VERITAS

Veritas Alta™ Application Resiliency for SAP HANA on Microsoft Azure

Providing high availability and disaster recovery protection

SAP® Certified
Integration with SAP S/4HANA®

VERITAS
ALTA

Contents

Abstract

An ever-increasing number of organizations are transitioning their mission-critical applications and services to run not just on-premises but in the public cloud as well. Nowhere is this more evident than with solutions such as SAP HANA and SAP NetWeaver (S/4HANA), which when combined represent nearly 25% of the global ERP market share.

As organizations seek to expand their SAP HANA footprint in the public cloud, the need to address and ultimately improve its availability becomes of paramount importance. In response to this, the HANA database framework provides a built-in high availability (HA) and System Replication (HSR) function. While seemingly adequate for most outage scenarios, when a failure event does in fact occur, the recovery process requires multiple manual steps to failover, reverse the replication as well as perform a failback. In addition there is no virtual IP or integrated HA failover orchestration with SAP Central services or components. This process is timely and prone to human error both of which involves server downtime and inevitably leads to loss of revenue opportunities and a potential impact to your business reputation.

The purpose of this document is to provide the necessary guidance for implementing a highly available SAP HANA and SAP NetWeaver / S/4HANA environment deployed in the Azure cloud using Veritas Alta™ Application Resiliency.

It is intended for the following audiences:

- Organizations who deploy SAP systems on Microsoft Azure for development, testing, training, sandboxing, demonstration, or production purposes and want to monitor and manage SAP HANA and SAP NetWeaver / S/4HANA solutions for high availability and disaster recovery.

- SAP Basis and SAP Implementation consultants who are familiar with Microsoft Azure and want to manage the availability of SAP Landscape on Microsoft Azure using Veritas Alta™ Application Resiliency

- This document does not replace any standard SAP documentation or Microsoft Azure documentation. For information on basic SAP high availability configurations on AZURE, refer to the Microsoft Azure documentation at: https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/hana-overview-high-availability-disaster-recovery

- https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/sap-hana-high-availability

When installing SAP solutions on AZURE, always refer to the standard SAP documentation and notes for the respective SAP solution For more information about SAP on AZURE, refer to the Microsoft Azure documentation at:

https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/sap-hana-availability-overview

Introduction to Veritas Alta™ Application Resiliency

Veritas Alta™ Application Resiliency is a new cloud-focused offering that is based on InfoScale which represents over 30 years of innovation and market leadership in both Software Defined Storage, High Availability and Disaster Recovery. Composed of Veritas Volume Manager, Veritas File System and Veritas Cluster Server, it is responsible for protecting the world's most mission-critical applications and databases across several industry verticals. Whether it's the financial sector, healthcare or state and local government, Veritas Alta™ Application Resiliency enables customers to rapidly deploy highly-available, performant, multi-tier services irrespective of the operating system, underlying storage, compute infrastructure or cloud platform. Moreover, it provides extensive integration with S4/HANA and SAP HANA database environments, with an emphasis on automation, data integrity, scale and minimizing downtime.

When considering whether or not to deploy Veritas Alta™ Application Resiliency within the Azure public cloud, you'll want to recognize that we provide not only an intuitive configuration model, with inclusion in the Marketplace, but a more granular, application-centric view of your critical services. As part of Azure's Shared Responsibility model, Azure addresses the potential for infrastructure outages only, if applications are installed across multiple Availability Zones (AZ's) for 99.99% uptime. The customers part of Azure's shared responsibility model is to ensure application availability which necessitates a dependency upon 3rd party clustering solutions. With Veritas Alta™ Application Resiliency, you gain out-of-the-box application availability support for all SAP HANA and S4/HANA components while simultaneously benefiting from the resilience of the Azure infrastructure.

Veritas Alta™ Application Resiliency protects the following critical SAP components, ensuring overall application availability in a distributed SAP environment.

- Databases:
  - SAP HANA DB
  - Oracle RDBMS
  - SAP MAxDB
  - SAP Sybase ASE
  - IBM DB2
  - Microsoft SQL server

- Central Services instance (ENQUEUE)

- Enqueue replication server (ERS)

- Primary application server (PAS)

- Additional application servers (AAS)

As an example, by itself SAP HANA databases and SAP Central services are installed on one instance at a time and are therefore considered single points of failure (SPOF). Since multiple SAP application server (dialog) instances can be configured to run in parallel, they do not form a SPOF. However, when an application deployed in the same AZ or across AZs fails, Microsoft Azure restarts only the application VM instances or redeploys the instance where the application has failed. This impacts the overall Recovery Time Objective (RTO). When deployed with Veritas Alta™ Application Resiliency, it ensures the proper failover of all SAP components to a designated or alternate Azure instance on which the application can reside in order to achieve the overall Recovery Time Objective (RTO) and Recovery Point Objective (RPO).

In order to monitor critical applications organizations often resort to OS-specific or customized scripts. To make this easier Veritas Alta™ Application Resiliency comes with the largest catalog of pre-built enterprise agents that simplify such deployments, thereby eliminating the need for custom tools. With intelligent failover capabilities, organizations can reduce the cost of redeploying instances by reducing the number of standby or passive servers within Azure.

By providing a packaged solution Veritas Alta™ Application Resiliency makes it simple and fast to configure high-availability (HA) and disaster recovery (DR) for critical SAP workloads. Moreover, the need for non-disruptive recovery validation across Azure regions can be met with Veritas Alta™ Application Resiliency's FireDrill DR testing capability.

In addition, Veritas Alta™ Application Resiliency provides agents for each of the following application and infrastructure components:

- SAP HANA (SAPHDB)
- SAP NetWeaver / S/4HANA (SAPNW)
- SAP Components (SAP Components)
- Microsoft Azure IP (Azure IP)
- Microsoft Azure Route (AzureDNSZone)

