SAP HANA on Azure

Hands-on lab step-by-step

December 2017

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, e-mail addresses, logos, people, places, and events depicted herein are fictitious, and no association with any real company, organization, product, domain name, e-mail 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

[SAP HANA on Azure hands-on lab step-by-step 1](#_Toc504404147)

[Abstract and learning objectives 1](#_Toc504404148)

[Overview 1](#_Toc504404149)

[Requirements 1](#_Toc504404150)

[Help references 2](#_Toc504404151)

[Before the hands-on lab 3](#_Toc504404152)

[Task 1: Validate the owner role membership in the Azure subscription 3](#_Toc504404153)

[Task 2: Validate availability of the SUSE Linux Enterprise Server image 3](#_Toc504404154)

[Exercise 1: Provision Azure infrastructure 4](#_Toc504404155)

[Task 1: Deploy an Azure virtual machine running Windows 4](#_Toc504404156)

[Task 2: Create a virtual network subnet for the HANA database tier 5](#_Toc504404157)

[Task 3: Deploy an Azure Resource Manager QuickStart template 5](#_Toc504404158)

[Task 4: Configure IP settings of Azure VMs running Linux 6](#_Toc504404159)

[Task 5: Configure storage of Azure VMs 9](#_Toc504404160)

[Exercise 2: Configure operating system on Azure VMs running Linux 11](#_Toc504404161)

[Task 1: Connect to Azure Linux VMs and register SUSE Linux Enterprise Server image 11](#_Toc504404162)

[Task 2: Add YaST packages, update the Linux operating system, and install HA Extensions 13](#_Toc504404163)

[Task 3: Enable cross-node password-less SSH access 21](#_Toc504404164)

[Task 4: Configure storage 23](#_Toc504404165)

[Task 5: Configure name resolution 26](#_Toc504404166)

[Exercise 3: Configure clustering on Azure VMs running Linux 27](#_Toc504404167)

[Task 1: Configure clustering 27](#_Toc504404168)

[Task 2: Configure corosync 29](#_Toc504404169)

[Exercise 4: Install SAP HANA 30](#_Toc504404170)

[Task 1: Copy installation media to Linux VMs 30](#_Toc504404171)

[Task 2: Run hdblcm on both Linux VMs 33](#_Toc504404172)

[Exercise 5: Configure SAP HANA replication 38](#_Toc504404173)

[Task 1: Create HANA DATA ADMIN user account 38](#_Toc504404174)

[Task 2: Configure keystore and perform a backup 38](#_Toc504404175)

[Task 3: Create the primary and the secondary sites 39](#_Toc504404176)

[Exercise 6: Configure cluster framework 40](#_Toc504404177)

[Task 1: Configure STONITH clustering options 40](#_Toc504404178)

[Task 2: Create an Azure AD application for the STONITH device 40](#_Toc504404179)

[Task 3: Grant permissions to Azure VMs to the service principal of the STONITH app 43](#_Toc504404180)

[Task 4: Configure the STONITH cluster device 45](#_Toc504404181)

[Task 5: Create SAPHanaTopology cluster resource agent 45](#_Toc504404182)

[Task 6: Create SAPHana cluster resource agent 45](#_Toc504404183)

[Exercise 7: Test the deployment 47](#_Toc504404184)

[Task 1: Install SAP HANA Studio Administration on the Azure VM running Windows 47](#_Toc504404185)

[Task 2: Modify Azure Internal Load Balancer configuration 50](#_Toc504404186)

[Task 3: Connect to HANA cluster by using SAP HANA Studio Administration 54](#_Toc504404187)

[Task 4: Connect to HANA cluster by using Hawk 61](#_Toc504404188)

[Task 5: Test a manual failover (from s03-db-0 to s03-db-1) 64](#_Toc504404189)

[Task 6: Test a migration (from s03-db-1 to s03-db-0) 69](#_Toc504404190)

[Task 7: Test fencing 72](#_Toc504404191)

[After the Hands-on Lab 78](#_Toc504404192)

[Task 1: Remove the resource group containing all Azure resources deployed in this lab 78](#_Toc504404193)

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

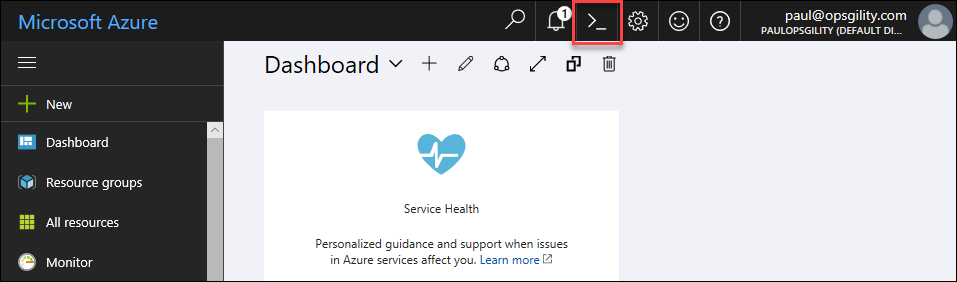
To complete this lab, you must verify your account has sufficient permissions to the Azure subscription that you intend to use to deploy Azure VMs. You also need to identify the availability of the SUSE Linux Enterprise Server image that you will use to deploy Azure VMs.

#### Task 1: Validate the owner role membership in the Azure subscription

1. Login to <http://portal.azure.com>, click on **All Services** and, in the service menu, click **Subscriptions**.
2. On the **Subscriptions** blade, click the name of the subscription you intend to use for this lab.
3. On the subscription blade, click **Access control (IAM)**.
4. Review the list of user accounts, and verify that your user account has the Owner role assigned to it

#### Task 2: Validate availability of the SUSE Linux Enterprise Server image

1. In the Azure portal at <http://portal.azure.com>, click the **Cloud Shell** icon.



1. If prompted, in the **Welcome to Azure Cloud Shell** window, click **Bash (Linux)**.
2. If prompted, in the **You have no storage mounted** window, click **Create storage**.
3. Once the storage account gets provisioned, at the Bash prompt, run the following: where ***location*** designates the target Azure region that you intend to use for this lab (e.g. ***eastus2***), and verify the output includes an existing image:

az vm image list --location ***location*** --publisher SUSE --offer SLES-SAP-BYOS --sku 12-SP3 --all --output table

## Exercise 1: Provision Azure infrastructure

Duration: 30 minutes

In this exercise, you will deploy Azure infrastructure prerequisites for implementing SAP HANA on Azure virtual machines (VMs). This will include creating such resources as an Azure virtual network, Azure VMs in the same availability set, an Azure load balancer, Azure Storage accounts as well as assigning static IPs to each VM. To automate the deployment, you will use an Azure Resource Manager QuickStart template available from <https://github.com/Azure/azure-quickstart-templates/tree/master/sap-3-tier-marketplace-image-multi-sid-db-md>

#### Task 1: Deploy an Azure virtual machine running Windows

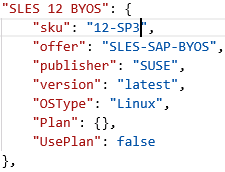
1. From the lab computer, start a Web browser, and navigate to the Azure portal at https://portal.azure.com
2. If prompted, on the **Sign in to your account** page, type in the user name and the password of the work or school or personal Microsoft account with the owner role to the Azure subscription you will be using for this lab, and click **Sign in**.
3. In the Azure portal interface, click **+ New**.
4. On the **New** blade, click **Compute.** Then, on the **Compute** blade, click **Windows Server 2016 Datacenter**.
5. On the **Basics** blade, specify the following settings, and click **OK**:
   * Name: **s03-hana-0**
   * VM disk type: **HDD**
   * User name: **demouser**
   * Password: **demo@pass123**
   * Confirm password: **demo@pass123**
   * Subscription: *the name of your Azure subscription*
   * Resource group: *create a new resource group named* **hana-s03-RG**
   * Location: *The Azure region you identified in the Before the Hands-on Lab section*
6. On the **Choose a size** blade, click **View all**. Next, in the list of VM sizes, click **D1\_V2 Standard**. Then, click **Select**.
7. On the **Settings** blade, specify the following settings, and click **OK**:
   * High availability: **None**
   * Use managed disks: **Yes**
   * Network: click **(new) hana-s03-RG-vnet**. On the **Create virtual network** blade, specify the following settings, and click **OK**:
     1. Name: **hana-s03-RG-vnet**
     2. Address space: **172.16.0.0/20**
     3. Subnet name: **subnet-0**
     4. Subnet address range: **172.16.0.0/24**
   * Subnet: **subnet-0 (172.16.0.0/24)**
   * Public IP address: *accept the default value*
   * Network security group: **Select Basic, chose RDP**
   * Extensions: **No extension**
   * Auto-shutdown: **Off**
   * Boot diagnostics: **Disabled**
   * Guest OS diagnostics: **Disabled**
8. On the **Summary** blade, click **Create**.
9. Wait for the deployment to complete. This should take a few minutes.

#### Task 2: Create a virtual network subnet for the HANA database tier

1. In the Azure portal, navigate to the **hana-s03-RG** resource group.
2. On the **hana-s03-RG** resource group blade, in the list of resources, click **hana-s03-RG-vnet**
3. On the **hana-s03-RG-vnet** blade, click **Subnets**.
4. On the **hana-s03-RG-vnet –** **Subnets** blade, click **+ Subnet**.
5. On the **Add subnet** blade, specify the following, and click **OK**:
   * Name: **subnet-1**
   * Address range: **172.16.1.0/24**
   * Network security group: **None**
   * Route table: **None**
   * Service endpoints (Preview): **0 selected**

#### Task 3: Deploy an Azure Resource Manager QuickStart template

1. From the lab computer, start a Web browser and navigate to <https://github.com/Azure/azure-quickstart-templates/tree/master/sap-3-tier-marketplace-image-multi-sid-db-md>
2. On the **SAP NetWeaver 3-tier multi SID DB (managed disks)** page, click **Deploy to Azure**.
3. If prompted, on the **Sign in to your account** page, type in the user name and the password of the work or school or personal Microsoft account with the owner role to the Azure subscription you will be using for this lab, and click **Sign in**. The Web browser window should automatically redirect to the Azure portal and display the **SAP NetWeaver 3-tier multi SID DB (managed disks)** blade.
4. On the **SAP NetWeaver 3-tier multi SID DB (managed disks)** blade, click **Edit template**.
5. On the **Edit template** blade, scroll down to the **“SLES 12 BYOS”** section, and change the value of the **sku** entry from **12-SP1** to **12-SP3**:



1. On the **Edit template** blade, click **Save**.
2. Back on the **SAP NetWeaver 3-tier multi SID DB (managed disks)** blade, specify the following settings:
   * Subscription: *the name of your Azure subscription*
   * Resource group: **hana-s03-RG**
   * Location: *The Azure region you identified in the Before the Hands-on Lab section*
   * Sap System Id: **S03**
   * Os Type: **SLES 12 BYOS**
   * Db Type: **HANA**
   * SAP System Size: **Demo**
   * System Availability: **HA**
   * Admin Username: **demouser**
   * Admin Password: **demo@pass123**
   * Subnet id: *To identify the value of the subnet id parameter, run the following three commands from the Cloud Shell’s Bash prompt to identify the value to enter here (use the value that ends with* **subnet-1***)*.

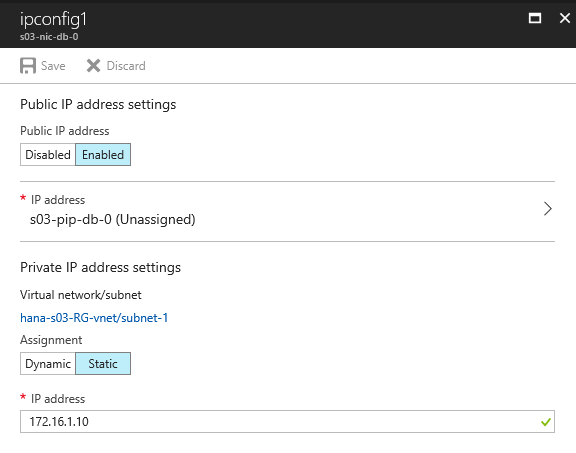
az network vnet subnet list –-resource-group hana-s03-RG –-vnet-name hana-s03-RG-vnet -–query “[?contains(id,’subnet-1’)].{id: id}”

* + \_artifacts Location: *accept the default value*
  + \_artifacts Location SaS Token: *accept the default value*

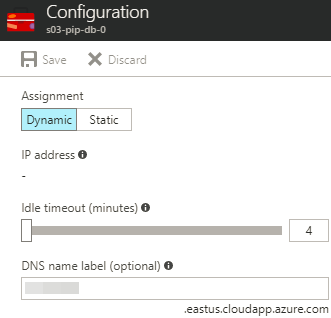
1. Enable the checkbox labeled **I agree to the terms and conditions stated above**,and click **Purchase**.
2. Wait for the deployment to complete. This might take about 30 minutes.

#### Task 4: Configure IP settings of Azure VMs running Linux

1. In the Azure portal, navigate to the **hana-s03-RG** resource group blade.
2. On the **hana-s03-RG** resource group blade, in the list of resources, click **s03-nic-db-0**.
3. On the **s03-nic-db-0** blade, click **IP configurations**.
4. On the **s03-nic-db-0 - IP configurations** blade, click **ipconfig1**.
5. On the **ipconfig1** blade, specify the following settings and click **Save** twice:
   * Public IP address: **Enabled** *(note that in a production environment you would not expose a public IP address)*
   * IP address: **s03-pip-db-0**
   * **Assignment:** **Static**.
   * IP address: **172.16.1.10**

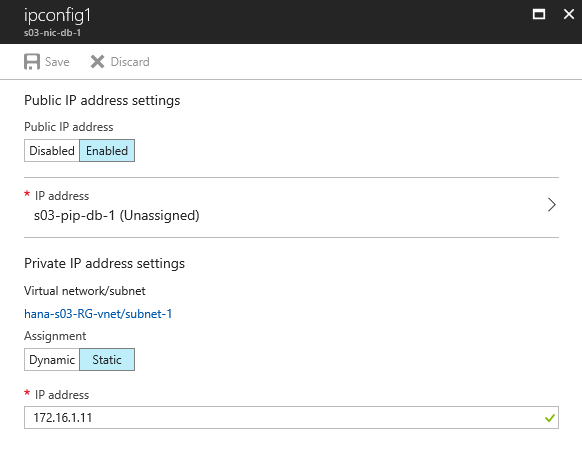


1. In the Azure portal, navigate back to the **hana-s03-RG** resource group blade, and click **s03-db-0**.
2. On the **s03-db-0** blade, click **Configure** under the **DNS name** label.
3. In the **DNS name label** text box, type a unique name you will use to connect to the **s03-db-0** Azure VM from your lab computer (the name will be in the format ***custom-name.Azure-region.*cloudapp.azure.com**),and click **Save**.

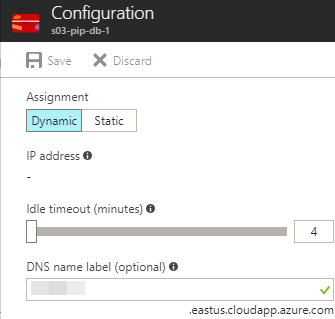


Now configure equivalent settings for the second Azure Linux VM.

1. On the **hana-s03-RG** resource group blade, in the list of resources, click **s03-nic-db-1**.
2. On the **s03-nic-db-1** blade, click **IP configurations**.
3. On the **s03-nic-db-1 - IP configurations** blade, click **ipconfig1**.
4. On the **ipconfig1** blade, specify the following settings and click **Save** twice:
   * Public IP address: **Enabled** *(note that in a production environment you would not expose a public IP address)*
   * IP address: **s03-pip-db-1**
   * **Assignment:** **Static**.
   * IP address: **172.16.1.11**



1. In the Azure portal, navigate back to the **hana-s03-RG** resource group blade, and click **s03-db-1**.
2. On the **s03-db-1** blade, click **Configure** under the **DNS name** label.
3. In the **DNS name label** text box, type a unique name you will use to connect to the **s03-db-1** Azure VM from your lab computer (the name will be in the format ***custom-name.Azure-region.*cloudapp.azure.com**), and click **Save**.



#### Task 5: Configure storage of Azure VMs

1. In the Azure portal, navigate to the **hana-s03-RG** resource group blade.
2. On the **hana-s03-RG** resource group blade, in the list of resources, click **s03-db-0**
3. On the **s03-db-0** blade, click **Disks**.
4. On the **s03-db-0 – Disks** blade, click **+ Add data disk**.
5. In the **NAME** column, in the drop-down list, select **Create disk**.
6. On the **Create managed disk** blade, specify the following settings, and click **Create**:
   * Name: **s03-db-0-data0**
   * Resource group: **hana-s03-RG**
   * Account type: **Premium (SSD)**
   * Source type: **None (empty disk)**
   * Size (GiB): **512**
7. Back on the **s03-db-0 – Disks** blade, click **+ Add data disk**.
8. On the **Create managed disk** blade, specify the following settings, and click **Create**:
   * Name: **s03-db-0-data1**
   * Resource group: **hana-s03-RG**
   * Account type: **Premium (SSD)**
   * Source type: **None (empty disk)**
   * Size (GiB): **512**
9. Back on the **s03-db-0 – Disks** blade, click **+ Add data disk**.
10. On the **Create managed disk** blade, specify the following settings, and click **Create**:
    * Name: **s03-db-0-logs0**
    * Resource group: **hana-s03-RG**
    * Account type: **Premium (SSD)**
    * Source type: **None (empty disk)**
    * Size (GiB): **128**

Note: If any other disks than OS disk is present, detach them otherwise you will go beyond the max of 8 disk for this VM.

1. Back on the **s03-db-0 – Disks** blade, in the **HOST CACHING** column for the first three disks to **Read-only**,and leave the fourth one with its default value of **None**.
2. Now apply the same changes to **s03-db-1**.In the Azure portal, navigate to the **hana-s03-RG** resource group blade.
3. On the **hana-s03-RG** resource group blade, in the list of resources, click **s03-db-1**
4. On the **s03-db-1** blade, click **Disks**.
5. On the **s03-db-1 – Disks** blade, click **+ Add data disk**.
6. In the **NAME** column, in the drop-down list, select **Create disk**.
7. On the **Create managed disk** blade, specify the following settings, and click **Create**:
   * Name: **s03-db-1-data0**
   * Resource group: **hana-s03-RG**
   * Account type: **Premium (SSD)**
   * Source type: **None (empty disk)**
   * Size (GiB): **512**
8. Back on the **s03-db-1 – Disks** blade, click **+ Add data disk**.
9. On the **Create managed disk** blade, specify the following settings, and click **Create**:
   * Name: **s03-db-1-data1**
   * Resource group: **hana-s03-RG**
   * Account type: **Premium (SSD)**
   * Source type: **None (empty disk)**
   * Size (GiB): **512**
10. Back on the **s03-db-1 – Disks** blade, click **+ Add data disk**.
11. On the **Create managed disk** blade, specify the following settings, and click **Create**:
    * Name: **s03-db-1-logs0**
    * Resource group: **hana-s03-RG**
    * Account type: **Premium (SSD)**
    * Source type: **None (empty disk)**
    * Size (GiB): **128**
12. Back on the **s03-db-1 – Disks** blade, in the **HOST CACHING** column for the first three disks to **Read-only** and leave the fourth one with its default value of **None**.

Note: If any other disks than OS disk is present, detach them otherwise you will go beyond the max of 8 disk for this VM.

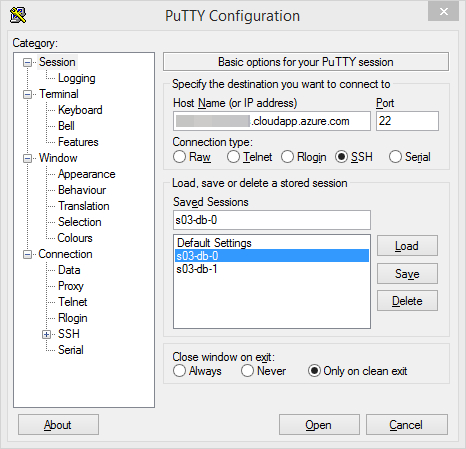
## Exercise 2: Configure operating system on Azure VMs running Linux

Duration: 30 minutes

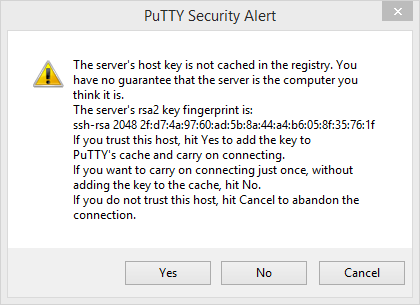
In this exercise, you will configure operating system settings on Azure VMs running SUSE Linux Enterprise Server to accommodate subsequent clustered installation of SAP HANA.

