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Veritas Alta™ Enterprise Resiliency for SAP S/4HANA on Google Cloud Platform

High Availability and Disaster Recovery Reference Architecture

SAP® Certified
Integration with SAP S/4HANA®

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Contents

Executive Summary

A growing number of organizations are migrating their business-critical IT applications and services to the public cloud. Nowhere is this more evident than with SAP S/4HANA, which represents nearly 25 percent of the global market share for Enterprise Resource Planning (ERP) applications. With public cloud providers largely operating on a shared responsibility model, there is an ongoing need to ensure that your business-critical SAP applications have a proven enterprise solution to ensure uptime and resiliency.

Veritas Alta Enterprise Resiliency is a cloud-focused solution designed to keep your SAP business-critical applications highly available in the Google Cloud Platform (GCP). With functionality designed specifically to ensure availability and resiliency for SAP S/4HANA and GCP cloud infrastructure, Veritas Alta Enterprise Resiliency provides several key benefits:

- Availability—ensure maximum uptime for your SAP S/4HANA business applications in the cloud

- Resiliency—automated disaster recovery minimizes application downtime and simplifies management

- Optimization—automate manual processes and minimize both downtime and operational costs

As an SAP certified solution, Veritas Alta Enterprise Resiliency has a proven track record of delivering high availability and resiliency for business-critical SAP applications for the world's largest organizations. When deploying SAP S/4HANA in GCP, Veritas Alta Enterprise Resiliency has been designed to ensure both your SAP applications and your cloud infrastructure is highly available and providing a smooth and predictable experience for end users.

Document Focus

This document will provide guidance on how to implement a highly available SAP S/4HANA environment in the GCP public cloud using Veritas Alta Enterprise Resiliency. It is intended for the following audiences:

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

- SAP Basis and SAP implementation consultants who are familiar with GCP and want to manage the availability of SAP systems running in GCP using Veritas Alta Enterprise Resiliency

Note: This document is not meant to replace any standard SAP documentation or GCP documentation. For information on basic SAP high availability configurations on GCP, refer to the GCP documentation at:

https://cloud.google.com/solutions/sap/docs/overview-of-sap-on-google-cloud

https://cloud.google.com/solutions/sap/docs/netweaver-ha-planning-guide

Veritas Alta Enterprise Resiliency

With advanced volume management, file system and application clustering technology, Veritas Alta Enterprise Resiliency is responsible for protecting the world's business-critical applications and databases across several industry verticals. It enables you to rapidly deploy highly available, performant, multi-tier services using nearly any operating system, underlying storage, compute infrastructure or cloud platform. Veritas Alta Enterprise Resiliency also includes extensive integration with S/4HANA and SAP HANA, with an emphasis on automation, data integrity, scalability and minimizing downtime.

Veritas Alta Enterprise Resiliency offers full support for the GCP public cloud and includes an intuitive configuration model that provides a granular, application-centric view of your critical services. GCP by design addresses the potential for infrastructure outages when applications are installed in multiple Availability Zones (AZ's). However, the cloud shared responsibility model implies that infrastructure high availability alone does not address the requirement to configure your SAP application environment for high availability – this requires an independent clustering solution. Veritas Alta Enterprise Resiliency delivers native support for all SAP S/4HANA components with the additional benefit of improved resiliency for the GCP cloud infrastructure services.

Veritas Alta Enterprise Resiliency is easily deployed and managed inside GCP compute engine instances, thereby offering operational parity with similar configurations on-premises. GCP cloud infrastructure does not directly integrate with the embedded resiliency features from SAP, hence the need for Veritas Alta Enterprise Resiliency which can automate high availability, resiliency and recovery procedures.

Veritas Alta Enterprise Resiliency for SAP

Veritas Alta Enterprise Resiliency protects the following critical SAP components, ensuring overall application availability in a distributed SAP environment:

- Database

- Central Services instance (ENQUEUE)

- Enqueue replication server (ERS)

- Primary application server (PAS)

- Additional application servers (AAS)

As an example, SAP HANA databases and SAP Central services are installed on one instance at a time and are therefore considered single points of failure. Since multiple SAP application server (dialog) instances can run in parallel, they do not form a single point of failure. However, when an application deployed in the same AZ or across AZs fails, GCP only restarts 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 Enterprise Resiliency, it ensures the proper failover of all SAP components to a designated GCP 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 Enterprise Resiliency comes with the largest catalog of pre-built enterprise agents that simplify such deployments, thereby eliminating the need for custom tools.

A Veritas Alta Enterprise Resiliency solution is simpler and faster because it provides automated DR and non-disruptive DR testing across GCP regions.

In addition, Veritas Alta Enterprise Resiliency provides agents for each of the following application and infrastructure components: SAP HANA (SAPHDB), SAP NetWeaver / S/4HANA (SAPNW), SAPComponents (SAP Component), Google IP (GCP IP).

Types of Veritas Alta Enterprise Resiliency configurations

The various availability and recovery configurations created using Veritas Alta Enterprise Resiliency are depicted in Figure 1.
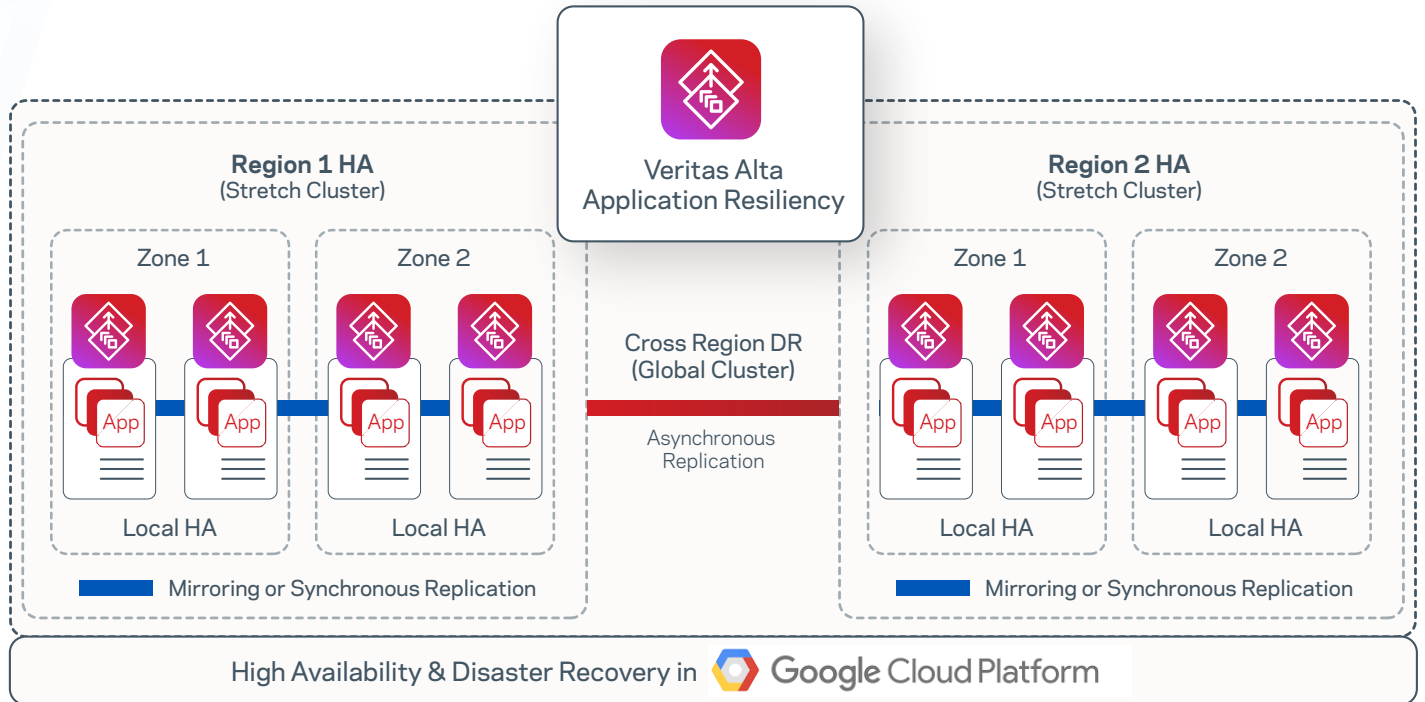