Types of Veritas Alta™ Application Resiliency configurations

The following graphic depicts various availability and recovery configurations created using Veritas Alta Application Resiliency in Azure:
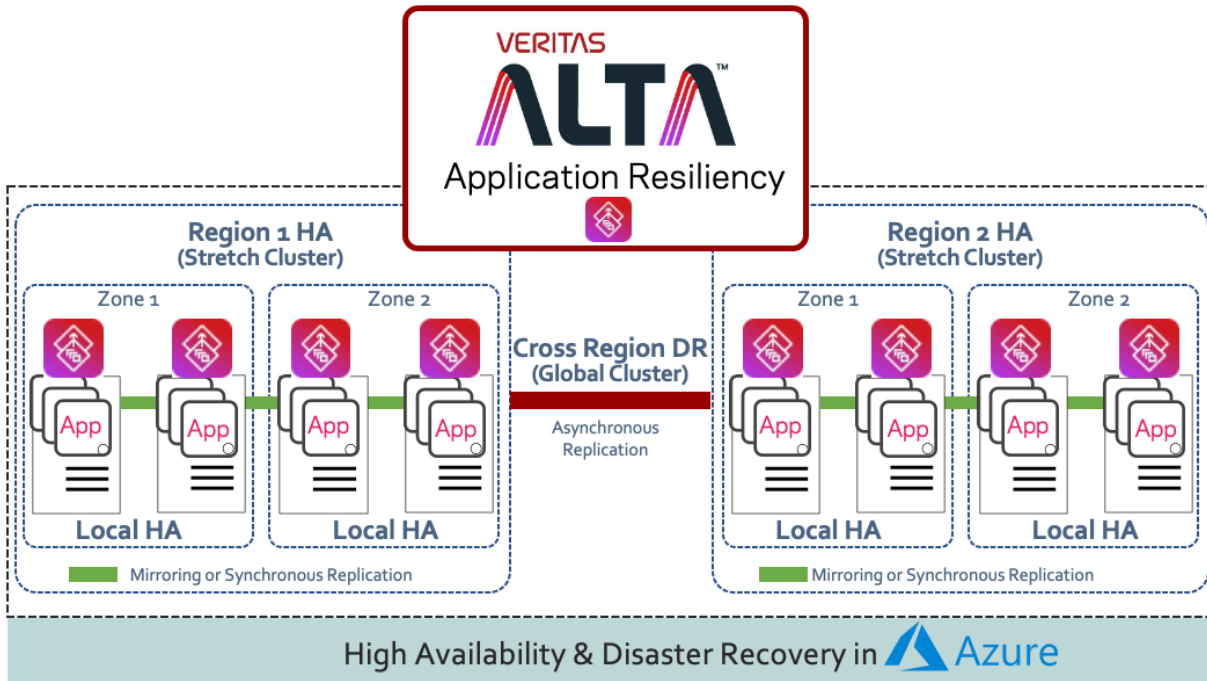
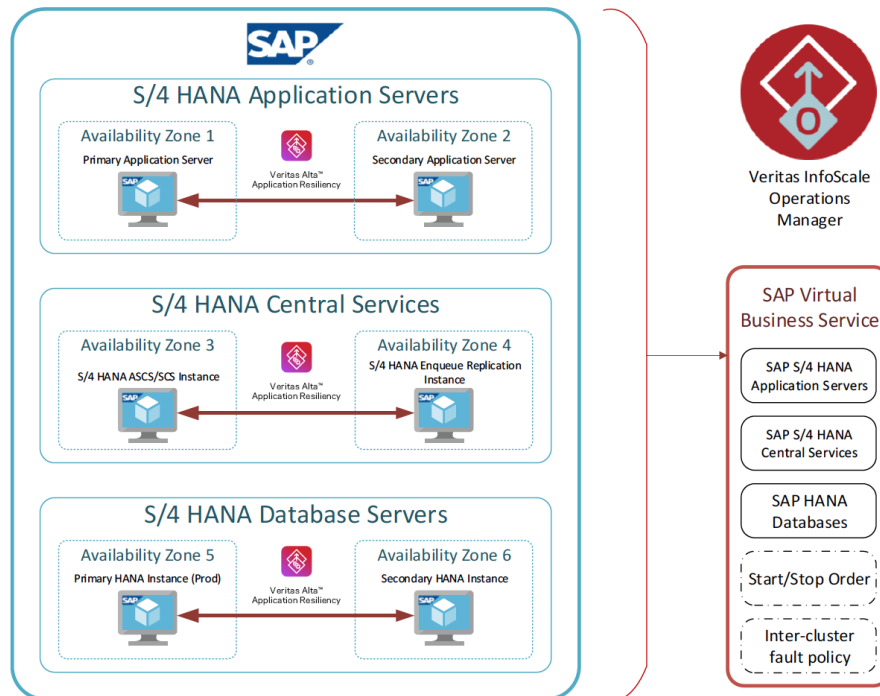**Veritas Alta™ Application Resiliency capabilities for SAP ecosystems**

The following HA and DR capabilities of Veritas Alta™ Application Resiliency make it ideal for managing an SAP ecosystem in Azure:

- Business continuity with minimal application downtime during failures through complete automation for the SAP landscape
- Optimal server utilization due to cost-effective failover configurations for development, testing, or production environments
- Support for cost optimization, Recovery Point Objective (RPO), and Recovery Time Objective (RTO) requirements for SAP workloads in Microsoft Azure
- Failover between on-premises data centers and Microsoft Azure
  - Failover between Microsoft Azure availability zones (AZ)
  - Failover between Microsoft Azure regions
  - Failover between Azure and other cloud service providers
- Supported on-premises SAP agents are still relevant in AZURE by providing:
  - A similar customer experience as on-premises
  - Flexible Storage Sharing (FSS) for data sharing in Microsoft Azure across instances
  - Replication across Microsoft Azure AZs and regions

About Veritas Virtual Business Services (VBS)

IT services are no longer standalone applications running on single servers. Business services or multi-tier applications like SAP Business Suite applications make up most of an IT organization's critical workloads, with different components of the application running on different tiers of infrastructure, each with their own unique availability requirements. A failure in any tier can bring down the entire business service and managing the recovery is time consuming and complex. Virtual Business Services are aware of the complete business service and takes the appropriate action in the event of a failure to restore the entire service. When an individual component fails, Virtual Business Service provides automated orchestration of the connections to other computing resources within an availability zone, across availability zones or even across regions. This means faster recovery and minimal downtime–with no manual intervention.

Sample VBS Architecture

Flexible Storage Sharing feature of Veritas Alta™ Application Resiliency

Veritas Alta™ Application Resiliency's FSS feature combines a distributed, high-performance, and highly available file system with the latest cloud storage and networking technologies. FSS lets you to unlock the potential of Direct Attached Azure managed disks, without sacrificing performance or availability. With FSS, you can use Microsoft Azure block storage services to create a highly available shared storage cluster in the cloud that provides high performance and resiliency for your critical applications.

Note: FSS supports all Azure storage volumes and can be used for SAP NetWeaver (S/4HANA) Application server instance mounts like sapmnt, trans, SAP Central service instance (ENQUEUE) and Enqueue Replication instance (ERS) mounts for fast failover over and high availability.

For details, see the Veritas FSS datasheet at:

https://www.veritas.com/content/dam/Veritas/docs/data-sheets/21327034_GA_ENT_DS-Veritas-Flexible-Storage-Sharing-EN.pdf

High Availability SAP Agents

Veritas Alta Application Resiliency provides a number of SAP specific high availability agents which can be found here: https://sort.veritas.com/agents.

Veritas Cluster Server Agent

The Cluster Server agent monitors specific resources within an enterprise application. They determine the status of resources and start or stop them based on external events that may affect application availability.

The Cluster Server agent for SAP HANA (SAPHDB) provides high availability for HANA instances where the data is replicated with HANA System Replication. The agent brings a HANA instance online, monitors the instance, and takes the instance offline. It also monitors the system processes and the server state and shuts down the server in case of a failover.

The SAPHDB agent supports the following HANA features:

- Fast failover of faulted Instance within an AZ (Availability Set)
- Primary instance takeover in case of an AZ failover
- Re-registration of the old primary as the secondary
- Auto-restart of a HANA instance before takeover
- In-depth trace level monitoring and IMF support

The agent supports the following types of HANA System Replication scenarios:

- Replication between AZs within the same Microsoft Azure region (local failover)
- Replication between AZs across regions (instances in different regions)
- Replication across AZs within one Microsoft Azure region and then to an AZ in a different region (two instances in the same region and a third instance in a remote region)

Veritas SAPNW agent for SAP S/4HANA / NetWeaver

The Veritas SAPNW agent is a certified cluster server agent from the SAP ICC program. The Cluster Server agent for SAP S/4HANA (SAPNW) provides high availability for S/4HANA instances. The agent can monitor and manage the status (online/offline) of an S/4HANA instance. It also monitors the system processes and the server state and shuts down the instance in case of a failover.