#### Task 1: Connect to Azure Linux VMs and register SUSE Linux Enterprise Server image

1. On the lab computer, start the PuTTY client. In the **Host name (or IP address)** text box, type the fully qualified DNS domain name you assigned to the public IP address of the **s03-db-0** Azure VM in Task 4 of Exercise 1 Ensure the **SSH** option is selected, and click **Open**. This will start an SSH session to **s03-db-0**.



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



1. When prompted, login as **demouser** with the password **demo@pass123**:

login as: demouser

Using keyboard-interactive authentication.

Password:

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

Forum: https://forums.suse.com/forumdisplay.php?93-SUSE-Public-Cloud

Have a lot of fun...

1. Elevate privileges by running **sudo –i** and, when prompted, providing the password for the demouser user account:

demouser@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 demouser:

s03-db-0:~ #

1. Register the SUSE image by using the trial registration code from your SUSE trial subscription:

s03-db-0:~ # SUSEConnect --url=https://scc.suse.com -e *your-user-name*@*your-company-name* -r *registration-code*

Registered SLES\_SAP 12.3 x86\_64

To server: https://scc.suse.com

Using E-Mail: *your-user-name*@*your-company-name*

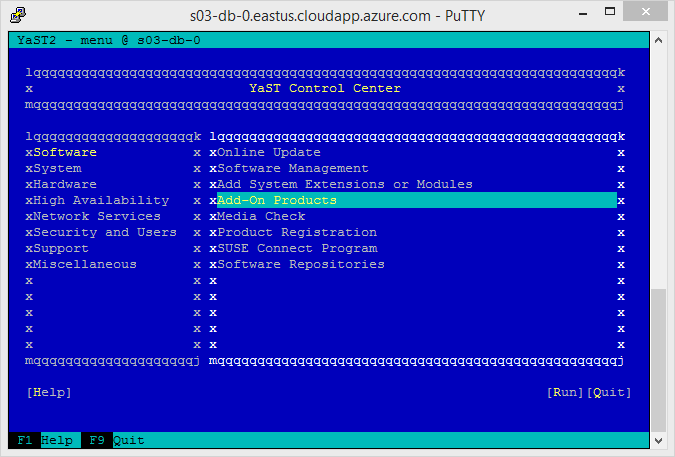
1. Repeat steps 1-5 for **s03-db-1**.

#### Task 2: Add YaST packages, update the Linux operating system, and install HA Extensions

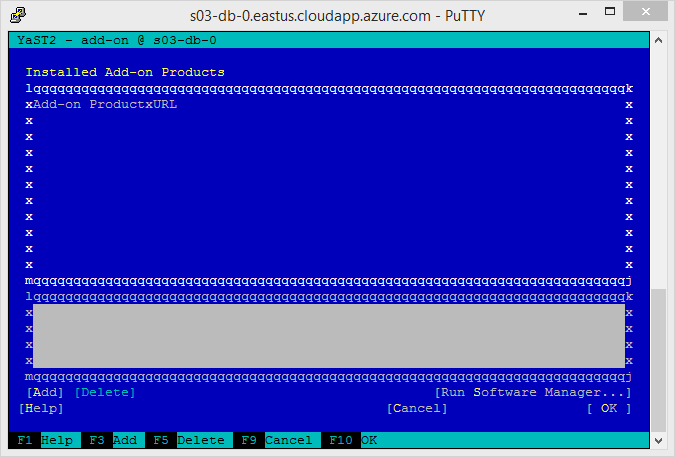
1. While connected via an SSH session to s03-db-0, launch YaST:

s03-db-0:~ # yast

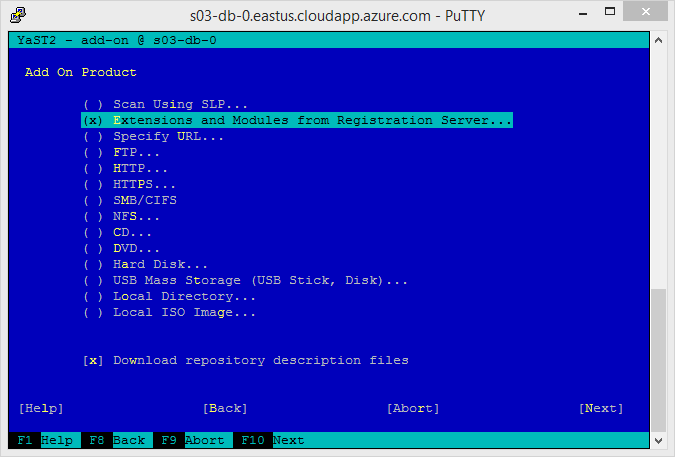
1. In **YaST Control Center**, select **Software -> Add-On Products** and press **Enter**. This will load **Package Manager**.



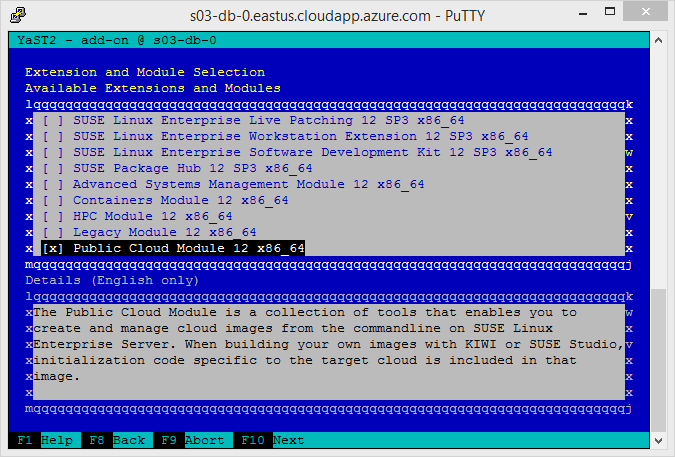
1. In the **Package Manager** interface, click **Add**:



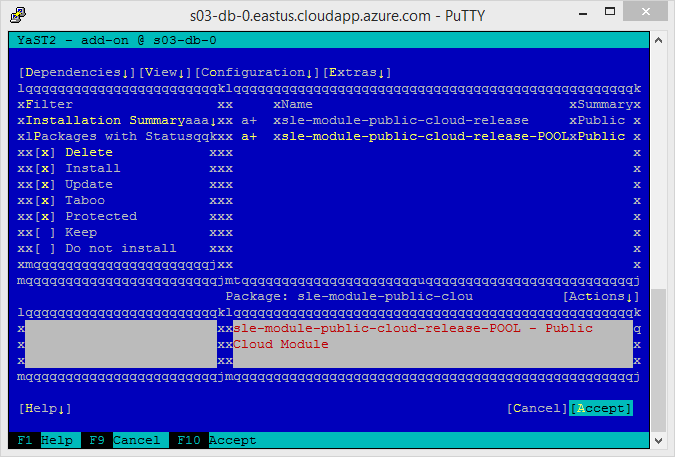
1. On the **Add on Product** screen, select **Extensions and Modules from Registration Server** -> **Next**:



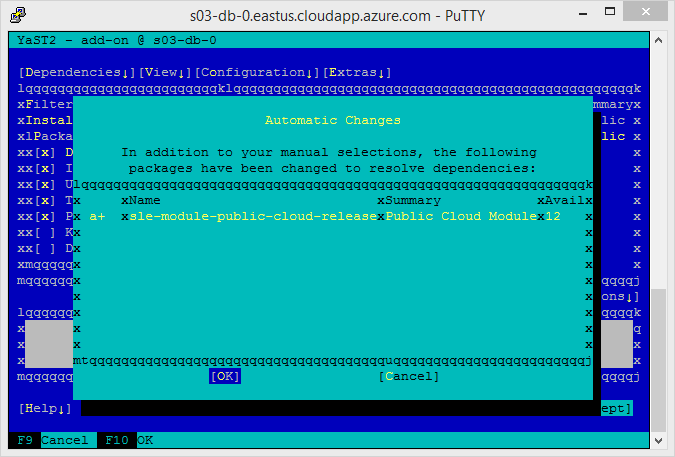
1. On the **Extension and Module Selection** screen, select **Public Cloud Module 12 x86\_64**.Then, press **F10 (Next)**:



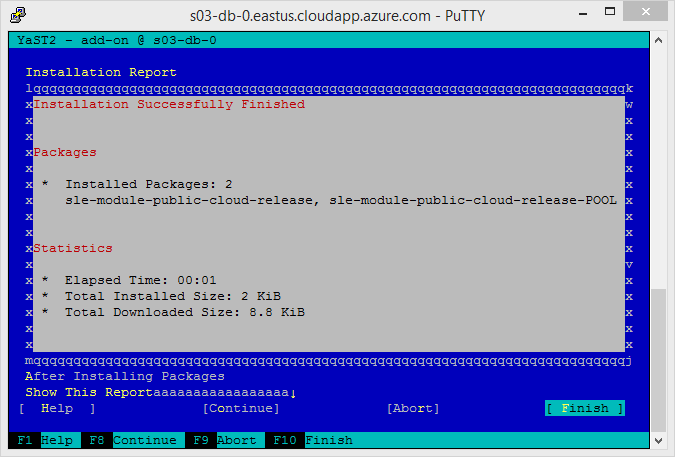
1. Select **Accept**.



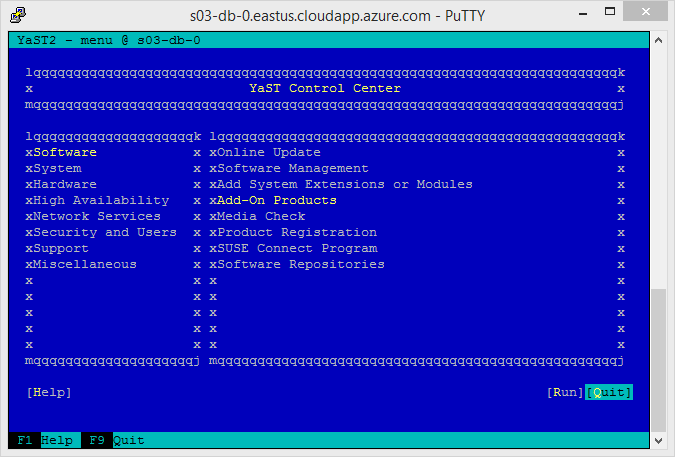
1. On the **Automatic Changes** screen, click **OK**:



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



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



1. Update operating system by running zipper 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 libauparse0 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 libsasl2-3 libsgutils2-2 libsmbconf0 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-prodlist

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)

(…)

1. 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:~ #

1. Repeat the steps 1-12 on **s03-db-1**

#### Task 3: Enable cross-node password-less SSH access

1. From the SSH session on s03-db-0, generate passphrase-less SSH key by running **ssh-keygen –tdsa**. When prompted, press **Enter** three times and then run **cat /root/.ssh/id\_dsa.pub** to display the key.

s03-db-0:~ # ssh-keygen -tdsa

Generating public/private dsa key pair.

Enter file in which to save the key (/root/.ssh/id\_dsa):

Created directory '/root/.ssh'.

Enter passphrase (empty for no passphrase):

Enter same passphrase again:

Your identification has been saved in /root/.ssh/id\_dsa.

Your public key has been saved in /root/.ssh/id\_dsa.pub.

The key fingerprint is:

SHA256:d52jKGzQ7o5+z+EqEcwcoD7rxCz3ld8E7+a6izW6+bE root@s03-db-0

The key's randomart image is:

+---[DSA 1024]----+

| .. |

| . . |

| . + . |

| . =. . . |

| o ..S . . + |

| o o .= + o . . |

|. \* o.O = . |

| = . ..X.@.. |

| . ..B\*EOB |

+----[SHA256]-----+

s03-db-0:~ # cat /root/.ssh/id\_dsa.pub

ssh-dss AAAAB3NzaC1kc3MAAACBALZjoS47twSwRPzEeCFtCl2QH/Az5m7HC9tJPavdocjx0RG0CBDj qdLiQ7IKrEL0FnupoE7LtVYNxXWN8lO1fEEmi4pJxIknLtKC/UgnSmkmqeZznXPztVZUPoHABw4TX90z Wm9YvrnciAnsMIPUBCe0Kg2ZIo2Z1F3kWmCEw6fhAAAAFQCRunrR7MAH/9RzM57qijQ1El7ybQAAAIEA lHLIvJnwg8czZv5JXIIL6vOO+GRSHNWeCbcw6auBZpJQWIDJQnCdq6kEMYZUXnBcb5QAxYPMMfD9FedU mxxuUJznlh4mnko9V0J4imMl28C8e1Lsjkh9TgH6a7jfB1RDOa8+if0speP2IyDxTuSLexJat8yuzClc lB9LnHu1Ep8AAACAa4ZphhcaCQlELcQao2YKu3br+B56Lj+apafFimLNQeiRY5kZQbAlGtBAVPs5gLpi 3w1kGLzTR3W9WNNwFzw8qpknbQyqSSs0GJmUrwL3PATBkvPn5cUSY+q/ZumCg54a14ooMB00CMQ5Vhup IpHX66hwXbTD9ja+W8XXJXejs8E= root@s03-db-0

1. From the SSH session on s03-db-1, create the directory **/root/.ssh/**,and paste the key you generated on s03-db-0 to a new file **/root/.ssh/authorized\_keys**:

s03-db-1:~ # mkdir /root/.ssh

s03-db-1:~ # vi /root/.ssh/authorized\_keys

1. From the SSH session on s03-db-1, generate passphrase-less SSH key by running **ssh-keygen –tdsa**. When prompted, press **Enter** three times and then run **cat /root/.ssh/id\_dsa.pub** to display the key.

s03-db-1:~ # ssh-keygen -tdsa

Generating public/private dsa key pair.

Enter file in which to save the key (/root/.ssh/id\_dsa):

Enter passphrase (empty for no passphrase):

Enter same passphrase again:

Your identification has been saved in /root/.ssh/id\_dsa.

Your public key has been saved in /root/.ssh/id\_dsa.pub.

The key fingerprint is:

SHA256:tziVIs8+N87mb/HObzVO8vasU83kjtMN9XSiAL0WaDE root@s03-db-1

The key's randomart image is:

+---[DSA 1024]----+

| E+ |

| +.o |

| . . o |

| +. . =|

| . S.+. . B+|

| + = .o..oB|

| = . o=\*+|

| ..o+ ..===|

| .\*++..=\*=|

+----[SHA256]-----+

s03-db-1:~ # cat /root/.ssh/id\_dsa.pub

ssh-dss  root@s03-db-1

1. From the SSH session on s03-db-0, paste the key you generated on s03-db-1 to a new file:**/root/.ssh/authorized\_keys**

s03-db-1:~ # vi /root/.ssh/authorized\_keys

1. From the SSH session on s03-db-0, edit **/etc/ssh/sshd\_config** file:

s03-db-1:~ # vi /root/.ssh/authorized\_keys

1. In the **/etc/ssh/sshd\_config** file, locate the **PermitRootLogin** and **AuthorizedKeysFile** entries, and configure them as follows:

PermitRootLogin yes

AuthorizedKeysFile /root/.ssh/authorized\_keys

1. Restart sshd daemon by running **systemctl restart sshd**:

s03-db-0:/ # systemctl restart sshd

1. Repeat steps 5-8 on **s03-db-1**.

#### Task 4: Configure storage

1. From the SSH session on s03-db-0, create physical volumes for all data disks by running:
   * **pvcreate /dev/sdc**
   * **pvcreate /dev/sdd**
   * **pvcreate /dev/sde**
   * **pvcreate /dev/sdf**

s03-db-0:~ # pvcreate /dev/sdc

Physical volume "/dev/sdc" successfully created

s03-db-0:~ # pvcreate /dev/sdd

Physical volume "/dev/sdd" successfully created

s03-db-0:~ # pvcreate /dev/sde

Physical volume "/dev/sde" successfully created

s03-db-0:~ # pvcreate /dev/sdf

Physical volume "/dev/sdf" successfully created

1. From the SSH session on s03-db-0, create volume groups by running:
   * **vgcreate vg\_hana\_shared /dev/sdc**
   * **vgcreate vg\_hana\_data /dev/sdd**
   * **vgcreate vg\_hana\_data /dev/sde**
   * **vgcreate vg\_hana\_log /dev/sdf**

s03-db-0:~ # vgcreate vg\_hana\_shared /dev/sdc

Volume group "vg\_hana\_shared" successfully created

s03-db-0:~ # vgcreate vg\_hana\_data /dev/sdd /dev/sde

Volume group "vg\_hana\_data" successfully created

s03-db-0:~ # vgcreate vg\_hana\_log /dev/sdf

Volume group "vg\_hana\_log" successfully created

1. From the SSH session on s03-db-0, create logical volumes by running:
   * **lvcreate –l 100%FREE –n hana\_shared vg\_hana\_shared**
   * **lvcreate –l 100%FREE –n hana\_data vg\_hana\_data**
   * **lvcreate –l 100%FREE –n hana\_log vg\_hana\_log**
   * **mkfs.xfs /dev/vg\_hana\_shared/hana\_shared**
   * **mkfs.xfs /dev/vg\_hana\_data/hana\_data**
   * **mkfs.xfs /dev/vg\_hana\_log/hana\_log**

s03-db-0:~ # lvcreate -l 100%FREE -n hana\_shared vg\_hana\_shared

Logical volume "hana\_shared" created.

s03-db-0:~ # lvcreate -l 100%FREE -n hana\_data vg\_hana\_data

Logical volume "hana\_data" created.

s03-db-0:~ # lvcreate -l 100%FREE -n hana\_log vg\_hana\_log

Logical volume "hana\_log" created.

s03-db-0:~ # mkfs.xfs /dev/vg\_hana\_shared/hana\_shared

meta-data=/dev/vg\_hana\_shared/hana\_shared isize=256 agcount=4, agsize=8388352 blks

= sectsz=4096 attr=2, projid32bit=1

= crc=0 finobt=0, sparse=0

data = bsize=4096 blocks=33553408, imaxpct=25

= sunit=0 swidth=0 blks

naming =version 2 bsize=4096 ascii-ci=0 ftype=1

log =internal log bsize=4096 blocks=16383, version=2

= sectsz=4096 sunit=1 blks, lazy-count=1

realtime =none extsz=4096 blocks=0, rtextents=0

s03-db-0:~ # mkfs.xfs /dev/vg\_hana\_data/hana\_data

meta-data=/dev/vg\_hana\_data/hana\_data isize=256 agcount=4, agsize=16776704 blks

= sectsz=4096 attr=2, projid32bit=1

= crc=0 finobt=0, sparse=0

data = bsize=4096 blocks=67106816, imaxpct=25

= sunit=0 swidth=0 blks

naming =version 2 bsize=4096 ascii-ci=0 ftype=1

log =internal log bsize=4096 blocks=32767, version=2

= sectsz=4096 sunit=1 blks, lazy-count=1

realtime =none extsz=4096 blocks=0, rtextents=0

s03-db-0:~ # mkfs.xfs /dev/vg\_hana\_log/hana\_log

meta-data=/dev/vg\_hana\_log/hana\_log isize=256 agcount=4, agsize=8388352 blks

= sectsz=4096 attr=2, projid32bit=1

= crc=0 finobt=0, sparse=0

data = bsize=4096 blocks=33553408, imaxpct=25

= sunit=0 swidth=0 blks

naming =version 2 bsize=4096 ascii-ci=0 ftype=1

log =internal log bsize=4096 blocks=16383, version=2

= sectsz=4096 sunit=1 blks, lazy-count=1

realtime =none extsz=4096 blocks=0, rtextents=0

1. From the SSH session on s03-db-0, create the mount directories:
   * **mkdir –p /hana/shared**
   * **mkdir –p /hana/data**
   * **mkdir –p /hana/log**

s03-db-0:~ # mkdir -p /hana/shared

s03-db-0:~ # mkdir -p /hana/data

s03-db-0:~ # mkdir -p /hana/log

1. From the SSH session on s03-db-0, display the ids of:
   * **/dev/vg\_hana\_shared/hana\_shared**
   * **/dev/vg\_hana\_data/hana\_data**
   * **/dev/vg\_hana\_log/hana\_log**

s03-db-0:~ # blkid

/dev/sda2: LABEL="ROOT" UUID="9bcf44e2-31a8-45f7-99ef-d5e589299b01" TYPE="ext4" PARTUUID="712a2bf3-02"

/dev/sda1: LABEL="BOOT" UUID="355e0bfc-6066-4b59-bb9a-4683f0a17f6f" TYPE="ext3" PARTUUID="712a2bf3-01"

/dev/sdb1: UUID="e38659f9-3399-4b6c-9596-1baa3023191c" TYPE="ext4" PARTUUID="bb515d16-01"

/dev/sdc: UUID="m9Sggn-VDl8-biZP-L37w-AsD6-vSOt-SK7WEo" TYPE="LVM2\_member"

/dev/sdf: UUID="U56Ikg-qVho-ESly-6nDA-eda3-Qssl-OrCLIE" TYPE="LVM2\_member"

/dev/sde: UUID="sGMDzY-KMJM-2TOX-Uazq-BSUS-3CY9-db7lDx" TYPE="LVM2\_member"

/dev/sdd: UUID="kjFfGL-jWtU-XOIT-Se1P-u4w0-EjQ0-QIUoRq" TYPE="LVM2\_member"

/dev/mapper/vg\_hana\_shared-hana\_shared: UUID="84f4b3b2-8ee0-47ed-b9a3-8390d45df0e0" TYPE="xfs"

/dev/mapper/vg\_hana\_data-hana\_data: UUID="c8840ee3-54ce-4113-a9dc-f62379df4df7" TYPE="xfs"

/dev/mapper/vg\_hana\_log-hana\_log: UUID="fb394cf0-51bf-4fed-89f2-346b03d3d635" TYPE="xfs"

1. From the SSH session on s03-db-0, edit **/etc/fstab**:

s03-db-0:~ # vi /etc/fstab

1. Add the following entries to **/etc/fstab**, where ***<UUID of /dev/vg\_hana\_shared/hana\_shared>***, ***<UUID of /dev/vg\_hana\_data/hana\_data>***, and ***<UUID of /dev/vg\_hana\_log/hana\_log>*** represent the ids you identified in step 5.