Figure 1. Veritas Alta Enterprise Resiliency HA and DR Configurations

Veritas Alta Enterprise Resiliency capabilities for SAP ecosystems

The following HA and DR capabilities of Veritas Alta Enterprise Resiliency make it ideal for managing an SAP ecosystem in Google Cloud:

- Business continuity with minimal application downtime during failures through complete automation for the SAP landscape

- Support for on-premises to GCP failover

- Optimal server utilization due to cost-effective failover configurations for development, testing, or production environments

- Support for failover between GCP availability zones (AZ)

- Support for failover between GCP regions

- Support for failover between GCP and other cloud service providers

- Support for cost optimization, Recovery Point Objective (RPO), and Recovery Time Objective (RTO) requirements for SAP workloads in GCP

- Supported on-premises SAP agents are relevant in GCP, because they offer:

    - Similar customer experience as on-premises

    - Flexible Storage Sharing (FSS) for data sharing in GCP across instances

    - Replication across GCP 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 services, with different components of the application running on different tiers of infrastructure with their own unique availability needs. A failure at 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 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. Figure 2 shows a sample VBS architecture.
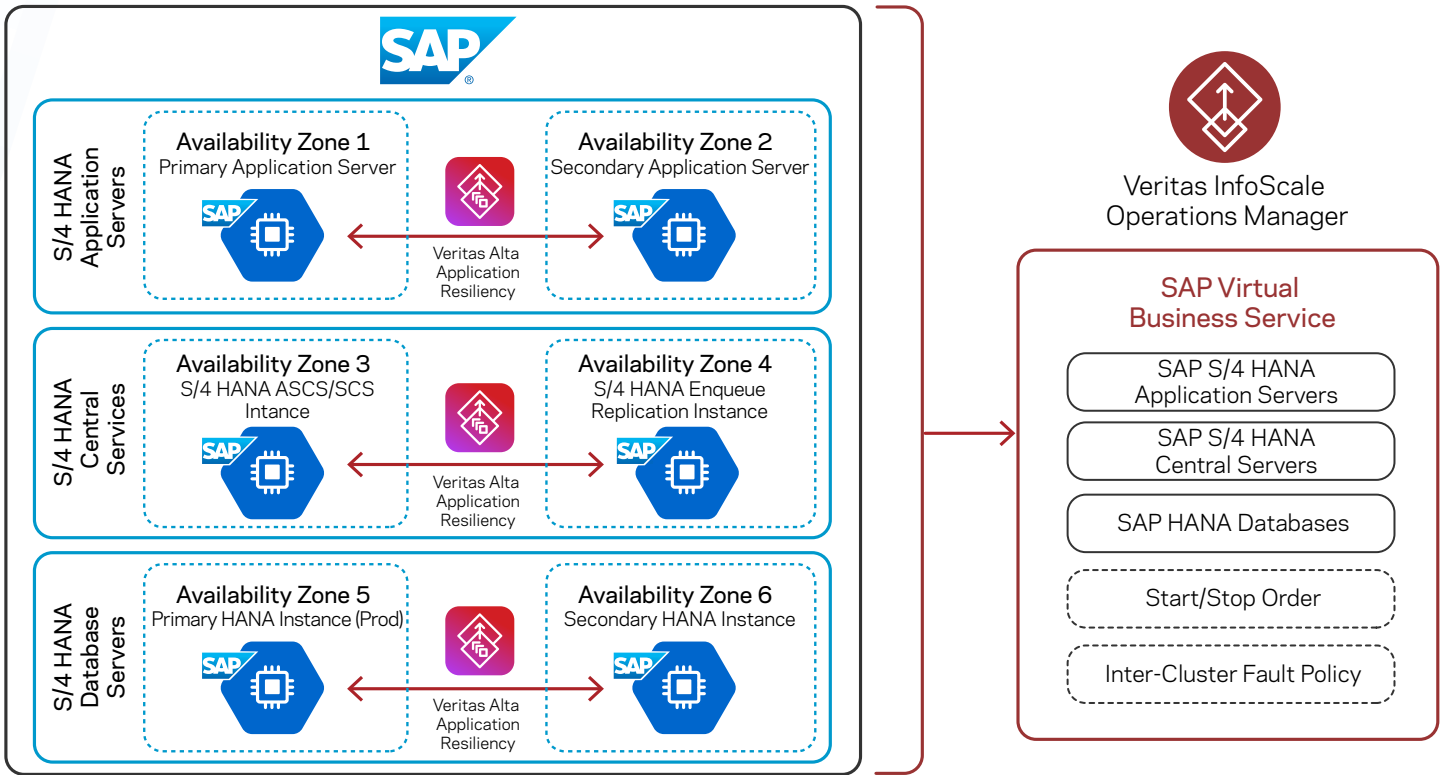

Figure 2. Sample VBS Architecture

Flexible Storage Sharing feature with Veritas Alta Enterprise Resiliency

Veritas Alta Enterprise 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 unlock the potential of persistent disks within GCP, without sacrificing performance or availability. With FSS, you can use these persistent disks 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 GCP 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 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 Enterprise Resiliency provides a number of SAP specific high availability agents which can be found here: https://sort.veritas.com/agents.

Veritas Cluster Server Agent for SAP HANA

The Cluster Server agents 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 GCP region (local failover)
- Replication between AZs across regions (instances in different regions)
- Replication across AZs within one GCP 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 Zone)
- 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 GCP region (local failover)
- Disaster Recovery between AZs across regions (instances in different regions)
- Availability across AZs within one GCP region and then to an AZ in a different region (two instances in the same region and a third instance in a remote region)

Standalone Enqueue Server 2 (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 in order to acquire a replicated enqueue table which resides in the shared memory of the active ERS node.

The new Standalone Enqueue Server 2 and Enqueue Replicator 2 provide 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 over to the active ERS2 node.

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

Veritas agent for Google IP

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

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

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

- Overlay IP: GCP allows you to redirect IP address traffic to a GCP 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