The SAPNW agent supports the following S/4HANA / NetWeaver features:

- Fast Failover of faulted Instances within an AZ (Availability Set)
- Primary instance takeover in case of an AZ failover
- Auto-restart of an S/4HANA instance before takeover
- In-depth monitoring and IMF support
- Support for in-depth TRACE and Debug Log levels for troubleshooting

The agent supports the following types of S/4HANA / NetWeaver scenarios:

- High availability between AZs within the same Microsoft Azure region (local failover)
- Disaster Recovery between AZs across regions (instances in different regions)
- Availability across AZs within one Microsoft Azure region and then to an AZ in a different region (two instances in the same region and a third instance in a remote region)

ENSA2 Support:

Under high availability it is mandatory that the old mechanism of Standalone Enqueue Server (ENSA1) has to fail over to the cluster node where the active ERS is running to acquire the replicated enqueue table which resides in the shared memory of the active ERS node.

The new Standalone Enqueue Server 2 and Enqueue Replicator 2 provides an improved high availability architecture with robust and fast replication, and failover.

In ENSA2, if the ASCS fails it can start on a separate node in the cluster and copy the lock entries from the enqueue replicator 2, it is not mandatory that it failover to the active ERS2 node.

The Veritas SAPNW agent supports both of the Enqueue replication methods and is certified by SAP.

SystemD Support:

SystemD is a system and service manager for the latest Enterprise Linux operating systems. It manages the application operations in system space. By default, SAP Application servers run in user space (init). As such, the SAP application servers do not stop gracefully during system reboots and this can cause application crashes in high availability systems.

The Veritas SAPNW/SAPHDB agents provide graceful shutdowns of the SAP applications during system reboots.

Veritas agent for Microsoft Azure IP

Veritas provides the AZUREIP agent, which lets you monitor and manage the following networking resources in AZURE:

- Private IP: A private IP is a private numerical address that networked devices use to communicate with one another

- Azure IP: An Azure IP address is a static IPv4 address designed for dynamic cloud computing, and it is associated with your Microsoft Azure account

- Overlay IP: Microsoft Azure allows you to redirect IP address traffic to an Azure instance in a Virtual Private Network (VPC) regardless of the subnet or AZ to which it belongs. An overlay IP lets you fail over IP addresses between cluster nodes when they are spread across multiple subnets or AZs

Veritas also supports the Azure load balancer which enables the movement of virtual IPs between the clustered hosts as an alternative.

**Veritas agent for Microsoft AzureDNSZone**

Azure DNSZone is a highly available and scalable cloud Domain Name System (DNS) web service. Veritas provides the AzureDNSZone agent to update and monitor the mapping between host names and IP addresses. The agent manages the mapping for the Azure route domain when failing over nodes across subnets. When you create a hosted zone, AzureDNSZone automatically creates a name server (NS) record and a start of authority (SOA) record for the zone.

If the resource records need to be dynamically added and deleted from the Azure route domain during failover, you must use the AzureDNSZone agent. The agent updates the NS with the new resource record mappings during failover and allows the clients to connect to the failed over instance of the application.

Note: If you do not want to use the AzureDNSZone agent, you can continue to use the Veritas DNS agent for managing DNS records.

## Typical S/4HANA / NetWeaver Deployment Architecture on Azure

The following graphic describes the overall deployment of an SAP S/4HANA application server with an SAP HANA database on AZURE.
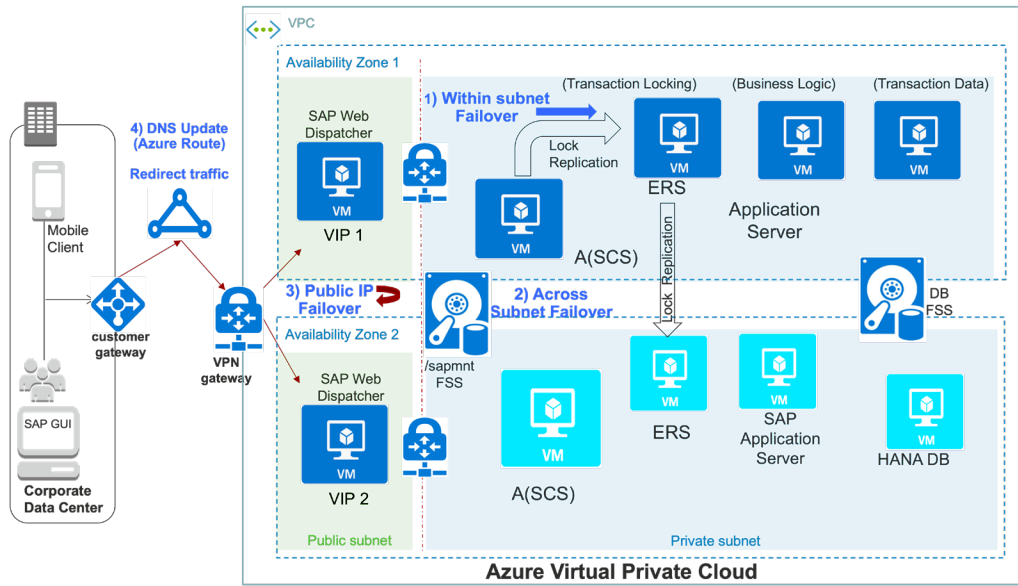
In addition to configuring SAP HANA for HA, DR, or both, you need to ensure that the client applications (for example, the S/4HANA/ NetWeaver application server, JDBC, ODBC connection, and so on) can re-establish their connection with the SAP HANA system after the failover. To do so, you can configure either network-based IP redirection or network-based DNS redirection of your SAP HANA system. Veritas agents for SAP support end-to-end HA and DR for SAP NetWeaver and SAP S/4HANA as well.

Common Dependency Between SAP S/4HANA and SAP HANA Database

The following graphic depicts the typical dependency between an SAP application and an SAP HANA database:
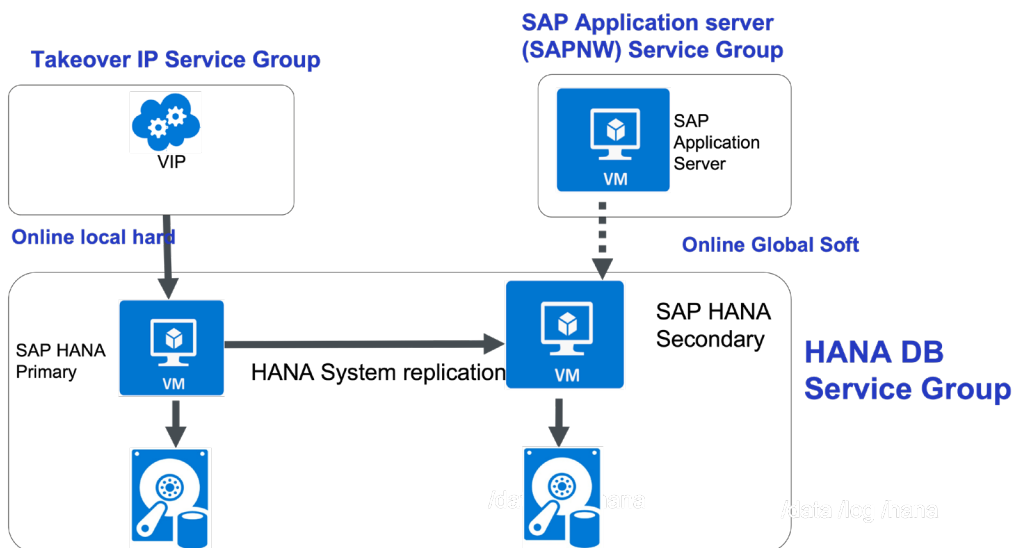
Cost Optimization of SAP Instances on Azure