/dev/disk/by-uuid/*<UUID of /dev/vg\_hana\_shared/hana\_shared>* /hana/shared xfs defaults,nofail 0 2

/dev/disk/by-uuid/*<UUID of /dev/vg\_hana\_data/hana\_data>* /hana/data xfs defaults,nofail 0 2

/dev/disk/by-uuid/*<UUID of /dev/vg\_hana\_log/hana\_log>* /hana/log xfs defaults,nofail 0 2

1. From the SSH session on s03-db-0, mount the new volumes by running **mount –a**:

s03-db-0:~ # mount -a

1. From the SSH session on s03-db-0, verify that the mount was successful by running **df -h**:

s03-db-0:~ # df -h

Filesystem Size Used Avail Use% Mounted on

devtmpfs 3.9G 8.0K 3.9G 1% /dev

tmpfs 8.0G 0 8.0G 0% /dev/shm

tmpfs 3.9G 18M 3.9G 1% /run

tmpfs 3.9G 0 3.9G 0% /sys/fs/cgroup

/dev/sda2 29G 2.4G 25G 9% /

/dev/sda1 976M 81M 844M 9% /boot

/dev/sdb1 16G 44M 15G 1% /mnt/resource

tmpfs 797M 0 797M 0% /run/user/1000

/dev/mapper/vg\_hana\_shared-hana\_shared 128G 33M 128G 1% /hana/shared

/dev/mapper/vg\_hana\_data-hana\_data 1024G 33M 1024G 1% /hana/data

/dev/mapper/vg\_hana\_log-hana\_log 128G 33M 128G 1% /hana/log

1. From the SSH session on s03-db-0, create a directory that will be used to host the SAP HANA installation media by running **mkdir –m 777 /hana/shared/media**:

s03-db-0:~ # mkdir –m 777 /hana/shared/media

1. Repeat steps 1-10 on **s03-db-1**.

#### Task 5: Configure name resolution

1. From the SSH session on s03-db-0, add an entry to the **/etc/hosts** file that provides the name resolution for both hosts within the virtual network:
   * **172.16.1.10 s03-db-0**
   * **172.16.1.11 s03-db-1**

s03-db-1:~ # vi /etc/hosts

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

## Exercise 3: 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

1. 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**
   * Network address to bind to (e.g.: 192.168.1.0) [172.16.1.0]: **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)?:

s03-db-0:~ # ha-cluster-init

! 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

Generating SSH key

Configuring csync2

Generating csync2 shared key (this may take a while)...done

csync2 checking files...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) [172.16.1.0]

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://172.16.1.10:7630/

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)

1. 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)? **y**

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\_dsa already exists - overwrite (y/n)? y

2 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://172.16.1.11:7630/

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)

1. From the SSH session on **s03-db-0**, run **passwd hacluster**, and follow the prompts to change the password of the hacluster accountto **demo@pass123**:

s03-db-0:/ # passwd hacluster

New password:

Retype new password:

passwd: password updated successfully

1. 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-1:~ # vi /etc/corosync/corosync.conf

1. Add the following bolded content to the file.

[...]

interface {

[...]

}

**transport: udpu**

**}**

**nodelist {**

**node {**

**ring0\_addr: 172.16.1.10**

**nodeid: 1**

**}**

**node {**

**ring0\_addr: 172.16.1.11**

**nodeid: 2**

**}**

**}**

logging {

[...]

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

s03-db-0:/ # service corosync restart

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

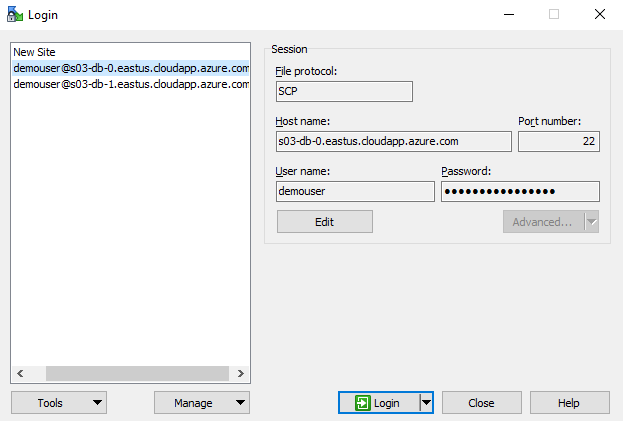
## Exercise 4: Install SAP HANA

Duration: 60 minutes

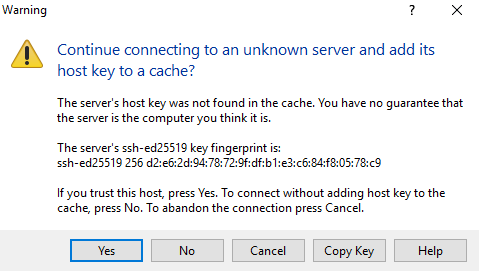
In this exercise, you will install SAP HANA.

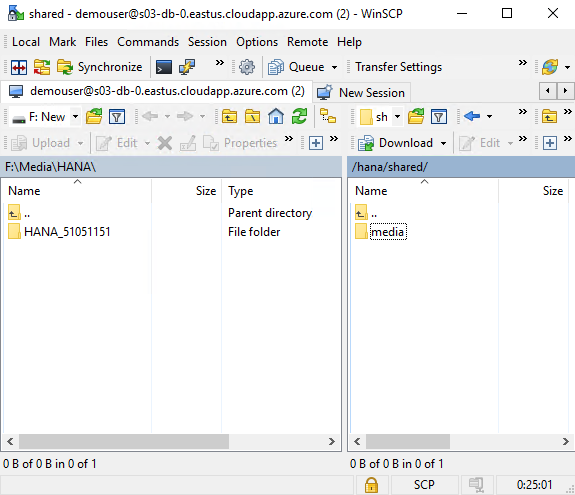
#### Task 1: Copy installation media to Linux VMs

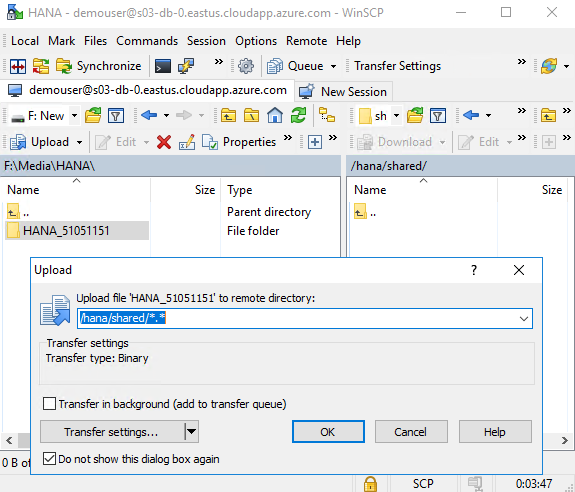
1. From the lab computer, start WinSCP and connect to the DNS name you assigned to the public IP address of the s03-db-0 Azure VM in Exercise 1 Task 4:



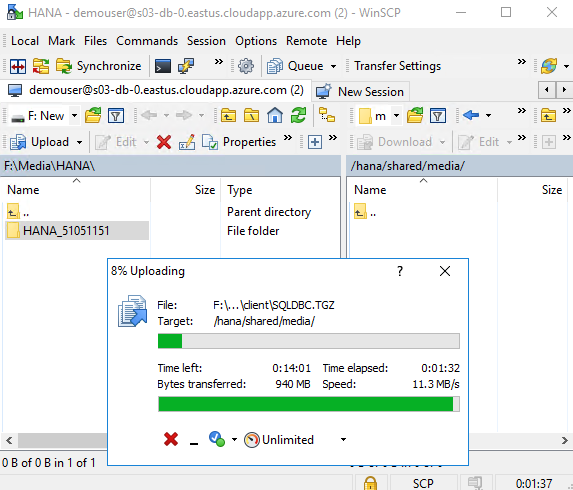
1. When prompted whether to continue, click **Yes**.



1. In the left window pane, navigate to the location of the HANA media files on the lab computer. In the right window pane, navigate to the media directory you created on s03-db-0 in Exercise 2 Task 5:  
   
2. Drag the folder containing the installation media files from the left window pane to the right window pane:



1. Wait for the copy to complete:



#### Task 2: Run hdblcm on both Linux VMs

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

s03-db-0:/ # cd /hana/shared/media/HANA\_51051151/DATA\_UNITS/HDB\_SERVER\_LINUX\_X86\_64

s03-db-0:/hana/shared/media/HANA\_51051151/DATA\_UNITS/HDB\_SERVER\_LINUX\_X86\_64 #

1. 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]: **1**
   * 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: **demo@pass123**
   * Confirm SAP Host Agent User (sapadm) Password: **demo@pass123**
   * Enter System Administrator (s03adm) Password: **demo@pass123**
   * Confirm System Administrator (s03adm) Password: **demo@pass123**
   * 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: **Demo@pass123**
   * Confirm Database User (SYSTEM) Password: **Demo@pass123**
   * Restart system after machine reboot? [n]: *accept the default*

s03-db-0:/hana/shared/media/HANA\_51051151/DATA\_UNITS/HDB\_SERVER\_LINUX\_X86\_64 # ./hdblcm

SAP HANA Lifecycle Management - SAP HANA 1.00.121.00.1466466057

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Scanning Software Locations...

Detected components:

SAP HANA Database (1.00.121.00.1466466057) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/HDB\_SERVER\_LINUX\_X86\_64/server

SAP HANA AFL (incl.PAL,BFL,OFL,HIE) (1.00.121.00.1466480725) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/HDB\_AFL\_LINUX\_X86\_64/packages

SAP TRD AFL FOR HANA (1.00.121.00.1466480725) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/HDB\_TRD\_AFL\_LINUX\_X86\_64/packages

SAP HANA Database Client (1.00.120.032.1464894911) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/HDB\_CLIENT\_LINUX\_X86\_64/client

SAP HANA Studio (2.3.6.000000) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/HDB\_STUDIO\_LINUX\_X86\_64/studio

SAP HANA Smart Data Access (1.00.6.001.0) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/SAP\_HANA\_SDA\_10\_LINUX\_X86\_64/packages

SAP HANA XS Advanced Runtime (1.0.28.271025) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/XSA\_RT\_10\_LINUX\_X86\_64/packages

SAP Web Ide 1 (3.012.0) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/XSAC\_SAP\_WEB\_IDE\_10/XSACSAPWEBIDE12\_0.ZIP

DI CORE 1 (3.012.0) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/XSAC\_DI\_CORE\_10/XSACDEVXDI12\_0.ZIP

XS Monitoring 1 (1.002.0) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/XSA\_CONTENT\_10/XSACMONITORING02\_0.ZIP

XS Services 1 (1.002.0) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/XSA\_CONTENT\_10/XSACSERVICES02\_0.ZIP

SAP HANA Runtime Tools 1 (1.002.2) in /hana/shared/media/HANA\_51051151/DATA\_UNITS/XSAC\_HRTT\_10/XSACHRTT02\_2.ZIP

Choose installation

Index | System | Database Properties

------------------------------------------------

1 | Install new system |

| |

2 | Extract components |

3 | Exit (do nothing) |

Enter selected system index [3]: 1

SAP HANA Database version '1.00.121.00.1466466057' will be installed.

Select additional components for installation:

Index | Components | Description

-----------------------------------------------------------------------------------------------

1 | server | No additional components

2 | all | All components

3 | client | Install SAP HANA Database Client version 1.00.120.032.1464894911

4 | afl | Install SAP HANA AFL (incl.PAL,BFL,OFL,HIE) version 1.00.121.00.1466480725

5 | smartda | Install SAP HANA Smart Data Access version 1.00.6.001.0

6 | studio | Install SAP HANA Studio version 2.3.6.000000

7 | trd | Install SAP TRD AFL FOR HANA version 1.00.121.00.1466480725

8 | xs | Install SAP HANA XS Advanced Runtime version 1.0.28.271025

Enter comma-separated list of the selected indices [3]: 1

Enter Installation Path [/hana/shared]:

Enter Local Host Name [s03-db-0]:

Do you want to add additional hosts to the system? (y/n) [n]:

Enter SAP HANA System ID: s03

Invalid SAP HANA System ID

The first character has to be an upper case letter.

Enter SAP HANA System ID: S03

Enter Instance Number [00]:

Index | Database Mode | Description

-----------------------------------------------------------------------------------------------

1 | single\_container | The system contains one database

2 | multiple\_containers | The system contains one system database and 1..n tenant databases

Select Database Mode / Enter Index [1]:

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]:

Enter Certificate Host Name For Host 's03-db-0' [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:

Password confirmation failed

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 Database User (SYSTEM) Password:

Confirm Database User (SYSTEM) Password:

Restart system after machine reboot? [n]:

Summary before execution:

=========================

SAP HANA Components Installation

Installation Parameters

Remote Execution: ssh

Installation Path: /hana/shared

Local Host Name: s03-db-0

SAP HANA System ID: S03

Instance Number: 00

Database Mode: single\_container

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 1.00.121.00.1466466057

Location: /hana/shared/media/HANA\_51051151/DATA\_UNITS/HDB\_SERVER\_LINUX\_X86\_64/server

SAP HANA AFL (incl.PAL,BFL,OFL,HIE)

Do not install

SAP TRD AFL FOR HANA

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 'Saphostagent Setup'...

Preparing package 'Python Support'...

Preparing package 'Python Runtime'...

Preparing package 'Product Manifest'...

Preparing package 'Binaries'...

Preparing package 'Data Quality'...

Preparing package 'Krb5 Runtime'...

Preparing package 'Installer'...

Preparing package 'Ini Files'...

Preparing package 'HWCCT'...

Preparing package 'Emergency Support Package'...

Preparing package 'EPM'...

Preparing package 'Documentation'...

Preparing package 'Delivery Units'...

Preparing package 'DAT Languages'...

Preparing package 'DAT Configfiles'...

Creating System...

Extracting software...

Installing package 'Saphostagent Setup'...

Installing package 'Python Support'...

Installing package 'Python Runtime'...

Installing package 'Product Manifest'...

Installing package 'Binaries'...

Installing package 'Data Quality'...

Installing package 'Krb5 Runtime'...

Installing package 'Installer'...

Installing package 'Ini Files'...

Installing package 'HWCCT'...

Installing package 'Emergency Support Package'...

Installing package 'EPM'...

Installing package 'Documentation'...

Installing package 'Delivery Units'...

Installing package 'DAT Languages'...

Installing package 'DAT Configfiles'...

Creating instance...

Starting SAP HANA Database system...

Starting 7 processes on host 's03-db-0' (worker):

Starting on 's03-db-0': hdbcompileserver, hdbdaemon, hdbindexserver, hdbnameserver, hdbpreprocessor, hdbwebdispatcher, hdbxsengine

Starting on 's03-db-0': hdbcompileserver, hdbdaemon, hdbindexserver, hdbpreprocessor, hdbwebdispatcher, hdbxsengine

Starting on 's03-db-0': hdbdaemon, hdbindexserver, hdbwebdispatcher, hdbxsengine

Starting on 's03-db-0': hdbdaemon, hdbwebdispatcher, hdbxsengine

Starting on 's03-db-0': hdbdaemon, hdbwebdispatcher

All server processes started on host 's03-db-0' (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\_XS\_BASE

Importing delivery unit HDC\_XS\_LM

Importing delivery unit SAPUI5\_1

Importing delivery unit SAP\_WATT

Importing delivery unit HANA\_BACKUP

Importing delivery unit HANA\_HDBLCM

Importing delivery unit HANA\_SEC\_BASE

Importing delivery unit HANA\_SEC\_CP

Importing delivery unit HANA\_ADMIN

Importing delivery unit HANA\_WKLD\_ANLZ

Installing Resident hdblcm...

Updating SAP HANA Instance Integration on Local Host...

Regenerating SSL certificates...

Deploying SAP Host Agent configurations...

Creating Component List...

SAP HANA system installed

You can send feedback to SAP with this form: https://s03-db-0:1129/lmsl/HDBLCM/S03/feedback/feedback.html

Log file written to '/var/tmp/hdb\_S03\_hdblcm\_install\_2017-11-12\_00.07.22/hdblcm.log' on host 's03-db-0'.

1. Repeat steps 1-2 on s03-db-1 using the same custom values and accepting the same default values.

## Exercise 5: Configure SAP HANA replication

Duration: 20 minutes

In this exercise, you will configure SAP HANA replication.