Typical S/4HANA / NetWeaver Deployment Architecture on GCP

Figure 3 describes the overall deployment of an SAP S/4HANA application server with an SAP HANA database on GCP.
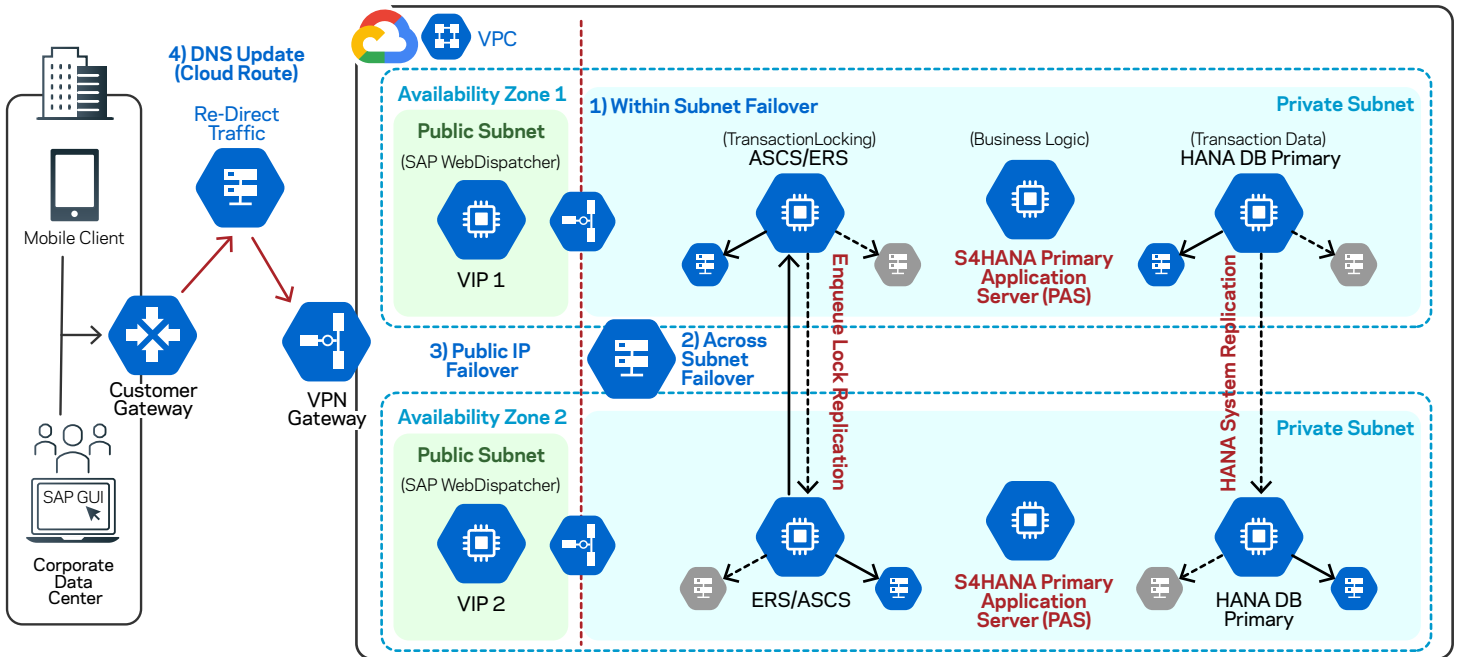
Figure 3. Deployment of an SAP S4HANA application server with an SAP HANA database on GCP

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. The Veritas agents for SAP support end-to-end HA and DR for SAP NetWeaver and SAP S/4HANA.

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

Figure 4 depicts the typical dependency between an SAP application and an SAP HANA database:
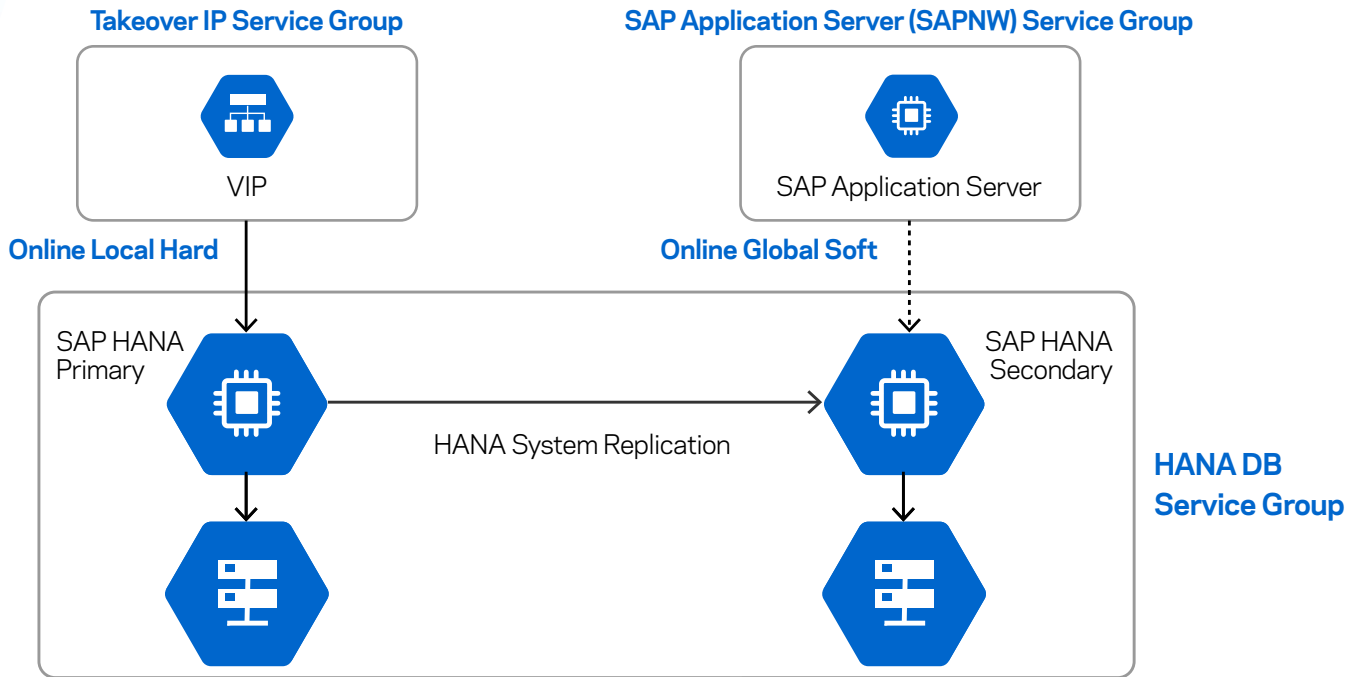

Figure 4. Dependency between an SAP application and SAP HANA database

Cost Optimization of SAP Instances on GCP

GCP lets you create and optimize SAP instances for development, testing, or production environments. If an SAP application instance outage occurs, Veritas Alta Enterprise 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 disaster or an outage of SAP instances on GCP.
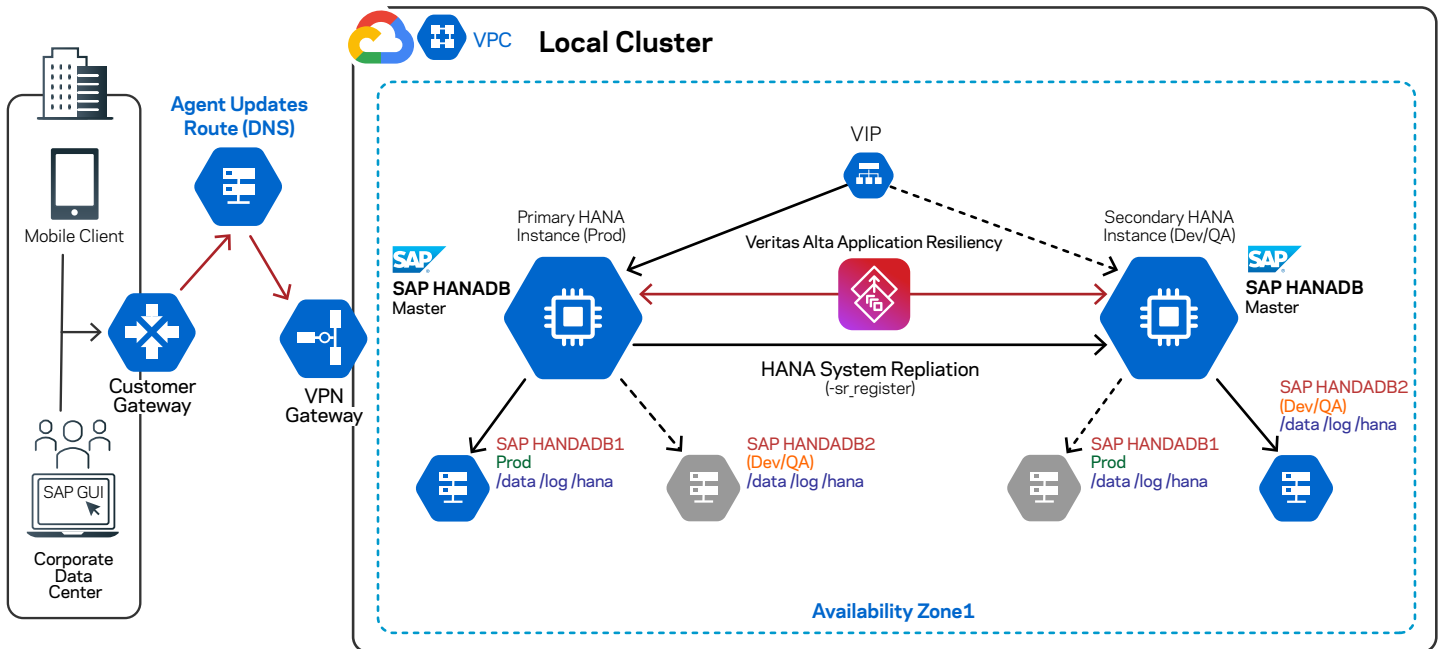
Figure 5. If an SAP HDB instance in production fails, Veritas Alta Enterprise Resiliency will detect the SAP HDB instance failures and non-disruptively fail over the instances between the designated SAP systems

