



# SAP on Azure Enablement

Thursday, Oct 15, 2020

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Module Two – Week One

Day 4 – Thursday, Oct 15, 2020

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# SAP on Azure Partner Enablement

## Module Two – Week One

Day 4

- SAP on AnyDB Wrap Up
- Architecting SAP HANA on Azure



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# Check-in

We are happy to host you 😊

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

<https://aka.ms/apac-sap-enablement>



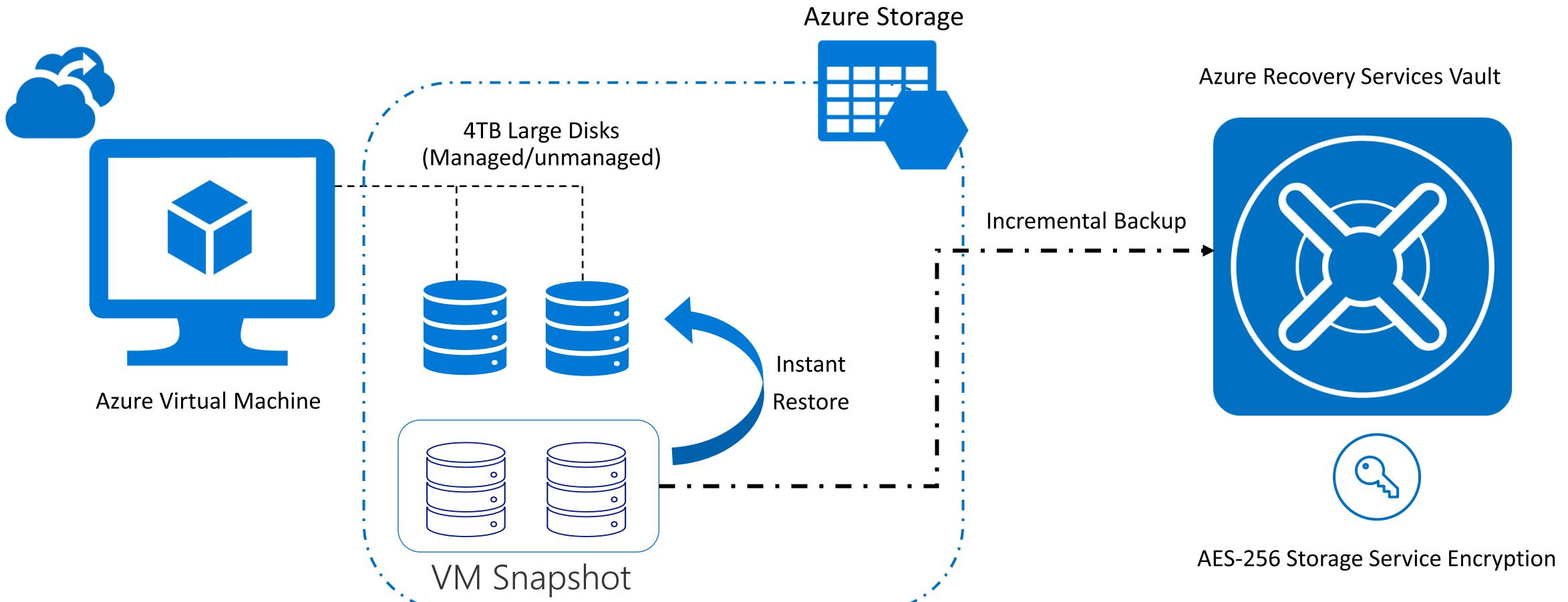
# Agenda

1. SAP Certification for Azure (Any DB)
2. Key Design Aspects
3. Reference Architecture
4. Backups
5. Migration to Azure

# SAP on Azure Backup solutions Overview

| Solution                        | Description   |
|---------------------------------|---|
| Azure IaaS VM Backup            | Azure backup ( VM snapshot backups)   |
| Standard Database backup        | SQL Server, Oracle, HANA, Sybase, DB2, MaxDB etc. native backup.  |
| Azure Backup Server (SCDPM)     | DPM running on an Azure VM, Azure Backup allows offload storage from the Azure disk. Storing older data in a Backup vault allows to storing new data to disk. |
| 3 <sup>rd</sup> party solutions | Commvault, NetBackup, advanced features like data depduplication, remote replication etc.   |
| HANA Backup using BackInt       | Azure Backup integration with backint for HANA database backup(in Preview)  |
| HANA on Azure Large Instances   | HANA backup, storage snapshots and third party (Commvault) backup   |

# Azure VM Backup



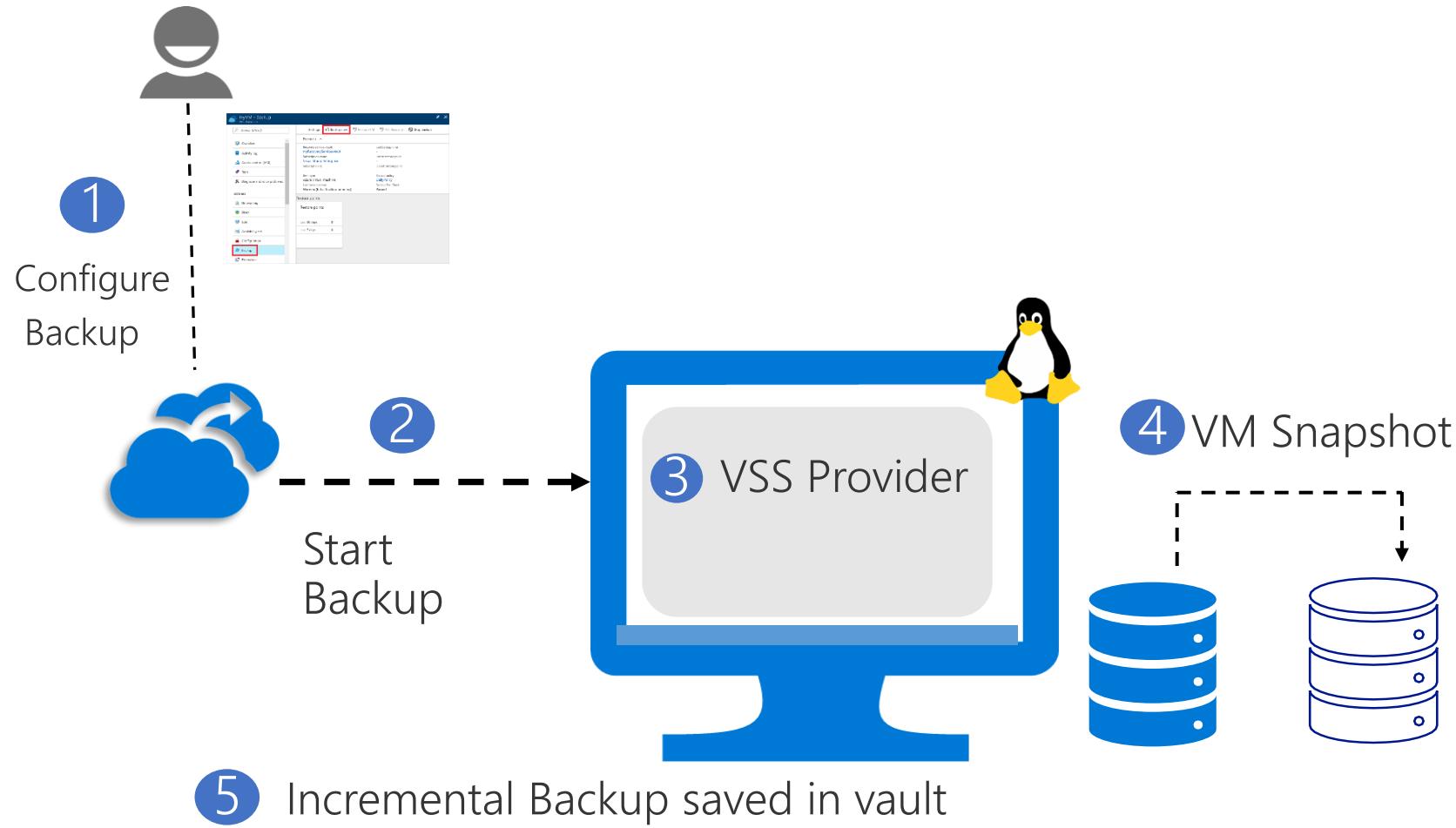
Backup with create VM

Large disk (4TB) support

Instant backup & restore

Intelligent restores for  
encrypted VMs

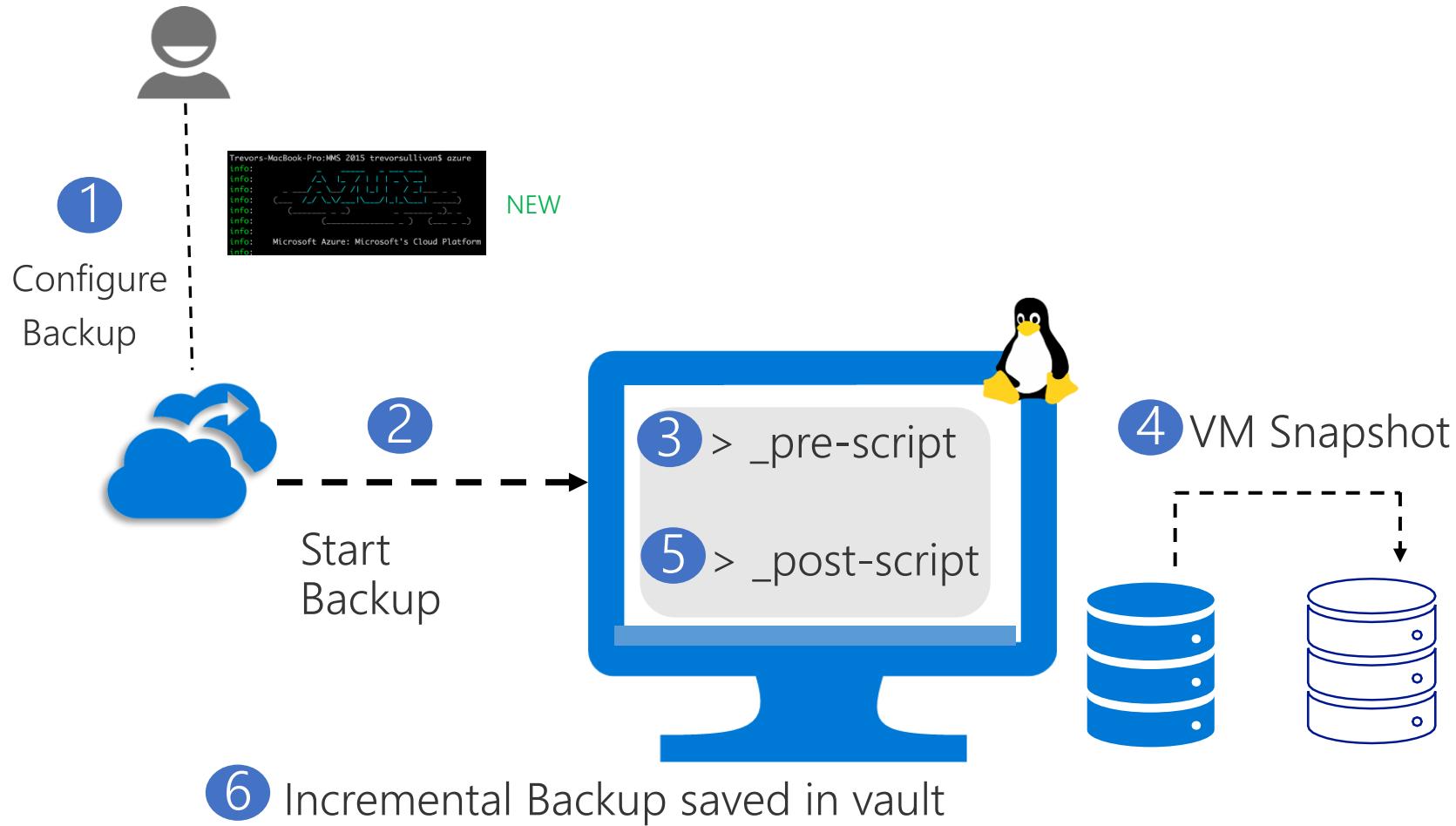
# Windows application-consistent backup



App consistent backup

Open support platform

# Linux application-consistent backup



App consistent backup

Open support platform

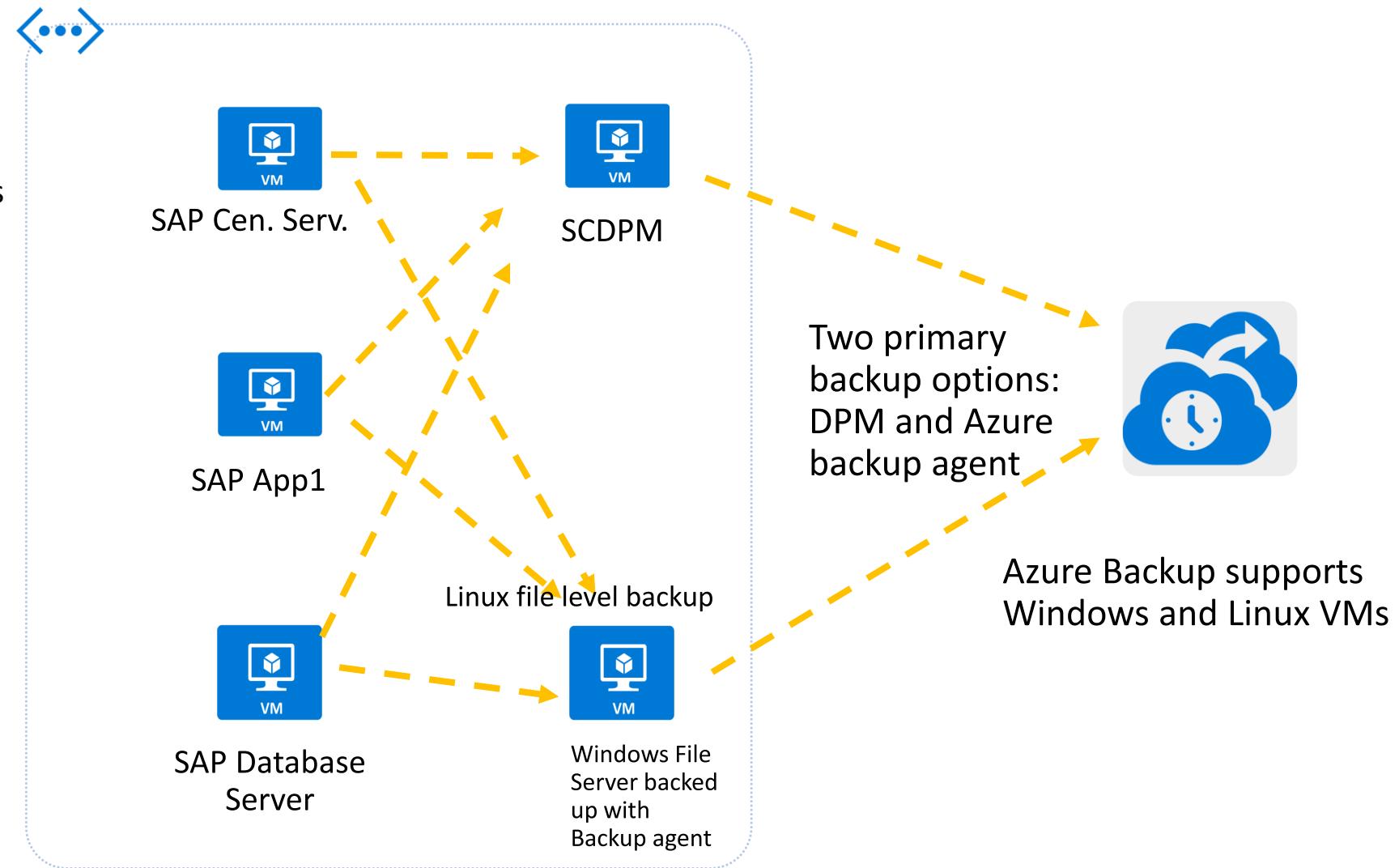
# SAP System backups: two options

## Windows Servers

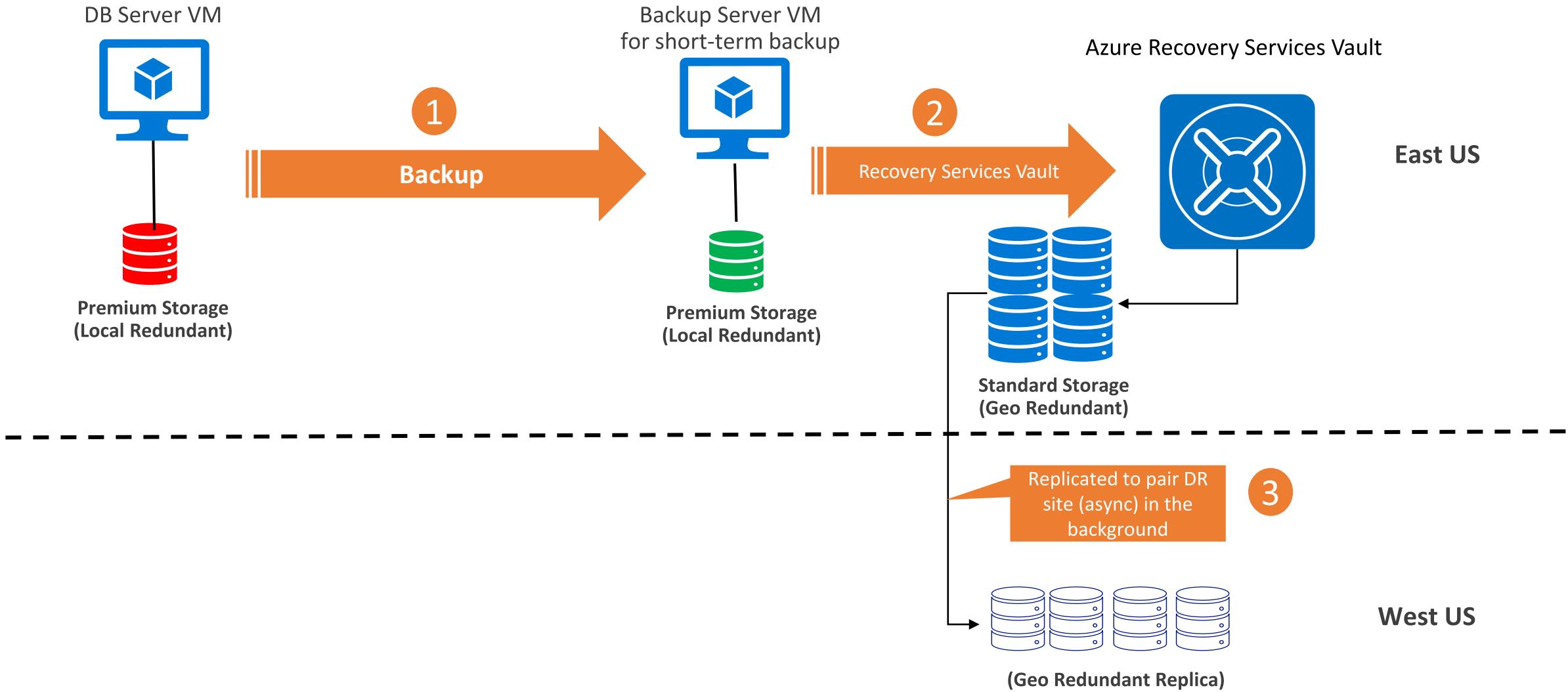
- Files/Dir level backup
- Azure Storage Blob snapshots
- Application level consistency for Windows OSes

## Linux Servers

- VM level backup
- Storage blob snapshot
- No file level backup integration yet. Need to leverage a Windows File Server which has the backup agent installed
- File level copy direct to Azure storage via open source tools
- File system level consistency for Linux OSes



# Two-step DB Backup – Premium and Geo Redundant Storage

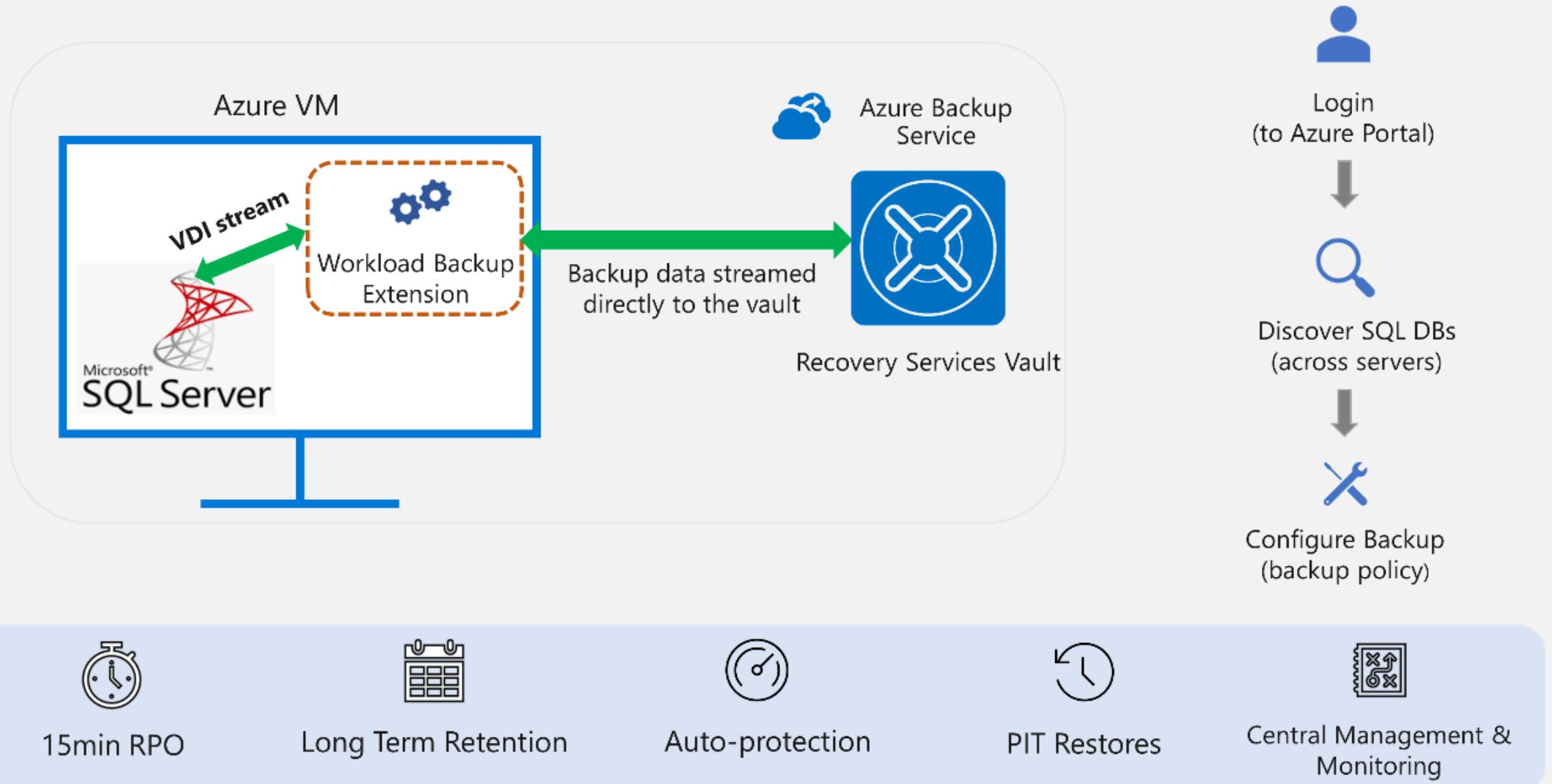


# Backups of SQL Server VM on Azure

## Backup Options for SQL Server

- **Manual Backups** – Perform conventional backups to attached Azure Disk. Good for the build process to take manual backups during a critical milestone or complex configuration task. Can be swiftly retrieved for restore.
- **Automatic Backups** – Service provided using the SQL Server IaaS Agent Extension. Can be setup via the Azure Portal by looking at the VM properties. Simplified solution to achieve automated backups.
- **3<sup>rd</sup> Party Backup Solutions** – May be the customers current preference for backups. Example Commvault.
- **Azure Backup for SQL Server VMs** – Latest service where the SQL server is backed up to Azure Recovery Service Vault. Low recovery point objective and long term retention options. Centralized solution that can be used to manage all backups and simplify monitoring and administration. SQL Always On introduces the option of using the secondary node for backups with some limitations.
- A good comprehensive guide on the different backup types and a decision matrix on which solution to use can be found [here](#).