#### Task 1: Create HANA DATA ADMIN user account

1. From the SSH session on s03-db-0, change the current directory to the root, and modify the path environment variable to include reference to the HANA binaries.
   * **cd /**
   * **PATH="$PATH:/usr/sap/S03/HDB00/exe"**

s03-db-0:/hana/shared/media/HANA\_51051151/DATA\_UNITS/HDB\_SERVER\_LINUX\_X86\_64 # cd /

s03-db-0:/ # PATH="$PATH:/usr/sap/S03/HDB00/exe"

1. From the SSH session on s03-db-0, create the s03hasync HANA DATA ADMIN user account (when prompted, provide the password for the HANA DB SYSTEM user which you set in Task2 of Exercise 4 to **Demo@pass123**):
   * **hdbsql -u system -i 00 'CREATE USER s03hasync PASSWORD "C0mpl3xp@55w0rd"'**
   * **hdbsql -u system -i 00 'GRANT DATA ADMIN TO s03hasync'**
   * **hdbsql -u system -i 00 'ALTER USER s03hasync DISABLE PASSWORD LIFETIME'**

s03-db-0:/ # hdbsql -u system -i 00 'CREATE USER s03hasync PASSWORD "C0mpl3xp@55w0rd"'

Password:

0 rows affected (overall time 15.504 msec; server time 14.420 msec)

s03-db-0:/ # hdbsql -u system -i 00 'GRANT DATA ADMIN TO s03hasync'

Password:

0 rows affected (overall time 5163 usec; server time 4054 usec)

s03-db-0:/ # hdbsql -u system -i 00 'ALTER USER s03hasync DISABLE PASSWORD LIFETIME'

Password:

0 rows affected (overall time 4733 usec; server time 3694 usec)

1. Repeat step 1 **(but not step 2)** on s03-db-1.

#### Task 2: Configure keystore and perform a backup

1. From the SSH session on s03-db-0, configure keystore by running **hdbuserstore SET S03haloc localhost:30015 S03hasync C0mpl3xp@55w0rd**:

s03-db-0:/ # hdbuserstore SET S03haloc localhost:30015 S03hasync C0mpl3xp@55w0rd

1. Repeat step 1 on s03-db-1.
2. From the SSH session on s03-db-0, perform a backup by running **hdbsql -u system -i 00 "BACKUP DATA USING FILE ('initialbackup')"** (when prompted, provide the password for the HANA DB SYSTEM user which you set in Task2 of Exercise 4 to **Demo@pass123**):

s03-db-0:/ # hdbsql -u system -i 00 "BACKUP DATA USING FILE ('initialbackup')"

Password:

0 rows affected (overall time 63.961412 sec; server time 63.960173 sec)

#### Task 3: Create the primary and the secondary sites

1. From the SSH session on s03-db-0, switch to the security context of the s03adm account by running **su – s03adm**:

s03-db-0:/ # su - s03adm

s03adm@s03-db-0:/usr/sap/S03/HDB00>

1. From the SSH session on s03-db-0, create the primary site by running **hdbnsutil –sr\_enable –-name=SITE1**:

s03adm@s03-db-0:/usr/sap/S03/HDB00> hdbnsutil -sr\_enable --name=SITE1

checking for active nameserver ...

nameserver is active, proceeding ...

successfully enabled system as system replication source site

done.

1. From the SSH session on s03-db-1, switch to the security context of the s03adm account by running **su – s03adm**:

s03-db-1:/ # su - s03adm

s03adm@s03-db-1:/usr/sap/S03/HDB00>

1. From the SSH session on s03-db-1, stop the HANA DB instance by running **sapcontrol -nr 00 -function StopWait 600 10**:

s03-db-1:/ # su - s03adm

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

12.11.2017 01:09:23

Stop

OK

s03adm@s03-db-1:/usr/sap/S03/HDB00>

1. From the SSH session on s03-db-1, create the secondary site by running **hdbnsutil -sr\_register --remoteHost=s03-db-0 --remoteInstance=00 --replicationMode=sync --name=SITE2**:

s03adm@s03-db-1:/usr/sap/S03/HDB00> hdbnsutil -sr\_register --remoteHost=s03-db-0 --remoteInstance=00 --replicationMode=sync --name=SITE2

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.

## Exercise 6: Configure cluster framework

Duration: 30 minutes

In this exercise, you will configure cluster framework.

#### Task 1: Configure STONITH clustering options

1. 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:/ #

1. 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" \

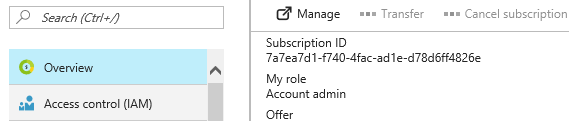
timeout="600"

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

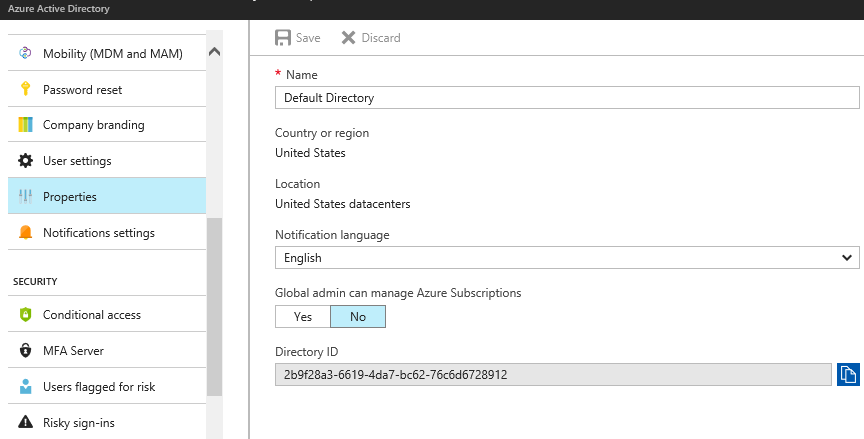
s03-db-0:/ # crm configure load update crm-defaults.txt

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

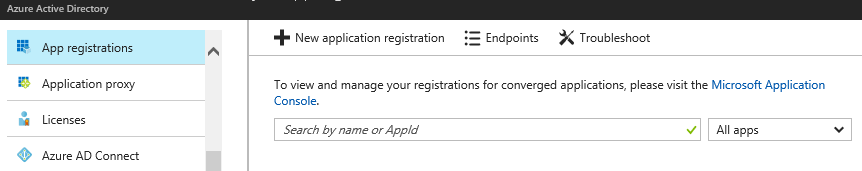
1. From the lab computer, start **Internet Explorer** and browse to the Azure portal at **https://portal.azure.com**
2. When prompted, sign in with the account that has the Global Administrator role in the Azure Active Directory tenant associated with your subscription.
3. In the Azure portal, navigate to the Subscription blade and note the **subscription ID**:



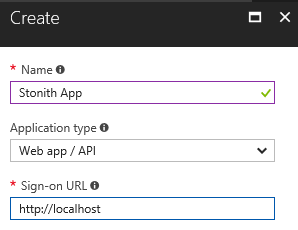
1. In the Azure portal, navigate to the Azure Active Directory blade.
2. On the Active Directory blade, click **Properties** and note the value of **Directory ID**. This will be referenced as the tenant id later in the exercise.



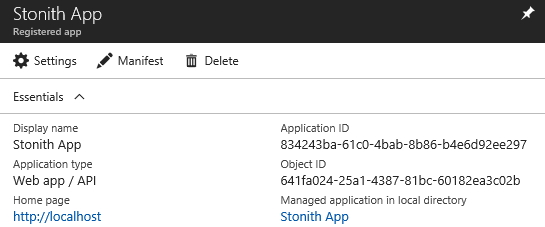
1. Click **App registrations** followed by selecting **+New application registration**:



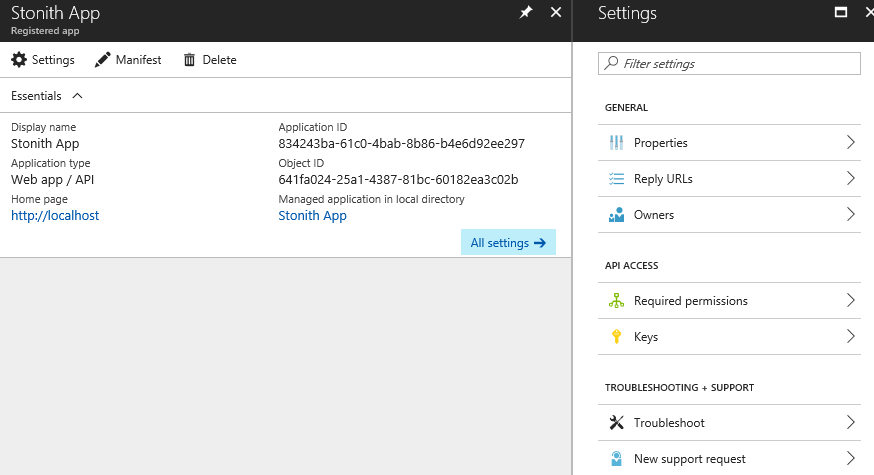
1. On the **Create** blade, specify the following settings, and click **Create**:
   1. Name: **Stonith app**
   2. Application type: **Web app /API**
   3. Sign-on URL: **http://localhost**



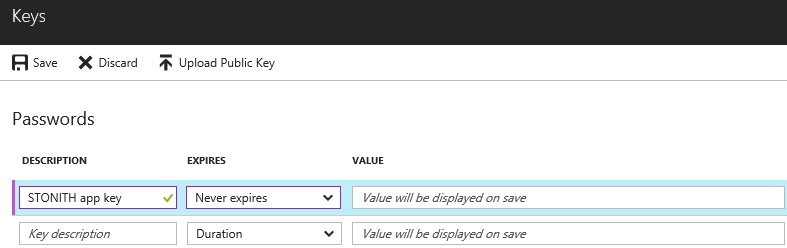
1. On the list of apps, click the newly created app. On the appblade, note the value of **Application ID**. This will be referenced as the login id later in this exercise:



1. On the **Settings** blade, click **Keys**:



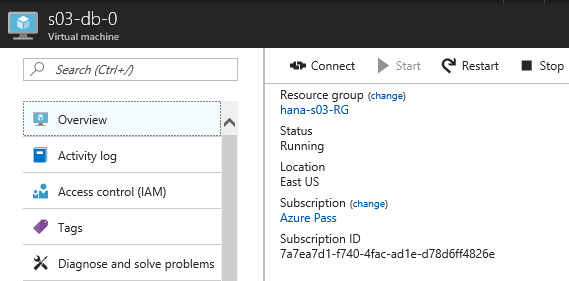
1. On the **Keys** blade, in the **DESCRIPTION** column, type **STONITH app key**. In the **EXPIRES** column, select **Never expires**. Then, click **Save**:



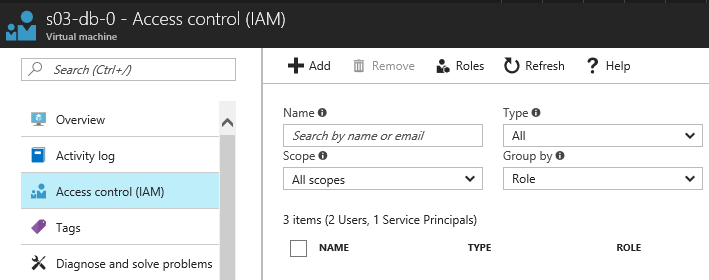
1. Make sure to write down the entry appearing in the **VALUE** column (this entry is displayed only once, after you click **Save**). This will be used as the password for the corresponding service principal.
2. Close the **Keys** blade.

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

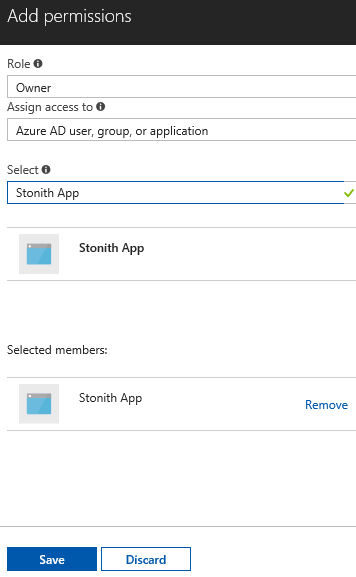
1. In the Azure portal, navigate to the s03-db-0 VM.



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



1. Click + **Add**.
2. On the **Add permissions** blade, specify the following settings and click **Save**:
   * Role: **Owner**
   * Assign access to: **Azure AD user, group, or application**
   * Select: **Stonith App**



1. 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

1. 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 5 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

1. 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

#### Task 5: Create SAPHanaTopology cluster resource agent

1. 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"

1. 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

#### Task 6: Create SAPHana cluster resource agent

1. 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="172.16.1.4"

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

1. 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

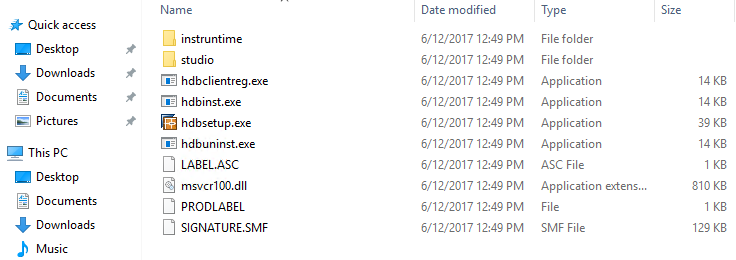
## Exercise 7: Test the deployment

Duration: 30 minutes

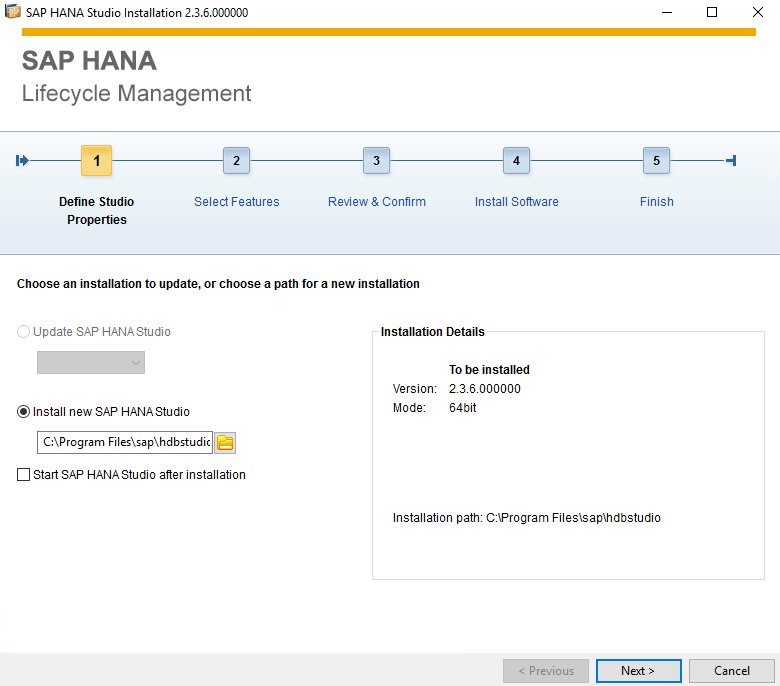
In this exercise, you will test the HANA deployment.

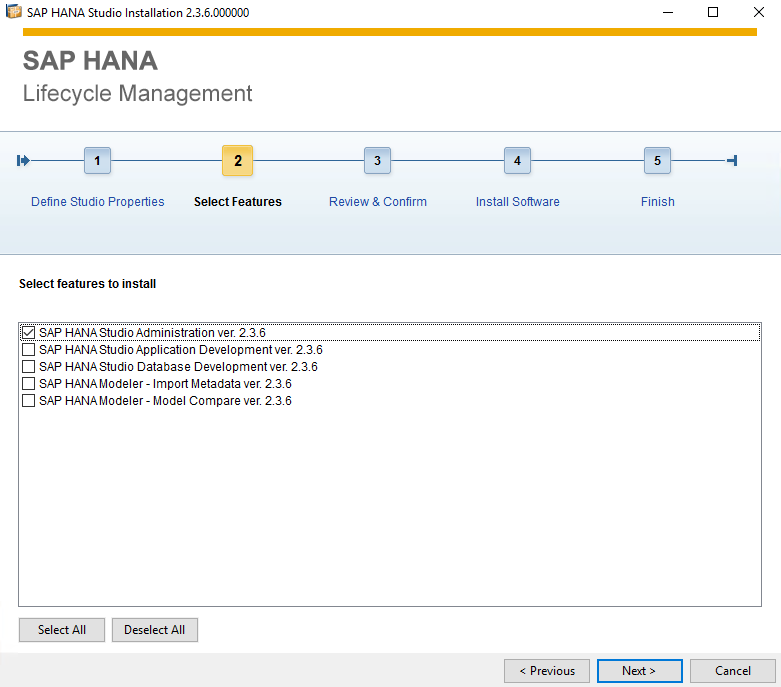
#### Task 1: Install SAP HANA Studio Administration on the Azure VM running Windows

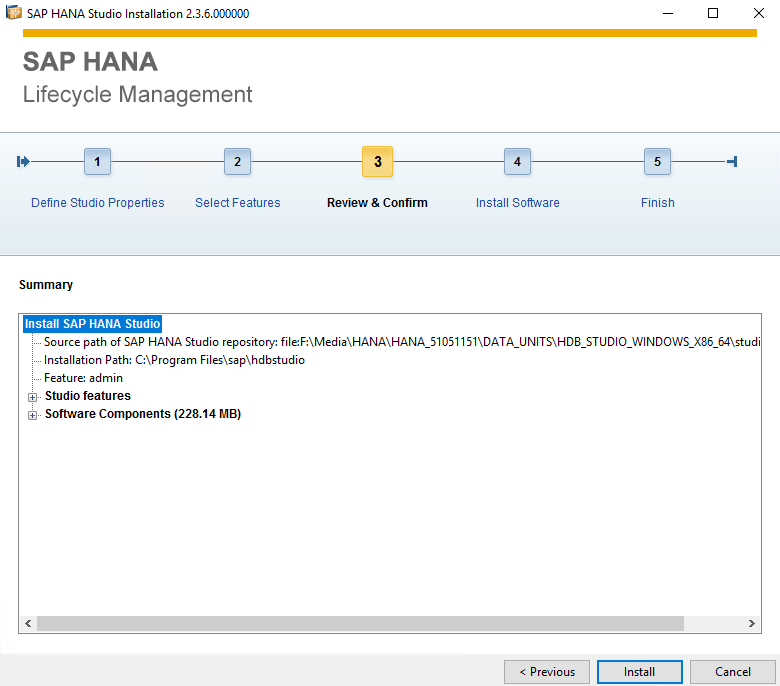
1. From the Azure portal, establish a Remote Desktop session to the s03-hana-0 Azure VM.
2. Use the drive redirection feature of Remote Desktop session to copy the DATA\_UNITS\HDB\_STUDIO\_WINDOWS\_X86\_64 folder from the installation media to the s03-hana-0 Azure VM.
3. From the Remote Desktop session to s03-hana-0 Azure VM, navigate to the DATA\_UNITS\HDB\_STUDIO\_WINDOWS\_X86\_64 folder and run hdbsetup.exe. This will start the SAP HANA Studio Installation wizard.



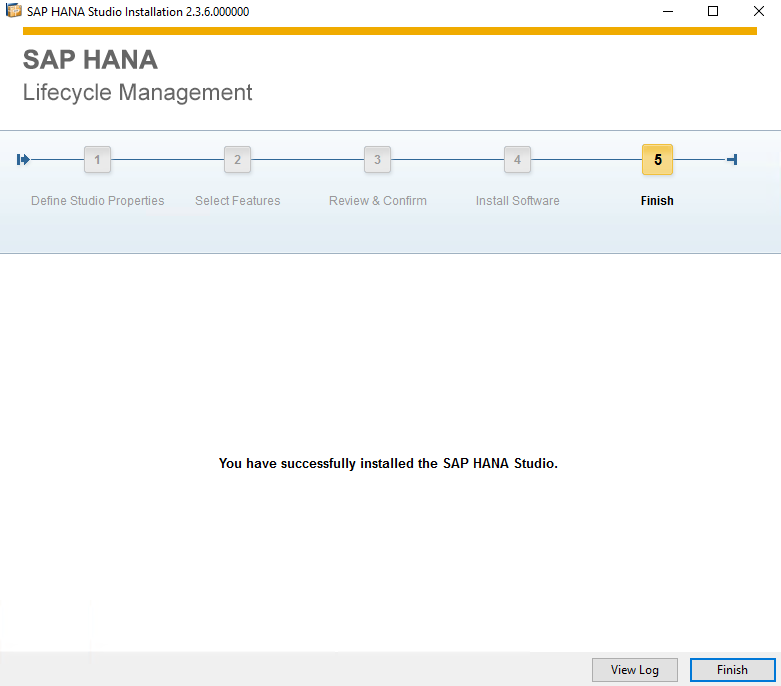
1. On the **Define Studio Properties** page, click **Next**:



1. On the **Select Features** page, ensure that only **SAP HANA Studio Administration** is selected, and click **Next**:
2. On the **Review & Confirm** page, click **Install**:



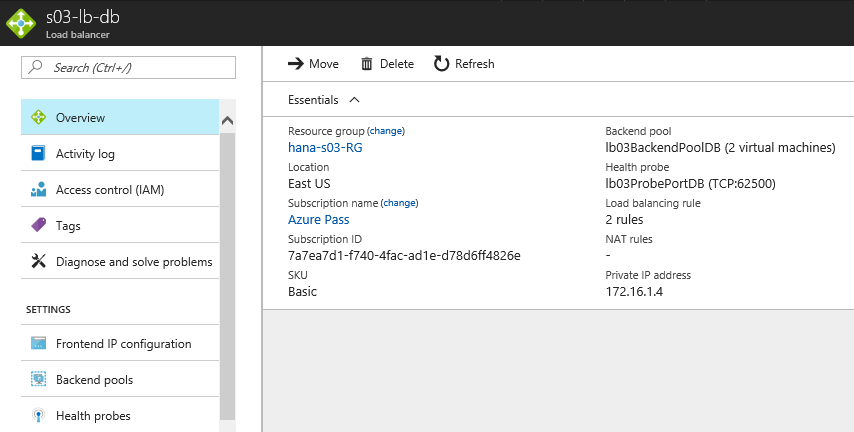
1. On the **Finish** page, click **Finish**:



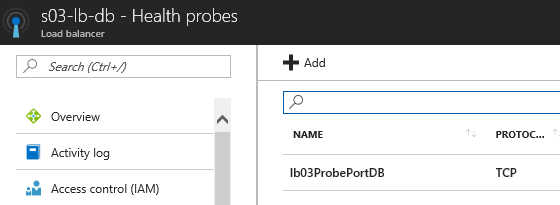
#### Task 2: Modify Azure Internal Load Balancer configuration

The template-based deployment of Azure components that form the SAP HANA infrastructure configures load balancer with the default value of its Health Probe ports and load balancing rules set for the instance 03 of SAP HANA. In this task, you will modify the load balancer configuration in order to account for the fact that you deployed instance 00.

