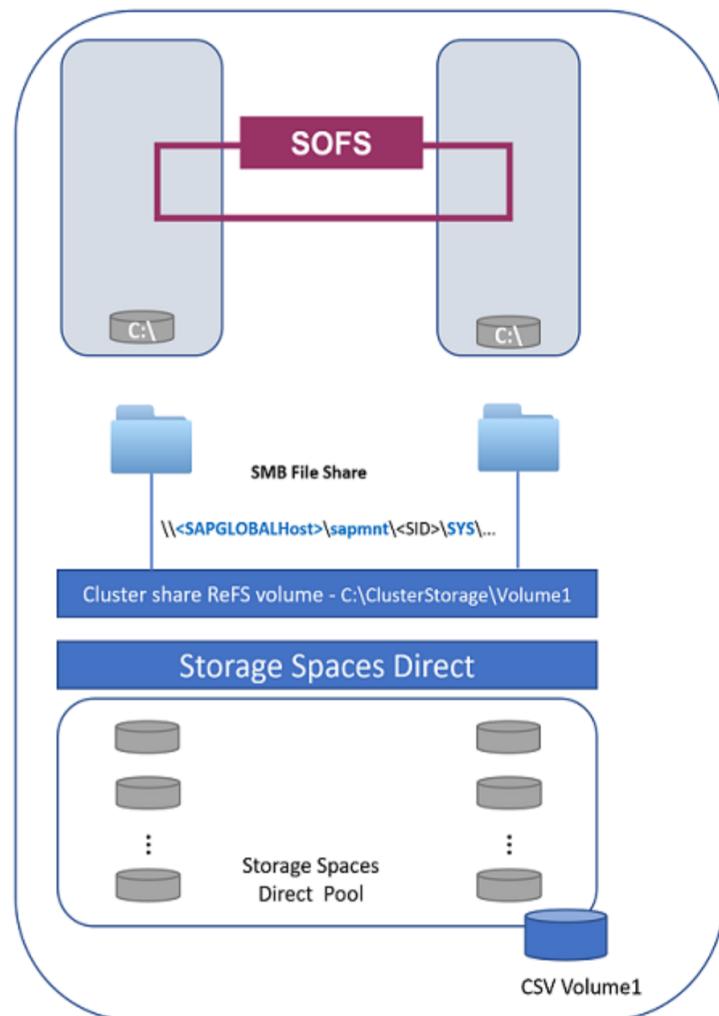
Combined SLA of 99.9% as shared disk can be SPOF

Flag maxShared controls number of VMs.
Need P15, P20 for 2 Node cluster.

Must use Premium disk. No support for Ultra Disk. No disk Striping.

Proximity Placement Group must be used for colocation.

SAP ASCS/SCS HA Architecture with Scale-out file share



C:\ClusterStorage\Volume1\usr\sap\<SID>\SYS\...

\\<SAPGLOBALHost>\sapmnt\<SID>\SYS\...

Disk replication between 2/3 VMs to create HA SMB share

Recommended for Av Set and not for AZ based.

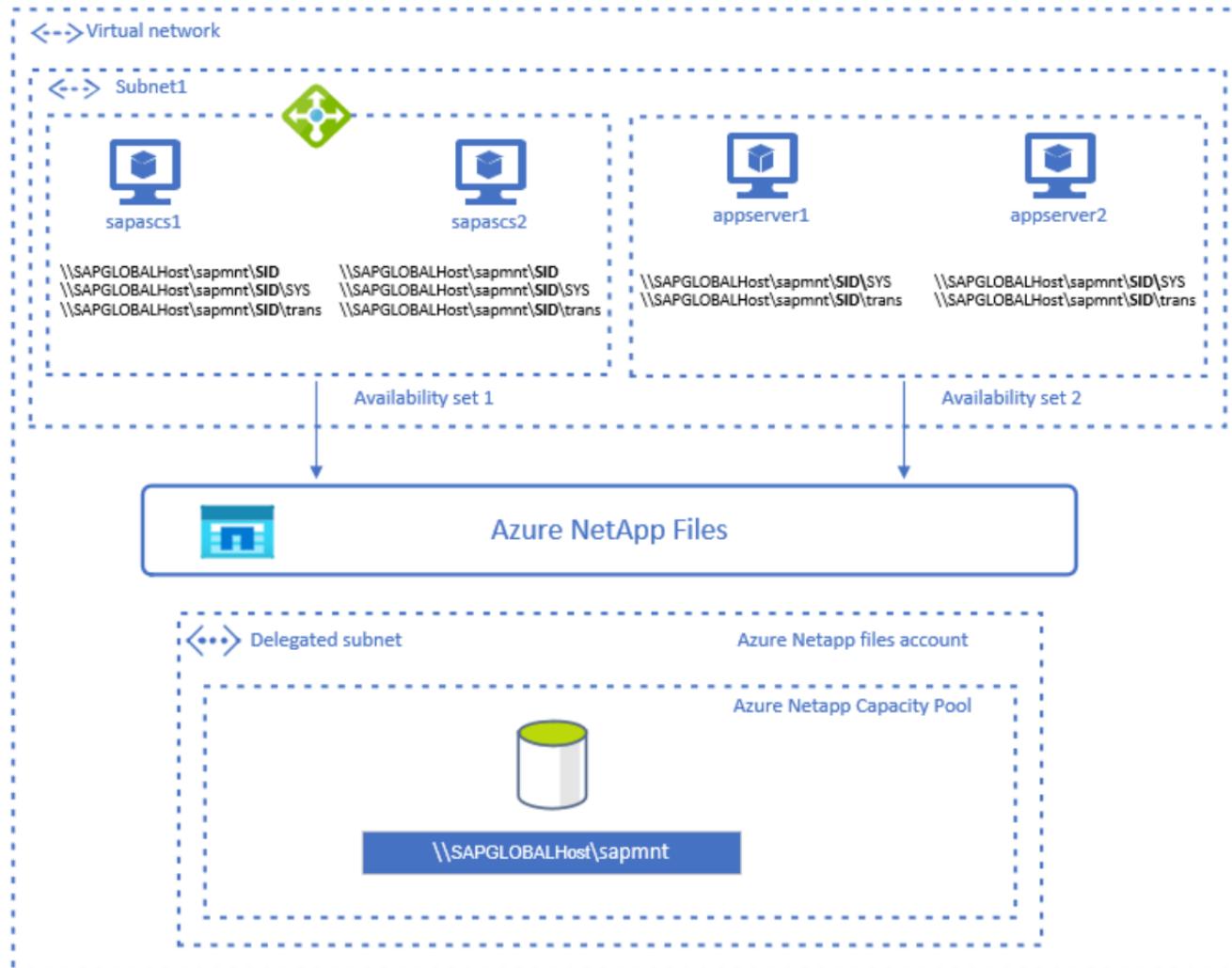
ASR for DR setup

Fast 2-way or 3-way synchronous mirroring

No ILB required.

Can host sapmnt share for multiple ASCS Clusters.

SAP ASCS/SCS HA Architecture with ANF



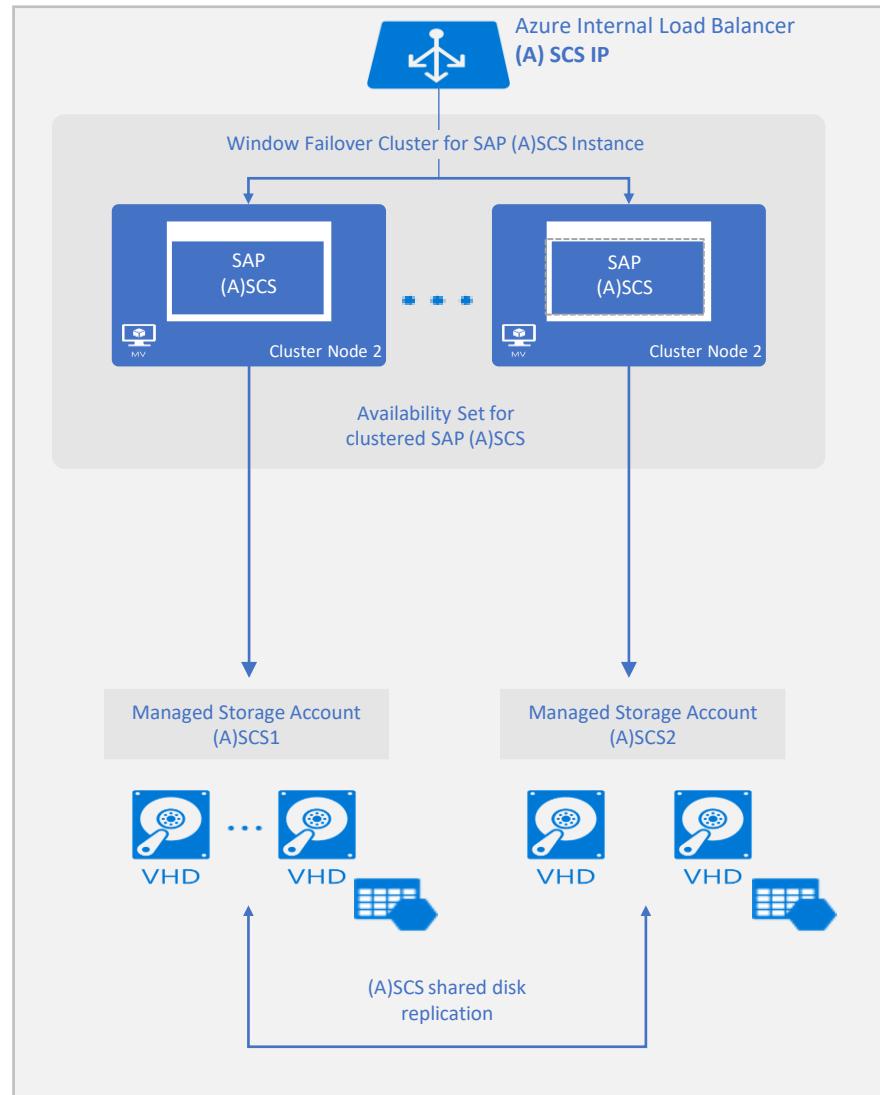
ANF as PaaS service. Ease of use.