# Backing up SQL Server running on Azure VM



# SQL Server Backup with file snapshots

- Available to users whose database files are located in Azure Storage
- Copies database using a virtual snapshot within Azure Storage
- Database data does *not* move between storage system and server instance, removing IO bottleneck
- Uses only a fraction of the space that a traditional backup would consume
- Very fast

# Note on DB2 backup recovery on Azure

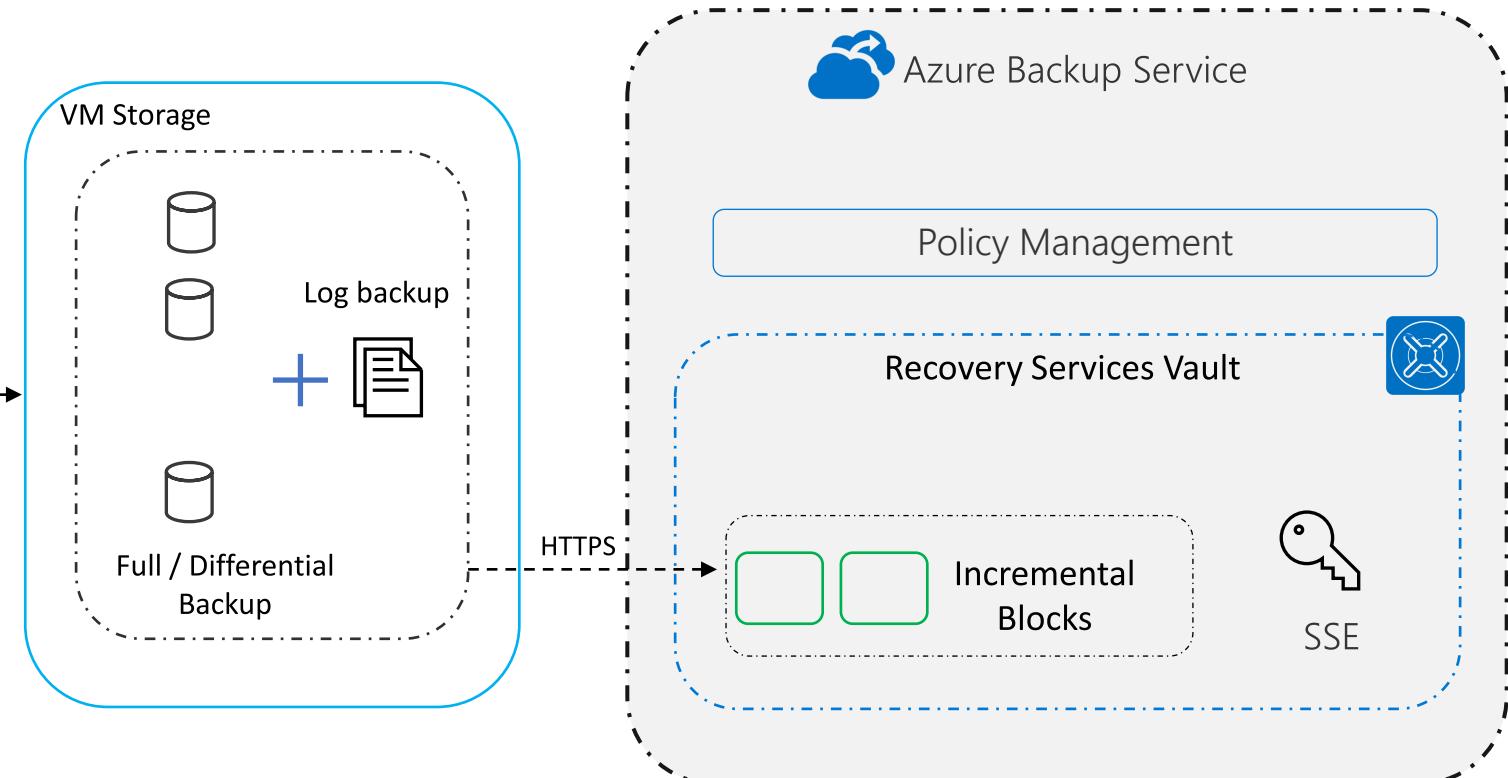
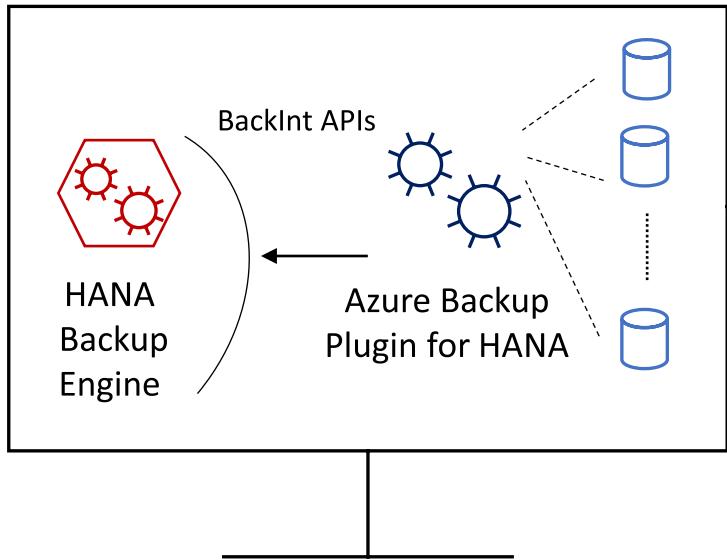
- IBM DB2 for LUW Backup supported same way as standard Windows Server/Linux Operating Systems
  - Native database backup to disks ( As discussed earlier)
  - Third party backup solutions
- Backup/restore performance depends on how many volumes can be read in parallel and volume throughput
- CPU consumption used by backup compression may play a significant role on VM
- Db2 on Windows does not support the Windows VSS technology, application consistent VM backup of Azure Backup Service cannot be leveraged.

## **Best Practices for DB2 Backups on Azure**

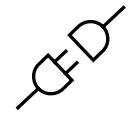
- Stripe the backup target volume over multiple disks in order to improve the IOPS throughput on that striped volume
- Using more than one target directory to write the backup
- Design solutions around the RPO/RTO requirements

# SAP HANA in Azure VM Backup

Azure VM running SAP HANA Server



No Infrastructure



Plugin-Model



Easy Restores – System  
Copy

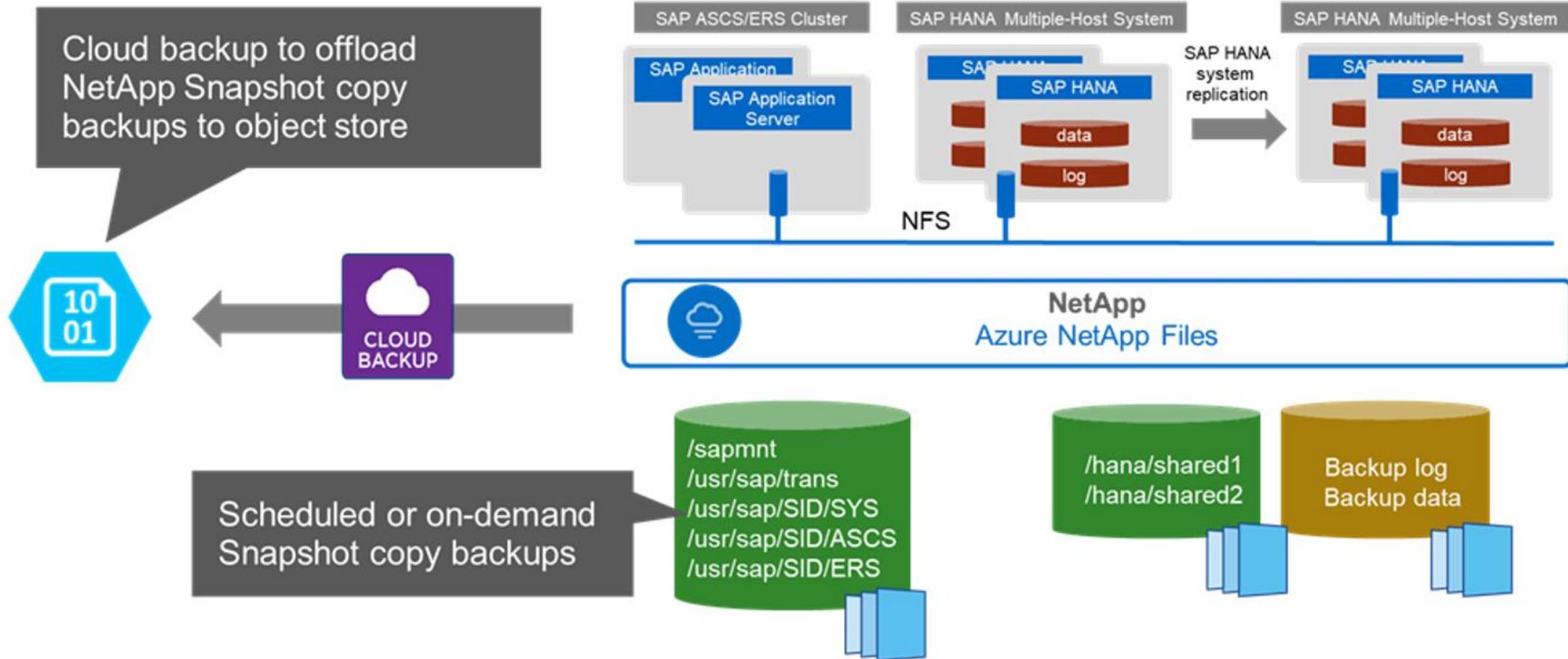


BackInt certified



Monitoring using LA

# ANF Snapshot backup (Preview)



# Azure HLI for SAP HANA Storage Snapshots

- Storage snapshot triggers SAP HANA snapshot
- Deletes SAP HANA snapshot after storage snapshot completes
- For restore, create a Microsoft Azure support request or self-service restore is also possible
- Apply transaction logs for a point in time recovery

# Azure HLI Storage Snapshots considerations

- A specific storage snapshot (at the point in time it is taken) consumes very little storage
- As data content changes and the content in SAP HANA data files change on the storage volume, the snapshot needs to store the original block content
- As such, the storage snapshot increases in size.
- The longer the snapshot is around, the larger the storage snapshot becomes
- The more changes made to the SAP HANA database volume over the lifetime of a storage snapshot, the larger the space consumption of the storage snapshot

# Azure HLI Backup & Restore

- Database & log backup
  - Do-it-yourself or use 3<sup>rd</sup> party tools
- File/dir level backups
  - Copy files to an NFS fileserver with storage backed by Azure standard or cold storage

# SAP-Certified 3rd party backup solutions (backint)



NetBackup 8.0

Legato Networker  
CloudBoost  
Data Domain Virtual Edition (DDVE)

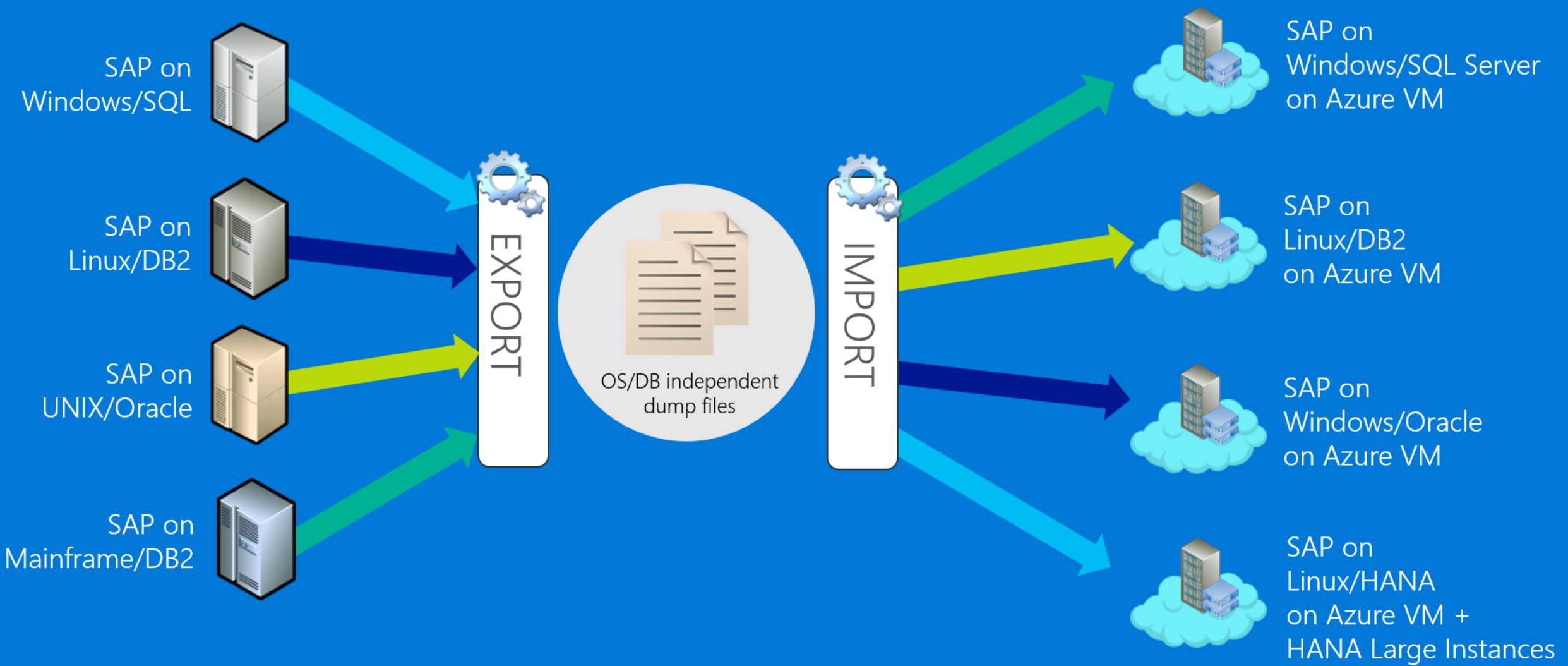
# SAP on Azure Backup Solutions Summary

|  | Standard DB backup<br>(e.g. SQL, Oracle, HANA)                 | Azure Backup Server<br>(=SCDPM on Azure)   | 3 <sup>rd</sup> party solutions (e.g.<br>Commvault, NetBackup)                      | Azure IaaS VM Backup  | HANA on Azure Large Instances<br>Storage Snapshot                                 | HANA Backup using BackInt (in Preview)  |
|--|--|--|---|---|---|---|
| Backup type                              | Database   | Network/Agent  | Network/Agent   | Snapshot  | Storage level snapshot  | Network/Agent   |
| Backup target                            | DBs within Azure VMs   | SQL Server DBs, Files and OS States<br>(Windows) within Azure VMs ( <a href="#">link</a> )   | SQL Server/Oracle/HANA, Files<br>and OS States (Windows, Linux)<br>within Azure VMs | Azure VMs (Windows, Linux) running<br>SQL Server ( <a href="#">link</a> ) | HANA database volume,<br>HANA log volume,<br>boot volume ( <a href="#">link</a> ) | HANA DBs ( <a href="#">link</a> )   |
| Linux (Guest OS) support                 | -  | No   | Yes   | Yes   | Yes   | Yes   |
| SQL Server database backup<br>capability | Transaction log (every<br>minute), differential, full          | Differential every 15 minutes and<br>full (express)  | Yes   | Up to 3 times per day   | -   | HANA database backup (log backups for<br>every 15 mins. Support for Full, differential.<br>Support for incremental coming soon). For<br>SQL backup, look here |
| Oracle database backup                   | No   | No   | Yes   | File consistent backup with RMAN  | -   | No  |
| Compression                              | Supported  | Supported<br>(storage sizing : <a href="#">link</a> )  | Supported   | None  | -   | None  |
| Backup servers running on                | DB Server  | Microsoft Azure Backup Server (on<br>VM) (installation kits downloadable<br>from Azure Portal) (VM sizing : <a href="#">link</a> ) | Backup Server (on VM)   | None (Backup as a Service)  | -   | None (Backup as a Service)  |
| Agent software required                  | No   | Agent in backup target VMs and<br>Azure Backup Agent in Azure Backup<br>Server VMs   | Yes   | No (* Only Azure VM Agent)  | No  | No (* Only Azure VM Agent)  |
| Network bandwidth required               | Yes but controllable   |  |   | None  | None  | Yes   |
| Short term retention                     | Yes (on local storage)   |  |   | None  | Yes (on local NFS storage)  | None  |
| Long term retention                      | Possible   |  |   |   | Up to 255 snapshots per volume<br>(or transfer to Blob Storage)                   | Possible  |
| Point-in-time recovery                   | Possible   |  |   |   |   |   |
| Recovery speed                           | Depend on I/O speed of underneath Blob storage or Backup Vault |  |   |   | Fast  | Depend on I/O speed of underneath Blob<br>storage or Backup Vault   |
| Monitoring/alerting console              | Database console   | Azure Backup Server Console  | Backup Server Console   | Azure Management Portal   | Script  | Azure Management Portal   |
| Reporting                                | Database console   | System Center Service Manager  | Backup Server Reporting   | None  | Script  |   |
| Licensing                                | Built-in   | Pay-per-use on Azure ( <a href="#">link</a> )  | Check vendor  | Pay-per-use on Azure ( <a href="#">link</a> )                             | Built-in  | Price model being built   |

# Agenda

1. SAP Certification for Azure (Any DB)
2. Key Design Aspects
3. Reference Architecture
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5. Migration to Azure

# Modernizing SAP platform on Microsoft Cloud OS

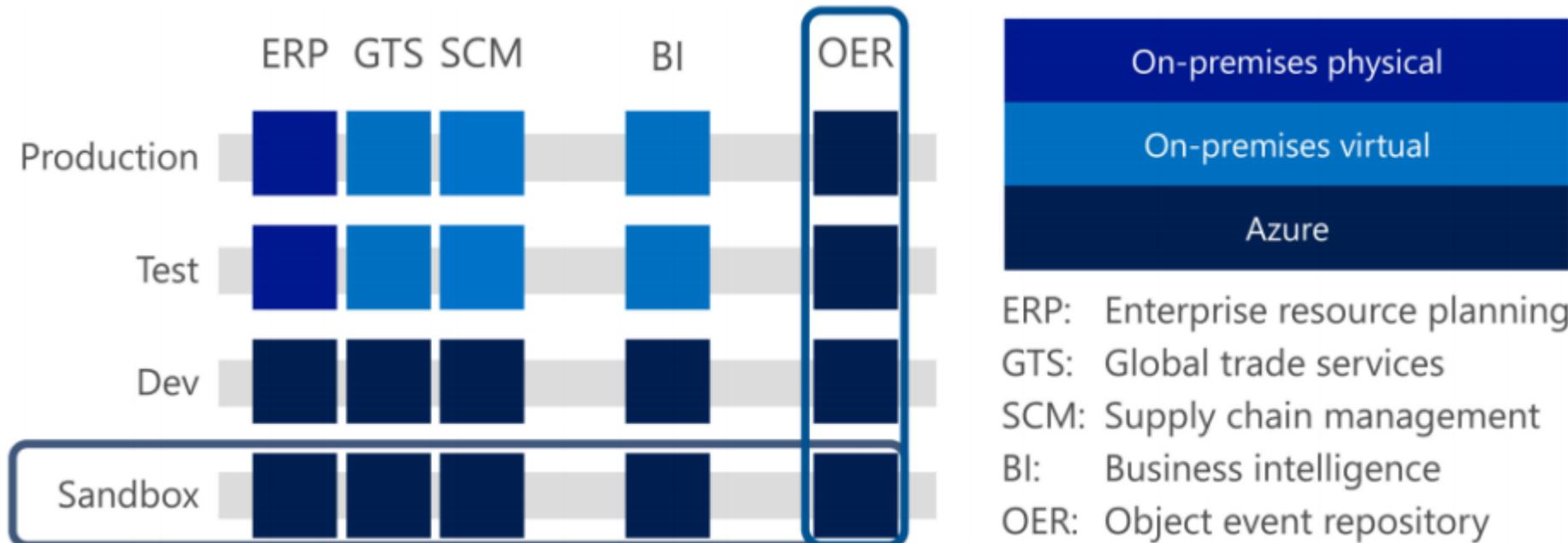


SAP Migration Requirements: SAP Note 82478

# Migration Methodology

## Horizontal vs Vertical Migration Methodology

- Horizontal Migration is moving the entire Tier starting with the non-prod tiers.
- Vertical Strategy is to move a product in all Tiers.
- Within Microsoft's own journey we took a combined strategy. Using Horizontal starting with Sandbox, but also Vertical with non-business critical systems to gain confidence in migrating to Production.



# Migration Methodology - 15 Lessons Learnt



## Assess your SAP environment:

- Prepare for migration.**  
Understand the complexity of your SAP workloads, underlying infrastructures, sizes of each workload and related databases (velocity, volume, and variety), and requirements for seasonal elasticity.
- Remove clutter.**  
While it didn't matter how much unused stuff was kept on the old, on-premises server; the cost of carrying around dead weight on the cloud adds up fast.
- Account for virtual machines.**  
Failure to allocate enough resources can result in weekly system increases.
- Determine an Azure region strategy.**  
Azure regions have global reach; verify resources are hosted in an Azure region or regions that provide the best connectivity.

# Migration Methodology - 15 Lessons Learnt



## Migrating SAP to the cloud:

- Consider a vertical strategy for moving low-risk systems to Azure.**  
Low-risk, end-to-end systems provide an opportunity to test your strategy and gain experience with a production environment in Azure.
- Benefit from building low-business impact systems in Azure.**  
When building new systems, consider building low-business impact systems in Azure from the start. This might save you money and help you learn about production environments in Azure.
- Determine which migration strategies can be best applied to your environment.**  
Understanding what to move and when to move it is essential for migrating SAP to Azure. Practical, business-friendly guidance can be found in [Strategies for migrating SAP systems to Microsoft Azure](#).
- Avoid moving systems when they're highly critical.**  
Schedule around big events like product releases, quarterly financial reporting, and projects that go live in the production environment.

# Migration Methodology - 15 Lessons Learnt



## Optimizing SAP in the cloud:

- Azure technology and available virtual machines are always advancing.**  
Achieve the best possible benefits for your business by staying up-to-date with new capabilities.
- Avoid wasting migration time on unneeded systems or data.**  
Confirm that retired systems aren't migrated, that your SAP infrastructure inventory is accurate, and that your disaster recovery plan is tested and in place.
- Design for high availability in your production systems.**  
Utilize Windows Server Failover Clustering, SQL Server Always On, and SAP features like logon groups, remote function call groups, and batch server groups
- Take advantage of the cloud.**  
Lower costs by limiting Azure usage to times when teams are out of the office on nights and weekends.

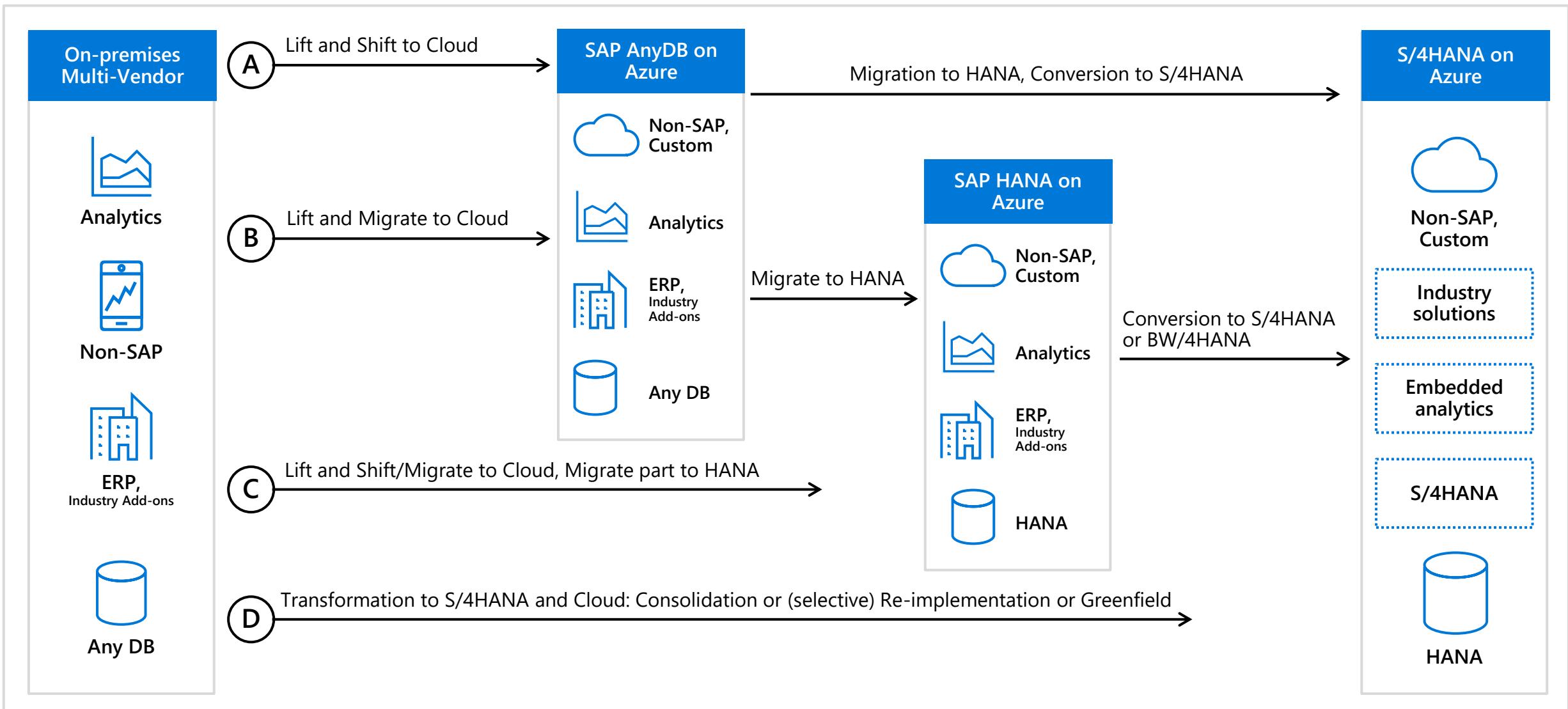
# Migration Methodology - 15 Lessons Learnt



## Securing and managing SAP in the cloud:

- Protecting business data is a top priority.**  
Consider all of the compliance and data security aspects of hosting data in the public cloud.
- Balance security needs with troubleshooting.**  
In a cluster installation, best practice is to open only the needed ports. A somewhat open environment can help with troubleshooting, but don't leave it too open.
- Plan to capture all legal requirements from the start.**  
Data safety and security can be complicated; work with the stakeholders and data owners for each application to capture all corporate and legal compliance needs.

# Journey to SAP on Azure



# SAP on Azure Migration Tools and Methodologies Overview

## Migration Tools and Methodologies:

1. **Backup, Transfer, Restore** – Commonly using Azure Storage options.
2. **Database Replication Technology** – Replicating the On Prem DB Node to the cloud
3. **SAP System Copy – Heterogeneous** - SAP Software Provisioning Manager includes tools to export/import the SAP system while changing the OS and/or DB.
4. **SAP System Copy – Homogeneous** - SAP Software Provisioning Manager includes tools to export/import the SAP system while keeping the OS/DB combination the same.
5. **SAP Database Migration Option (DMO)** – Migrate and Upgrade the solution in the same process.

**It is common for migration to use a combination of these tools and methodologies.**

# SAP on Azure Migration Tools and Methodologies

## **Backup, Transfer, Restore:**

Easiest method is to use a DB native tools such HANA Studio backup / SQL backup:

1. Perform a backup of the On-Premise source SAP system.
2. Copy backup into Azure.
3. Restore in Azure VM that runs your DBMS instance.
4. Optional: Set up log-shipping so that the changes applied in the meantime can be moved into the Azure hosted instances and applied there.
5. Stop the on-premise SAP instance. Take a last transaction log backup. Make sure the last transaction log backup gets copied to the Azure hosted instance and applied.
6. Start SAP system that you installed in Azure against the Azure hosted DBMS instance.
7. Perform post-system copy tasks.

