HANA System Replication in AWS
Fast SAP HANA Failover Architecture with a SUSE High Availability Cluster in the AWS Cloud
TUT91614

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SUSE & AWS at SAP

AWS
- 6+ years of joint testing and development at the SAP LinuxLab
- All SAP products starting with NW 7.21 are certified on AWS with SLES
- SLES 12 for SAP SP1 is currently the only certified OS on the 2TB x1.32xlarge

SUSE
- 17+ years of joint testing and development at the SAP LinuxLab
- Strong collaboration with AWS inside and outside of the SAP LinuxLab
- SUSE Linux Enterprise is the leading platform for SAP workloads on Linux
- SUSE Linux Server for SAP Applications delivers built-in high availability, superior performance and security
- First and leading OS for SAP HANA
SUSE Linux Enterprise Server 12
Towards Zero Downtime
SUSE Linux Enterprise Server for SAP Applications 12
Towards Zero Downtime

- Extended Service Pack Support
  - 18 Month Grace Period
- 24x7 Priority Support for SAP
- Page Cache Management
- Installation Wizard
- SAP HANA Firewall
- SAP HANA Resource Agents
- SUSE Linux Enterprise Server
- SLE High Availability
- SAP HANA & SAP NetWeaver
- SAP specific update channel
# Lifecycle Model / Extended Service Pack Support

**13-year lifecycle** (10 years general support, 3 years extended support)

Up to **5-year lifecycle per Service Pack** (3 years general + 2 years extended support)

**18 month migration period** between two service packs

**6 month** window to support “skip service pack” functionality (e.g. SPn to SPn+2)

Long Term Service Pack Support (LTSS) available on top (x86-64 only)

More information available on: [http://www.suse.com/lifecycle](http://www.suse.com/lifecycle)
Full System Rollback with One Click

Update

Rollback

Reduce downtime from service pack update errors
Business Continuity
SAP HANA Business Continuity

**Business Continuity**

- **HA per Datacenter**
  - SAP HANA Host Auto Failover (scale out with standby)
    - SAP
    - HW
  - SAP HANA System Replication
    - SAP

- **Disaster recovery between Datacenter**
  - SAP HANA Storage Replication
    - HW
  - SAP HANA System Replication
    - SAP
Automate SAP HANA System Replication

“sr_takeover” is a Manual process
Automate SAP HANA System Replication

SAP HANA System Replication + SUSE High Availability Solution

Automates the “sr_takeover”
Automate SAP HANA System Replication

SAP HANA System Replication + SUSE High Availability Solution

improves

Service Level Agreement
SAP HANA System Replication Automation
SUSE High Availability Solution for SAP HANA

- SAP HANA Primary
- SAP HANA Secondary
- Cluster Communication
- SAPHana Master/Slave Resource
- SAPHanaTopology Clone Resource
- Node A
- Node B
- vIP
- Clone
- Clone
- Fencing
Four Steps to Install and Configure

1. Install SAP HANA
2. Configure SAP HANA System Replication
3. Install and initialize SUSE Cluster
4. Configure SR Automation using HAWK wizard
SAPHanaSR HAWK Wizard
What is the Delivery?
SUSE Linux Enterprise Server for SAP Applications

The package **SAPHanaSR**
- the two resource agents
  - **SAPHanaTopology**
  - **SAPHana**
- HAWK setup Wizard

The package **SAPHanaSR-doc**
- the important **SetupGuide**
Supported Scenarios
Allowed Scenarios

Scale-Up *performance-optimized* (syncron =>)
A => B

Scale-Up in a chain or *multi tier* (asyncron ->)
A => B -> C

Scale-Up in a *cost-optimized* scenario (+)
A => B + Q

Scale Up in a mixed scenario
A => B -> C + Q

Now all with *multi tenancy* (%) - here cost optimized
%A => %B + %Q
SAP HANA Scale-Up: Performance Optimized

**Node 2 Usage:** Dedicated

**Data pre-load on Secondary:** Yes

**Take-over decision:** Fully automated by SUSE cluster solution

**Take-over process:** Fully automated by SUSE cluster solution

**Take-over reaction time:** Fast due to pacemaker heartbeat

**Take-over speed:** Fast since data pre-loaded

Diagram:
- Node A
  - SAP HANA (PR1) primary
  - PR1
- Node B
  - SAP HANA (PR1) secondary
  - PR1
- pacemaker
- active/active
- HANA System Replication
- A => B
### SAP HANA Scale-Up: Cost Optimized

<table>
<thead>
<tr>
<th><strong>Node 2 Usage:</strong></th>
<th>Shared with other system (e.g. QA1). Additional storage required for QA1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data pre-load on Secondary:</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Take-over decision:</strong></td>
<td>Fully automated by SUSE cluster solution</td>
</tr>
<tr>
<td><strong>Take-over process:</strong></td>
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</tr>
<tr>
<td><strong>Take-over reaction time:</strong></td>
<td>Fast due to pacemaker heartbeat</td>
</tr>
<tr>
<td><strong>Take-over speed:</strong></td>
<td>Slow: stop QA1 (meaning QA1 downtime) + completely load PR1 into memory</td>
</tr>
</tbody>
</table>

![Diagram of SAP HANA System Replication](image_url)
SAP HANA Multitenant Database Containers (MDC)

MDC Considerations:

• Can apply “Performance Optimized” or “Cost Optimized” scenarios

• A take-over acts on the parent HANA Database.