Supported Uses Cases for SAP HANA on GCP

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

Veritas Alta Enterprise Resiliency lets you monitor and control SAP HANA database instances for the following use cases.

SAP HANA instances in the same Availability Zone

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

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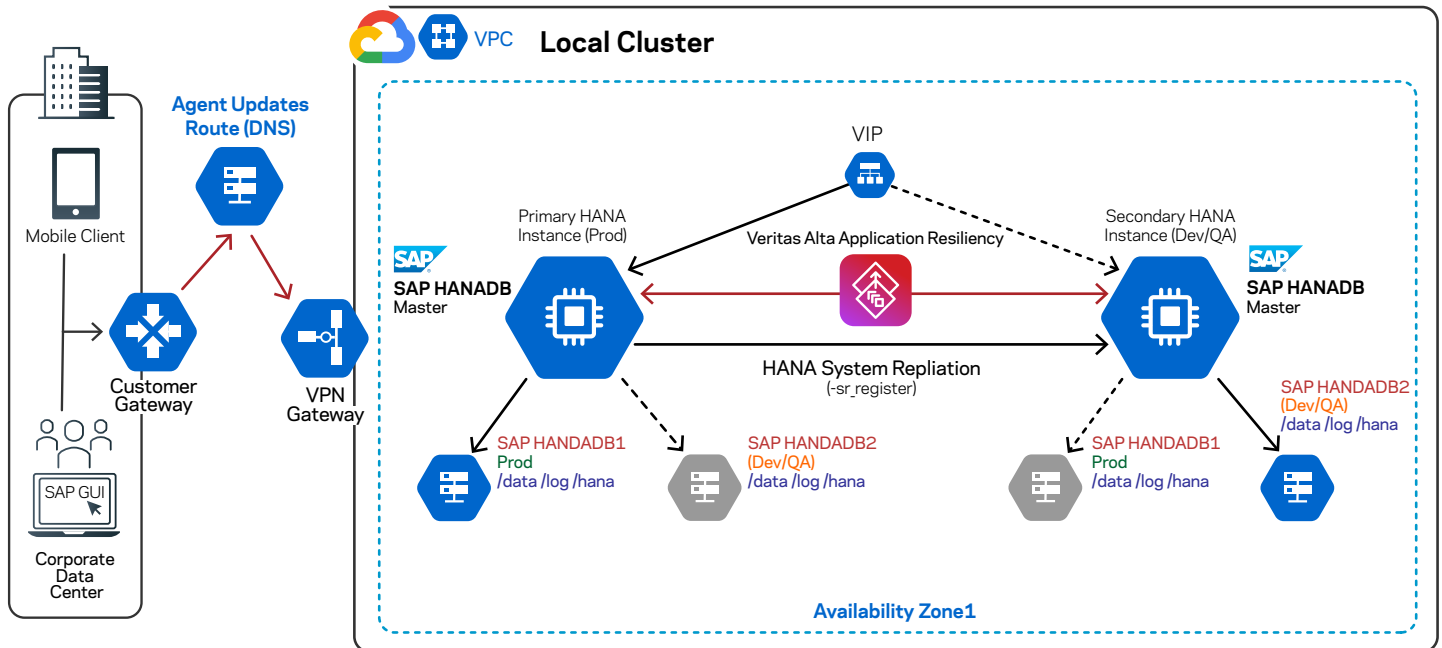
Note: The failover operations are performed according to the HANA HA takeover guidelines and the SAPHDB agent adheres to the HANA takeover rules.

SAP HANA instances across AZs in the same GCP 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.
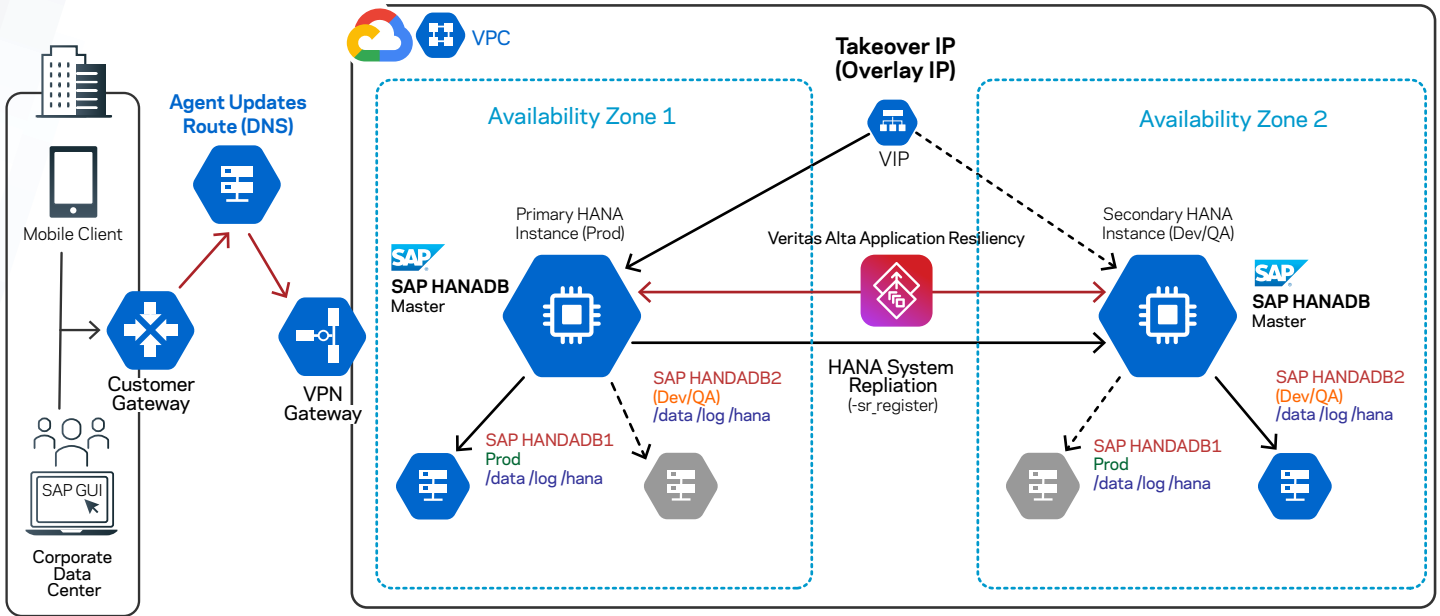
In this example, the primary (master) and the secondary (worker) instances are configured in different AZs with local clustering.

