



CLOUD ALLIANCE PARTNERS



Cloud Alliance Partners Workshop

SAP HANA on Azure

Hands-on lab step-by-step

April 2018

Information in this document, including URL and other Internet Web site references, is subject to change without notice. Unless otherwise noted, the example companies, organizations, products, domain names, email addresses, logos, people, places, and events depicted herein are fictitious, and no association with any real company, organization, product, domain name, email address, logo, person, place or event is intended or should be inferred. Complying with all applicable copyright laws is the responsibility of the user. Without limiting the rights under copyright, no part of this document may be reproduced, stored in or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), or for any purpose, without the express written permission of Microsoft Corporation.

Microsoft may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from Microsoft, the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

The names of manufacturers, products, or URLs are provided for informational purposes only and Microsoft makes no representations and warranties, either expressed, implied, or statutory, regarding these manufacturers or the use of the products with any Microsoft technologies. The inclusion of a manufacturer or product does not imply endorsement of Microsoft of the manufacturer or product. Links may be provided to third party sites. Such sites are not under the control of Microsoft and Microsoft is not responsible for the contents of any linked site or any link contained in a linked site, or any changes or updates to such sites. Microsoft is not responsible for webcasting or any other form of transmission received from any linked site. Microsoft is providing these links to you only as a convenience, and the inclusion of any link does not imply endorsement of Microsoft of the site or the products contained therein.

© 2017 Microsoft Corporation. All rights reserved.

Microsoft and the trademarks listed at <https://www.microsoft.com/en-us/legal/intellectualproperty/Trademarks/Usage/General.aspx> are trademarks of the Microsoft group of companies. All other trademarks are property of their respective owners

Contents

Abstract and learning objectives	4
Overview	4
Requirements	4
Help references	4
Before the hands-on lab	4
Task 1: Connect & Register at CAP Labs Portal	5
Task 2: Login to Azure and Verify Resources.	6
Task 3: Create VM's: s03-db-0, s03-db-1 & hana-jumpbox (ARM Templates)	7
Task 4: Create VM's: s03-db-0, s03-db-1 & hana-jumpbox (Manual)	10
Task 5: Create Load Balancer	19
Exercise 1: Configure operating system on Azure VMs running Linux	15
Task 1: Configure OS on Azure VMs running Linux	15
Task 2: Copy the HANA Binaries in both the VM's:	19
Task 3: Add YaST packages, update the Linux operating system, and install HA Extensions	25
▶ Checkpoint	32
Task 4: Configure Passwordless SSH between 2 linux VM's.	32
▶ Checkpoint	34
Exercise 2: Configure clustering on Azure VMs running Linux	35
Task 1: Configure clustering	35
Task 2: Configure corosync	37
▶ Checkpoint	37
Exercise 3: Install SAP HANA	39
Task 1: Add Storage Disk for Hana Installation (s03-db-0, s03-db-1) & Mount :	39
Task 2: Install HANA Database in Both the VM's	44
▶ CheckPoint	48
Exercise 4: Configure SAP HANA replication	49
Prerequisite :	49
Task 1: Install SAP HANA Studio Administration on the Azure VM running Windows	50
Task 2: Initial Setup and Configuring SAP HANA Studio	56
Task 3: Backup Database	59
Task 4: System Replication using SAP HANA Studio	61
▶ Checkpoint	68

Exercise 5: Configure cluster framework	68
Task 1: Configure STONITH clustering options	69
Task 2: Create an Azure AD application for the STONITH device	69
Task 3: Grant permissions to Azure VMs to the service principal of the STONITH app	73
Task 4: Configure the STONITH cluster device	75
Task 5: Create SAPHanaTopology cluster resource agent	76
Task 6: Create SAP Hana cluster resource agent	77
🚩 Checkpoint	78
Exercise 6: Test the deployment	79
Task 1: Connect to HANA cluster by using SAP HANA Studio Administration	79
Task 2: Executing Query in Hana	83
Task 3: Connect to HANA cluster by using Hawk	85
Task 4: Test a manual failover (from s03-db-0 to s03-db-1)	88
Task 5: Test a migration (from s03-db-1 to s03-db-0)	93
Task 6: Test fencing	96
After the Hands-on Lab	99
Task 1: Remove the resource group containing all Azure resources deployed in this lab	100

SAP HANA on Azure hands-on lab step-by-step

Abstract and learning objectives

This Hands-on Lab guides you through implementation of a highly available SAP HANA deployment on Microsoft Azure virtual machines running SUSE Linux Enterprise Server. After its completion, students should be able to:

- Provision Azure infrastructure components necessary to support highly available SAP HANA deployments
- Configure Azure virtual machines to support highly available SAP HANA installations
- Implement SUSE Linux Enterprise clustering
- Install SAP HANA
- Configure SAP HANA system replication

Overview

In this Hands-on Lab, you are working with Contoso to develop a process of implementing a highly available deployment of SAP HANA on Azure virtual machines (VMs). Your tasks will include the provisioning of Azure infrastructure components of the deployment, setting up a clustered pair of Azure Linux VMs running SUSE Linux Enterprise Server to support SAP HANA, installing SAP HANA instance on each of the Azure VMs, and configuring SAP HANA system replication between them.

Requirements

- A Microsoft Azure subscription
- A lab computer running Windows 10 or Windows Server 2016 with:
 - access to Microsoft Azure
 - access to the SAP HANA installation media (requires an SAP Online Service System account)
 - an SSH client e.g. PuTTY, available from <https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>
 - WinSCP client available from <https://winscp.net/eng/download.php>
- SUSE Linux Enterprise Server 60-day free trial subscription (available from <https://www.suse.com/products/sles-for-sap/download/>) via which you obtain registration code for an evaluation copy of SUSE Linux Enterprise Server for SAP Applications 12 SP3 for x86-64

Help references

High Availability of SAP HANA on Azure Virtual Machines (VMs)	https://docs.microsoft.com/en-us/azure/virtual-machines/workloads/sap/sap-hana-high-availability
---	---

Before the hands-on lab

Duration: 10 minutes

To complete this lab, you must verify your account has sufficient permissions to the Azure subscription that you intend to use to deploy Azure VMs. You also need to identify the availability of the SUSE Linux Enterprise Server image that you will use to deploy Azure VMs.

Task 1: Connect & Register at CAP Labs Portal

1. Click on the link provided to register yourself for the lab session
2. Register yourself by providing the necessary information and click **SUBMIT**.



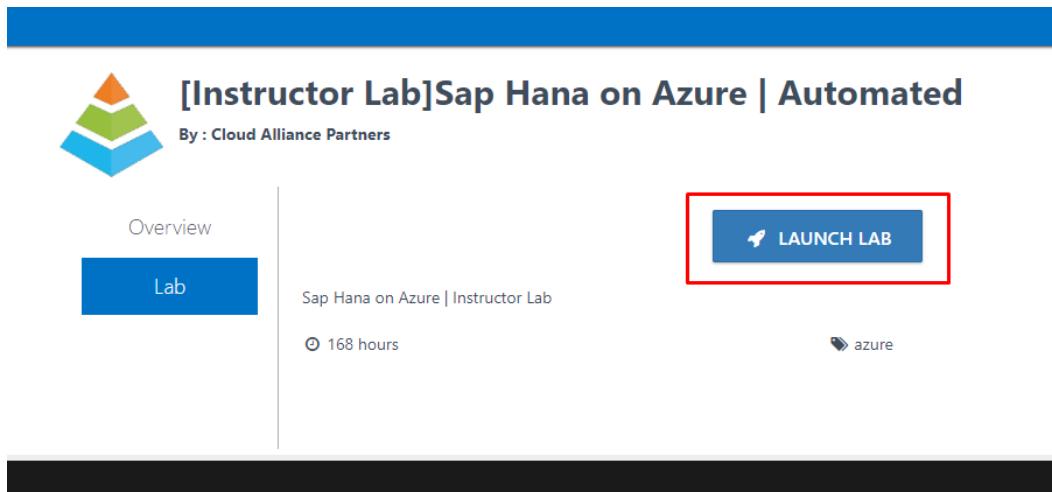
CLOUD ALLIANCE PARTNERS

Register Now

Your Full Name	<input type="text" value="Your Full Name"/>	Lab Name
Your Email ID	<input type="text" value="Your Email ID"/>	Seoul ILT HOL Day 2
Your Org. Name	<input type="text" value="Your Org. Name"/>	About Us
Lab Code	<input type="text" value="CB99BDEE74CDC6F516D4FFF96387D"/>	CAP - YOUR SAP ON CLOUD SPECIALIST Our mission is to be world's best go-to partner for SAP on cloud Implementations. We are a company based out of Australia and have operating offices in the Silicon Valley, Singapore and India. We have a strong SAP on Cloud practice, where we have the best in class experts from the best of both worlds SAP as well as Cloud Infrastructure.

Microsoft or training providers may use your contact information to provide updates and special offers about Microsoft Azure and other Microsoft products and services. You can unsubscribe at any time. To learn more you can read the [Privacy Policy](#).

3. Once registered you'll be redirected to Lab activation page. It is recommended to save a copy of the URL on the browser to save a copy of the URL on the browser to save the Activation ID. Optionally you'll be receiving a mail which will take you to the deployment page.



[Instructor Lab]Sap Hana on Azure | Automated

By : Cloud Alliance Partners

Overview

Lab

Sap Hana on Azure | Instructor Lab

168 hours

LAUNCH LAB

azure

4. Throughout the duration of workshop, standby instances will be made available for immediate deployment. In the event of standby instances non-availability, a new deployment may be launched in the background. The deployment of new azure resources may take approximately 15 minutes to complete. Once deployment is successful, a screen showing Azure Credentials and Environment Details will be displayed on screen. It is recommended to copy and paste the Azure Credentials and Environment Details to a text file like notepad. You should also receive these details on your email.



Dear Sathish Kumar V

Your **Seoul ILT HOL Day 2** On demand lab is ready. You have 8 hours to try the product.

Please note that the credentials in this email were generated the first time you registered with us. If you have since changed your password you should use the most recent password.

Please use the below details for future use in your labs:

Login Credentials:

username	hol_sea_usr_2701@azureparipoorna.onmicrosoft.com
password	#51c02@e3f7d

If you have any questions, please contact us at info@cloudalliancepartners.com

5. Please ensure to make note of values assigned to your deployment.

Task 2: Login to Azure and Verify Resources.

1. Open azure portal <https://portal.azure.com> in Private/Incognito mode and enter the provided credentials from your CAP Labs portal.

A screenshot of the Microsoft Azure sign-in page. It features the Microsoft logo and the heading "Sign in to Microsoft Azure". Below this is a text input field labeled "Email, phone, or Skype" containing the placeholder text "Email, phone, or Skype". A large blue "Next" button is positioned below the input field. At the bottom of the page, there are links for "No account? Create one!" and "Can't access your account?".A screenshot of the Microsoft Azure password entry page. The top bar displays "Microsoft Azure". Below it, the Microsoft logo is followed by a back arrow and the email address "hol_sea_usr_2701@azureparipoorna.onmicrosoft.com...". The main heading is "Enter password", with a "password" input field below it. A "Forgot my password" link is located just below the input field. A "Sign in" button is at the bottom right of the form area.

2. Click on Resource group from the category menu on your Left tab.

The screenshot shows the Azure portal's 'Resource groups' page. On the left, a sidebar lists various service categories: 'Create a resource', 'All services', 'FAVORITES' (Dashboard, All resources), 'Resource groups' (which is selected and highlighted with a red box), 'App Services', 'Function Apps', and 'SQL databases'. The main content area shows a single resource group named 'ODL_sap-hana-1720', also highlighted with a red box. The page includes standard navigation and search controls.

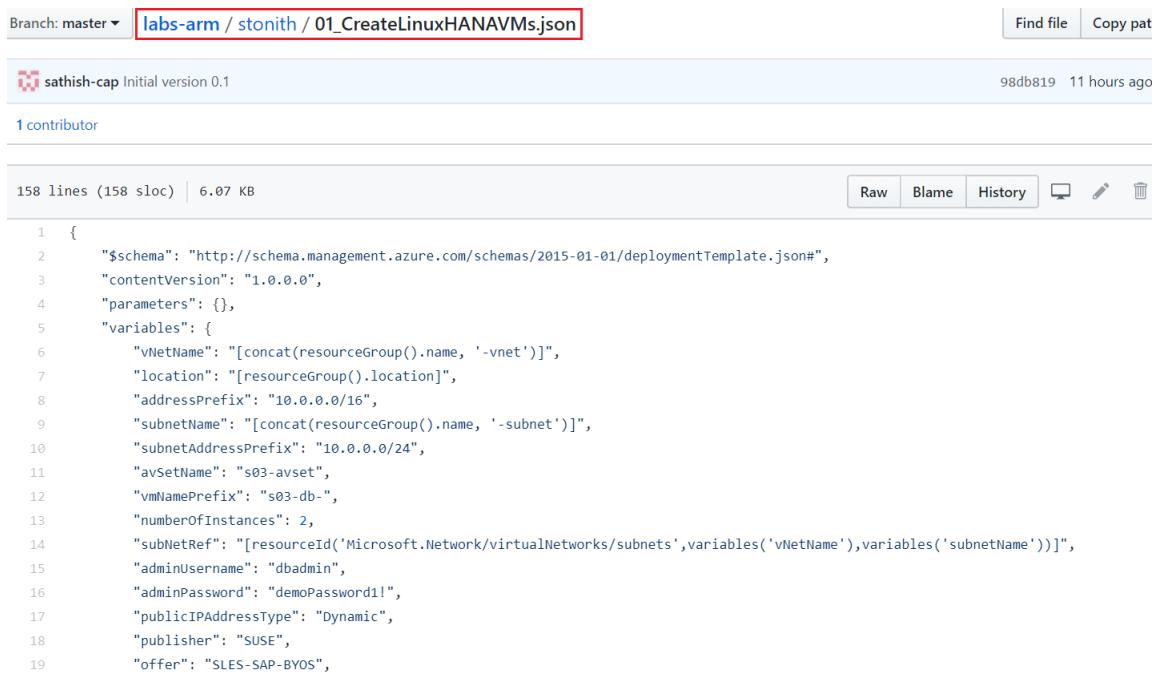
Task 3: Create VM's: s03-db-0, s03-db-1 & hana-jumpbox (ARM Templates)

1. Click into the below link.

URL: <https://github.com/sathish-cap/labs-arm>

The screenshot shows a GitHub repository page for 'sathish-cap/labs-arm'. The repository summary indicates 3 commits, 1 branch, 0 packages, 0 releases, and 1 contributor. The 'Branch: master' dropdown is set to 'master'. The 'Clone or download' button is visible. The repository details show a commit by 'sathish-cap' updating 'README.md' 11 hours ago. Below the repository summary, there is a preview of the 'README.md' file content, which includes a heading 'ARM Automation Scripts' and a section titled 'STONITH Lab' containing two JSON files: '01_CreateLinuxHANAVMs.json' and '02_CreateWindowsJumpboxVM.json'.

2. Click to Stonith → 01_CreateLinuxHANAVMs.json → Copy the json script.

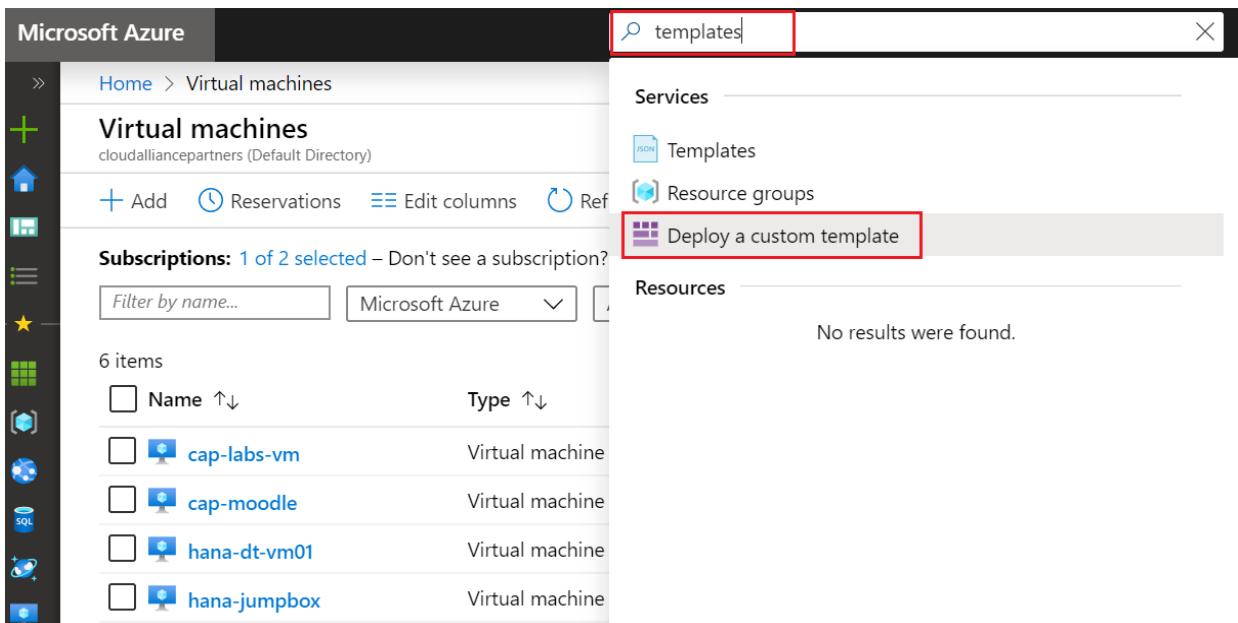


```

Branch: master | labs-arm / stonith / 01_CreateLinuxHANAVMs.json | Find file | Copy path
sathish-cap Initial version 0.1 | 98db819 11 hours ago
1 contributor
158 lines (158 sloc) | 6.07 KB | Raw | Blame | History | ⚙️ | 🖊️ | 🗑️
1 {
2   "$schema": "http://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
3   "contentVersion": "1.0.0.0",
4   "parameters": {},
5   "variables": {
6     "vNetName": "[concat(resourceGroup().name, '-vnet')]",
7     "location": "[resourceGroup().location]",
8     "addressPrefix": "10.0.0.0/16",
9     "subnetName": "[concat(resourceGroup().name, '-subnet')]",
10    "subnetAddressPrefix": "10.0.0.0/24",
11    "avSetName": "s03-avset",
12    "vmNamePrefix": "s03-db-",
13    "numberOfInstances": 2,
14    "subNetRef": "[resourceId('Microsoft.Network/virtualNetworks/subnets',variables('vNetName'),variables('subnetName'))]",
15    "adminUsername": "dbadmin",
16    "adminPassword": "demoPassword1!",
17    "publicIPAddressesType": "Dynamic",
18    "publisher": "SUSE",
19    "offer": "SLES-SAP-BYOS",

```

3. Switch into Portal → Search as “templates” → Deploy a custom template.



Microsoft Azure

Home > Virtual machines

Virtual machines cloudalliancepartners (Default Directory)

+ Add Reservations Edit columns Ref

Subscriptions: 1 of 2 selected – Don't see a subscription?

Filter by name... Microsoft Azure

Services

- Templates
- Resource groups
- Deploy a custom template**

Resources

No results were found.

6 items

	Name ↑↓	Type ↑↓
<input type="checkbox"/>	cap-labs-vm	Virtual machine
<input type="checkbox"/>	cap-moodle	Virtual machine
<input type="checkbox"/>	hana-dt-vm01	Virtual machine
<input type="checkbox"/>	hana-jumpbox	Virtual machine

4. Select Build your own template in the editor.

Home > Custom deployment

Custom deployment

Deploy from a custom template

Learn about template deployment

[Read the docs](#)

[Build your own template in the editor](#)

Common templates

- [Create a Linux virtual machine](#)
- [Create a Windows virtual machine](#)
- [Create a web app](#)
- [Create a SQL database](#)

5. Remove the existing code & paste the copied script → Save

Home > Custom deployment > Edit template

Edit template

Edit your Azure Resource Manager template

+ Add resource [Quickstart template](#) [Load file](#) [Download](#)

Parameters (0)

Variables (17)

Resources (5)

```

1  {
2    "$schema": "http://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
3    "contentVersion": "1.0.0.0",
4    "parameters": {},
5    "variables": {
6      "vNetName": "[concat(resourceGroup().name, '-vnet')]",
7      "location": "[resourceGroup().location]",
8      "addressPrefix": "10.0.0.0/16",
9      "subnetName": "[concat(resourceGroup().name, '-subnet')]",
10     "subnetAddressPrefix": "10.0.0.0/24",
11     "avSetName": "s03-avset",
12     "vmNamePrefix": "s03-db-",
13     "numberOfInstances": 2,
14     "subNetRef": "[resourceId('Microsoft.Network/virtualNetworks/subnets',variables('vNetName'),variables
15     ('subnetName'))]",
16     "adminUsername": "dbadmin",
17     "adminPassword": "demoPassword1!",
18     "publicIPAddressType": "Dynamic",
19     "published": "true"
20   }
21 }
```

[Save](#) [Discard](#)

6. Select the resource group & location. Accept the Terms and conditions → Purchase.

The screenshot shows the 'Custom deployment' wizard in the Azure portal. The 'Basics' section is filled out with:

- Subscription ***: Microsoft Azure
- Resource group ***: caplabs2019 (highlighted with a red box)
- Create new**
- Location ***: (Asia Pacific) South India

The 'TERMS AND CONDITIONS' section contains the Azure Marketplace Terms and a checkbox for agreeing to the terms.

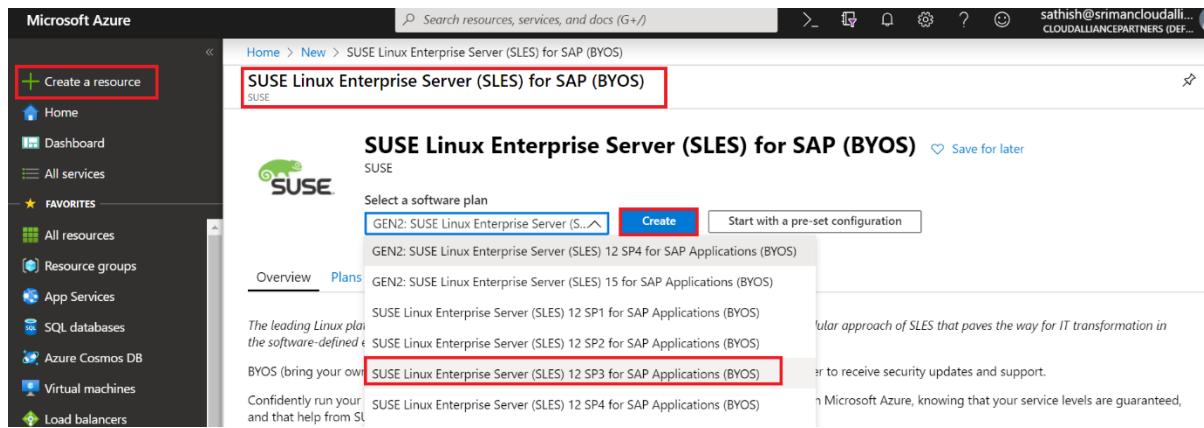
I agree to the terms and conditions stated above

Purchase

- Similarly, execute the file "02_CreateWindowsJumpboxVM.json" file. (Windows jumpbox creation).

Task 4: Create VM's: s03-db-0, s03-db-1 & hana-jumpbox (Manual)

- Create New "SLES 12 SP3 for SAP (BYOS)" VM. In Portal Create Resource → Search "SUSE Linux Enterprise Server (SLES) for SAP".



- Enter the below details.

Resource Group:	default value
Virtual Machine Name:	s03-db-0
Region:	Refer RG's location
Availability Option:	Availability Set
Availability Set:	Create-New
Name:	s03-avset

Home > New > SUSE Linux Enterprise Server (SLES) for SAP > Create a virtual machine

Create a virtual machine

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ Microsoft Azure

Resource group * ⓘ hol_sea_usr_2701_RG

Instance details

Virtual machine name * ⓘ s03-db-0

Region * ⓘ (Asia Pacific) Southeast Asia

Availability options ⓘ Availability set

Availability set * ⓘ No existing availability sets in current resource group and location.

Image * ⓘ SUSE Linux Enterprise Server (SLES) 12 SP3 for SAP Applications

[Review + create](#) < Previous Next : Disks >

Create new

Group two or more VMs in an availability set to ensure that at least one is available during planned or unplanned maintenance events. [Learn more](#)

Name * s03-avset

Fault domains ⓘ 2

Update domains ⓘ 5

Use managed disks ⓘ No (Classic) Yes (Aligned)

[OK](#)

3. Size: Change Size → Select “D8_v3” (If Filter applied, Clear Filter).

Select a VM size								
Browse available virtual machine sizes and their features								
VM SIZE	OFFERING	FAMILY	VCPUS	RAM (GB)	DATA DISKS	MAX IOPS	TEMPORARY STOR...	PREMIUM DISK SUP...
D8_v3	Standard	General purpose	8	32	16	16x500	200 GB	No
D8s_v3	Standard	General purpose	8	32	16	12800	64 GB	Yes

[Select](#) Prices presented are estimates in your local currency that include only Azure infrastructure costs and any discounts for the subscription and location. To applicable software costs. Final charges will appear in your local currency in cost analysis and billing views. [View Azure pricing calculator](#). Activate Windows Go to PC settings to activate Windows

Authentication Type:	Password
Username:	dbadmin
Password:	demoPassword1!

Image * ⓘ SUSE Linux Enterprise Server (SLES) 12 SP3 for SAP Applications (BYOS) ▾
[Browse all public and private images](#)

Size * ⓘ Standard D8 v3
 8 vcpus, 32 GiB memory
[Change size](#)

Administrator account

Authentication type ⓘ Password SSH public key

Username * ⓘ dbadmin ✓

Password * ⓘ ✓

Confirm password * ⓘ ✓

[Review + create](#) < Previous [Next : Disks >](#)

4. Click → Disks → Standard SSD → Networking.

Basics Disks **Networking** Management Guest config Tags Review + create

Azure VMs have one operating system disk and a temporary disk for short-term storage. You can attach additional data disks. The size of the VM determines the type of storage you can use and the number of data disks allowed. [Learn more](#)

DISK OPTIONS

* OS disk type ⓘ Standard SSD

DATA DISKS

You can add and configure additional data disks for your virtual machine or attach existing disks. This VM also comes with a temporary disk.

LUN	NAME	SIZE (GiB)	DISK TYPE	HOST CACHING
Create and attach a new disk Attach an existing disk				

▼ ADVANCED

[Review + create](#) [Previous](#) [Next : Networking >](#)

5. Accept the Vnet, Subnet, Public IP, Security Group as “Advanced”.

Home > New > SUSE Linux Enterprise Server (SLES) for SAP > Create a virtual machine

Create a virtual machine

Network interface

When creating a virtual machine, a network interface will be created for you.

Virtual network * ⓘ (new) hol_sea_usr_2701_RG-vnet

Subnet * ⓘ (new) default (10.0.0.0/24)

Public IP ⓘ (new) s03-db-0-ip

NIC network security group ⓘ None Basic Advanced

i This VM image has preconfigured NSG rules

Configure network security group * ⓘ (new) s03-db-0-nsg

6. Boot diagnostics → off → Click “Review+Create”.

Home > New > SLES for SAP 12 SP3 (BYOS) > Create a virtual machine

Create a virtual machine

Basics Disks Networking Management Guest config Tags Review + create

Configure monitoring and management options for your VM.

MONITORING

Boot diagnostics ⓘ On Off

OS guest diagnostics ⓘ On Off

IDENTITY

System assigned managed identity ⓘ On Off

AUTO-SHUTDOWN

Enable auto-shutdown ⓘ On Off

Review + create Previous Next : Guest config >

7. Similarly Create the “s03-db-1” & Windows (2016 datacentre edition) Jump Box “hana-jumpbox” & use the following values.

Vnet:	default Value
Subnet:	default
Public Inbound Ports:	Allow Selected Ports
Select Inbound Ports:	RDP

Note: **Don't include the “hana-jumpbox” into availability set.**

ADMINISTRATOR ACCOUNT

* Username ✓

* Password ✓

* Confirm password ✓

INBOUND PORT RULES

Select which virtual machine network ports are accessible from the public internet. You can specify more limited or granular network access on the Networking tab.

* Public inbound ports None Allow selected ports

* Select inbound ports HTTP (80) HTTPS (443) SSH (22) RDP (3389)

SAVE MONEY

Save up to 49% with a license you already own using Azure Hybrid Benefit. [Learn more](#)

Review + create **Previous** **Next : Disks >**

Exercise 1: Configure operating system on Azure VMs running Linux

Duration: 30 minutes

In this exercise, you will configure operating system settings on Azure VMs running SUSE Linux Enterprise Server to accommodate subsequent clustered installation of SAP HANA using Windows Jump box.

Task 1: Configure OS on Azure VMs running Linux

1. Login to the VM “hana-jumpbox” with the below credentials. Go to the Portal → Select the VM “hana-jumpbox” → Networking → Public IP address.

hana-jumpbox

Resource group (change)
hol_sea_usr_2729

Status
Running

Location
UK South

Subscription (change)
Microsoft Azure

Subscription ID
58380bf6-f9a8-4430-85d0-c0a7ba0efef0

Public IP address
51.145.25.251

Private IP address
10.0.3.23

Virtual network/subnet
hol_sea_usr_2729-vnet/azure-netapp2729

2. Run → MSTSC → Public IP address <Windows Jumpbox>

Remote Desktop Connection

Computer: 104.211.229.28

User name: None specified

You will be asked for credentials when you connect.

Show Options Connect Help

Enter your credentials
These credentials will be used to connect to 104.211.229.28.

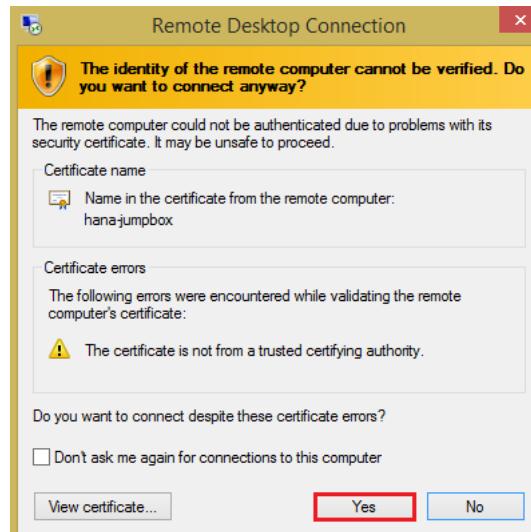
dbadmin
.....