# SAP on Azure Migration Tools and Methodologies

## **Database Replication Technology:**

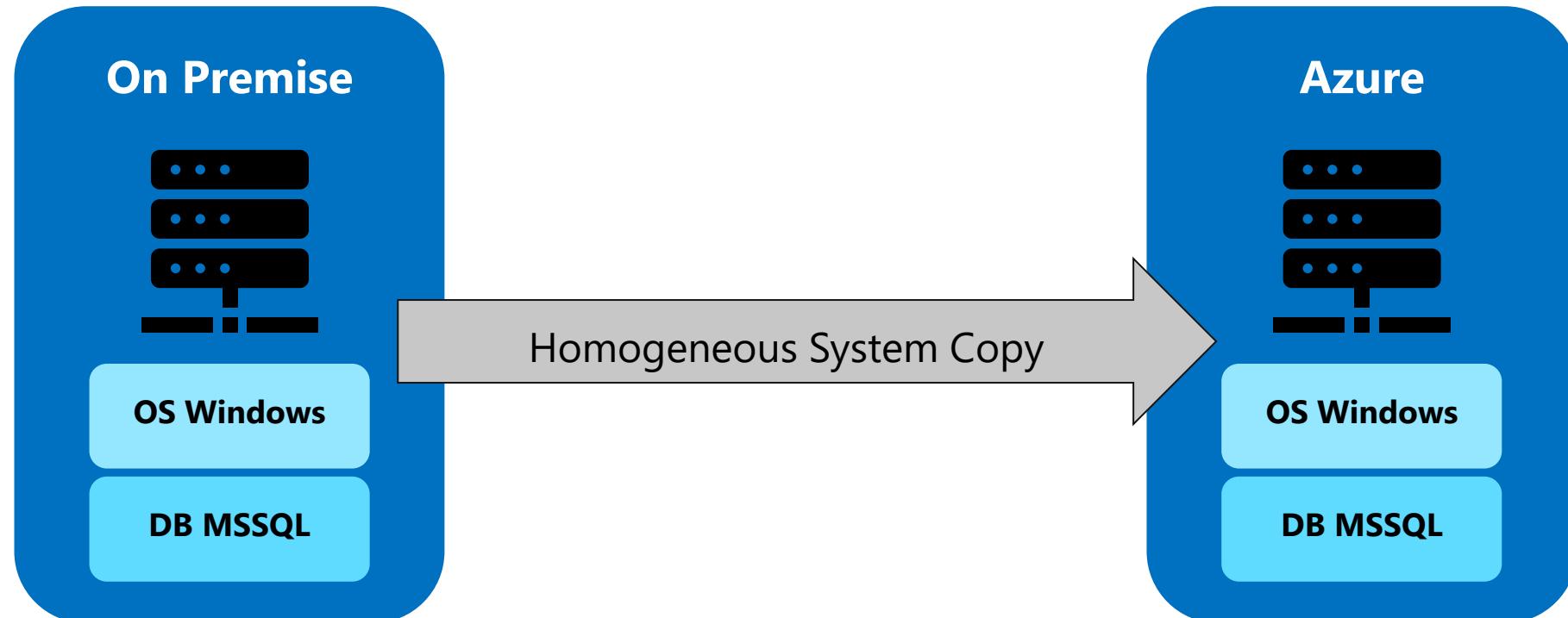
This could be HANA System Replication or SQL Server Always On:

1. Establish your connection to Azure. (Express Route / Site to Site VPN)
2. Setup the initial Sync (For large DB's recommend Backup/Restore method first)
3. Make sure the nodes are in Sync. Stop the on-premise SAP instance.
4. Either migrate the Application VM's or reinstall in Azure.
5. Start SAP system that you installed in Azure against the Azure hosted DBMS instance.
6. Perform post-system copy tasks.

# SAP on Azure Migration Tools and Methodologies

## SAP System Copy:

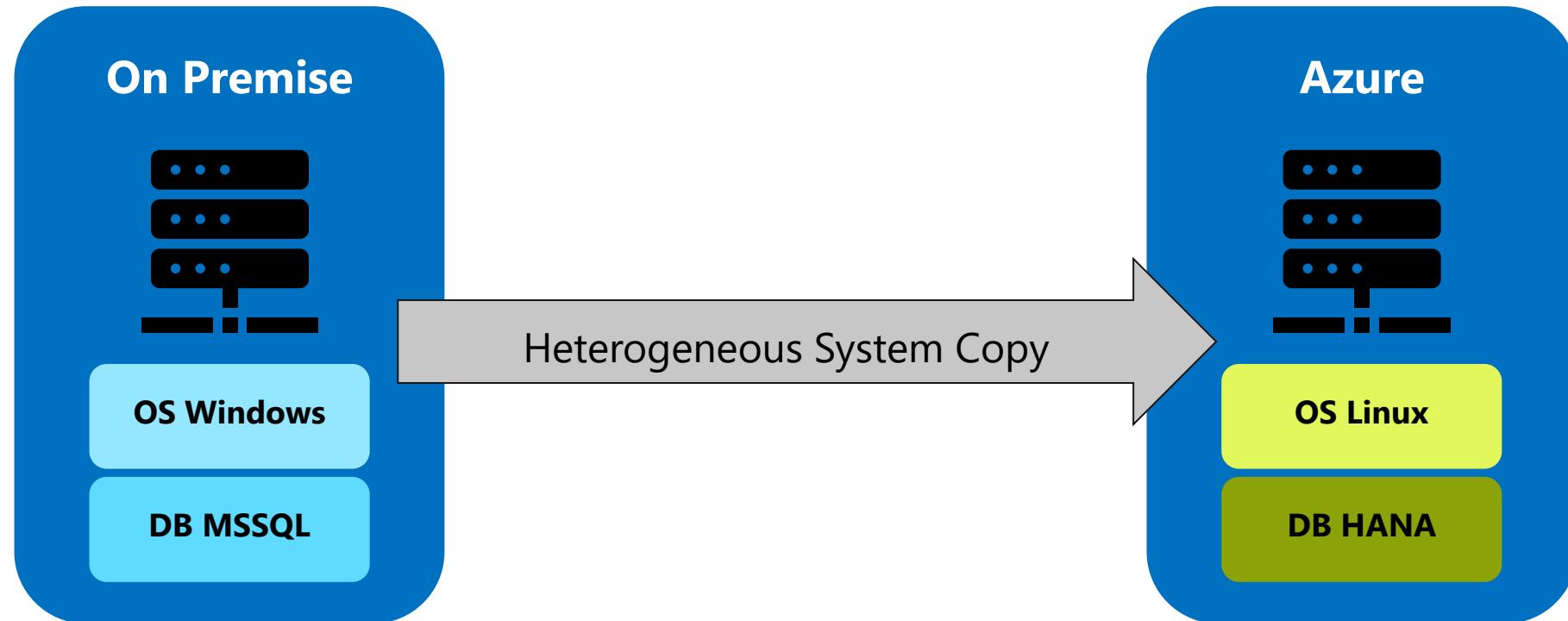
**Homogeneous System Copy** – Essentially keeping the same target OS/DB combination as what is running On-Premise. The DB is typically either flat file copied or backed up/restored into the cloud. The System Copy procedure will use SAP Software Provisioning Manager and will build the entire stack including the Application Servers, ASCS etc.



# SAP on Azure Migration Tools and Methodologies

## SAP System Copy:

**Heterogeneous System Copy** – In this example the Target OS, DB or Both will change from what is running On-Premise. The DB is exported to a bunch of OS/DB independent files and the SAP Software Provisioning Manager will import them into the new OS/DB combination on Azure.



# SAP on Azure Migration Tools and Methodologies

## **SAP Database Migration Option (DMO) :**

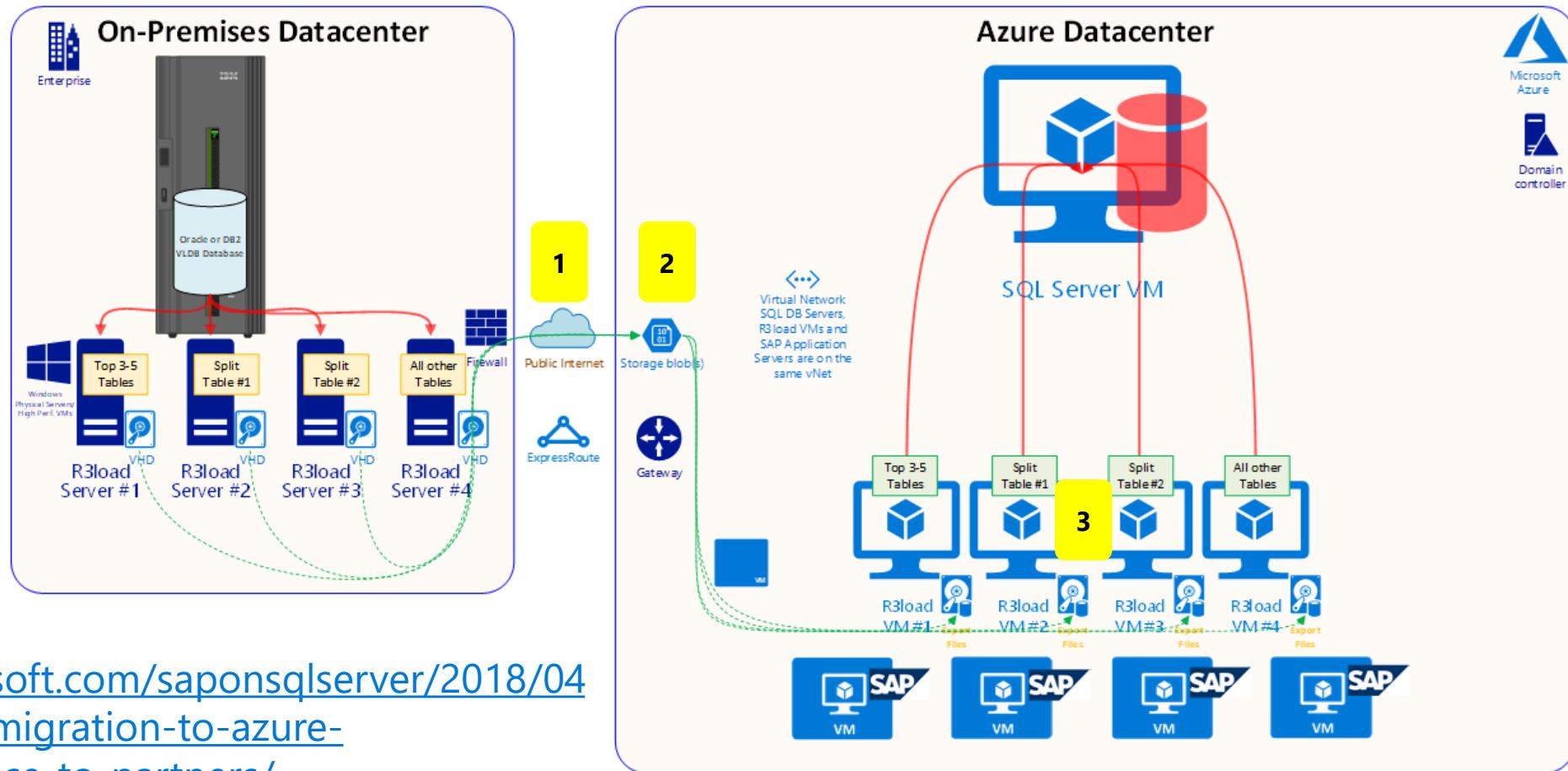
This scenario involves migrating any SAP Application from on-premises to Azure while you switch your database from AnyDB to HANA

1. Install a new SAP application server and HANA Database on Azure. This can be done through predefined Azure ARM templates.
2. Run export using the SAP Data Migration Options (DMO) system move tool for the on-premise SAP server
3. There are 2 ways of uploading the finished export files to Azure through ExpressRoute from the on premise SAPserver. One is sequential mode and the other is Parallel mode. Parallel mode is used to minimize downtime.
4. Run import using SAP DMO System Move option in Azure.
5. Run all post-migration steps for the Azure SAP App server.

# SAP on Azure Migration Tools and Methodologies

## Large DB Example:

- 1 ExpressRoute Connectivity
- 2 Blob Storage for export target.
- 3 Multiple VMs in azure to process the DB export files into the new target.



# SAP on Azure Migration Tools and Methodologies

## Important Points to consider:

1. ExpressRoute Connectivity – Ensure you have the bandwidth for the migration. Can you uplift the bandwidth for the migration? Ensure no unnecessary Network Virtual Appliances in the migration path.
2. Make sure your disk is optimized with high IOPS.
3. Ensure you have the appropriate compute to handle the load. This is especially important for when running in parallel mode. Setup extra Azure VM's temporarily for the migration.
4. Run plenty of mock runs on a copy of production to bed down the process.
5. Ensure you have SAP Router setup in the target location in advance so SAP can do post migration checks and help if any support needs are required post migration.
6. For every migration always consult the SAP System Copy Guides and related SAP notes.
7. Always use the latest versions of the SAP System Copy Tools. They update frequently.

# SAP on Azure Migration Tools and Methodologies

## Important Points to consider:

8. Certified OS/DB Migration Consultant is required.
9. SAP OS/DB Migration Check
10. At least 1 test migration of production.
11. Don't burn your source systems. Always have a fallback.

SAP Migration Requirements: SAP Note 82478

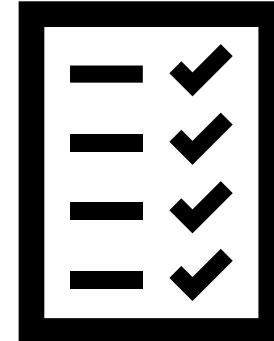
<https://launchpad.support.sap.com/#/notes/82478>

# SAP on Azure Migration Tools and Methodologies

## **Post Migration:**

Before handing over the system:

- Smoke Test the landscape.
- Catchup the Batch Jobs including Housekeeping jobs.
- Backup the system.
- Functional Test critical business processes.
- Confirm High Availability is in place.
- Check Disaster Recovery nodes are in sync.
- Confirm system and application monitoring is working.

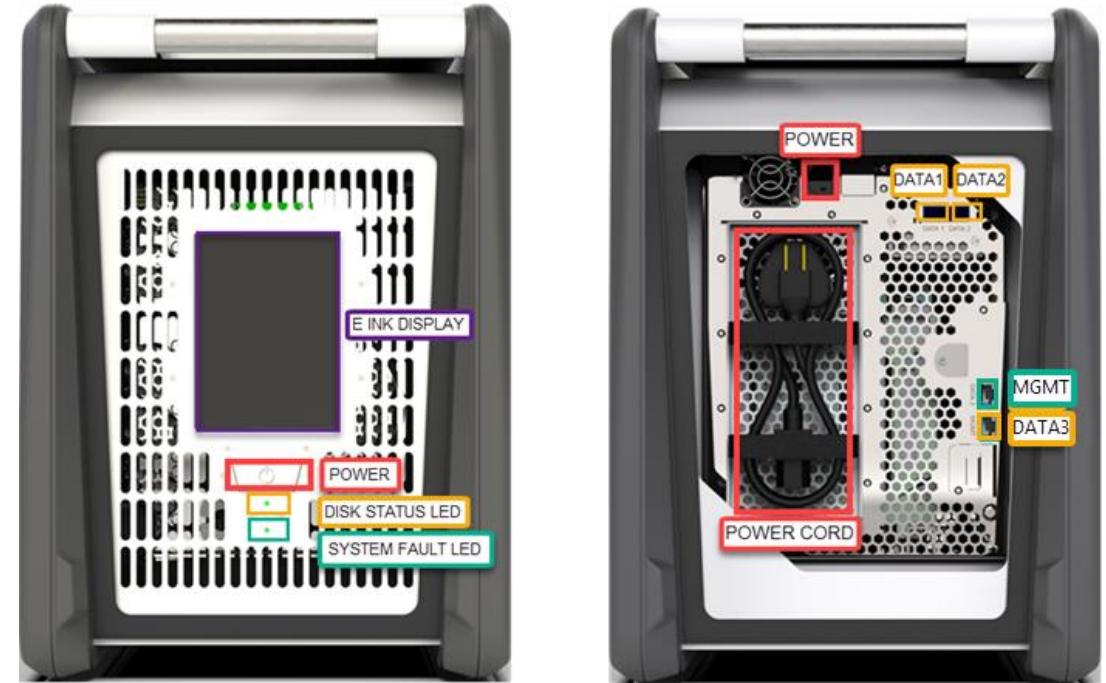


# SAP on Azure Migration Tools and Methodologies

## Azure Data Box:

Data Box is ideally suited to transfer data sizes larger than 40 TBs in scenarios with no or limited network connectivity. The data movement can be one-time, periodic, or an initial bulk data transfer followed by periodic transfers.

- 80TB Storage
- Has an Inbuilt Local UI and integrated into the Azure Portal via a Data Box Service.
- Availability - <https://azure.microsoft.com/en-us/global-infrastructure/services/?products=databox&regions=all>
- More Information - <https://docs.microsoft.com/en-us/azure/databox/data-box-overview>

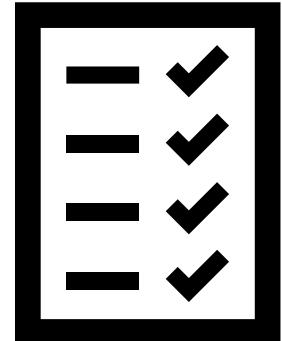


Data Box front view (left) and back view (right)

# SAP on Azure Migration Tools and Methodologies

## Resources:

- Very large database migration to azure recommendations guidance to partners -  
<https://docs.microsoft.com/en-us/archive/blogs/saponsqlserver/very-large-database-migration-to-azure-recommendations-guidance-to-partners>
- DMO Technical Procedure - <https://blogs.sap.com/2014/03/10/dmo-technical-procedure/>
- SCN FAQ System Copy and Migration –  
<https://wiki.scn.sap.com/wiki/display/SL/FAQ++System+Copy+and+Migration>
- SAP OS/DB Migration Certification –  
[https://training.sap.com/certification/c\\_tadm70\\_19-sap-certified-technology-associate---osdb-migration-for-sap-netweaver-752-g/](https://training.sap.com/certification/c_tadm70_19-sap-certified-technology-associate---osdb-migration-for-sap-netweaver-752-g/)



# Azure NetApp Files Migration Options



## Migrating from OnPrem to ANF

- If running NetApp OnPrem then using the NetApp Snap Mirror is an option.
- Alternatively you can mount the volumes over Express Route and use a replication tool (robocopy/rsync etc) that also replicates folder permissions.
- HANA System Replication also an option.
- Azure Data Box is currently not support for ANF.

## Migrating from Azure VM NFS to ANF NFS

- SAP documentation on the migration steps available here: [Link](#)
- **Migration in a nutshell:**
  - Create ANF Account, Capacity Pool and Volumes
  - Mount to your servers
  - Stop SAP
  - Copy data from old NFS to ANF
  - Drop NFS Mounts and alter ANF Mounts to use the same file UNC.
  - Start SAP
  - Test!

## Let's Kahoot it now...

Step 1 - Open your mobile phone and go to <https://kahoot.it/>

Step 2 - Enter the Code and Join to answer questions

Step 3 - Win the Race

# Agenda

1. SAP Compute and Storage for HANA
2. Reference Architecture (HANA)
3. SAP HANA High Availability and Disaster Recovery
4. HANA deployment options
5. HANA Backup
6. HANA on Azure Large Instances Onboarding

# SAP HANA on Azure

## Workloads:

SAP BW on SAP HANA, SAP Business Suite on HANA, BW/4HANA and S/4HANA

### Virtualized: production SAP BW and S/4HANA workloads

Microsoft offers SAP-certified SAP HANA capabilities on VM's in the Azure public cloud. (Non-production workloads can be run on other SAP-certified Azure VM types).



Optimized for  
Database  
Workloads



Optimized for  
Database  
Workloads

### Large Instances: for production and non-production workloads

Microsoft offers certified SAP HANA capabilities via purpose-built hardware specifically tuned for SAP HANA.

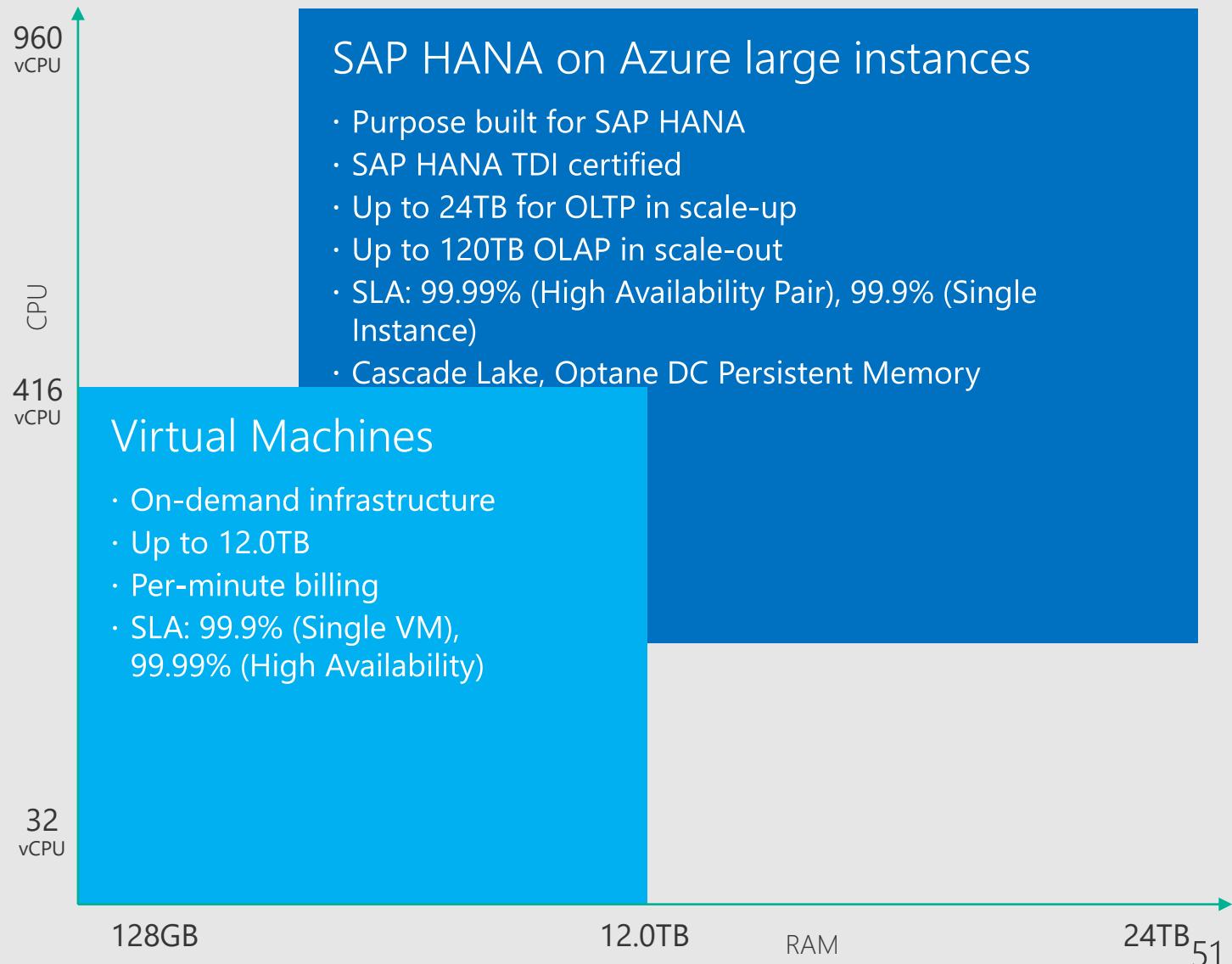
- SAP HANA instance runs in a non-virtualized environment on SAP HANA TDI certified hardware in an Azure-certified data center.
- SAP HANA is connected to the SAP application tier running on Azure VMs.
  - The two environments are connected via Azure ExpressRoute.



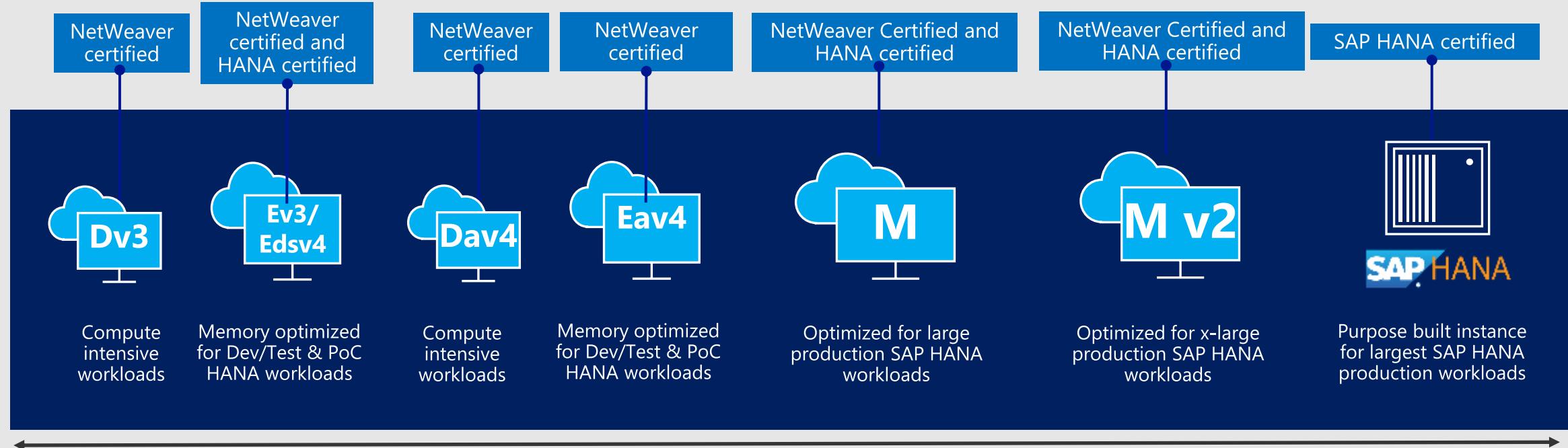
Optimized for  
large  
SAP HANA  
workloads

# Most powerful & scalable cloud for SAP HANA

A combination of VMs and purpose-built server instances provides the largest scale and widest range for SAP HANA of any hyperscale cloud



# SAP on Azure— Large Variety on Compute Instances



|           | 2 – 64  | 2 – 64   | 2 – 64  | 2 – 96   | 32 - 128        | 208 - 416          | 96 - 768         |
|-----------|---------|----------|---------|----------|-----------------|--------------------|------------------|
| vCPUs     | 2 – 64  | 2 – 64   | 2 – 64  | 2 – 96   | 32 - 128        | 208 - 416          | 96 - 768         |
| RAM (GiB) | 8 - 256 | 16 - 504 | 8 - 256 | 16 - 672 | 192 – 3,892 GiB | 2,918 – 11,673 GiB | 768 – 24,576 GiB |
| Max SAPS  | 69,680  | 100,500  | 96,700  | 96,700   | 134,630         | 488,230            | 786,100          |

# M-Series Virtual Machines

## Massive memory, CPU, storage, and scale

- Hyper-Threaded support
- Premium, Ultra and ANF Storage as well as Write Accelerator support
- SAP Certified for both HANA and AnyDB

| VM size | vCPU | Memory: GiB        | SAPS    | Max cached IOPS | Max cached storage throughput (GiB) | Network Bandwidth | HANA Workload |
|---------|------|--------------------|---------|-----------------|-------------------------------------|-------------------|---------------|
| M32ts   | 32   | 192                | 33,670  | 40,000          | 400                                 | 8 Gbps            | OLTP          |
| M32ls   | 32   | 256                | 33,300  | 40,000          | 400                                 | 8 Gbps            | OLTP          |
| M64ls   | 64   | 512                | 66,600  | 80,000          | 800                                 | 16 Gbps           | OLTP          |
| M64s    | 64   | 1,024              | 67,315  | 80,000          | 800                                 | 16 Gbps           | OLAP and OLTP |
| M64ms   | 64   | 1,792              | 68,930  | 80,000          | 800                                 | 16 Gbps           | OLTP          |
| M128s   | 128  | 2,048              | 134,630 | 160,000         | 1,600                               | 25 Gbps           | OLAP and OLTP |
| M128ms  | 128  | 3,800 (= 4,080 GB) | 134,630 | 160,000         | 1,600                               | 25 Gbps           | OLTP          |
| M208s   | 208  | 3,133              | 259,950 | 80,000          | 800                                 | 16 Gbps           | OLAP and OLTP |
| M208ms  | 208  | 6,267              | 259,950 | 80,000          | 800                                 | 16 Gbps           | OLAP and OLTP |
| M416s   | 416  | 6,267              | 488,230 | 250,000         | 1,600                               | 32 Gbps           | OLAP and OLTP |
| M416ms  | 416  | 12,534             | 488,230 | 250,000         | 1,600                               | 32 Gbps           | OLAP and OLTP |