Microsoft Azure lets you create and optimize SAP instances for development, testing, or production environments. If an SAP application instance outage occurs, Veritas Alta™ Application Resiliency fails over the instances between the designated SAP systems without disrupting the client connections. Thus, it reduces the overall Total Cost of Ownership (TCO) in case of a disruption or outage of SAP instances on AZURE.
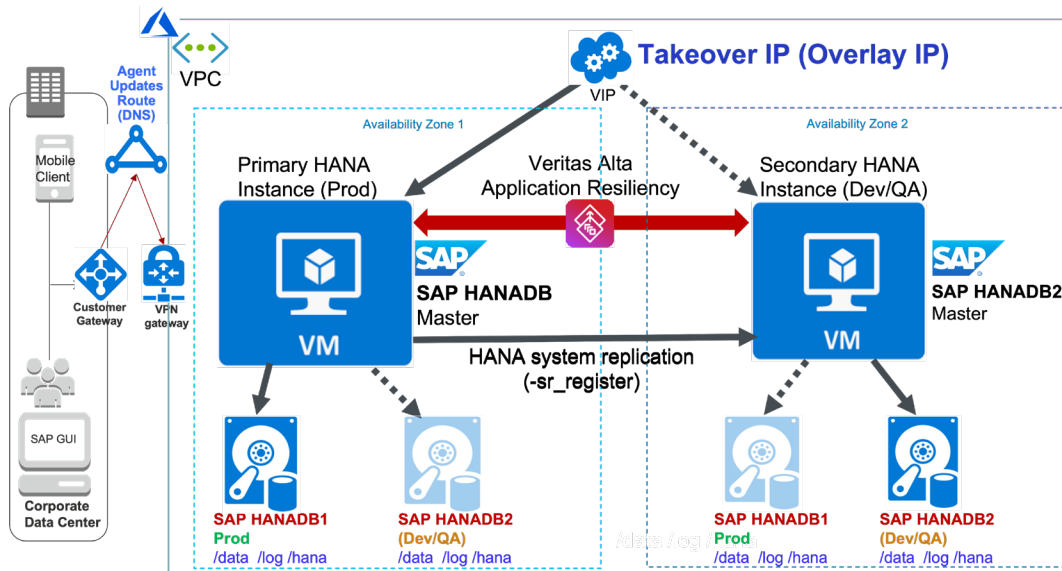
## Supported Use Cases for SAP HANA on Azure

The following graphics represent the availability configuration scenarios supported by Veritas Alta™ Application Resiliency for SAP HANA. If an SAP HDB instance in a production environment fails, Veritas detects the failure and moves that instance to either a development or a testing node.

Veritas Alta™ Application Resiliency lets you monitor and control SAP HANA database instances in the following use cases:

SAP HANA Instances in the Same Availability Set

In this scenario, a master instance (primary) and a standby instance (secondary) are configured along with HANA System Replication in the same AZ and availability set.

If the master instance fails, the SAPHDB agent promotes the secondary to the primary.
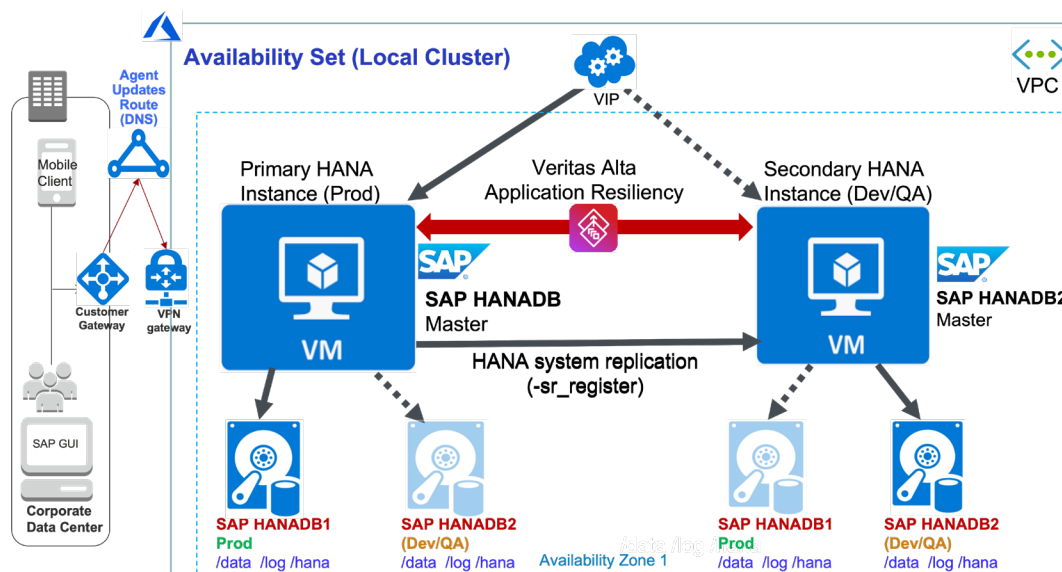
Note: The failover operations are performed according to the HANA HA takeover guidelines and the SAPHDB agent adheres to the HANA takeover rules.

You can refer to the following link to learn more about availability set:

https://docs.microsoft.com/en-us/azure/virtual-machines/linux/tutorial-availability-sets

SAP HANA Instances Across AZs in the Same Microsoft Azure Region

In this configuration, the primary and the secondary instances of SAP HANA exist either in the same AZ or in different AZs in the same region. When HANA System Replication is enabled between the two instances, all the data and the logs are replicated to the secondary instance.

