# SAP HANA on the Amazon Web Services Cloud: Quick Start Reference Deployment

July 2014 Last updated: December 2015 (<u>revisions</u>)

Supports SAP HANA SP 7-11

Karthik Krishnan Sabareesan Radhakrishnan



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## Abstract

This Quick Start Reference Deployment guide includes architectural considerations and configuration steps for deploying SAP HANA in the Amazon Web Services (AWS) cloud. We'll discuss best practices for deploying SAP HANA on AWS using services such as Amazon Elastic Compute Cloud (Amazon EC2) and Amazon Virtual Private Cloud (Amazon VPC). We also provide links to automated AWS CloudFormation templates that you can leverage for your deployment or <u>launch</u> <u>directly into your AWS account</u>.

## **Before You Get Started**

Implementing SAP HANA in the AWS cloud is an advanced topic. If you are new to AWS, see the <u>Getting Started section</u> of the AWS documentation. In addition, familiarity with the following technologies is recommended:

- Amazon EC2
- <u>Amazon VPC</u>
- AWS CloudFormation

This deployment method uses a Bring Your Own License (BYOL) model for SAP HANA. You must already own a license for SAP HANA and you must have access to the <u>SAP Software Download Center</u> to download the software.

### Note

In addition to your SAP HANA license, you are responsible for all costs related to your use of any AWS services used while running this Quick Start reference deployment. As of the date of publication, the cost for all the resources created by this Quick Start for a single SAP HANA node ranges from approximately \$1.84 to \$4.23 an hour, depending on which instance type you choose for the SAP HANA instance to fit your memory and compute requirements. Prices are subject to change and depend on the region and the billing option you choose. See the pricing pages for each AWS service you will be using or the <u>AWS Simple Monthly Calculator</u> for full details.

### Implementing SAP Business One, Version for SAP HANA

If you are implementing SAP Business One, version for SAP HANA, follow the instructions in the <u>SAP Business One</u>, <u>version for SAP HANA</u>, <u>Quick Start reference deployment guide</u>, which builds on the SAP HANA Quick Start.

## What We'll Cover

This guide serves as a reference for customers interested in deploying SAP HANA on AWS in a self-service fashion. The following section outlines the steps for two deployment options provided by this Quick Start:

- An end-to-end deployment that includes building the Amazon VPC, subnets, and an SAP HANA Server
- A deployment of SAP HANA into an existing Amazon VPC

This Quick Start supports the deployment of SAP HANA on two operating systems: You can choose either SUSE Linux Enterprise Server (SLES) or Red Hat Enterprise Linux (RHEL).



## End-to-end Deployment (Option 1)

#### Step 1: Prepare an AWS Account to Deploy the SAP HANA Solution

- Sign up for an AWS account
- Review default account limits for Amazon EC2 instances and Amazon EBS volumes

#### Step 2: Launch the Virtual Network and Configure AWS Services for SAP HANA Deployment

- Set up the Amazon Virtual Private Cloud (Amazon VPC)
- Deploy a Microsoft Windows Server for the SAP software download and SAP HANA Studio functions
- Deploy a NAT instance
- Configure security to help ensure secure access to and from resources located within the Amazon VPC

#### Step 3: Download SAP HANA Media

Manually download SAP HANA media from the <u>SAP Software Download Center</u> (SAP Support Portal access required) to an Amazon EBS Volume on the Microsoft Windows Server provisioned in the previous step.

#### Step 4: Launch and Configure the SAP HANA Servers.

The Microsoft Windows instance launched in Step 2 includes all the necessary AWS CloudFormation and PowerShell scripts to initiate the SAP HANA deployment on AWS. These scripts will perform the following tasks:

- Create an Amazon EBS snapshot of the SAP Media Volume
- Provision Amazon EC2 instance(s) for SAP HANA deployment
- Provision Amazon EBS storage using the new General Purpose (SSD) volumes for SAP HANA servers
- Operating system-level tasks in support of SAP HANA Installation
- Perform SAP HANA Installation and post configuration steps

### Deploy SAP HANA into an Existing Amazon VPC (Option 2)

#### Step 1: Download SAP HANA Media

- Manually download SAP HANA media from the <u>SAP Software Download Center</u> (SAP Support Portal access required) to an Amazon EBS Volume and extract the media
- Create a snapshot of the volume

#### Step 2: Deploy SAP HANA Nodes

- Use an AWS CloudFormation template to deploy SAP HANA nodes.
- Manually enter Amazon VPC parameters and other details.

## **Overview of SAP HANA on AWS**

This deployment primarily uses AWS CloudFormation and AWS Tools for Windows PowerShell to deploy SAP HANA on AWS. AWS CloudFormation provides an easy way to create and manage a collection of related AWS resources, provisioning and updating them in an orderly and predictable fashion. AWS Tools for Windows PowerShell enables automation of operations on AWS resources from the PowerShell command line.