# What is SAP HANA on Azure Large Instances ?

SAP TDI certified  
HANA hardware  
infrastructure  
with 99.99% SLA  
in Azure

Ultimate scalability  
to run SAP HANA  
OLTP up to 24TB  
OLAP up to 120TB

Built-in storage capabilities –  
storage snapshot,  
DR replication and volume  
encryption

Built-in backend 10Gbps  
network  
with full integrations with  
Azure IaaS

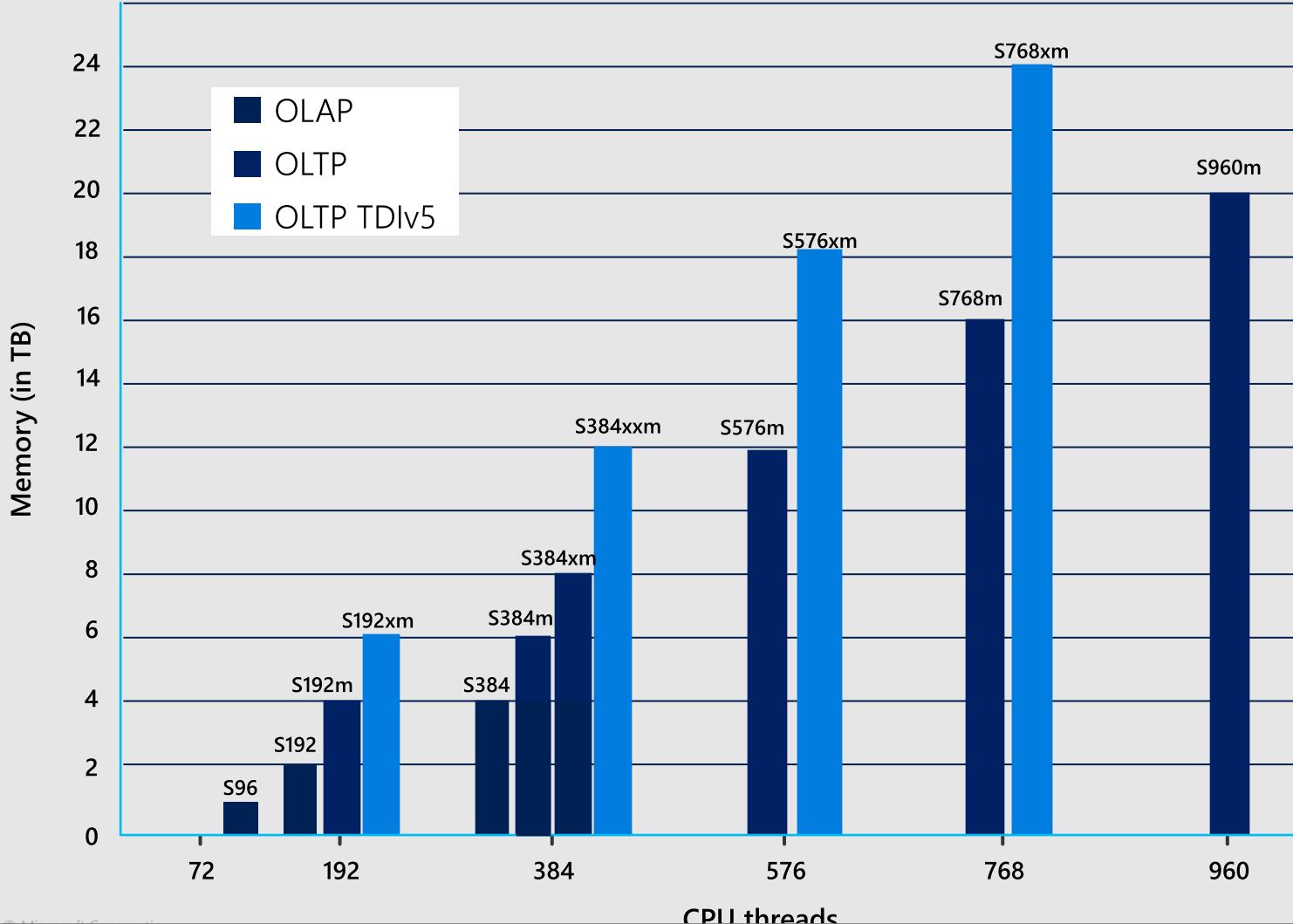
| SKU #    |  | # CPU threads | RAM (GiB) | NFS Storage (GiB)<br>(persistent) | Supported HANA<br>scenarios |
|----------|--|---------------|-----------|-----------------------------------|-----------------------------|
| SR72     | S72: 2 x Intel® Xeon® Processor E7-8890 v3     | 72            | 768       | 3,072                             | OLAP/OLTP                   |
| SR72m    | S72m: 2 x Intel® Xeon® Processor E7-8890 v3    | 72            | 1,536     | 6,144                             | OLTP                        |
| SR96     | S96: 2 x Intel® Xeon® Processor E7-8890 v4     | 96            | 768       | 3,072                             | OLAP/OLTP                   |
| SR192    | S192: 4 x Intel® Xeon® Processor E7-8890 v4    | 192           | 2,048     | 8,192                             | OLAP/OLTP                   |
| SR192m   | S192m: 4 x Intel® Xeon® Processor E7-8890 v4   | 192           | 4,096     | 18,432                            | OLTP                        |
| SR192xm  | S192xm: 4 x Intel® Xeon® Processor E7-8890 v4  | 192           | 6,144     | 16,384                            | OLTP TDI v5                 |
| SR384    | S384: 8 x Intel® Xeon® Processor E7-8890 v4    | 384           | 4,096     | 16,384                            | OLAP/OLTP                   |
| SR384m   | S384m: 8 x Intel® Xeon® Processor E7-8890 v4   | 384           | 6,144     | 18,432                            | OLTP                        |
| SR384xm  | S384xm: 8 x Intel® Xeon® Processor E7-8890 v4  | 384           | 8,192     | 22,528                            | OLTP                        |
| SR384xxm | S384xxm: 8 x Intel® Xeon® Processor E7-8890 v4 | 384           | 12,288    | 28,672                            | OLTP TDI v5                 |
| SR576m   | S576m: 12 x Intel® Xeon® Processor E7-8890 v4  | 576           | 12,288    | 28,672                            | OLTP                        |
| SR768m   | S768m: 16 x Intel® Xeon® Processor E7-8890 v4  | 768           | 16,384    | 36,864                            | OLTP                        |
| SR576xm  | S576xm: 12 x Intel® Xeon® Processor E7-8890 v4 | 576           | 18,432    | 41,984                            | OLTP TDI v5                 |
| SR960m   | S960m: 20 x Intel® Xeon® Processor E7-8890 v4  | 960           | 20,480    | 47,104                            | OLTP                        |
| SR768xm  | S768xm: 16 x Intel® Xeon® Processor E7-8890 v4 | 768           | 24,576    | 57,344                            | OLTP TDI v5                 |

# What is HLI?

- Purpose-built infrastructure
- SAP certified Tailored Data Integration (TDI)
- Not a VM
- To run SAP HANA
- Reserve for 1 or 3 years
- 99.99% SLA (High Availability)
- Single node supports up to 24TB for OLTP, and 60TB OLAP in scale-out mode (120TB(TDIv5))



# Purpose-built infrastructure—SAP HANA Large Instances



## Rev 3 Instances

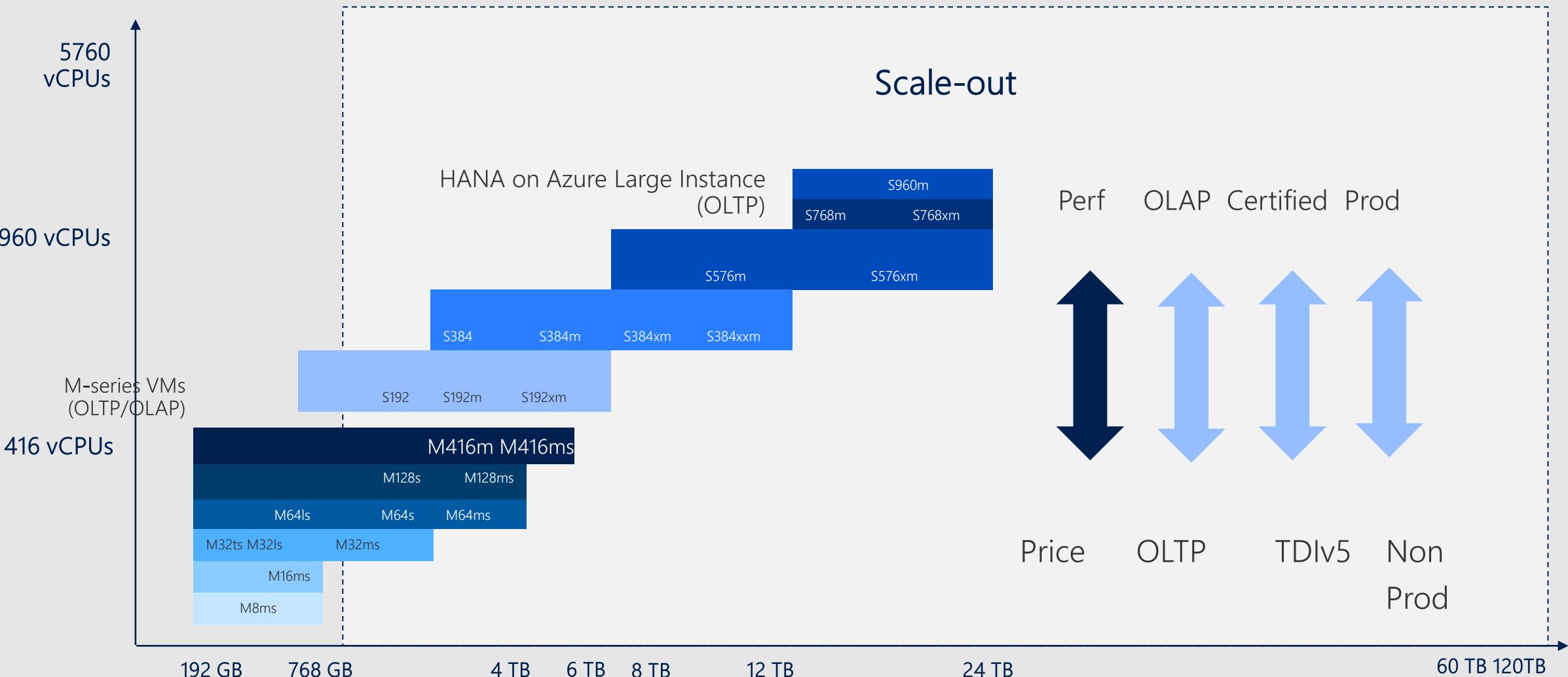
- SAP HANA TDI configuration
- Persistent NFS storage
- Scale-up to 20 TB in TDIv4, 24 TB in TDIv5
- Scale-out to 60 TB in TDIv4, 120 TB in TDIv5
- Snapshot based backups in seconds
- Available in U.S., E.U., AU and JP
- 99.99% SLA for HA Pair and 99.9% SLA for a single node

## Rev 4 Instances

- Launched Intel Xeon Scalable Gen 2 (Cascade Lake)
- 350 microsecond network latency between DB instance and App server VM



# Scale Trade-Offs : Right Size, Right Prize, StepUp/Resize



# SAP HANA on Azure Large Instances (Compute + Storage)

SAP TDI certified  
HANA hardware  
infrastructure  
with 99.99% SLA  
in Azure

Ultimate scalability  
to run SAP HANA  
OLTP up to 24TB  
OLAP up to 120TB

Built-in storage capabilities –  
storage snapshot,  
DR replication and volume  
encryption

Built-in backend 10Gbps  
network  
with full integrations with  
Azure IaaS

| SKU #   |  | # CPU threads | RAM (GiB) | NFS Storage (GiB)<br>(persistent) | Supported HANA<br>scenarios |
|---------|--|---------------|-----------|-----------------------------------|-----------------------------|
| S96     | S96: 2 x Intel® Xeon® Processor E7-8890 v4     | 96            | 768       | 3,072                             | OLTP / OLAP                 |
| S192    | S192: 4 x Intel® Xeon® Processor E7-8890 v4    | 192           | 2,048     | 8,192                             | OLTP / OLAP                 |
| S192m   | S192m: 4 x Intel® Xeon® Processor E7-8890 v4   | 192           | 4,096     | 16,384                            | OLTP                        |
| S192xm  | S192xm: 4 x Intel® Xeon® Processor E7-8890 v4  | 192           | 6,144     | 16,384                            | OLTP TDI v5                 |
| S384    | S384: 8 x Intel® Xeon® Processor E7-8890 v4    | 384           | 4,096     | 16,384                            | OLTP / OLAP                 |
| S384m   | S384m: 8 x Intel® Xeon® Processor E7-8890 v4   | 384           | 6,144     | 18,432                            | OLTP                        |
| S384xm  | S384xm: 8 x Intel® Xeon® Processor E7-8890 v4  | 384           | 8,192     | 22,528                            | OLTP / OLAP TDI v5          |
| S384xxm | S384xxm: 8 x Intel® Xeon® Processor E7-8890 v4 | 384           | 12,288    | 28,672                            | OLTP TDI v5                 |
| S576m   | S576m: 12 x Intel® Xeon® Processor E7-8890 v4  | 576           | 12,288    | 28,672                            | OLTP                        |
| S768m   | S768m: 16 x Intel® Xeon® Processor E7-8890 v4  | 768           | 16,384    | 36,864                            | OLTP                        |
| S576xm  | S576xm: 12 x Intel® Xeon® Processor E7-8890 v4 | 576           | 18,432    | 41,984                            | OLTP TDI v5                 |
| S960m   | S960m: 20 x Intel® Xeon® Processor E7-8890 v4  | 960           | 20,480    | 47,104                            | OLTP                        |
| S768xm  | S768xm: 16 x Intel® Xeon® Processor E7-8890 v4 | 768           | 24,576    | 57,344                            | OLTP TDI v5                 |

# HANA Large Instance Improvements- Rev 4

- Network Improvements – Latencies as low as 0.3ms
  - Cutting distance
  - Reducing hops
- Optimized for Next gen Large Instances
  - 40 gig backplane,
  - Next gen all-flash storage
  - Separate Bulk data path
- Unified Disk Snapshots, Storage DR Replication and Archiving
  - Ease of installation, setup and monitoring
  - Integrated with Snapvault and Catalog
  - Self service restore from snapshot, Vault or DR replicated copy
  - Support for multi tenant
- Global Reach enabled
  - HSR replication to any DR site
  - On Prem to HLI
  - Migration
- Azure Portal Experience
- Zones – in US by Q3CY2019
  - For customers who want to HA within region
  - Or want to protect against DC wide disaster without having to failover surrounding apps
- LI Type 2 Improvements
  - OS snapshots
  - OS hdw based encryption

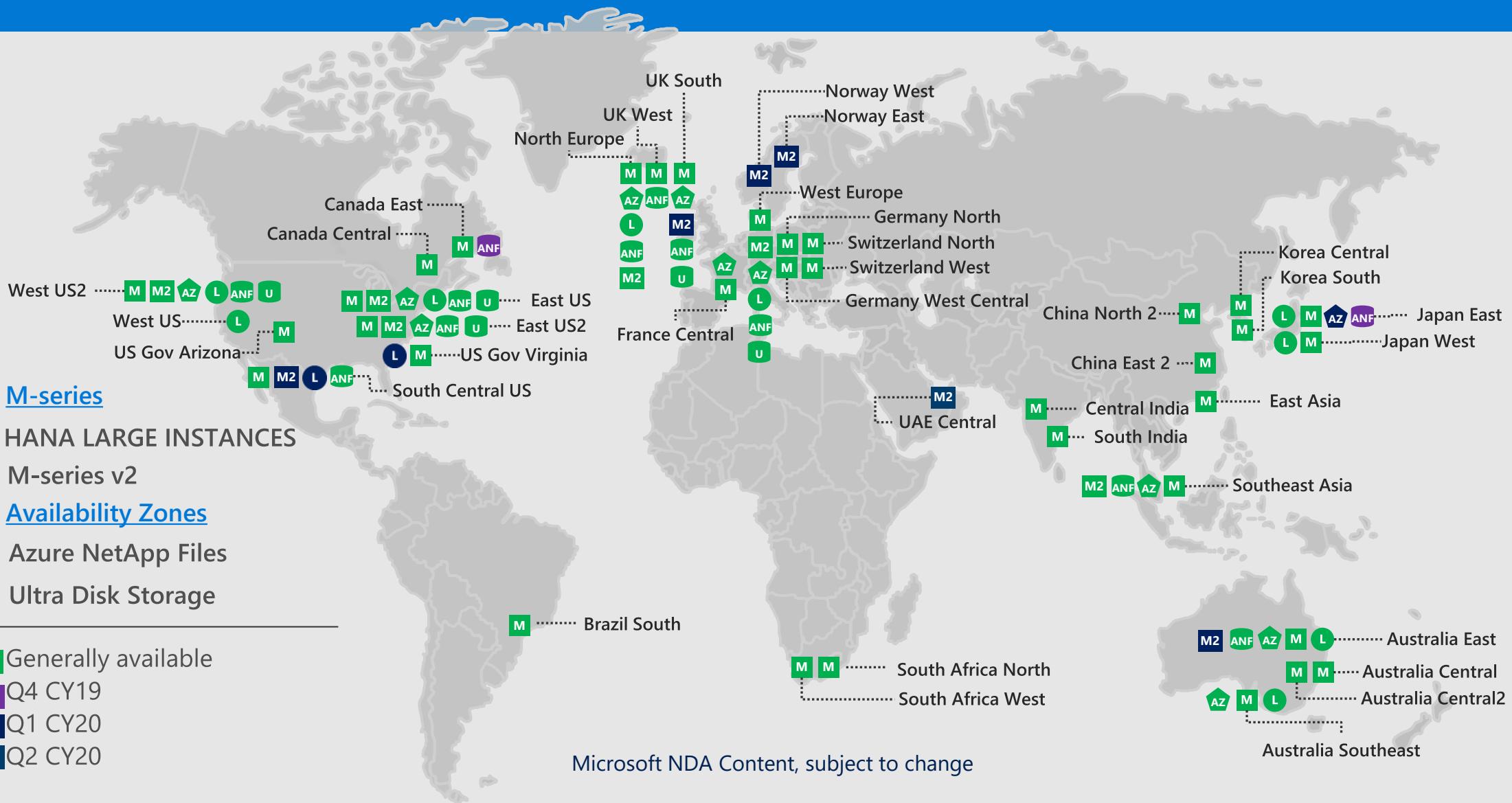


# HANA Large Instance - Latest SKUs

| SKU     | Total memory (TB) | DDR4 memory | Intel Optane persistent memory (TB) | SAP HANA certification                                   |
|---------|-------------------|-------------|-------------------------------------|--|
| S224    | 3                 | 3           | -                                   | OLTP, OLAP scale-up and scale-out up to 16 nodes         |
| S224oo  | 4.5               | 1.5         | 3                                   | Planned: OLAP and OLTP; Customer workload specific TDlv5 |
| S224m   | 6                 | 6           | -                                   | OLTP   |
| S224m   | 6                 | 6           | -                                   | Planned: OLAP; Customer workload specific TDlv5          |
| S224om  | 6                 | 3           | 3                                   | Planned: OLAP and OLTP; Customer workload specific TDlv5 |
| S224ooo | 7.5               | 1.5         | 6                                   | Planned: OLAP and OLTP; Customer workload specific TDlv5 |
| S224oom | 9                 | 3           | 6                                   | Planned: OLAP and OLTP; Customer workload specific TDlv5 |

- High performance
- SAP TDIV5
- In some cases, can eliminate the need for high availability (HA) configurations
- Save cost
- Reduce complexity

# SAP on Azure Roadmap



# SAP on Azure Certifications

- Azure VM Backup support for HANA (Backint) - [Public Preview](#), GA H2 CY19
- Availability Zones support - Supported (10 regions)
- Ultra SSD -> ES64 v3, Certified
- Proximity Placement Group (PPG) – Public Preview
- M v2 “CXL-Series” (Cascade Lake, replacing M v1) – Q2 CY20
- Certification for M Series VM to place HANA DB files with scale up on ANF (NFS v4.1) - GA
- Certification for M Series VM to place HANA DB files with scale out (N + M) on ANF (NFS v4.1) - GA

# SAP on Azure Certifications

- Cascade Lake-based HLI SKUs (4-socket, All DIMM) - Announced
- Cascade Lake-based HLI SKUs (4-socket, DIMM + AEP/Optane) – Announced

# SAP on Azure Certifications (HANA)

| Category | Scenario | SAP Product   | Guest OS      | Database | VM/Server Type   |
|----------|----------|---|---------------|----------|--|
| SAP HANA | OLAP     | SAP Business Warehouse (BW); BW/4HANA, HANA Enterprise, HANA Side Car | SUSE, Red Hat | SAP HANA | GS5, HANA on Azure (Large Instances), E_v3, M                              |
|          | OLTP     | S/4HANA   | SUSE, Red Hat | SAP HANA | GS5 (** Controlled Availability), HANA on Azure (Large Instances), E_v3, M |
|          | OLTP     | SAP Business Suite on HANA, SAP NetWeaver                             | SUSE, Red Hat | SAP HANA | HANA on Azure (Large Instances), E_v3, M                                   |
|          | OLTP     | SAP Business One on HANA  | SUSE, Red Hat | SAP HANA | DS14_v2, E_v3, M   |
|          | -        | SAP HANA One  | SUSE, Red Hat | SAP HANA | DS14_v2  |

<https://www.sap.com/dmc/exp/2014-09-02-hana-hardware/enEN/iaas.html#categories=Microsoft%20Azure>

# Azure Premium Storage



- Consistent low latency SSD with predictable throughput
- For high-performance IO-intensive DB workloads
- Single digit ms latencies
- Supports up to 32 TB blob/disk size
- Stripe up to 64 disks for a total of 256 TB
- Pay for what you provision
- Check Azure VMs for maximum IOPS

| Premium Storage Disk Type | P4      | P6      | P10      | P15      | P20      | P30            | P40            | P50            | P60            | P70              | P80              |
|---------------------------|---------|---------|----------|----------|----------|----------------|----------------|----------------|----------------|------------------|------------------|
| Disk size                 | 32 GB   | 64 GB   | 128 GB   | 256 GB   | 512 GB   | 1024 GB (1 TB) | 2048 GB (2 TB) | 4096 GB (4 TB) | 8192 GB (8 TB) | 16384 GB (16 TB) | 32768 GB (32 TB) |
| IOPS per disk             | 120     | 240     | 500      | 1100     | 2,300    | 5,000          | 7,500          | 7,500          | 12,500         | 15,000           | 20,000           |
| Throughput per disk       | 25 MB/s | 50 MB/s | 100 MB/s | 125 MB/s | 150 MB/s | 200 MB/s       | 250 MB/s       | 250 MB/s       | 480 MB/s       | 750 MB/s         | 750 MB/s         |

Stripe Premium SSD Managed Disks on Database VM to Aggregate Throughput (important for HANA/HWCCT), IOPS and Storage Capacity

Standard Storage can be used for APP/ASCS when used in conjunction with Availability Set/Standard Managed Disks

# Ultra SSD (\*) KPIs



- Sub millisecond latency
- Dynamically tune disk performance without need to restart VM
- Stripe up to 64 disks for a total of 64 TiB
- Pay for what you provision – based on disk size, IOPS and throughput
- Check Azure VMs for maximum IOPS

| Ultra SSD Disk Type | 4         | 8         | 16         | 32         | 64         | 128        | 256        | 512         | 1024-65,536       |
|---------------------|-----------|-----------|------------|------------|------------|------------|------------|-------------|-------------------|
| Disk size           | 4 GiB     | 8 GiB     | 16 GiB     | 32 GiB     | 64 GiB     | 128 GiB    | 256 GiB    | 512 GiB     | 1024 - 65,536 GiB |
| IOPS per disk       | 100-1,200 | 100-2,400 | 100-4,800  | 100-9,600  | 100-19,200 | 100-38,400 | 100-76,800 | 100-153,600 | 100-160,000       |
| Throughput per disk | 300 MB/s  | 600 MB/s  | 1,200 MB/s | 2,000 MB/s  | 2,000 MB/s        |

Stripe Ultra SSD Managed Disks on Database VM to Aggregate Throughput (important for HANA/HWCCT), IOPS and Storage Capacity

# High Level Guidance choosing the right Storage for SAP

| Block storage             |              |               |             |            |              | NFS Storage        |
|---------------------------|--------------|---------------|-------------|------------|--------------|--------------------|
|                           | Standard HDD | Standard SSD  | Premium SSD | Ultra Disk | NetApp Files |                    |
| Suitable for OS           | No           | Non-Prod Only | Yes         | Yes        | Yes          | SAP HANA certified |
| Global Trans Dir          | No           | No            | Yes         | Yes        | Yes          |                    |
| SAPMNT                    | No           | Non-Prod Only | Yes         | Yes        | Yes          |                    |
| HANA DBMS Data Volume     | No           | No            | Yes         | Yes        | Yes          |                    |
| HANA DBMS Log Volume      | No           | No            | Yes         | Yes        | Yes          |                    |
| Non-HANA DBMS Data Volume | No           | Non-Prod Only | Yes         | Yes        | Yes          |                    |
| Non-HANA DBMS Log Volume  | No           | Non-Prod Only | Yes         | Yes        | Yes          |                    |

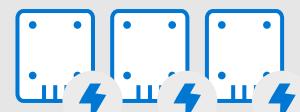
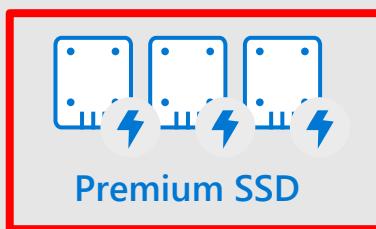
For more details: <https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/planning-guide-storage>

# Premium Storage Guidance

Architecting in the cloud uses the same methodology as On-Premise.

Use these recommendations as a baseline. Always try to validate your IOPS and Throughput requirements and adjust accordingly.