Recommended for Av Set based setup

Cross Region Replication for DR setup

Sizing based on IOPS and throughput requirement. Dynamic selection now possible.

SAP ASCS/SCS HA Architecture with SIOS DataKeeper



Shared Disk based solution with internal Disk Replication.

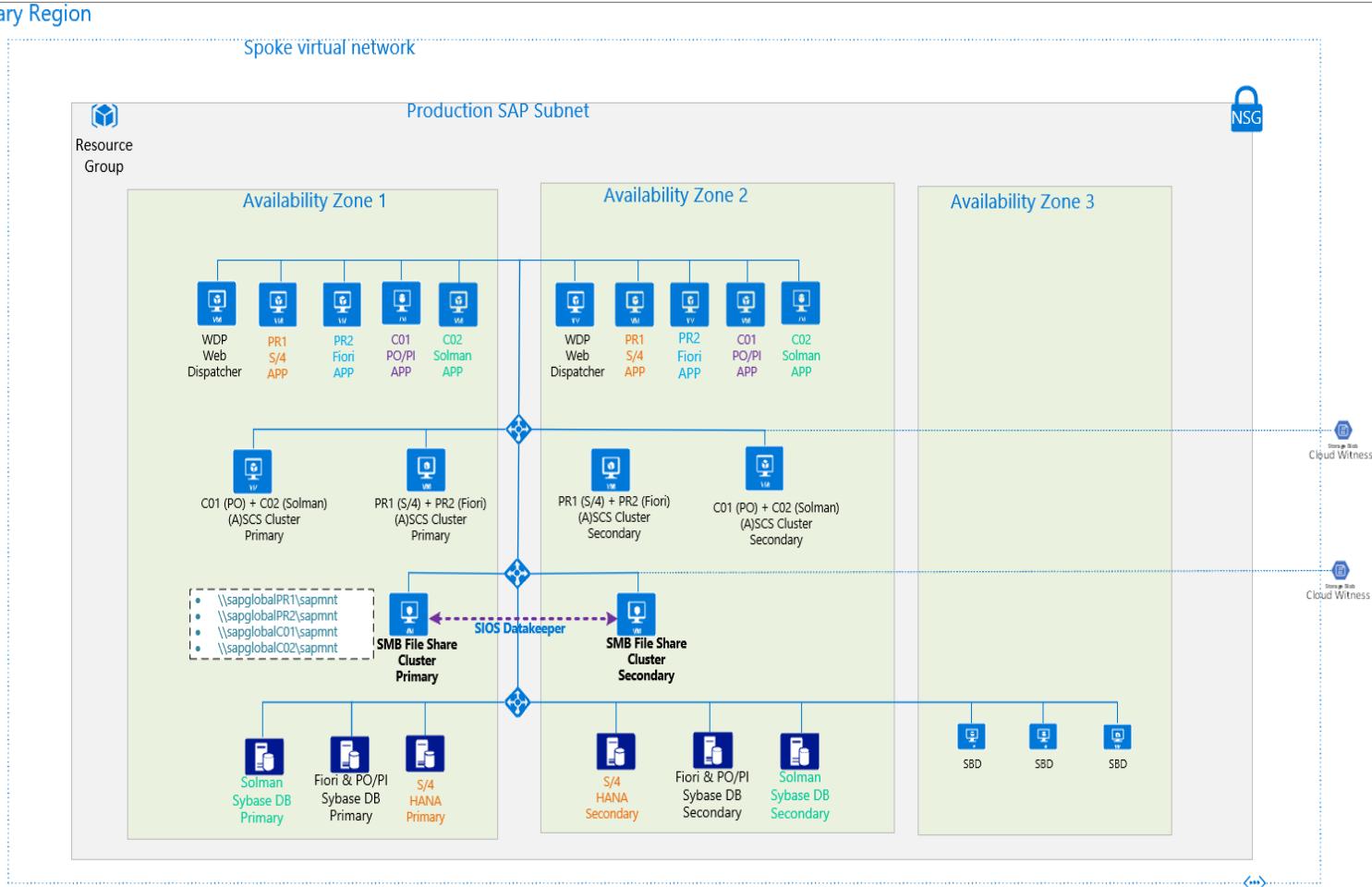
Recommended for Av Set and AZ based setup

Azure Site Recovery for DR setup

Third Party License required

SAP ASCS/SCS HA Architecture with SIOS DataKeeper (multi-SID)

Primary Region



SMB File Share based Solution.

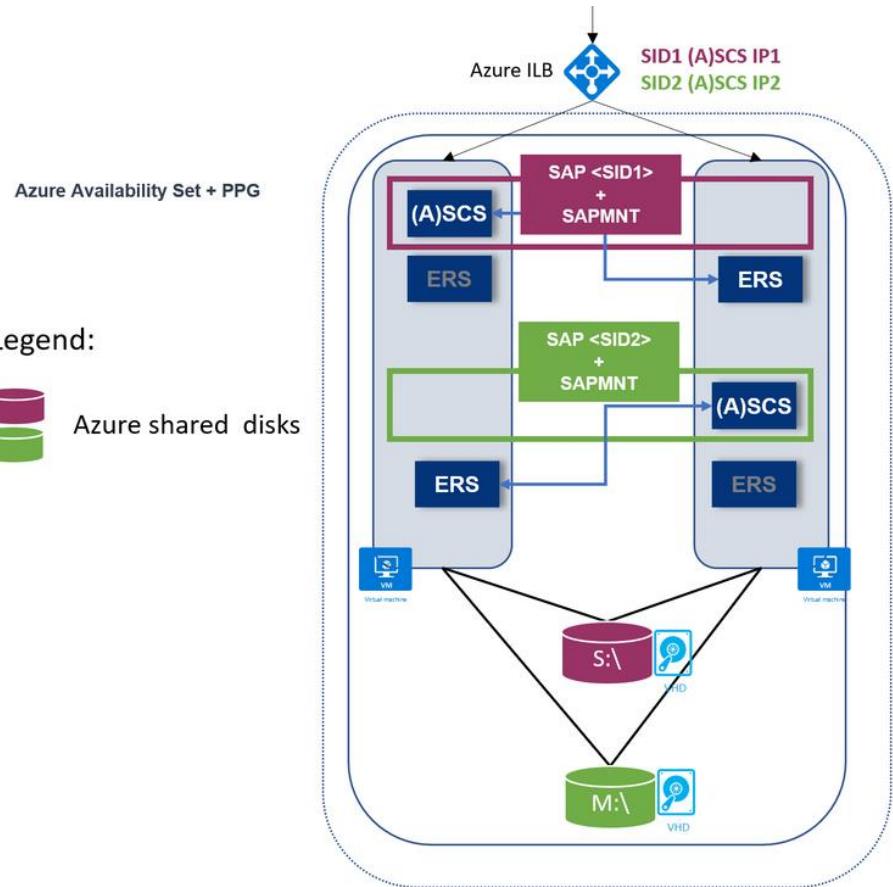
Recommended for Av Set and AZ based setup

Azure Site Recovery for DR setup

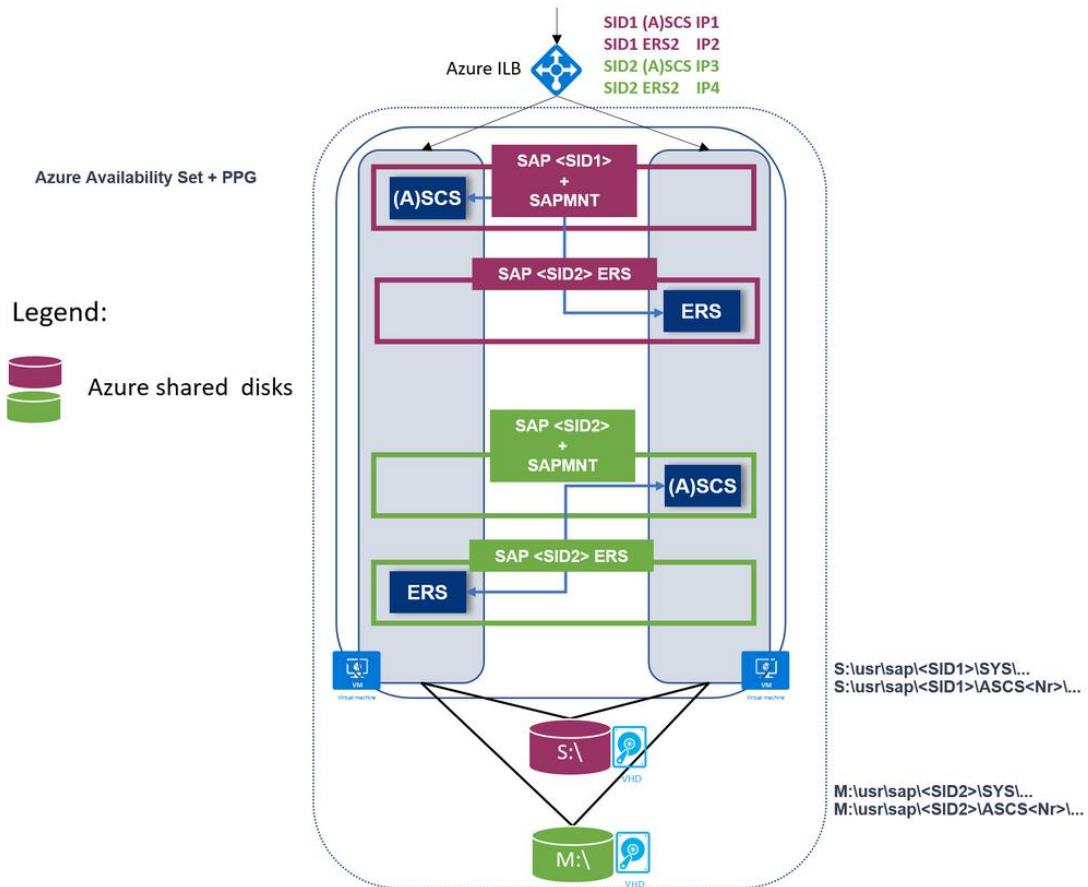
One pair of SIOS Fileshare can host 'sapmnt' of multiple SAP SID independently.