In this example, the primary (master) and the secondary (worker) instances are configured in different AZs with local clustering.
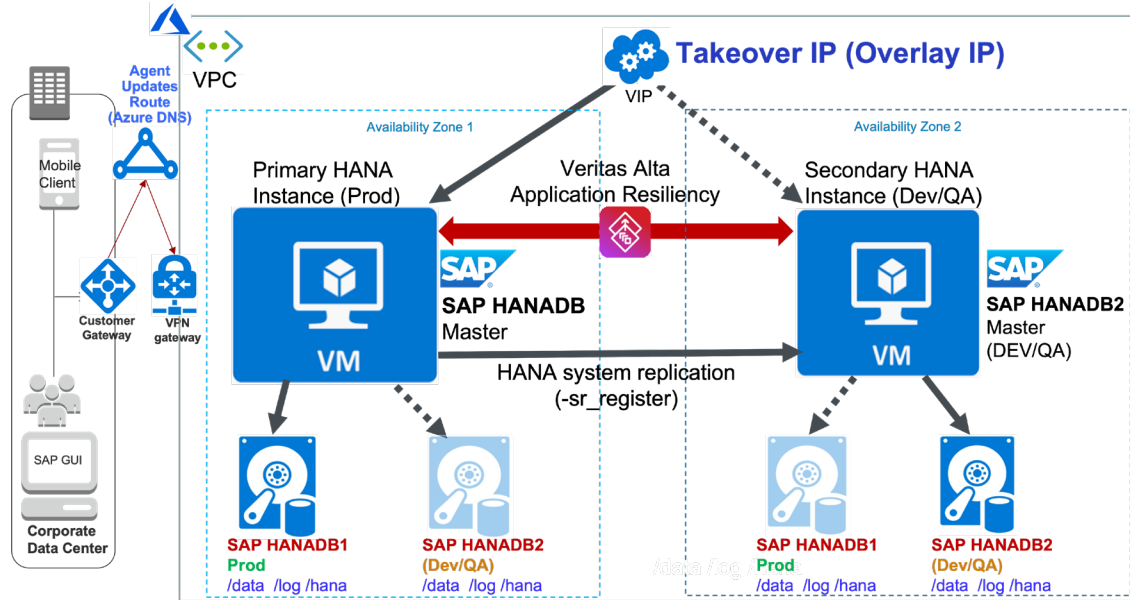
If the primary instance fails or becomes unavailable, the SAPHDB agent identifies the fault and automatically triggers the takeover operation on the secondary instance. The following graphic depicts this action:
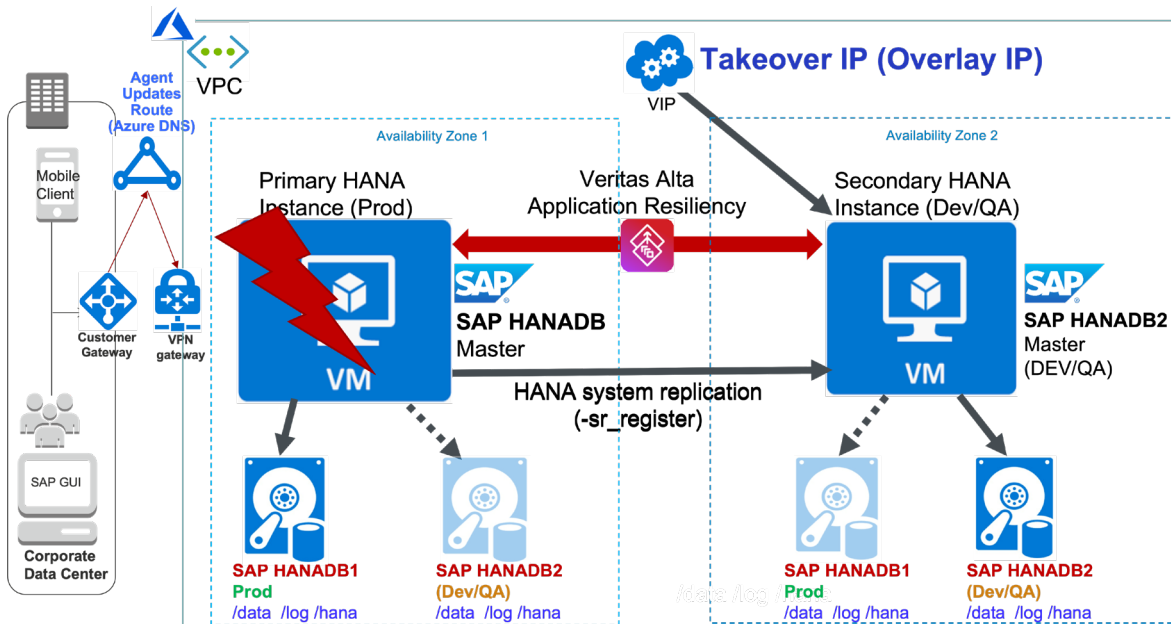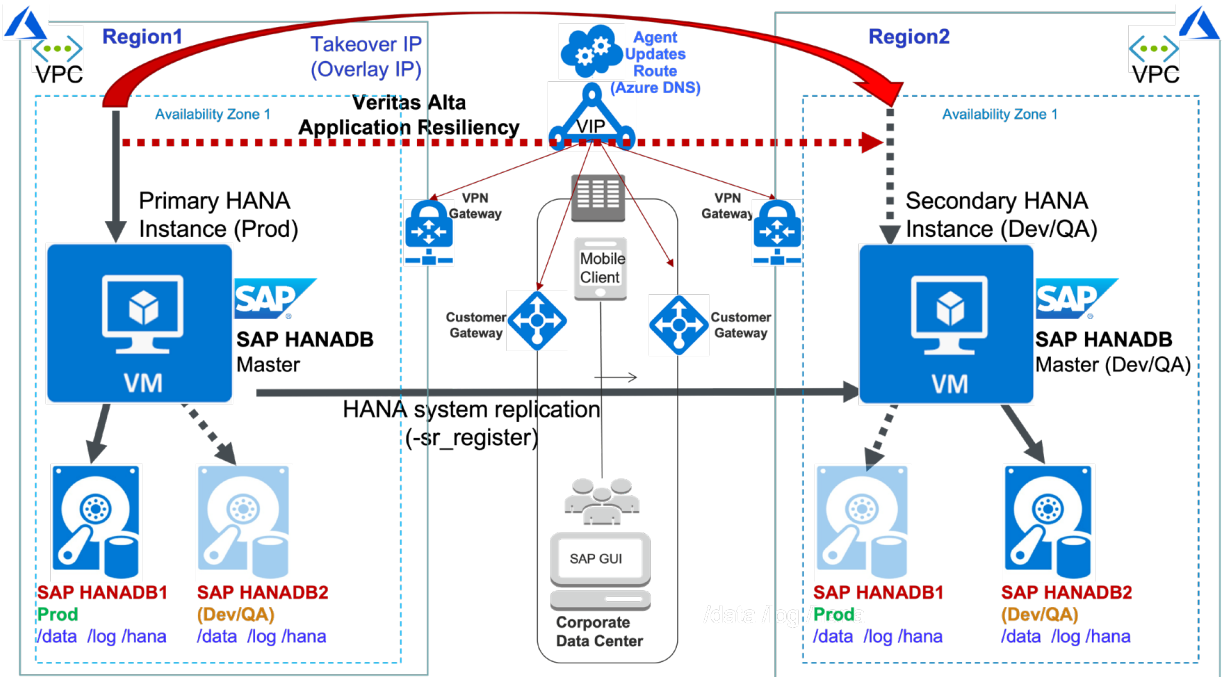