<https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/hana-vm-operations-storage>



Ultra SSD



NetApp Files

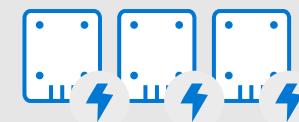
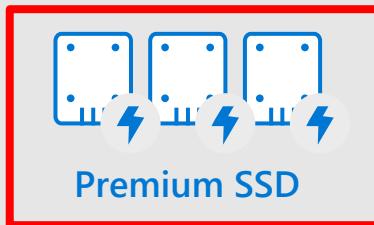
Enable Write Accelerator

| VM SKU    | RAM       | Max. VM I/O Throughput |           |              | /hana/shared | /root volume | /usr/sap | hana/backup |
|-----------|-----------|------------------------|-----------|--------------|--------------|--------------|----------|-------------|
|           |           | /hana/data             | /hana/log | /hana/shared |              |              |          |             |
| M32ts     | 192 GiB   | 500 MB/s               | 3 x P20   | 2 x P20      | 1 x P20      | 1 x P6       | 1 x P6   | 1 x P20     |
| M32ls     | 256 GiB   | 500 MB/s               | 3 x P20   | 2 x P20      | 1 x P20      | 1 x P6       | 1 x P6   | 1 x P20     |
| M64ls     | 512 GiB   | 1000 MB/s              | 3 x P20   | 2 x P20      | 1 x P20      | 1 x P6       | 1 x P6   | 1 x P30     |
| M64s      | 1000 GiB  | 1000 MB/s              | 4 x P20   | 2 x P20      | 1 x P30      | 1 x P6       | 1 x P6   | 2 x P30     |
| M64ms     | 1750 GiB  | 1000 MB/s              | 3 x P30   | 2 x P20      | 1 x P30      | 1 x P6       | 1 x P6   | 3 x P30     |
| M128s     | 2000 GiB  | 2000 MB/s              | 3 x P30   | 2 x P20      | 1 x P30      | 1 x P10      | 1 x P6   | 2 x P40     |
| M128ms    | 3800 GiB  | 2000 MB/s              | 5 x P30   | 2 x P20      | 1 x P30      | 1 x P10      | 1 x P6   | 4 x P40     |
| M208s_v2  | 2850 GiB  | 1000 MB/s              | 4 x P30   | 2 x P20      | 1 x P30      | 1 x P10      | 1 x P6   | 3 x P40     |
| M208ms_v2 | 5700 GiB  | 1000 MB/s              | 4 x P40   | 2 x P20      | 1 x P30      | 1 x P10      | 1 x P6   | 3 x P50     |
| M416s_v2  | 5700 GiB  | 2000 MB/s              | 4 x P40   | 2 x P20      | 1 x P30      | 1 x P10      | 1 x P6   | 3 x P50     |
| M416ms_v2 | 11400 GiB | 2000 MB/s              | 8 x P40   | 2 x P20      | 1 x P30      | 1 x P10      | 1 x P6   | 4 x P50     |

# Cost conscious solution with Azure premium storage

We also offer cost conscious solutions where the administration and complexity is higher but the storage costs are lower.

<https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/hana-vm-operations-storage>



Ultra SSD



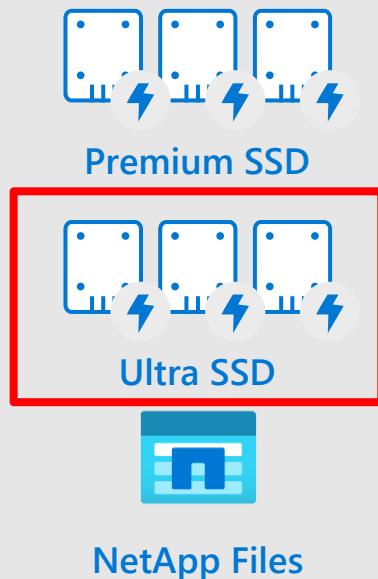
NetApp Files

| VM SKU    | RAM       | Max. VM I/O Throughput | /hana/data and /hana/log striped with LVM or MDADM | /hana/shared | /root volume | /usr/sap | comments   |
|-----------|-----------|------------------------|--|--------------|--------------|----------|--|
| M64ms     | 1,750 GiB | 1,000 MB/s             | 6 x P20  | 1 x E30      | 1 x E6       | 1 x E6   | Using Write Accelerator for combined data and log volume will limit IOPS rate to 10,000 <sup>2</sup> |
| M128s     | 2,000 GiB | 2,000 MB/s             | 6 x P20  | 1 x E30      | 1 x E10      | 1 x E6   | Using Write Accelerator for combined data and log volume will limit IOPS rate to 20,000 <sup>2</sup> |
| M208s_v2  | 2,850 GiB | 1,000 MB/s             | 4 x P30  | 1 x E30      | 1 x E10      | 1 x E6   | Using Write Accelerator for combined data and log volume will limit IOPS rate to 10,000 <sup>2</sup> |
| M128ms    | 3,800 GiB | 2,000 MB/s             | 5 x P30  | 1 x E30      | 1 x E10      | 1 x E6   | Using Write Accelerator for combined data and log volume will limit IOPS rate to 20,000 <sup>2</sup> |
| M208ms_v2 | 5,700 GiB | 1,000 MB/s             | 4 x P40  | 1 x E30      | 1 x E10      | 1 x E6   | Using Write Accelerator for combined data and log volume will limit IOPS rate to 10,000 <sup>2</sup> |
| M416s_v2  | 5,700 GiB | 2,000 MB/s             | 4 x P40  | 1 x E30      | 1 x E10      | 1 x E6   | Using Write Accelerator for combined data and log volume will limit IOPS rate to 20,000 <sup>2</sup> |
| M416ms_v2 | 11400 GiB | 2,000 MB/s             | 7 x P40  | 1 x E30      | 1 x E10      | 1 x E6   | Using Write Accelerator for combined data and log volume will limit IOPS rate to 20,000 <sup>2</sup> |

# Ultra Disk Guidance

Similar to Premium Storage we also offer Ultra Disk Guidance, but always confirm your customers requirements against these recommendations.

<https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/hana-vm-operations-storage>

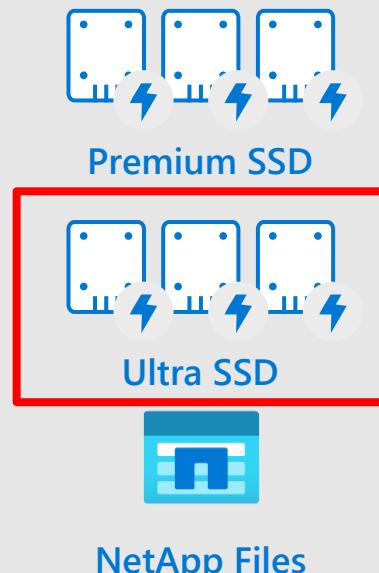


| VM SKU    | RAM        | Max. VM I/O Throughput | /hana/data volume | /hana/data I/O throughput | /hana/data IOPS | /hana/log volume | /hana/log I/O throughput | /hana/log IOPS |
|-----------|------------|------------------------|-------------------|---------------------------|-----------------|------------------|--------------------------|----------------|
| M32ts     | 192 GiB    | 500 MB/s               | 250 GB            | 400 MBps                  | 2,500           | 96 GB            | 250 MBps                 | 1,800          |
| M32ls     | 256 GiB    | 500 MB/s               | 300 GB            | 400 MBps                  | 2,500           | 256 GB           | 250 MBps                 | 1,800          |
| M64ls     | 512 GiB    | 1,000 MB/s             | 620 GB            | 400 MBps                  | 3,500           | 256 GB           | 250 MBps                 | 1,800          |
| M64s      | 1,000 GiB  | 1,000 MB/s             | 1,200 GB          | 600 MBps                  | 5,000           | 512 GB           | 250 MBps                 | 2,500          |
| M64ms     | 1,750 GiB  | 1,000 MB/s             | 2,100 GB          | 600 MBps                  | 5,000           | 512 GB           | 250 MBps                 | 2,500          |
| M128s     | 2,000 GiB  | 2,000 MB/s             | 2,400 GB          | 750 MBps                  | 7,000           | 512 GB           | 250 MBps                 | 2,500          |
| M128ms    | 3,800 GiB  | 2,000 MB/s             | 4,800 GB          | 750 MBps                  | 9,600           | 512 GB           | 250 MBps                 | 2,500          |
| M208s_v2  | 2,850 GiB  | 1,000 MB/s             | 3,500 GB          | 750 MBps                  | 7,000           | 512 GB           | 250 MBps                 | 2,500          |
| M208ms_v2 | 5,700 GiB  | 1,000 MB/s             | 7,200 GB          | 750 MBps                  | 14,400          | 512 GB           | 250 MBps                 | 2,500          |
| M416s_v2  | 5,700 GiB  | 2,000 MB/s             | 7,200 GB          | 1,000 MBps                | 14,400          | 512 GB           | 400 MBps                 | 4,000          |
| M416ms_v2 | 11,400 GiB | 2,000 MB/s             | 14,400 GB         | 1,500 MBps                | 28,800          | 512 GB           | 400 MBps                 | 4,000          |

# Azure Netapp Files Disk Guidance

ANF IOPS and Throughput statistics are based on Sizing. The bigger the disk the faster the performance. The below table gives you a starting guide but again always confirm your requirements.

<https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/hana-vm-operations-storage>



| Volume                 | Size<br>Premium Storage tier              | Size<br>Ultra Storage tier                | Supported NFS protocol |
|------------------------|---|---|------------------------|
| /hana/log/             | 4 TiB                                     | 2 TiB                                     | v4.1                   |
| /hana/data             | 6.3 TiB                                   | 3.2 TiB                                   | v4.1                   |
| /hana/shared scale-up  | Min(1 TB, 1 x RAM)                        | Min(1 TB, 1 x RAM)                        | v3 or v4.1             |
| /hana/shared scale-out | 1 x RAM of worker node per 4 worker nodes | 1 x RAM of worker node per 4 worker nodes | v3 or v4.1             |
| /hana/logbackup        | 3 x RAM                                   | 3 x RAM                                   | v3 or v4.1             |
| /hana/backup           | 2 x RAM                                   | 2 x RAM                                   | v3 or v4.1             |

# HANA Scale Out with Azure NetApp Files

This is a good diagram to demonstrate how the storage is configured for HANA Scale Out.

3 VM's are architected in this example.

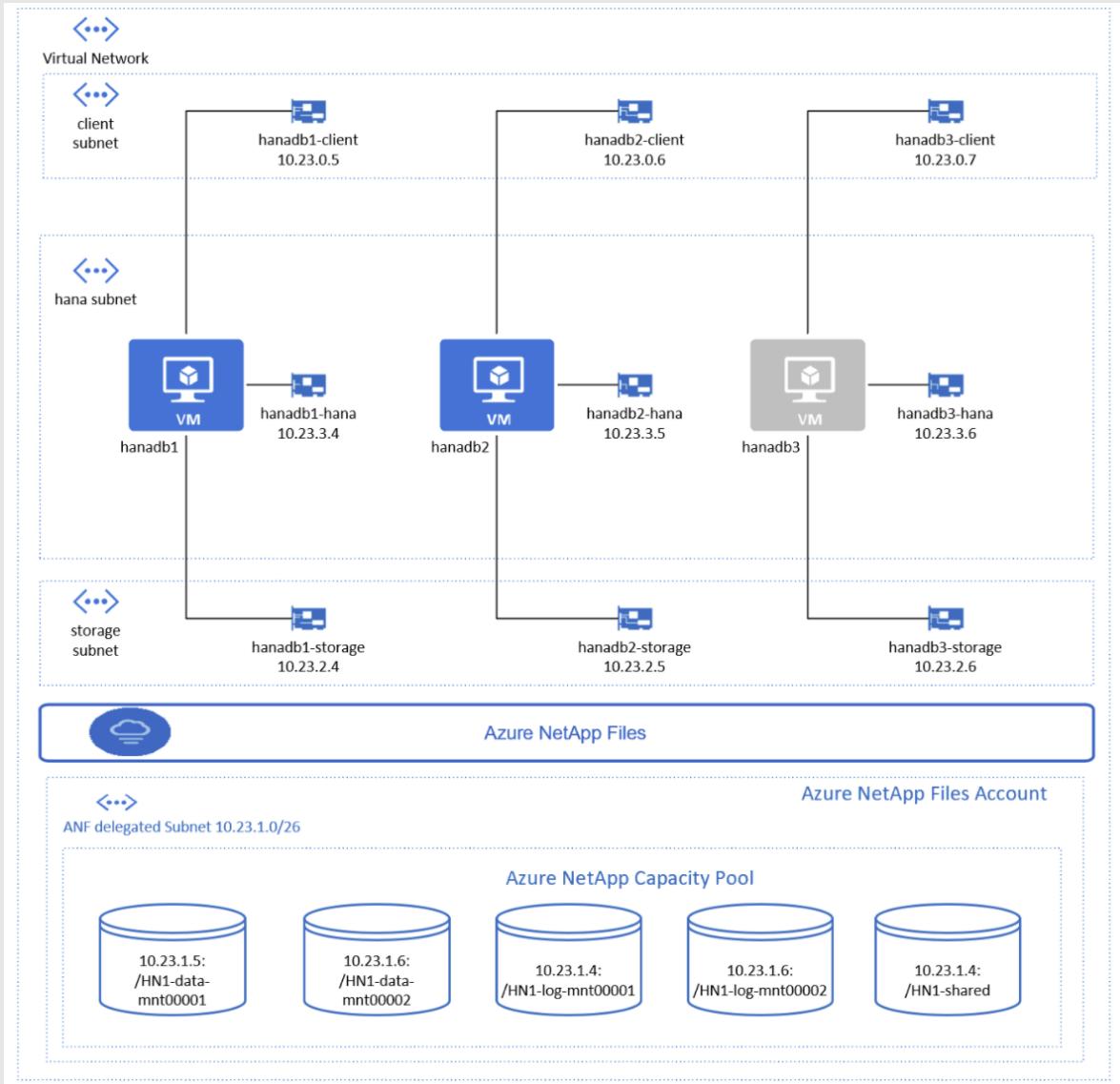
Master, Worker and Standby Node.

Note that NetApp Files must be used for Scale Out configurations that include a Standby Node.

<https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/sap-hana-scale-out-standby-netapp-files-suse>



NetApp Files



# Agenda

1. SAP Certification for Azure (HANA)
2. Reference Architecture (HANA)
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4. HANA deployment options
5. HANA Backup
6. HANA on Azure Large Instances Onboarding

# HANA on Azure Characteristics

- 
- 1 Highly responsive with low DB/network latency
  - 2 In-memory Database Performance
  - 3 High Availability & Disaster Recovery
  - 4 Enterprise Data Protection & Security
  - 5 Safe Migration with Downtime Minimized
  - 6 Taking advantage of HANA applications

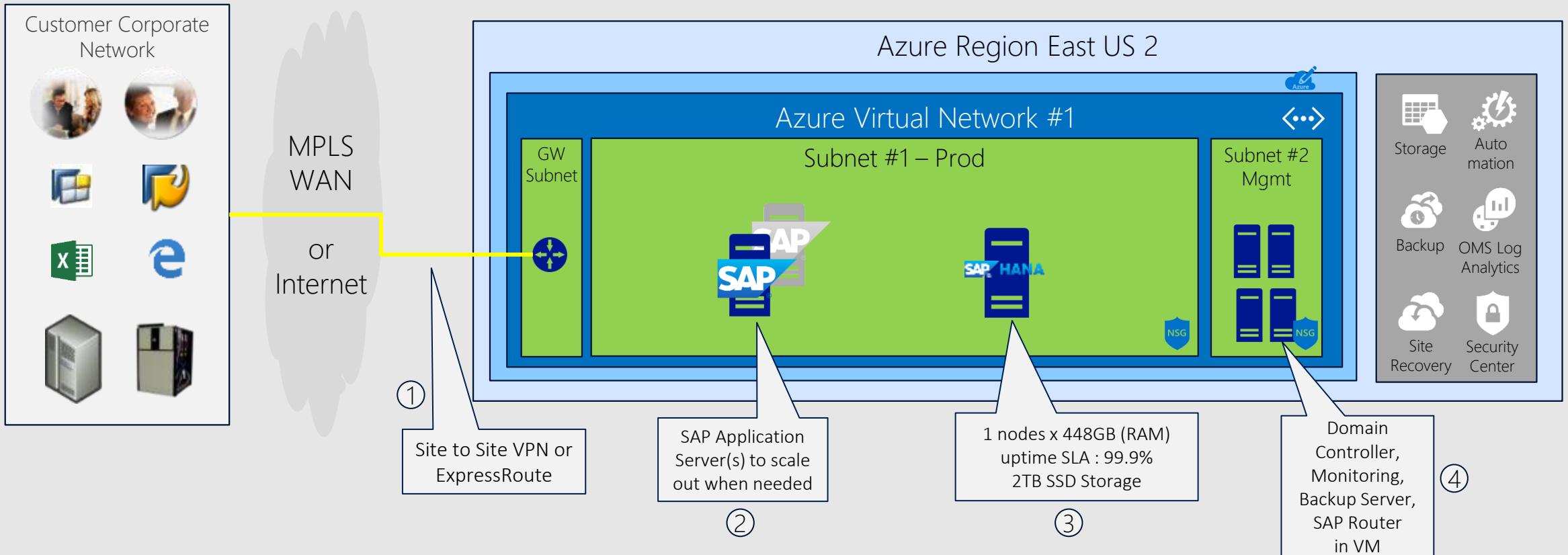
# SAP HANA on Azure Reference Architecture

| # | DB                |   |                      |
|---|-------------------|---|----------------------|
| 1 | HANA DB Scale Up  | S/4HANA, BW on HANA, HANA Enterprise, Side Car                | Single VM            |
| 2 | HANA DB Scale Up  | S/4HANA, BW on HANA, HANA Enterprise, Side Car, Suite on HANA | Single blade         |
| 3 | HANA DB Scale Up  | S/4HANA, BW on HANA, HANA Enterprise, Side Car                | VM with HA           |
| 4 | HANA DB Scale Up  | S/4HANA, BW on HANA, HANA Enterprise, Side Car, Suite on HANA | Blade with HA        |
| 5 | HANA DB Scale Up  | S/4HANA, BW on HANA, HANA Enterprise, Side Car                | VM with HA/DR        |
| 6 | HANA DB Scale Up  | S/4HANA, BW on HANA, HANA Enterprise, Side Car, Suite on HANA | Blade with HA/DR     |
| 7 | HANA DB Scale Out | BW on HANA, HANA Enterprise                                   | Scale out with HA    |
| 8 | HANA DB Scale Out | BW on HANA, HANA Enterprise                                   | Scale out with HA/DR |

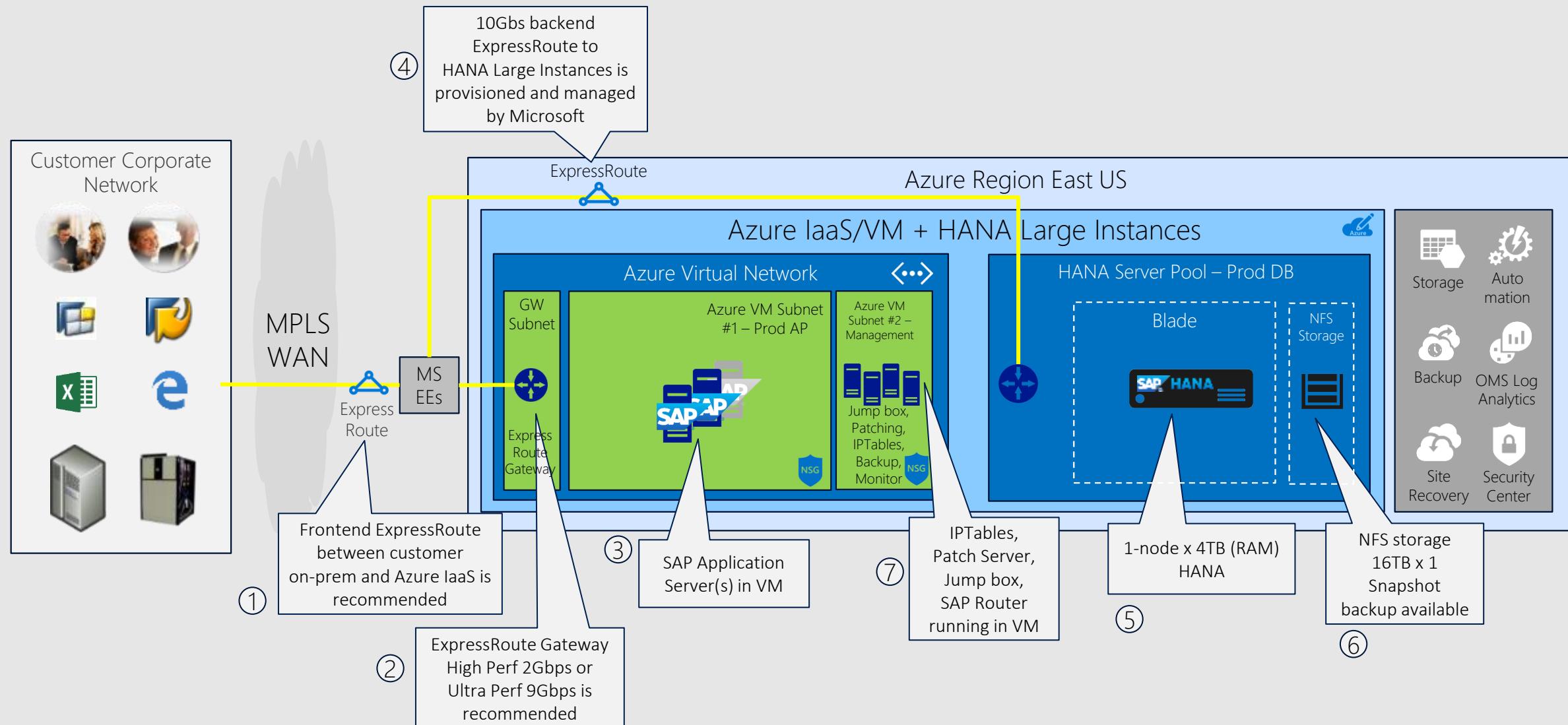
# Baseline Knowledge for SAP as a Service on Azure

| Icon | Name                                    | Description  |
|------|---|--|
|      | Region                                  | An area within a geo that does not cross national borders and contains one or more datacenters.  |
|      | Subscription                            | A customer's agreement with Microsoft that enables them to obtain Azure services.  |
|      | Azure Active Directory (Tenant)         | Azure Active Directory helps you manage user identities and create intelligence-driven access policies to secure your resources.                                       |
|      | ExpressRoute                            | Direct Connectivity from customer network to Microsoft Enterprise Edge (MSEE)  |
|      | MSEE (Enterprise Edge)                  | Each ExpressRoute circuit consists of two connections to two Microsoft Enterprise edge routers (MSEEs) from the connectivity provider/your network edge.               |
|      | Virtual Network                         | A network that provides connectivity between your Azure resources that is isolated from all other Azure tenants.   |
|      | Subnet                                  | A subnetwork or subnet is a logical subdivision of an IP network.  |
|      | Network Security Group                  | NSG contains a list of security rules that allow or deny network traffic to resources connected to Azure Virtual Networks (VNet)                                       |
|      | VPN Gateway                             | A specific type of virtual network gateway that is used to send encrypted traffic between an Azure virtual network and an on-premises location over internet.          |
|      | ExpressRoute Gateway                    | A specific type of virtual network gateway that is used to send traffic between an Azure virtual network and an on-premises location over ExpressRoute/Direct Peering. |
|      | Virtual Machines                        | The software implementation of a physical computer that runs an operating system.  |
|      | Azure Premium Storage and Managed Disks | Azure Storage offers a massively scalable object store for data objects, a file system service for the cloud   |
|      | Availability Set                        | A collection of virtual machines that are managed together to provide application redundancy and reliability.  |
|      | Internal Load Balancer                  | ILB directs traffic only to resources that are inside a virtual network or that use a VPN to access Azure infrastructure. (Layer 4)                                    |
|      | HANA on Azure Large Instances           | HANA tailored data center integration (TDI) certified server hardware infrastructure   |
|      | NFS Storage                             | HANA tailored data center integration (TDI) certified storage infrastructure   |
|      | High Availability Pair                  | two or more identical HANA large instances deployed in the same region and configured by the customer for system replication   |
|      | Backend ExpressRoute                    | Backend network to connect Azure Virtual Network and HANA Large Instances stamp  |
|      | Azure Backbone Network                  | Microsoft owned global fiber network linking all Azure datacenters   |
|      | Regional Pairs                          | Regional protection within data residency boundaries   |

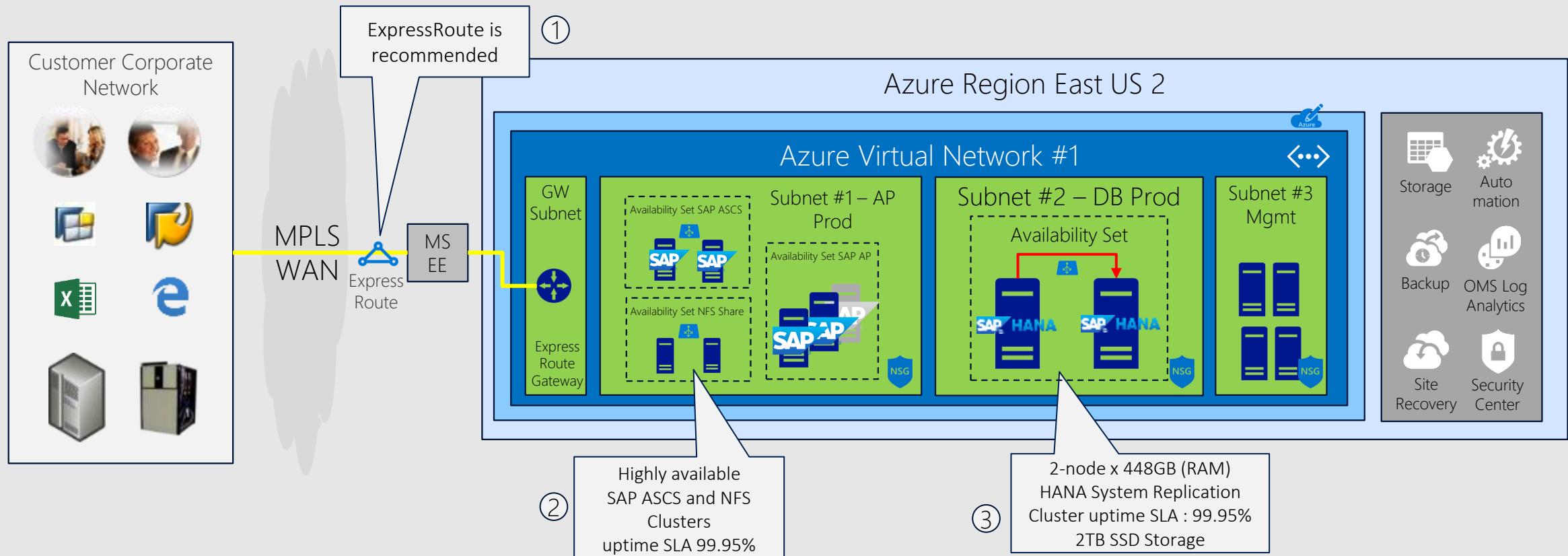
# S/4HANA, BW on HANA, HANA Enterprise, Side Car – Single VM 3-tier