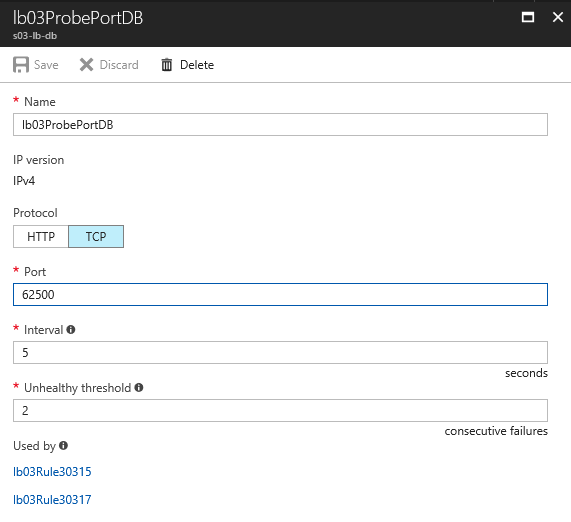
1. From the lab computer, in the Internet Explorer window / Azure portal, navigate to the **s03-lb-db** load balancer. Then, on the **s03-lb-db** blade, click **Health probes**:



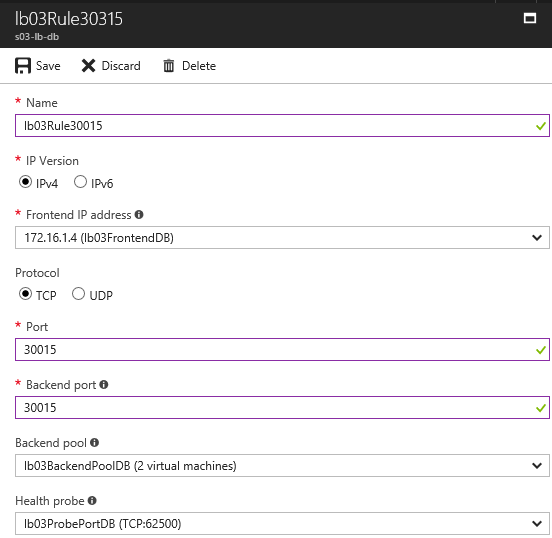
1. On the **s03-lb-db – Health Probes** blade, click **lb03ProbePortDB**:



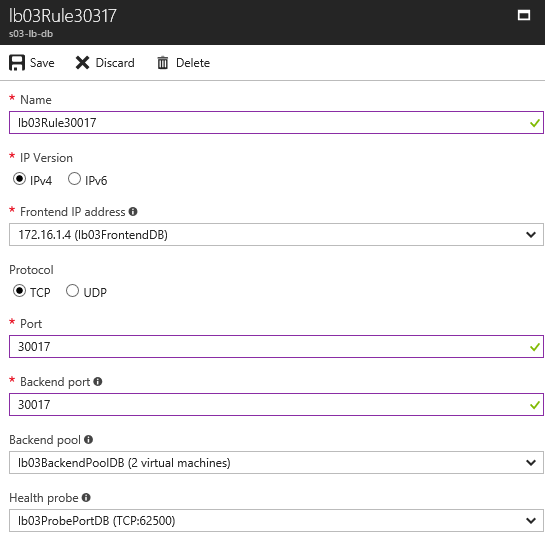
1. On the **lb03ProbePortDB** blade, set the port to **62500**, and click **Save**:



1. On the **lb03ProbePortDB**, click the link to the **lb03Rule30315**. This will display the **l03Rule30315** blade.
2. On the **lb03Rule30315** blade, change the name of the rule to **lb03Rule30015**,set both the port and the backend port entries to **30015**, and click **Save**:



1. Navigate back to the **lb03ProbePortDB**, click the link to the **lb03Rule30317**. This will display the **l03Rule30317** blade.
2. On the **lb03Rule30317** blade, change the name of the rule to **lb03Rule30017**,set both the port and the backend port entries to **30017**, and click **Save**:



#### Task 3: Connect to HANA cluster by using SAP HANA Studio Administration

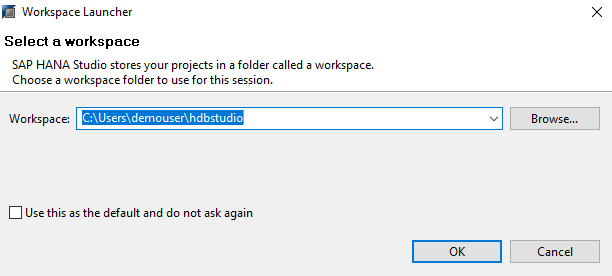
1. From the Remote Desktop session, start **Notepad**, and open the **hosts** file located in **C:\Windows\System32\drivers\etc**.
2. Add the following entries to the host file, save your changes, and close the file:

172.16.1.10 s03-db-0

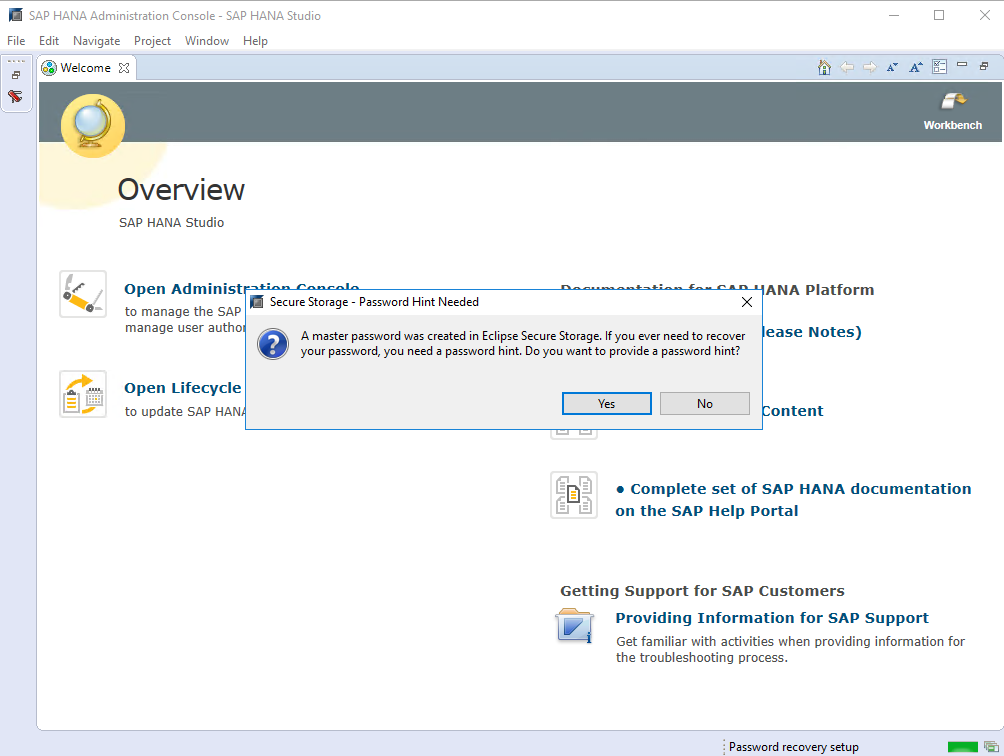
172.16.1.11 s03-db-1

172.16.1.4 s03-db-ha-01

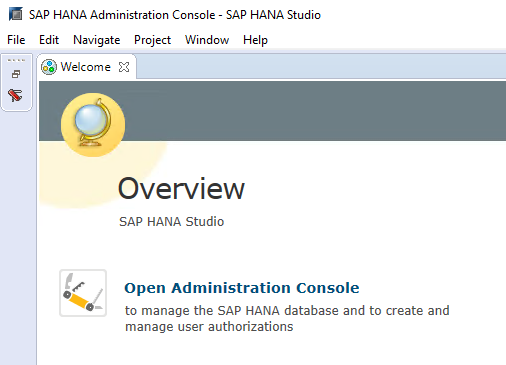
1. From the Remote Desktop session, start SAP HANA Studio Administration.
2. When prompted to select a workspace, accept the default value, and click **OK**:



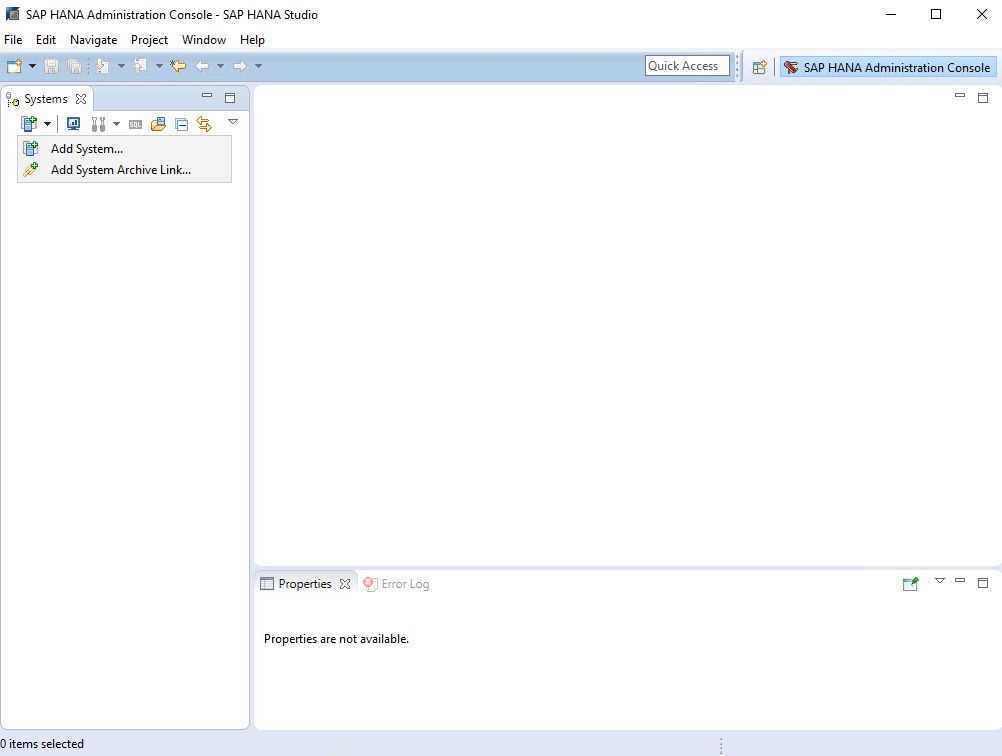
1. When prompted to provide a password hint, click **No**:



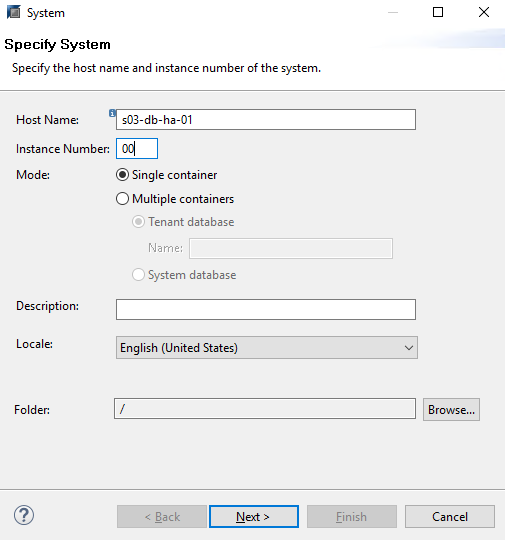
1. On the **Overview** page, click **Open Administration Console**:



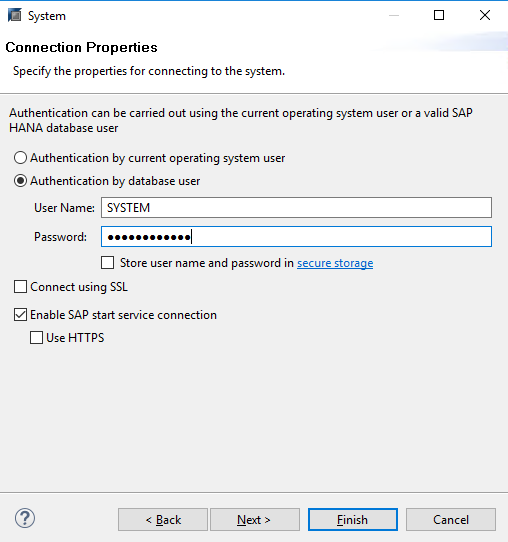
1. In the **SAP HANA Administration Console**, expand the **Systems** menu, and click **Add System**:



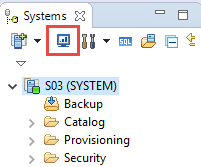
1. In the Specify System dialog box, specify the following information, and click **Next**:
   * Host Name: **s03-db-ha-01**
   * Instance number: **00**

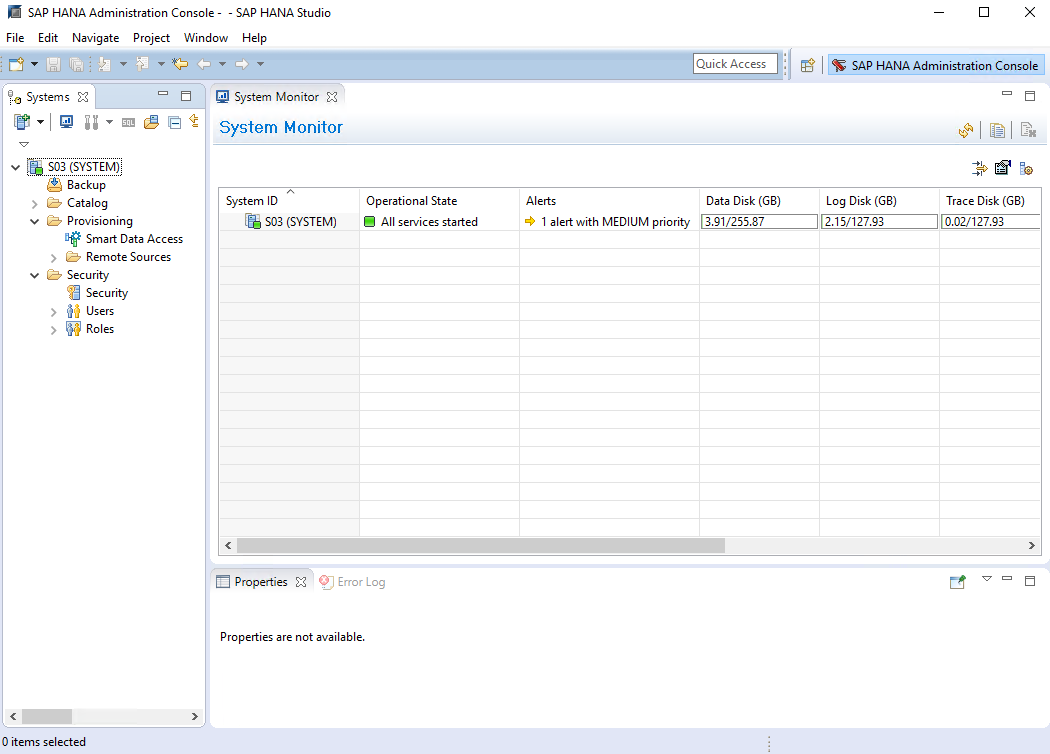


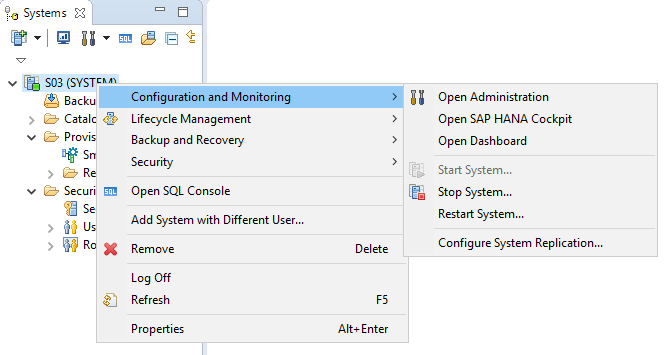
1. In the **Connection Properties** dialog box, select the **Authentication by database user** option, specify the following information, and click **Finish**:
   * User Name: **SYSTEM**
   * Password: **Demo@pass123**



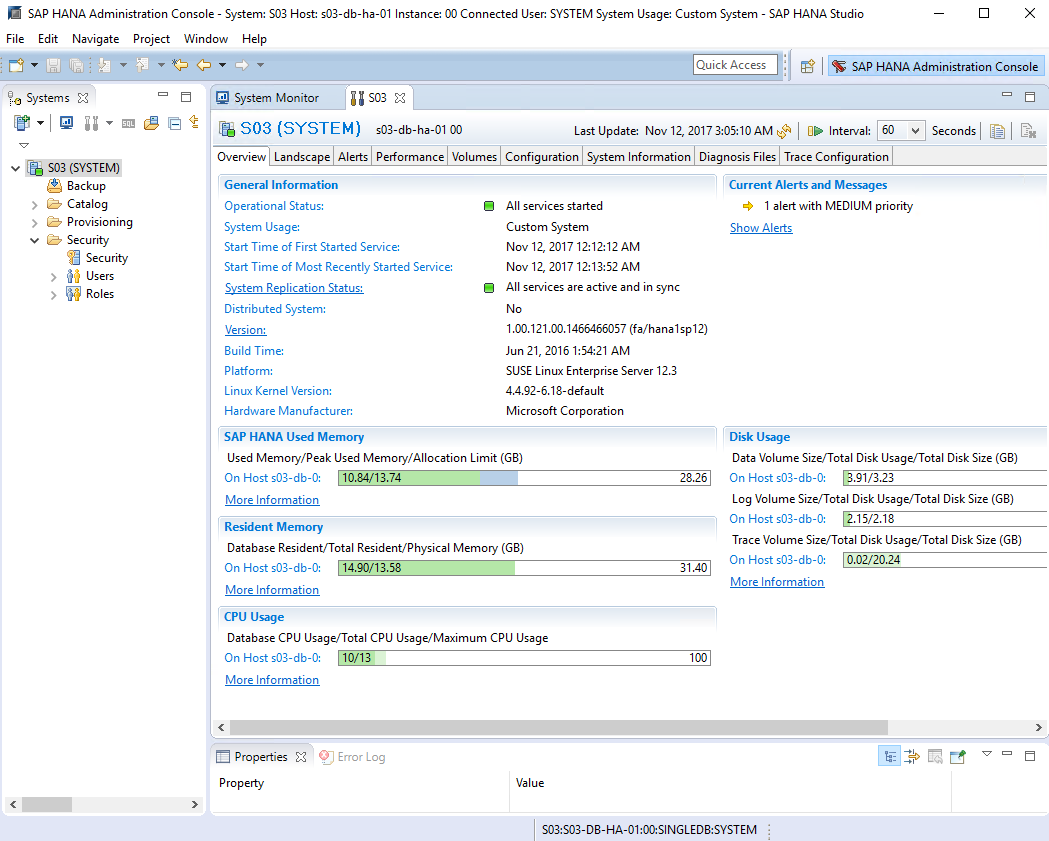
1. Once you successfully connected to **S03** as **SYSTEM**, click the **System Monitor** icon in the Systems toolbar.