Domain: PARIPORNA

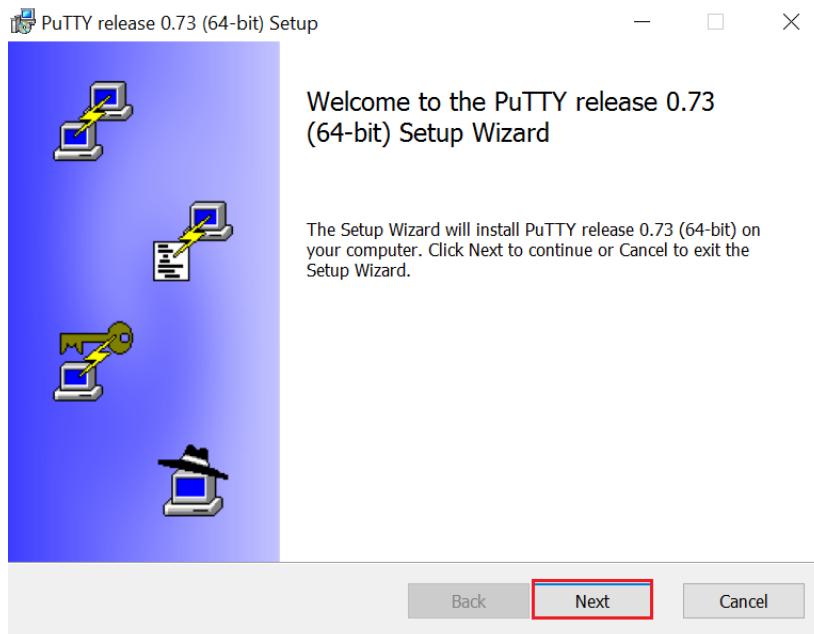
Remember my credentials

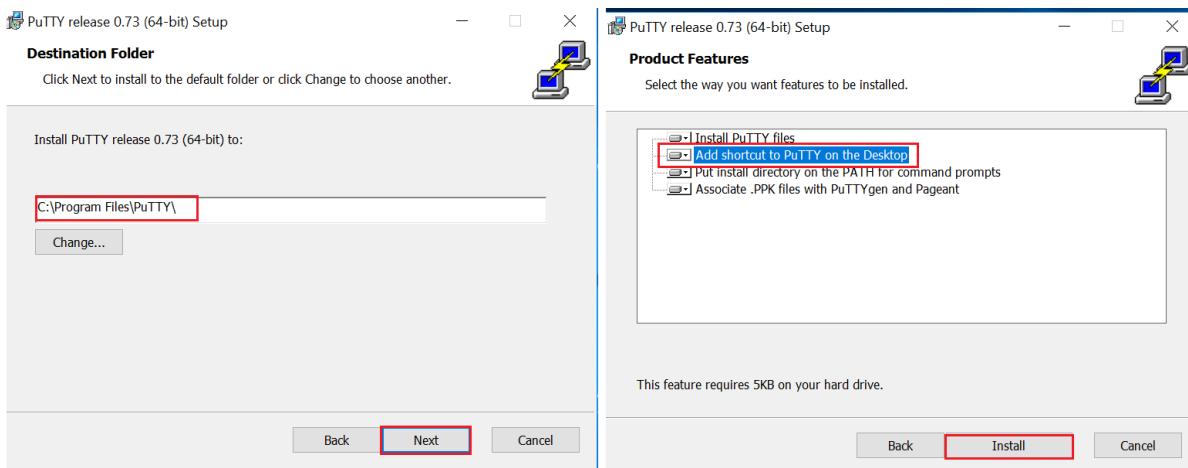
Username: dbadmin
Password: demoPassword1!

3. Accept the Security Alert



4. Install the PuTTY in “hana-jumpbox”. Double click the PuTTY exe → Click “Next” & Install.





5. From the hana-jumpbox, start the PuTTY client Login to the VM “s03-db-0” with the below credentials. Go to the Portal → Select the VM “s03-db-0” → Networking → Private IP address.

Home > Virtual machines > s03-db-0 - Networking

s03-db-0 - Networking
Virtual machine

Search (Ctrl+ /)

Overview Activity log Access control (IAM) Tags Diagnose and solve problems

Networking

Attach network interface Detach network interface

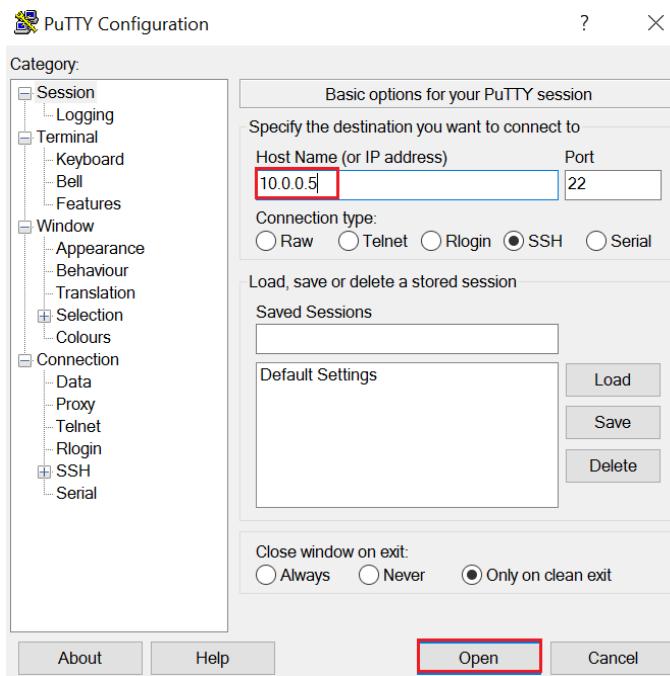
Network Interface: s03-db-0-nic Effective security rules Topology

Virtual network/subnet: hana-stonith2709-vnet/hana-stonith2709-subnet NIC Public IP: 52.172.6.87 NIC Private IP: **10.0.0.5**

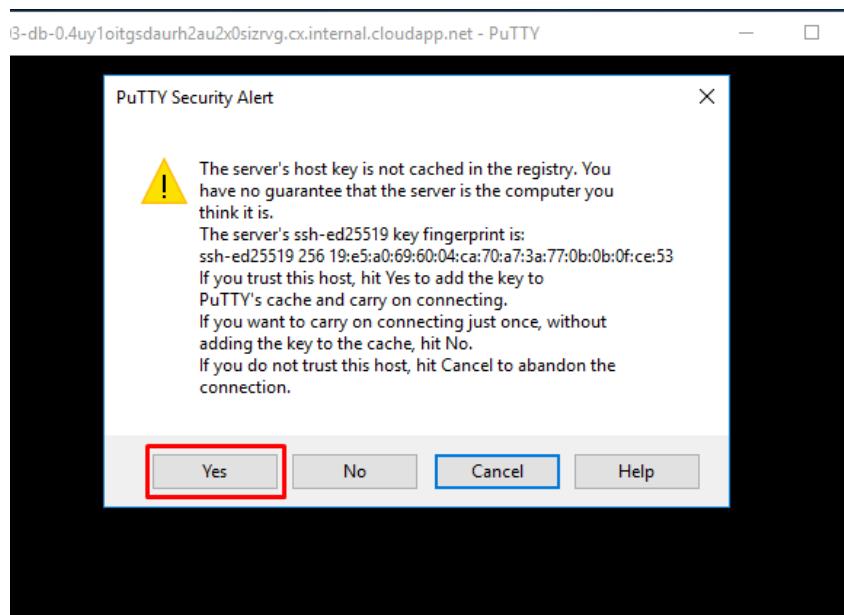
networking: **Disabled**

Inbound port rules Outbound port rules Application security groups Load balancing

This network interface does not contain network security groups



6. When prompted, in the **PuTTY Security Alert** dialog box, click **Yes**.



7. When prompted, login as **dbadmin** with the password **demoPassword1!**:

```
login as: dbadmin
Using keyboard-interactive authentication.
Password:
```

8. Elevate privileges by running **sudo -i** and, when prompted, providing the password for the dbadmin user account:

```
dbadmin@s03-db-0:~> sudo -i
```

We trust you have received the usual lecture from the local System

Administrator. It usually boils down to these three things:

- #1) Respect the privacy of others.
- #2) Think before you type.
- #3) With great power comes great responsibility.

[sudo] password for dbadmin:
s03-db-0:~ #

9. Activate the SUSE Linux with the below command

```
SUSEConnect -r 4FFDCC436AEF3C -e naarayanaa.lk@paripoorna.in
```

10. Repeat steps 1-5 for **s03-db-1**.

Task 2: Copy the HANA Binaries in both the VM's:

1. Switch into "s03-db-0" machine. Create the Directories "binaries" & "software".

```
mkdir /binaries /software
```

2. Mount the Software Binaries into the VM

<<<<Refer the Commands Text File for the Mount Instruction>>>>

3. Copy the hana Binaries into "s03-db-0" VM.

<<<<Refer the Copy Command Text File for the Mount Instruction>>>>

4. Repeat the same steps in "s03-db-1".

Task 3: Create Load Balancer

1. Go to the Portal → Create Resources → Load Balancer → Add.

The screenshot shows the Azure portal interface. On the left, a dark sidebar lists various services: Home, Dashboard, All services, Favorites (with All resources, Resource groups, App Services, SQL databases, Azure Cosmos DB, Virtual machines, and Load balancers), and Load balancers. The 'Load balancers' item is highlighted with a red box. At the top right, the title 'Load balancers' is followed by 'cloudalliancepartners (Default Directory)'. Below the title are buttons for '+ Add', 'Edit columns', 'Refresh', and 'Assign tags'. A message says 'Subscriptions: 1 of 2 selected - Don't see a subscription? Open Directory + Subscription settings'. There are filters for 'Filter by name...', 'Microsoft Azure', 'All resource groups', and 'All locations'. The main area displays a table header with columns 'Name ↑↓', 'Resource group ↑↓', and 'Location ↑↓'. To the right of the table is a large gray diamond icon with four arrows pointing outwards.

2. Select the following values,

RG:	Select default RG
Name:	s03-lb-db
Region:	RG's Location
Type:	Internal
Sku:	Basic
VNet & Subnet: Choose the default one	
IP Address:	static

Create load balancer

Name * ✓

Region * ▼

Type * Internal Public

SKU * Basic Standard

Configure virtual network.

Virtual network * ▼

Subnet * ▼
Manage subnet configuration

IP address assignment * Static Dynamic

Private IP address * ✓

Review + create < Previous Next : Tags > Download a template for automation

3. Create Backend Pools. Select Load balancer → s03-lb-db.

Name	Resource group	Location
s03-lb-db	hol_pu_ae_d1_4789_RG	South India

4. Create a Backend pool with name “**s03-lb-db-backendpool**”. Associate to create availability set. Add the both target virtual machine. Click Ok

Home > Load balancers > s03-lb-db - Backend pools

s03-lb-db - Backend pools

Load balancer

+ Add Refresh

Search (Ctrl+)

Overview Activity log Access control (IAM) Tags Diagnose and solve problems

Virtual machine Virtual machin... Network interface

No results.

Frontend IP configuration

Backend pools

Add backend pool

s03-lb-db

* Name: s03-lb-db-backendpool

IP version: IPv4

Associated to: Availability set

Availability set: s03-avset (number of virtual machines: 2)

Target network IP configurations

Only VMs within the current availability set can be chosen. Once a VM is chosen, you can select a network IP configuration related to it.

Virtual machine: s03-db-0

Network IP configuration: s03-db-0474/ipconfig1 (10.0.1.4)

* Target virtual machine: s03-db-1 (size: Standard_DS4_v2, network interfaces: 1)

* Network IP configuration: ipconfig1 (10.0.1.6)

+ Add a target network IP configuration

OK

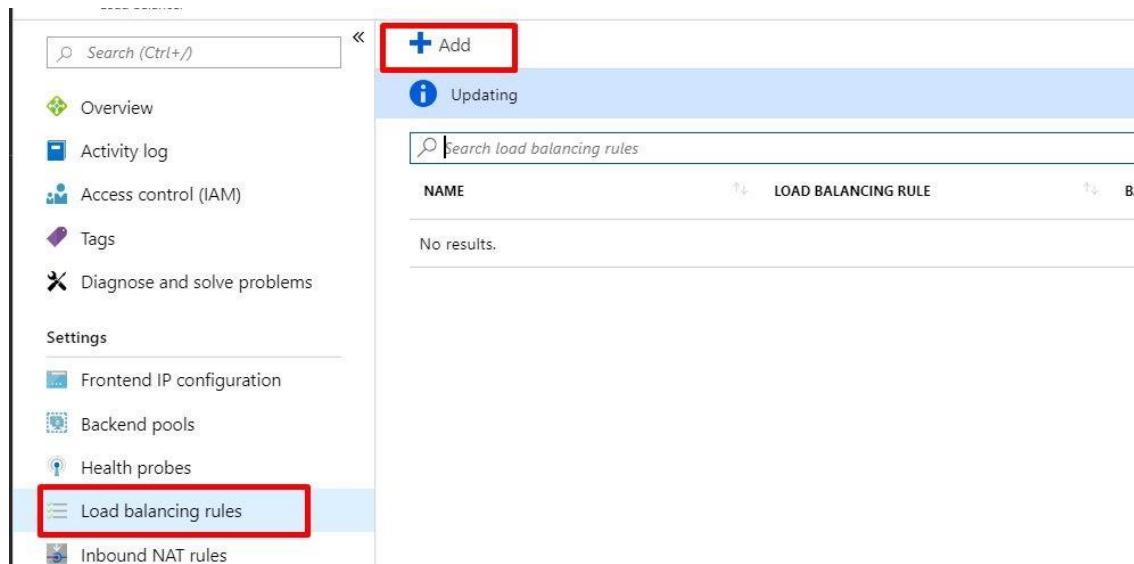
5. Create Health probe & Click Add.

The screenshot shows the Azure portal interface for managing a load balancer. On the left, there's a sidebar with various navigation options: Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Settings, Frontend IP configuration, Backend pools, Health probes (which is currently selected and highlighted with a red box), and Load balancing rules. At the top right, there's a large 'Add' button with a plus sign, also highlighted with a red box. The main area is titled 's03-lb-db - Health probes' and shows a table with one row: 'No results.' The table has columns for NAME, PROTOCOL, and PORT.

6. Add Health Probe and name it **s03-lb-db-probe** and port number to **62500**

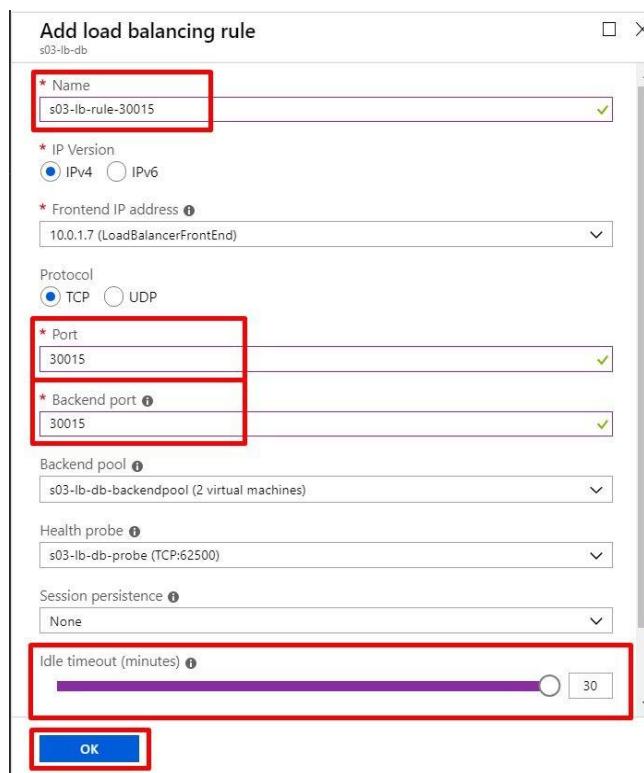
The screenshot shows the 'Add health probe' dialog box. It has fields for Name (set to 's03-lb-db-probe'), IP version (IPv4), Protocol (TCP), Port (62500), Interval (5 seconds), and Unhealthy threshold (2 consecutive failures). The 'OK' button at the bottom is highlighted with a red box.

7. Add Load balancing rule for port **30015** and **30017**. Select Load balancing rule and click Add.



The screenshot shows the Azure portal interface for managing load balancing rules. On the left, there's a sidebar with various navigation options like Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Settings, Frontend IP configuration, Backend pools, Health probes, Load balancing rules (which is selected and highlighted with a red box), and Inbound NAT rules. The main area is titled 'Updating' and shows a table with columns 'NAME' and 'LOAD BALANCING RULE'. A message at the top says 'No results.'

8. Add the load balancing rule with name **s03-lb-db-rule-30015**. Set Port & Backend port to **30015**. Set Idle timeout **30 Minutes** then press OK.



The dialog box is titled 'Add load balancing rule' and has the identifier 's03-lb-db'. It contains the following fields:

- * Name: s03-lb-rule-30015
- * IP Version: IPv4 (radio button selected)
- * Frontend IP address: 10.0.1.7 (LoadBalancerFrontEnd)
- Protocol: TCP (radio button selected)
- * Port: 30015
- * Backend port: 30015
- Backend pool: s03-lb-db-backendpool (2 virtual machines)
- Health probe: s03-lb-db-probe (TCP:62500)
- Session persistence: None
- Idle timeout (minutes): 30 (sliderset from 0 to 30)

At the bottom is a blue 'OK' button.

9. Repeat the same rule for port 30017

Home > Load balancers > s03-lb-db - Load balancing rules > Add load balancing rule

Add load balancing rule

s03-lb-db

Name *

 ✓

IP Version *

IPv4 IPv6

Frontend IP address * ⓘ

10.0.3.7 (LoadBalancerFrontEnd) ✓

Protocol

TCP UDP

Port *

 ✓

Backend port * ⓘ

 ✓

Backend pool ⓘ

s03-lb-db-backendpool (2 virtual machines) ✓

OK

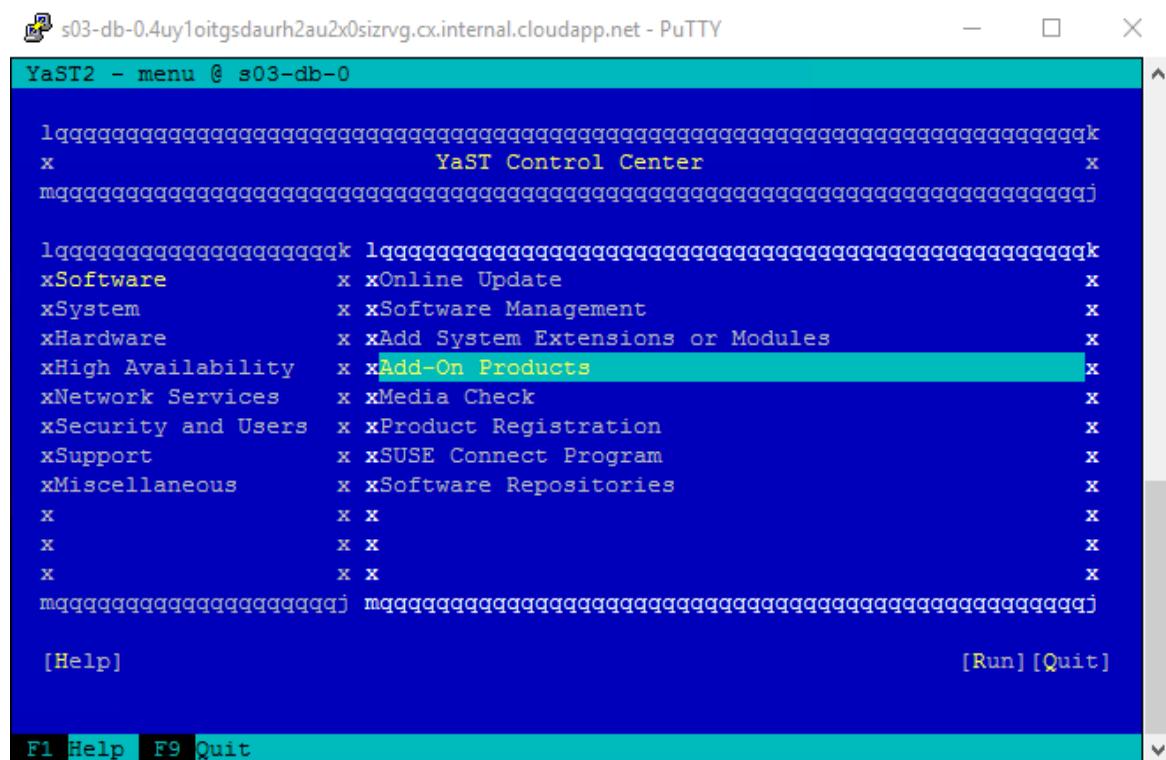
Task 4: Add YaST packages, update the Linux operating system, and install HA Extensions

ⓘ Use **Function Keys** or **Tab** and **Arrow Keys** to Move around in YaST Control Center. Use **Space** key to select options and **Enter** key to finalize options.

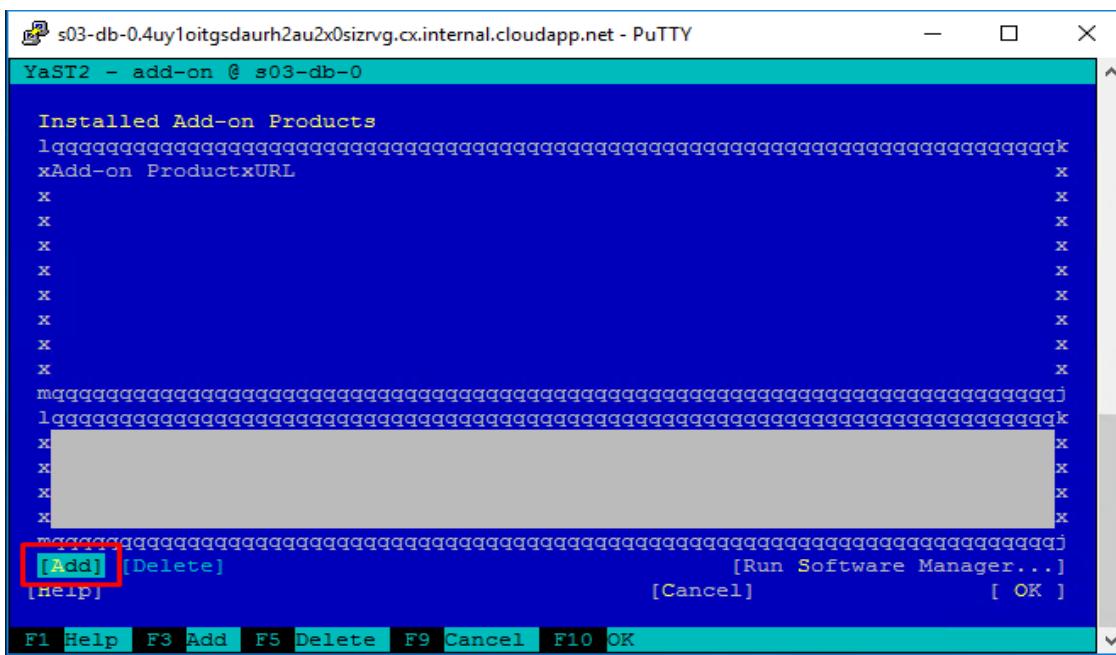
1. While connected via an SSH session to s03-db-0, launch YaST:

```
s03-db-0:~ # yast
```

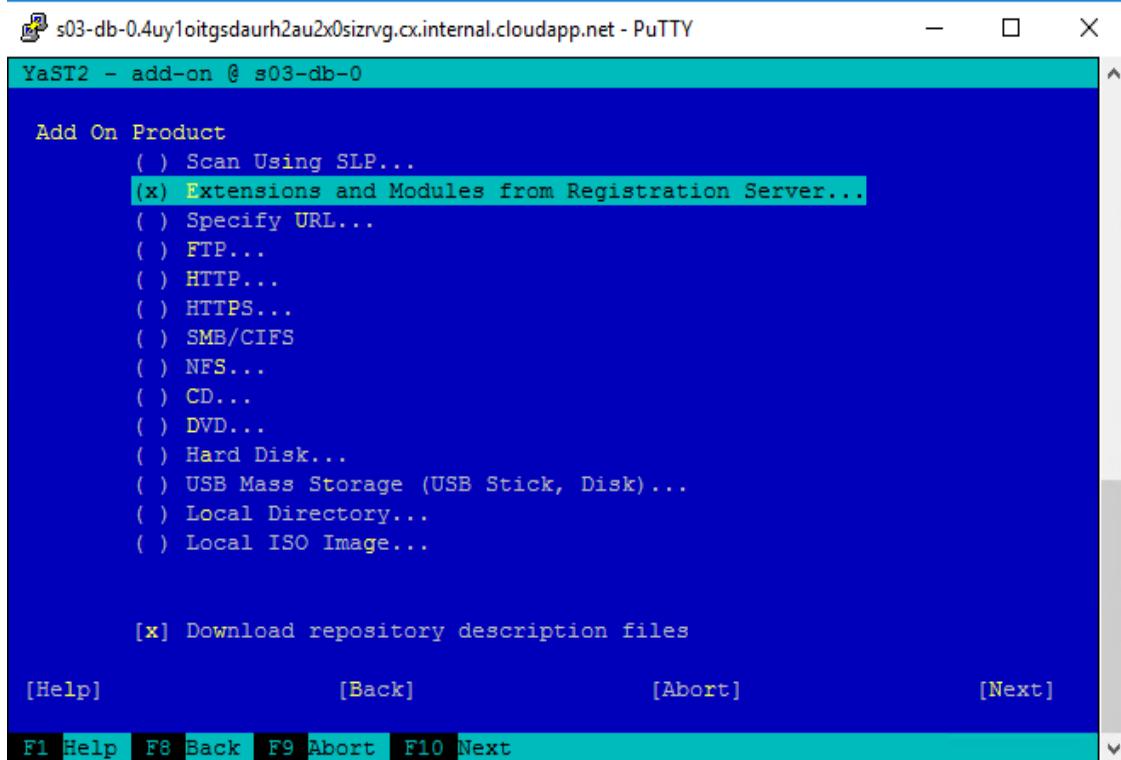
2. In **YaST Control Center**, select **Software -> Add-On Products** and press **Enter**. This will load **Package Manager**.



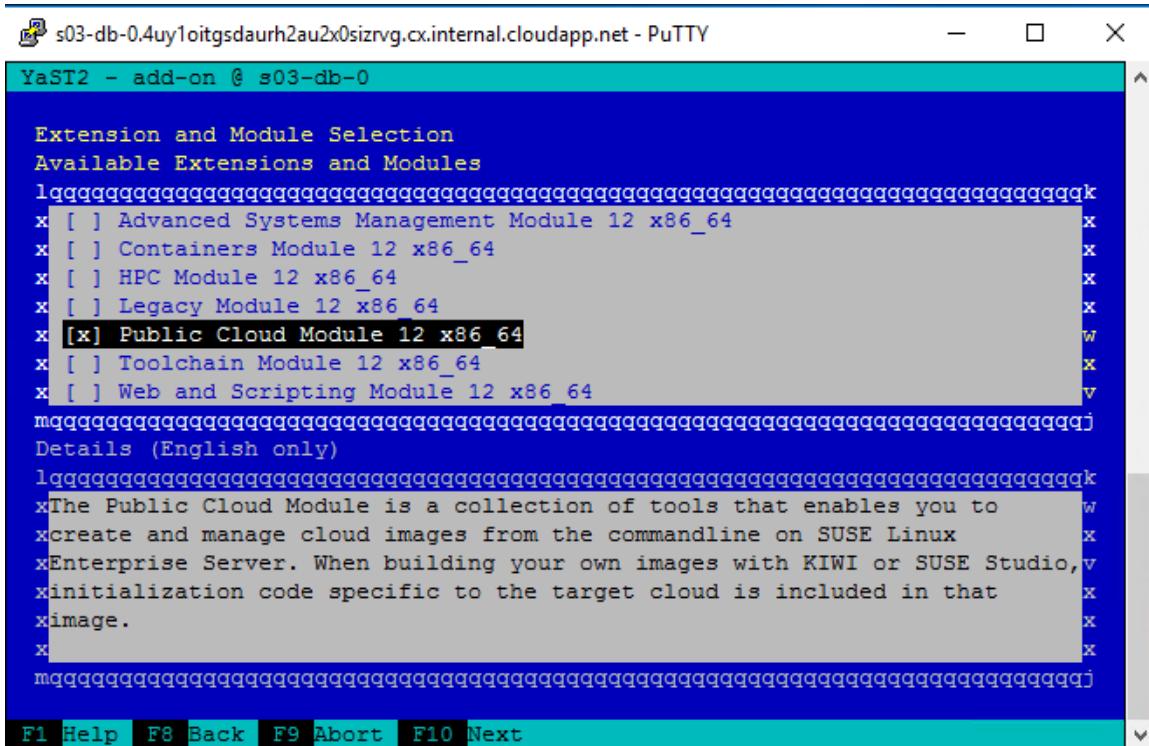
3. In the Package Manager interface, Select and Click Add:



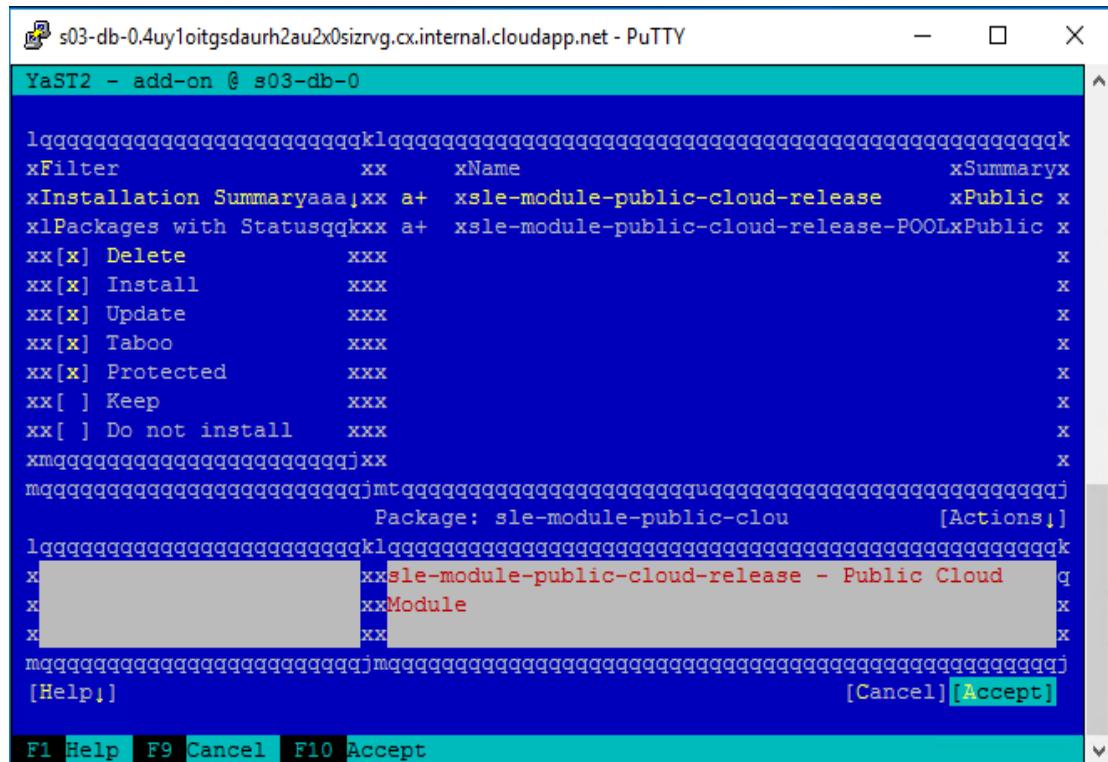
4. On the Add on Product screen, select Extensions and Modules from Registration Server -> Next:



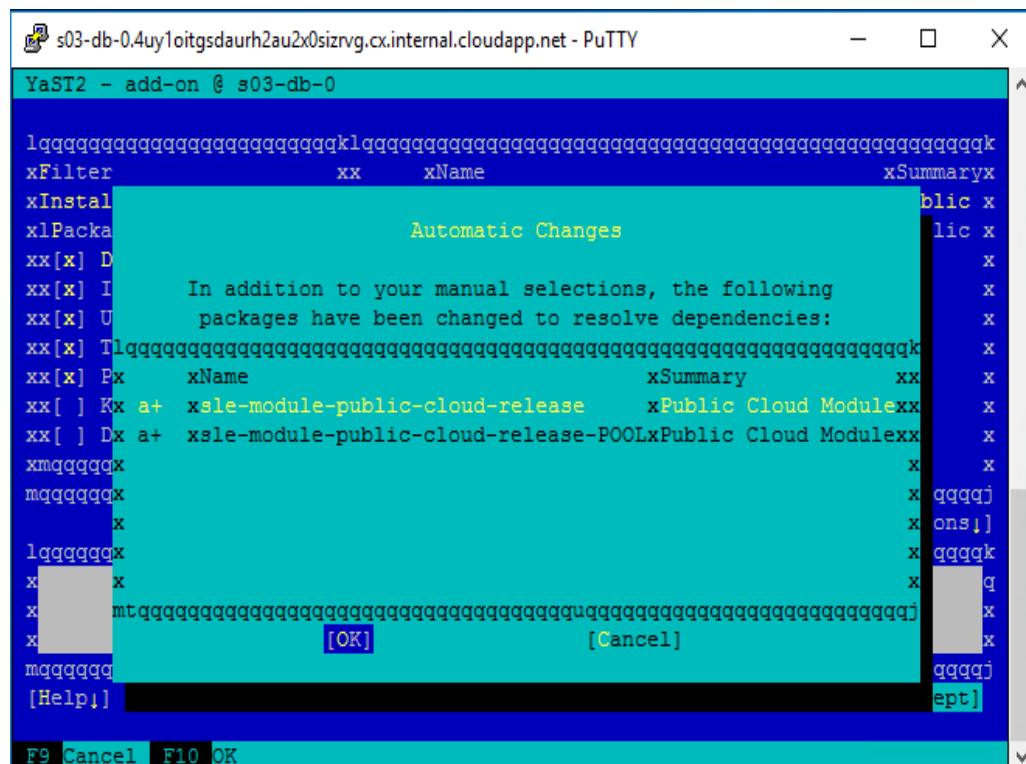
5. On the **Extension and Module Selection** screen, select **Public Cloud Module 12 x86_64**. Then, press **F10 (Next)**:



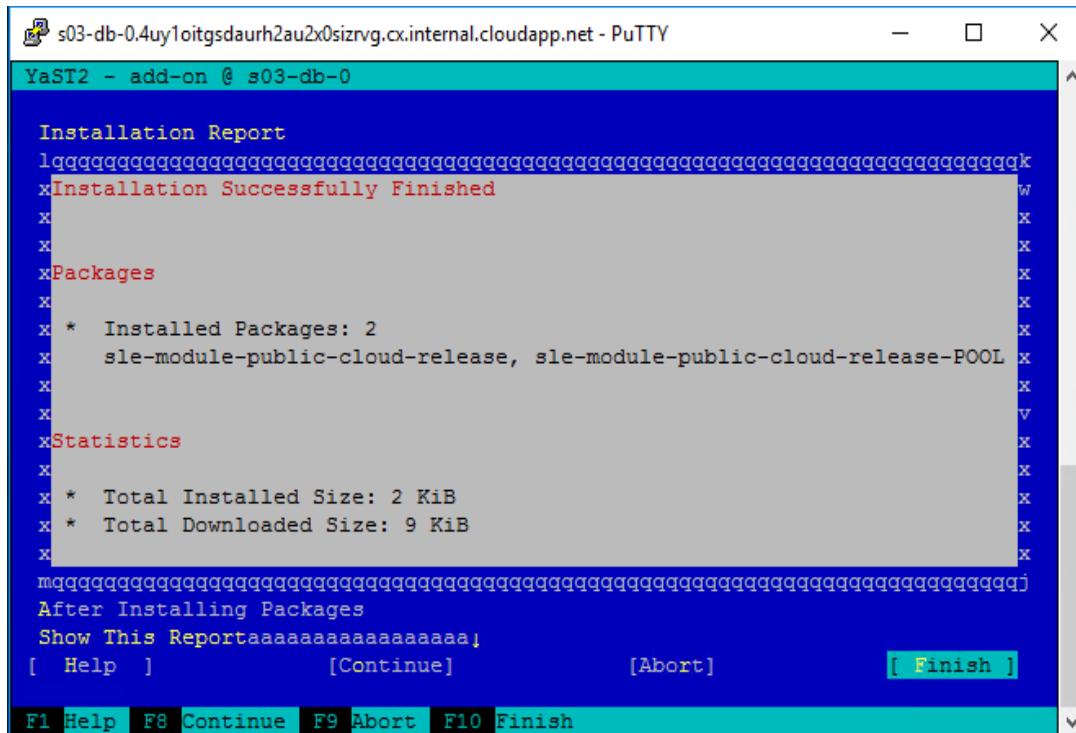
6. Select **Accept**.