Azure Shared Disk Multi SID – ERS1 & ERS2

RESTRICTION:
Do not mix ERS1 & ERS2!

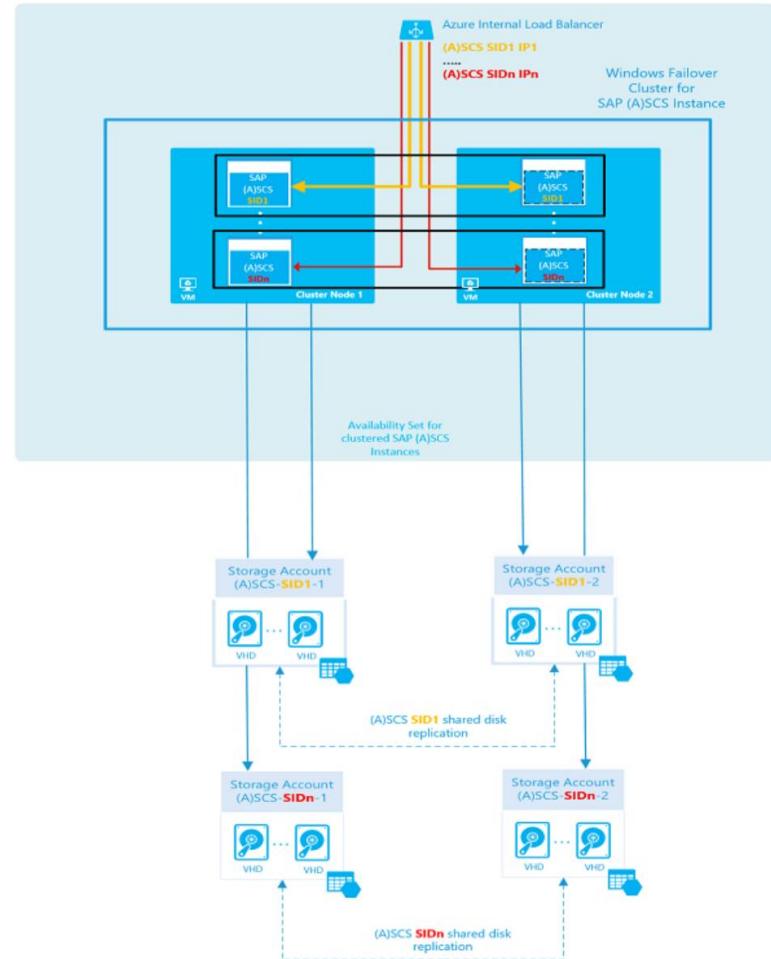


ERS1

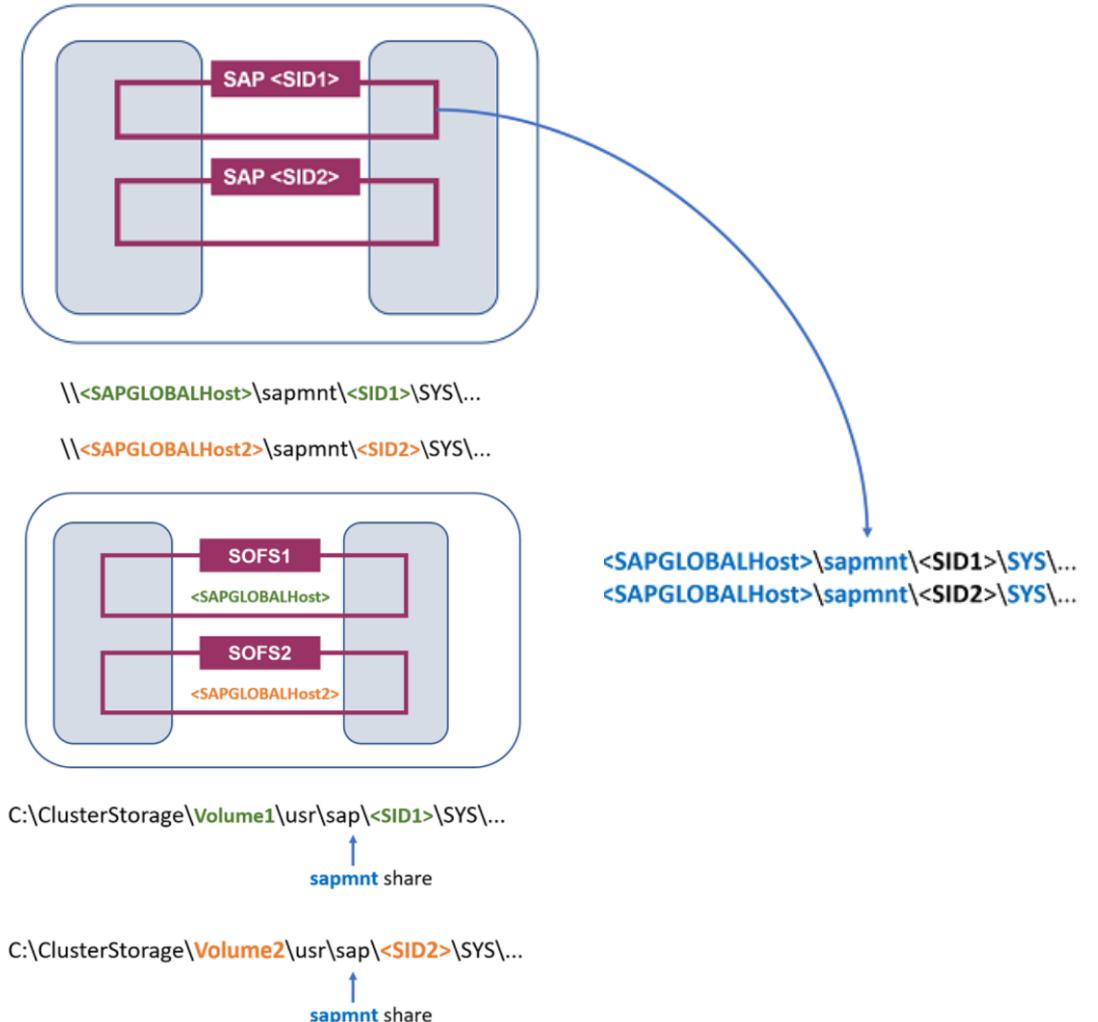


ERS2

SAP ASCS/SCS Cluster Multi SID



SIOS Based

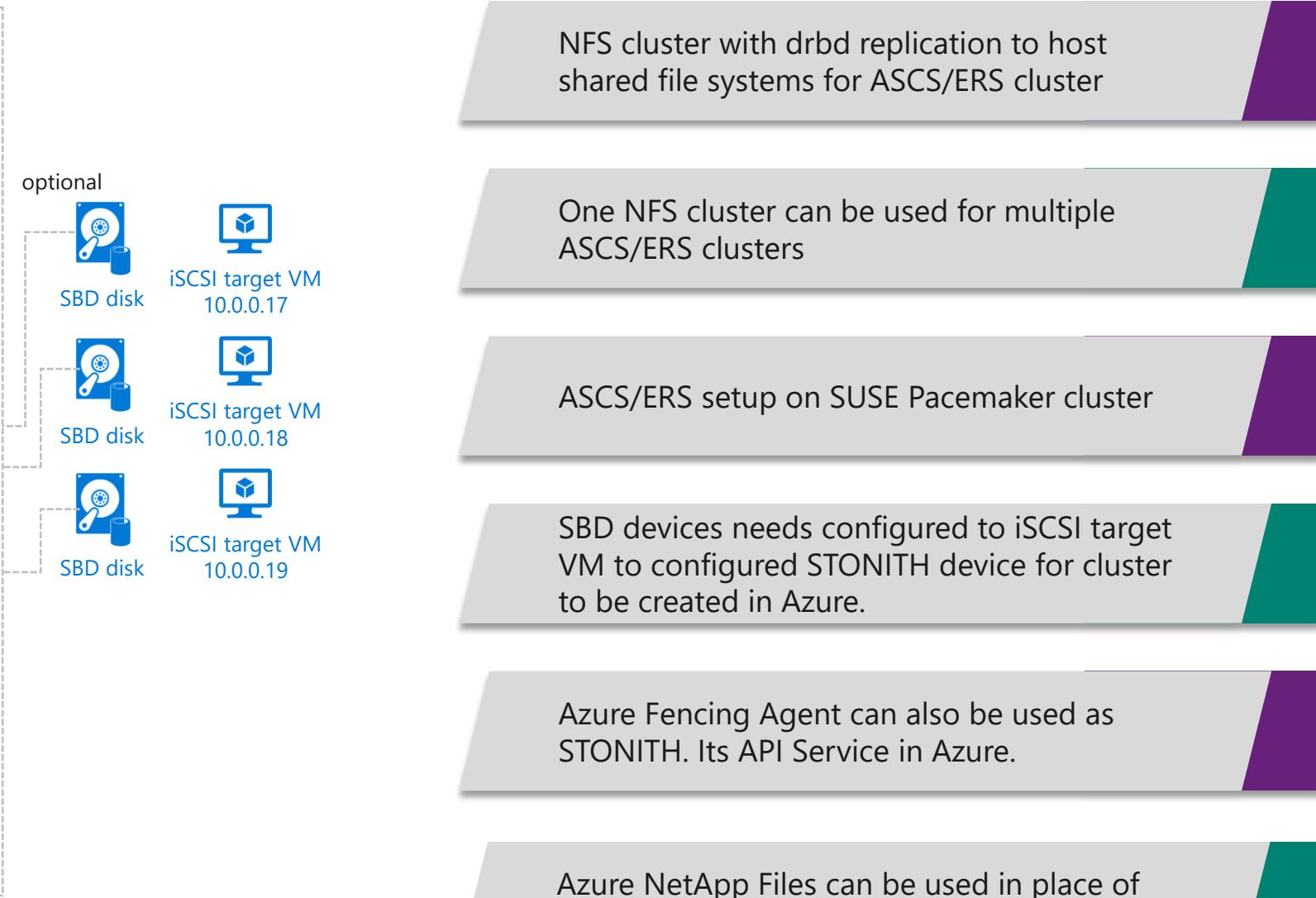
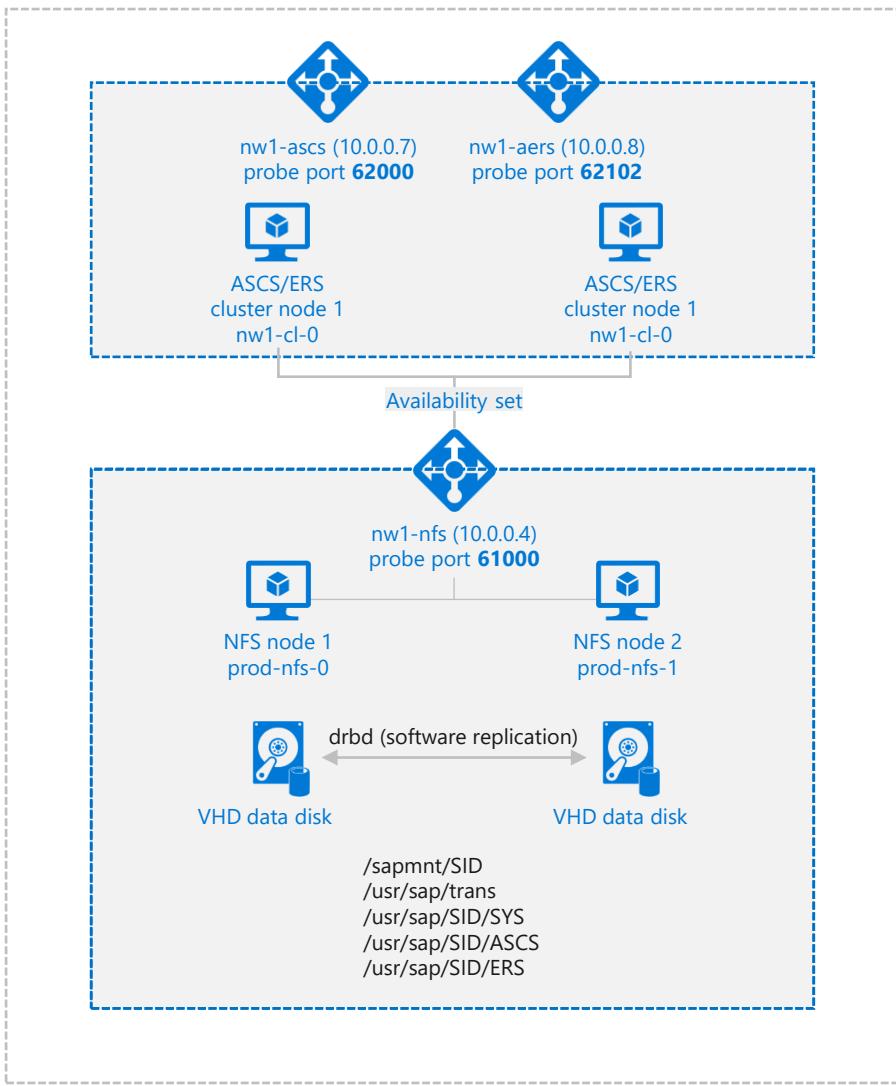