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:
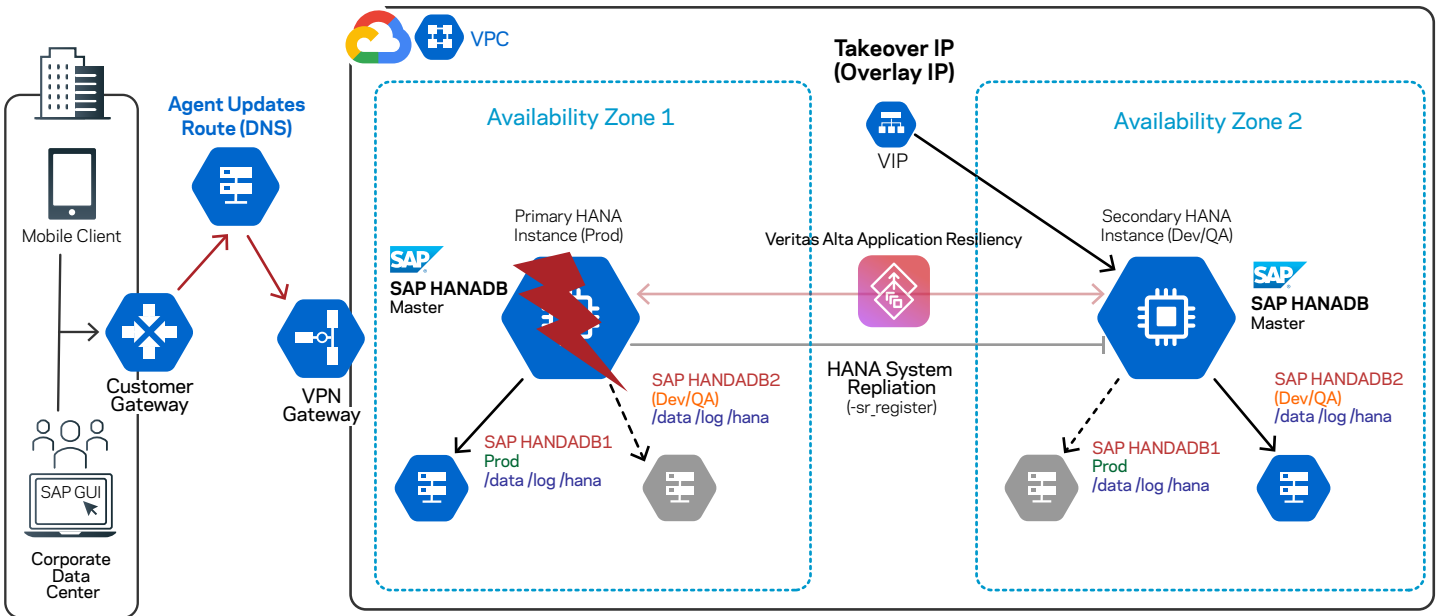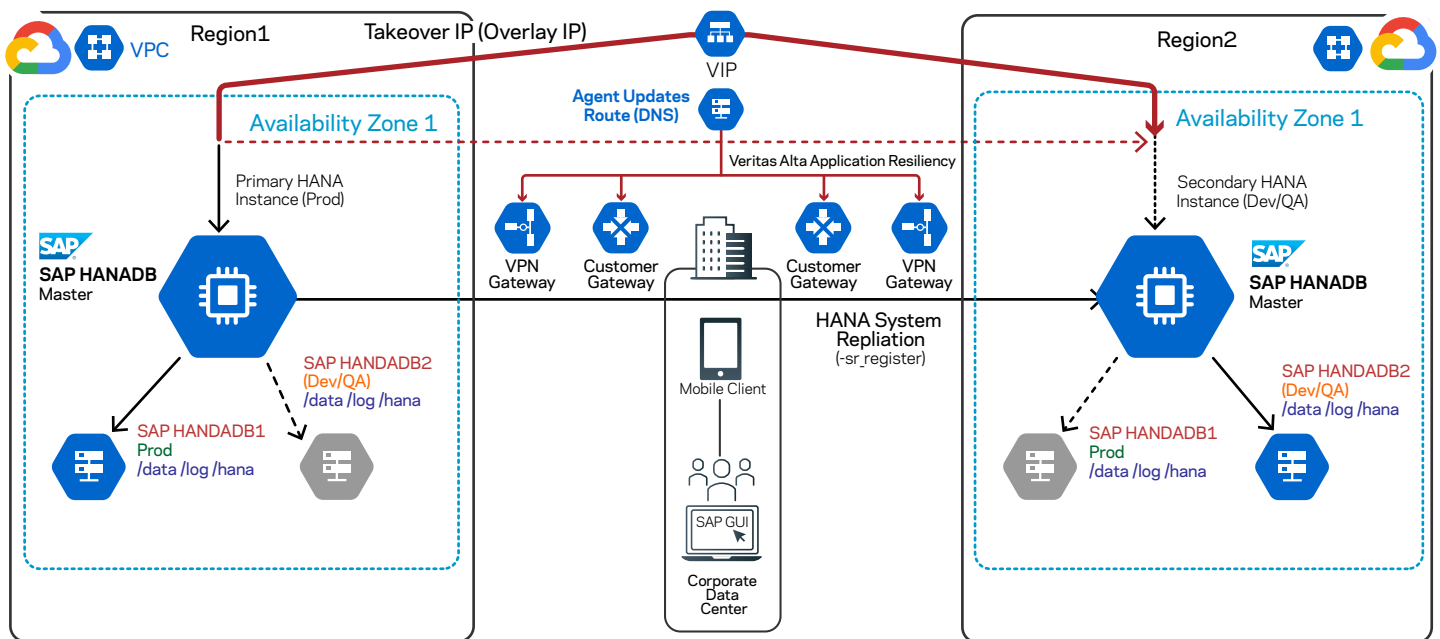