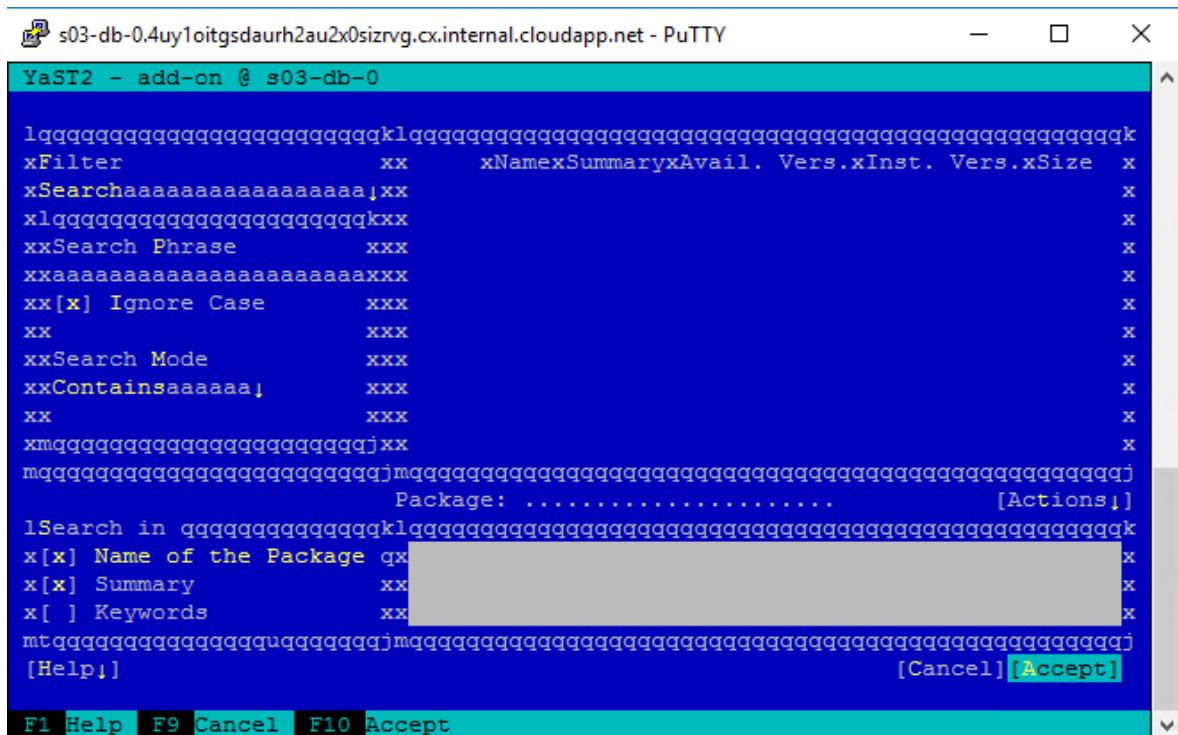
7. On the **Automatic Changes** screen, click **OK**:



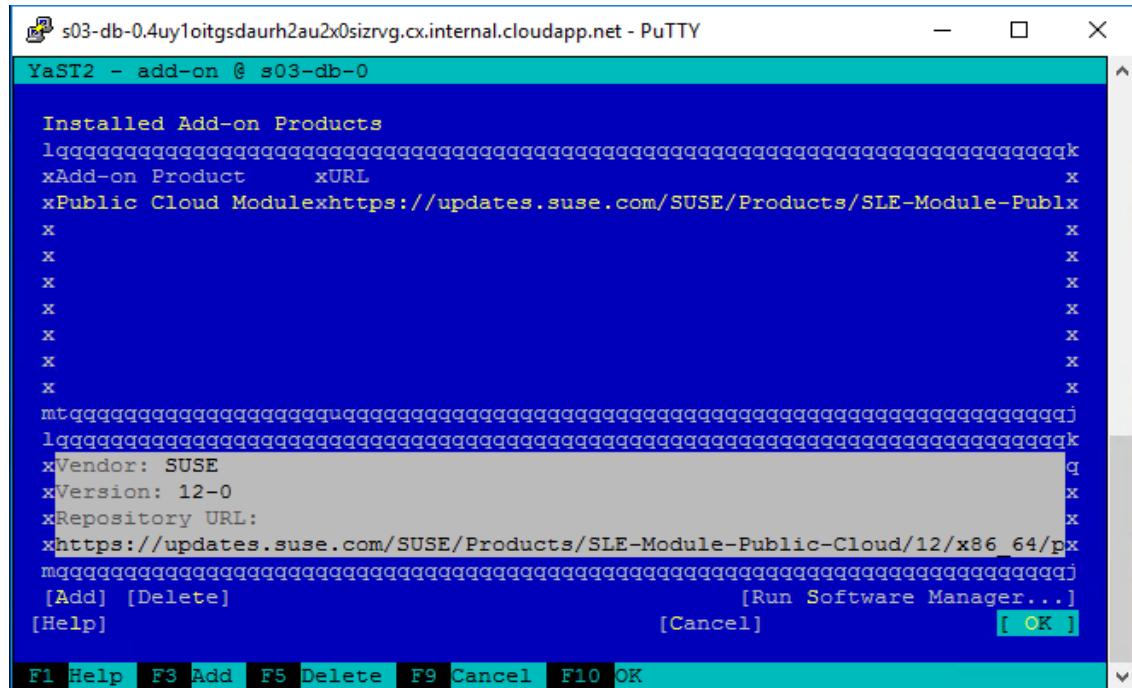
8. Once the installation has completed, click **Finish**:



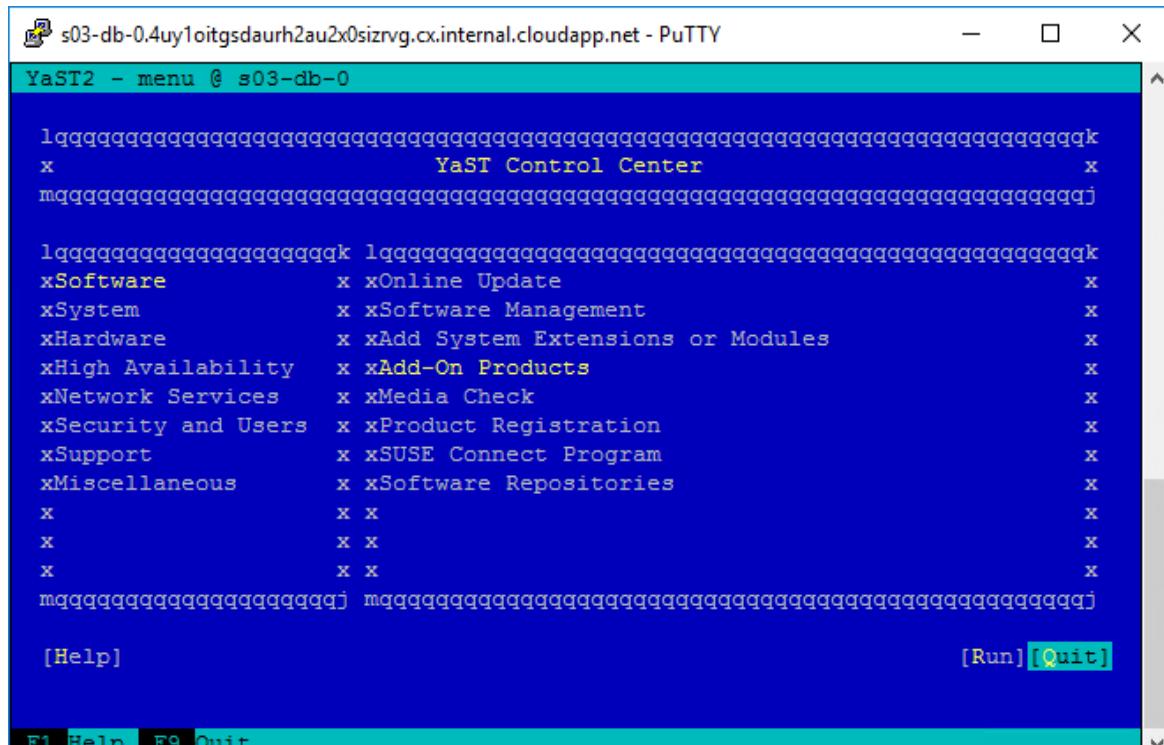
9. Click Accept.



10. Click **OK**



11. Back in YaST Control Center, click **Quit**:



12. Update operating system by running `zypper update`. When prompted, press `y`:

```
s03-db-0:~ # zypper update  
Refreshing service 'Public Cloud Module 12 x86_64'.
```

```
Refreshing service 'SUSE_Linux_Enterprise_Server_for_SAP_Applications_12_SP3_x86_64'.
Loading repository data...
Reading installed packages...
```

The following 19 NEW packages are going to be installed:

```
bash-completion crash-kmp-default gdk-pixbuf-lang grub2-systemd-sleep-plugin
kernel-default-4.4.92-6.18.1 kernel-firmware liblcms1 libmng1
libqt5-qtimageformats libqt5-qttranslations libwebp5 libwebpdemux1
libyui-qt-pkg7 openssh-askpass openssh-helpers plymouth-dracut postfix
sed-lang systemd-bash-completion
```

The following 135 packages are going to be upgraded:

```
Mesa Mesa-libEGL1 Mesa-libGL1 Mesa-libglapi0 SuSEfirewall2 at audit autofs
autoyast2 autoyast2-installation binutils corosync cpp48 ctdb curl cyrus-sasl
cyrus-sasl-digestmd5 cyrus-sasl-gssapi cyrus-sasl-plain cyrus-sasl-saslauthd
dbus-1 dbus-1-x11 desktop-data-SLE device-mapper dracut drbd-utils expat
gdk-pixbuf-query-loaders hyper-v insserv-compat iproute2 iptables
java-1_7_1-ibm javapackages-tools kexec-tools kpartx krb5 krb5-client
ldirectord libQt5Core5 libQt5DBus5 libQt5Gui5 libQt5Network5 libQt5Widgets5
libXvnc1 libaudit1 libbauparse0 libcorosync4 libcurl4 libdbus-1-3
libdcerpc-binding0 libdcerpc0 libexpat1 libfreebl3 libgbm1 libgcrypt20
libgdk_pixbuf-2_0-0 libicu52_1 libicu52_1-data libiptc0 liblua5_1 libncurses5
libncurses6 libndr-krb5pac0 libndr-nbt0 libndr-standard0 libndr0 libnetapi0
libopenssl1_0_0 libpcre1 libpcre16-0 libprocps3 librados2
libsamba-credentials0 libsamba-errors0 libsamba-hostconfig0 libsamba-passdb0
libsamba-util0 libsamdb0 libasl2-3 libsgutils2-2 libsmcconf0 libsmbldap0
libsoftokn3 libsystemd0 libtevent-util0 libtiff5 libudev1 libvirt-client
libvirt-libs libwbclient0 libxml2-2 libxtables10 logrotate lsscsi lvm2
lvm2-clvm lvm2-cmirrord mozilla-nss mozilla-nss-certs multipath-tools
ncurses-utils netcat-openbsd openssh openssl permissions procps
python-azure-agent python-pycrypto python-requests release-notes-sles
resource-agents samba-libs sed sg3_utils shadow supportutils
supportutils-plugin-suse-public-cloud systemd systemd-sysvinit tcpdump tcsh
terminfo terminfo-base udev xen-libs xinetd xorg-x11-Xvnc xtables-plugins
yast2-bootloader yast2-ca-management yast2-packager yast2-sap-scp-prolist
yast2-storage yast2-xml
```

135 packages to upgrade, 19 new.

Overall download size: 239.0 MiB. Already cached: 0 B. After the operation,
additional 376.6 MiB will be used.

Continue? [y/n/...? shows all options] (y): y

```
Retrieving package python-pycrypto-2.6.1-10.3.1.x86_64
(1/154), 371.8 KiB ( 2.0 MiB unpacked)
```

(...)

13. Update HA extensions dependencies by running **zypper install sle-ha-release fence-agents**. When prompted, press **y**, read through the **SUSE End User License Agreement**, press **q**, type **yes** to agree with the terms of the license, and press **Enter**.

```
s03-db-0:~ # zypper install sle-ha-release fence-agents
Refreshing service 'Public_Cloud_Module_12_x86_64'.
Refreshing service 'SUSE_Linux_Enterprise_Server_for_SAP_Applications_12_SP3_x86_64'.
```

```

Loading repository data...
Reading installed packages...
'fence-agents' is already installed.
No update candidate for 'fence-agents-4.0.25+git.1485179354.eb43835-2.19.x86_64'. The highest available version is already installed.
Resolving package dependencies...

The following 2 NEW packages are going to be installed:
  sle-ha-release sle-ha-release-POOL

The following NEW product is going to be installed:
  "SUSE Linux Enterprise High Availability Extension 12 SP3"

2 new packages to install.
Overall download size: 7.6 KiB. Already cached: 0 B. After the operation,
additional 1.7 KiB will be used.
Continue? [y/n/...? shows all options] (y): y
Do you agree with the terms of the license? [yes/no] (no): yes
Retrieving package sle-ha-release-POOL-12.3-1.53.x86_64
(1/2), 3.1 KiB ( 67 B unpacked)
Retrieving: sle-ha-release-POOL-12.3-1.53.x86_64.rpm .....[done]
Retrieving package sle-ha-release-12.3-1.53.x86_64
(2/2), 4.5 KiB ( 1.6 KiB unpacked)
Retrieving: sle-ha-release-12.3-1.53.x86_64.rpm .....[done]
Checking for file conflicts: .....[done]
(1/2) Installing: sle-ha-release-POOL-12.3-1.53.x86_64 .....[done]
(2/2) Installing: sle-ha-release-12.3-1.53.x86_64 .....[done]
s03-db-0:~ #

```

14. Repeat the steps 1-13 on **s03-db-1**

Checkpoint

Verify the installation of packages by entering anyone of the following commands,

```

s03-db-0:~ # rpm -qa --last | grep cloud
sle-module-public-cloud-release-POOL-12-1.96.x86_64 Tue Apr  3 10:55:24 2018
sle-module-public-cloud-release-12-7.3.1.x86_64 Tue Apr  3 10:55:24 2018
cloud-netconfig-azure-0.6-2.1.noarch      Wed Feb 21 17:23:19 2018
supportutils-plugin-suse-public-cloud-1.0.2-6.3.1.noarch Wed Feb 21 17:23:09 2018
s03-db-0:~ # zypper lu

```

Task 5: Configure Passwordless SSH between 2 linux VM's.

1. Reset the root password to **demoPassword1!**

```

s03-db-0:/# passwd root
New password: demoPassword1!
Retype new password: demoPassword1!
passwd: password updated successfully

```

2. Permit the root Login

```
vim /etc/ssh/sshd_config  
  
Uncomment the line "PermitRootLogin yes"  
  
:wq  
Save exit the file
```

3. Type the following command to enable SSH.

```
s03-db-0:/ # ssh-keygen  
Generating public/private rsa key pair.  
Enter file in which to save the key (/root/.ssh/id_rsa): <Press Enter>  
Created directory '/root/.ssh'.  
Enter passphrase (empty for no passphrase): <Press Enter>  
Enter same passphrase again: <Press Enter>  
Your identification has been saved in  
/root/.ssh/id_rsa. Your public key has been  
saved in /root/.ssh/id_rsa.pub. The key  
fingerprint is:  
  
SHA256:zMb5SKqoJUnEM/Uv1PTGJuEBdJsxmdV4V7cbAqRZdm0  
root@s03-db-0 The key's randomart image is:  
| . o . =+ ..  
| . . . - .  
| . . + |  
| o . . |  
| o . |  
| ... |  
+----[SHA256]--
```

4. Repeat the step on the other vm s03-db-1

5. Copy the Auth Key from s03-db0 to s03-db-1. Run the below command from "s03-db-0" VM.

```
cat .ssh/id_rsa.pub | ssh root@s03-db-1 'cat >> .ssh/authorized_keys'
```

```
s03-db-0:~ # cat .ssh/id_rsa.pub | ssh root@s03-db-1 'cat >> .ssh/authorized_keys'
The authenticity of host 's03-db-1 (10.0.0.4)' can't be established.
ECDSA key fingerprint is SHA256:oJRXkt2qTn70tOs98ZBOZMVnI8NIzits1F066i5urBo.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 's03-db-1,10.0.0.4' (ECDSA) to the list of known hosts.
Password:
s03-db-0:~ #
```

6. Run the following command from s03-db-1

```
cat .ssh/id_rsa.pub | ssh root@s03-db-0 'cat >> .ssh/authorized_keys'
```

```
10.0.0.4 - PuTTY
s03-db-1:~ # cat .ssh/id_rsa.pub | ssh root@s03-db-0 'cat >> .ssh/authorized_keys'
The authenticity of host 's03-db-0 (10.0.0.5)' can't be established.
ECDSA key fingerprint is SHA256:14T2KVAGuMokd7gYkDBpvUhzlJ8GN2tS0RS5mTHRjhU.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 's03-db-0,10.0.0.5' (ECDSA) to the list of known hosts.
Password:
s03-db-1:~ #
```

►Checkpoint

Verify the Password Less SSH connection. Try the below command from s03-db-0. Type “exit” to close the connection.

```
ssh root@s03-db-1
```

```
10.0.0.5 - PuTTY
s03-db-0:~ # ssh root@s03-db-1
Last login: Sun Nov 24 14:51:39 2019 from 10.0.0.5
SUSE Linux Enterprise Server 12 SP3 for SAP Applications x86_64 (64-bit)

Please register this image using your existing SUSE entitlement.

As "root" (sudo or sudo -i) use either one of the following commands:
- SUSEConnect --url=https://scc.suse.com -e company@example.com -r YOUR_CODE
- yast scc

to register the instance with SCC

Without registration this instance does not have access to updates and
security fixes.

If you are using extensions consider to enable the auto-update feature
of the extension agent and restarting the service. As root execute:
- sed -i s/AutoUpdate.Enabled=n/AutoUpdate.Enabled=y/ /etc/waagent.conf
- rcwaagent restart

Management and Config: https://www.suse.com/suse-in-the-cloud-basics
Documentation: https://www.suse.com/documentation/sles-12/
Forum: https://forums.suse.com/forumdisplay.php?93-SUSE-Public-Cloud

Have a lot of fun...
s03-db-1:~ #
```

Exercise 2: Configure clustering on Azure VMs running Linux

Duration: 15 minutes

In this exercise, you will configure clustering on Azure VMs running Linux.

Task 1: Configure clustering

- From the SSH session on **s03-db-0**, run **ha-cluster-init** and follow the prompts:

- Do you want to continue anyway (y/n)? **y**
- /root/.ssh/id_rsa already exists - overwrite (y/n)? **n**
- Network address to bind to (e.g.: 192.168.1.0) [172.17.1.0]: **ENTER**
- Multicast address (e.g.: 239.x.x.x) [239.119.57.183]: **ENTER**
- Multicast port [5405]: **ENTER**
- Do you wish to use SBD (y/n)?: **n**
- Do you wish to configure an administration IP (y/n)?: **n**

```
s03-db-0:~ # ha-cluster-init
! No watchdog device found. If SBD is used, the cluster will be unable to start without a watchdog.
Do you want to continue anyway (y/n)? y
/root/.ssh/id_rsa already exists - overwrite (y/n)? n
Configuring csync2
Generating csync2 shared key (this may take a while)...done
```

Configure Corosync:

This will configure the cluster messaging layer. You will need to specify a network address over which to communicate (default is eth0's network, but you can use the network address of any active interface).

Network address to bind to (e.g.: 192.168.1.0) [172.17.1.0]
Multicast address (e.g.: 239.x.x.x) [239.119.57.183]
Multicast port [5405]

Configure SBD:

If you have shared storage, for example a SAN or iSCSI target, you can use it avoid split-brain scenarios by configuring SBD. This requires a 1 MB partition, accessible to all nodes in the cluster. The device path must be persistent and consistent across all nodes in the cluster, so /dev/disk/by-id/* devices are a good choice. Note that all data on the partition you specify here will be destroyed.

Do you wish to use SBD (y/n)? **n**
! Not configuring SBD - STONITH will be disabled.
Hawk cluster interface is now running. To see cluster status, open:
<https://172.17.1.10:7630/>
Log in with username 'hacluster', password 'linux'
! You should change the hacluster password to something more secure!
Waiting for cluster.....done
Loading initial cluster configuration

Configure Administration IP Address:

Optionally configure an administration virtual IP address. The purpose of this IP address is to provide a single IP that can be used to interact with the cluster, rather than using the IP address of any specific cluster node.

Do you wish to configure an administration IP (y/n)? n
Done (log saved to /var/log/ha-cluster-bootstrap.log)

2. From the SSH session on **s03-db-1**, run **ha-cluster-join** and follow the prompts:

- Do you want to continue anyway (y/n)? **y**
- IP address or hostname of existing node (e.g.: 192.168.1.1) []: **s03-db-0**
- /root/.ssh/id_dsa already exists - overwrite (y/n)? **n**

```
s03-db-1:/ # ha-cluster-join
! NTP is not configured to start at system boot.
! No watchdog device found. If SBD is used, the cluster will be unable to start without a watchdog.
Do you want to continue anyway (y/n)? y
Join This Node to Cluster:
You will be asked for the IP address of an existing node, from which
configuration will be copied. If you have not already configured
passwordless ssh between nodes, you will be prompted for the root
password of the existing node.

IP address or hostname of existing node (e.g.: 192.168.1.1) []s03-db-0
Retrieving SSH keys - This may prompt for root@s03-db-0:
/root/.ssh/id_rsa already exists - overwrite (y/n)? n
No new SSH keys installed
Configuring csync2
Merging known_hosts
Probing for new partitions...done
Call cib_query failed (-6): No such device or address
Hawk cluster interface is now running. To see cluster status, open:
  https://172.17.1.11:7630/
Log in with username 'hacluster', password 'linux'
! You should change the hacluster password to something more secure!
Waiting for cluster.....done
Done (log saved to /var/log/ha-cluster-bootstrap.log)
```

3. From the SSH session on **s03-db-0**, run **passwd hacluster**, and follow the prompts to change the password of the hacluster account to **demoPassword1!**:

```
s03-db-0:/ # passwd hacluster
New password:
Retype new password:
passwd: password updated successfully
```

4. Repeat step 3 on **s03-db-1**.

Task 2: Configure corosync

1. From the SSH session on s03-db-0, modify the **/etc/corosync/corosync.conf** file:

```
s03-db-0:~ # vi /etc/corosync/corosync.conf
```

2. Add the following bolded content to the file.

```
[...]
interface {
    [...]
}
transport:udpu
}
nodelist {
node {
    ring0_addr: <<<Private IP for s03-db-0>>>
    nodeid: 1
}
node {
    ring0_addr: <<<Private IP for s03-db-1>>>
    nodeid: 2
}
}
logging {
[...]
```

3. Save the file, and restart the corosync service by running **service corosync restart**:

```
s03-db-0:/ # service corosync restart
```

4. Repeat steps 1-3 on **s03-db-1**.

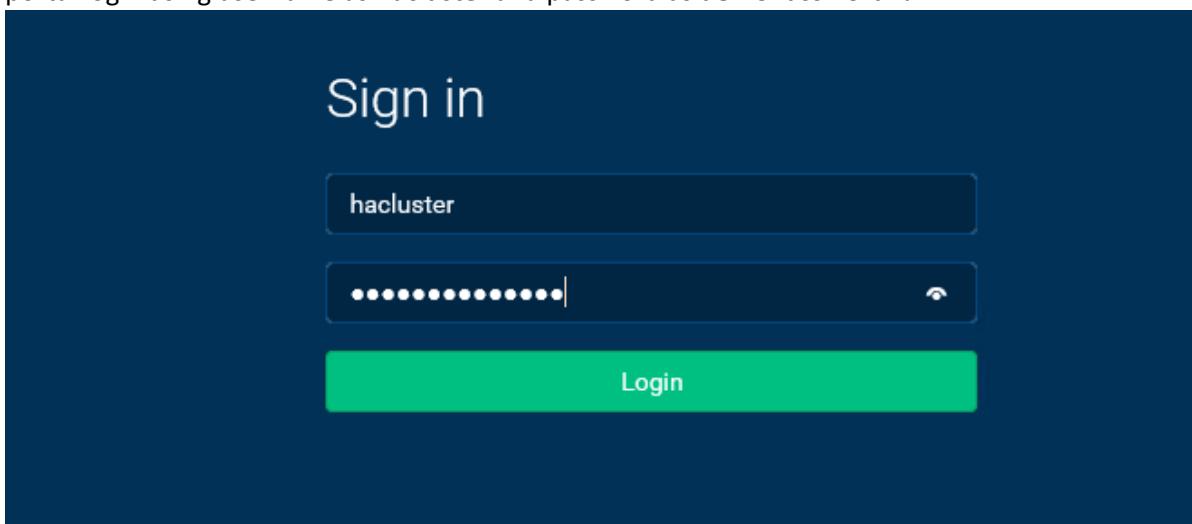
➤ Checkpoint

1. Check service status of corosync by typing in the following command. Which will show the clustering status of VM

```
s03-db-0:/ # service corosync status
```

```
s03-db-0:~ # service corosync restart
s03-db-0:~ # service corosync status
● corosync.service - Corosync Cluster Engine
  Loaded: loaded (/usr/lib/systemd/system/corosync.service; disabled; vendor pres
  et: disabled)
  Active: active (running) since Tue 2018-04-03 11:19:15 UTC; 9s ago
    Process: 22092 ExecStop=/usr/share/corosync/corosync stop (code=exited, status=0
/SUCCESS)
    Process: 22104 ExecStart=/usr/share/corosync/corosync start (code=exited, status
=0/SUCCESS)
  Main PID: 22112 (corosync)
    Tasks: 2 (limit: 512)
   CGroup: /system.slice/corosync.service
           └─22112 corosync
```

- From your jump box vm, open browser and type in the url as <https://s03-db-0:7630>. Which opens the hawk portal login using username as **hacluster** and password as **demoPassword1!**.



- After logging in, click on Nodes, then verify that both linux vm has been added for clustering.

Status	Name	Maintenance
	s03-db-0	
	s03-db-1	

- Verify it from the command line by typing the following command

```
s03-db-0:/ # crm status
```

```
s03-db-0:~ # crm status
Stack: corosync
Current DC: s03-db-0 (version 1.1.16-4.8-77ea74d) - partition with quorum
Last updated: Tue Apr 3 11:37:53 2018
Last change: Tue Apr 3 11:19:37 2018 by hacluster via crmd on s03-db-0

2 nodes configured
0 resources configured

Online: [ s03-db-0 s03-db-1 ]

No resources

s03-db-0:~ #
```

Exercise 3: Install SAP HANA

Duration: 60 minutes

In this exercise, you will install SAP HANA.

Task 1: Add Storage Disk for Hana Installation (s03-db-0, s03-db-1) & Mount :

- Add Additional disk to the VM “s03-db-0”. Go to the portal → VM’s → s03-db-0 → Disks → add Data Disk.