SOFS Based

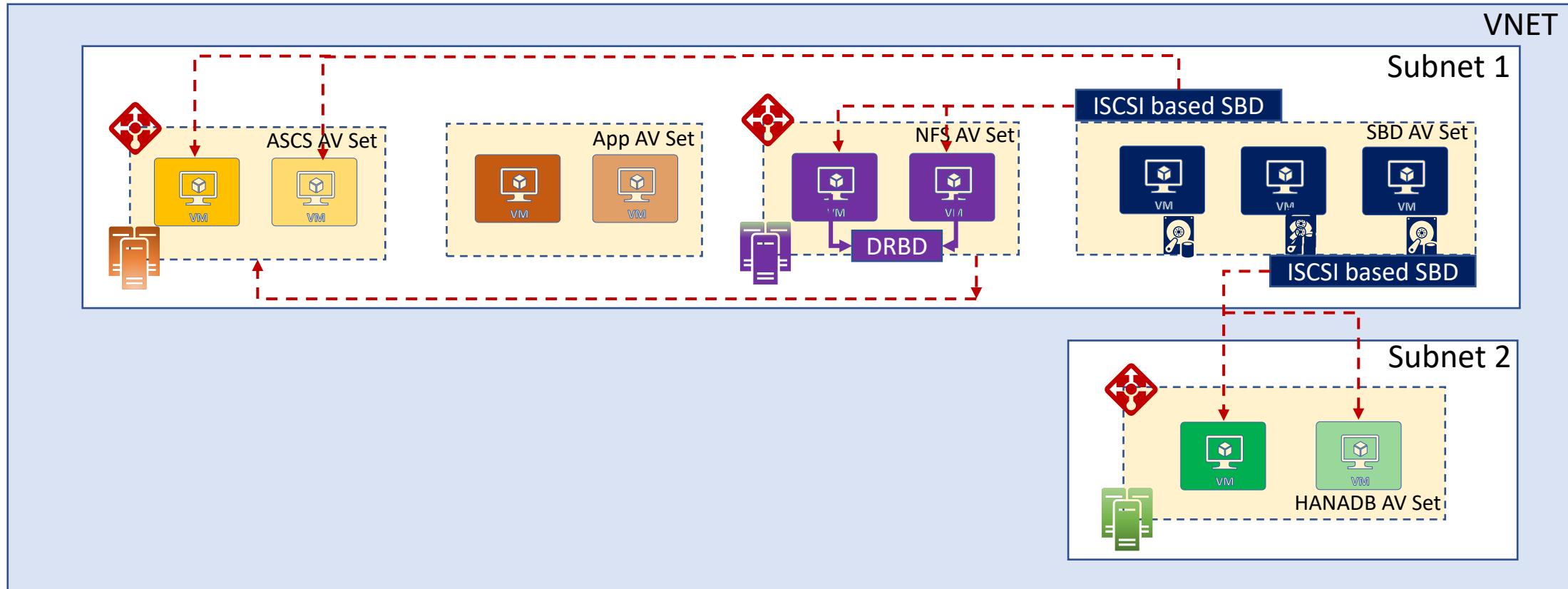
HA/DR for Linux

- ASCS HA (SLES)
 - NFS Server
 - ANF

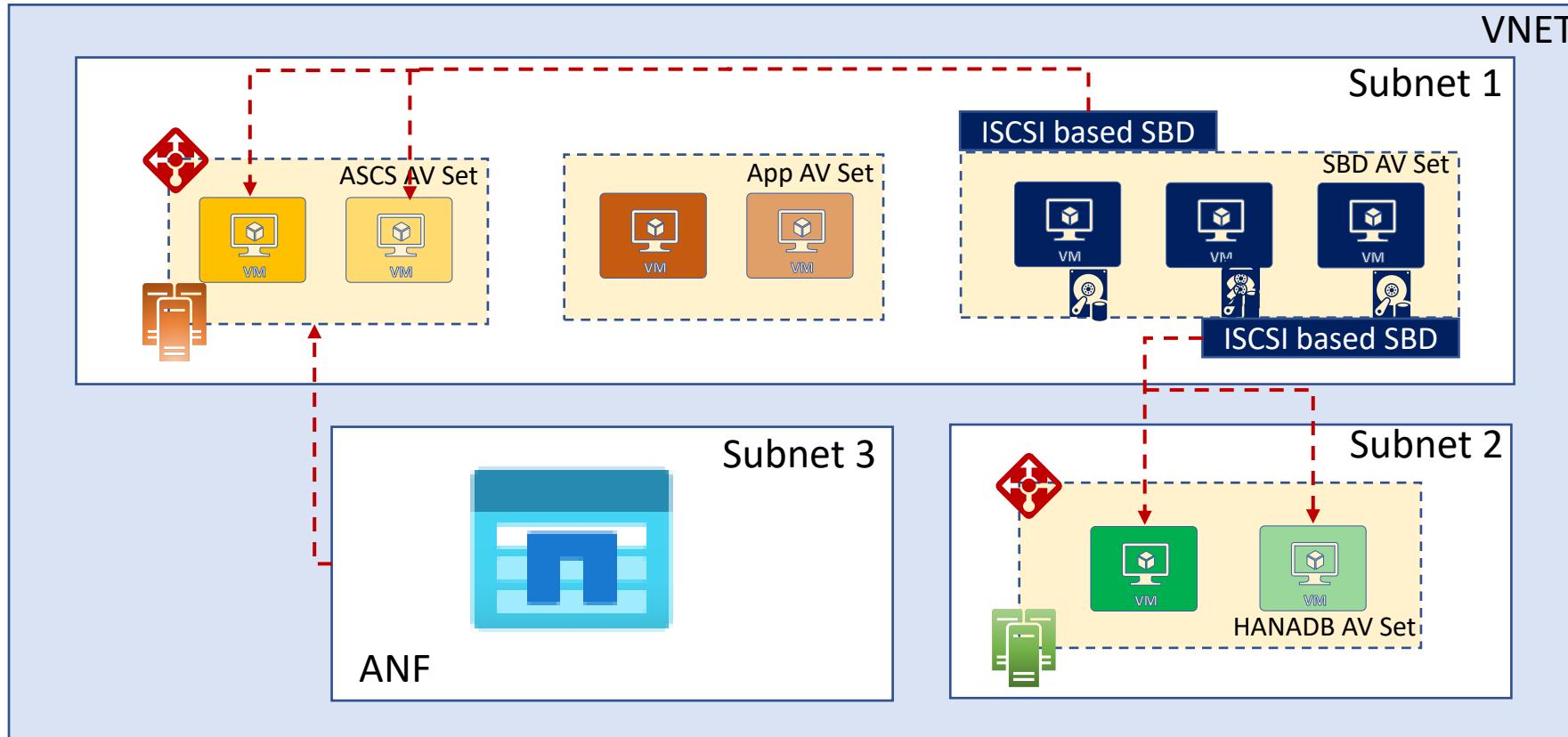
HA Setup – (A)SCS/ERS on Linux Servers



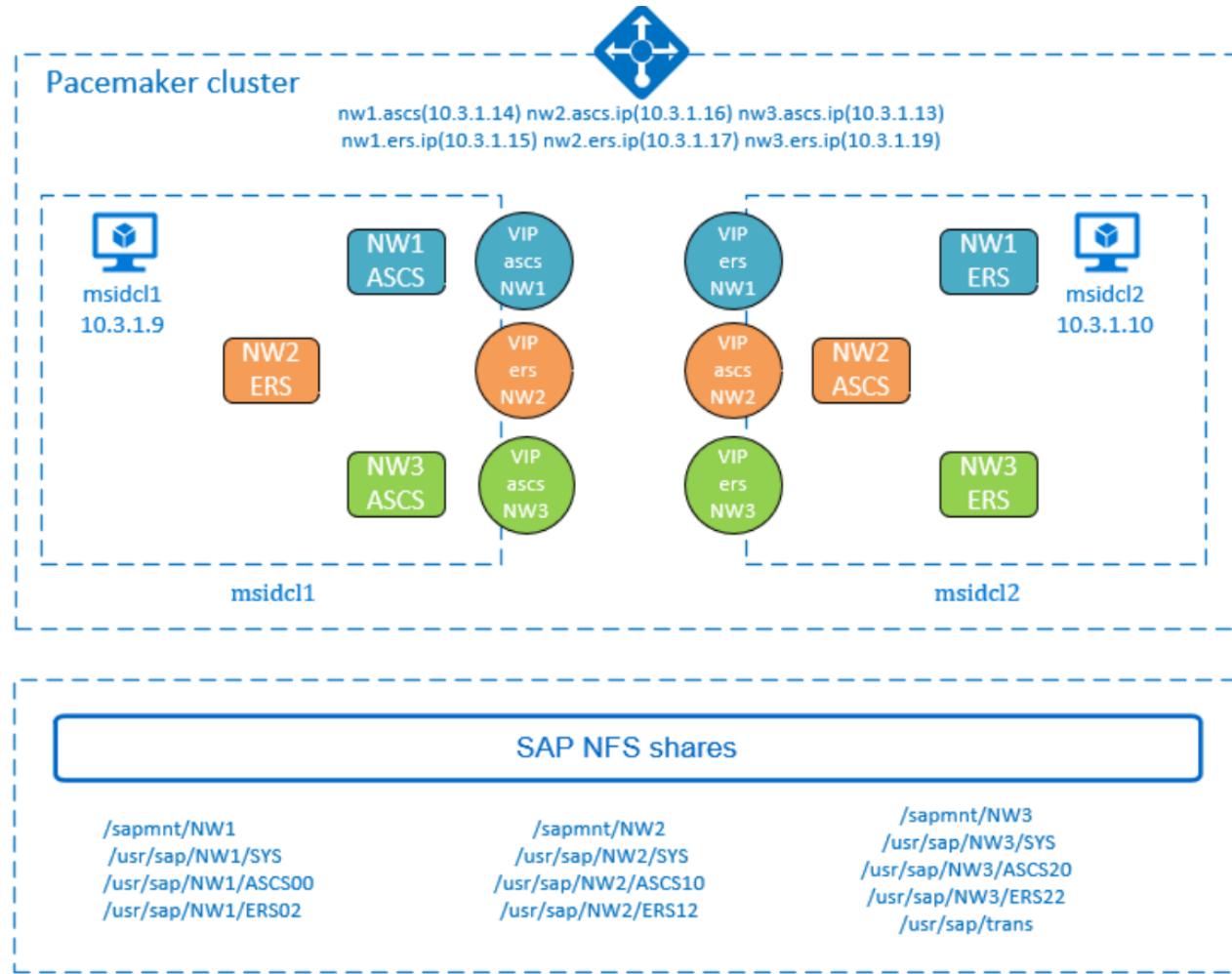