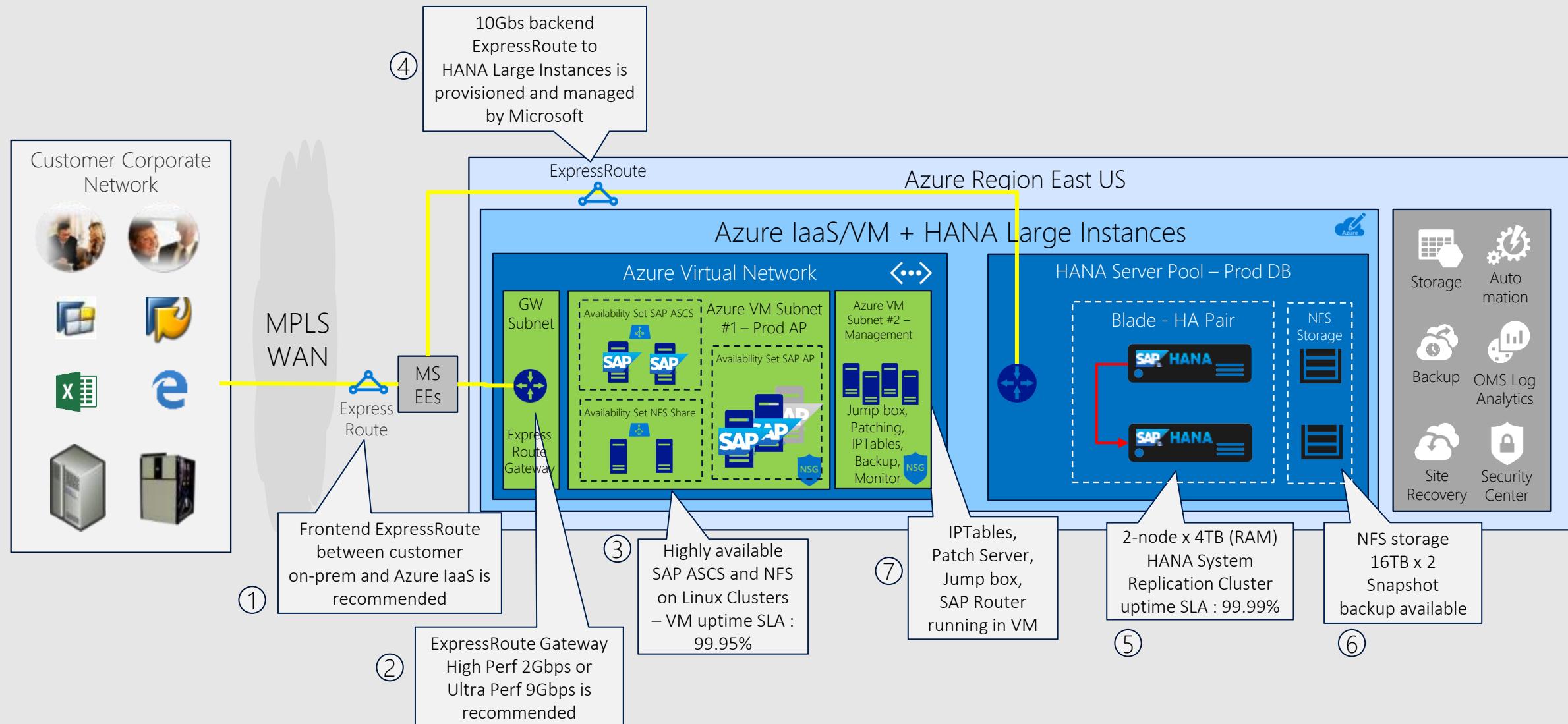
# S/4HANA, BW on HANA, HANA Enterprise, Side Car, Suite on HANA – Single Blade 3-tier



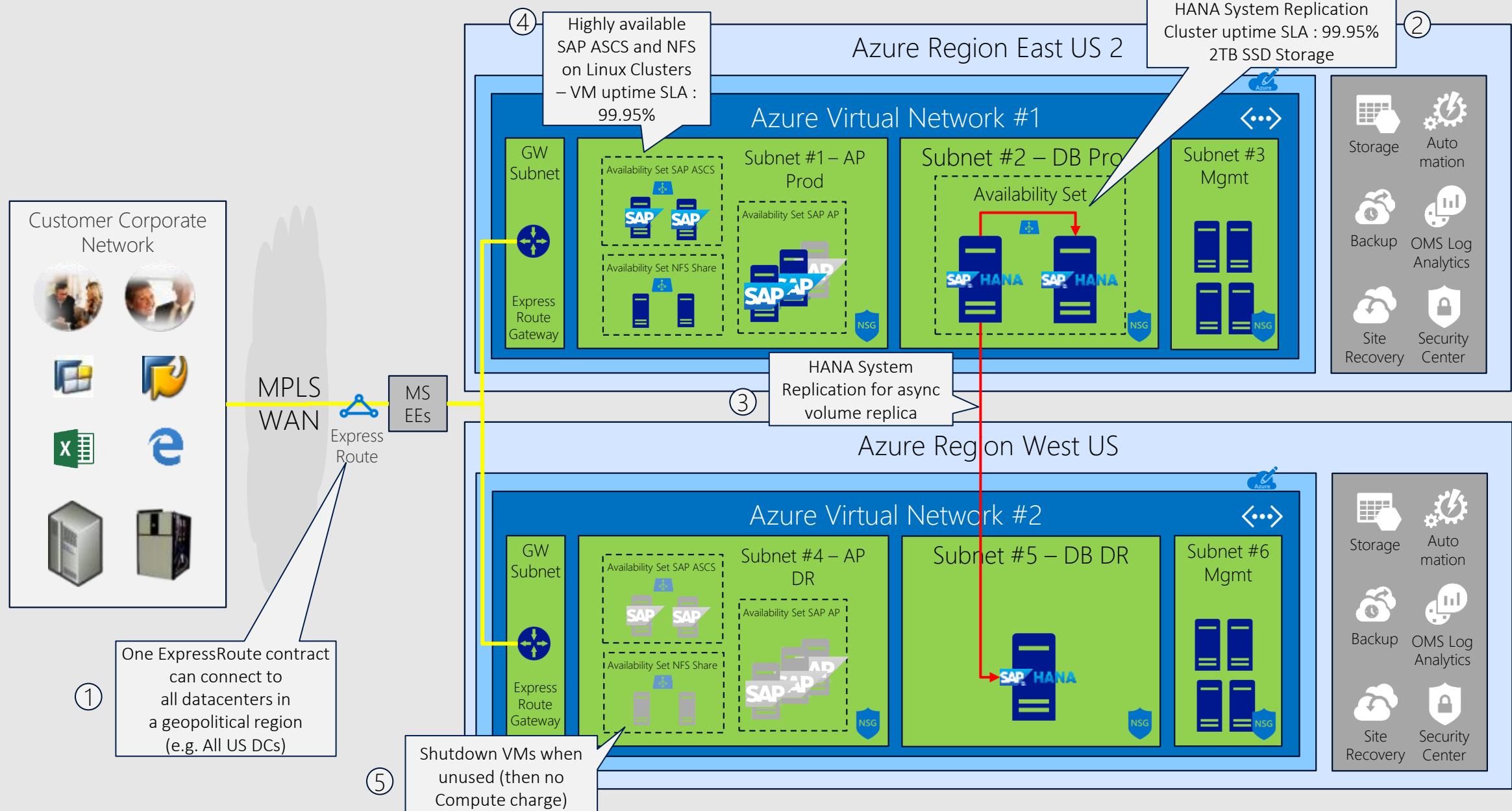
# S/4HANA, BW on HANA, HANA Enterprise, Side Car – VM with HA



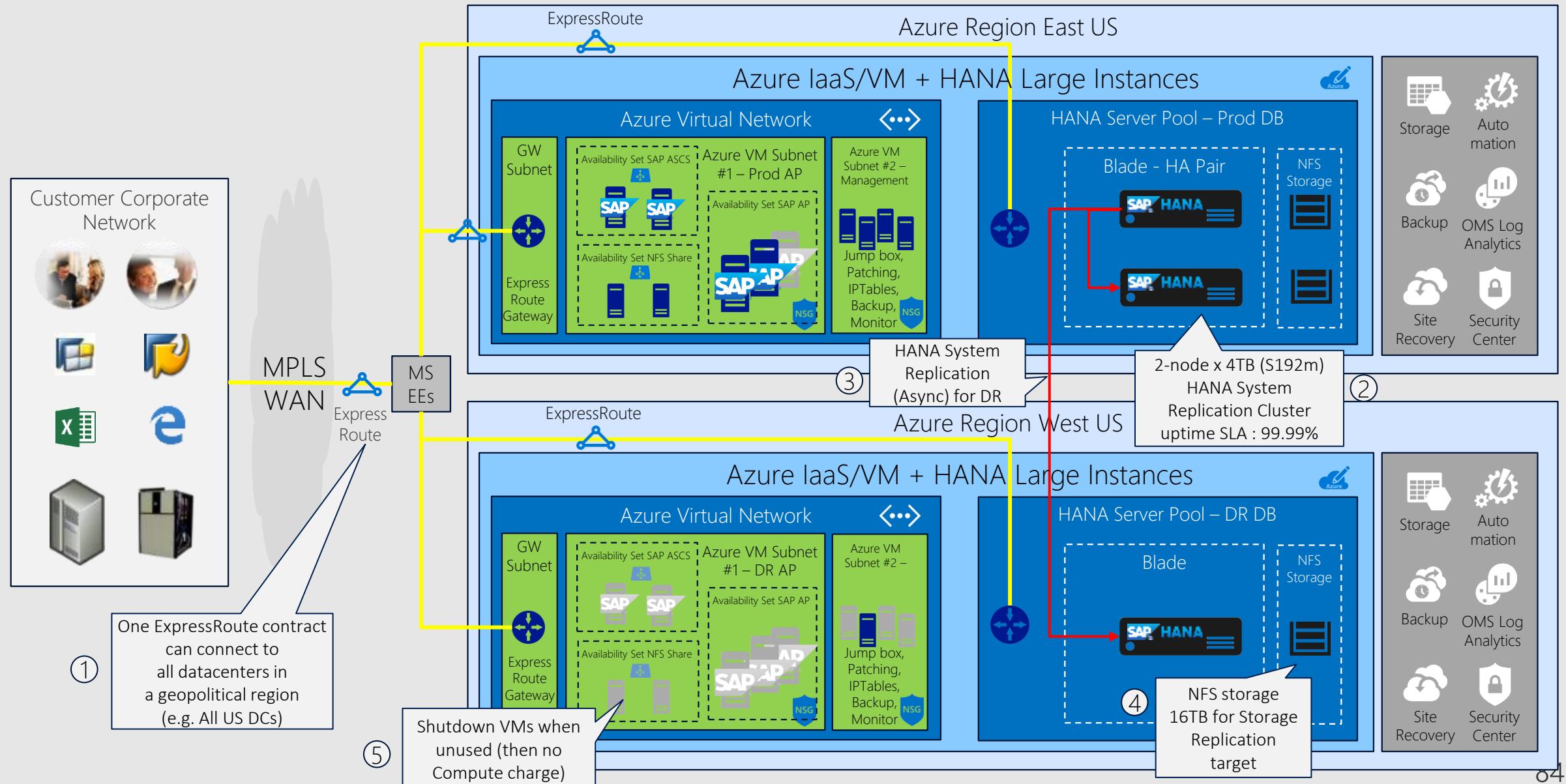
# S/4HANA, BW on HANA, HANA Enterprise, Side Car, Suite on HANA – Blade HA



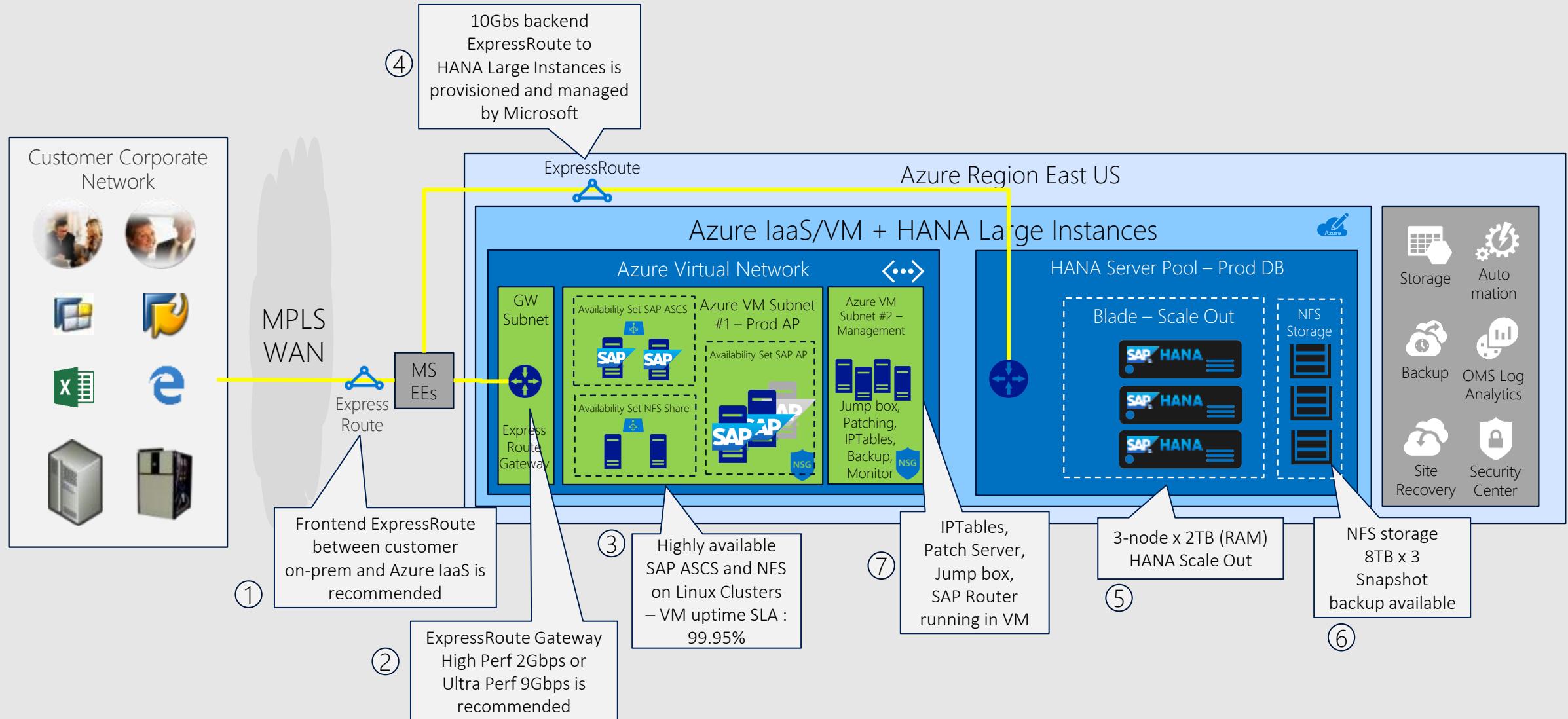
# S/4HANA, BW on HANA, HANA Enterprise, Side Car – VM with HA/DR



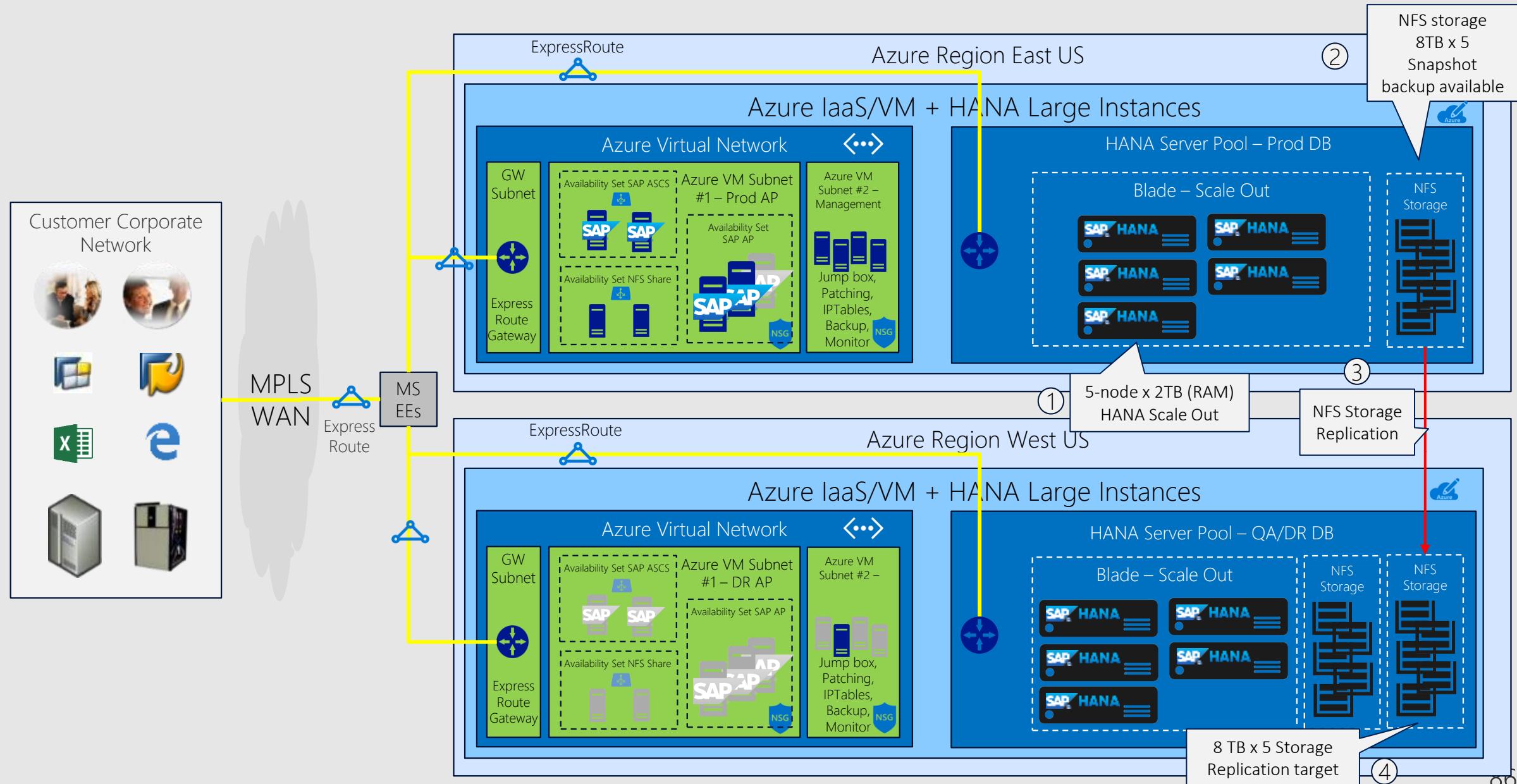
# S/4HANA, BW on HANA, HANA Enterprise, Side Car, Suite on HANA – Blade HA/DR



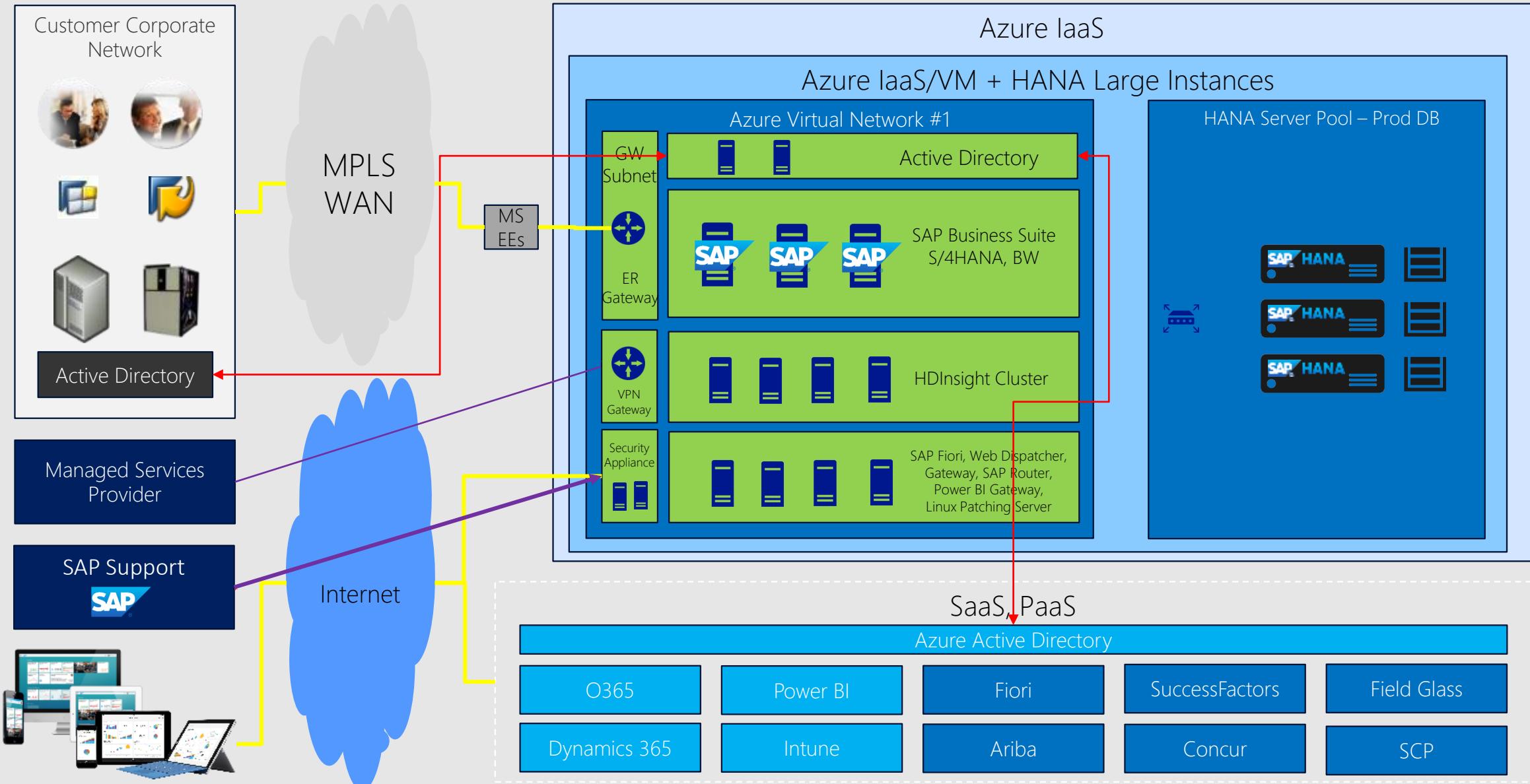
# BW on HANA, HANA Enterprise – Scale Out Blade with HA



# BW on HANA, HANA Enterprise – Scale Out Blade with HA/DR

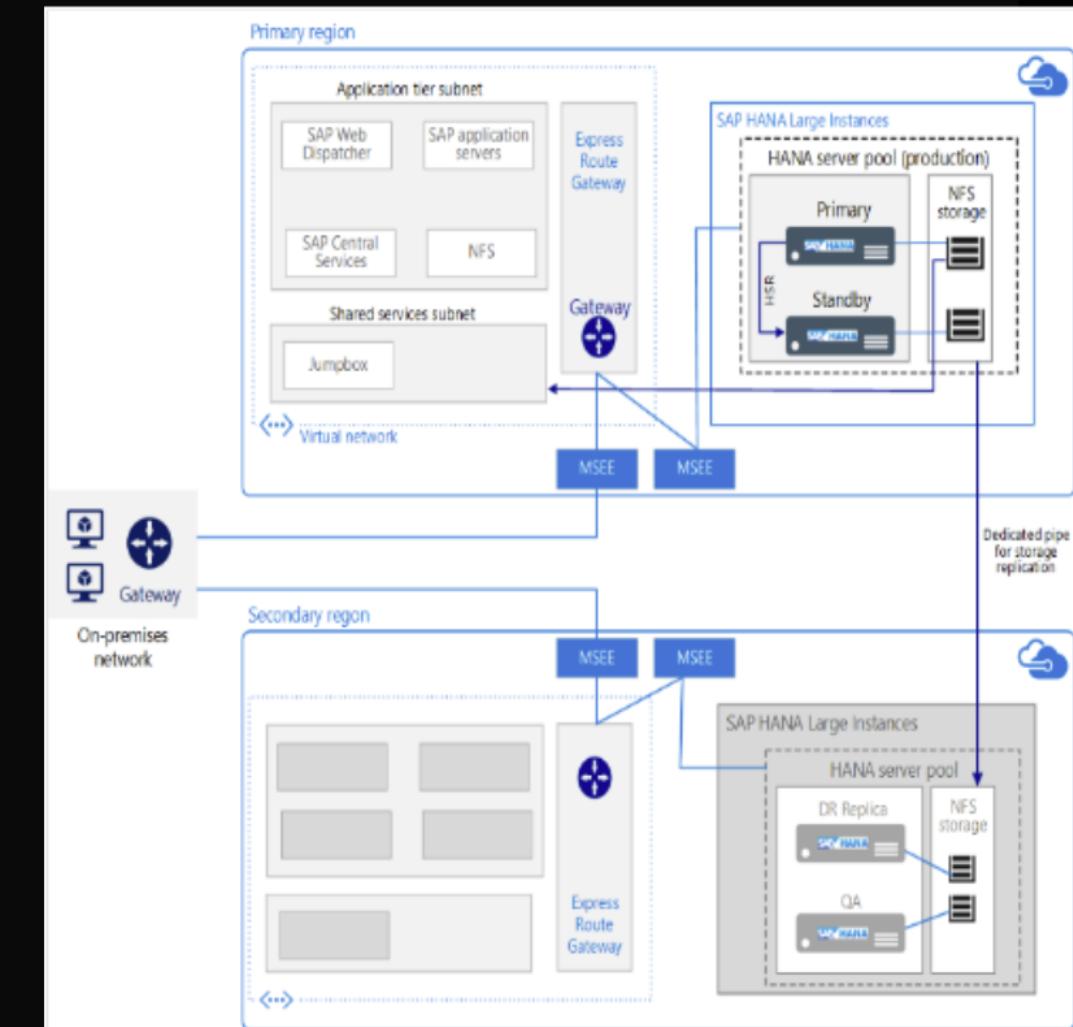


# Entire Network Diagram – SAP, Non-SAP and SaaS



# SAP HANA on Azure (Large Instances) – Key items

- (H/V)LI type I and II
  - Type I class: S72, S72m, S96m, S144, S144m, S192, S192m, S224, and S224m, S224om
  - Type II class: S384, S384m, S384xm, S448S448m, S576m, S672, S672m, S768m, S896, S896m, and S960m
- HLI rev 3 and 4
- Rev4 improvements
  - Network Improvements – Latencies as low as 0.3ms
  - Zone deployment in The US (not on RA yet)
  - Optimized for Next gen Large Instances
    - 40 gig backplane
    - Global Reach & Fastpath
    - Next gen Netapp All-Flash storage