The following components are deployed and configured as part of the reference deployment:



- An Amazon Virtual Private Cloud (Amazon VPC) configured with two subnets, one public and the other private.
- A NAT instance deployed into the public subnet and configured with an Elastic IP address (EIP) for outbound Internet connectivity and inbound SSH (Secure Shell) access.
- A Windows Server instance deployed in the public subnet for downloading SAP HANA media as well as hosting the SAP HANA Studio application.
- An AWS Identity and Access Management (IAM) instance role with fine-grained permissions for access to AWS services necessary for the deployment process.
- An SAP HANA system installed with the proper Amazon Elastic Block Store (Amazon EBS based on the new General Purpose (SSD)) volumes configured for SAP HANA performance needs.
- Security Groups for each instance or function to restrict access to only necessary protocols and ports.
- Single-node or multi-node SAP HANA virtual appliances automatically configured according to SAP best practices on a supported operating system.

## **Single-node Architecture**

This reference deployment includes options for either single-node or multi-node configurations of SAP HANA. The single-node deployment includes installation of the SAP HANA platform on a single instance. The reference deployment also follows security best practices by establishing an Amazon VPC designed to provide secure access to an SAP HANA server placed in a private subnet that is not directly accessible from the Internet. The SAP HANA Studio is installed on a separate Windows Server and SSH access to the SAP HANA server can be established by using SSH through the NAT instance or by using an SSH client on the Windows Server.



Figure 1: Single-node Architecture



## **Multi-node Architecture**

The multi-node deployment includes installation of the SAP HANA platform on a cluster of servers and supports configurations of up to 17<sup>\*</sup> nodes. Note that all the SAP HANA servers are deployed into the same subnet regardless of function, taking into consideration the security best practices previously mentioned.

As in the single-node installation, access to all of the SAP HANA servers is provided either by tunneling through the NAT instance or by using the Windows Server with an SSH client of your choice. The Security Group or firewall rules are extended to allow for internode communication over the appropriate ports and protocols. For more information, see <u>Appendix A: Security Group Specifics</u>.



Figure 2: Multi-node Architecture

<sup>\*</sup> HANA scale-out clusters that are larger than 5 nodes are currently in controlled availability. SAP will need to verify your BW sizing report result before you implement a HANA scale-out cluster that is larger than 5 nodes on AWS. Please contact SAP at HWC@sap.com and AWS at <u>sap-on-aws@amazon.com</u> before you implement HANA scale-out clusters of this size. Refer to <u>SAP OSS</u> Note 1964437 – SAP HANA on AWS: Supported AWS EC2 Products for details.



### **Storage Architecture**

The storage configuration for this deployment is based on Amazon Elastic Block Store (Amazon EBS) General Purpose (SSD) volumes. General Purpose (SSD) volumes take advantage of the increasing cost-effectiveness of SSD storage to offer customers 10x more IOPS, 1/10th the latency, and more bandwidth and consistent performance than offerings based on magnetic storage. With a simple pricing structure, you only pay for the storage provisioned with no need to provision IOPS or to factor in the cost of I/O operations.

These volumes predictably burst up to 3,000 IOPS and reliably deliver three sustained IOPS for every GB of configured storage. The volumes are designed to deliver the configured level of IOPS performance with 99% consistency. For more information about the new General Purpose volumes, please refer to <u>http://aws.amazon.com/blogs/aws/new-ssd-backed-elastic-block-storage/</u>.

We support the following volume configurations in this reference. We recommend using r3.8xlarge (SAP supported) for production use and the other instance types for development and testing.

Instance Type	RAM (GiB)	General Purpose (SSD) Storage HANA Data, Log, and Shared Volumes	General Purpose (SSD) Storage HANA Backup Volumes <sup>†</sup>	Total SAP HANA Volume Size (GiB)
c3.8xlarge	60	3 x 400 GiB	2 x 250 GiB x number of nodes	1,700
r3.2xlarge	61	3 x 400 GiB	2 x 250 GiB x number of nodes	1,700
r3.4xlarge	122	3 x 400 GiB	2 x 250 GiB x number of nodes	1,700
r3.8xlarge	244	3 x 400 GiB	2 x 250 GiB x number of nodes	1,700

## **AWS Instance Type for SAP HANA**

We support four instance types (c3.8xlarge, r3.2xlarge, r3.4xlarge, r3.8xlarge), which are customizable during deployment. For more information about different instance types and their use cases, see the <u>Amazon EC2 Instances</u> webpage. The r3.8xlarge instance type is officially supported by SAP for production use.

By default this reference deployment leverages the m3.xlarge instance type for the Windows Server where SAP HANA Studio is installed. However, you can customize this parameter during the deployment.