SLES High Availability using NFS server



SLES High Availability using ANF



SAP ASCS/SCS HA Architecture in Linux (multi-SID)



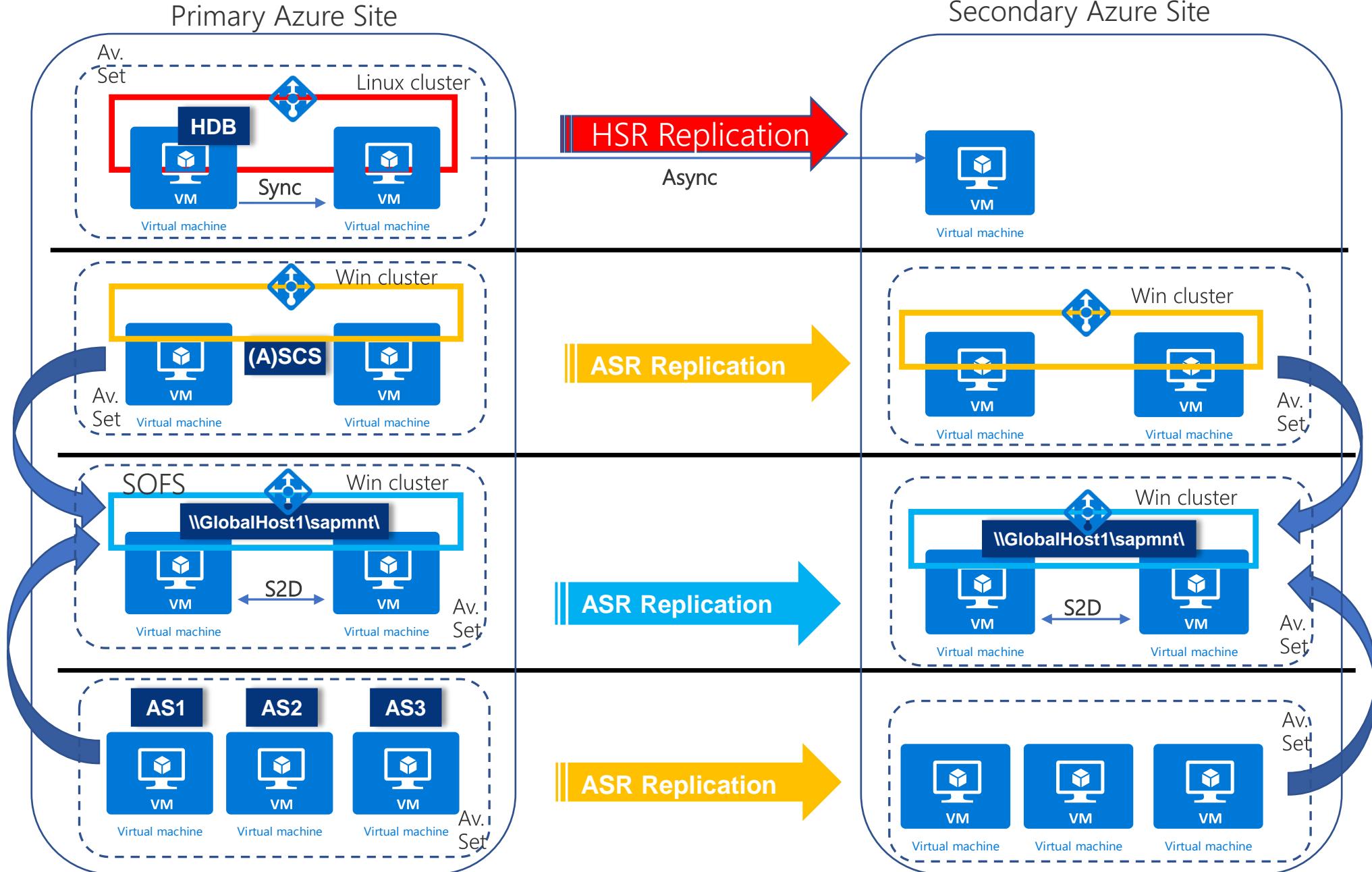
Pacemaker resource group for each SID.