The screenshot shows the Azure portal interface for managing disks. The top navigation bar includes 'Search (Ctrl+)', 'Edit', 'Refresh', 'Encryption', and 'Swap OS Disk'. The main content area displays disk settings for the 's03-db-0' virtual machine. It shows one 'OS disk' named 's03-db-0_OsDisk_1_c47f82d9641b412dace6a5ca8f...', which is 30 GiB in size, uses a Standard SSD storage account, and is not encrypted. Below this, under 'Data disks', it says 'None'. At the bottom right of the blade, there is a prominent blue button labeled '+ Add data disk'.

- Create Disk.

Search (Ctrl+ /)

Save Discard Refresh Encryption Swap OS Disk

Ultra Disk compatibility is not available for this location.

Disk settings

Enable Ultra Disk compatibility ⓘ

Yes No

OS disk

Name	Size	Storage account ...	Encryption
s03-db-0_OsDisk_1_c47f82d9641b412dace6a5ca8...	30 GiB	Standard SSD	Not enabled

Data disks

LUN	Name	Storage account ...	Encryption
0	No managed disks available. ⚡ The value must not be empty.	-	Not enabled
	Create disk		
	No managed disks available.		

3. Create new disk & enter the following parameters.

Storage Disk Name:	hanastr01
Resource Group:	Refer RG's location
Account Type:	Standard SSD
Size:	128 GB

Home > Virtual machines > s03-db-0 - Disks > Create managed disk

Create managed disk

Create a new disk to store applications and data on your VM. Disk price is based on size, storage type, and number of transactions.

Disk name * ⓘ

hanastr

Resource group * ⓘ

hol_sea_usr_2701_RG

Create new

Location

Southeast Asia

Availability zone ⓘ

None

Source type ⓘ

None

Select a disk size

Browse available disk sizes and their features.

Account type ⓘ

Standard SSD

Size	Disk tier	Max IOPS	Max throughput
4 GiB	E1	120	25
8 GiB	E2	120	25
16 GiB	E3	120	25
32 GiB	E4	120	25
64 GiB	E6	240	50
128 GiB	E10	500	60
256 GiB	E15	500	60
512 GiB	E20	500	60
1024 GiB	E30	500	60
2048 GiB	E40	500	60

Create OK

4. Save the disk.

s03-db-0 - Disks

Ultra Disk compatibility is not available for this location.

Name	Size	Storage account ...	Encryption
s03-db-0_OsDisk_1_c47f82d9641b412dace6a5ca8...	30 GiB	Standard SSD	Not enabled

LUN	Name	Size	Storage account ...	Encryption
0	hanastr1	128 GiB	Standard SSD	Not enabled

5. Switch into Putty & Execute the command from “root” user.

```
fdisk /dev/sdc
```

```
23.98.70.12 - PuTTY
s03-db-0:~ # fdisk /dev/sdc

Welcome to fdisk (util-linux 2.29.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table.
Created a new DOS disklabel with disk identifier 0xd9727c25.

Command (m for help) :
```

6. Create new partition → “n” Enter → “p” primary partition
Partition number → Accept the default value
First Sector → Accept the default Value
Last Sector → Accept the default Value
Partition has been successfully created with 128 GB.

```
Command (m for help): n
Partition type
  p  primary (0 primary, 0 extended, 4 free)
  e  extended (container for logical partitions)
Select (default p): p
Partition number (1-4, default 1):
First sector (2048-2145386495, default 2048):
Last sector, +sectors or +size{K,M,G,T,P} (2048-2145386495, default 2145386495):

Created a new partition 1 of type 'Linux' and of size 1023 GiB.

Command (m for help):
```

7. Save the partition with the command “w”.

```
Created a new partition 1 of type 'Linux' and of size 1023 GiB.

Command (m for help): w
The partition table has been altered.
Calling ioctl() to re-read partition table.
Syncing disks.

hana-poc-nfs:~ #
```

8. Format the new partition with ext4 file system.

mkfs.ext4 /dev/sdc1

```
hana-poc-nfs:~ # mkfs.ext4 /dev/sdc1
mke2fs 1.42.11 (09-Jul-2014)
Creating filesystem with 268173056 4k blocks and 67043328 inodes
Filesystem UUID: 97ca8fc4-2954-4bc9-9860-38a0b72825aa
Superblock backups stored on blocks:
      32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
     4096000, 7962624, 11239424, 20480000, 23887872, 71663616, 78675968,
    102400000, 214990848

Allocating group tables: done
Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done

hana-poc-nfs:~ #
```

9. Create directory “hana” in root directory.

cd /
mkdir hana

10. Verify the directory creation by executing the below command.

ls -l

```

hana-poc-nfs:/ # mkdir hana
hana-poc-nfs:/ # ls -l
total 104
drwxr-xr-x  2 root      root   4096 Aug 17 11:05 bin
drwxr-xr-x  4 root      root   4096 Dec 25 17:37 boot
-rw-r--r--  1 root      root    30 Aug 17 11:05 bootincluded_archives fileList
drwxr-xr-x 19 root      root  3820 Dec 26 16:40 dev
drwxr-xr-x 106 root     root 12288 Dec 26 12:55 etc
drwxr-xr-x  2 root      root  4096 Dec 26 16:49 hana
drwxr-xr-x  3 root      root  4096 Dec 25 18:00 home
drwxr-xr-x  2 dbadmin  users  4096 Feb  6 2017 kiwi-hooks
drwxr-xr-x 10 root     root  4096 Aug 17 11:05 lib
drwxr-xr-x  8 root      root  4096 Aug 17 11:04 lib64
drwx-----  2 root      root 16384 Aug 17 11:08 lost+found
drwxr-xr-x  4 root      root  4096 Dec 25 17:39 mnt
drwxr-xr-x  2 root      root  4096 Jun 27 2017 opt

```

11. Mount the new partition into /hana directory

```
mount dev/sdc1 /hana/
```

12. Verify the disk mount.

```
df -hT
```

```

hana-poc-nfs:~ # df -hT
Filesystem      Type  Size  Used  Avail Use% Mounted on
devtmpfs        devtmpfs 16G    0    16G  0% /dev
tmpfs           tmpfs   24G    0    24G  0% /dev/shm
tmpfs           tmpfs   16G   18M   16G  1% /run
tmpfs           tmpfs   16G    0    16G  0% /sys/fs/cgroup
/dev/sda2       ext4   29G   1.6G   26G  6% /
/dev/sdal       ext3   976M   46M   880M  5% /boot
/dev/sdb1       ext4   197G   60M   187G  1% /mnt/resource
tmpfs           tmpfs   3.2G    0    3.2G  0% /run/user/1000
/dev/sdc1       ext4  1007G  72M   956G  1% /hana
hana-poc-nfs:~ #

```

13. Mount the disk permanently by enter the below commands in “/etc/fstab” file.

```
vim /etc/fstab
```

press “i” for the insert mode

```
/dev/sdc1 /hana ext4 defaults 1 2
```

Press “escape” key to exit insert mode

```
:wq <save and exit the file>
```

14. Repeat steps 1-12 on s03-db-1 using the same custom values and accepting the same default values.

Task 2: Install HANA Database in Both the VM's

- From the SSH session on s03-db-0, change the current directory to the location of the hdblcm binary:

```
s03-db-0:/ # cd /binaries/DATA_UNITS/HDB_SERVER_LINUX_X86_64
s03-db-0/binaries/DATA_UNITS/HDB_SERVER_LINUX_X86_64 #
```

- From the SSH session on s03-db-0, run **./hdblcm** and follow prompts:

- Enter selected system index [3]: **1**
- Enter comma-separated list of the selected indices [3]: **2**
- Enter Installation Path [/hana/shared]: *accept the default*
- Enter Local Host Name [s03-db-0]: *accept the default*
- Do you want to add additional hosts to the system? (y/n) [n]: *accept the default*
- Enter SAP HANA System ID: **S03**
- Enter Instance Number [00]: *accept the default*
- Select Database Mode / Enter Index [1]: *accept the default*
- Select System Usage / Enter Index [4]: **4**
- Enter Location of Data Volumes [/hana/data/S03]: *accept the default*
- Enter Location of Log Volumes [/hana/log/S03]: *accept the default*
- Enter Certificate Host Name for Host 's03-db-0' [s03-db-0]: *accept the default*
- Enter SAP Host Agent User (sapadm) Password: **demoPassword1!**
- Confirm SAP Host Agent User (sapadm) Password: **demoPassword1!**
- Enter System Administrator (s03adm) Password: **demoPassword1!**
- Confirm System Administrator (s03adm) Password: **demoPassword1!**
- Enter System Administrator Home Directory [/usr/sap/S03/home]: *accept the default*
- Enter System Administrator Login Shell [/bin/sh]: *accept the default*
- Enter System Administrator User ID [1001]: *accept the default*
- Enter ID of User Group (sapsys) [79]: *accept the default*
- Enter Database User (SYSTEM) Password: **demoPassword1!**
- Confirm Database User (SYSTEM) Password: **demoPassword1!**
- Restart system after machine reboot? [n]: *accept the default*

```
s03-db-0:/ # cd /hana/shared/media/SAP-Media/51052325/DATA_UNITS/HDB_SERVER_LINUX_X86_64
s03-db-0:/hana/shared/media/SAP-Media/51052325/DATA_UNITS/HDB_SERVER_LINUX_X86_64 # ./hdblcm
SAP HANA Lifecycle Management - SAP HANA Database 2.00.020.00.1500920972
*****
Scanning software locations...
Detected components:
SAP HANA Database (2.00.020.00.1500920972) in
    /hana/shared/media/51052325/DATA_UNITS/HDB_SERVER_LINUX_X86_64/server SAP
HANA AFL (incl.PAL,BFL,OFL,HIE) (2.00.020.0000.1500932993) in
/hana/shared/media/51052325/DATA_UNITS/HDB_AFL_LINUX_X86_64/packages SAP
HANA EML AFL (2.00.020.0000.1500932993) in
/hana/shared/media/51052325/DATA_UNITS/HDB_EML_AFL_10_LINUX_X86_64/packages
SAP HANA EPM-MDS (2.00.020.0000.1500932993) in /hana/shared/media/51052325/DATA_UNITS/SAP_HANA_EPM-
MDS_10/packages SAP HANA Database Client (2.2.23.1499440855) in
/hana/shared/media/51052325/DATA_UNITS/HDB_CLIENT_LINUX_X86_64/client
SAP HANA Studio (2.3.27.000000) in /hana/shared/media/51052325/DATA_UNITS/HDB_STUDIO_LINUX_X86_64/studio
SAP HANA Smart Data Access (2.00.0.0000.0) in
/hana/shared/media/51052325/DATA_UNITS/SAP_HANA_SDA_20_LINUX_X86_64/packages
SAP HANA XS Advanced Runtime (1.0.63.292045) in
```

/hana/shared/media/51052325/DATA_UNITS/XSA_RT_10_LINUX_X86_64/packages
 GUI for HALM for XSA (including product installer) Version 1 (1.12.2) in
 /hana/shared/media/51052325/DATA_UNITS/XSA_CONTENT_10/XSACALMPIUI12_2.zip
 XSAC FILEPROCESSOR 1.0 (1.000.3) in /hana/shared/media/51052325/DATA_UNITS/XSA_CONTENT_10/XSACFILEPROC00_3.zip
 SAP
 Enterprise Architecture Designer 1.0 for SAP HANA (1.002.00) in
 /hana/shared/media/51052325/DATA_UNITS/XSA_CONTENT_10/XSACHANAEAD02_0.ZIP
 SAP HANA tools for accessing catalog content, data preview, SQL console, etc. (2.002.6) in
 /hana/shared/media/51052325/DATA_UNITS/XSAC_HRTT_20/XSACHRTT02_6.zip
 XS Monitoring 1 (1.005.2) in /hana/shared/media/51052325/DATA_UNITS/XSA_CONTENT_10/XSACMONITORING05_2.zip
 Develop and run portal services for custome apps on XSA (1.001.1) in
 /hana/shared/media/51052325/DATA_UNITS/XSA_CONTENT_10/XSACPORTALSERV01_1.zip
 SAP Web IDE Web Client (4.002.0) in
 /hana/shared/media/51052325/DATA_UNITS/XSAC_SAP_WEB_IDE_20/XSACSAPWEBIDE02_0.zip XS
 Services 1 (1.005.3) in /hana/shared/media/51052325/DATA_UNITS/XSA_CONTENT_10/XSACSERVICES05_3.zip
 SAPUI5 FESV3 XSA 1 - SAPUI5 SDK 1.44 (1.044.18) in
 /hana/shared/media/51052325/DATA_UNITS/XSA_CONTENT_10/XSACUI5FESV344_18.zip
 XSAC XMLA Interface For Hana 1 (1.000.2) in
 /hana/shared/media/51052325/DATA_UNITS/XSA_CONTENT_10/XSACXMLAINT00_2.zip
 Xsa Cockpit 1 (1.000.7) in /hana/shared/media/51052325/DATA_UNITS/XSA_CONTENT_10/XSACXSACOCKPIT00_7.zip
 Choose an action
[Index](#) | [Action](#) | [Description](#)

1 | install | Install new system
 2 | extract_components | Extract components
 3| Exit (do nothing) |
 Enter selected action index [3]: 1
 SAP HANA Database version '2.00.020.00.1500920972' will be installed.
 Select additional components for installation:
[Index](#) | [Components](#) | [Description](#)

1 | all | All components
 2 | server | No additional components
 3 | client | Install SAP HANA Database Client version 2.2.23.1499440855
 4 | studio | Install SAP HANA Studio version 2.3.27.000000
 5 | smartda | Install SAP HANA Smart Data Access version 2.00.0.000.0
 6 | xs | Install SAP HANA XS Advanced Runtime version 1.0.63.292045
 7 | afl | Install SAP HANA AFL (incl.PAL,BFL,OFL,HIE) version 2.00.020.0000.1500932993
 8 | eml | Install SAP HANA EML AFL version 2.00.020.0000.1500932993
 9 | epmmds | Install SAP HANA EPM-MDS version 2.00.020.0000.1500932993
 Enter comma-separated list of the selected indices [3]: 2
 Enter Installation Path [/hana/shared]:
 Enter Local Host Name [s03-db- 0]:
 Do you want to add hosts to the system? (y/n) [n]:
 Enter SAP HANA System ID: S03
 Enter Instance Number [00]:
 Enter Local Host Worker Group [default]:
[Index](#) | [System Usage](#) | [Description](#)

1 | production | System is used in a production environment
 2 | test | System is used for testing, not production
 3 | development | System is used for development, not production
 4 | custom | System usage is neither production, test nor development
 Select System Usage / Enter Index [4]: 4

```
Enter Location of Data Volumes [/hana/data/S03]:  
Enter Location of Log Volumes [/hana/log/S03]:  
Restrict maximum memory allocation? [n]:  
Enter Certificate Host Name For Host &#39;s03-db- 0&#39; [s03-db- 0]:  
Enter SAP Host Agent User (sapadm) Password:  
Confirm SAP Host Agent User (sapadm) Password:  
Enter System Administrator (s03adm) Password:  
Confirm System Administrator (s03adm) Password:  
Enter System Administrator Home Directory [/usr/sap/S03/home]:  
Enter System Administrator Login Shell [/bin/sh]:  
Enter System Administrator User ID [1001]:  
Enter ID of User Group (sapsys) [79]:  
Enter System Database User (SYSTEM) Password:  
Confirm System Database User (SYSTEM) Password:  
Restart system after machine reboot? [n]:  
Summary before execution:  
=====  
SAP HANA Database System Installation  
Installation Parameters  
Remote Execution: ssh  
Database Isolation: low  
Installation Path: /hana/shared  
Local Host Name: s03-db- 0  
SAP HANA System ID: S03  
Instance Number: 00  
Local Host Worker Group: default  
System Usage: custom  
Location of Data Volumes: /hana/data/S03  
Location of Log Volumes: /hana/log/S03  
Certificate Host Names: s03-db- 0 -> s03-db- 0  
System Administrator Home Directory: /usr/sap/S03/home  
System Administrator Login Shell: /bin/sh  
System Administrator User ID: 1001  
ID of User Group (sapsys): 79  
Software Components  
SAP HANA Database  
Install version 2.00.020.00.1500920972  
Location: /hana/shared/media/51052325/DATA_UNITS/HDB_SERVER_LINUX_X86_64/server  
SAP HANA AFL (incl.PAL,BFL,OFL,HIE)  
Do not install  
SAP HANA EML AFL  
Do not install  
SAP HANA EPM-MDS  
Do not install  
SAP HANA Database Client  
Do not install  
SAP HANA Studio  
Do not install  
SAP HANA Smart Data Access  
Do not install  
SAP HANA XS Advanced Runtime  
Do not install  
Do you want to continue? (y/n): y  
Installing components...  
Installing SAP HANA Database...
```

```
Preparing package &#39;Saphostagent Setup&#39;...
Preparing package &#39;Python Support&#39;...
Preparing package &#39;Python Runtime&#39;...
Preparing package &#39;Product Manifest&#39;...
Preparing package &#39;Binaries&#39;...
Preparing package &#39;Data Quality&#39;...
Preparing package &#39;Krb5 Runtime&#39;...
Preparing package &#39;Installer&#39;...
Preparing package &#39;Ini Files&#39;...
Preparing package &#39;HW CCT&#39;...
Preparing package &#39;Documentation&#39;...
Preparing package &#39;Delivery Units&#39;...
Preparing package &#39;Offline Cockpit&#39;...
Preparing package &#39;DAT Languages (EN, DE)&#39;...
Preparing package &#39;DAT Languages (other)&#39;...
Preparing package &#39;DAT Configfiles (EN, DE)&#39;...
Preparing package &#39;DAT Configfiles (other)&#39;...
Creating System...
Extracting software...
Installing package &#39;Saphostagent Setup&#39;...
Installing package &#39;Python Support&#39;...
Installing package &#39;Python Runtime&#39;...
Installing package &#39;Product Manifest&#39;...
Installing package &#39;Binaries&#39;...
Installing package &#39;Data Quality&#39;...
Installing package &#39;Krb5 Runtime&#39;...
Installing package &#39;Installer&#39;...
Installing package &#39;Ini Files&#39;...
Installing package &#39;HW CCT&#39;...
Installing package &#39;Documentation&#39;...
Installing package &#39;Delivery Units&#39;...
Installing package &#39;Offline Cockpit&#39;...
Installing package &#39;DAT Languages (EN, DE)&#39;...
Installing package &#39;DAT Languages (other)&#39;...
Installing package &#39;DAT Configfiles (EN, DE)&#39;...
Installing package &#39;DAT Configfiles (other)&#39;...
Creating instance...
Installing SAP Host Agent version 7.21.26...
Starting SAP HANA Database system...
Starting 4 processes on host &#39;s03-db-0&#39; (worker):
Starting on &#39;s03-db-0&#39;; hdbcompileserver, hdbdaemon, hdbnameserver, hdbpreprocessor
Starting 7 processes on host &#39;s03-db-0&#39; (worker):
Starting on &#39;s03-db-0&#39;; hdbcompileserver, hdbdaemon, hdbindexserver, hdbnameserver, hdbpreprocessor,
hdbwebdispatcher, hdbxsengine
Starting on &#39;s03-db-0&#39;; hdbcompileserver, hdbdaemon, hdbindexserver, hdbpreprocessor, hdbwebdispatcher,
hdbxsengine
Starting on &#39;s03-db-0&#39;; hdbdaemon, hdbindexserver, hdbwebdispatcher, hdbxsengine
Starting on &#39;s03-db-0&#39;; hdbdaemon, hdbwebdispatcher, hdbxsengine
Starting on &#39;s03-db-0&#39;; hdbdaemon, hdbwebdispatcher
All server processes started on host &#39;s03-db-0&#39; (worker).
Importing delivery units...
Importing delivery unit HCO_INA_SERVICE
Importing delivery unit HANA_DT_BASE
Importing delivery unit HANA_IDE_CORE
Importing delivery unit HANA_TA_CONFIG
Importing delivery unit HANA_UI_INTEGRATION_SVC
```

```
Importing delivery unit HANA_UI_INTEGRATION_CONTENT
Importing delivery unit HANA_XS_BASE
Importing delivery unit HANA_XS_DBUTILS
Importing delivery unit HANA_XS_EDITOR
Importing delivery unit HANA_XS_IDE
Importing delivery unit HANA_XS_LM
Importing delivery unit HDC_ADMIN
Importing delivery unit HDC_BACKUP
Importing delivery unit HDC_IDE_CORE
Importing delivery unit HDC_SEC_CP
Importing delivery unit HDC_SYS_ADMIN
Importing delivery unit HDC_XS_BASE
Importing delivery unit HDC_XS_LM
Importing delivery unit SAPUI5_1
Importing delivery unit SAP_WATT
Importing delivery unit HANA_SEC_CP
Importing delivery unit HANA_BACKUP
Importing delivery unit HANA_HDBLCM
Importing delivery unit HANA_SEC_BASE
Importing delivery unit HANA_SYS_ADMIN
Importing delivery unit HANA_ADMIN
Importing delivery unit HANA_WKLD_ANLZ
Installing Resident hdblcm...
Updating SAP HANA Database Instance Integration on Local Host...
Regenerating SSL certificates...
Deploying SAP Host Agent configurations...
Creating Component List...
SAP HANA Database System installed
You can send feedback to SAP with this form: https://s03-db-0:1129/lms1/HDBLCM/S03/feedback/feedback.html
Log file written to '&#39;/var/tmp/hdb_S03_hdblcm_install_2018-02-22_07.21.27/hdblcm.log&#39; on host &#39;s03-db-0&#39;;
Repeat steps 1-2 on s03-db-1 using the same custom values and accepting the same default values.
```

► CheckPoint

Verify that instances of HANA Installation are running fine, by running any one of the following commands.

```
s03-db-0:~ # su - s03adm
s03adm@s03-db-0:/usr/sap/S03/HDB00> sapcontrol -nr 00 -function GetProcessList
```

You must be able to see that all the services are returning status as **GREEN**.

```
s03adm@s03-db-0:/usr/sap/S03/HDB00> sapcontrol -nr 00 -function GetProcessList
04.04.2018 04:28:05
GetProcessList
OK
name, description, dispstatus, textstatus, starttime, elapsedtime, pid
hdbdaemon, HDB Daemon, [GREEN], Running, 2018 04 03 12:10:08, 16:17:57, 24127
hdbcompileserver, HDB Compileservice, [GREEN], Running, 2018 04 03 12:10:56, 16:17:09
, 24390
hdbnameserver, HDB Nameserver, [GREEN], Running, 2018 04 03 12:10:09, 16:17:56, 2414
3
hdbpreprocessor, HDB Preprocessor, [GREEN], Running, 2018 04 03 12:10:56, 16:17:09,
24392
hdbwebdispatcher, HDB Web Dispatcher, [GREEN], Running, 2018 04 03 12:12:53, 16:15:1
2, 24825
hdbindexserver, HDB Indexserver-S03, [GREEN], Running, 2018 04 03 12:10:58, 16:17:07
, 24432
hdbxsengine, HDB XSEngine-S03, [GREEN], Running, 2018 04 03 12:10:58, 16:17:07, 2443
4
```

You can also verify using other set of commands to verify the status :

- **Logged In as demouser/root**
 - ps aux | grep s03adm
 - service sapconf status
- **Logged In as S03ADM**
 - HDB proc
 - HDB info

Exercise 4: Configure SAP HANA replication

Duration: 20 minutes

In this exercise, you will configure SAP HANA replication.

Before you start setting up SAP HANA system replication, your HANA databases need to fulfill the following prerequisites:

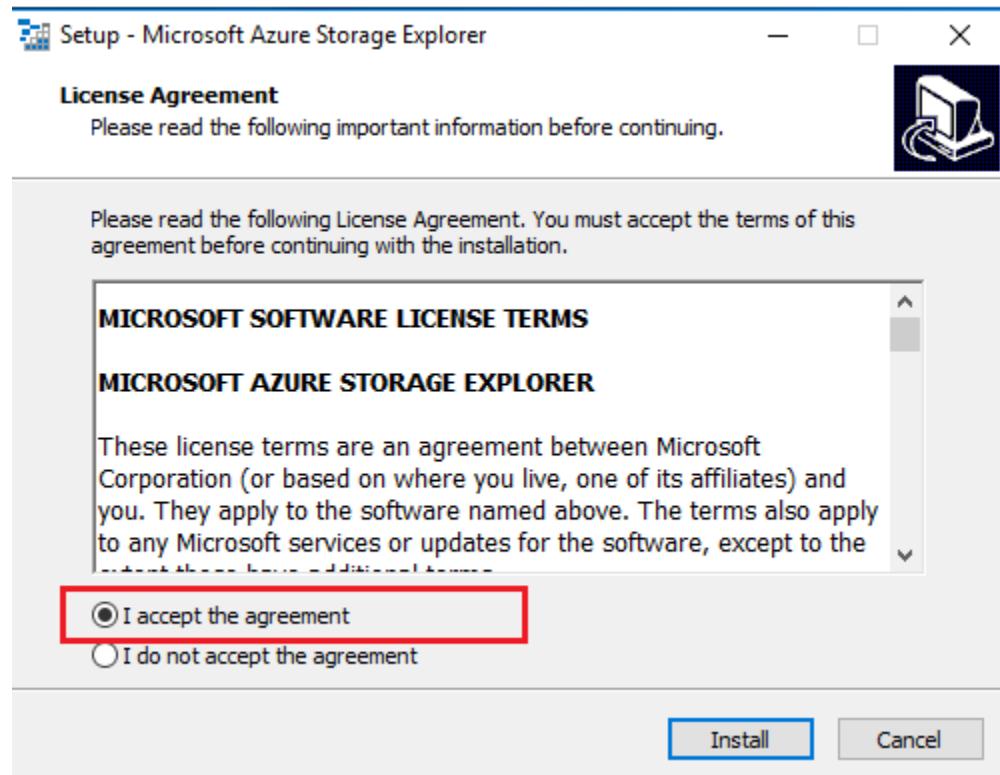
Prerequisite :

- The primary and secondary systems are both installed and configured. You have verified that both are independently up and running.
- In HANA 2.0 the System PKI SSFS key and data files were copied from the primary to the secondary site according to this SAP Note 2369981.
 - The files can be found here
 - `$/usr/sap/<SID>/SYS/global/security/rsecssfs/data/ SSFS_S03.DAT`
 - `$/usr/sap/<SID>/SYS/global/security/rsecssfs/key/ SSFS_S03.KEY`
- The number of nodes in the secondary system has to be equal to the number of active nodes in the primary system. (As of HANA 1.0 SPS06 the secondary system does not need to have standby nodes.)
- All configuration steps have to be executed on the master name server node; for SAP HANA Multitenant Database Containers this means on the System DB (and not on the tenant DBs).

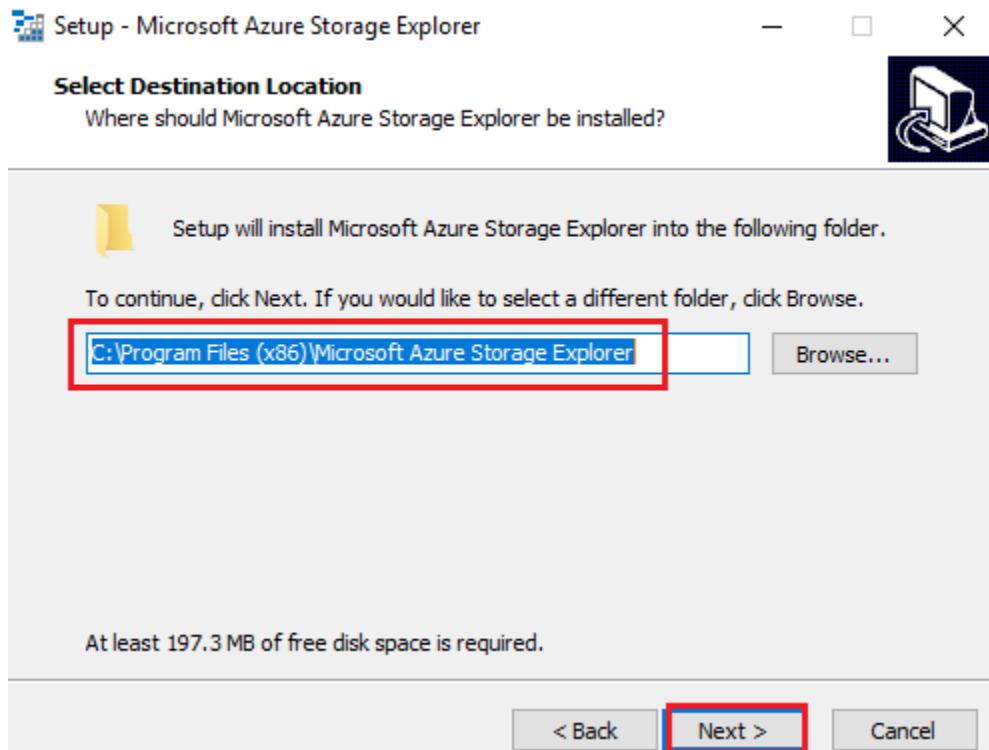
- The SAP HANA software version of the secondary has to be equal to or newer than the one on the primary; however, if you want to make use of a read enabled secondary system in an Active/Active (read enabled) configuration, the SAP HANA software versions have to be identical.
- The secondary system must have the same SAP system ID, <SID>, and instance number as the primary system. The primary replicates all relevant license information to the secondary.
- System replication between two systems on the same host is not supported.
- Changes to the ini file configuration parameters made on one system should be duplicated on the other system. As of HANA 1.0 SPS06 the configuration parameter checker reports differences between primary and secondary parameter settings (generating alerts in the SAP HANA studio). As of HANA 1.0 SPS12INI parameters can be replicated to the secondary system.
- The required ports must be available. The same <instance number> is used for primary and secondary systems. The <instance number> +1 must be free on both systems, because this port range is used for system replication communication 6 .
- An initial data backup or snapshot must be performed on the primary before the system replication can be activated. In SAP HANA Multitenant Database Containers all databases must have been backed up, i. e. the system DB as well as all tenant DBs7 .
 - 6 For additional port specific information in Multitenant Database Containers running in System Replication please refer to http://help.sap.com/hana/SAP_HANA_Administration_Guide_en.pdf - section:SAP HANA System Replication with Multitenant Database Containers
 - 7 In an already running SAP HANA system replication for a Multitenant Database Container HANA, every newly created tenant DB has to be backed up for the replication to start.