You may choose to clear the fault and perform any other necessary maintenance activities on the old primary instance. Thereafter, the SAPHDB agent can automatically designate it as the secondary instance by using the auto re-register feature. HANA System Replication can then continue the data replication in the reverse direction. The following graphic depicts this action:
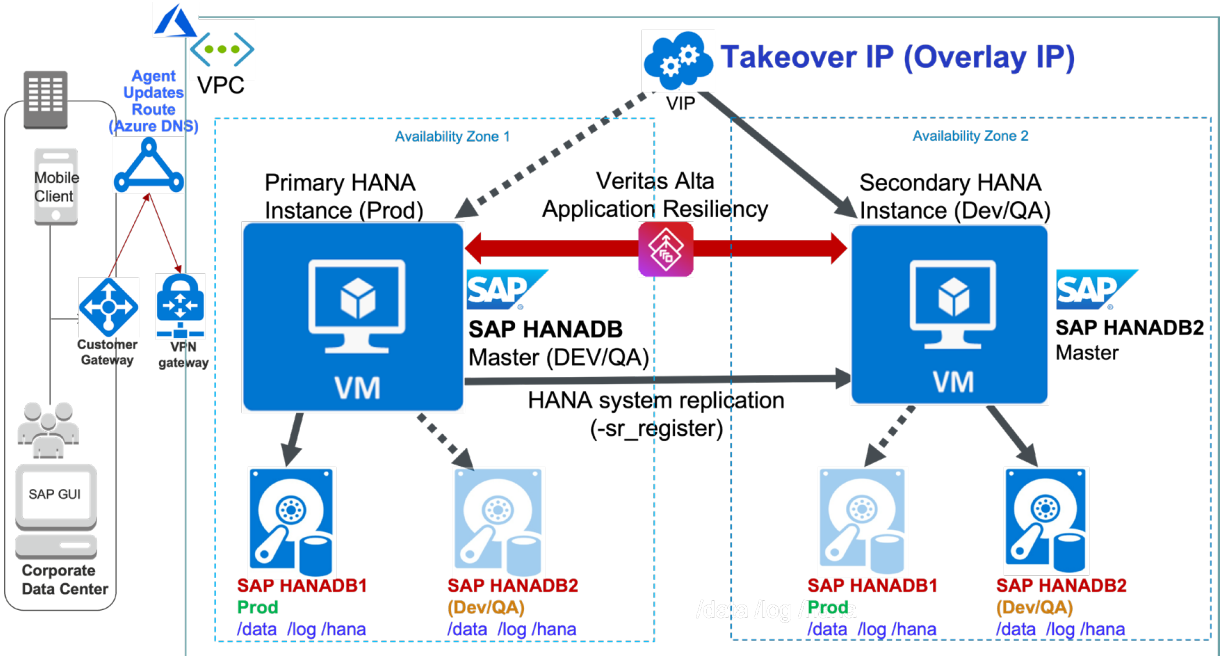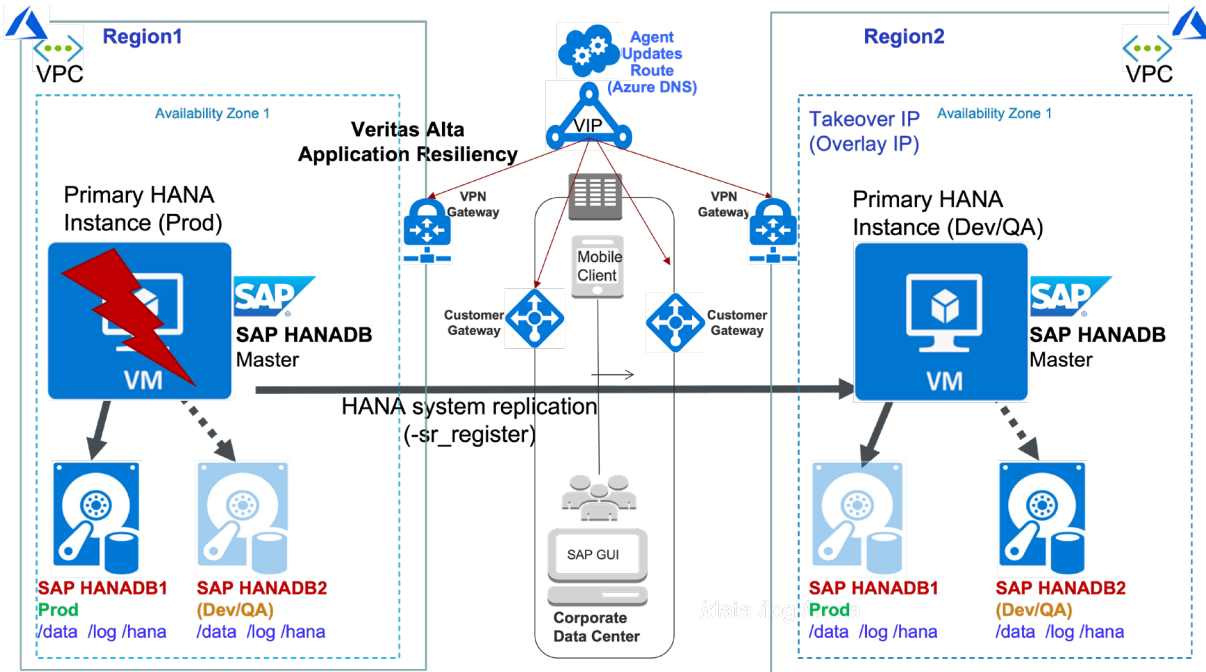
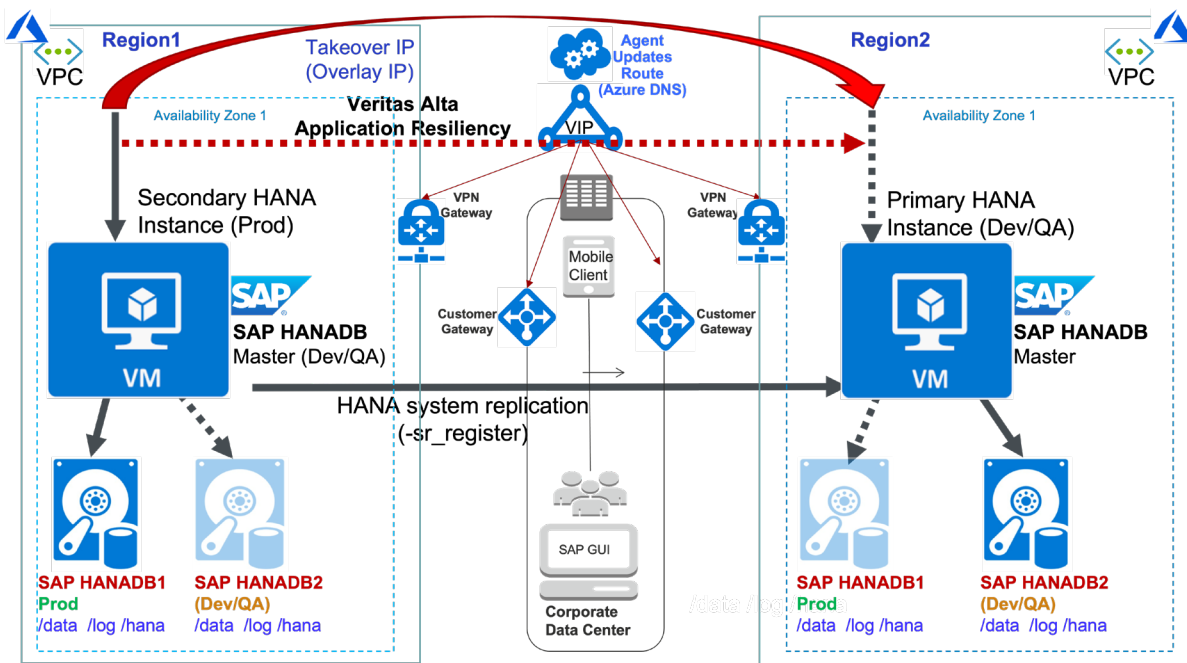**Single-instance SAP HANA Databases Across Microsoft Azure Regions**

You can configure single SAP HANA database instances across Microsoft Azure regions, and they can be controlled and monitored by Veritas agents using a Global Cluster Option (GCO) configuration. The following graphic depicts such a configuration:

If the primary instance fails or becomes unavailable, the SAPHDB agent identifies the fault and automatically triggers the takeover operation on the secondary instance in the other region. The following graphic depicts this action:


You'll need to clear the fault and perform any other necessary maintenance activities on the old primary instance. Thereafter, the SAPHDB agent automatically designates it as the secondary instance by using the auto re-register feature. The following graphic depicts this action:

SAP HANA Database Instances Across Microsoft Azure Regions (cascading scenario)