NFS share can be on NFS cluster or ANF

Max 5 SID in 1 Cluster

Don't mix ERS and ERS2 based setup.

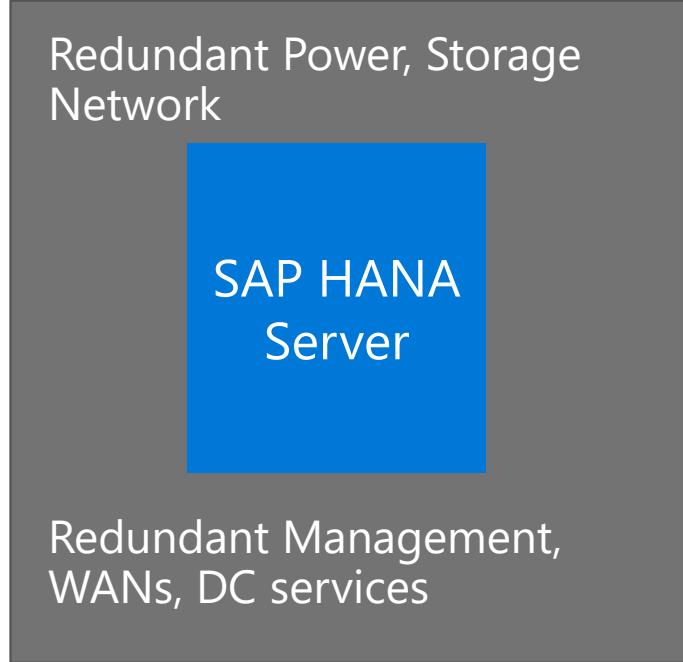
SAP app on Windows with HANA on Azure VMs HA/DR



HANA Large Instances

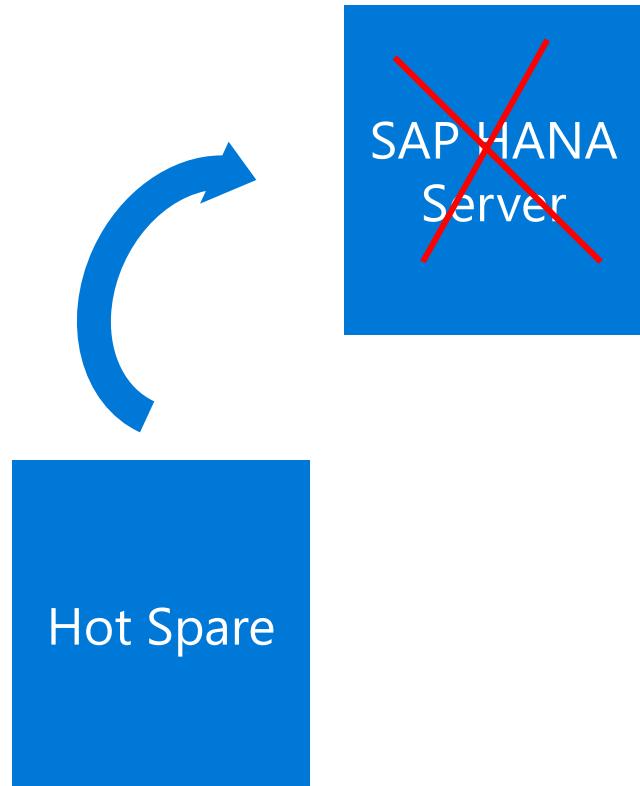
- Architecture using Storage replication
- Architecture using HSR

HLI Reliability and Resiliency



- DC Redundancy (Power, cooling)
- Management & NOC redundancy
- Network Redundancy – all paths
- Storage Redundancy- All controllers and disks
- **Hot Spares**
- Mission critical RAS features (CPU, Memory and IO) for resiliency
- Predictive monitoring
- Scheduled downtime for firmware updates on node (not forced)
- Isolated network and storage per tenant
- Dedicated and Reserved

Single Node

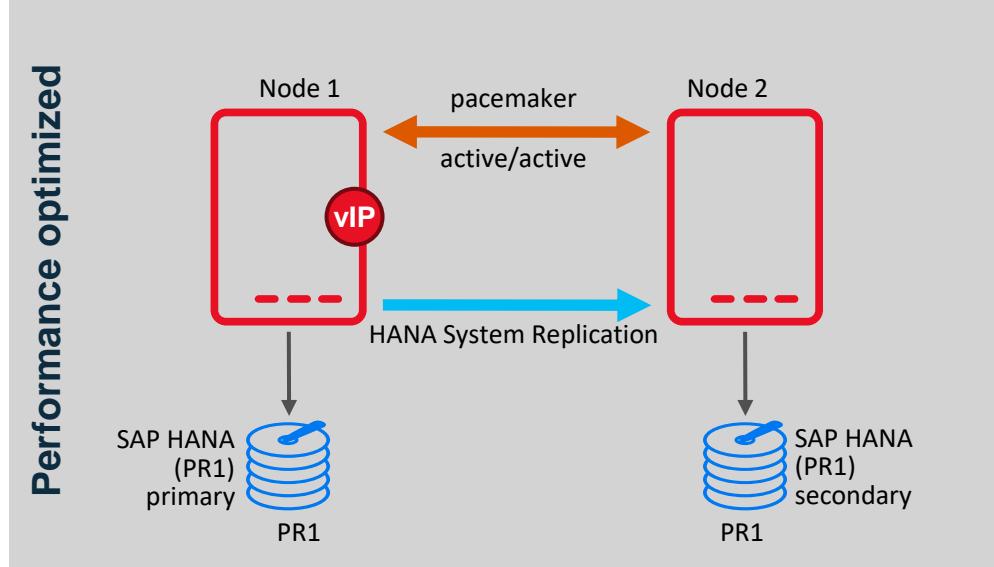


Type 1 LI : Hot spare replacement is transparent – keeps state, MAC, ip addresses, everything. (Our bare metal competition does not have this in most cases)

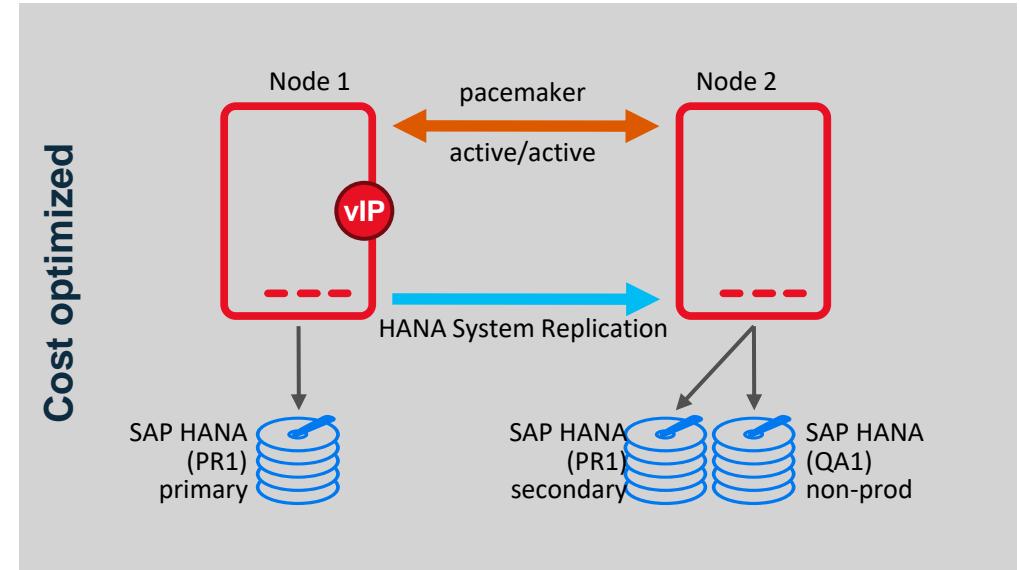
Type 2 LI : Hot spare replacement – keeps OS and SAP HANA licenses state. (Our bare metal competition does not have this in most cases)