Task 1: Install SAP HANA Studio Administration on the Azure VM running Windows

1. Install the Storage Explorer into Windows Jumpbox. Switch into the windows jumpbox machine from LAB computer. Select the software right click → “run As Administrator”

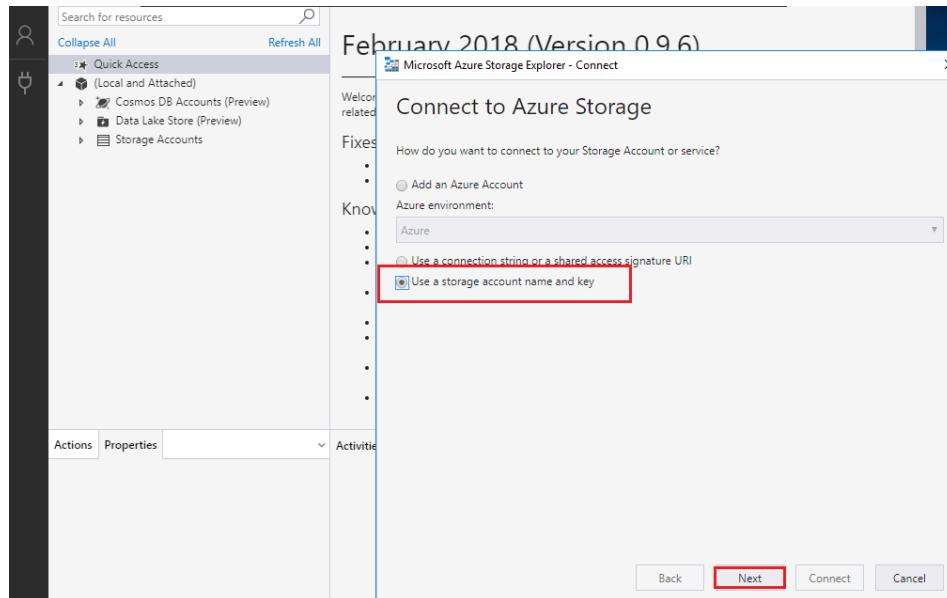


2. Choose the Software installation location as default, click → Next & Complete the installation.



3. Launch the Storage Explorer & Connect to azure Storage by using the Storage account name & key.

<<Please refer the attached file “Commands-Day3-HOL.txt” file for azure storage location>>



4. Enter the Display Name, Storage Account Name & key values.

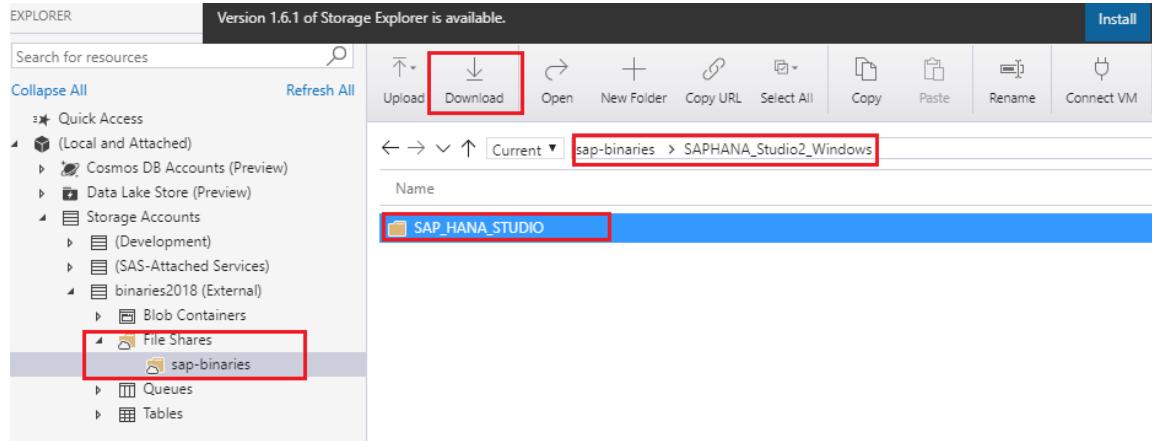
This screenshot shows the "Connect with Name and Key" configuration dialog. It has several input fields:

- Display name: "Softwares" (highlighted with a red box)
- Account name: "Others2019" (highlighted with a red box)
- Account key: "UzuOqP7UEjAwjNRlxsC9GI7vmjcFom5ib/misaSkAVBCJzVvUdb44R+5fKw6cMCFLf23EcTfnVW13WFwi8pCtC" (highlighted with a red box)
- Storage domain: "Azure"
- A checkbox for "Use HTTP (not recommended)" is present but unchecked.

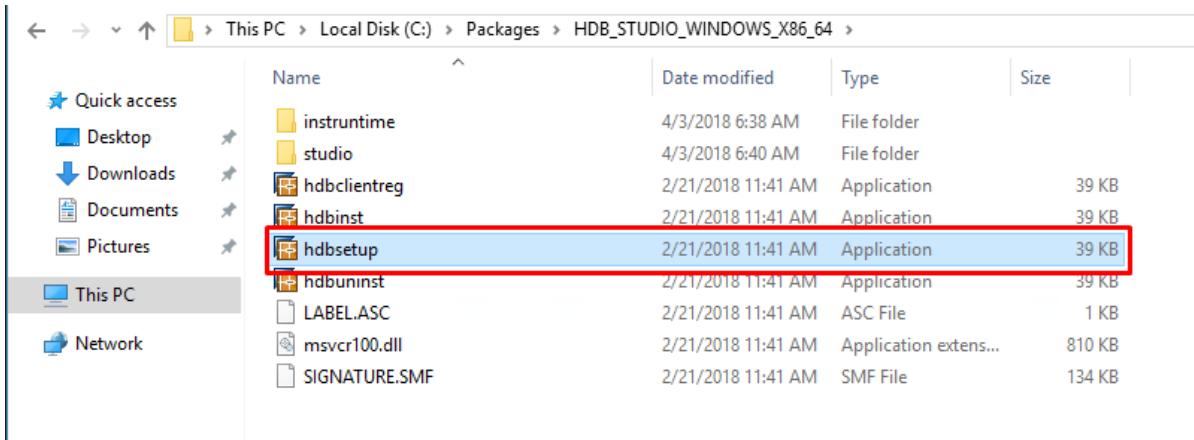
At the bottom of the dialog are buttons for "Back", "Next", and "Cancel", with "Next" being highlighted with a red box.

5. Connect the Azure Storage & Download the SAP_HANA_Studio.

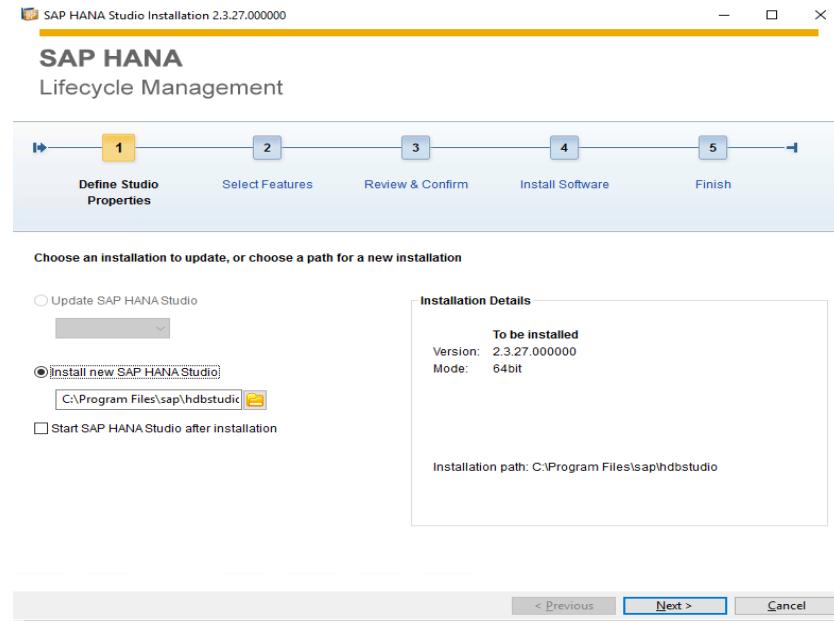
File Shares → softwares → SAPHANA_Studio2_Windows → SAP_HANA_STUDIO



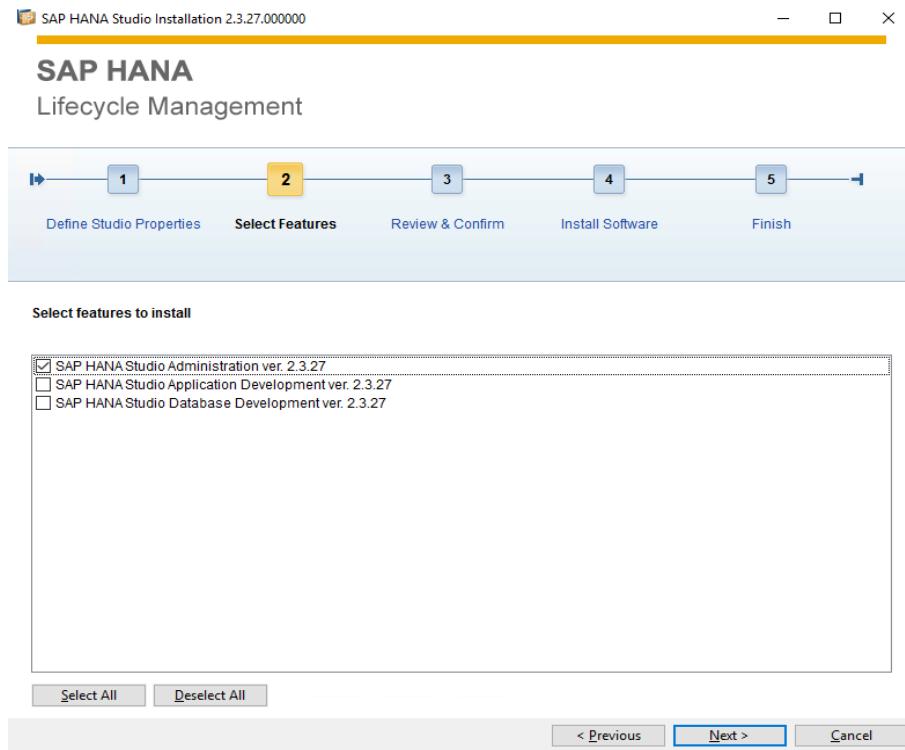
6. Open the Downloaded folder & click on **hdbsetup.exe** installation media and click **yes** when prompted for administrative privileges.



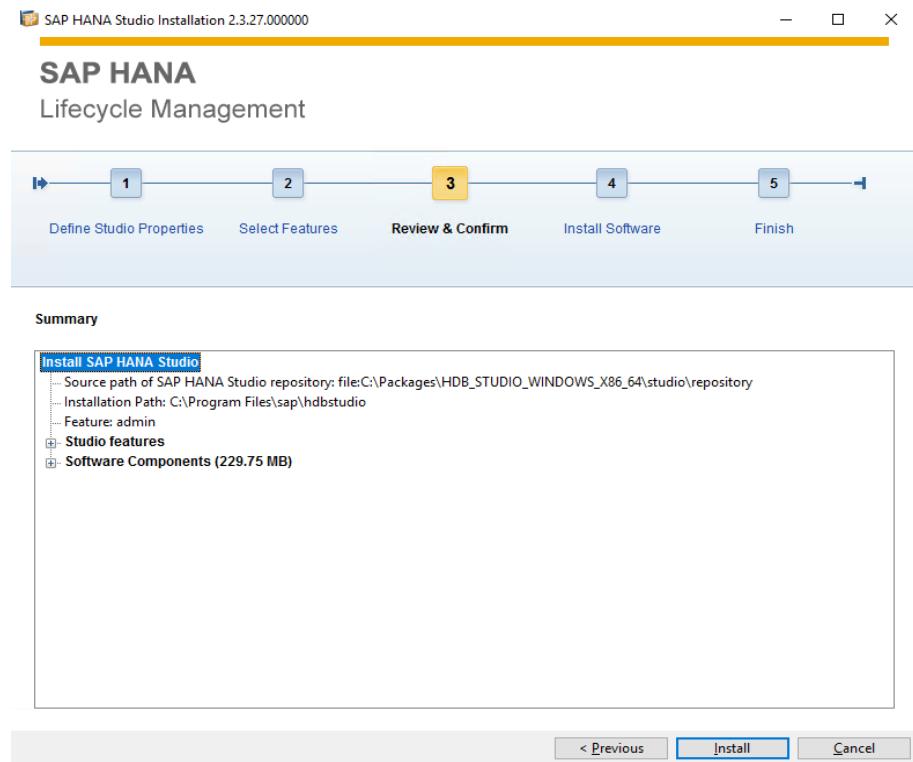
7. Choose the installation location & click **Next**:



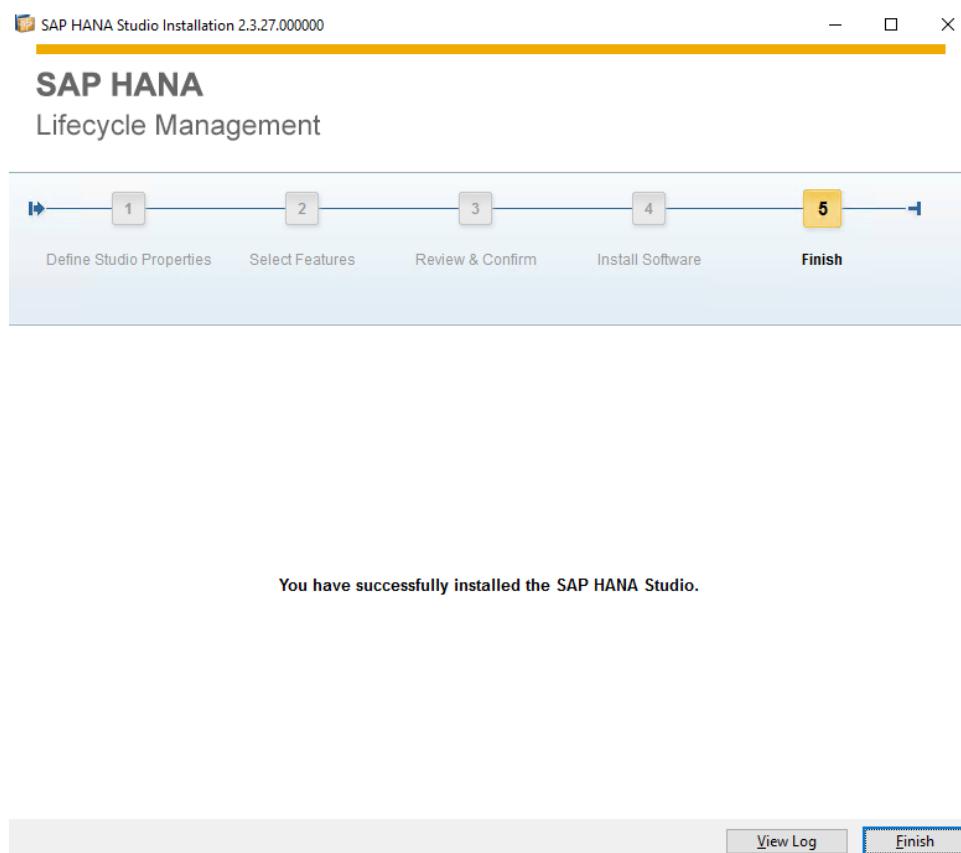
8. On the **Select Features** page, ensure that only **SAP HANA Studio Administration** is selected, and click **Next**:



9. On the **Review & Confirm** page, click **Install**

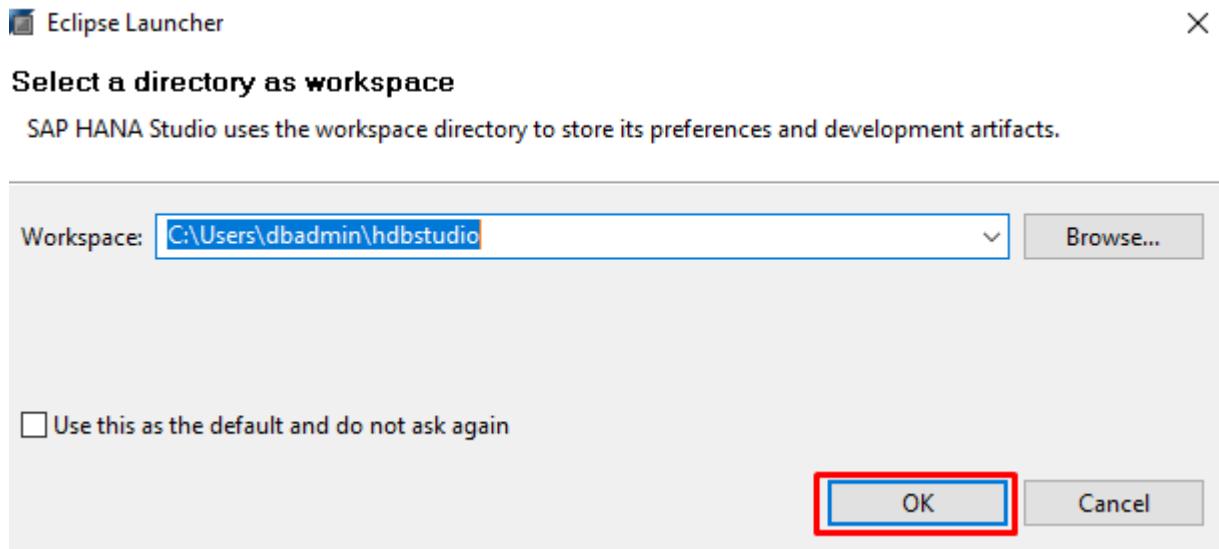


10. On the **Finish** page, click **Finish**:

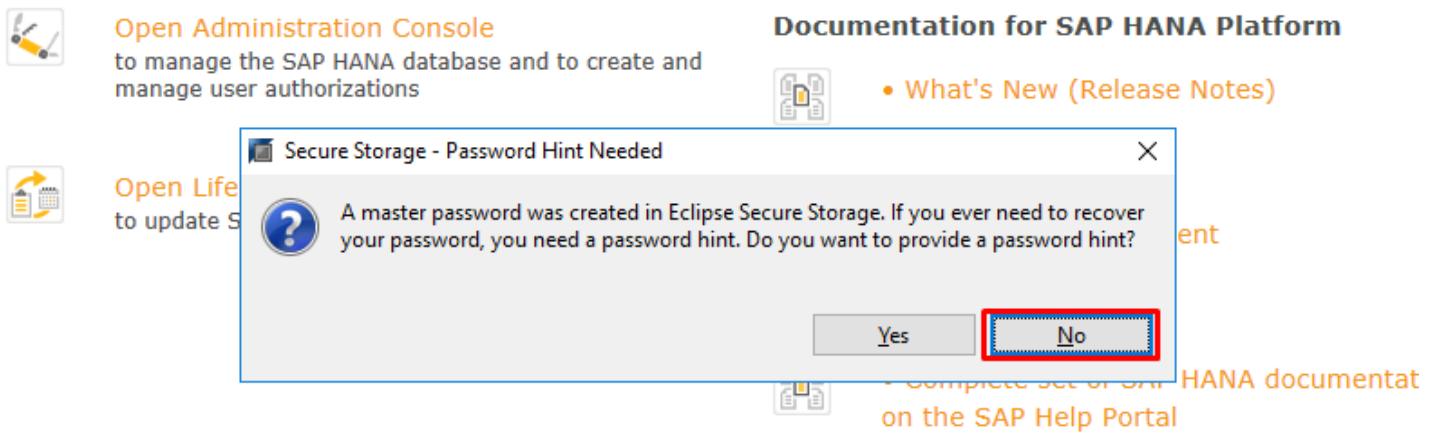


Task 2: Initial Setup and Configuring SAP HANA Studio

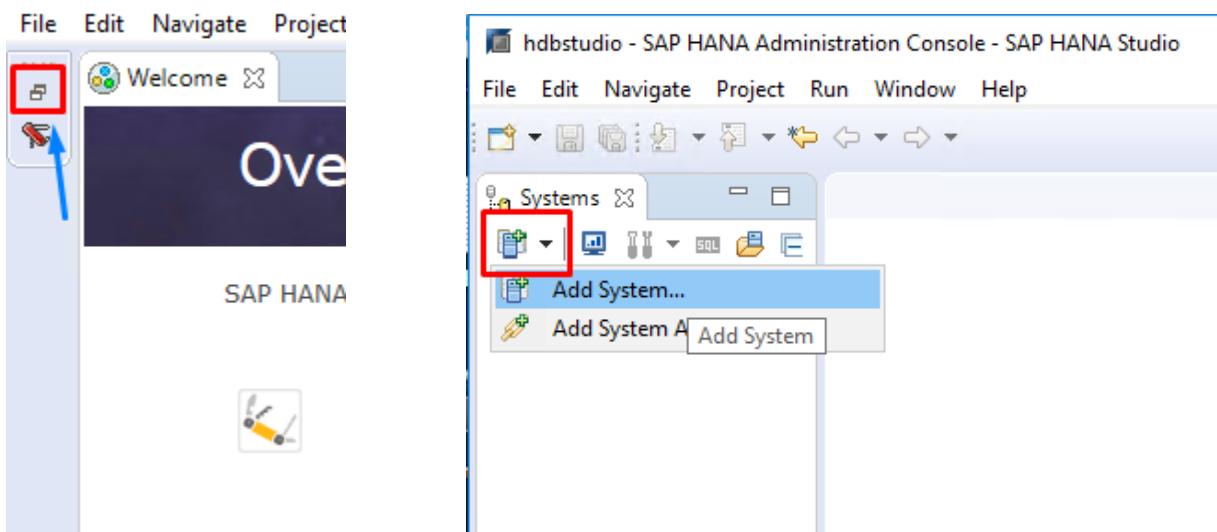
1. Open HANA Studio Administration from Windows VM
2. when prompted to select a workspace, accept the default value and click **OK**.



3. When prompted to provide a password hint, click **NO**.

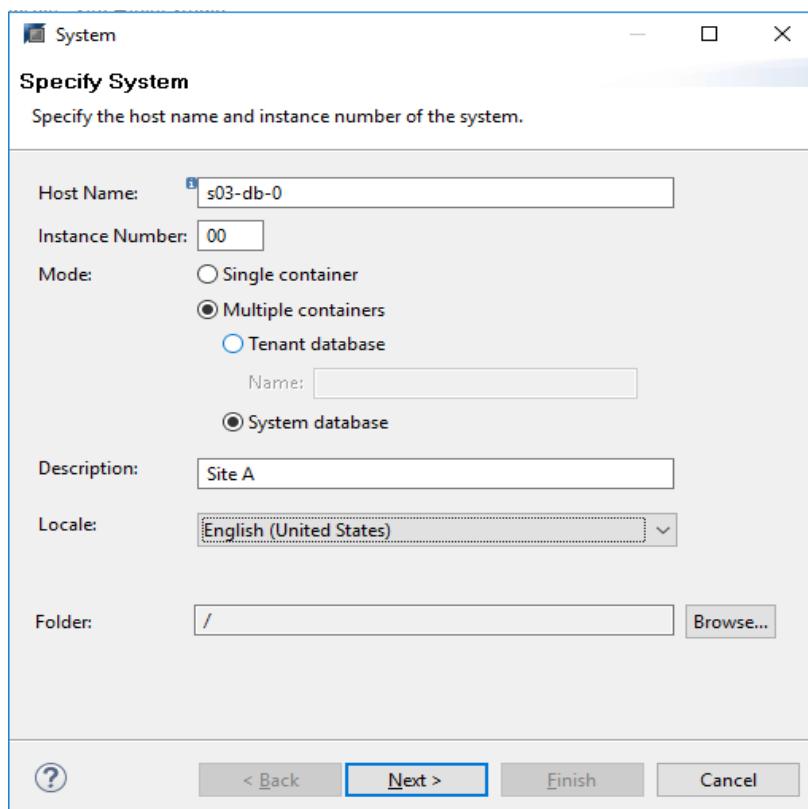


4. Use the SAP HANA studio to set up system replication between two identically configured systems:

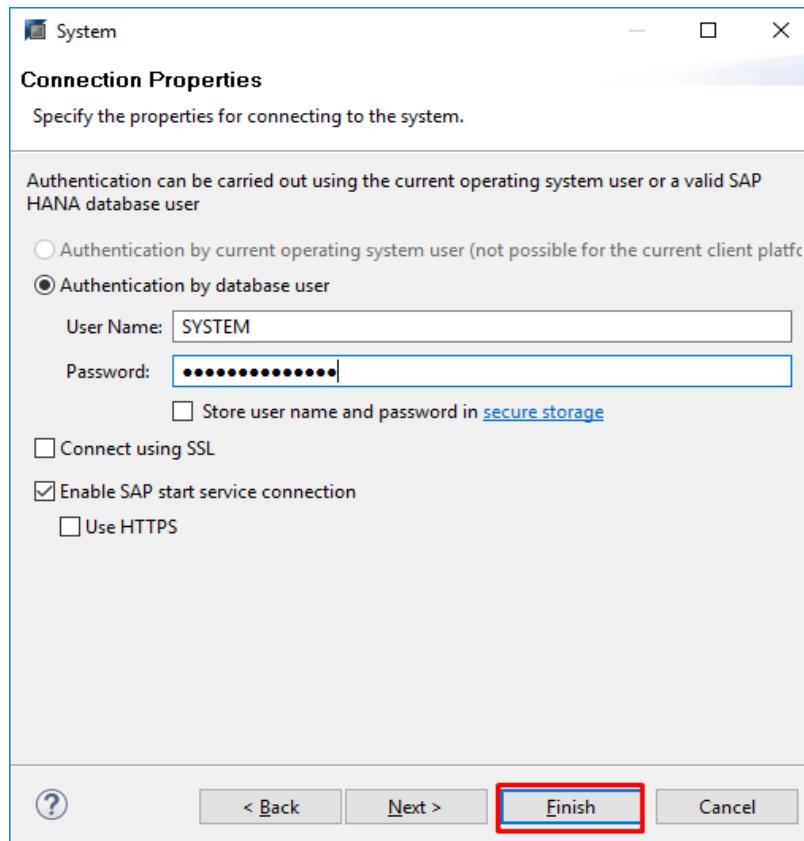


5. Expand the **Systems** menu. Click and **Add System**

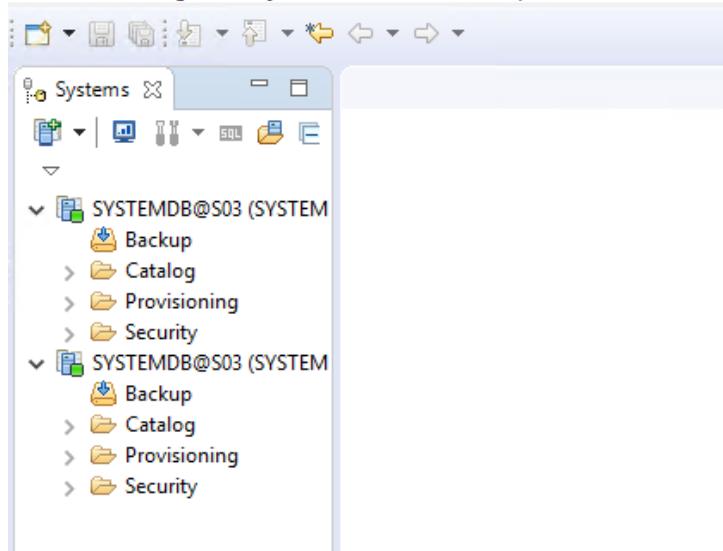
- Enter Host Name: **s03-db-0**
- Instance Number: **00**
- Mode: Choose Multiple Containers and Select System database
- Description: **SiteA**, Click **Next**.



6. In the following Connection Properties screen,
 - a. User Name: **SYSTEM**
 - b. Password: **demoPassword1!**
 - c. Now we have a connection to a System Database of a multi-database container (**SiteA**)

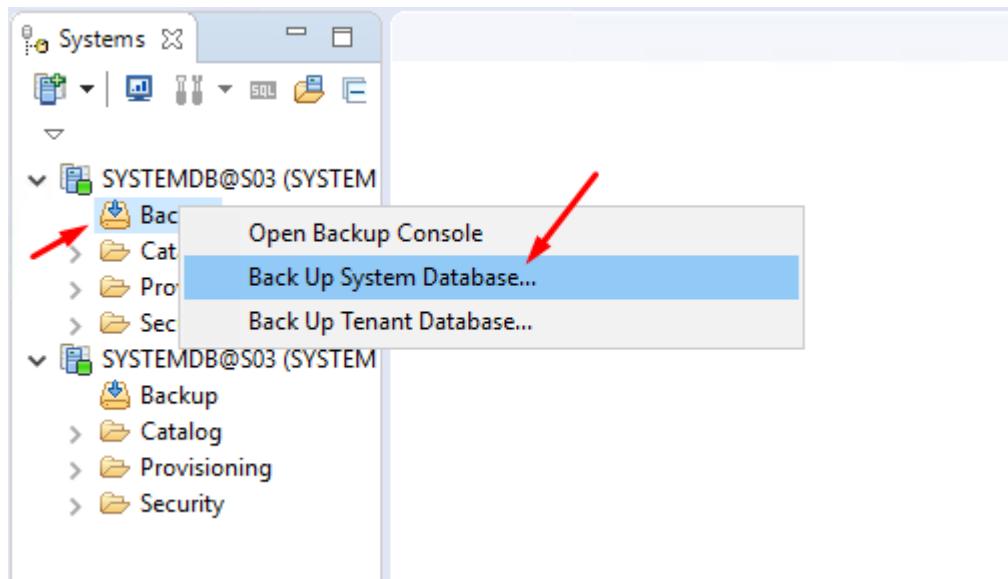


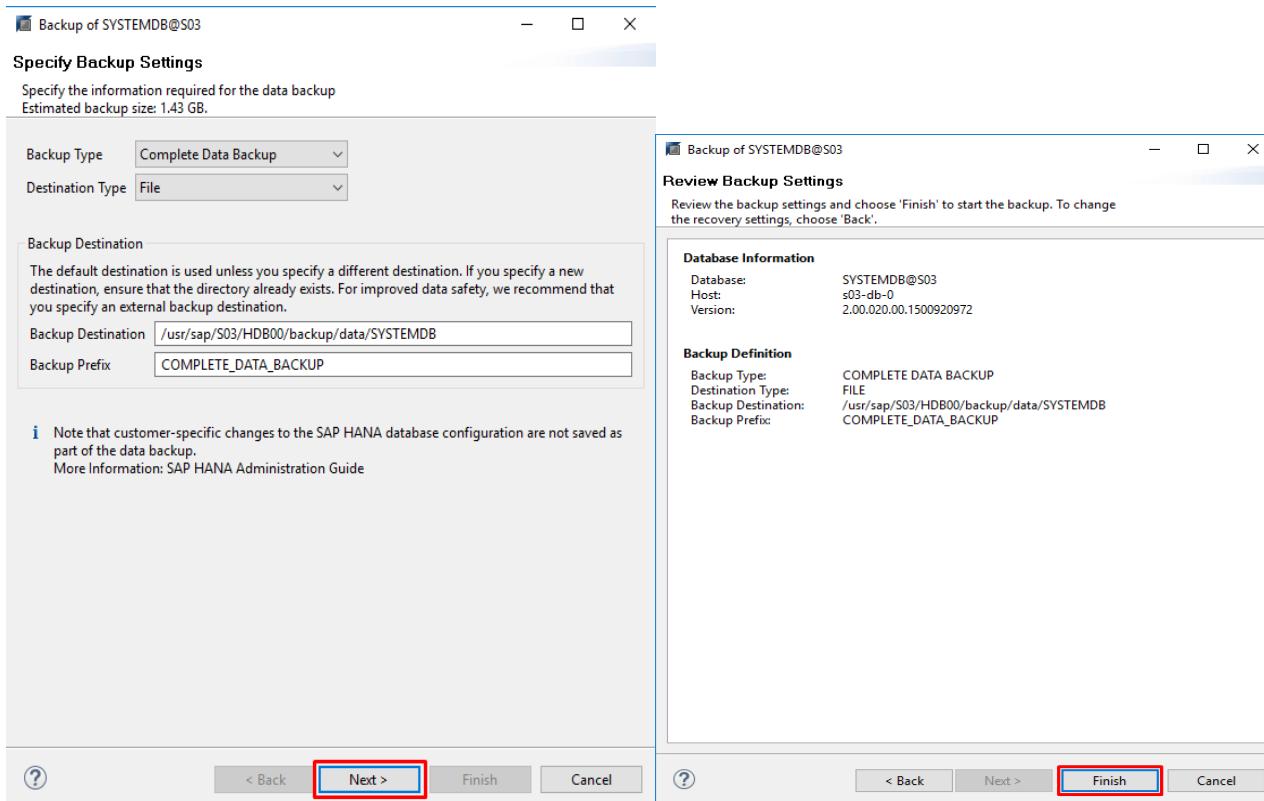
7. Repeat the steps 4-6 for **s03-db-1**.
8. You'll be able to see both the databases have been added to the studio.