• All tenant database containers and associated services and therefore affected by a take-over.

• For new installations with SAP HANA rev > 120 MDC is the default and any installation results into a system and a data tenant.
SAP HANA Scale-Up: Multi Tier

<table>
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<th>Node 2 Usage:</th>
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![Diagram of SAP HANA Scale-Up: Multi Tier]

A => B → C
SUSE SAPHanaSR in 3 Facts

- **Reduces complexity**
  - provides a wizard for easy configuration with just SID, instance number and IP address
  - automates the sr-takeover and IP failover ("bind")

- **Reduces risk**
  - includes always a consistent picture of the SAP HANA topology
  - provides a choice for automatic registrations and site takeover preference

- **Increases reliability**
  - provides short takeover times in special for table preload scenarios
  - includes the monitoring of the system replication status to increase data consistency
SAP HanaSR in the AWS Cloud
HANA System Replication on AWS
Cloud HA and Disaster Recovery Options

**High Availability**
- Same Availability Zone (Data Center)
- HANA synchronous replication
- IP address switch in sub second intervals

**Disaster Recovery**
- Different Availability Zone (Data Center)
- HANA synchronous or asynchronous replication
- IP address switch in sub second intervals
Improved Security in the Cloud

Security
Policies to grant permission to stop and start systems by defined AIM users or systems
Policies to grant permissions to change network routing for defined AIM users and or systems

Auditing
AWS tracks when failover happened
AWS tracks tracks who started and shutdown systems
SUSE HanaSR Architecture on AWS
HanaSR in EC2

HA Resource Agents communicate to the Cloud via EC2 API

EC2

controls

Pacemaker

controls

node 1

SAP HANA
PR1 primary

System PR1

viP

node 2

SAP HANA
PR1 secondary

System Replication
STONITH fencing in HA clusters

Loss of network connectivity results in split cluster partitions (split brain)

STONITH fencing...

... solves split-brain situations in Pacemaker clusters ...

... by remotely shutting off or rebooting one or more nodes ...

... ensuring that just one cluster partition survives.
STONITH fencing in EC2

1 Cluster detects split-brain
   network communication broken

2 Send STONITH request to EC2 API
   node 1 requests force shut-off for node 2 via EC2 API

3 EC2 API shuts-off node 2
   EC2 instance shut-off on the hypervisor
EC2 STONITH agent fence_ec2_sap

STONITH fencing agent for Pacemaker clusters running in AWS EC2

Agent uses EC2 API to hard-shutoff or reboot a cluster node
`ec2-stop-instances <Instance ID> --force`

Uses EC2 instance tags to Identify nodes belonging to a cluster
Floating IP address within VPC

**Challenge**
Move IP address (floating IP) between two EC2 instances in a VPC among different AV's

**Research**
Standard Pacemaker cluster IP failover mechanism not possible (→ EC2 instances / cluster nodes are not in the same Layer-2 LAN segment)
EC2 standard IP failover (EC2 Elastic IP) not available in VPCs
DDNS updates might not work with all SAP frontends (SAP GUI, HANA Studio, etc.)

**Solution**
Remotely changes routing table entries of a virtual router in the VPC (Setup of a /32 host-route pointing to an instance / cluster node)
Developed resource agent, that uses that mechanism to fail-over IP's
Resource Agent “aws-vpc-move-ip”

Provides floating IP addresses for EC2 instances in VPC's among different AV's
Locally adds & removes the “floating IP address”
Changes routing table entry to route traffic to correct destination instance using EC2 API commands
Outlook

- Joint Whitepaper between AWS and SUSE upcoming
- Support for SAP HANA ScaleOut scenarios
- Improved handling of IP address / service failover
More information
http://www.suse.com/products/sles-for-sap
More information
https://www.suse.com/promo/cloud/public/aws

Because you need enterprise quality service, speed and cost

SUSE and Amazon Web Services (AWS) share a common goal—making computing convenient and cost-effective. Together SUSE and AWS deliver SUSE Linux Enterprise Server on Amazon EC2 for on-demand, pay-as-you-go use. Amazon EC2 users can develop and run their workloads on the enterprise Linux that powers half of the world’s largest supercomputer clusters and is the leading platform for SAP solutions on Linux.