You may choose to clear the fault and perform any other necessary maintenance activities on the old primary instance. Thereafter, the SAPHDB agent can automatically designate it as the secondary instance by using the auto re-register feature. HANA System Replication can then continue the data replication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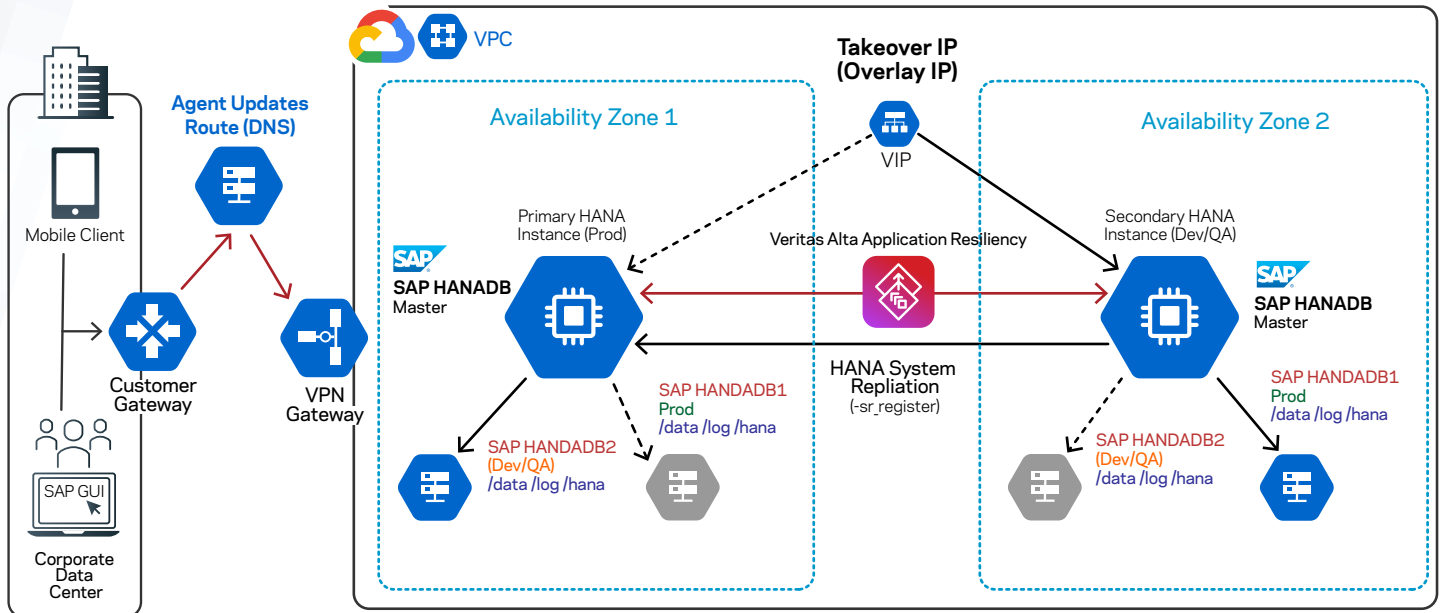
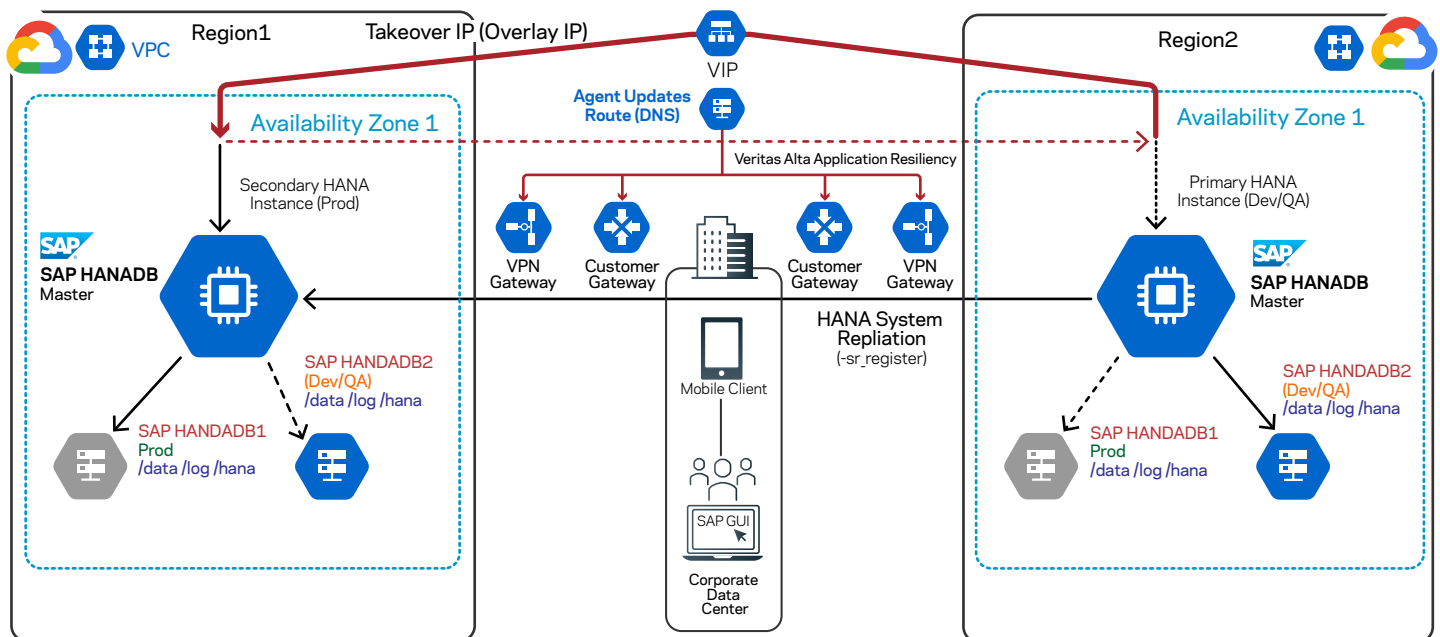**Single-instance SAP HANA databases across GCP regions**

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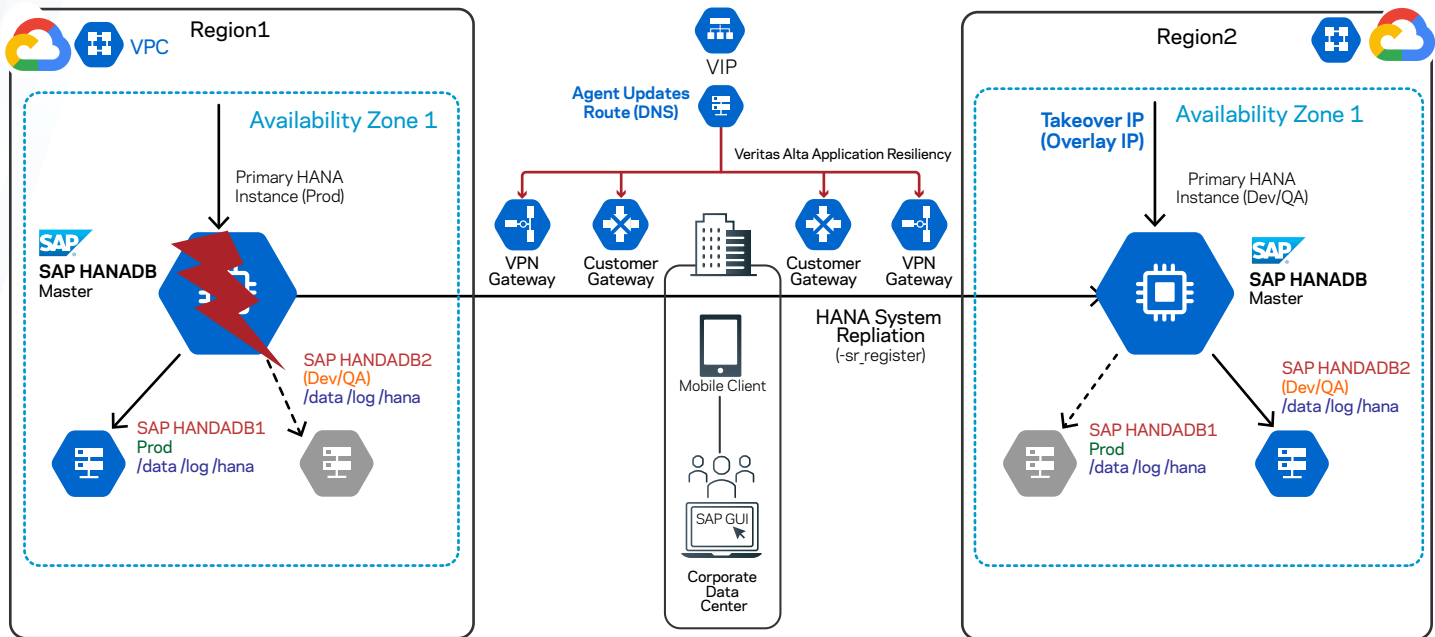
You'll need to clear the fault and perform any other necessary maintenance activities on the old primary instance. Thereafter, the SAPHDB agent automatically designates it as the secondary instance by using the auto re-register feature. The following graphic depicts this action:


SAP HANA database instances across GCP regions (cascading scenario)

In in this scenario, the HANA database primary and secondary are configured in AvailabilityZone1 and AvailabilityZone2 respectively in Region1. The third HANA database instance is in Region2.
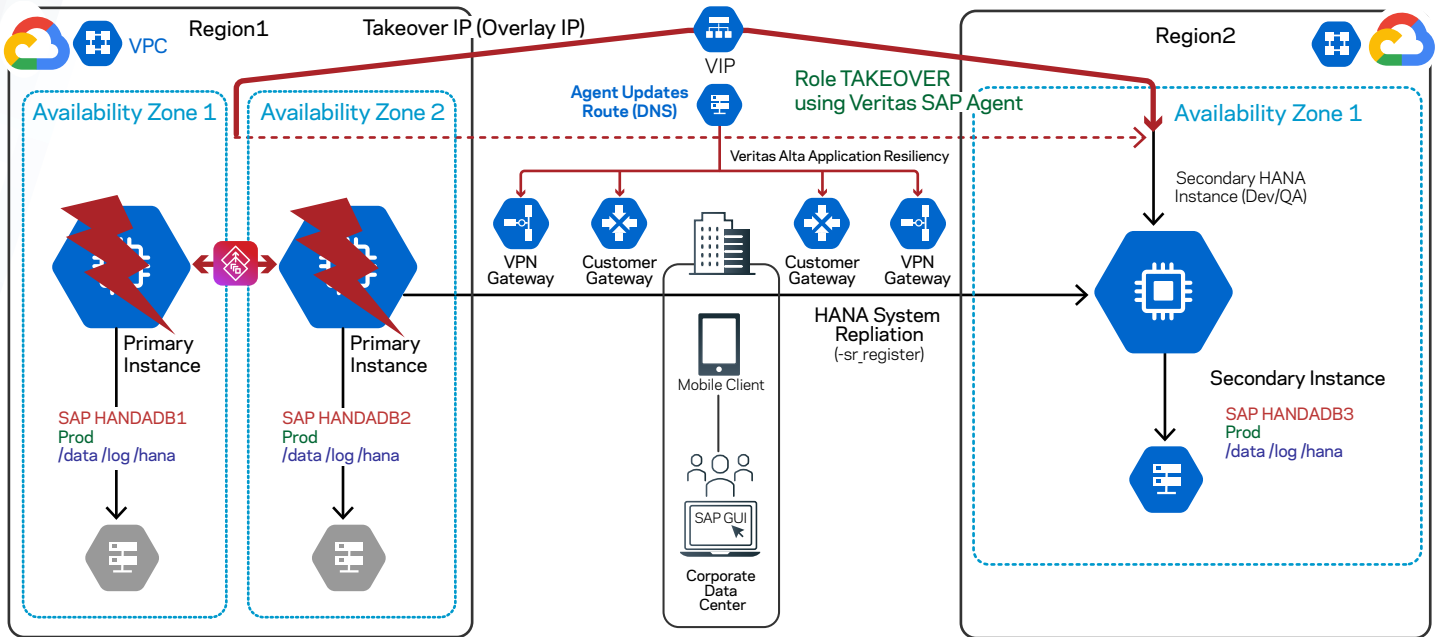
The following graphic depicts this cascading configuration:
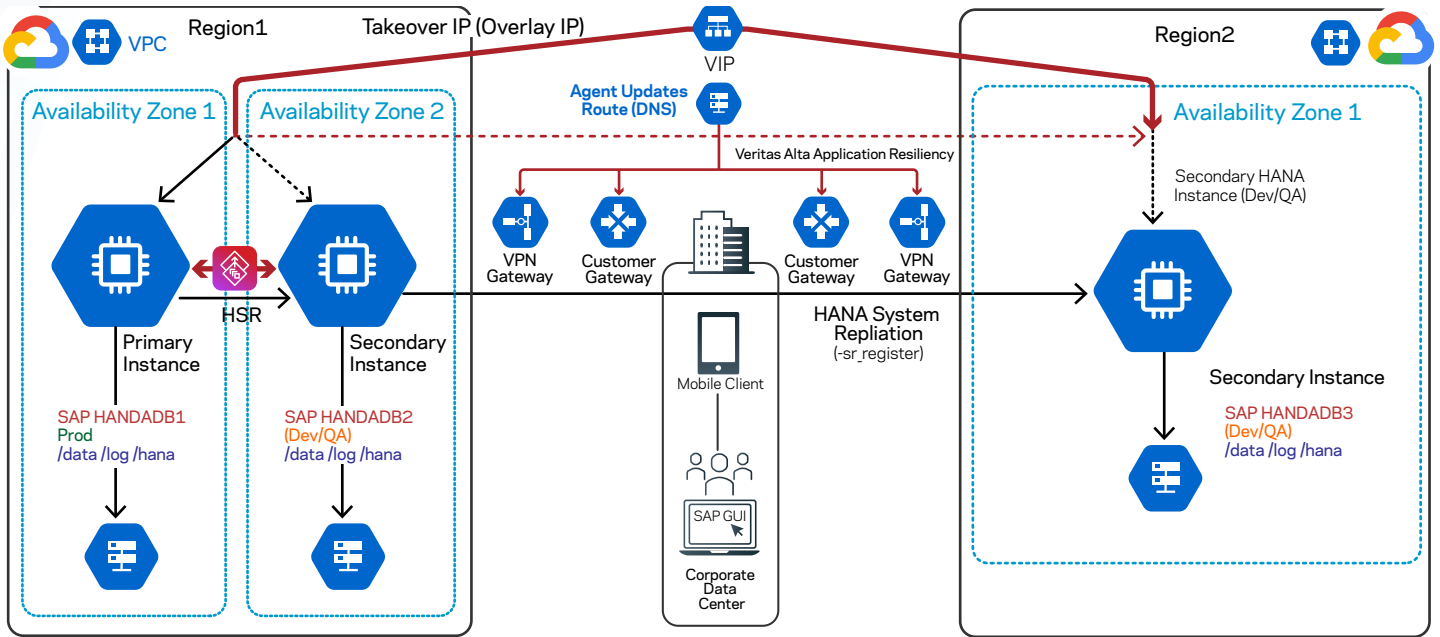
If the primary instance fails, the SAPHDB agent automatically triggers the takeover by failing over the IP resource from the primary to the secondary instance in the same region. Virtual IP failover operations are managed by the GoogleIP and the IP agents. The following graphic depicts how the secondary becomes the primary and is active in Availability Zone2:
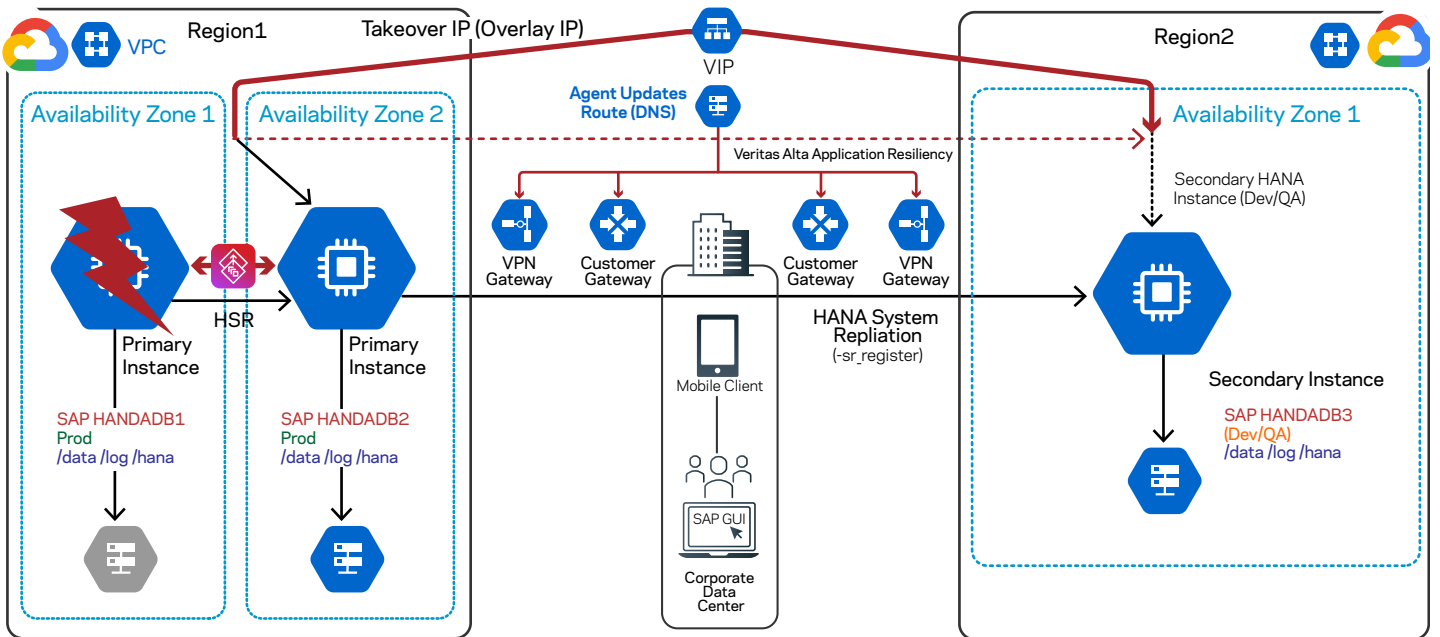
If all the instances within in an AZ or a region fail, the SAPHDB agent automatically triggers the takeover action by failing over the IP resource from the primary to the secondary instance in the remote region. The following graphic depicts how the secondary in the remote region becomes the primary:

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 depicts the reversed replication direction:
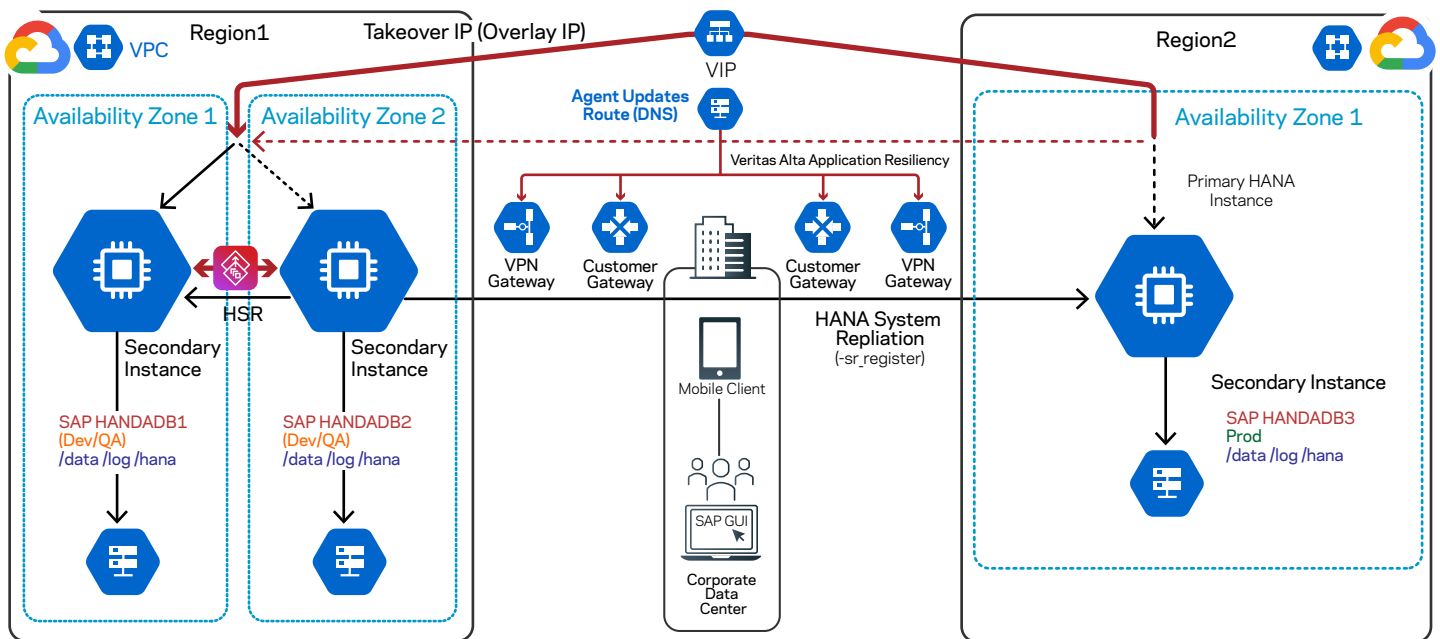
For details, refer to the Veritas agent installation and configuration documentation at: https://sort.veritas.com/agents/

Configuration Procedure

1. Configure a VPN to connect the GCP cloud.

Follow the procedure as per GCP documentation

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

3. Install and configure Veritas Alta Enterprise 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 GCP instances.

    b) Allocate SAP-recommended storage.

    c) Mount the following SAP mount points by using SAP 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 Enterprise Resiliency FSS storage for the following SAP application directories:

      /sapmnt
      /usr/sap
      /sapmnt, /usr/sap

Note: FSS supports all GCP storage services. VxVM, VxFS, and FSS are supported and 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

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

8. Configure SAP HANA system replication between the sites on GCP. Ensure that all the required ports are enabled for replication.

9. Configure InfoScale cluster service groups and resources for the SAP HANA instances.

For details, refer to the following 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

The Google Cloud Platform has emerged as one of the leading cloud providers for enterprise SAP deployments. Veritas Alta Enterprise Resiliency is a certified solution for providing high availability and disaster recovery for SAP S/4HANA and HANA databases in GCP. Veritas Alta Enterprise Resiliency's direct integration with both SAP S/4HANA and GCP delivers visibility into all the components and processes that need to be managed as part of a highly available configuration for maximum application uptime. Some key benefits Veritas Alta Enterprise Resiliency provides for SAP S/4HANA:

- Automation of the entire failover process with integrated non-disruptive DR testing capability

- Near-instant fault detection that provides minimal RTO and RPO for S/4HANA applications and HANA databases

- Flexible configuration options that support multiple usage scenarios within the GCP cloud

With the ability to provide best-in-class architectural flexibility, availability, and resiliency for SAP S/4HANA and SAP HANA databases, Veritas Alta Enterprise Resiliency enables businesses to improve on SAP application SLA's while reducing infrastructure footprints by integrating cloud into their IT strategy. When running your SAP S/4HANA applications and HANA databases in GCP, Veritas Alta Enterprise Resiliency is the leading SAP certified availability and resiliency solution that provides the tools needed to run SAP applications with maximum uptime.

References

SAP notes for SAP on GCP:

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

GCP documentation:

- SAP on Google Cloud
- Overview of SAP on Google Cloud
- Reference Architecture: SAP S/4HANA on Google Cloud Platform
- SAP HANA High Availability and Disaster Recovery Planning Guide on Google Cloud

Veritas documentation:

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

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