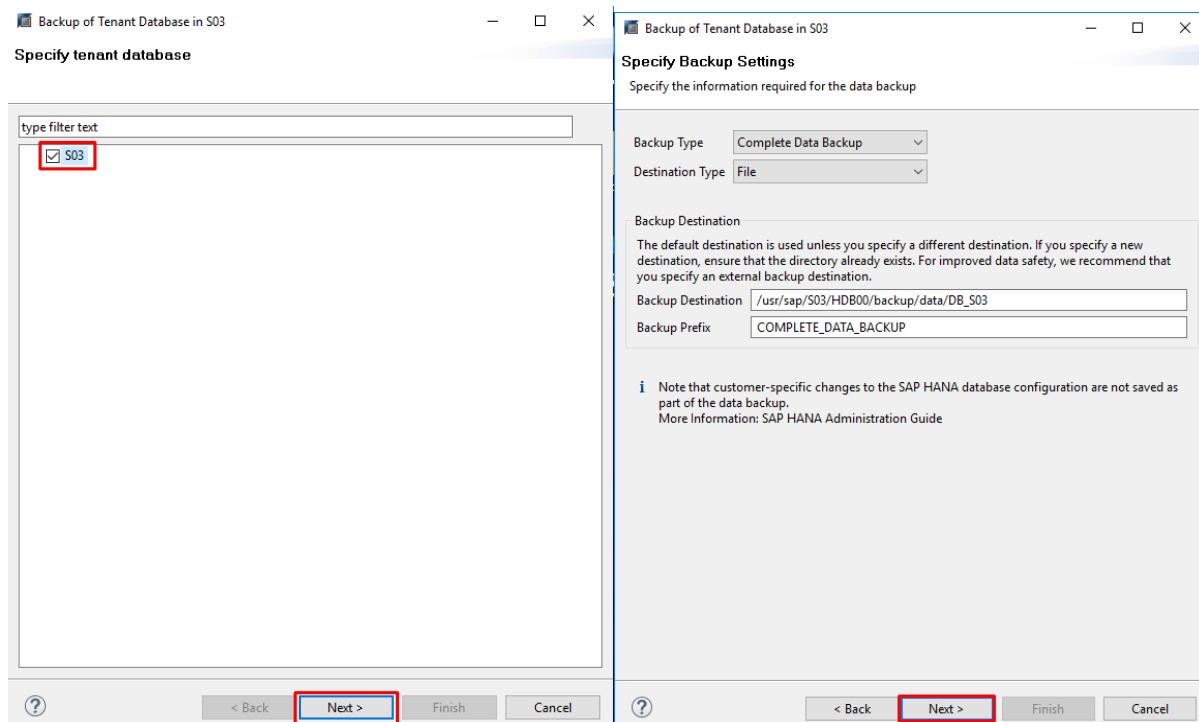
Task 3: Backup Database

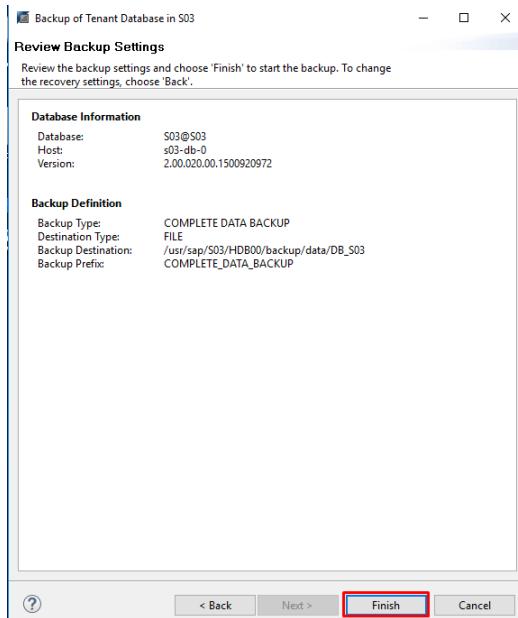
1. Use SAP HANA Studio to take backup of databases. Create a backup of System database in **Primary system** (s03-db-0)





2. Create a backup of Tenant database in Primary system.





3. Repeat the above steps from **1-3 for Secondary system (s03-db-1)**

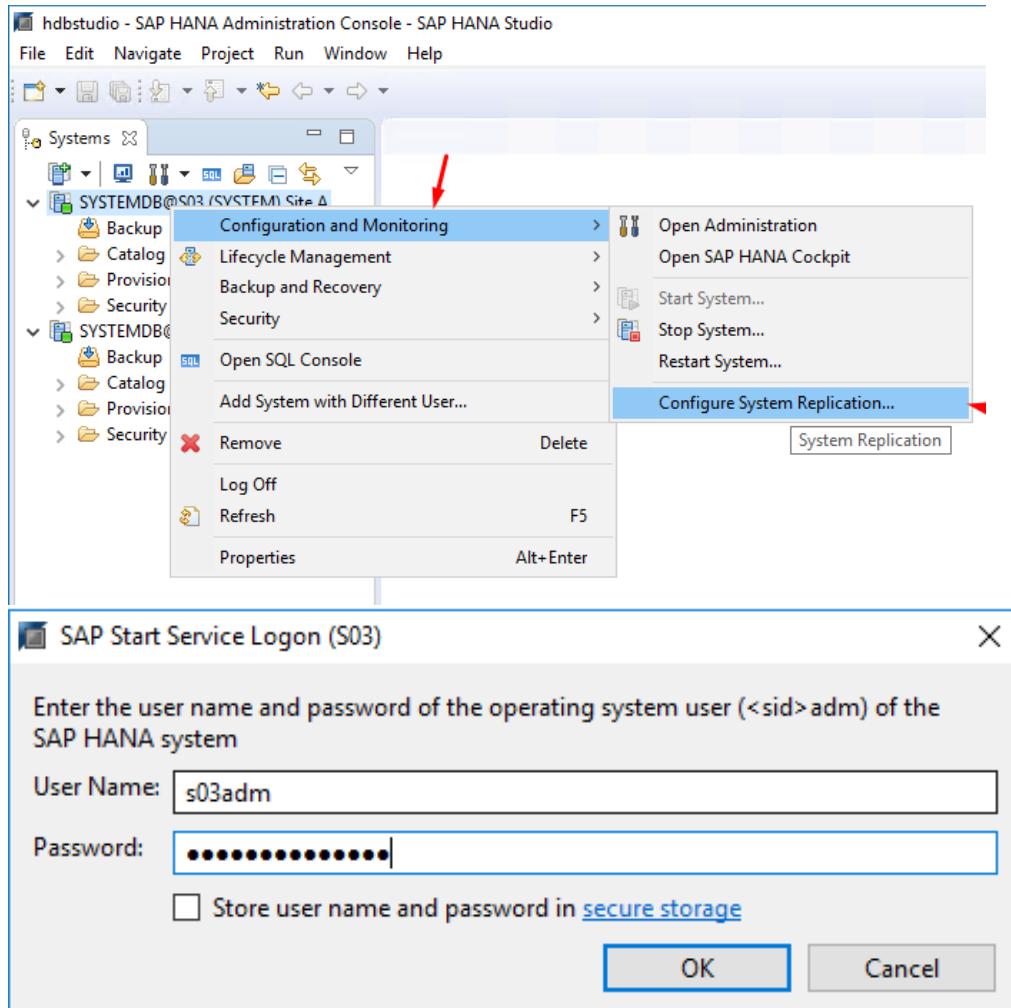
Task 4: System Replication using SAP HANA Studio

To configure system replication, proceed as follows:

1. Go to configure system replication Primary System → Configuration and Monitoring → Configure System Replication.

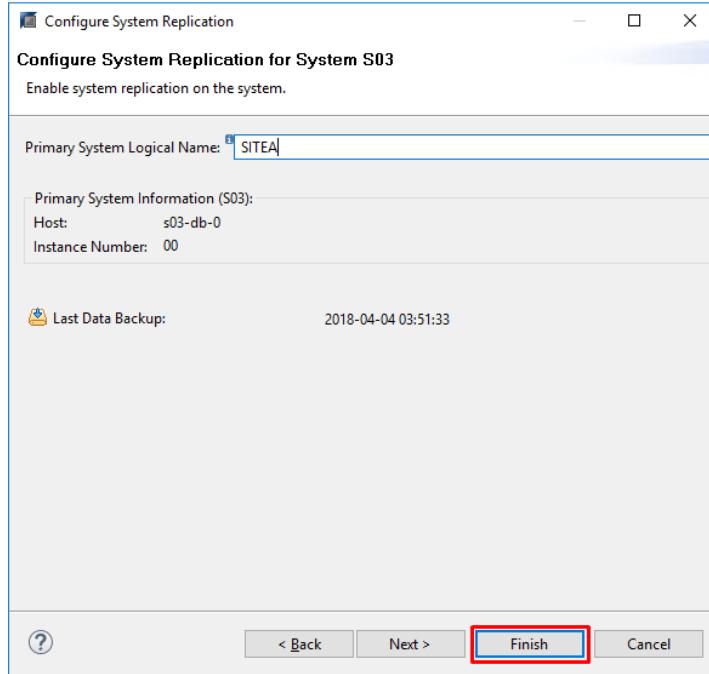
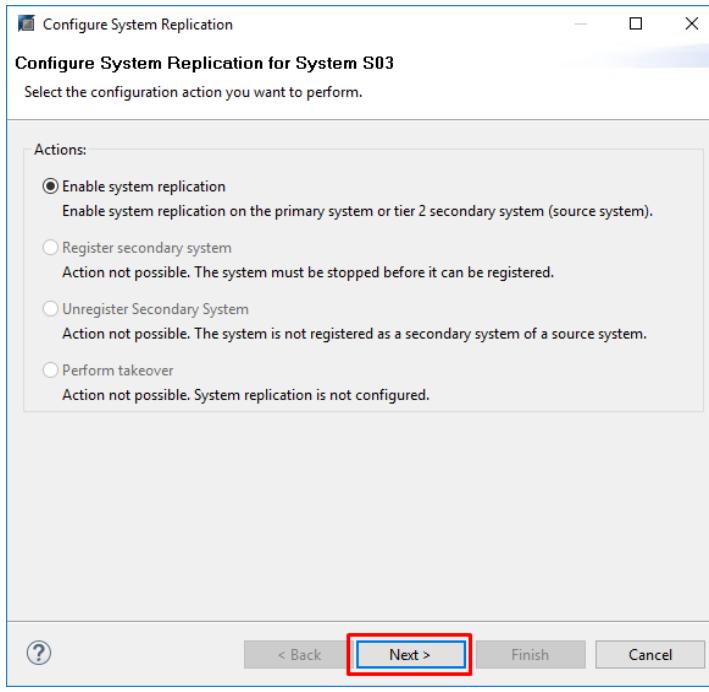
If prompted for username and password :

Enter username: **s03adm**, password: **demoPassword1!**

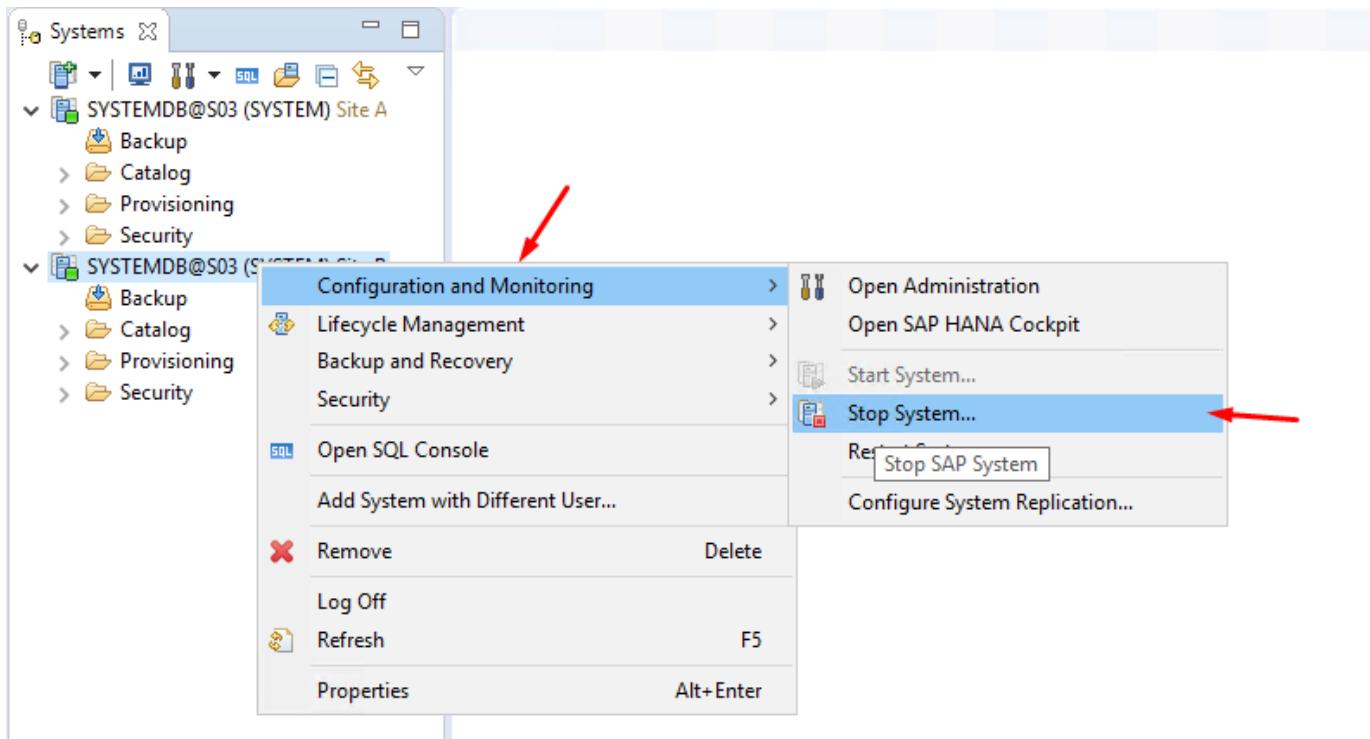


Choose under actions : **Enable system replication**, Click **Next**.

2. In the next step, give the primary a logical site name, for example **SITEA**, Click **Finish**.

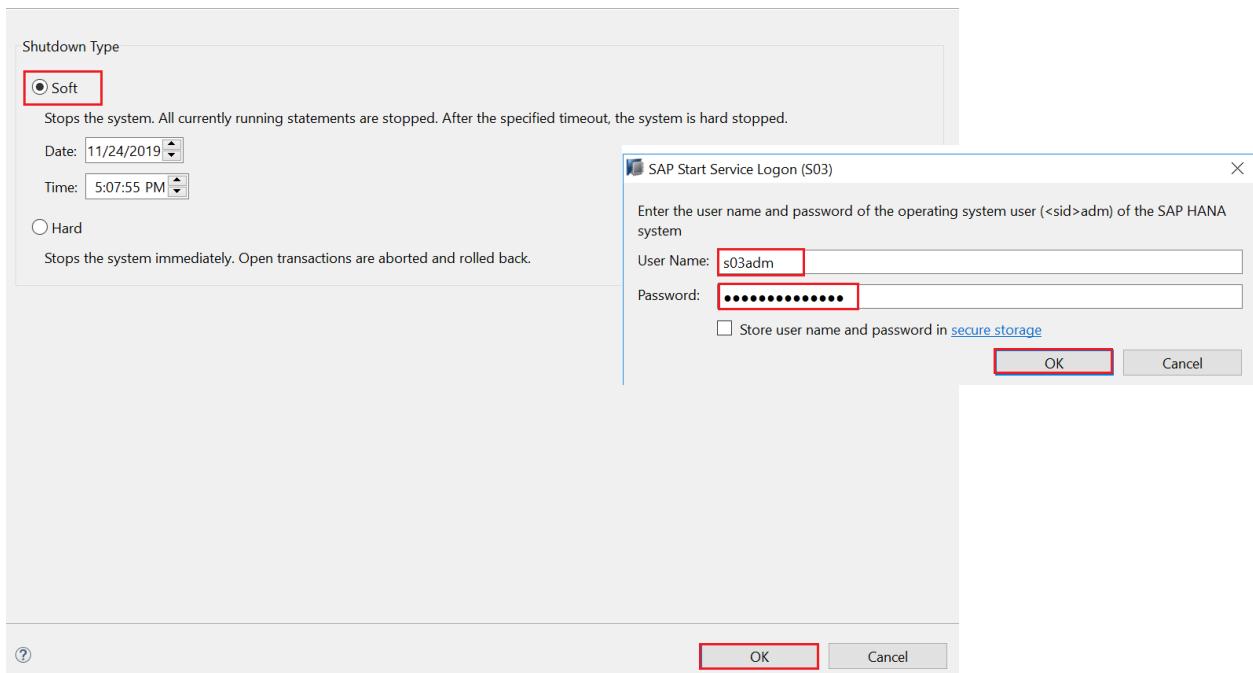


3. **STOP** the secondary system with right mouse-click on Secondary System → Configuration and Monitoring → **Stop System. (SYSTEMDB@S03 (SITEB) is STOPPED).**

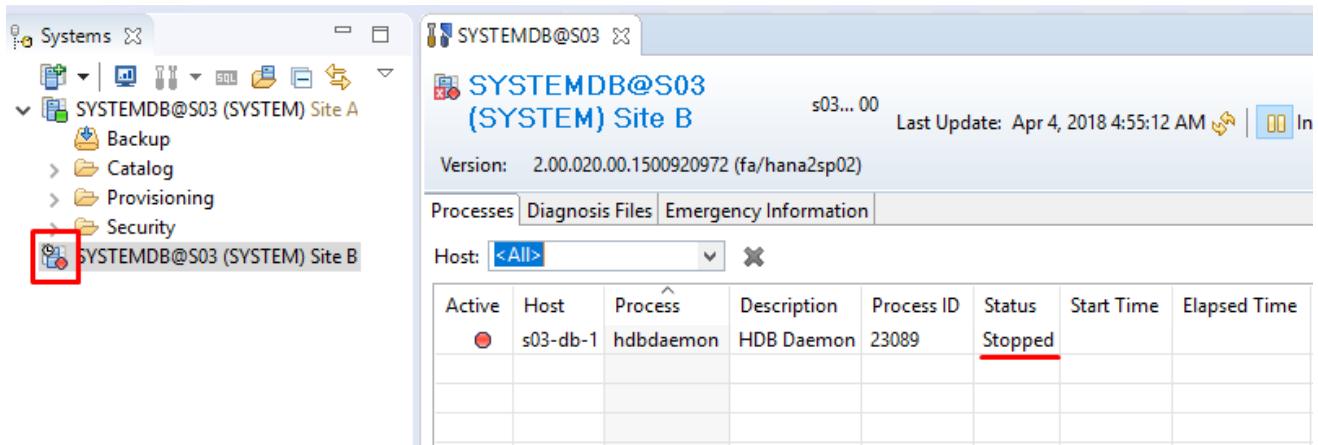


Stop System S03

Stop all databases of system S03 based on the specified parameters



4. Verify that **Site B** has been stopped.



5. ! CAUTION :

If you are running with HANA 2.0 you will need to copy the system PKI SSFS key and data file from the primary to the secondary before registering the secondary. The corresponding files can be found on the primary at the path below:

```
$/usr/sap/<SID>/SYS/global/security/rsecssfs/data/ SSFS_S03.DAT
```

```
$/usr/sap/<SID>/SYS/global/security/rsecssfs/key/ SSFS_S03.KEY
```

- From the SSH session on **s03-db-0**, switch to the security context of the **s03adm** account by running **su-s03adm**: Securely copy **SSFS_S03.DAT** file from Primary System (**s03-db-0**) to Secondary System (**s03-db-1**).

```
s03-db-0:~ # su - s03adm
s03adm@s03-db-0:/usr/sap/S03/HDB00>cd /usr/sap/S03/SYS/global/security/rsecssfs/data/
s03adm@s03-db-0:/usr/sap/S03/SYS/global/security/rsecssfs/data/>scp SSFS_S03.DAT s03adm@s03-db-1:/usr/sap/S03/SYS/global/security/rsecssfs/data/
```

```
10.0.0.5 - PuTTY
s03-db-0:/software/SAPHANA2SPS2/51052325/DATA_UNITS/HDB_SERVER_LINUX_X86_64 # su - s03adm
s03adm@s03-db-0:/usr/sap/S03/HDB00> cd /usr/sap/S03/SYS/global/security/rsecssfs/data/
s03adm@s03-db-0:/usr/sap/S03/SYS/global/security/rsecssfs/data> scp SSFS_S03.DAT s03adm@s03-db-1:/usr/sap/S03/SYS/global/security/rsecssfs/data/
The authenticity of host 's03-db-1 (10.0.0.4)' can't be established.
ECDSA key fingerprint is SHA256:oJRXkt2qTn70tOs98ZBOZMVnI8NIzits1F066i5urBo.
Are you sure you want to continue connecting [yes/no]? yes
Warning: Permanently added 's03-db-1,10.0.0.4' (ECDSA) to the list of known hosts.
Password:
SSFS_S03.DAT                                         100% 2960          2.9KB/s   00:00
s03adm@s03-db-0:/usr/sap/S03/SYS/global/security/rsecssfs/data>
```

7. Repeat the step to securely copy **SSFS_S03.KEY** file from Primary System (**s03-db-0**) to Secondary System (**s03-db-1**). From the command prompt switch to **/usr/sap/S03/SYS/global/security/rsecssfs/key/** and run the **scp** command from below:

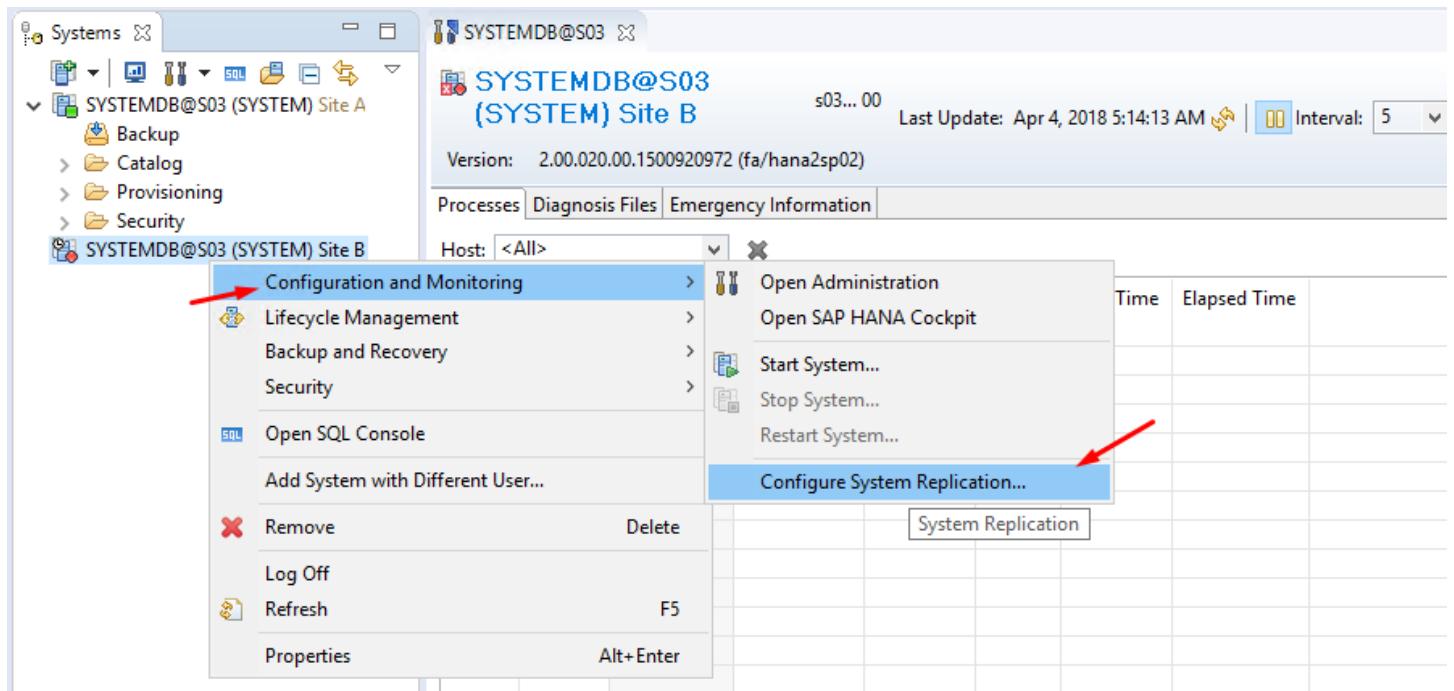
```
s03-db-0:~ # su - s03adm
s03adm@s03-db-0:/usr/sap/S03/HDB00>cd /usr/sap/S03/SYS/global/security/rsecssfs/key/
s03adm@s03-db-0:/usr/sap/S03/SYS/global/security/rsecssfs/key/>scp SSFS_S03.KEY s03adm@s03-db-1:/usr/sap/S03/SYS/global/security/rsecssfs/key/
```

8. Register the secondary system to finish replication configuration on secondary system.

① If prompted for username and password :

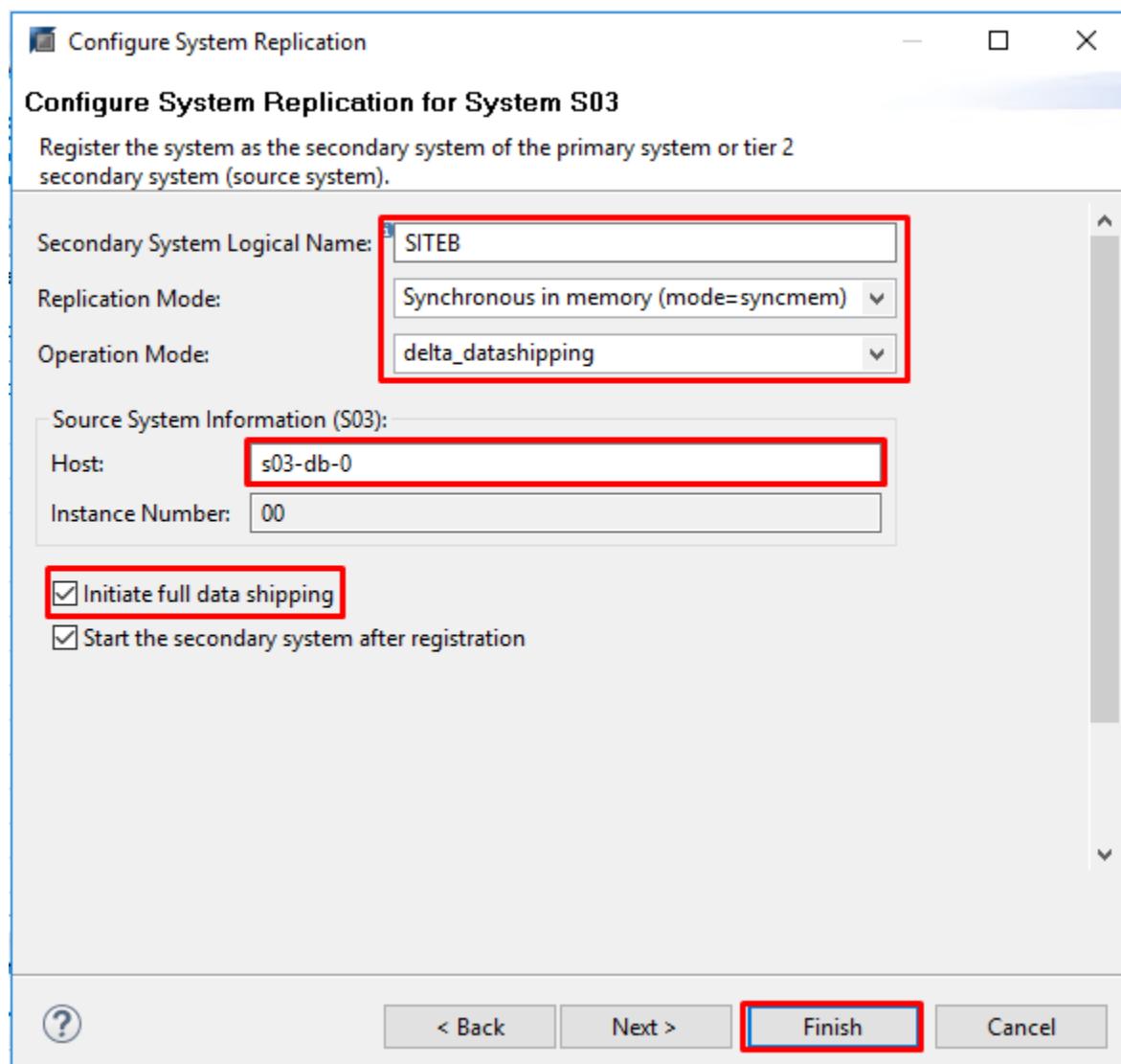
Enter username: **s03adm**, password: **demoPassword1!**

9. Register secondary system, Click **Next**.



10. Set the following configurations

- Type a logical name for secondary system (**SITEB**)
- Choose a replication mode (**Synchronous in memory(mode=syncmem)**)
- an operation mode (**delta_shipping**), and enter the primary site's hostname (**s03-db-0**)
- check the boxes **Initiate full data shipping**, **Start the secondary system after registration**
- Click, **Finish** button.



► Checkpoint

After the secondary system starts examine the status under SiteA to make sure '**All services are active and in sync**'.

SYSTEMDB@S03 (SYSTEM) Site A

Last Update: Apr 4, 2018 5:25:54 AM | Interval: 60 Seconds

General Information

Operational Status:	<input checked="" type="checkbox"/> All services started
System Usage:	Custom System
Start Time of First Started Service:	Apr 3, 2018 12:10:09 PM
Start Time of Most Recently Started Service:	Apr 3, 2018 12:12:53 PM
<u>System Replication Status:</u>	<input checked="" type="checkbox"/> All services are active and in sync
Distributed System:	No
Version:	2.00.020.00.1500920972 (fa/hana2sp02)
Build Time:	Jul 24, 2017 8:35:12 PM
Platform:	SUSE Linux Enterprise Server 12.3
Linux Kernel Version:	4.4.114-94.11-default
Hardware Manufacturer:	Microsoft Corporation

Current Alerts and Messages

2 alerts with MEDIUM priority

[Show Alerts](#)

In the SAP HANA Administration Console, click on the Landscape → System Replication to explore further replication status.

SYSTEMDB@S03 (SYSTEM) Site A

Last Update: Apr 4, 2018 5:26:51 AM | Interval: 60 Seconds

Landscape **System Replication**

Enter your filter | Visible rows: 3/3 | Filters... | Save as File |

HOST	SECONDARY_HOST	REPLICATION_MODE	REPLICATION_STATUS	REPLICATION_STATUS_DETAILS
s03-db-0	s03-db-1	SYNCMEM	ACTIVE	
s03-db-0	s03-db-1	SYNCMEM	ACTIVE	
s03-db-0	s03-db-1	SYNCMEM	ACTIVE	

Exercise 5: Configure cluster framework

Duration: 30 minutes

In this exercise, you will configure cluster framework.