HANA HSR – Performance vs Cost Optimized

Performance Optimized



Cost Optimized



- Data Preloaded on Secondary
- RPO = 0
- RTO = ~0

Repl. Mode = SYNC/FULLSYNC RPO = 0
Operation Mode = Log Replay

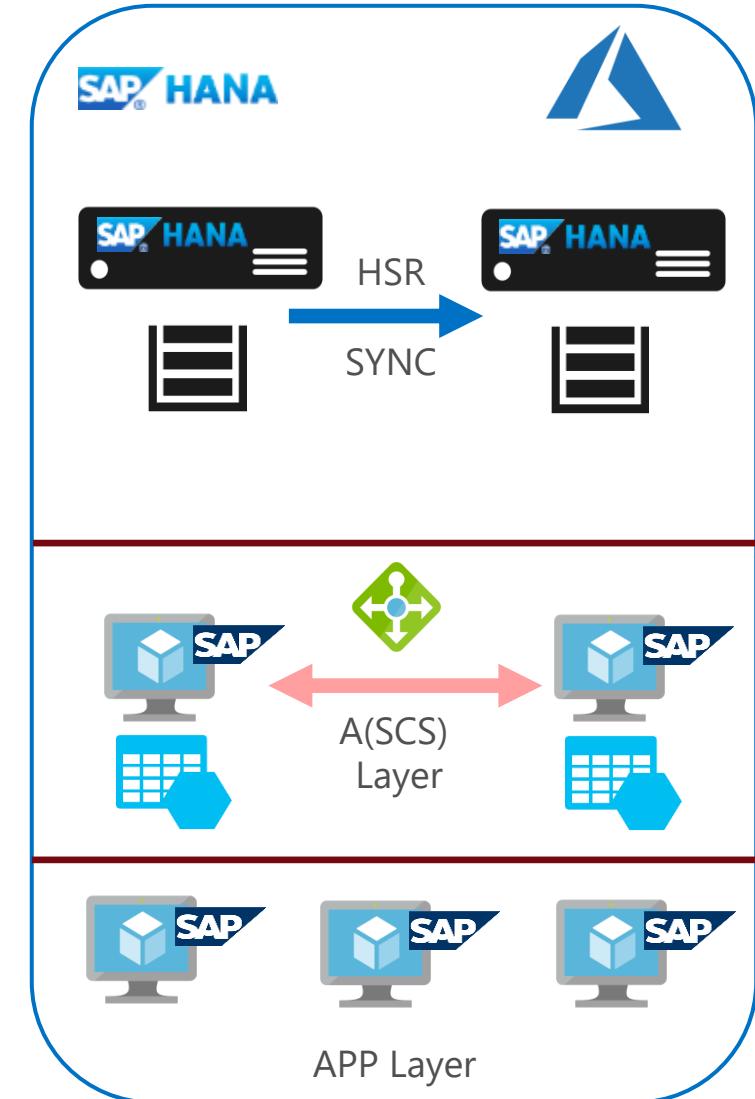
- No Data Preload on Secondary
global.ini/[sys_replication]->
preload_column_tables=false
- RPO = 0 ; RTO = mins/hours (shut QA, start PRD)
- Requires additional storage sec. node

SAP on HANA – Large Instances with HA

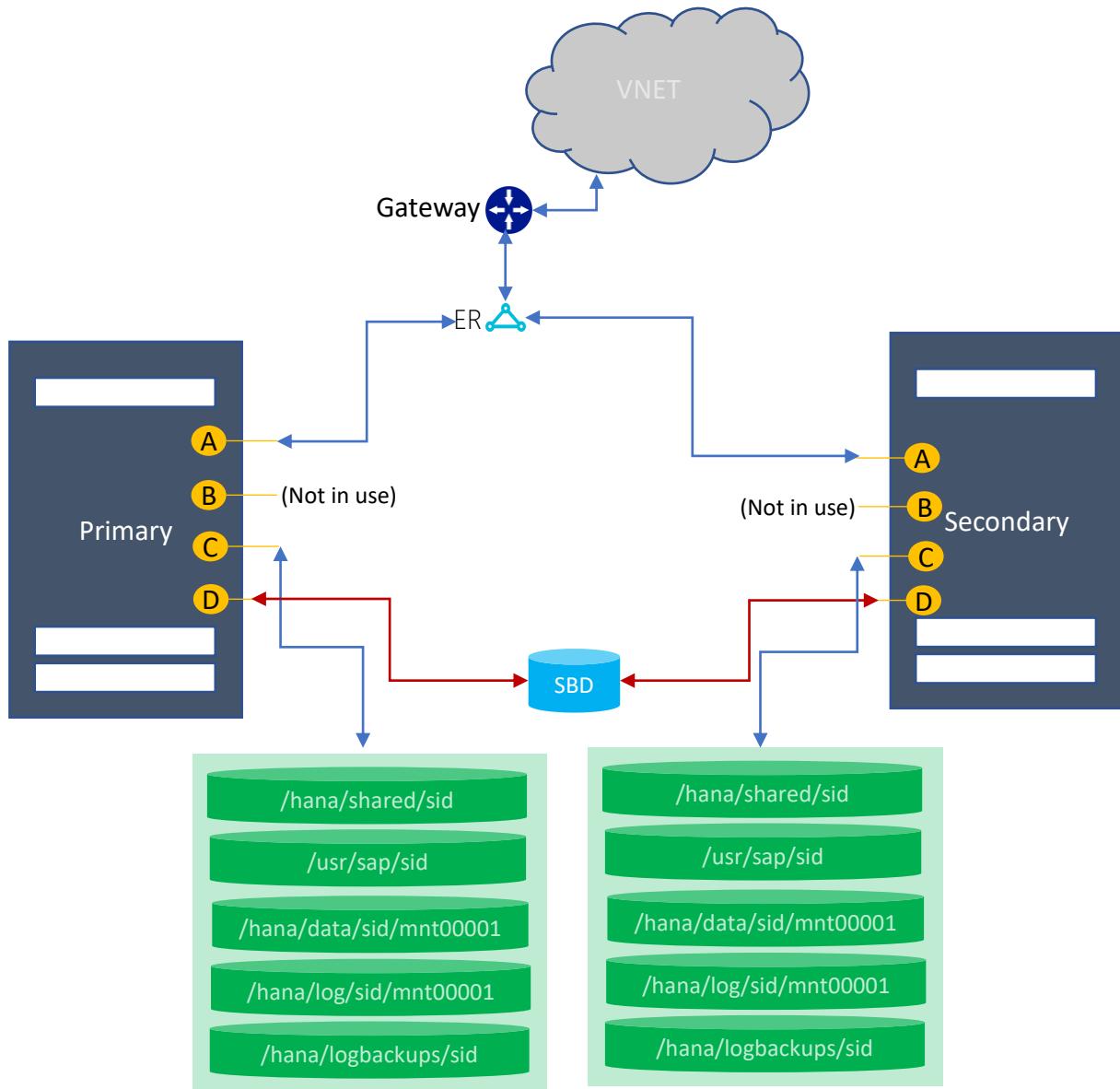
SLA 99.99%

Implementation:

- Two identical SAP HANA on Azure large instances deployed in the same region
- Configured by the customer/partner for system replication at the application layer.
- Declared as the members of HSR Pair during the Microsoft architecture design process.



HSR with STONITH for HA



Important call out

Stonith comes by default
Supported for SUSE OS only
MCOS supported

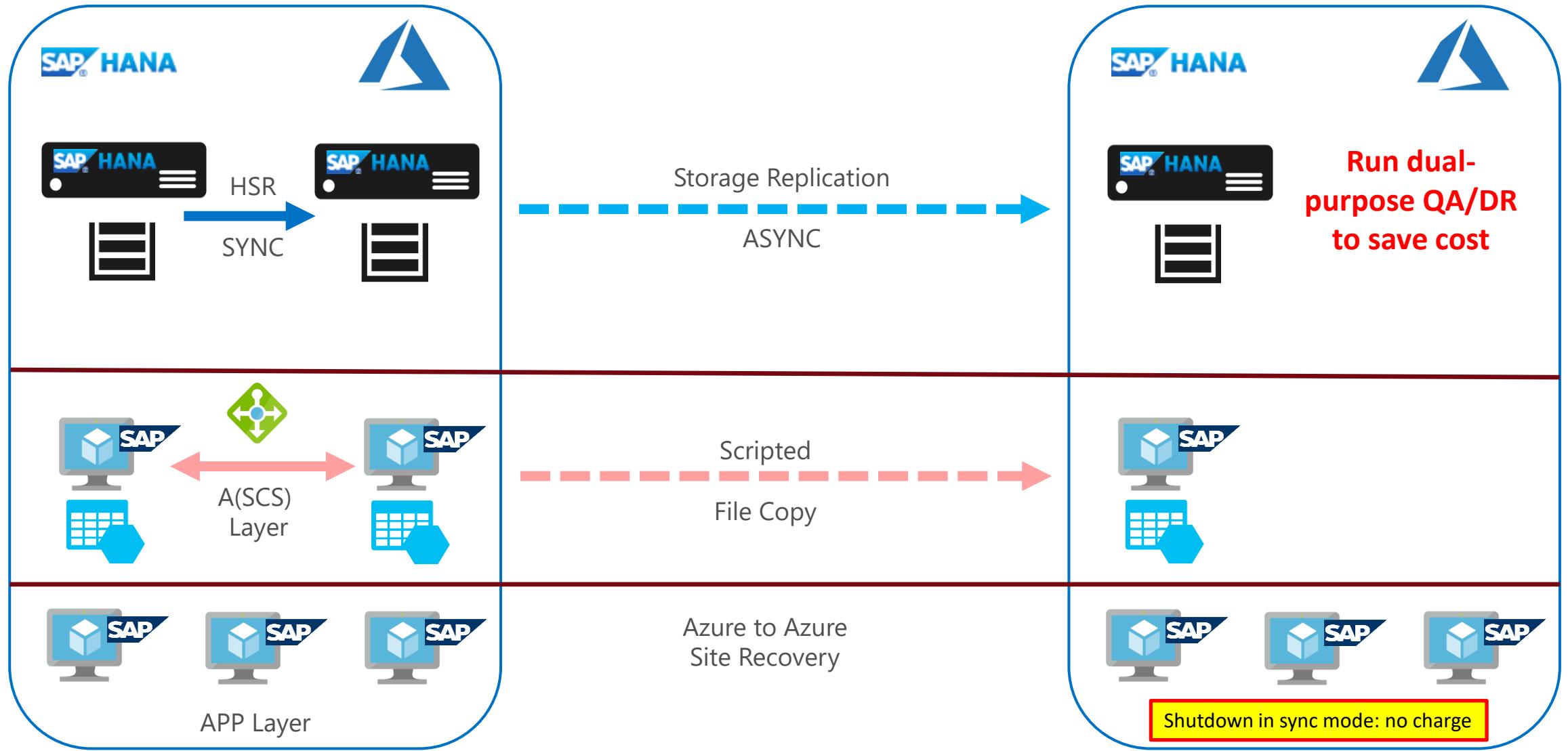
Network Card Configuration

eth0: Client access
eth1: Node to node communication
eth2: Node to Storage communication
eth3: Node to ISCSI (for STONITH)