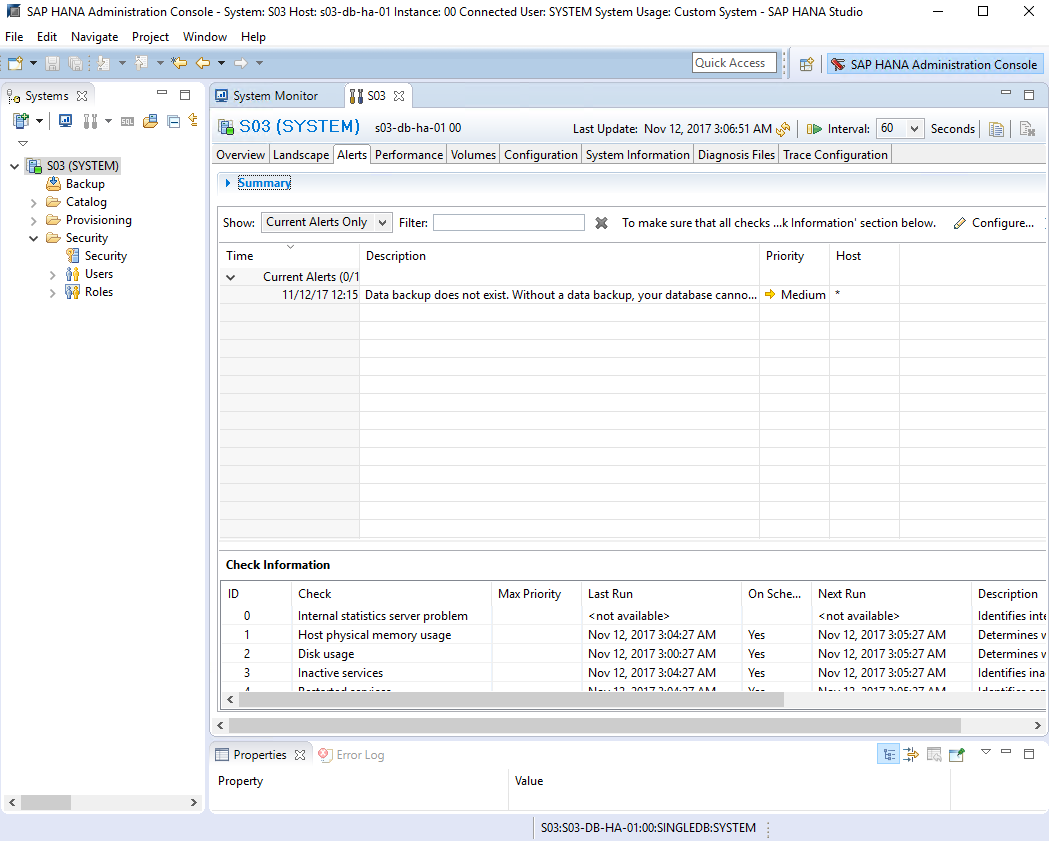
1. Review the **System Monitor** status. 
2. Right click the **S03 (SYSTEM)** node and in the right click menu. Click **Configuration and Monitoring** followed by **Open Administration**.



1. 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.

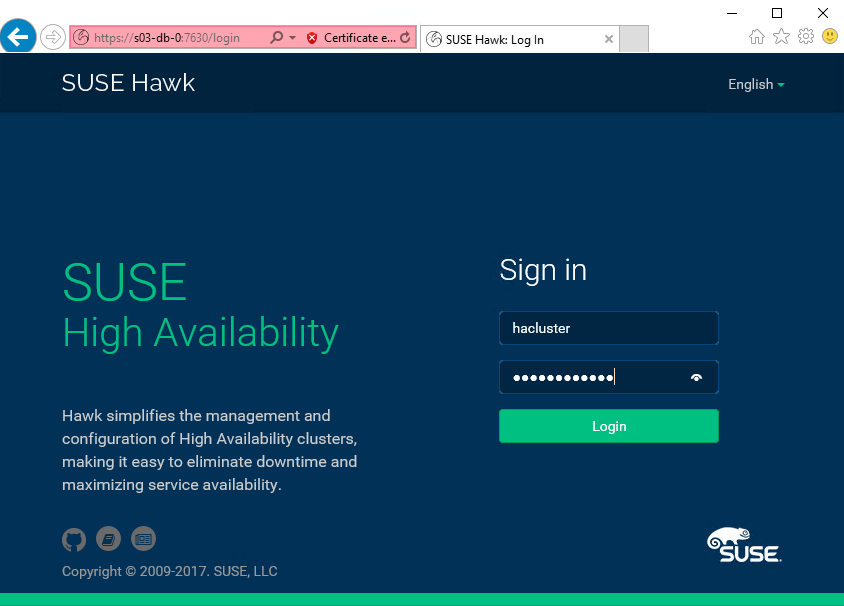


1. Switch to the **Alerts** tab, and verify they are not indicating any operational issues:

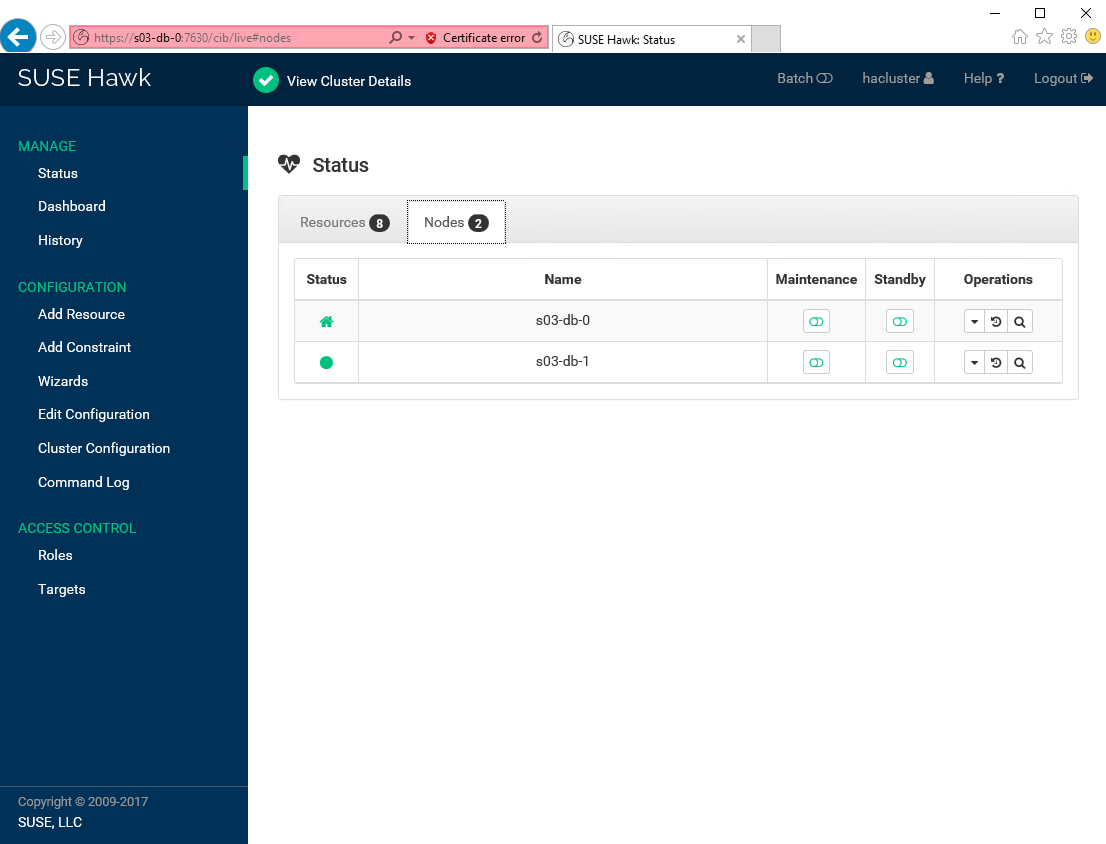


#### Task 4: Connect to HANA cluster by using Hawk

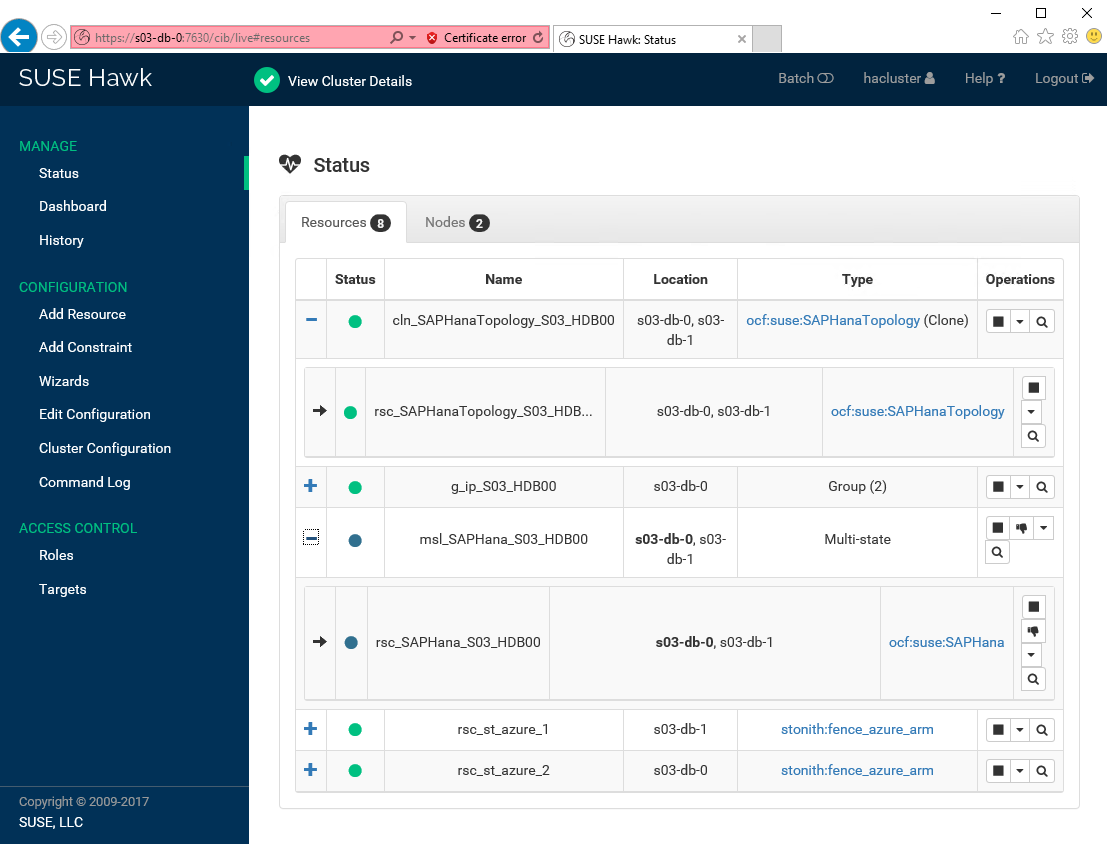
1. From the Remote Desktop session, to s03-hana-0 Azure VM, start **Internet Explorer**, and browse to **https://s03-db-0:7630**. On the **SUSE Hawk Sign in** page, sign in as **hacluster** with the password **demo@pass123**.



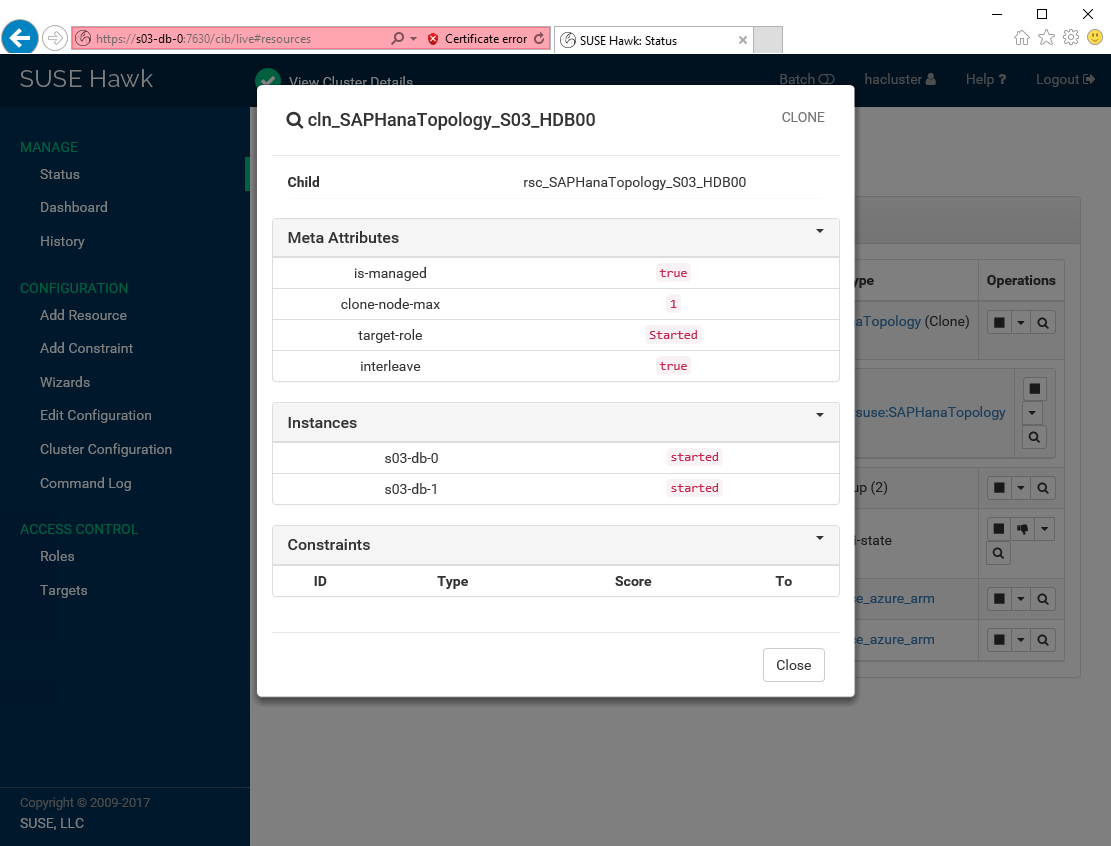
1. Once you sign in, review the **Nodes** tab on the **Status** page:



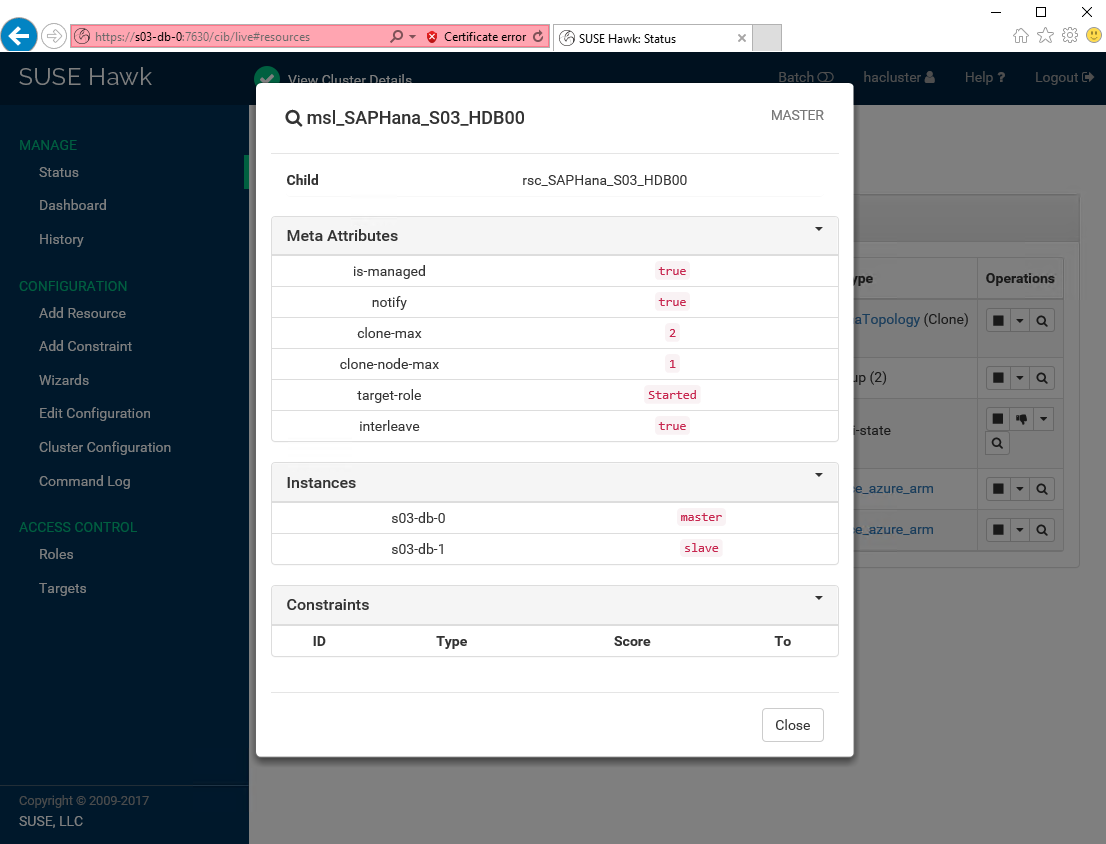
1. Next, switch to the **Resources** tab on the **Status** page:



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

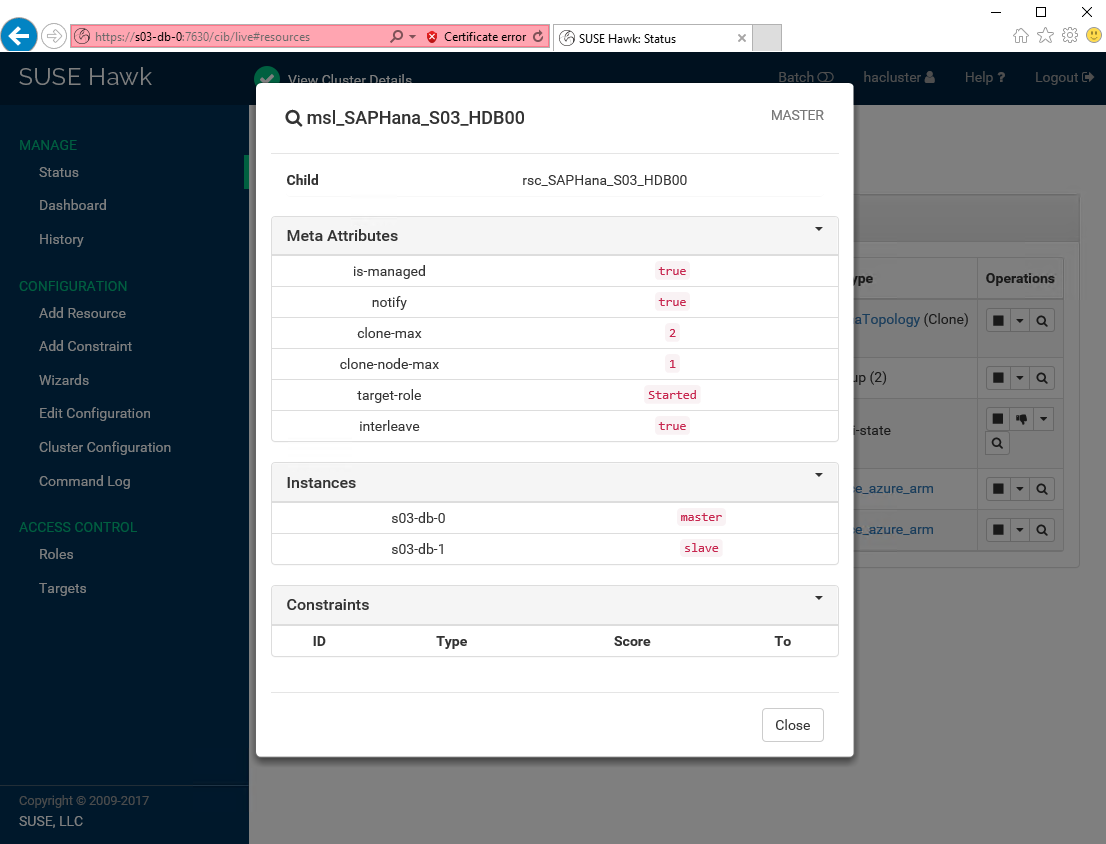


1. Examine the state of the **SAPHana** resource:



#### Task 5: Test a manual failover (from s03-db-0 to s03-db-1)

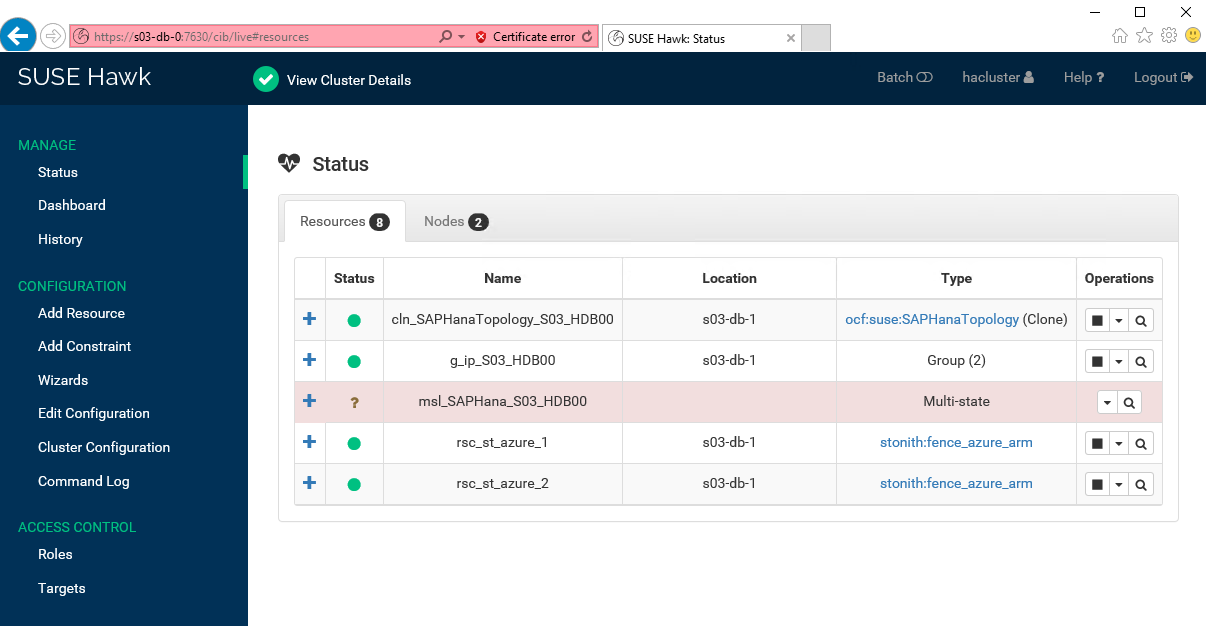
1. From the Remote Desktop session, to **s03-hana-0** Azure VM, in the Internet Explorer window displaying the **SUSE Hawk** page, from the **msl\_SAPHana\_S03\_HDB00** page, identify the system currently serving the master role.

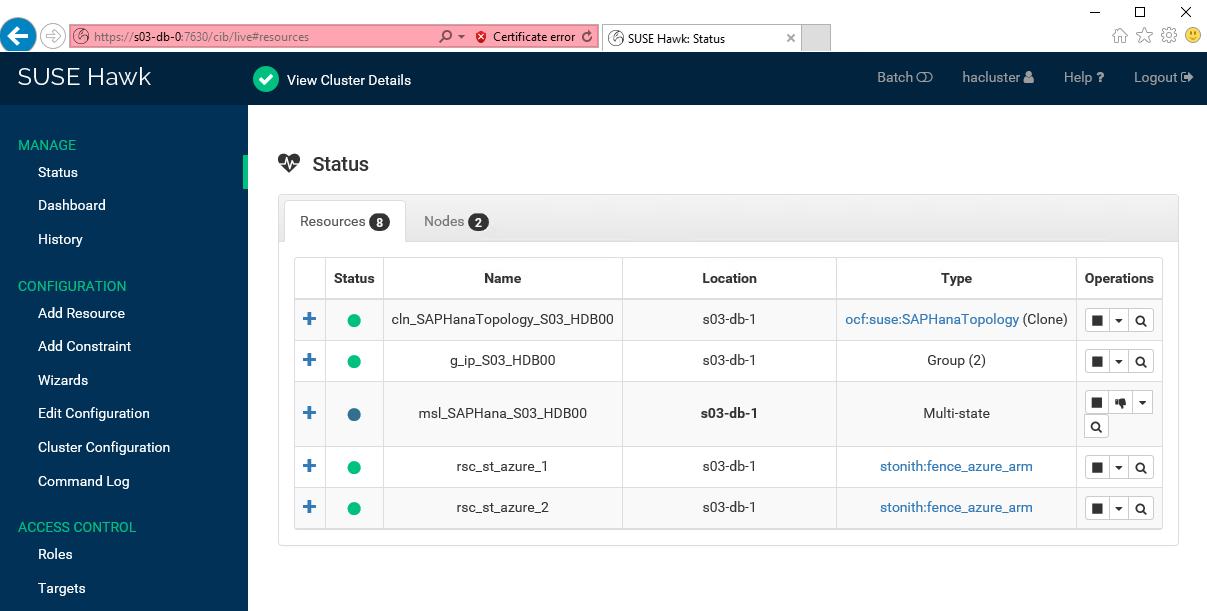


Switch to the SSH session on s03-db-0, and stop the pacemaker service by running **service pacemaker start** (This will trigger the failover of the **SAPHana** clustered resource.):

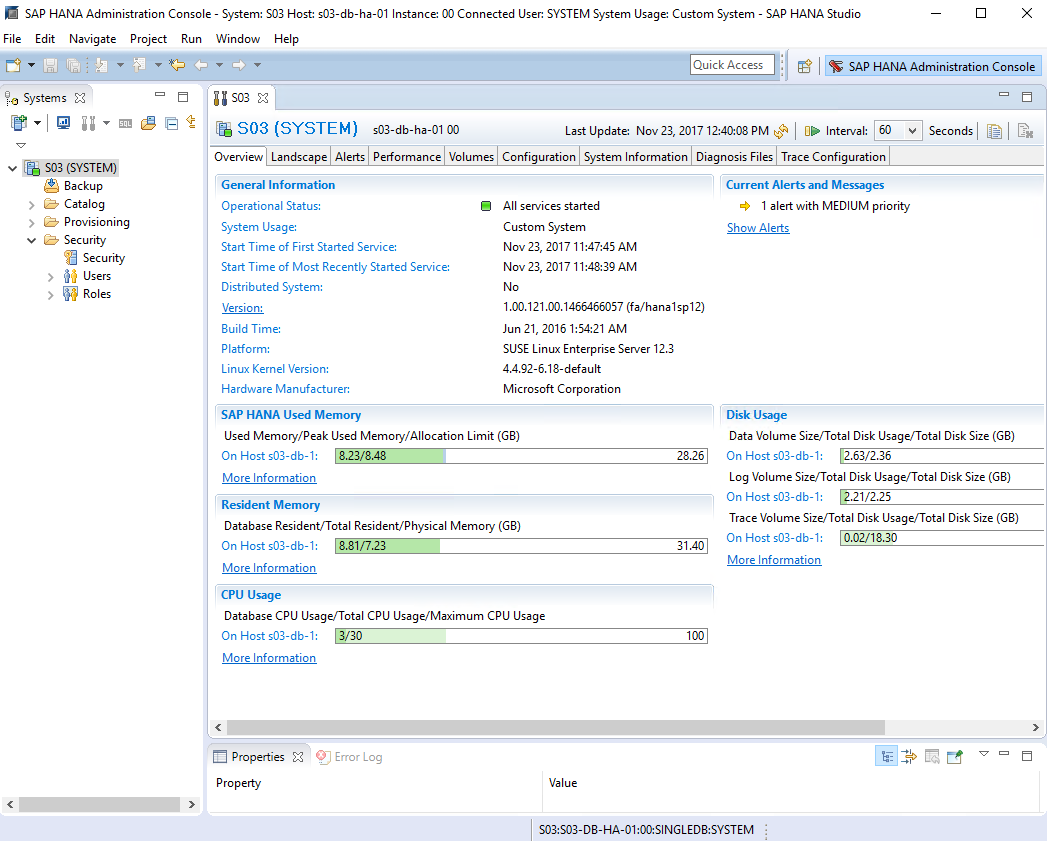
s03-db-0:~ # service pacemaker start

1. 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**:





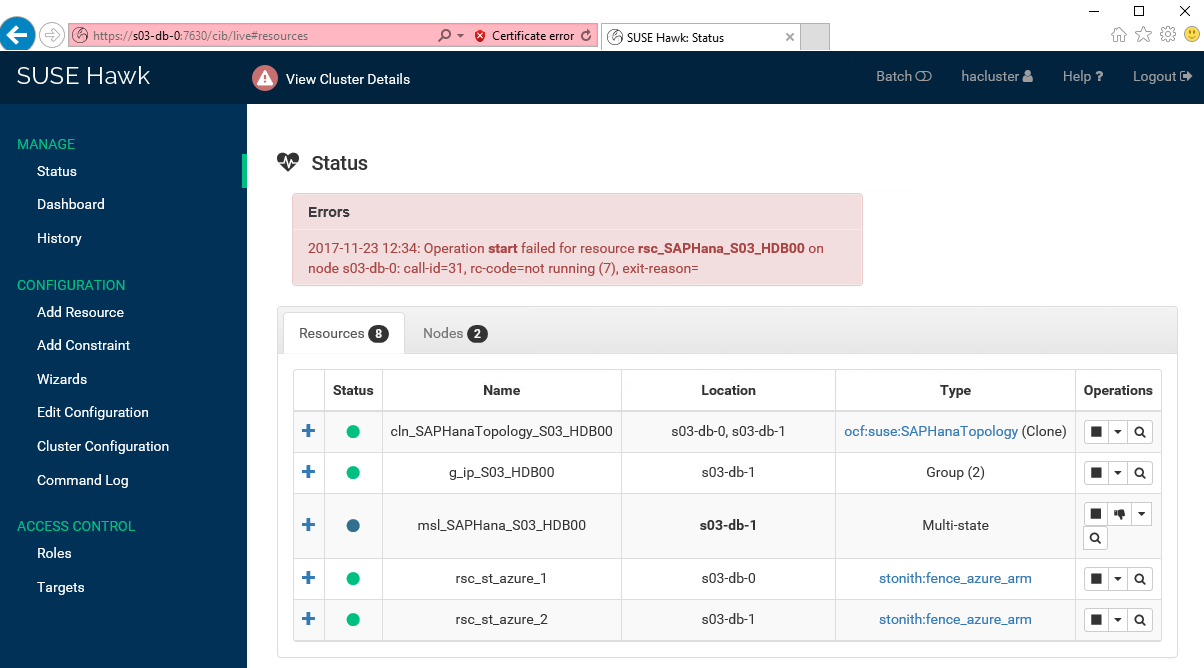
1. Switch to **SAP HANA Administration Console**,and refresh the Overview tab in the **Configuration and Monitoring** view. Note that SAP HANA is running at this point on the **s03-db-1** node, and it is operational:



1. 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 stop

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



1. 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=sync --name=SITE1** (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=sync --name=SITE1

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

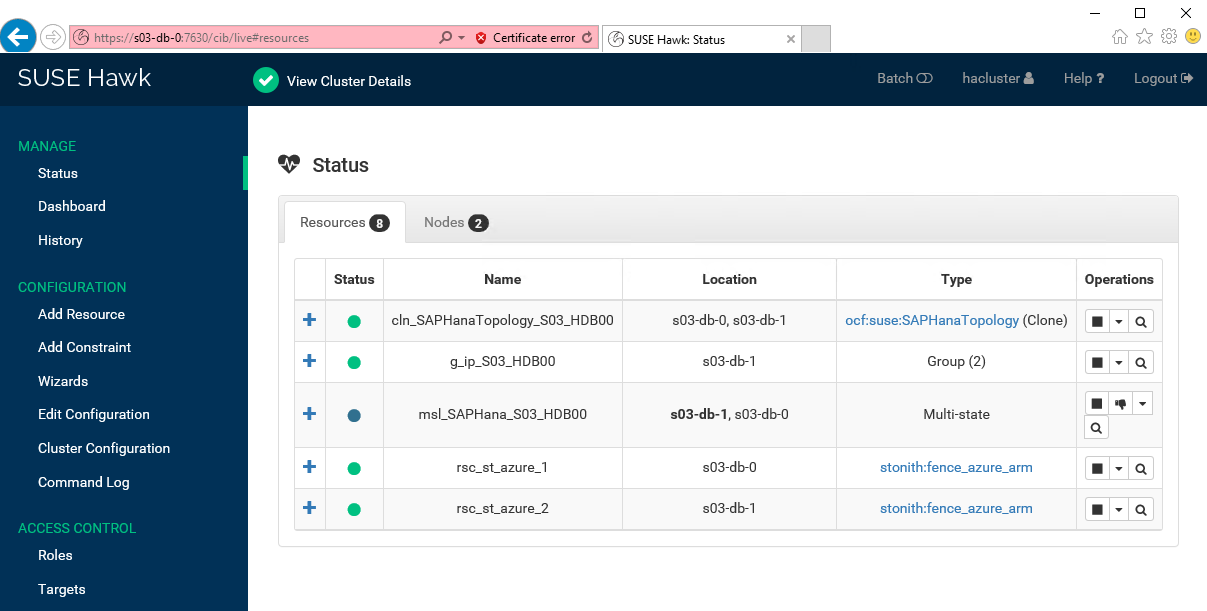
logout

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

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



#### Task 6: Test a migration (from s03-db-1 to s03-db-0)

1. From the SSH session on s03-db-1, migrate the **SAPHana** 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**

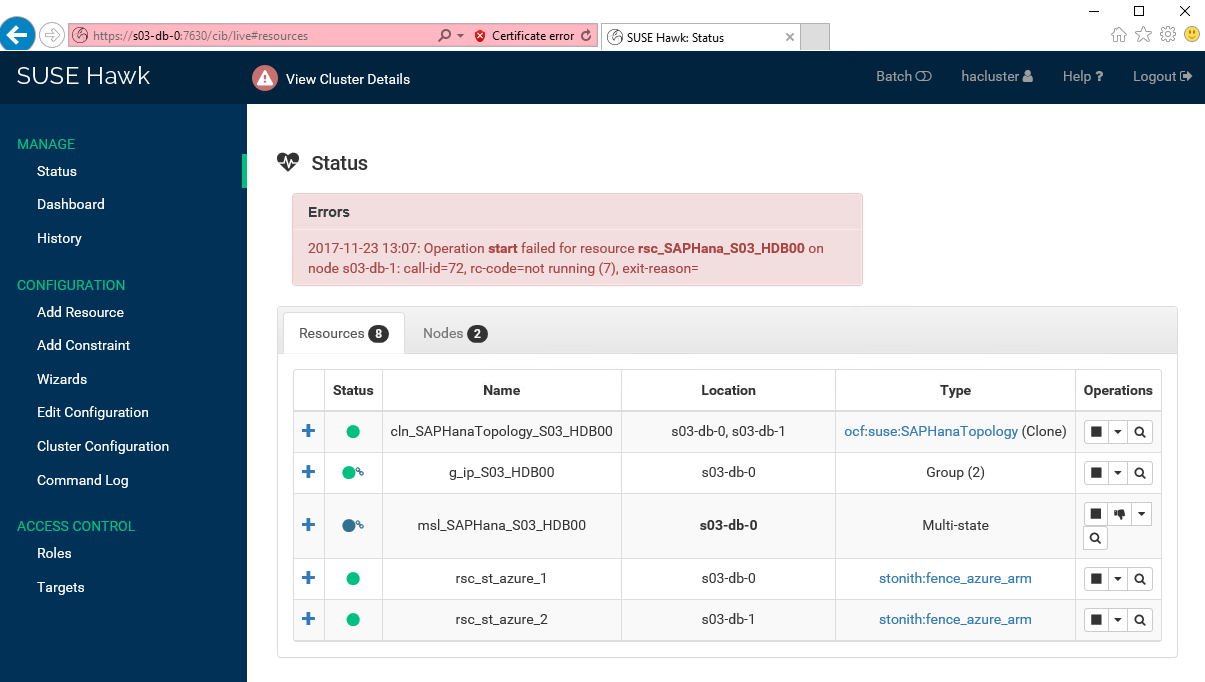
s03-db-1:~ # crm resource migrate msl\_SAPHana\_S03\_HDB00 s03-db-0

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

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



1. 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=sync --name=SITE2** (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=sync --name=SITE2

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 ...

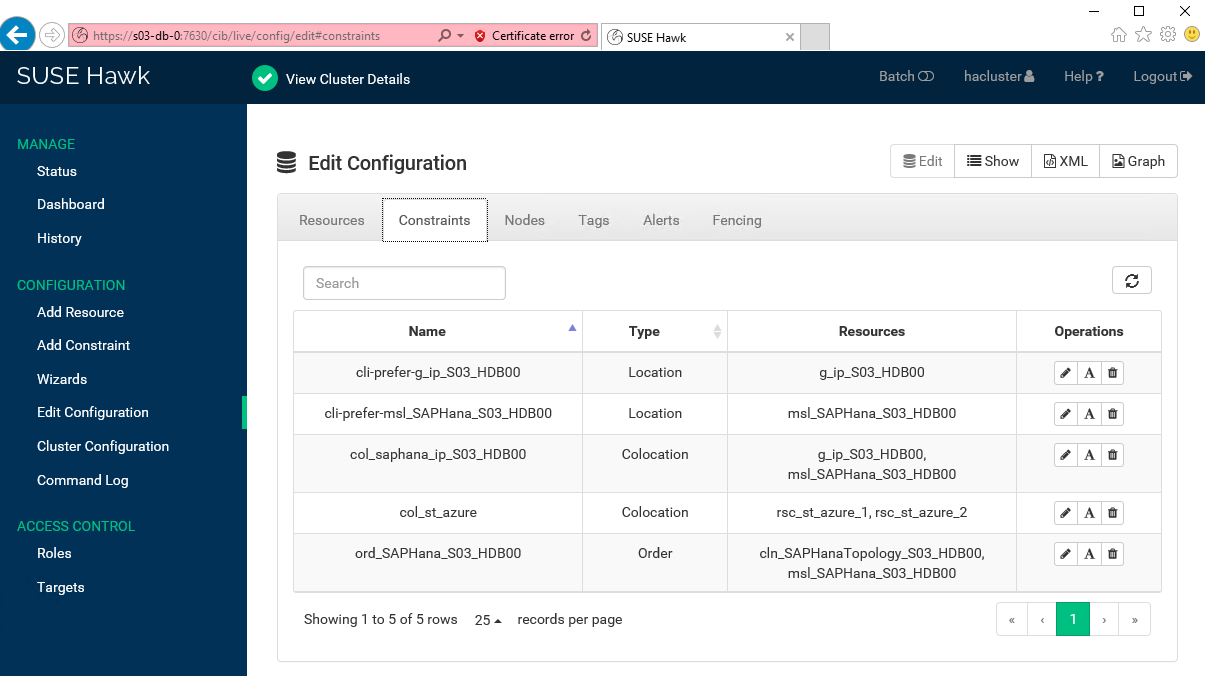
updating local ini files ...

done.