Task 1: Configure STONITH clustering options

- From the SSH session on s03-db-0, switch to the privileged mode by typing **exit**:

```
s03adm@s03-db-0:/usr/sap/S03/HDB00> exit  
logout  
s03-db-0:/ #
```

- From the SSH session on s03-db-0, create a new file named **crm-defaults.txt** with the following content:

```
property $id="cib-bootstrap-options" \  
no-quorum-policy="ignore" \  
stonith-enabled="true" \  
stonith-action="reboot" \  
stonith-timeout="150s"  
rsc_defaults $id="rsc-options" \  
resource-stickiness="1000" \  
migration-threshold="5000"  
op_defaults $id="op-options" \  
timeout="600"
```

- From the SSH session on s03-db-0, apply the settings in the file by running **crm configure load update crm-defaults.txt**

```
s03-db-0:/ # crm configure load update crm-defaults.txt  
s03-db-0:/ # crm status
```

```
s03-db-0:/ # crm status  
Stack: corosync  
Current DC: s03-db-0 (version 1.1.16-4.8-77ea74d) - partition with quorum  
Last updated: Wed Apr 4 05:57:11 2018  
Last change: Wed Apr 4 05:57:08 2018 by root via cibadmin on s03-db-0  
  
2 nodes configured  
0 resources configured  
  
Online: [ s03-db-0 s03-db-1 ]  
  
No resources
```

Task 2: Create an Azure AD application for the STONITH device

- Switch into the Azure Portal & navigate to the Subscription blade and note the **subscription ID**:

The screenshot shows the Azure portal's 'All services' blade. A red box highlights the 'All services' link in the sidebar. In the main area, under 'GENERAL (11)', the 'Subscriptions' item is highlighted with a red box. Below this, there is a search bar and a table listing subscriptions. One subscription, 'CAP Labs - D', is selected, and its 'SUBSCRIPTION ID' (86c7b850-49b7-435b-b29d-8539830b16f6) is highlighted with a red box.

SUBSCRIPTION	SUBSCRIPTION ID	MY ROLE
CSP CAP Labs - D	86c7b850-49b7-435b-b29d-8539830b16f6	Resource access

2. In the Azure portal, navigate to the Azure Active Directory blade.
3. On the Active Directory blade, click **Properties** and note the value of **Directory ID**. This will be referenced as the tenant id later in the exercise.

The screenshot shows the 'Properties' blade for Azure Active Directory. The left sidebar lists various options: Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, **Azure Active Directory** (highlighted with a red box), and Monitor. The main pane shows the 'Properties' section, which includes fields for Global admin can manage Azure Subscriptions (Yes/No), Directory ID (8bec7b7a-7668-4207-ba7a-0478e8cc0f94), Technical contact (manesh@manesh.me), Global privacy contact, and Privacy statement URL. A red box highlights the 'Properties' link in the sidebar and the 'Directory ID' field in the main pane.

4. Click **App registrations** followed by selecting **+New registration**:

All services > cloudalliancepartners (Default Directory) - App registrations

cloudalliancepartners (Default Directory) - App registrations

+ New registration Endpoints Troubleshooting Got feedback?

Welcome to the new and improved App registrations (now Generally Available). See what's new →

Looking to learn how it's changed from App registrations (Legacy)? [Learn more](#)
Still want to use App registrations (Legacy)? [Go back and tell us why](#)

All applications Owned applications

Start typing a name or Application ID to filter these results

Display name	Application (client) ID	Created On	Certificates & secrets
stonithapp	f79585e4-958d-4116-9...	10/25/2019	✓ Current
stonithapp0811	cf60eaa9-ee19-4f95-b4...	11/8/2019	✓ Current
StonithApp2709	88acfcd0-84f7-4678-97...	11/19/2019	✓ Current

Organizational relationships Roles and administrators Enterprise applications Devices App registrations Identity Governance Application proxy Licenses Azure AD Connect Custom domain names

5. On the **Create** blade, specify the following settings, and click **Register**:
 - a. Name: **stonithapp <<Last 4 digits of your unique Id>>** *This has to be a unique name.*
 - b. Redirect URI: **http://localhost**

All services > cloudalliancepartners (Default Directory) - App registrations > Register an application

Register an application

* Name

The user-facing display name for this application (this can be changed later).

stonithapp2709 ✓

Supported account types

Who can use this application or access this API?

Accounts in this organizational directory only (cloudalliancepartners (Default Directory) only - Single tenant)

Accounts in any organizational directory (Any Azure AD directory - Multitenant)

Accounts in any organizational directory (Any Azure AD directory - Multitenant) and personal Microsoft accounts (e.g. Skype, Xbox)

Redirect URI (optional)

We'll return the authentication response to this URI after successfully authenticating the user. Providing this now is optional and it can be changed later, but a value is required for most authentication scenarios.

Web http://localhost ✓

6. On the list of apps, click the newly created app. On the app blade, note the value of **Application ID**. This will be referenced as the **Login ID** later in this exercise:

All services > cloudalliancepartners (Default Directory) - App registrations > stonithapp2709

stonithapp2709

Search (Ctrl+ /)

Delete Endpoints

Overview Quickstart

Manage

- Branding
- Authentication
- Certificates & secrets
- API permissions

Display name: stonithapp2709

Application (client) ID: 429010c7-9555-4d2e-bdb0-6319951f7f7d

Directory (tenant) ID: adff4f186-9c21-4da1-8169-de8006a7b6ec

Object ID: e59bda0c-b485-41c4-b7e2-c232c57a6ab3

Supported account types: My organization only

Redirect URLs: 1 web, 0 public client

Application ID URI: Add an Application ID URI

Managed application in local directory: stonithapp2709

7. Click On the **Certificates & Secrets** blade, click **New Client Secret Key**:

stonithapp2709 - Certificates & secrets

Search (Ctrl+ /)

Quickstart

Manage

- Branding
- Authentication
- Certificates & secrets
- API permissions
- Expose an API
- Owners
- Roles and administrators (Pr...
- Manifest

Support + Troubleshooting

Troubleshooting

Credentials enable applications to identify themselves to the authentication service when receiving tokens at a web addressable location (using an HTTPS scheme). For a higher level of assurance, we recommend using a certificate (instead of a client secret) as a credential.

Certificates

Certificates can be used as secrets to prove the application's identity when requesting a token. Also can be referred to as public keys.

Upload certificate

No certificates have been added for this application.

Thumbprint	Start Date	Expires

Client secrets

A secret string that the application uses to prove its identity when requesting a token. Also can be referred to as application password.

New client secret

8. On the **Keys** blade, in the **DESCRIPTION** column, type **stonithappkey**. In the **EXPIRES** column, select **Never expires**. Then, click **Save**:

Add a client secret

Description
stonithappkey

Expires

In 1 year

In 2 years

Never

Add **Cancel**

9. Make sure to note down the entry appearing in the **VALUE** column (this entry is displayed only once, after you click **Save**). This will be used as the password for the corresponding service principal.

Client secrets

A secret string that the application uses to prove its identity when requesting a token. Also can be referred to as application password.

+ New client secret	Description	Expires	Value
	stonithappkey	12/31/2299	M8Bg]/r_BK@y2Xm8pNtmAq48EJFzzUhj

10. Close the **Keys** blade.

Task 3: Grant permissions to Azure VMs to the service principal of the STONITH app

1. In the Azure portal, navigate to the s03-db-0 VM.

The screenshot shows the Azure portal interface. On the left, there's a sidebar with various service categories: Favorites, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines (which is selected and highlighted with a red box), Load balancers, and Storage accounts. The main area is titled 'Subscriptions: CAP Labs - D'. It has a search bar 'Filter by name...', dropdowns for 'All resource groups' and 'All types', and a table showing three items. The table columns are NAME, TYPE, and STATUS. The items listed are 's03-db-0' (Virtual machine, Running), 's03-db-1' (Virtual machine, Running), and 's03-hana-0' (Virtual machine, Running). The 's03-db-0' row is also highlighted with a red box.

2. On the s03-db-0 blade, click **Access control (IAM)**.

The screenshot shows the 's03-db-0 - Access control (IAM)' blade. On the left, there's a sidebar with links: Overview, Activity log, Access control (IAM) (which is selected and highlighted with a red box), Tags, and Diagnose and solve problems. The main content area has a search bar 'Search (Ctrl+ /)', a toolbar with '+ Add' (highlighted with a red box), Remove, Roles, Refresh, and Help. There are input fields for Name, Type (set to All), and Role (set to Owner). Below this, it says '5 items (2 Users, 2 Groups, 1 Service Principals)' and shows a table with columns NAME, TYPE, and ROLE. The first item listed is 'OWNER'.

3. Click **+ Add** → Add role assignment.

The screenshot shows the 'Access control (IAM)' blade for a virtual machine named 's03-db-0'. The 'Add role assignment' button is highlighted with a red box. The left sidebar shows 'Access control (IAM)' selected.

4. On the **Add permissions** blade, specify the following settings and click **Save**:

- Role: **Owner**
- Assign access to: **Azure AD user, group, or application**
- Select: **stonithapp <>Unique userid>**

The screenshot shows the 'Add role assignment' blade. The 'Role' dropdown is set to 'Owner'. The 'Assign access to' dropdown is set to 'Azure AD user, group, or service principal'. The 'Select' dropdown contains 'stonithapp2709'. Below it, a list shows 'Selected members: stonithapp2709'. At the bottom are 'Save' and 'Discard' buttons.

5. Repeat steps 1 to 4 to assign the Stonith App the Owner role to the **s03-db-1** Azure VM.

Task 4: Configure the STONITH cluster device

- From the SSH session on s03-db-0, create a new file named **crm-fencing.txt** with the following content (where *subscription_id*, *resource_group*, *tenant_id*, *login_id*, and *password* are placeholders for the values you identified in Exercise 4 Task 2):

```
primitive rsc_st_azure_1 stonith:fence_azure_arm \
```

```

params subscriptionId="subscription_id" resourceGroup="hana-s03-RG" tenantId="tenant_id" login="login_id"
passwd=password

primitive rsc_st_azure_2 stonith:fence_azure_arm \
params subscriptionId="subscription_id" resourceGroup="hana-s03-RG" tenantId="tenant_id" login="login_id"
passwd=password

colocation col_st_azure -2000: rsc_st_azure_1:Started rsc_st_azure_2:Started

```

- From the SSH session on s03-db-0, apply the settings in the file by running **crm configure load update crm-fencing.txt**:

```
s03-db-0:/ # crm configure load update crm-fencing.txt
s03-db-0:/ # crm status
```

```

s03-db-0:/ # crm status
Stack: corosync
Current DC: s03-db-0 (version 1.1.16-4.8-77ea74d) - partition with quorum
Last updated: Wed Apr  4 06:04:05 2018
Last change: Wed Apr  4 06:04:02 2018 by root via cibadmin on s03-db-0

2 nodes configured
2 resources configured

Online: [ s03-db-0 s03-db-1 ]

Full list of resources:

rsc_st_azure_1 (stonith:fence_azure_arm):      Starting s03-db-1
rsc_st_azure_2 (stonith:fence_azure_arm):      Starting s03-db-0

```

Task 5: Create SAPHanaTopology cluster resource agent

- From the SSH session on s03-db-0, create a new file named **crm-saphanatop.txt** with the following content:

```

primitive rsc_SAPHanaTopology_S03_HDB00 ocf:suse:SAPHanaTopology \
operations $id="rsc_sap2_S03_HDB00-operations" \
op monitor interval="10" timeout="600" \
op start interval="0" timeout="600" \
op stop interval="0" timeout="300" \
params SID="S03" InstanceNumber="00"

clone cln_SAPHanaTopology_S03_HDB00 rsc_SAPHanaTopology_S03_HDB00 \
meta is-managed="true" clone-node-max="1" target-role="Started" interleave="true"

```

- From the SSH session on s03-db-0, apply the settings in the file by running **crm configure load update crm-saphanatop.txt**:

```
s03-db-0:/ # crm configure load update crm-saphanatop.txt
s03-db-0:/ # crm status
```

```
s03-db-0:/ # crm status
Stack: corosync
Current DC: s03-db-0 (version 1.1.16-4.8-77ea74d) - partition with quorum
Last updated: Wed Apr 4 06:04:54 2018
Last change: Wed Apr 4 06:04:52 2018 by root via cibadmin on s03-db-0

2 nodes configured
4 resources configured

Online: [ s03-db-0 s03-db-1 ]

Full list of resources:

rsc_st_azure_1 (stonith:fence_azure_arm): Started s03-db-1
rsc_st_azure_2 (stonith:fence_azure_arm): Started s03-db-0
Clone Set: cln_SAPHanaTopology_S03_HDB00 [rsc_SAPHanaTopology_S03_HDB00]
    Stopped: [ s03-db-0 s03-db-1 ]
```

Task 6: Create SAP Hana cluster resource agent

- From the SSH session on s03-db-0, create a new file named **crm-saphana.txt** with the following content:

```
primitive rsc_SAPHana_S03_HDB00 ocf:suse:SAPHana \
  operations $id="rsc_sap_S03_HDB00-operations" \
  op start interval="0" timeout="3600" \
  op stop interval="0" timeout="3600" \
  op promote interval="0" timeout="3600" \
  op monitor interval="60" role="Master" timeout="700" \
  op monitor interval="61" role="Slave" timeout="700" \
  params SID="S03" InstanceNumber="00" PREFER_SITE_TAKEOVER="true" \
  DUPLICATE_PRIMARY_TIMEOUT="7200" AUTOMATED_REGISTER="false"

ms msl_SAPHana_S03_HDB00 rsc_SAPHana_S03_HDB00 \
  meta is-managed="true" notify="true" clone-max="2" clone-node-max="1" \
  target-role="Started" interleave="true"

primitive rsc_ip_S03_HDB00 ocf:heartbeat:IPaddr2 \
  meta target-role="Started" is-managed="true" \
  operations $id="rsc_ip_S03_HDB00-operations" \
  op monitor interval="10s" timeout="20s" \
  params ip="10.0.0.7"

primitive rsc_nc_S03_HDB00 anything \
  params binfile="/usr/bin/nc" cmdline_options="-l -k 62500" \
  op monitor timeout=20s interval=10 depth=0

group g_ip_S03_HDB00 rsc_ip_S03_HDB00 rsc_nc_S03_HDB00

colocation col_saphana_ip_S03_HDB00 2000: g_ip_S03_HDB00:Started \
  msl_SAPHana_S03_HDB00:Master
order ord_SAPHana_S03_HDB00 2000: cln_SAPHanaTopology_S03_HDB00 \
  msl_SAPHana_S03_HDB00
```

- From the SSH session on s03-db-0, apply the settings in the file by running **crm configure load update crm-saphana.txt**:

```
s03-db-0:/ # crm configure load update crm-saphana.txt
```

```
s03-db-0:/ # crm status
```

```
s03-db-0:/ # crm status
Stack: corosync
Current DC: s03-db-0 (version 1.1.16-4.8-77ea74d) - partition with quorum
Last updated: Wed Apr 4 06:32:54 2018
Last change: Wed Apr 4 06:32:12 2018 by root via crm_attribute on s03-db-0

2 nodes configured
8 resources configured

Online: [ s03-db-0 s03-db-1 ]

Full list of resources:

rsc_st_azure_1 (stonith:fence_azure_arm):           Started s03-db-1
rsc_st_azure_2 (stonith:fence_azure_arm):           Started s03-db-0
Clone Set: cln_SAPHanaTopology_S03_HDB00 [rsc_SAPHanaTopology_S03_HDB00]
    Started: [ s03-db-0 s03-db-1 ]
Resource Group: q_ip_S03_HDB00
    rsc_ip_S03_HDB00   (ocf::heartbeat:IPAddr2):      Started s03-db-0
    rsc_nc_S03_HDB00  (ocf::heartbeat:anything):      Started s03-db-0
Master/Slave Set: ms1_SAPHana_S03_HDB00 [rsc_SAPHana_S03_HDB00]
    Masters: [ s03-db-0 ]
    Slaves: [ s03-db-1 ]
```

► Checkpoint

Login to Hawk site from your Jump Box VM, Verify that the SAP HANA Topology has been configured, where **s03-db-0** acts as master and **s03-db-1** as slave.

Type	Operations
ocf:suse:SAPHanaTopology (Clone)	<input type="button"/> <input type="button"/> <input type="button"/>
Group (2)	<input type="button"/> <input type="button"/> <input type="button"/>
Multi-state	<input type="button"/> <input type="button"/> <input type="button"/> <input type="button"/>
stonith:fence_azure_arm	<input type="button"/> <input type="button"/> <input type="button"/>
stonith:fence_azure_arm	<input type="button"/> <input type="button"/> <input type="button"/>

Exercise 6: Test the deployment

Duration: 30 minutes

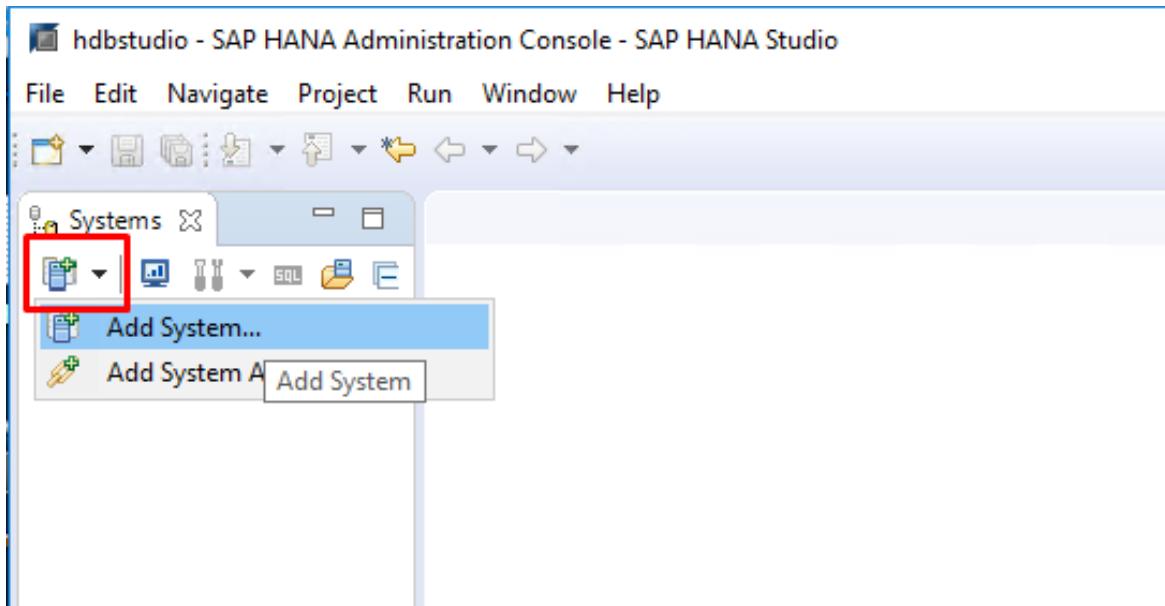
In this exercise, you will test the HANA deployment.

Task 1: Connect to HANA cluster by using SAP HANA Studio Administration

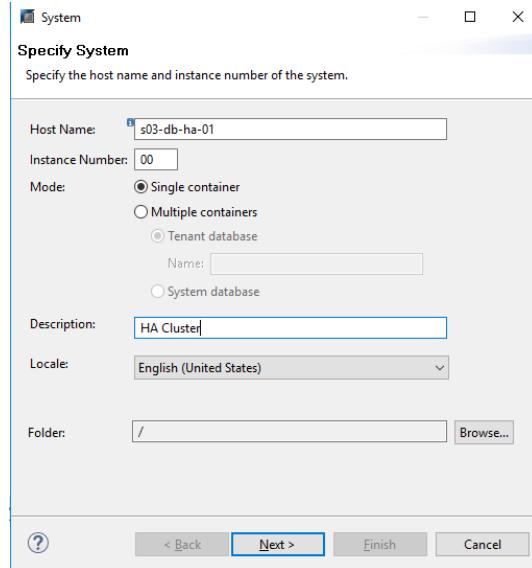
1. From the Remote Desktop session, start **Notepad**, and open the **hosts** file located in **C:\Windows\System32\drivers\etc**.
2. Add the following entries to the host file, save your changes, and close the file:

```
172.17.1.10    s03-db-0
172.17.1.11    s03-db-1
172.17.1.4     s03-db-ha-01
```

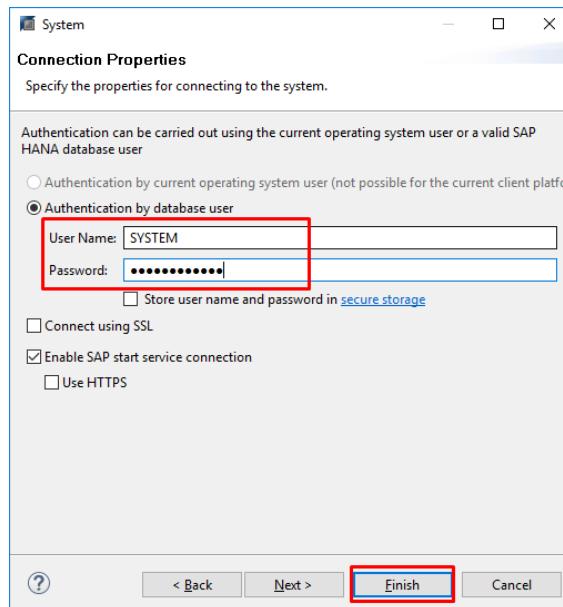
3. Open **SAP HANA Studio Administration**.
4. In the **SAP HANA Administration Console**, expand the **Systems** menu, and click **Add System**:



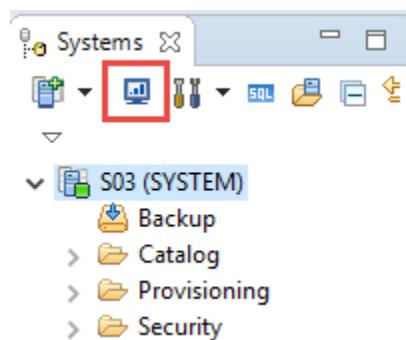
5. In the Specify System dialog box, specify the following information, and click **Next**:
 - Host Name: **s03-db-ha-01**
 - Instance number: **00**



6. In the **Connection Properties** dialog box, select the **Authentication by database user** option, specify the following information, and click **Finish**:
 - User Name: **SYSTEM**
 - Password: **demoPassword1!**



7. Once you successfully connected to **S03** as **SYSTEM**, click the **System Monitor** icon in the Systems toolbar.



8. Review the **System Monitor** status.

System ID	Operational State	Alerts
S03 (SYSTEM)	All services started	The system is running without errors.

9. Right click the **S03 (SYSTEM)** node and in the right click menu. Click **Configuration and Monitoring** followed by **Open Administration**.

10. In the **Configuration and Monitoring** view, examine the **Overview** tab. Verify that all services are started, active, and in sync. You might need to wait a few minutes before the operational status is identified.

SAP HANA Administration Console - System: S03 Host: s03-db-ha-01 Instance: 00 Connected User: SYSTEM System Usage: Custom System - SAP HANA Studio

File Edit Navigate Project Window Help

System Monitor S03

S03 (SYSTEM) s03-db-ha-01 Last Update: Nov 12, 2017 3:05:10 AM Interval: 60 Seconds

Overview Landscape Alerts Performance Volumes Configuration System Information Diagnosis Files Trace Configuration

General Information

Operational Status: All services started

System Usage: Custom System

Start Time of First Started Service: Nov 12, 2017 12:12:12 AM

Start Time of Most Recently Started Service: Nov 12, 2017 12:13:52 AM

System Replication Status: All services are active and in sync

Distributed System: No

Version: 1.00.121.00.1466466057 (fa/hana1sp12)

Build Time: Jun 21, 2016 1:54:21 AM

Platform: SUSE Linux Enterprise Server 12.3

Linux Kernel Version: 4.4.92-6.18-default

Hardware Manufacturer: Microsoft Corporation

Current Alerts and Messages

1 alert with MEDIUM priority

Show Alerts

SAP HANA Used Memory

Used Memory/Peak Used Memory/Allocation Limit (GB)

On Host s03-db-0: 10.84/13.74 28.26

More Information

Disk Usage

Data Volume Size/Total Disk Usage/Total Disk Size (GB)

On Host s03-db-0: 3.91/3.23

Log Volume Size/Total Disk Usage/Total Disk Size (GB)

On Host s03-db-0: 2.15/2.18

Trace Volume Size/Total Disk Usage/Total Disk Size (GB)

On Host s03-db-0: 0.02/20.24

More Information

Resident Memory

Database Resident/Total Resident/Physical Memory (GB)

On Host s03-db-0: 14.90/13.58 31.40

More Information

CPU Usage

Database CPU Usage/Total CPU Usage/Maximum CPU Usage

On Host s03-db-0: 10/13 100

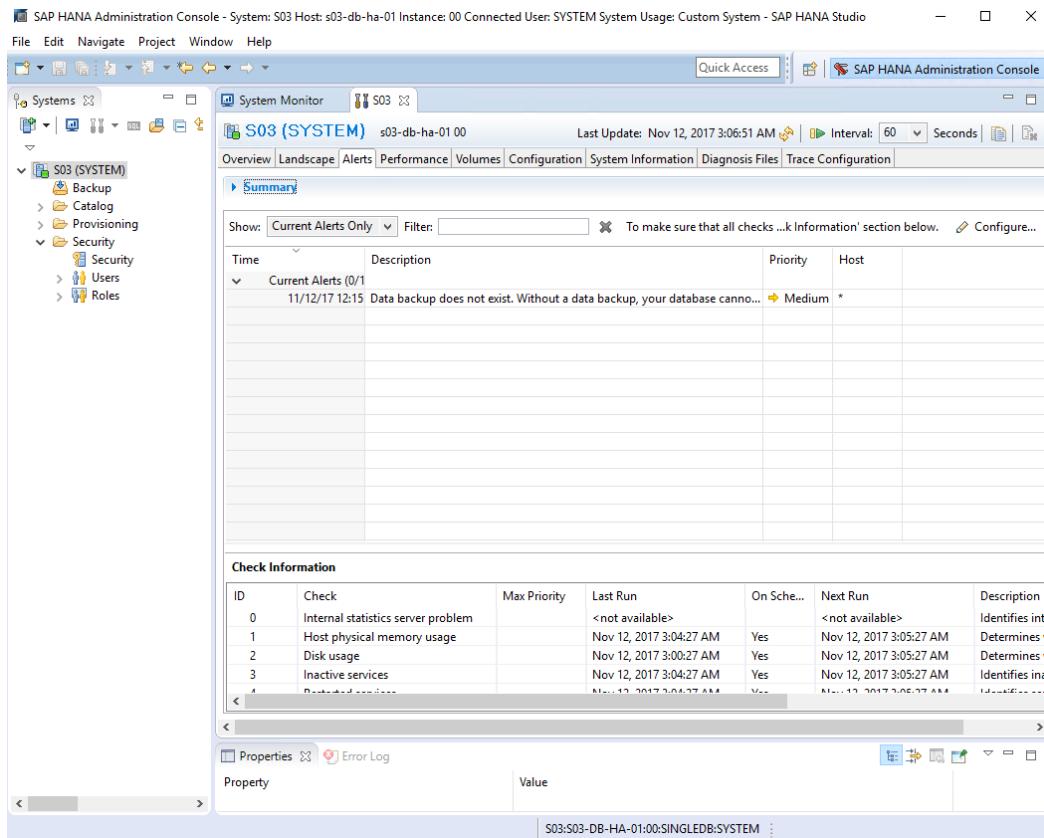
More Information

Properties

Property Value

S03:S03-DB-HA-01:00:SINGLEDDB:SYSTEM

11. Switch to the **Alerts** tab, and verify they are not indicating any operational issues:



Task 2: Executing Query in Hana

1. In order to Execute a Query select the primary system and click on SQL icon. Which will Open the SQL Editor window as given below.

2. To Visually verify that the replication process is properly happening we need to invoke some information in database. Following we'll be executing the following set of query which will create a simple table with few entries. The following is the list of queries which we will be executed.

```

CREATE TABLE MYTABLE(id INT, name VARCHAR(10), PRIMARY KEY(id));

INSERT INTO MYTABLE(id,name) VALUES(1, 'john');
INSERT INTO "MYTABLE"(id,name) VALUES(2, 'doe');
INSERT INTO "MYTABLE"(id,name) VALUES(3, 'jane');
INSERT INTO "MYTABLE"(id,name) VALUES(4, 'lorem');
INSERT INTO "MYTABLE"(id,name) VALUES(5, 'ipsum');

SELECT * FROM MYTABLE;

```

```

SELECT DISTINCT
    HOST, PORT, CONNECTION_STATUS
    FROM M_CONNECTIONS
    WHERE CONNECTION_STATUS LIKE 'RUNNING';

```

The screenshot shows the SAP Studio interface. On the left, the object browser displays the database structure under 'S03 (SYSTEM) HA Cluster'. A red box highlights the 'Tables' node, which contains a table named 'MYTABLE'. In the center, a SQL editor window titled 'S03 (SYSTEM) s03-db-ha-01 00' shows two queries. The first query creates the 'MYTABLE' table and inserts five rows of data. The second query selects distinct connection details for running connections.

```

CREATE TABLE MYTABLE(id INT, name VARCHAR(10), PRIMARY KEY(id));

INSERT INTO MYTABLE(id,name) VALUES(1, 'john');
INSERT INTO "MYTABLE"(id,name) VALUES(2, 'doe');
INSERT INTO "MYTABLE"(id,name) VALUES(3, 'jane');
INSERT INTO "MYTABLE"(id,name) VALUES(4, 'lorem');
INSERT INTO "MYTABLE"(id,name) VALUES(5, 'ipsum');

SELECT * FROM MYTABLE;

SELECT DISTINCT
    HOST, PORT, CONNECTION_STATUS
    FROM M_CONNECTIONS
    WHERE CONNECTION_STATUS LIKE 'RUNNING';

```

- After Executing The Above query the data inserted is viewed as a result and current server hostname.

```
SELECT * FROM MYTABLE
+----+----+-----+
| ID | NAME|
+----+----+-----+
| 1  | john |
| 2  | doe  |
| 3  | jane |
| 4  | lorem|
| 5  | ipsum |
+----+----+-----+
```



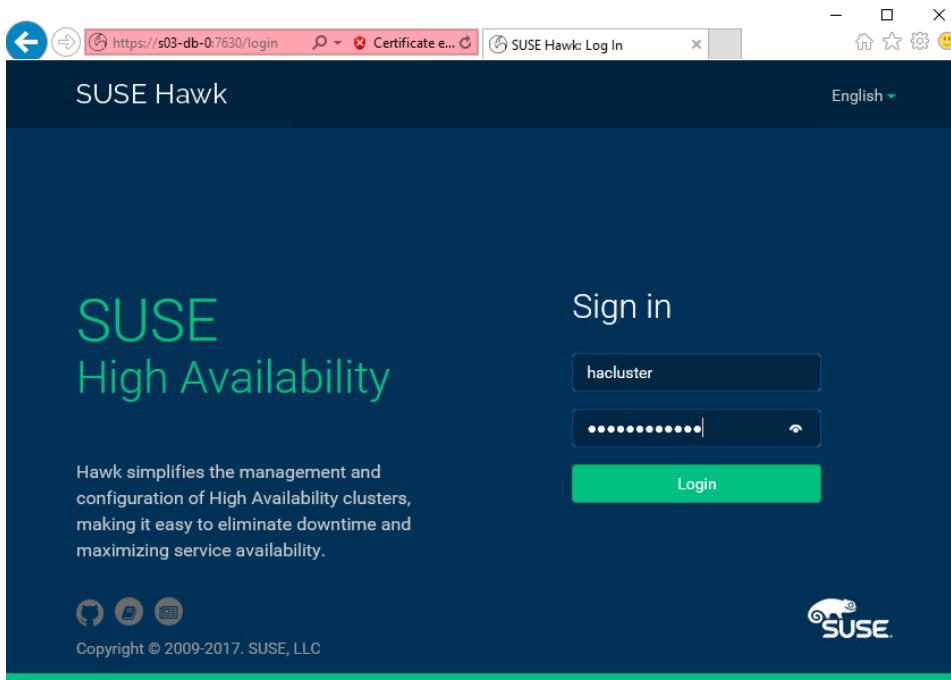
```
SELECT DISTINCT
  HOST, PORT, CONNECTION_STATUS
FROM M_CONNECTIONS
+-----+-----+-----+
| HOST | PORT | CONNECTION_STATUS|
+-----+-----+-----+
| s03-db-0 | 30,003 | RUNNING |
+-----+-----+-----+
```

4.