In this scenario, the HANA database primary and secondary are configured in AvailabilityZone1 and AvailabilityZone2 respectively in the N.Virginia region. The third HANA database instance is in the WestUS region. The following graphic depicts this cascading configuration:
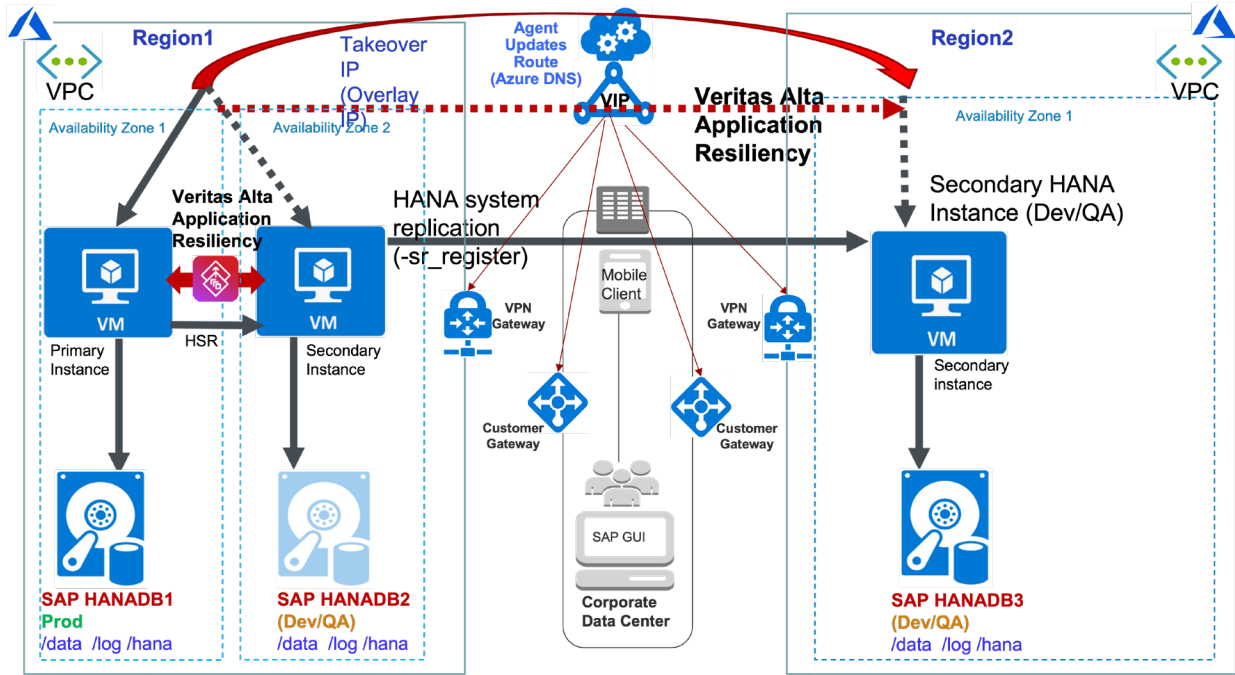

If the primary instance fails, the SAPHDB agent automatically triggers the takeover by failing over the IP resource from the primary to the secondary instance in the same region. Virtual IP failover operations are managed by the AZUREIP and the IP agents. The following graphic depicts how the secondary becomes the primary and is active in AvailabilityZone2:
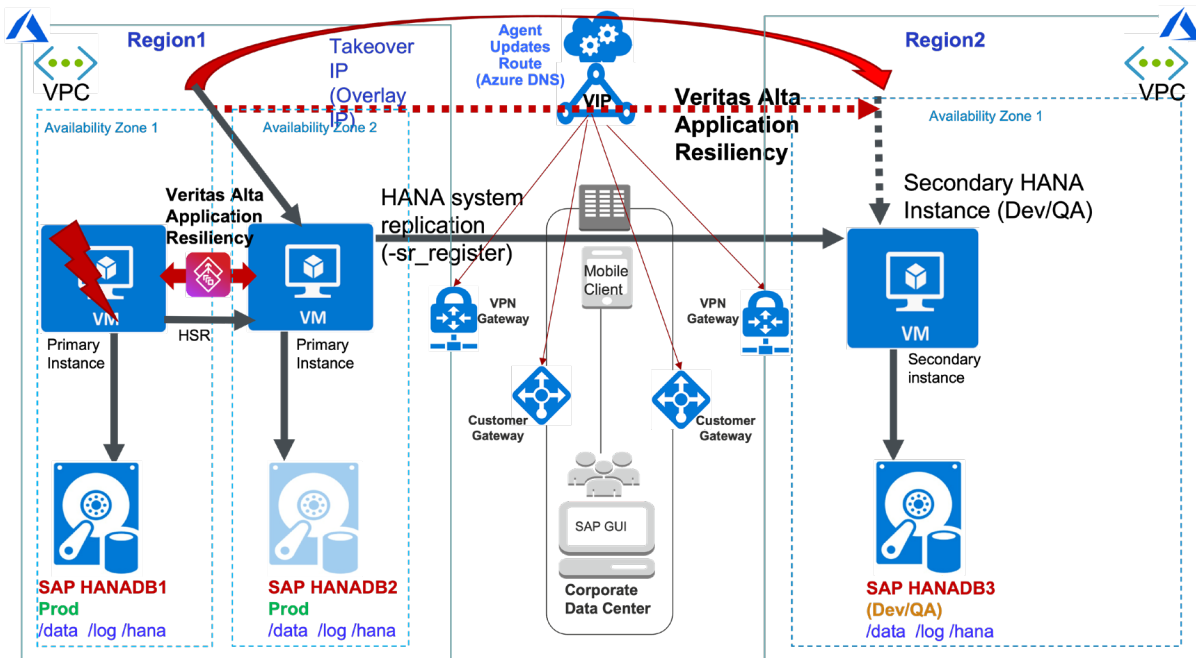
If all the instances within in an AZ or a region fail, the SAPHDB agent automatically triggers the takeover action by failing over the IP resource from the primary to the secondary instance in the remote region. The following graphic depicts how the secondary in the remote region becomes the primary:
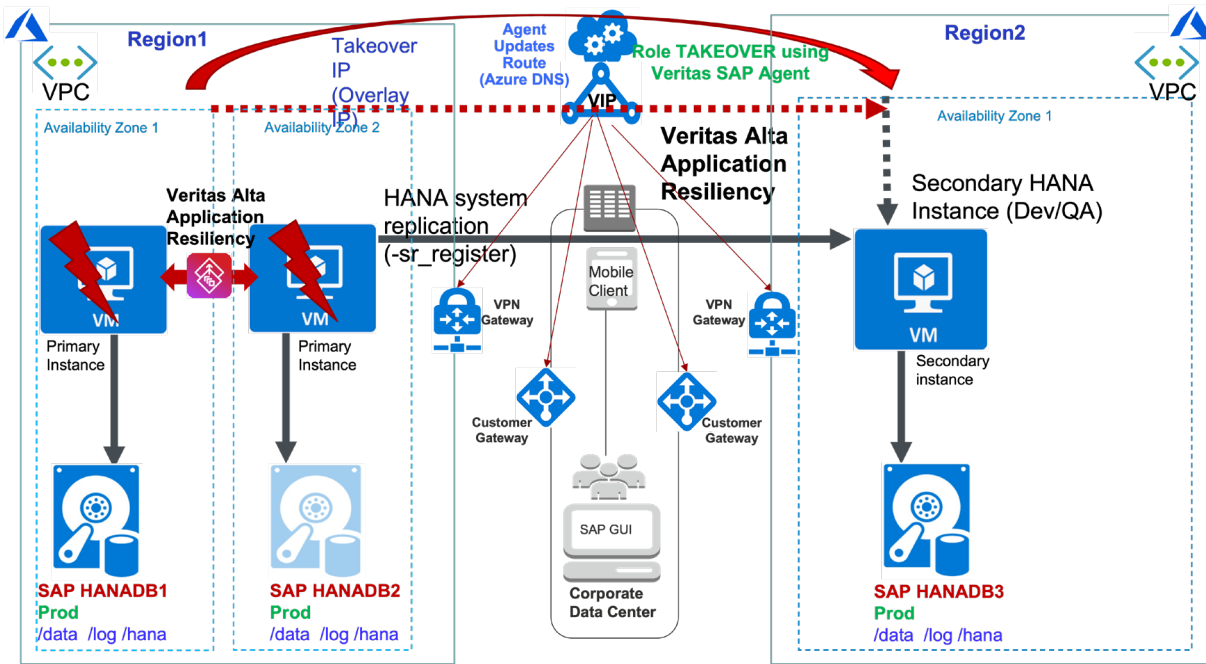
Thereafter, you'll need to clear the faults on the instances in the Region1 and re-register them with the current primary in Region2. The following graphic shows the direction of the replication being reversed:
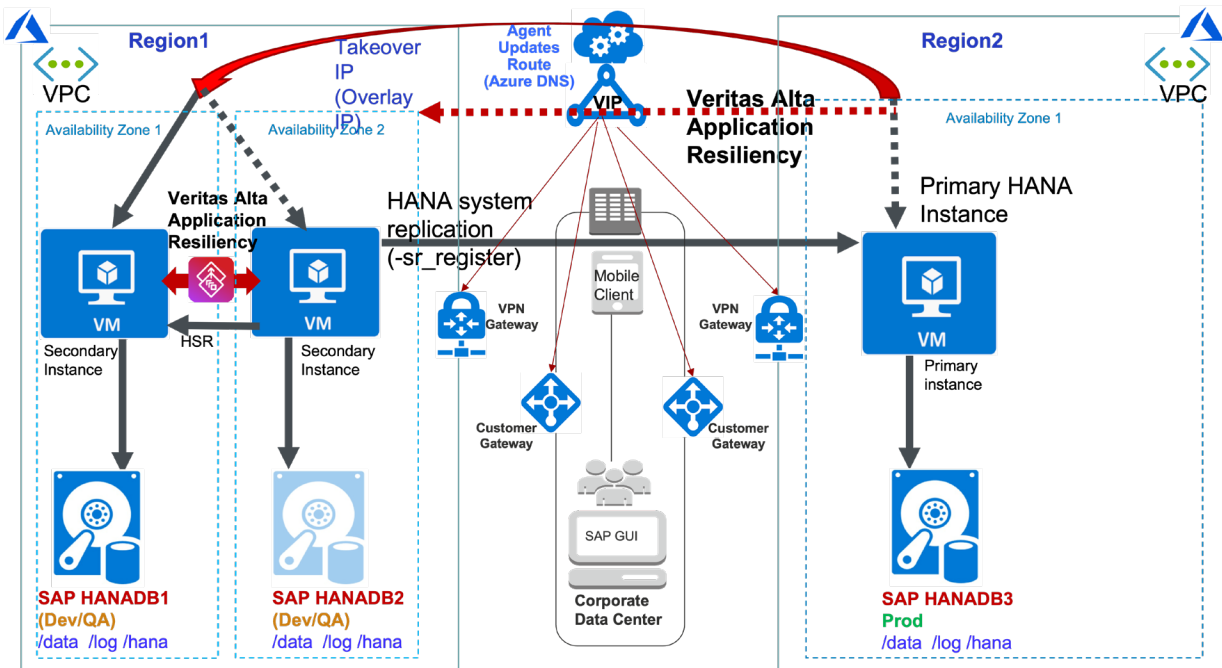
For details, refer to the Veritas agent installation and configuration documentation at:

https://sort.veritas.com/agents/getting_started

Configuration Procedure

1. Configure a VPN to connect to the Microsoft Azure cloud.
   Follow the procedure as per Azure documentation.

2. Create Azure instances based on the planning document and the sizing of Instances recommended by Azure for SAP systems.

3. Install and configure Veritas Alta™ Application Resiliency on all the systems that must be part of the cluster. For details, refer to the Veritas InfoScale Installation Guide.

4. Allocate SAP-recommended Storage.

5. Prepare the cloud environment as follows:

   a. Create the Azure instances.

   b. Allocate SAP-recommended storage.

   c. Mount the following SAP mount points using SAP the recommended file system for HANA DB:
      - /hana/shared/
      - /hana/data/
      - /hana/log/

6. If installing and configuring SAP S/4HANA / NetWeaver for use with HANA, use Veritas Alta™ Application Resiliency for storage configuration for /sapmnt, /usr/sap directories.

   Note: FSS supports all Azure storage services. VxVM, VxFS, and FSS can be used with S/4HANA / SAP NetWeaver application servers as well as most database management systems, however these utilities are not currently supported for use with SAP HANA databases.

   For details, refer to the following InfoScale documentation:
   Storage Foundation and High Availability Configuration and Upgrade Guide
   Storage Foundation Cluster File System High Availability Administrator's Guide
   Storage Foundation Cluster File System High Availability Configuration and Upgrade Guide
   Veritas InfoScale Disaster Recovery Implementation Guide

For specific instructions, see the Storage Foundation Cluster File System High Availability Administrator's Guide.

7. Install and configure SAP HANA on the Microsoft Azure instances on primary and secondary sites as per your disaster recovery plan.

8. Configure SAP HANA system replication between the sites on AZURE. Ensure that all the required ports in Microsoft Azure are enabled for replication.

9. Configure InfoScale cluster service groups and resources for the SAP HANA instances. For details, refer to the following Veritas Alta™ Application Resiliency documentation: Storage Foundation and High Availability Configuration and Upgrade Guide
   VCS saphdb install guide: https://sort.veritas.com/agents/download_docs/19450/vcs_saphdb_install

Summary

With SAP HANA being a popular option for enterprise SAP deployments, Veritas Alta™ Application Resiliency is a certified solution to ensure HA as well as simplified DR automation and testing for HANA databases running in Azure. It has direct integration with SAP HANA and Azure native tools, giving it visibility into all of the components and processes that need to be managed as part of an HA configuration for maximum application uptime. Some key benefits of using Veritas Alta™ Application Resiliency to manage HA and DR for SAP HANA in Azure are:

- ✓ Near-instant fault detection that provides minimal RTO and RPO for HANA databases
- ✓ Automation of the entire failover process and non-disruptive DR testing across Azure regions
- ✓ Flexible configuration options that support multiple usage scenarios within Azure zones and regions
- ✓ Support for the broader SAP ecosystem that may include non-HANA SAP deployments

With the ability to provide best-in-class architectural flexibility, availability and resiliency for SAP HANA, Veritas Alta™ Application Resiliency enables businesses to improve upon SAP application SLA's while reducing infrastructure footprints by integrating cloud into their IT strategy. Whether running on-premises, in a hybrid cloud configuration or entirely within a cloud environment, Veritas Alta™ Application Resiliency is an enterprise software-defined availability and resiliency solution for SAP HANA in Azure that provides the tools needed to run SAP applications with maximum uptime and fulfill an organizations portion of Microsoft Azure's shared responsibility model.

References

SAP Notes for SAP on AZURE:

- 1588667: Overview of related SAP Notes and Web-Links
- 1656099: Supported SAP, DB/OS and Microsoft Azure products
- 1656250: Support prerequisites
- 171356: SAP Software on Linux: Essential information

Azure Documentation:

- SAP on Azure
- SAP on Azure Implementation Guide

Veritas Documentation:

- Veritas InfoScale
- Veritas InfoScale Trial License
- Veritas InfoScale Windows Documentation
- Cluster Server Agent Pack Getting Started Guide

About Veritas

Veritas Technologies is a leader in multi-cloud data management. Over 80,000 customers—including 95 percent of the Fortune 100—rely on Veritas to help ensure the protection, recoverability, and compliance of their data. Veritas has a reputation for reliability at scale, which delivers the resilience its customers need against the disruptions threatened by cyberattacks, like ransomware. No other vendor is able to match the ability of Veritas to execute, with support for 800+ data sources, 100+ operating systems, 1,400+ storage targets, and 60+ clouds through a single, unified approach. Powered by Cloud Scale Technology, Veritas is delivering today on its strategy for Autonomous Data Management that reduces operational overhead while delivering greater value. Learn more at veritas.com. Follow us on Twitter at @veritastechllc.

VERITAS™

2625 Augustine Drive
Santa Clara, CA 95054
+1 (866) 837 4827
veritas.com

For global contact
information visit:
veritas.com/company/contact