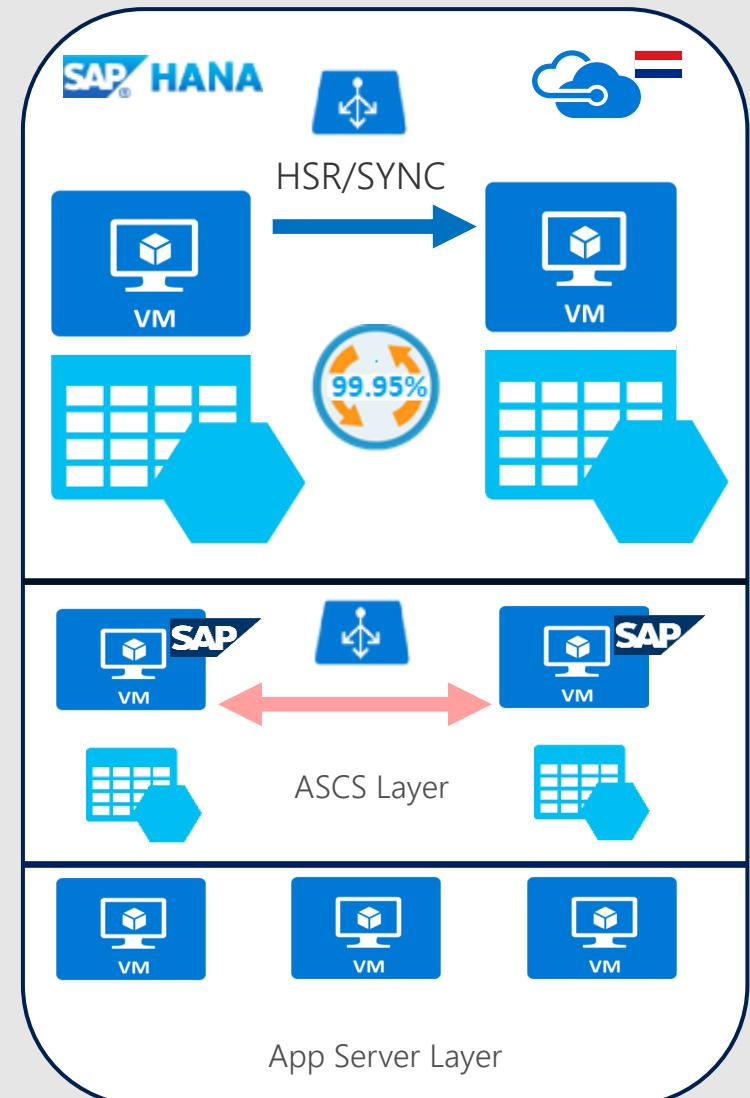


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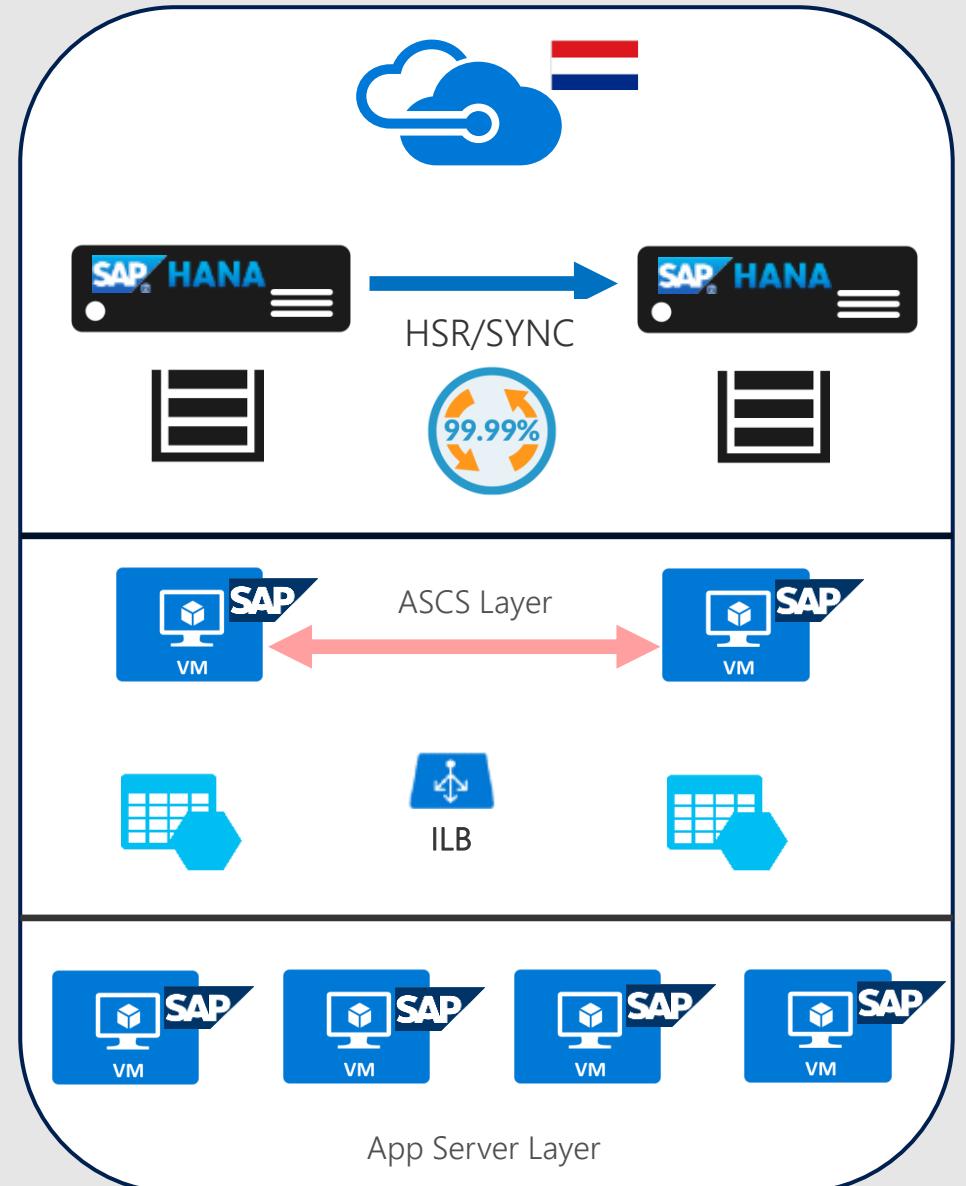
# HANA Virtual Machine HA

- SLA 99.95%
- Implementation:
  - VMs in the same availability set (behind a load balancer)
  - Configured by the customer for system replication at the application layer
  - Linux HA extensions (SUSE, RedHat)
  - Multi-disk configuration (LVM recommended):
    - /hana/data
    - /hana/log
    - /hana/shared
  - Cluster software
  - HANA HA package
  - SAP HANA resources



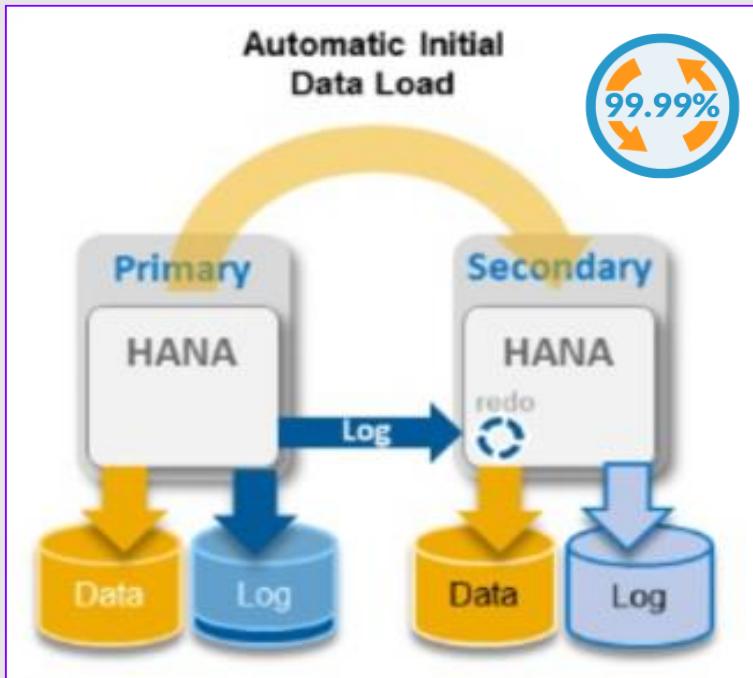
# HANA Large Instance HA

- 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 a High Availability Pair to Microsoft during the architecture design process.



# HANA HSR/HA – Performance vs Cost Optimized

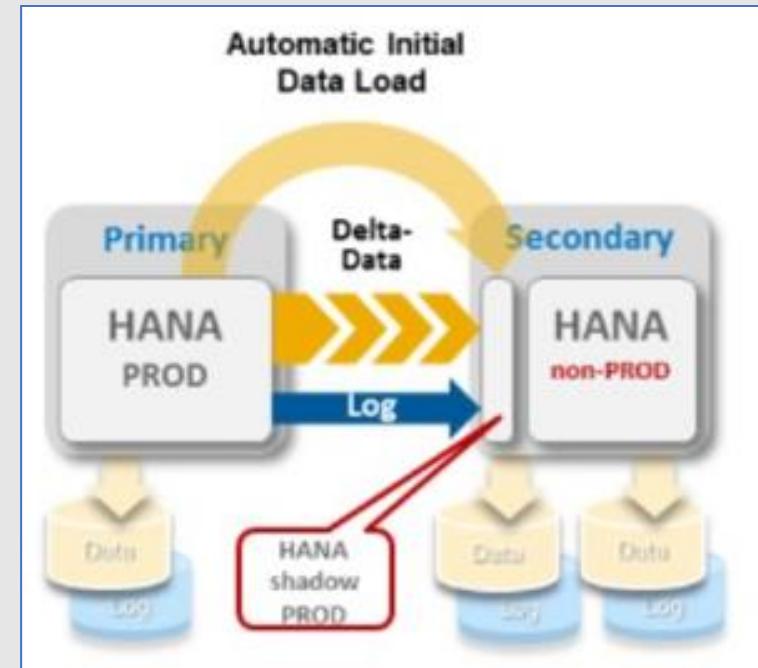
Performance Optimized



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

Replication Mode = SYNC/FULLSYNC for RPO = 0  
Operation Mode = Log Replay

Cost Optimized

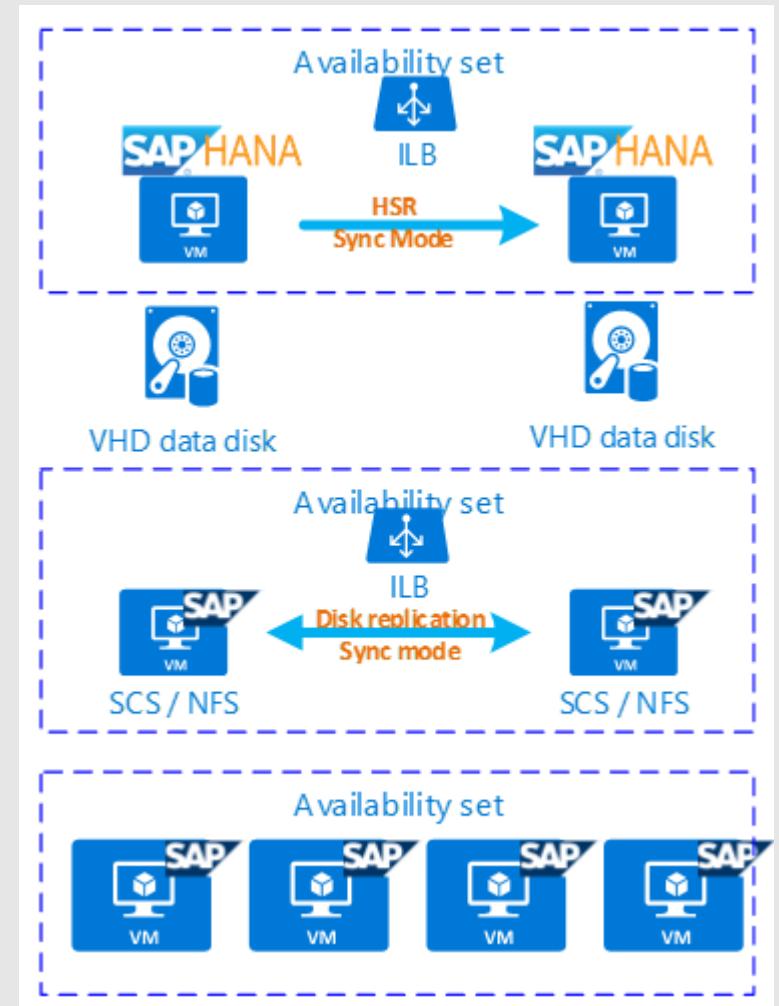


- No Data Preload on Secondary  
global.ini/[sys\_replication]->  
preload\_column\_tables=false
- RPO = 0
- RTO = mins/hours, shutdown non-PRD  
and startup PRD
- Requires additional storage sec. node

# HANA HA with SUSE Cluster Software for SAP

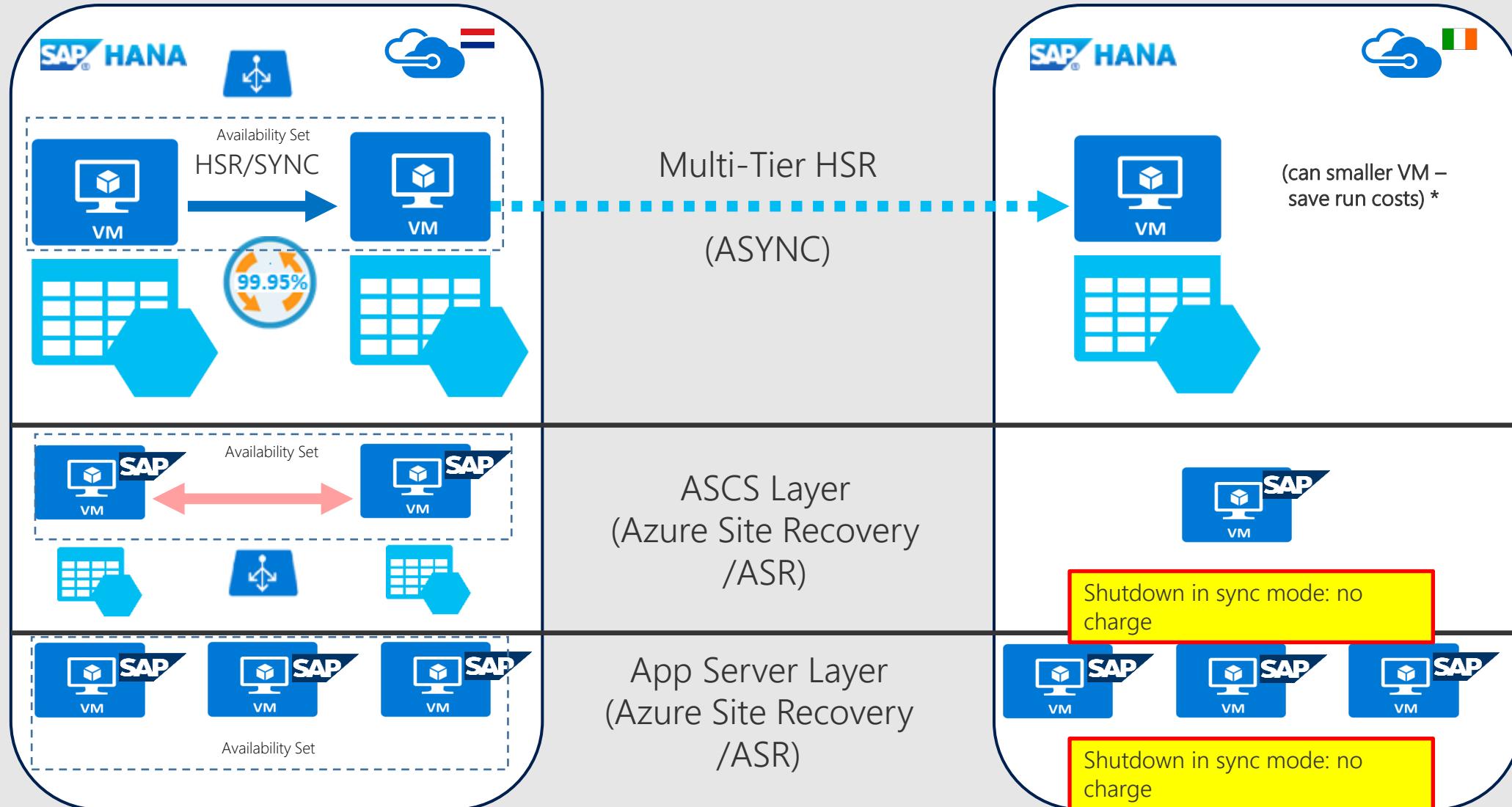
## SUSE Cluster software for SAP

- Automatic failover of SAP HANA
- Automatic failover of SAP A(SCS) & NFS
- SUSE cluster software to be used (Pacemaker, Corosync)
- SUSE fencing agent for Azure to SLES 12 SP1+
- Storage replication done with distributed replicated block devices (DRDB) technology.



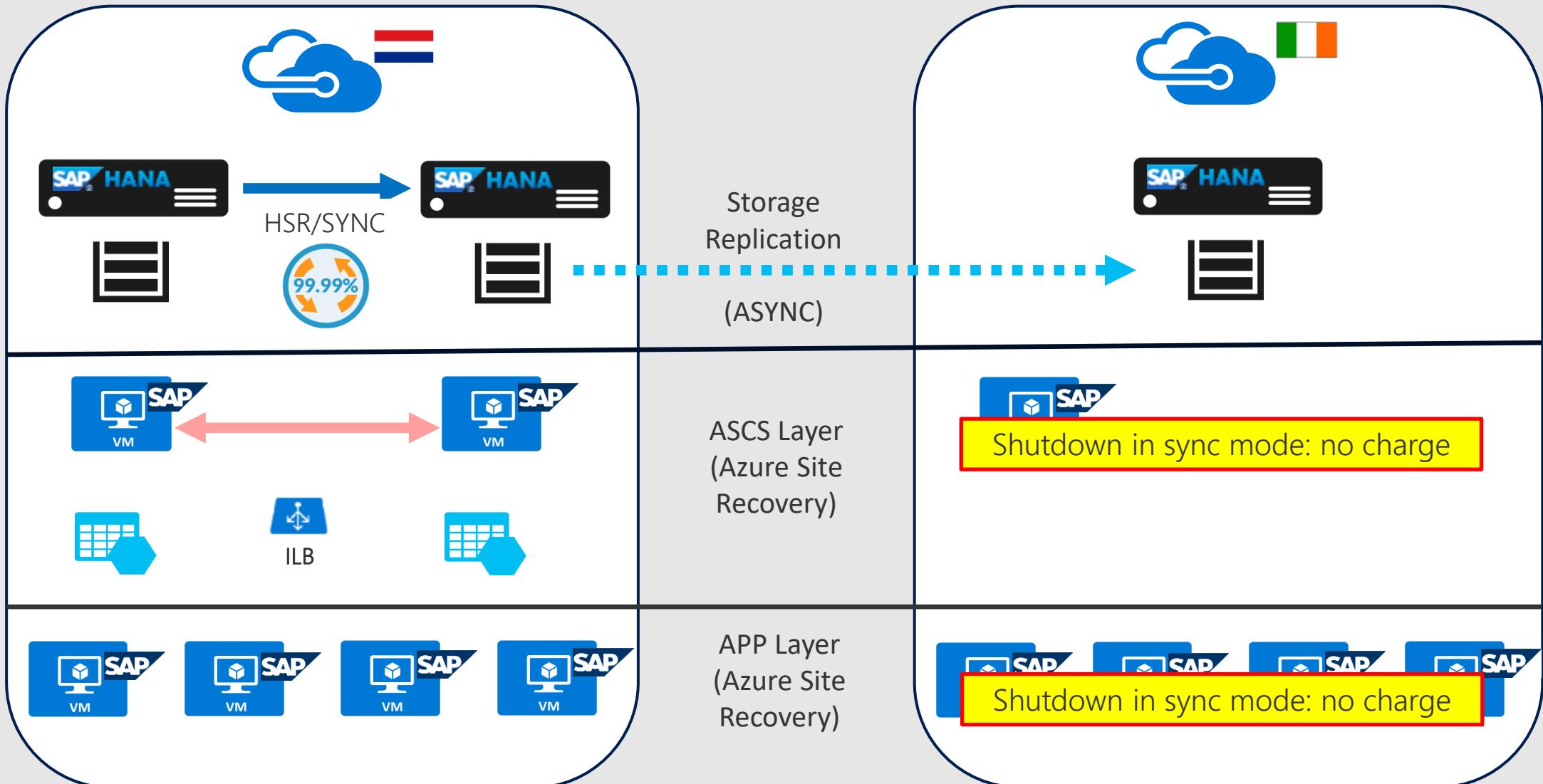
Resource: [High Availability of SAP HANA on Azure Virtual Machines \(VMs\)](#)

# VM/HANA HA + DR (MULTI-TIER HSR)



\* See SAP Note 1999880 - FAQ: SAP HANA System Replication – buffer for replication target has a minimum size of 64GB or row store + 20GB (whichever is higher)

# HANA LARGE INSTANCE HA + DR



# HANA Large Instances – DR (Storage Replication)

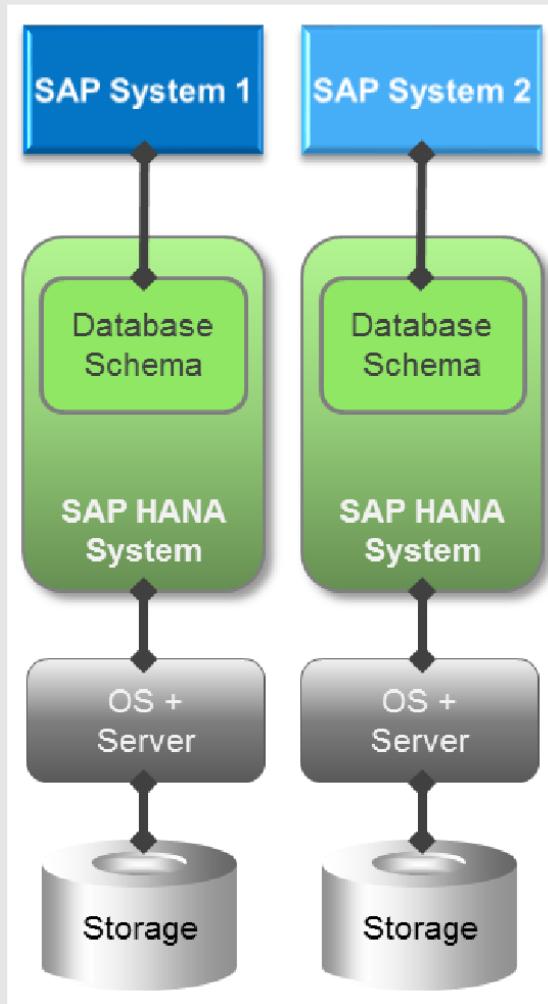
- Storage snapshots – ready-to-use scripts to be implemented by the customer
  - A prerequisite for DR
  - A snapshot of the boot LUN and HANA volumes (hana/data, hana/log, hana/log\_backup, hana/shared)
  - RPO from 15 to 25 minutes – to lower, include transaction log backups
  - Up to 255 snapshots supported – although a lower number is recommended
  - The customer responsible for space allocation and usage, and scheduling (cron)
  - Serves as the built-in backup and restore method
    - Invokes a HANA snapshot, performs a storage snapshot, and deletes the HANA snapshot
    - Customers can implement other backup methods (Azure Backup or Marketplace)
  - Restores require engagement of SAP HANA on Azure Service Management
  - Avoid snapshots during R3load, restores, table reorganization, etc.
- Transaction log backups – implemented by the customer (HANA Studio)
  - Requires at least one file-based backup (e.g. via HANA Administration console)
  - DR:
    - Backup to /hana/log/backup
    - Copy to an Azure VM in the same region
    - Copy from the Azure VM in the same region to an Azure VM in the DR region
    - Restore from the Azure VM in the DR region to the large instance in the DR region
  - Restore: apply after snapshot restore for point-in-time restore (DR or Prod)

# Agenda

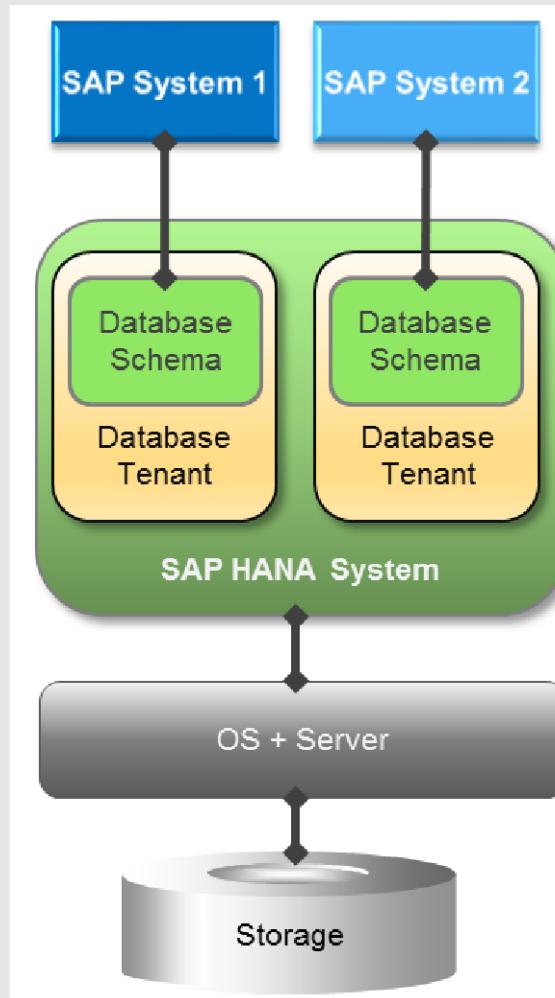
1. SAP Certification for Azure (HANA)
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# HANA Technical Deployment Architectures