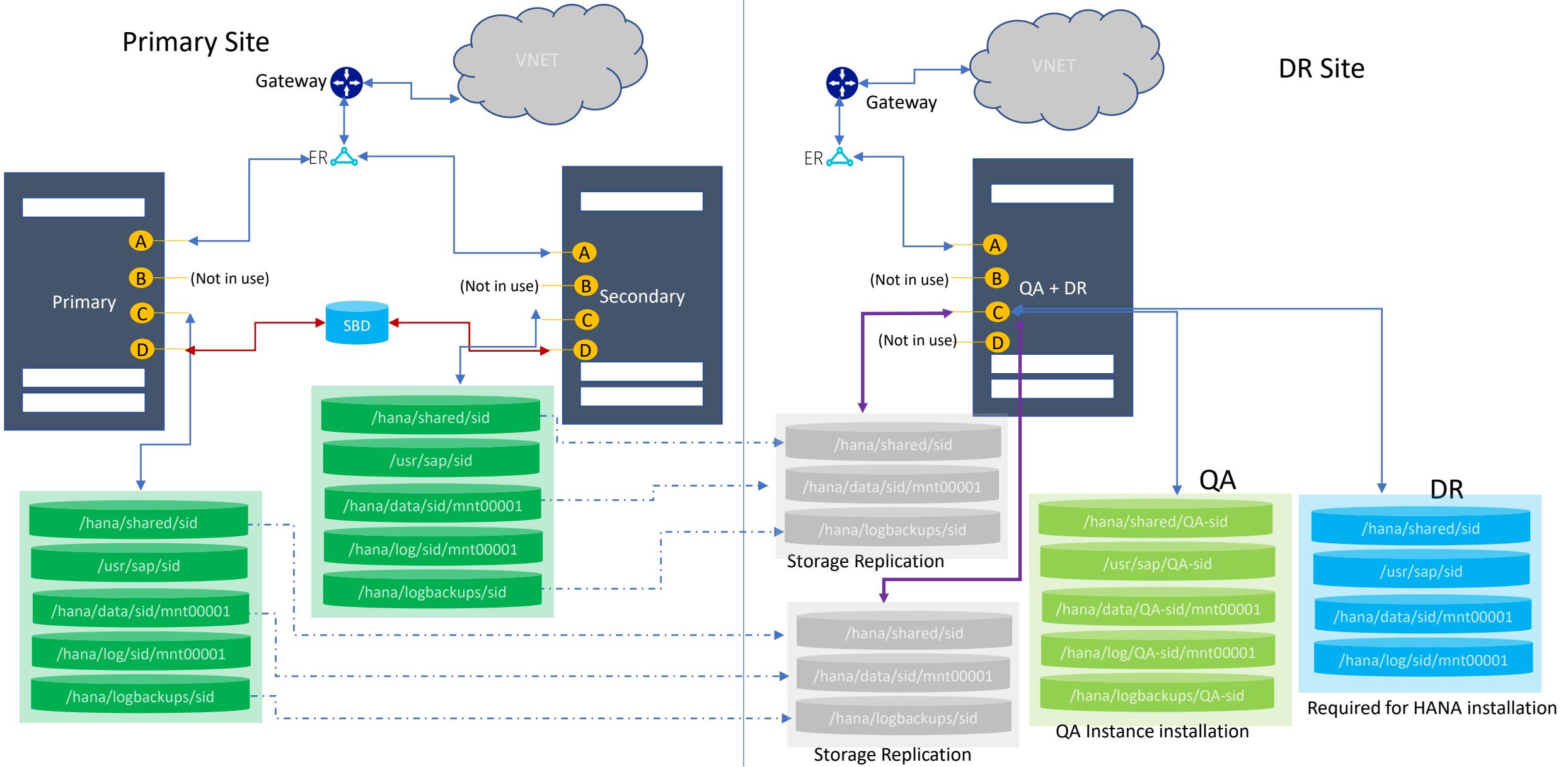
Storage Configuration

Node1: /hana/shared/<SID>
Node1: /usr/sap/<SID>
Node1: /hana/data/<SID>/mnt00001
Node1: /hana/log/<SID>/mnt00001
Node1: /hana/logbackups/<SID>
.....
Node2: /hana/shared/<SID>
Node2: /usr/sap/<SID>
Node2: /hana/data/<SID>/mnt00001
Node2: /hana/log/<SID>/mnt00001
Node2: /hana/logbackups/<SID>

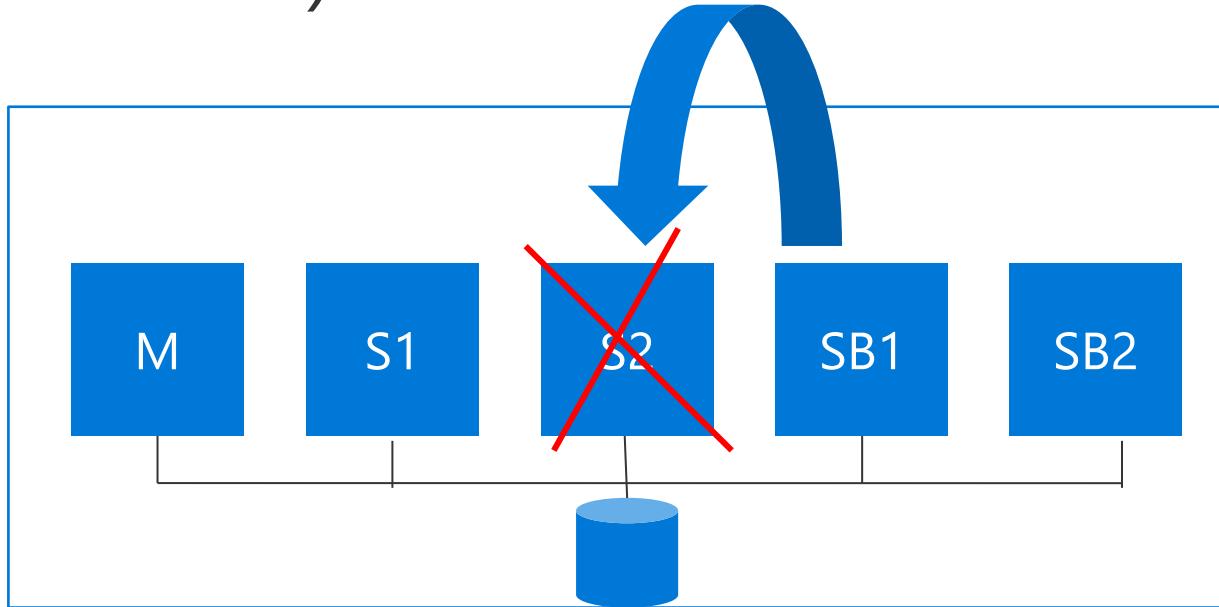
SAP on HANA – Large Instances with HA/DR



HSR with storage replication DR



HDI High Availability N+M (Automatic Host Failover)



Best Scale, Price-Performance-SLA of any cloud

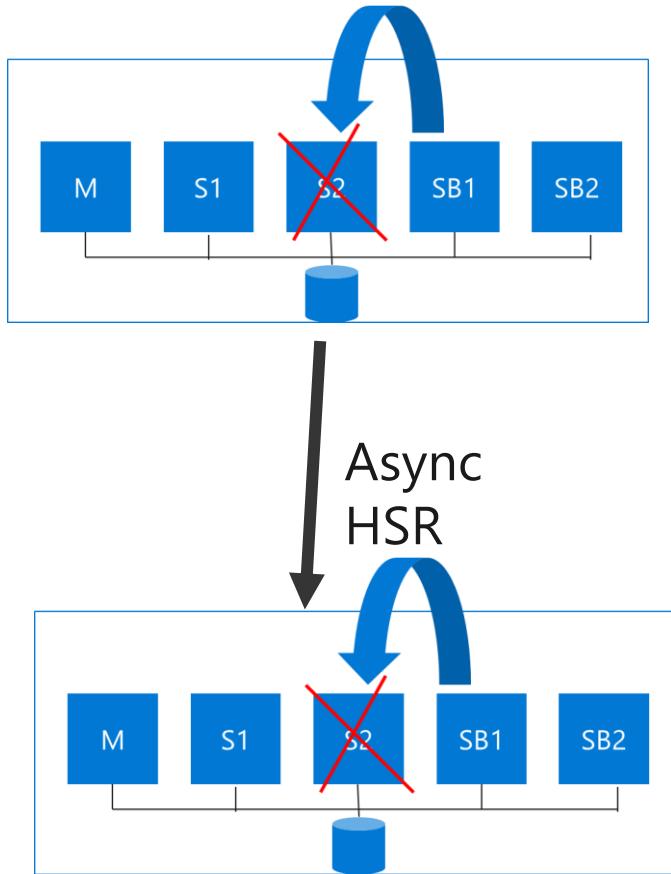
Cost advantage N+M/N (instead of 2x)

$$\text{Effective SLA} = 100 - {}^N C_m * ((100-S)^{m+1})$$

e.g. 5+2 cluster at a cost of 1.4x

- OLAP and OLTP
- Zero RPO and RTO
- N+M clusters supported
- Shared NFS Storage
- Single node SLA allows for cluster wide SLA to be calculated.
- Dedicated Node to Node network
- BW upto 60 TB certified and 120 TB TDIV5
- Live Consistent snapshots and mirroring to DR site

DR



Nodes can be replaced by Clusters for a similar topology for DR of 1+1 and N+M

Demo

- SAP HA on Linux
- SAP HA on Windows

Q & A

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SAP on Azure Enablement

Next Session – Monitoring SAP workloads on Azure

Tuesday, Oct 28, 2020, 10am SGT

Reach out to the team
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