- The Above query views that currently the data is in **s03-db-0** which is getting replicated simultaneously to **s03-db-1**.

Task 3: Connect to HANA cluster by using Hawk

- From the Remote Desktop session, to s03-hana-0 Azure VM, start **Internet Explorer**, and browse to <https://s03-db-0:7630>. On the **SUSE Hawk Sign in** page, sign in as **hacluster** with the password **demoPassword1!**.



- Once you sign in, review the **Nodes** tab on the **Status** page:

SUSE Hawk

Status hacluster

Resources 8 Nodes 2

Status	Name	Maintenance
	s03-db-0	
	s03-db-1	

3. Next, switch to the **Resources** tab on the **Status** page:

SUSE Hawk

Status

Resources 8 Nodes 2

Status	Name	Location	Type	Operations
	cln_SAPHanaTopology_S03_HDB00	s03-db-0, s03-db-1	ocf:suse:SAPHanaTopology (Clone)	
	rsc_SAPHanaTopology_S03_HDB...	s03-db-0, s03-db-1	ocf:suse:SAPHanaTopology	
	g_ip_S03_HDB00	s03-db-0	Group (2)	
	msl_SAPHana_S03_HDB00	s03-db-0, s03-db-1	Multi-state	
	rsc_SAPHana_S03_HDB00	s03-db-0, s03-db-1	ocf:suse:SAPHana	
	rsc_st_azure_1	s03-db-1	stonith:fence_azure_arm	
	rsc_st_azure_2	s03-db-0	stonith:fence_azure_arm	

Copyright © 2009-2017
SUSE, LLC

4. Examine the state of the HANA resources starting with the **SAPHANATopology**:

The screenshot shows the SUSE Hawk Status interface with the 'hacluster' cluster selected. The 'Resources' tab is active, displaying 8 resources and 2 nodes. The resources listed are:

- cIn_SAPHanaTopology_S03_HDB00**: Status green, Type ocf:suse:SAPHanaTopology (Clone), Location s03-db-0, s03-db-1.
- rsc_SAPHanaTopology_S03_HDB...**: Status green, Type ocf:suse:SAPHanaTopology, Location s03-db-0, s03-db-1.
- g_ip_S03_HDB00**: Status green, Type Group (2).

Red boxes highlight the 'cIn...' row, the 'rsc...' row, and the search icon in the top right corner of the resource list.

5. Examine the state of the SAP Hana resource:

The screenshot shows the detailed view of the SAP Hana resource **rsc_SAPHanaTopology_S03_HDB00**. The resource is identified as a PRIMITIVE type with the agent **ocf:suse:SAPHanaTopology**.

Parameters

SID	503
InstanceNumber	00

Operations

Name	Timeout	Interval
monitor	600	10
start	600	0
stop	300	0

Instances

s03-db-0	started
s03-db-1	started

A red box highlights the 'Instances' table, which lists the two database instances (s03-db-0 and s03-db-1) both in the 'started' state.

Task 4: Test a manual failover (from s03-db-0 to s03-db-1)

- From the Remote Desktop session, to **s03-hana-0** Azure VM, in the Internet Explorer window displaying the **SUSE Hawk** page, from the **msl_SAPHana_S03_HDB00** page, identify the system currently serving the master role.

The screenshot shows the SUSE Hawk interface with the following details:

- Resource Name:** msl_SAPHana_S03_HDB00
- Status:** MASTER
- Child:** rsc_SAPHana_S03_HDB00
- Meta Attributes:**
 - is-managed: true
 - notify: true
 - clone-max: 2
 - clone-node-max: 1
 - target-role: Started
 - interleave: true
- Instances:**

ID	Type
s03-db-0	master
s03-db-1	slave
- Constraints:** (Table with columns ID, Type, Score, To)

Switch to the SSH session on s03-db-0, and stop the pacemaker service by running **service pacemaker stop** (This will trigger the failover of the SAP Hana clustered resource.):

```
s03-db-0:~ # service pacemaker stop
```

2. Wait until the status of the resource changes from the question mark to a blue circle and verify that its location changed to s03-db-1:

	Status	Name	Location	Type	Operations
+	●	cln_SAPHanaTopology_S03_HDB00	s03-db-1	ocf:suse:SAPHanaTopology (Clone)	☰ 🔍
+	●	g_ip_S03_HDB00	s03-db-1	Group (2)	☰ 🔍
+	?	msl_SAPHana_S03_HDB00	s03-db-1	Multi-state	☰ 🔍
+	●	rsc_st_azure_1	s03-db-1	stonith:fence_azure_arm	☰ 🔍
+	●	rsc_st_azure_2	s03-db-1	stonith:fence_azure_arm	☰ 🔍

	Status	Name	Location	Type	Operations
+	●	cln_SAPHanaTopology_S03_HDB00	s03-db-1	ocf:suse:SAPHanaTopology (Clone)	☰ 🔍
+	●	g_ip_S03_HDB00	s03-db-1	Group (2)	☰ 🔍
+	●	msl_SAPHana_S03_HDB00	s03-db-1	Multi-state	☰ 🔍
+	●	rsc_st_azure_1	s03-db-1	stonith:fence_azure_arm	☰ 🔍
+	●	rsc_st_azure_2	s03-db-1	stonith:fence_azure_arm	☰ 🔍

3. Switch to **SAP HANA Administration Console**, and refresh the Overview tab in the **Configuration and Monitoring** view.

Note that SAP HANA is running at this point on the **s03-db-1** node, and it is operational:

The screenshot shows the SAP HANA Administration Console interface. On the left, the 'Overview' tab is selected, displaying various system metrics. Key data points include:

- SAP HANA Used Memory:** Used Memory/Peak Used Memory/Allocation Limit (GB) - On Host s03-db-1: 8.22/8.37/49.53
- Resident Memory:** Database Resident/Total Resident/Physical Memory (GB) - On Host s03-db-1: 12.46/11.67/55.03
- CPU Usage:** Database CPU Usage/Total CPU Usage/Maximum CPU Usage - On Host s03-db-1: 24/29/100
- Disk Usage:** Data Volume Size/Total Disk Usage/Total Disk Size (GB) - On Host s03-db-1: 2.07/3.48
- Log Volume Size/Total Disk Usage/Total Disk Size (GB):** On Host s03-db-1: 2.02/2.18
- Trace Volume Size/Total Disk Usage/Total Disk Size (GB):** On Host s03-db-1: 0.10/57.73

The right pane is a dark-themed 'eclipse' logo with the word 'eclipse' in white. Below the logo, there's a 'Welcome' message: 'Get an overview of the features'.

4. Perform the following **Query** to See if the data is retrieved and check the hostname to verify it is from s03-db-1. On Executing the following set of Queries you will be able to that the active database **s03-db-1**.

```
SELECT * FROM MYTABLE;

SELECT DISTINCT
    HOST, PORT, CONNECTION_STATUS
FROM M_CONNECTIONS
WHERE CONNECTION_STATUS LIKE 'RUNNING';
```

5. After the failover, switch to the SSH session on s03-db-0, and start the pacemaker service by running **service pacemaker start**:

```
s03-db-0:~ # service pacemaker start
```

6. Switch to the **SUSE Hawk Status** page, and note that the **SAP Hana** clustered resource on s03-db-0 failed to start as secondary (This is because **AUTOMATED_REGISTER** property was set to **false** in Exercise 5 Task 6.):

The screenshot shows the SUSE Hawk Status interface. The left sidebar has sections for MANAGE (Status, Dashboard, History), CONFIGURATION (Add Resource, Add Constraint, Wizards, Edit Configuration, Cluster Configuration, Command Log), and ACCESS CONTROL (Roles, Targets). The main area has tabs for Resources (8) and Nodes (2). A red box highlights an error message: "2017-11-23 12:34: Operation start failed for resource rsc_SAPHana_S03_HDB00 on node s03-db-0: call-id=31, rc-code=not running (7), exit-reason=". Below this is a table of resources:

	Status	Name	Location	Type	Operations
+	●	cln_SAPHanaTopology_S03_HDB00	s03-db-0, s03-db-1	ocf:suse:SAPHanaTopology (Clone)	[] ▼ 🔍
+	●	g_ip_S03_HDB00	s03-db-1	Group (2)	[] ▼ 🔍
+	●	msl_SAPHana_S03_HDB00	s03-db-1	Multi-state	[] ▼ 🔍
+	●	rsc_st_azure_1	s03-db-0	stonith:fence_azure_arm	[] ▼ 🔍
+	●	rsc_st_azure_2	s03-db-1	stonith:fence_azure_arm	[] ▼ 🔍

7. To remediate this, switch to the SSH session on s03-db-0, and reconfigure the HANA instance as secondary by running the following sequence of commands:

- **su – s03adm** (switch to the s03adm security context)
- **sapcontrol –nr 00 –function StopWait 600 10** (stop the HANA instance in case it is running)
- **hdbnsutil -sr_register --remoteHost=s03-db-1 --remoteInstance=00 --replicationMode=memsync --name=SITEA** (register the local instance as secondary)
- **exit** (switch back to the root)
- **crm resource cleanup msl_SAPHana_S03_HDB00 s03-db-0** (clean up the failed state)

```
s03-db-0:~ # su - s03adm
s03adm@s03-db-0:/usr/sap/S03/HDB00> sapcontrol -nr 00 -function StopWait 600 10

23.11.2017 12:51:16
Stop
OK

23.11.2017 12:51:16
StopWait
OK
s03adm@s03-db-0:/usr/sap/S03/HDB00> hdbnsutil -sr_register --remoteHost=s03-db-1 --remoteInstance=00 --
replicationMode=memsync --name=SITEA
adding site ...
--operationMode not set; using default from global.ini/[system_replication]/operation_mode: delta_datashipping
checking for inactive nameserver ...
nameserver s03-db-0:30001 not responding.
collecting information ...
updating local ini files ...
done.
s03adm@s03-db-0:/usr/sap/S03/HDB00> exit
logout
s03-db-0:~ # crm resource cleanup msl_SAPHana_S03_HDB00 s03-db-0
```

Cleaned up rsc_SAPHana_S03_HDB00:0 on s03-db-0
Waiting for 1 replies from the CRMd. OK

8. Switch to the **SUSE Hawk Status** page, and note the **SAP Hana** clustered resource is operational on both s03-db-0 and s03-db-1 with s03-db-1 as the primary:

The screenshot shows the SUSE Hawk Status interface. The top navigation bar includes links for View Cluster Details, Batch, hacluster, Help, and Logout. The left sidebar has sections for MANAGE (Status, Dashboard, History), CONFIGURATION (Add Resource, Add Constraint, Wizards, Edit Configuration, Cluster Configuration, Command Log), and ACCESS CONTROL (Roles, Targets). The main content area is titled "Status" and shows two tabs: "Resources" (8) and "Nodes" (2). The "Resources" tab displays a table with the following data:

	Status	Name	Location	Type	Operations
+	●	cln_SAPHanaTopology_S03_HDB00	s03-db-0, s03-db-1	ocf:suse:SAPHanaTopology (Clone)	■ ▾ Q
+	●	g_ip_S03_HDB00	s03-db-1	Group (2)	■ ▾ Q
+	●	msl_SAPHana_S03_HDB00	s03-db-1, s03-db-0	Multi-state	■ ▾ ■ Q
+	●	rsc_st_azure_1	s03-db-0	stonith:fence_azure_arm	■ ▾ Q
+	●	rsc_st_azure_2	s03-db-1	stonith:fence_azure_arm	■ ▾ Q

Below the table, there are sections for "Child" (rsc_SAPHana_S03_HDB00) and "Meta Attributes". The "Meta Attributes" section contains the following key-value pairs:

Attribute	Value
is-managed	true
notify	true
clone-max	2
clone-node-max	1
target-role	Started
interleave	true

The "Instances" section shows two entries: "s03-db-0" (slave) and "s03-db-1" (master), both highlighted with a red box.

The "Constraints" section is currently empty.

Task 5: Test a migration (from s03-db-1 to s03-db-0)

- From the SSH session on s03-db-1, migrate the **SAP Hana** master node and the group containing the virtual IP address of the cluster to **s03-db-0** by running the following commands:
 - `crm resource migrate msl_SAPHana_S03_HDB00 s03-db-0`
 - `crm resource migrate g_ip_S03_HDB00 s03-db-0`

```
s03-db-1:~ # crm resource migrate msl_SAPHana_S03_HDB00 s03-db-0
INFO: Move constraint created for msl_SAPHana_S03_HDB00 to s03-db-0
s03-db-1:~ # crm resource migrate g_ip_S03_HDB00 s03-db-0
INFO: Move constraint created for g_ip_S03_HDB00 to s03-db-0
```

- Switch to the **SUSE Hawk Status** page, and note the **SAP Hana** clustered resource on s03-db-1 failed to start as secondary. This is because **AUTOMATED_REGISTER** property was set to **false** in Exercise 5 Task 6.

The screenshot shows the SUSE Hawk Status interface. The left sidebar has sections for MANAGE (Status, Dashboard, History), CONFIGURATION (Add Resource, Add Constraint, Wizards, Edit Configuration, Cluster Configuration, Command Log), and ACCESS CONTROL (Roles, Targets). The main area is titled 'Status' and shows an 'Errors' section with a message: '2017-11-23 13:07: Operation start failed for resource rsc_SAPHana_S03_HDB00 on node s03-db-1: call-id=72, rc-code=not running (7), exit-reason=' followed by a detailed table of resources and nodes.

	Status	Name	Location	Type	Operations
+	●	cln_SAPHanaTopology_S03_HDB00	s03-db-0, s03-db-1	ocf:suse:SAPHanaTopology (Clone)	■ ▼ 🔍
+	●%	g_ip_S03_HDB00	s03-db-0	Group (2)	■ ▼ 🔍
+	●%	msl_SAPHana_S03_HDB00	s03-db-0	Multi-state	■ ▼ 🔍
+	●	rsc_st_azure_1	s03-db-0	stonith:fence_azure_arm	■ ▼ 🔍
+	●	rsc_st_azure_2	s03-db-1	stonith:fence_azure_arm	■ ▼ 🔍

- To remediate this, switch to the SSH session on s03-db-1, and reconfigure the HANA instance as secondary by running the following sequence of commands:
 - `su - s03adm` (switch to the s03adm security context)
 - `sapcontrol -nr 00 -function StopWait 600 10` (stop the HANA instance in case it is running)
 - `hdbnsutil -sr_register --remoteHost=s03-db-0 --remoteInstance=00 --replicationMode=memsync --name=SITEB` (register the local instance as secondary)
 - `exit` (switch back to the root)

```
s03-db-1:~ # su - s03adm
s03adm@s03-db-1:/usr/sap/S03/HDB00> sapcontrol -nr 00 -function StopWait 600 10

23.11.2017 13:22:33
Stop
OK

23.11.2017 13:22:33
StopWait
OK
```

```
s03adm@s03-db-1:/usr/sap/S03/HDB00> hdbnsutil -sr_register --remoteHost=s03-db-0 --remoteInstance=00 --
    replicationMode=memsync --name=SITEB
adding site ...
--operationMode not set; using default from global.ini/[system_replication]/operation_mode: delta_datashipping
checking for inactive nameserver ...
nameserver s03-db-1:30001 not responding.
collecting information ...
updating local ini files ...
done.
s03adm@s03-db-1:/usr/sap/S03/HDB00> exit
logout
```

4. Switch to the **SUSE Hawk Status** page, click **Edit Configuration**. On **Edit Configuration** page, click **Constraints**:

The screenshot shows the SUSE Hawk Status interface. On the left, there's a sidebar with 'MANAGE' (Status, Dashboard, History), 'CONFIGURATION' (Add Resource, Add Constraint, Wizards, Edit Configuration, Cluster Configuration, Command Log), and 'ACCESS CONTROL' (Roles, Targets). The main area has a title 'Edit Configuration' with tabs: Resources, Constraints (which is selected and highlighted in dashed blue), Nodes, Tags, Alerts, and Fencing. Below the tabs is a search bar and a table listing constraints. The table columns are Name, Type, Resources, and Operations. The rows listed are:

Name	Type	Resources	Operations
cli-prefer-g_ip_S03_HDB00	Location	g_ip_S03_HDB00	
cli-prefer-msl_SAPHana_S03_HDB00	Location	msl_SAPHana_S03_HDB00	
col_saphana_ip_S03_HDB00	Colocation	g_ip_S03_HDB00, msl_SAPHana_S03_HDB00	
col_st_azure	Colocation	rsc_st_azure_1, rsc_st_azure_2	
ord_SAPHana_S03_HDB00	Order	cln_SAPHanaTopology_S03_HDB00, msl_SAPHana_S03_HDB00	

At the bottom of the table, it says 'Showing 1 to 5 of 5 rows 25 ▲ records per page' and has navigation buttons.

5. From the **Constraints** page, delete the **cli-prefer-g_ip_S03_HDB00** constraint:

Name	Type	Resources	Operations
cli-prefer-g_ip_S03_HDB00	Location	g_ip_S03_HDB00	

6. From the **Constraints** page, delete the **cli-prefer-msl_SAPHana_S03_HDB00** constraint:

Name	Type	Resources	Operations
cli-prefer-msl_SAPHana_S03_HDB00	Location	msl_SAPHana_S03_HDB00	

7. Switch to the SSH session on s03-db-1, and clean up the failed state by running **crm resource cleanup msl_SAPHana_S03_HDB00 s03-db-1**:

```
s03-db-1:~ # crm resource cleanup msl_SAPHana_S03_HDB00 s03-db-1
Cleaned up rsc_SAPHana_S03_HDB00:0 on s03-db-1
```

Waiting for 1 replies from the CRMd. OK

8. Switch to the **SUSE Hawk Status** page, and verify the **SAP Hana** clustered resource is operational on both nodes with s03-db-0 as the master:

The screenshot shows the SUSE Hawk Status interface. On the left, there's a sidebar with 'MANAGE' (Status, Dashboard, History), 'CONFIGURATION' (Add Resource, Add Constraint, Wizards, Edit Configuration, Cluster Configuration, Command Log), and 'ACCESS CONTROL' (Roles, Targets). The main area has tabs for 'Resources' (8) and 'Nodes' (2). The 'Resources' tab is active, displaying a table with the following data:

	Status	Name	Location	Type	Operations
+	●	cln_SAPHanaTopology_S03_HDB00	s03-db-0, s03-db-1	ocf:suse:SAPHanaTopology (Clone)	■ ▾ Q
+	●	g_ip_S03_HDB00	s03-db-0	Group (2)	■ ▾ Q
+	●	msl_SAPHana_S03_HDB00	s03-db-0, s03-db-1	Multi-state	■ ▾ Q
+	●	rsc_st_azure_1	s03-db-0	stonith:fence_azure_arm	■ ▾ Q
+	●	rsc_st_azure_2	s03-db-1	stonith:fence_azure_arm	■ ▾ Q

9. Switch to **SAP HANA Administration Console**, and refresh the Overview tab in the **Configuration and Monitoring** view. Note that SAP HANA is running at this point on the **s03-db-0** node and is operational:

The screenshot shows the SAP HANA Administration Console Overview tab for the 'S03 (SYSTEM)' node. The left sidebar shows a tree structure with 'Systems' expanded, showing 'S03 (SYSTEM)' selected. Under 'S03 (SYSTEM)', there are nodes like 'Backup', 'Catalog', 'Provisioning', 'Security' (with 'Security', 'Users', and 'Roles' children), and others. The main panel displays various system metrics:

- General Information:**
 - Operational Status: All services started
 - System Usage: Custom System
 - Start Time of First Started Service: Nov 23, 2017 12:53:13 PM
 - Start Time of Most Recently Started Service: Nov 23, 2017 12:54:09 PM
 - System Replication Status: All services are active and in sync
 - Distributed System: No
 - Version: 1.00.121.00.1466466057 (fa/hana1sp12)
 - Build Time: Jun 21, 2016 1:54:21 AM
 - Platform: SUSE Linux Enterprise Server 12.3
 - Linux Kernel Version: 4.4.92-6.18-default
 - Hardware Manufacturer: Microsoft Corporation
- SAP HANA Used Memory:**
 - Used Memory/Peak Used Memory/Allocation Limit (GB): On Host s03-db-0: 8.44/8.68 28.26
 - [More Information](#)
- Resident Memory:**
 - Database Resident/Total Resident/Physical Memory (GB): On Host s03-db-0: 9.18/7.91 31.40
 - [More Information](#)
- CPU Usage:**
 - Database CPU Usage/Total CPU Usage/Maximum CPU Usage: On Host s03-db-0: 10/15 100
 - [More Information](#)
- Disk Usage:**
 - Data Volume Size/Total Disk Usage/Total Disk Size (GB): On Host s03-db-0: 3.84/3.40
 - Log Volume Size/Total Disk Usage/Total Disk Size (GB): On Host s03-db-0: 2.21/2.25
 - Trace Volume Size/Total Disk Usage/Total Disk Size (GB): On Host s03-db-0: 0.02/0.35
 - [More Information](#)

Task 6: Test fencing

- From the SSH session on s03-db-0, shut down the eth0 network interface:

```
s03-db-0:~ # ifdown eth0
```

- This will trigger restart of the Azure virtual machine, as you can verify it by checking its status from the Azure portal:

Virtual machines
liveid100outlook (Default Directory)

Add **Assign Tags** **Columns** **Refresh** **Start** **Restart** **Stop** **Delete**

Subscriptions: Azure Pass – Don't see a subscription? [Switch directories](#)

Filter by name... **All resource groups** **All types** **All locations**

4 items

<input type="checkbox"/>	NAME	TYPE	STATUS	RESOURCE...	LOCATION
<input type="checkbox"/>	s03-db-0	Virtual machine	Updating	hana-s03-RG	East US
<input type="checkbox"/>	s03-db-1	Virtual machine	Running	hana-s03-RG	East US
<input type="checkbox"/>	s03-hana-0	Virtual machine	Running	hana-s03-RG	East US

3. From the Remote Desktop session, to s03-hana-0 Azure VM, start Internet Explorer, and browse to <https://s03-db-1:7630>. On the **SUSE Hawk Sign in** page, sign in as **hacluster** with the password **demoPassword1!**:

4. Wait until the status of the resource changes from the question mark to a blue circle, and verify its location changed to **s03-db-1**:

The screenshot shows the SUSE Hawk Status interface. On the left, there's a sidebar with 'MANAGE' (Status, Dashboard, History), 'CONFIGURATION' (Add Resource, Add Constraint, Wizards, Edit Configuration, Cluster Configuration, Command Log), and 'ACCESS CONTROL' (Roles, Targets). The main area has a 'Status' card with a heart icon. Below it is a table titled 'Status' with two tabs: 'Resources' (8) and 'Nodes' (2). The 'Resources' tab shows a table:

	Status	Name	Location	Type	Operations
+	●	cln_SAPHanaTopology_S03_HDB00	s03-db-1	ocf:suse:SAPHanaTopology (Clone)	[] ▼ Q
+	●	g_ip_S03_HDB00	s03-db-1	Group (2)	[] ▼ Q
+	●	mst_SAPHana_S03_HDB00	s03-db-1	Multi-state	[] ▼ Q
+	●	rsc_st_azure_1	s03-db-1	stonith:fence_azure_arm	[] ▼ Q
+	●	rsc_st_azure_2	s03-db-1	stonith:fence_azure_arm	[] ▼ Q

5. Switch to **SAP HANA Administration Console**, and refresh the Overview tab in the **Configuration and Monitoring** view.

Note that SAP HANA is running at this point on the **s03-db-0** node:

The screenshot shows the SAP HANA Administration Console Overview tab for node **s03-db-0**. The left sidebar shows a tree structure with 'Systems' expanded, showing 'S03 (SYSTEM)' with subfolders like 'Backup', 'Catalog', 'Provisioning', 'Security' (selected), 'Users', and 'Roles'. The main panel has tabs: Overview, Landscape, Alerts, Performance, Volumes, Configuration, System Information, Diagnosis Files, Trace Configuration. The 'Overview' tab is selected. It displays general information, current alerts, SAP HANA used memory, resident memory, and CPU usage.

General Information

- Operational Status: All services started
- System Usage: Custom System
- Start Time of First Started Service: Nov 23, 2017 1:32:25 PM
- Start Time of Most Recently Started Service: Nov 23, 2017 1:33:35 PM
- Distributed System: No
- Version: 1.00.121.00.1466466057 (fa/hana1sp12)
- Build Time: Jun 21, 2016 1:54:21 AM
- Platform: SUSE Linux Enterprise Server 12.3
- Linux Kernel Version: 4.4.92-6.18-default
- Hardware Manufacturer: Microsoft Corporation

SAP HANA Used Memory

- Used Memory/Peak Used Memory/Allocation Limit (GB): On Host s03-db-1: 8.21/8.30 (28.26%)
- [More Information](#)

Resident Memory

- Database Resident/Total Resident/Physical Memory (GB): On Host s03-db-1: 8.87/7.47 (31.40%)
- [More Information](#)

CPU Usage

- Database CPU Usage/Total CPU Usage/Maximum CPU Usage: On Host s03-db-1: 13/44 (100%)
- [More Information](#)

Disk Usage

- Data Volume Size/Total Disk Usage/Total Disk Size (GB): On Host s03-db-1: 2.63/2.37
- Log Volume Size/Total Disk Usage/Total Disk Size (GB): On Host s03-db-1: 2.15/2.18
- Trace Volume Size/Total Disk Usage/Total Disk Size (GB): On Host s03-db-1: 0.02/18.32
- [More Information](#)

6. From the Azure portal, verify the s03-db-0 virtual machine is running:

<input type="checkbox"/>	NAME	TYPE	STATUS	RESOURCE...	LOCATION
<input type="checkbox"/>	s03-db-0	Virtual machine	Running	hana-s03-RG	East US
<input type="checkbox"/>	s03-db-1	Virtual machine	Running	hana-s03-RG	East US
<input type="checkbox"/>	s03-hana-0	Virtual machine	Running	hana-s03-RG	East US

7. Restart the SSH session to s03-db-0, and run the following commands in order to restore its operational status:

- **su –s03adm** (switch to the s03adm security context)
- **sapcontrol -nr 00 –function StopWait 600 10** (stop the HANA instance in case it is running)
- **hdbnsutil -sr_register --remoteHost=s03-db-1 --remoteInstance=00 --replicationMode=memsync --name=SITEA** (register the local instance as secondary)
- **exit** (switch back to the root)
- **crm resource cleanup msl_SAPHana_S03_HDB00 s03-db-0** (clean up the failed state)

```
s03-db-0:~ # su - s03adm
s03adm@s03-db-0:/usr/sap/S03/HDB00> sapcontrol -nr 00 -function StopWait 600 10
23.11.2017 14:33:39
Stop
OK

23.11.2017 14:33:39
StopWait
OK
s03adm@s03-db-0:/usr/sap/S03/HDB00> hdbnsutil -sr_register --remoteHost=s03-db-1 --remoteInstance=00 --
replicationMode=memsync --name=SITEA
adding site ...
--operationMode not set; using default from global.ini/[system_replication]/operation_mode: delta_datashipping
checking for inactive nameserver ...
nameserver s03-db-0:30001 not responding.
collecting information ...
updating local ini files ...
done.
s03adm@s03-db-0:/usr/sap/S03/HDB00> exit
logout
s03-db-0:~ # crm resource cleanup msl_SAPHana_S03_HDB00 s03-db-0
Cleaned up rsc_SAPHana_S03_HDB00:0 on s03-db-0
Waiting for 1 replies from the CRMd. OK
```

9. Switch to the **SUSE Hawk Status** page, and note that the **SAP Hana** clustered resource is operational on both s03-db-0 and s03-db-1 with s03-db-1 as the primary:

The screenshot shows the SUSE Hawk Status interface. On the left, a sidebar with 'MANAGE' (Status, Dashboard, History), 'CONFIGURATION' (Add Resource, Add Constraint, Wizards, Edit Configuration, Cluster Configuration, Command Log), and 'ACCESS CONTROL' (Roles, Targets) sections. The main area has tabs for 'Resources' (8) and 'Nodes' (2). The 'Status' table lists the following resources:

	Status	Name	Location	Type	Operations
+	●	cln_SAPHanaTopology_S03_HDB00	s03-db-0, s03-db-1	ocf:suse:SAPHanaTopology (Clone)	■ ▼ 🔍
+	●	g_ip_S03_HDB00	s03-db-1	Group (2)	■ ▼ 🔍
+	●	msl_SAPHana_S03_HDB00	s03-db-1, s03-db-0	Multi-state	■ ▼ 🔍
+	●	rsc_st_azure_1	s03-db-0	stonith:fence_azure_arm	■ ▼ 🔍
+	●	rsc_st_azure_2	s03-db-1	stonith:fence_azure_arm	■ ▼ 🔍

8. Switch to **SAP HANA Administration Console**, and on the **Overview** tab in the **Configuration and Monitoring** view, click the **System Replication Status** link.

The screenshot shows the SAP HANA Administration Console Overview tab. It displays general information like Operational Status (All services started), System Usage (Custom System), and Start Time of First Started Service (Nov 23, 2017 1:32:25 PM). The 'System Replication Status' section is highlighted with a red box. It shows that all services are active and in sync.

Operational Status:	█ All services started
System Usage:	Custom System
Start Time of First Started Service:	Nov 23, 2017 1:32:25 PM
Start Time of Most Recently Started Service:	Nov 23, 2017 1:33:35 PM
System Replication Status:	█ All services are active and in sync

9. From the System Replication tab, verify the replication status is active:

The screenshot shows the SAP HANA Administration Console System Replication tab. The table lists replication status for three entries:

HOST	SECONDARY_HOST	REPLICATION_MODE	REPLICATION_STATUS	REPLICATION_STATUS_DETAILS	PORT
s03-db-1	s03-db-0	SYNC	ACTIVE		30,007
s03-db-1	s03-db-0	SYNC	ACTIVE		30,001
s03-db-1	s03-db-0	SYNC	ACTIVE		30,003

After the Hands-on Lab

After completing the hands-on lab, you will remove the resource group and all its resources.

Task 1: Remove the resource group containing all Azure resources deployed in this lab

1. From the lab computer, in the Azure portal at <http://portal.azure.com>, click the **Cloud Shell** icon.
2. If prompted, in the **Welcome to Azure Cloud Shell** window, click **Bash (Linux)**.
3. At the Bash prompt, run the following:

```
az group delete --name s03-hana-RG --no-wait --yes
```