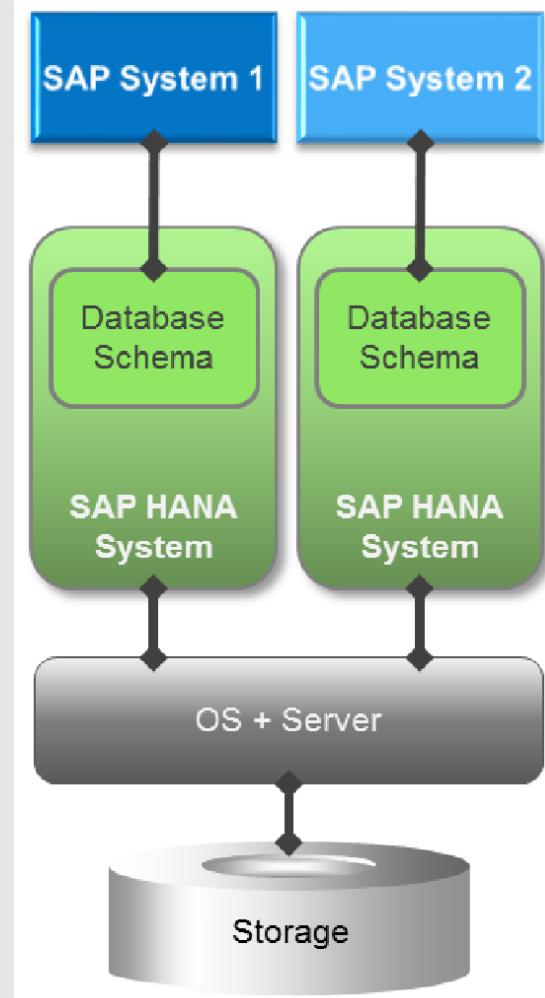
**Standard/SCOS**



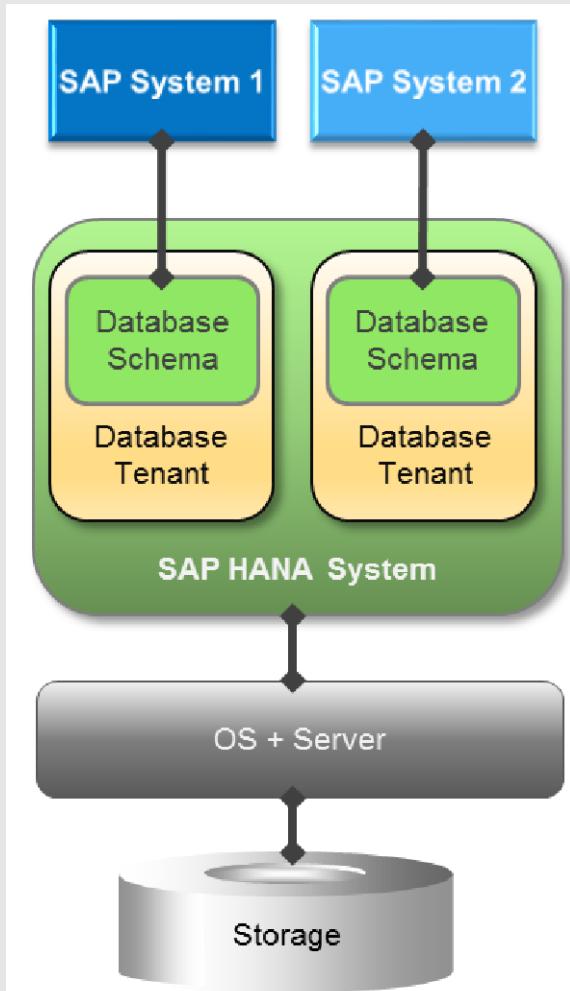
**MDC**



**MCOS**



# HANA Consolidation - MDC

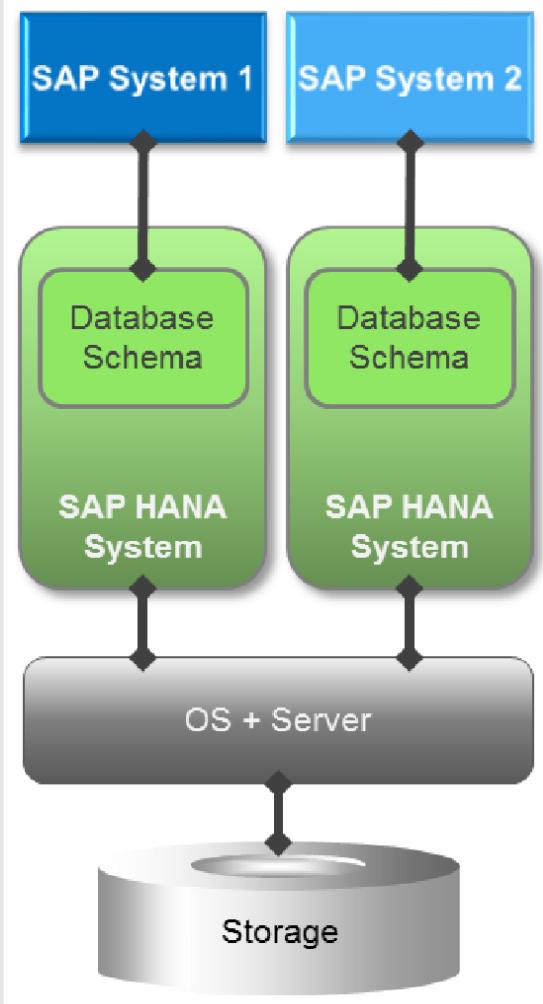


## Multi Tenant Database Containers (MDC)

- Multiple DBs on the same HANA hardware reducing maintenance efforts for OS & DBA/SAP Basis - *reduce opex/TCO*
- Multi-tenant is the *strategic deployment option* for SAP (default for HANA 2.0 SP 01)
- Offers integrated administration, monitoring, resource management, *strong isolation* (data & security)
- Offers *optimized cross-database operation (#2312583)* within the system (read access between tenants)

**MDC-“multi tenant” *snapshot backups* not yet supported by SAP  
Can configure MDC and run backint backup to enterprise backup solution (VNet)**

# HANA Consolidation - MCOS



## Multiple Components One System (MCOS)

- Useful for *initial technical verification* of HANA database software
- Use for systems with *different software maintenance cycles*.
- Flexibility to reuse free capacity for multiple SAP systems.

## ***HANA Large Instance - MCOS***

- Type I class: S72, S72m, S144, S192: Smallest starting unit **256 GB**, with minimal increments of **256 GB**.
- Type I class: S144m and S192m: Smallest starting unit **512 GB**, with minimal increments of **256 GB**
- Type II class: S384, S384m, S384xm, S576, S768, and S960. Smallest starting unit **2 TB**, with minimal increments of **512 GB**

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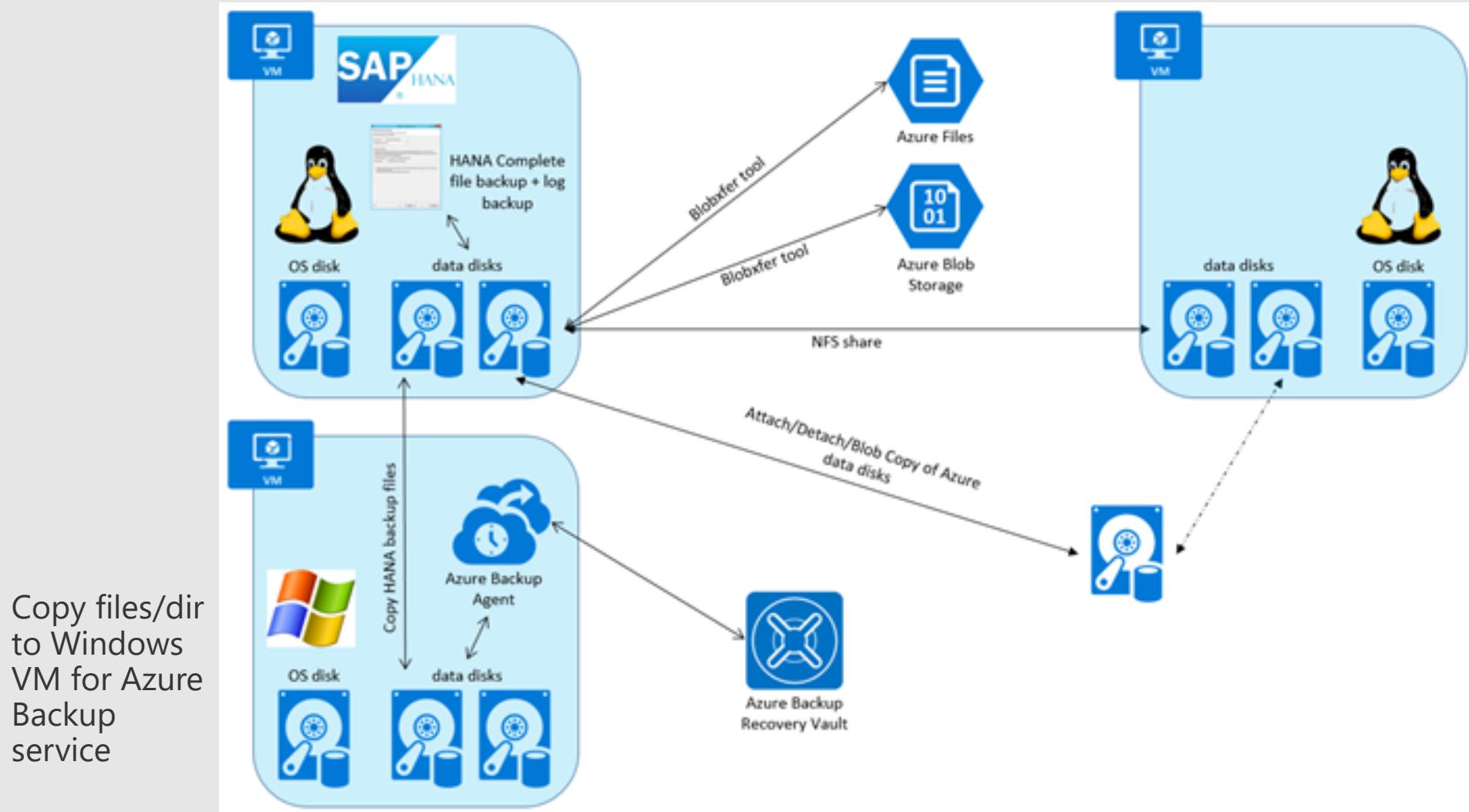
# SAP HANA snapshot on Azure VMs

## HANA snapshot process

- Initiating the SAP HANA snapshot prepare
- Freeze the filesystem (e.g., use `xfs_freeze`)
- Run the storage snapshot (Azure blob snapshot, for example)
- Unfreeze the filesystem
- Confirm the SAP HANA snapshot

Restore to a new VM or restore only the disks

# SAP HANA on Azure VM Files Backup

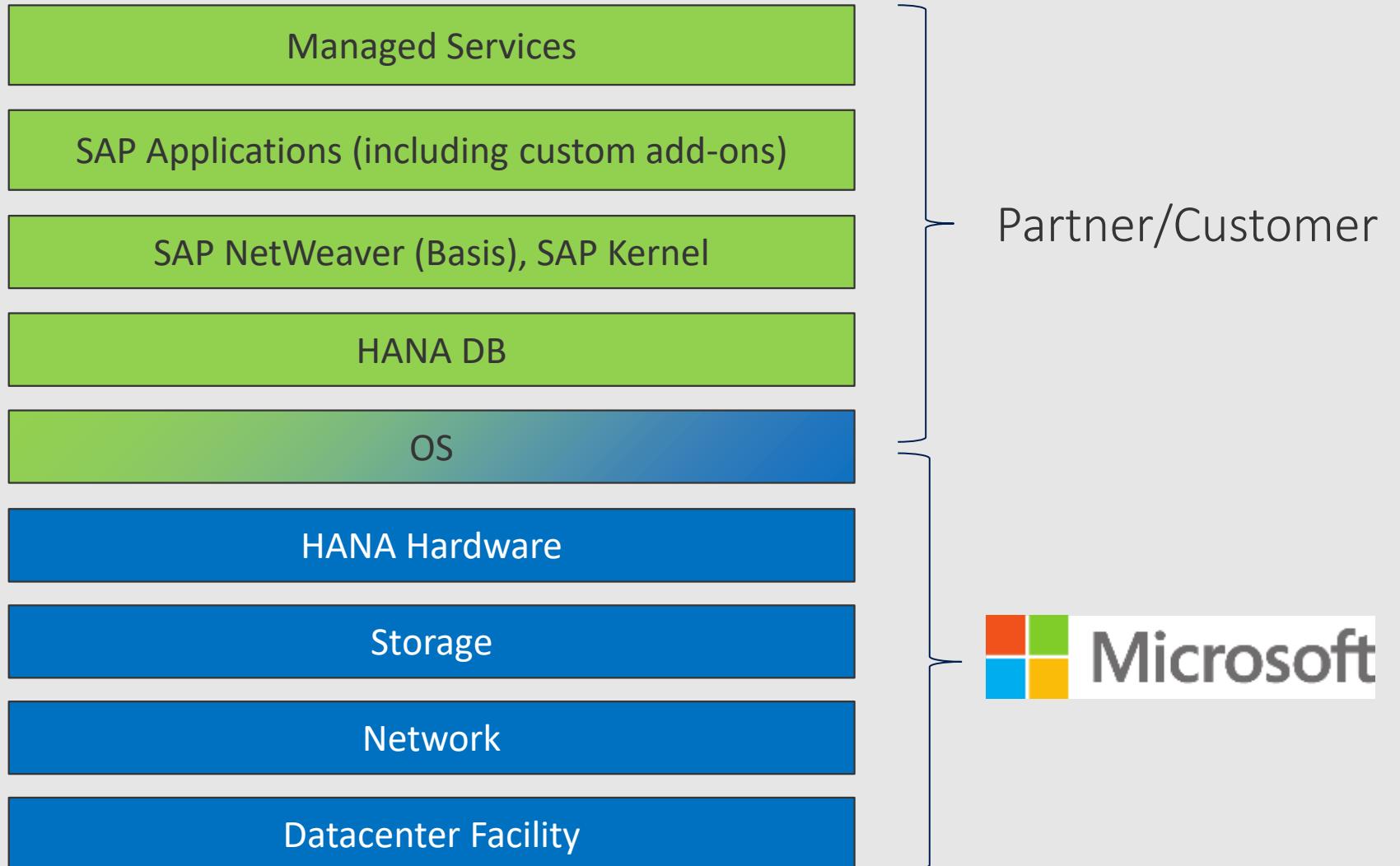


# Agenda

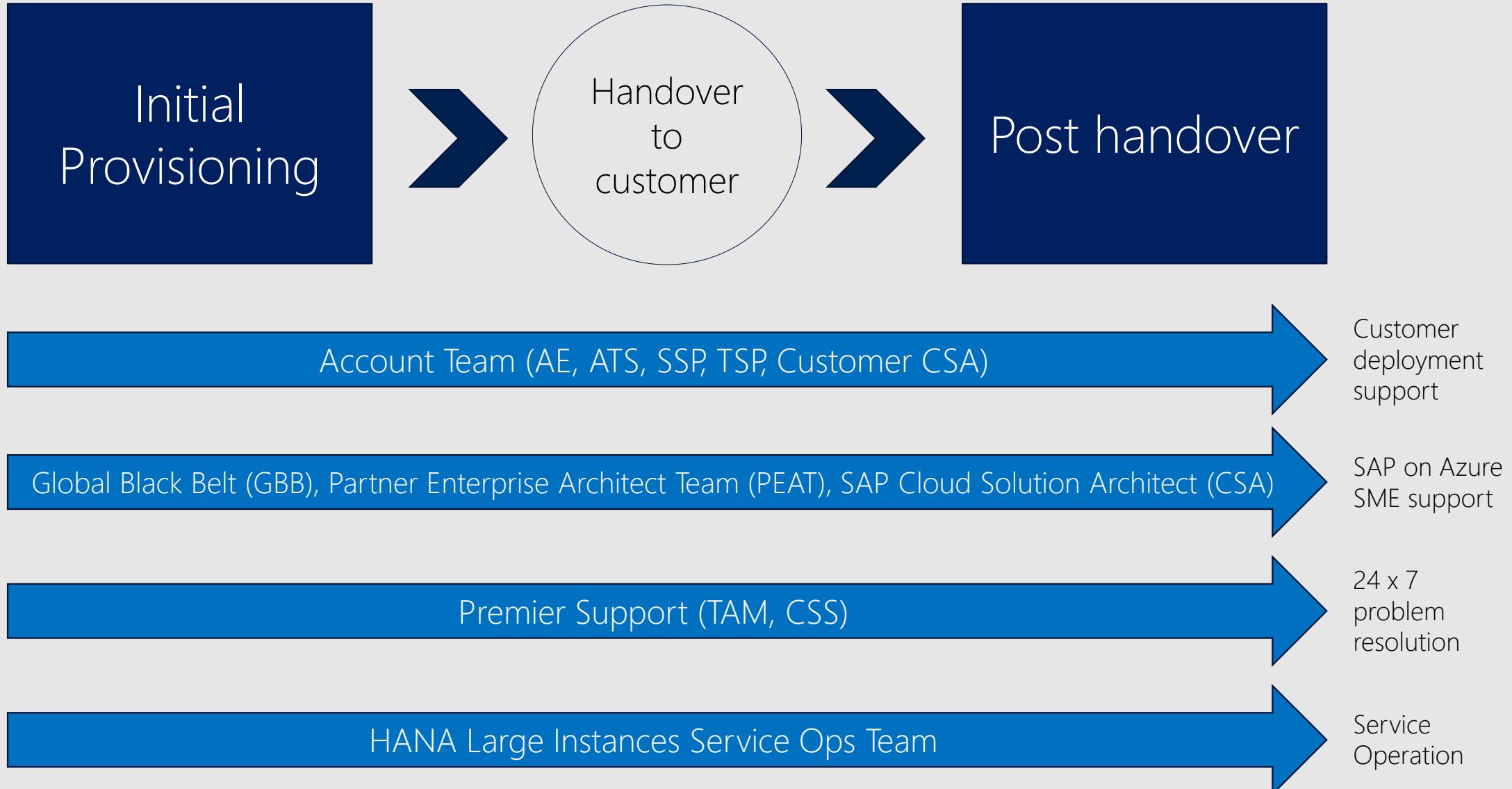
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# SAP HANA on Azure Large Instances Offering

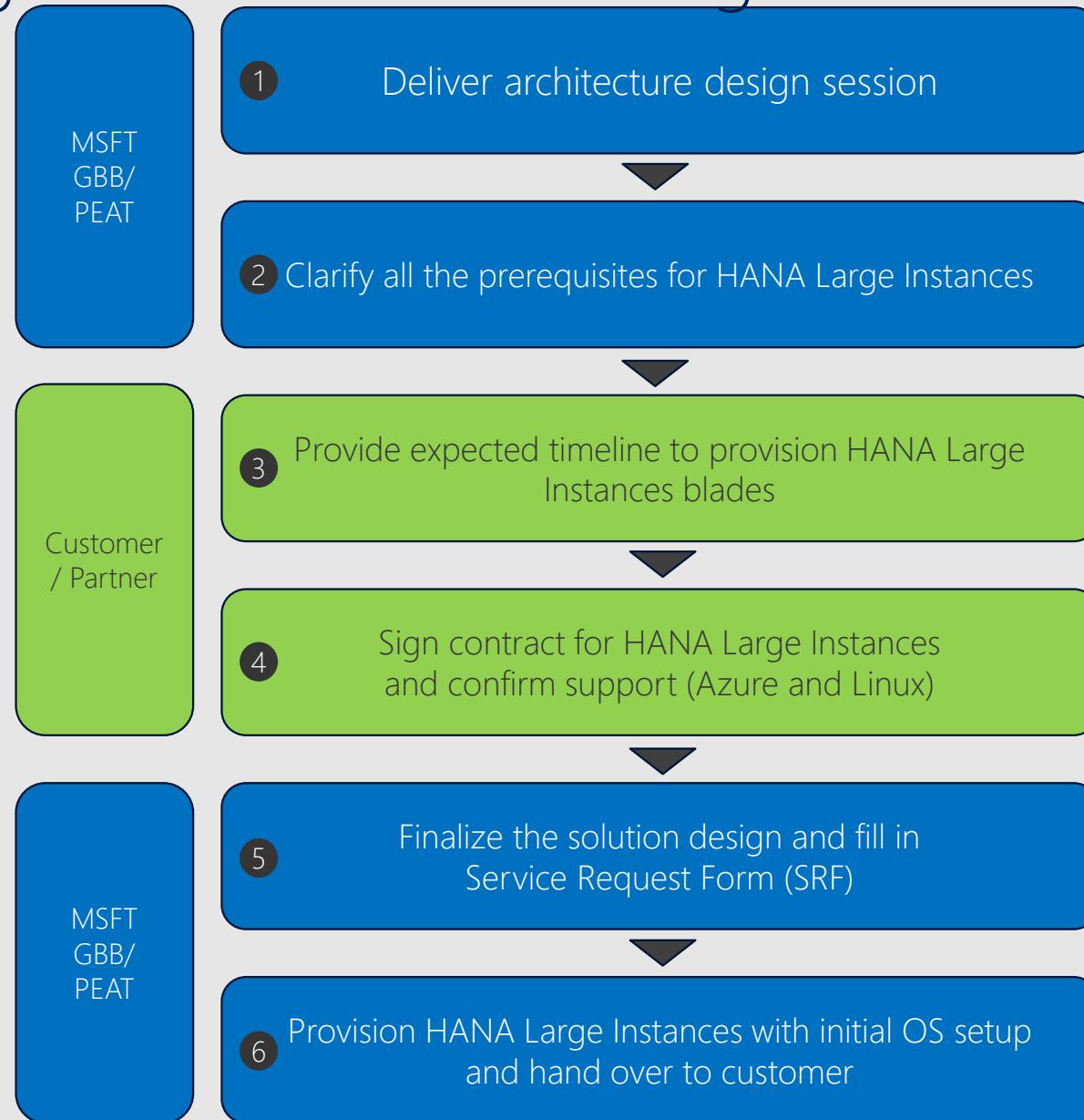
Managed by Customer/Partner  
Managed by Microsoft



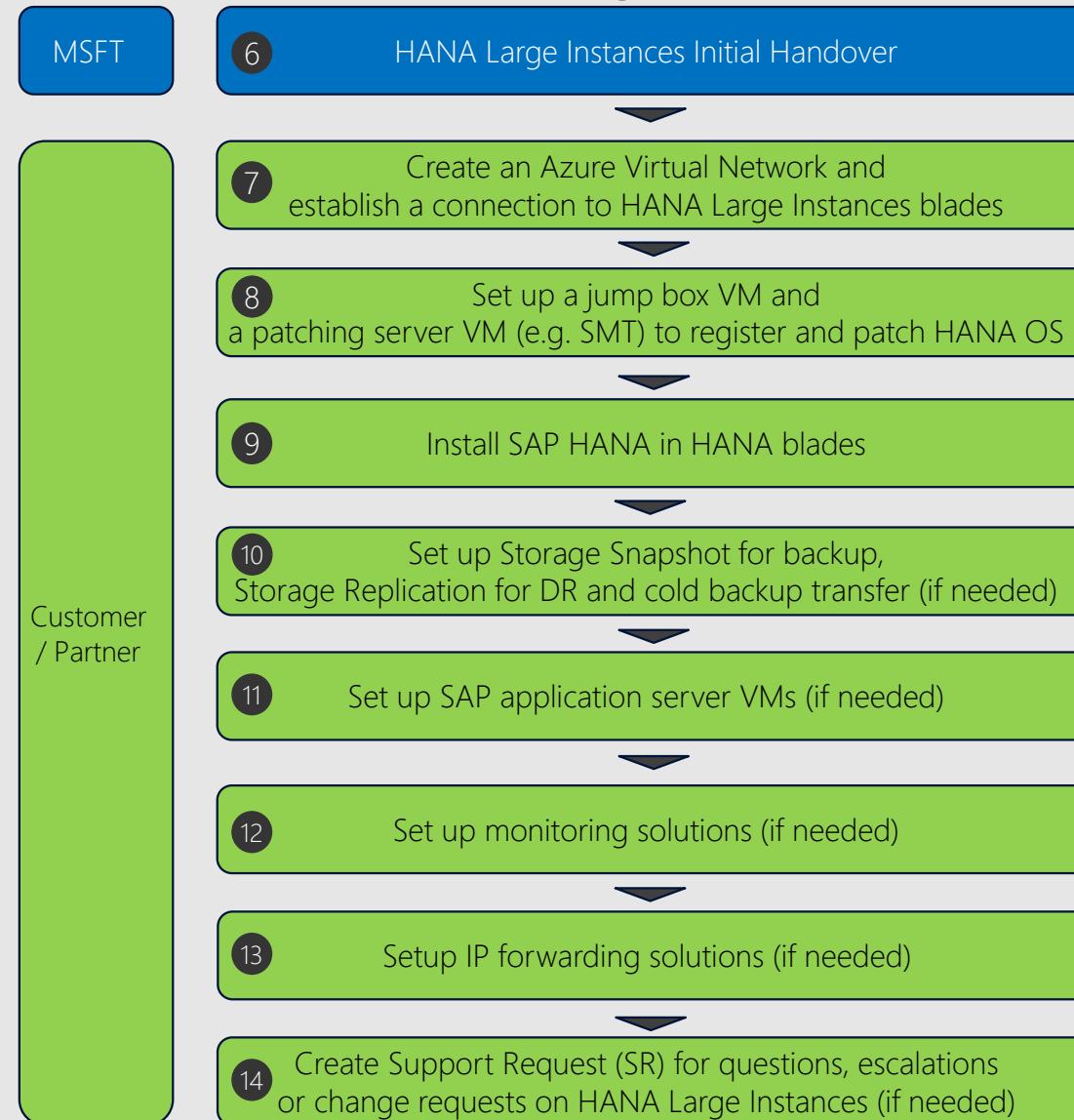
# Who in MSFT help customer deploy HANA Large Instances



# Initial Provisioning of HANA on Azure Large Instances -Overview



# Post Provisioning of HANA on Azure Large Instances – Detailed View



# Documentation on HANA on Azure Large Instances

1. [Overview and Architecture](#)
2. [Infrastructure and Connectivity](#)
3. [VNET connection to HANA Large Instances](#)
4. [Install SAP HANA](#)
5. [High Availability and Disaster Recovery](#)
6. [Troubleshoot and Monitor](#)
7. How to
  1. [High availability set up in SUSE using the STONITH](#)
  2. [OS backup and restore for Type II SKUs](#)
8. NetWeaver Application Server
  1. [Running SAP NetWeaver on Microsoft Azure SUSE Linux VMs](#)
  2. [High availability for SAP NetWeaver on Azure VMs on SUSE Linux Enterprise Server for SAP applications](#)



# Q&A

Reach out to the team  
[sap-on-azure-pe-apac@microsoft.com](mailto:sap-on-azure-pe-apac@microsoft.com)

# Feedback

Your feedback is very important  
for us.

Your responses are Anonymous

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





# SAP on Azure Enablement

Next Session – Azure Security & Best Practices for SAP

Monday, Oct 19, 2020, 10am SGT

Reach out to the team  
[sap-on-azure-pe-apac@microsoft.com](mailto:sap-on-azure-pe-apac@microsoft.com)

