1. Solution Overview
Azure Stack HCI provides enterprise customers a highly available, cost efficient, flexible platform to run a high-performance Microsoft SQL Server leveraging the power of state-of-the-art hardware and Storage Spaces Direct. Azure Stack HCI presents a highly competitive solution for delivering exceptionally performant Microsoft SQL Server. Whether running Online Transaction Processing (OLTP) workloads, or Data Warehouse and BI, to AI and advance analytics over Big Data, you will benefit from the resiliency that Azure Stack HCI offers. This is especially important for mission critical databases. Leveraging the flexibility to run SQL Server in VMs (Windows Server or Linux), it allows you to consolidate multiple database workloads and easily scale out by adding additional VMs to the Azure Stack HCI environment as needed. Additionally, Azure Stack HCI enables you to integrate Microsoft SQL Server with Azure Backup service and Azure Blob Storage service to provide cloud-based backup solutions that are reliable and secure.

2. Plan your Azure Stack HCI environment with **S2D Series 2224**
- Maximum flexibility and scaleability
- Up to 2x Intel Scalable CPU 2nd-generation each Node
- Up to 1 TB RAM each Node
- Up to 2x 100 GbE RDMA-Network each Node
- Up to 24x 2,5" tray
- Up to 92 TB Storage-Capacity per Node
- Individual calculated full-flash Storage-Capacity available\(^{(2)}\)
  - NVMe-Storage
  - SSD-Storage

\(^{(2)}\) Nested two-way Mirror is highly recommended for 2-Node-S2D-Clusters

Please consider backup and restore times for large-capacity configurations. Most data protection solutions are not able to ingest and restore at speeds businesses expect.

3. Network and Switch Connectivity
1. **RoCE/RDMA** technology for Storage Spaces Direct Traffic. With RoCE there is additional DCB and PFC configuration required. Network devices have to support this capabilities.
2. Available as switch-connected or direct-attached solution\(^{(3)}\)
   - One single/standalone switch
   - Two redundant/stacked switches
   - Optional: Direct-attached for RDMA (storage/cluster) traffic

\(^{(3)}\) Thomas-Krenn.AG recommends a switched configuration. The switch helps the cluster determine whether loss of node connectivity is due to node or network failure, ensuring more predictable failover behavior.
4. Configure Azure Stack HCI
   For details, refer to Step by Step guide to deploy Azure Stack HCI.
   In general, follow these simple steps:
   1. Customize hostnames
   2. Join your active directory domain, different deployment options available
      - Fully self-contained, virtualized domain controllers within the cluster itself.
        a. Do not store DC VMs on cluster shared volumes, keep all VM files on storage local to each node.
        b. Do not include DC VMs in cluster management: do not add them to cluster manager.
        c. Run one DC on each node.
        d. On each DC, configure the remote DC as primary DNS and itself as secondary DNS. This ensures all DNS records are live and current, even after booting up from a long time offline.
        e. Domain controllers are redundant and highly available by design.
      - Dedicated physical domain controller, for example deployed on a Thomas-Krenn.AG LES
        a. We recommend a second, virtual domain controller on the cluster itself. Follow the guidelines above.
   3. Prepare Witness for Cluster-Quorum
      - Azure Cloud Witness, when on-prem infrastructure is to be kept at a minimum.
      - SMB File Share or USB witness with write-access from all nodes for on premises based witness
   4. Configure network ports
      - Set up a Switch Embedded Teaming (SET) for Traffic-NICs
      - Set up RoCE / RDMA for SMB-NICs
   5. Add Roles and Features for each node
   6. Setup Storage Spaces Direct
      - Setup Failover Clustering and enable a Witness
      - Enable Storage Spaces Direct
      - Create Volumes
   7. Install Windows Admin Center (WAC) (Download here)

   (4) Both variants are officially supported. Thomas-Krenn.AG recommends the dedicated physical scenario.

5. Set up Microsoft SQL Server on Azure Stack HCI
   Set up a Windows Server 2019 or a Linux VM
   - Install SQL Server on Linux
   - Install SQL Server on Windows

6. Monitoring and performance tuning
   To insure performance and health of your Microsoft SQL Server instances on Azure Stack HCI, it is important that appropriate monitoring and tuning is put in place. Additional SQL Server database engine tutorials are included here.
   For tuning SQL Server 2016/2017 for high performance, the following recommended practices are provided.

7. High Availability (HA)
   Azure Stack HCI leverages Windows Server Failover Clustering (WSFC) and can be utilized to support Microsoft SQL Server running in VMs (designed to help with hardware failure). Microsoft SQL Server also offers Always On availability groups (AG) which provides database-level high availability and is designed to help with application and software faults. In addition to WSFC and AG, Azure Stack HCI can also leverage Always On Failover Cluster Instance (FCI) based on using Storage Spaces Direct technology for shared storage. All of these options can leverage the Microsoft Azure Cloud witness for quorum control. It is recommended that cluster AntiAffinity rules in WSFC be leveraged for the VMs to be placed on different physical nodes in order to maintain uptime for SQL Server in the event of host failures when you configure Always On availability groups.
8. Set up Azure hybrid scenarios

Azure Backup supports backing up and restoring Microsoft SQL Server with application consistency. Install Azure Backup Server to start backup of your on-prem SQL data.

Alternatively, you can also leverage Azure Blob Storage service for SQL Server to backup and restore to Azure Blob Storage service. This is suitable for off-site archiving. To manage the Azure Blob Storage backups, you can leverage the Managed SQL Backup feature included in Microsoft SQL Server.

In addition to the backup scenario, you can set up other database services that Microsoft SQL Server (Microsoft SQL Server 2016/2017/2019) offers, connecting to Azure services such as (but not limited to) Azure Replica, Stretch Database, Azure Data Factory.

Summary

With completion of Microsoft SQL Server deployment using Azure Stack HCI, you now have a platform capable of running complex, highly available database workloads in VMs.