s03adm@s03-db-1:/usr/sap/S03/HDB00> exit

logout

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



1. From the **Constraints** page, delete the **cli-prefer-g\_ip\_S03\_HDB00** constraint:



1. From the **Constraints** page, delete the **cli-prefer-msl\_SAPHana\_S03\_HDB00** constraint:



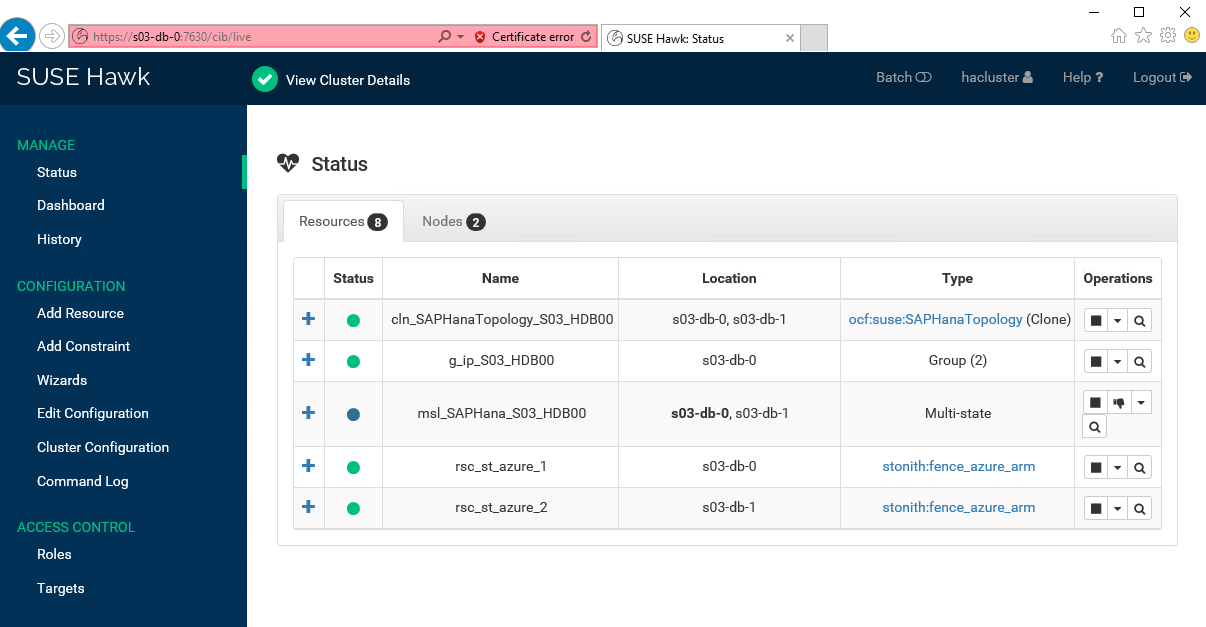
1. Switch to the SSH session on s03-db-1, and clean up the failed state by running **crm resource cleanup msl\_SAPHana\_S03\_HDB00 s03-db-1**:

s03-db-1:~ # crm resource cleanup msl\_SAPHana\_S03\_HDB00 s03-db-1

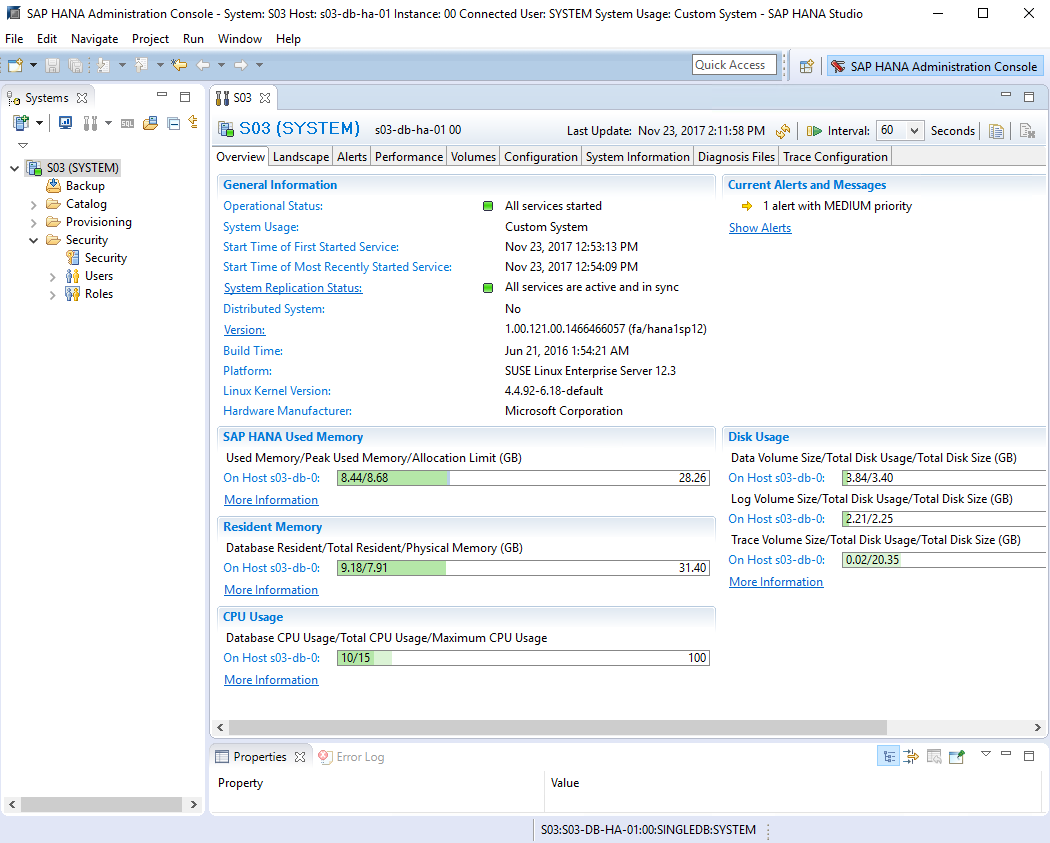
Cleaned up rsc\_SAPHana\_S03\_HDB00:0 on s03-db-1

Waiting for 1 replies from the CRMd. OK

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



1. 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:

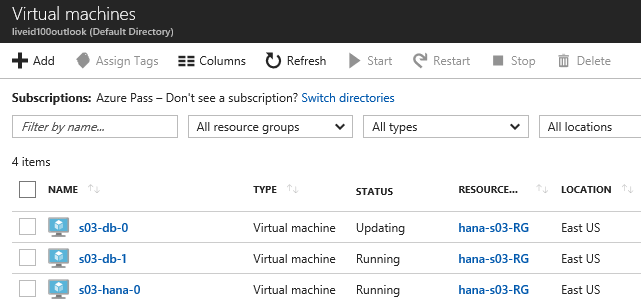


#### Task 7: Test fencing

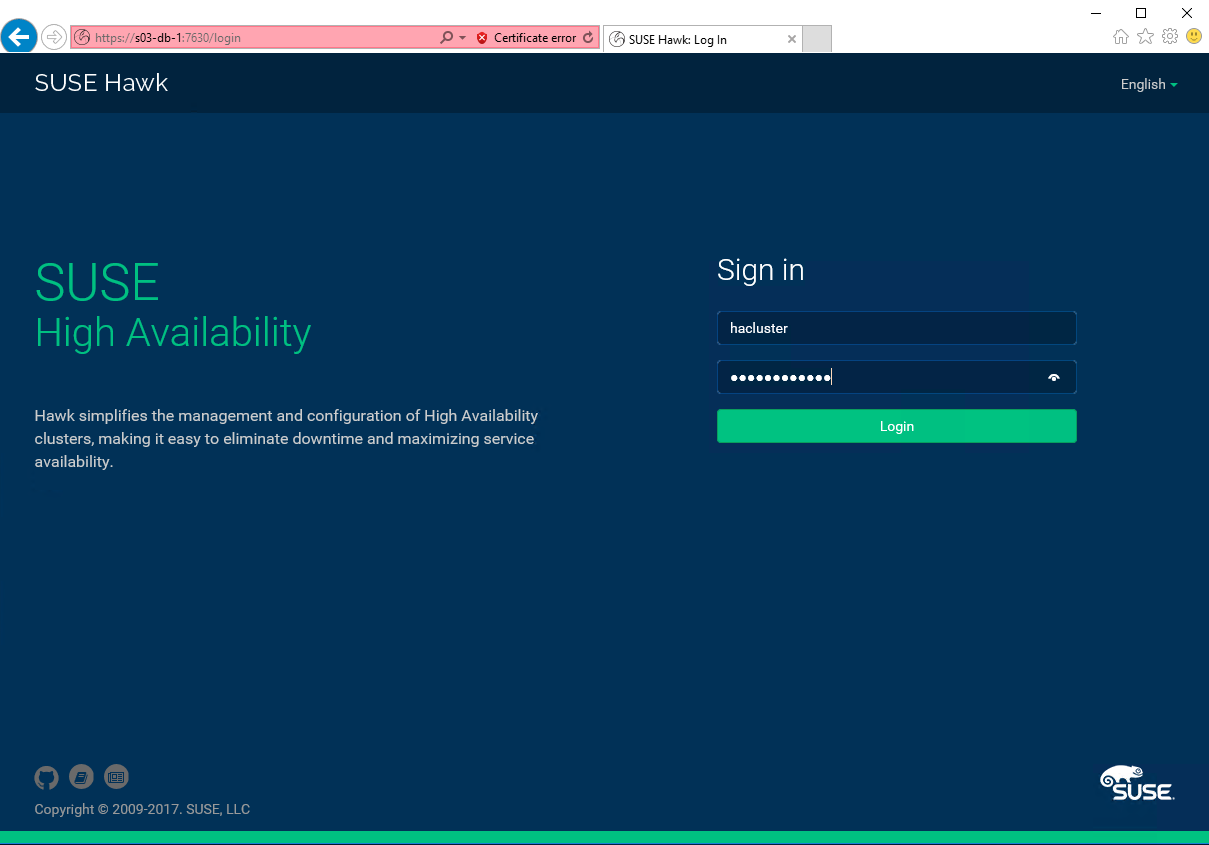
1. From the SSH session on s03-db-0, shut down the eth0 network interface:

s03-db-0:~ # ifdown eth0

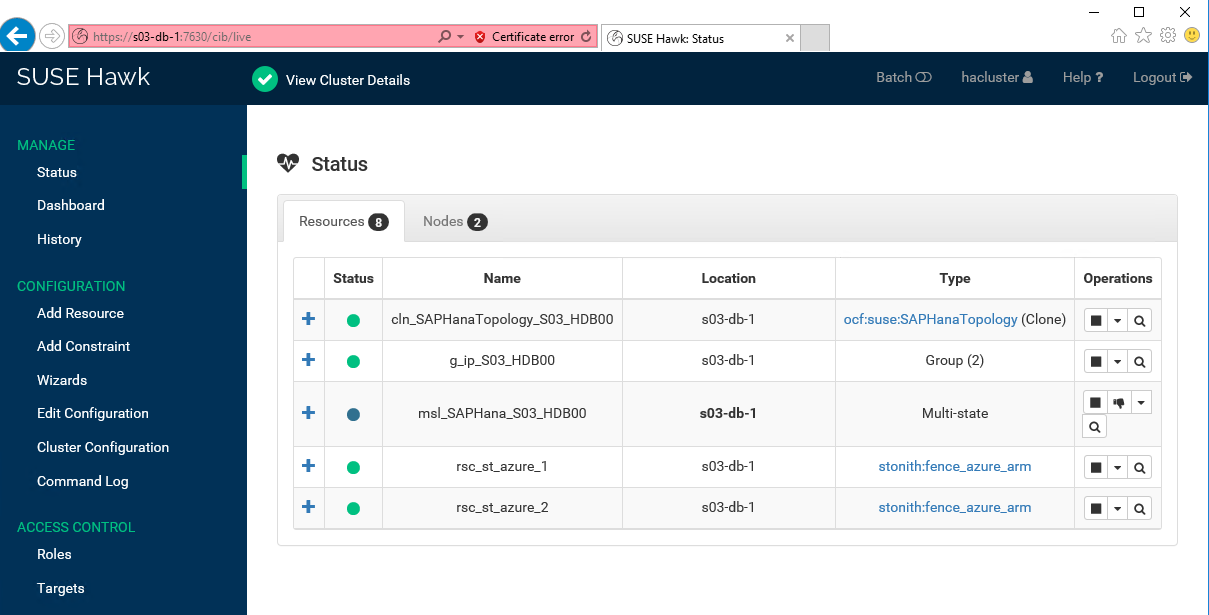
1. This will trigger restart of the Azure virtual machine, as you can verify it by checking its status from the Azure portal:



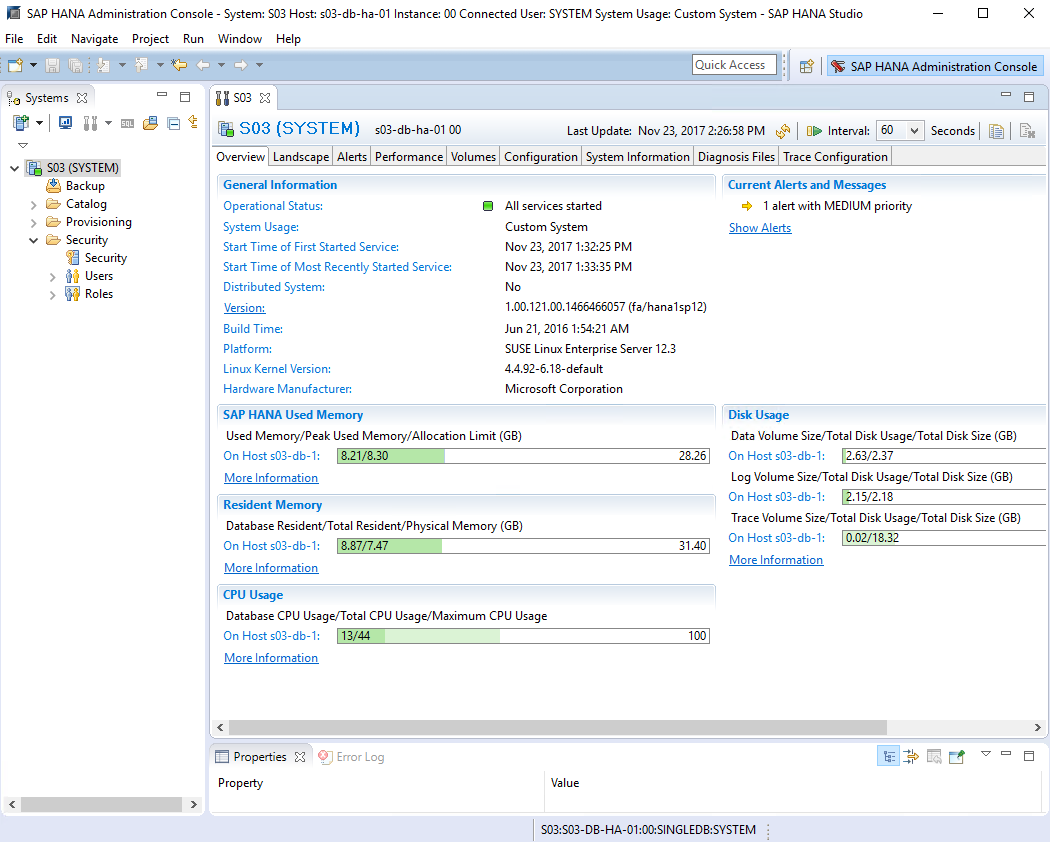
1. From the Remote Desktop session, to s03-hana-0 Azure VM, start **Internet Explorer**, and browse to **https://s03-db-1:7630**. On the **SUSE Hawk Sign in** page, sign in as **hacluster** with the password **demo@pass123**:



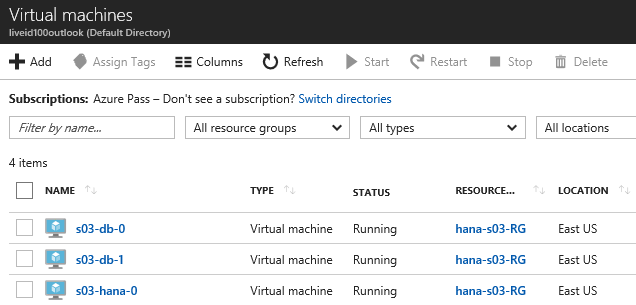
1. Wait until the status of the resource changes from the question mark to a blue circle, and verify its location changed to **s03-db-1**:



1. 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:



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



1. 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=sync --name=SITE1** (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=sync --name=SITE1

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

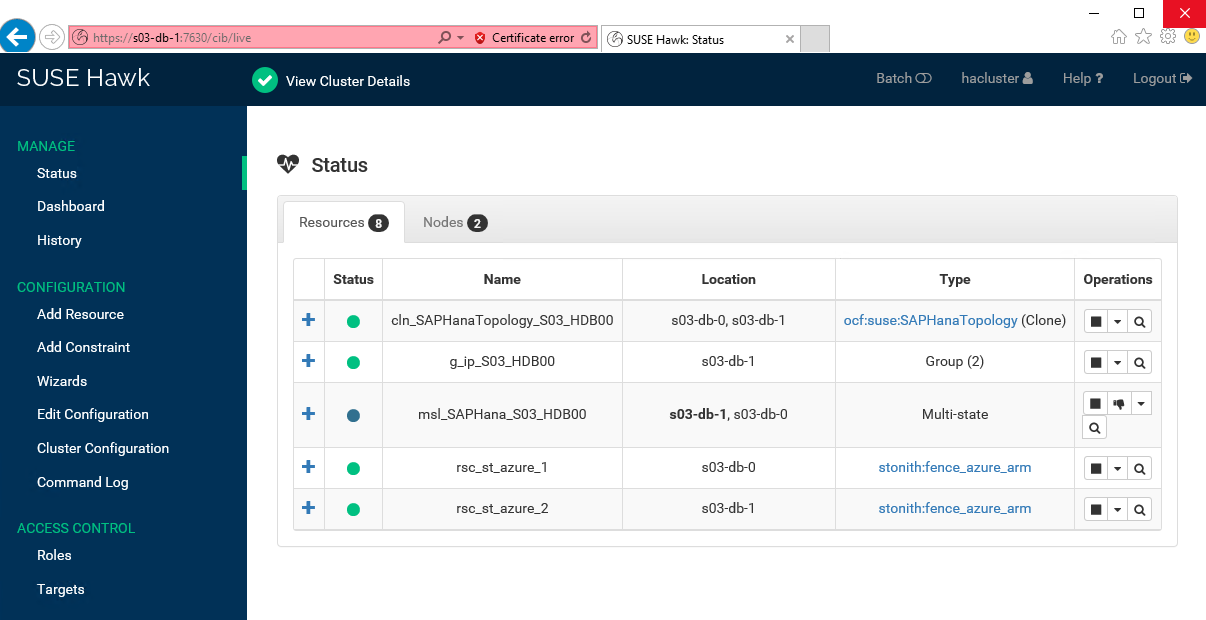
logout

s03-db-0:~ # crm resource cleanup msl\_SAPHana\_S03\_HDB00 s03-db-0

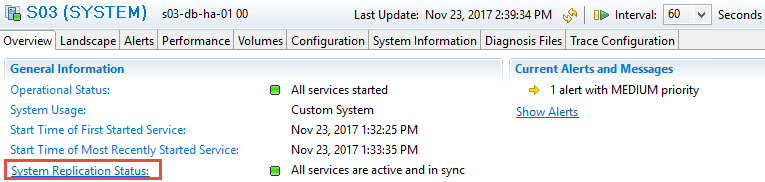
Cleaned up rsc\_SAPHana\_S03\_HDB00:0 on s03-db-0

Waiting for 1 replies from the CRMd. OK

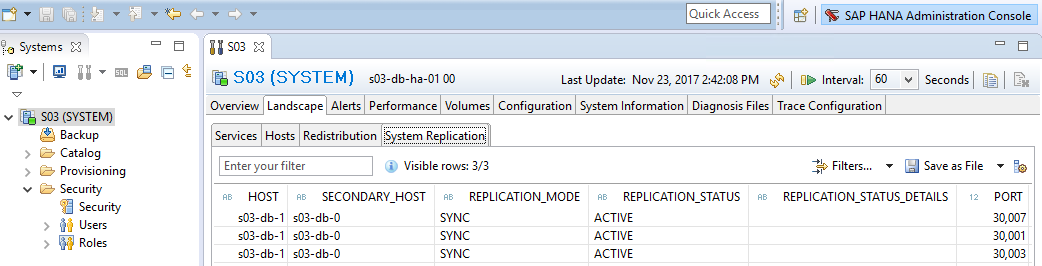
1. Switch to the **SUSE Hawk Status** page, and note that the **SAPHana** clustered resource is operational on both s03-db-0 and s03-db-1 with s03-db-1 as the primary:



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



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



## After the Hands-on Lab

Duration: 10 minutes

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