## **Memory Sizing for Deployment**

Before you begin deployment, please consult the SAP documentation referenced below to determine memory sizing for your needs. This evaluation will inform your choice of Amazon EC2 instances during deployment.

• To obtain sizing information for a system that has not yet been implemented, use the <u>SAP QuickSizer</u>. The SAP QuickSizer provides information on both the SAP HANA in-memory database and the SAP NetWeaver application server where applicable.

<sup>&</sup>lt;sup>†</sup> The HANA backup volume is provisioned only for the master node. In a scale-out scenario, all worker nodes will access backup volumes via NFS.



• To migrate an existing SAP NetWeaver BW system from any database platform to SAP HANA, SAP strongly recommends the new ABAP sizing report for SAP NetWeaver BW described in SAP note <u>1736976</u>.

Further sizing information is also available in the <u>SAP HANA Administration Guide</u> and in the following SAP HANA Notes:

SAP Note #	Description
<u>1736976</u>	Sizing Report for BW on SAP HANA
<u>1637145</u>	SAP BW on SAP HANA: Sizing SAP In-Memory Database
<u>1702409</u>	HANA DB: Optimal number of scale-out nodes for BW on SAP HANA
<u>1855041</u>	Sizing Recommendation for Master Node in BW-on-HANA
<u>1793345</u>	Sizing for SAP Business Suite on SAP HANA
<u>1872170</u>	Business Suite on SAP HANA memory sizing

#### Note

In addition to your SAP HANA license, you are responsible for all costs related to your use of any AWS services used while running this Quick Start Reference Deployment. The cost for launching the reference deployment for a single SAP HANA node ranges from approximately \$1.84 to \$4.23 per hour depending on which instance type you choose for the SAP HANA instance to fit your memory and compute requirements. Other factors that influence the cost are billing options (All Upfront, Partial Upfront, No Upfront, or On-Demand) and the region in which the AWS resources are launched.

AWS Instance for SAP HANA	vCPU	RAM (GiB)	Approximate Hourly Cost (RHEL)*	Approximate Hourly Cost (SLES)*
r3.2xlarge	8	61	\$1.88	\$1.84
r3.4xlarge	16	122	\$2.66	\$2.62
c3.8xlarge	32	60	\$2.98	\$2.94
r3.8xlarge	32	244	\$4.23	\$4.19

\*The approximate cost is based on the On-Demand billing option for the US East (N. Virginia) region as of June 5, 2015. See the pricing pages of the AWS services you will be using for full details.

## **End-to-end Deployment (Option 1)**

The following sections guide you through deployment of SAP HANA on AWS primarily through the use of AWS CloudFormation templates. This deployment includes building the Amazon VPC, subnets, and an SAP HANA Server. We also walk through any manual steps required for the deployment.

## Step 1: Prepare an AWS Account to Deploy the SAP HANA Solution

This section describes preparation steps that may be necessary for this reference deployment. Prerequisites for deployment include creating a key pair for deployment and requesting Amazon EC2 or Amazon EBS limit increases if applicable.



#### Note

These limit increases are not needed for non-production deployment scenarios.

- 1. If needed, create an AWS account at <a href="http://aws.amazon.com">http://aws.amazon.com</a> and follow the on-screen instructions. Part of the sign-up process involves receiving a phone call and entering a PIN using the phone keypad.
- 2. Choose the Amazon EC2 region where you want to deploy SAP HANA on AWS.

Amazon EC2 locations are composed of <u>regions and Availability Zones</u>. Regions are dispersed and located in separate geographic areas. As previously discussed, we are leveraging the R3 instance type for the SAP HANA portion of the deployment. R3 instances are currently available in all AWS regions except China (Beijing) and South America (São Paulo).

#### Тір

Consider choosing a region closest to your data center or corporate network to reduce network latency between systems running on AWS and systems and users on your corporate network.

3. Create a key pair in your preferred region.

Amazon EC2 uses public-key cryptography to encrypt and decrypt login information. To be able to log into your instances, you must create a key pair. With Windows instances, we use the key pair to obtain the administrator password via the Amazon EC2 console and then log in using Remote Desktop Protocol (RDP) as explained in the <u>step-by-step instructions</u> in the Amazon Elastic Compute Cloud User Guide. On Linux, we use the key pair to authenticate SSH login.

4. If necessary request a limit increase for the Amazon EC2 r3.8xlarge instance type. The current default limit for the r3.8xlarge instance type is 5. If you already have an existing deployments leveraging this instance type and plan on exceeding this default with this reference deployment you will need to request an Amazon EC2 Instance service limit increase.



Support Center			Account Number
Dashboard	Create Case		
Create Case	Name		Choose language
	cc	Required for IAM users; use commas or semicolons email addresses	to separate
	Regarding*	Account and Billing Support     Service Limit Increase     Technical Support	
	Limit Type*	EC2 Instances	
		Request 1 Region* US East (Northern Virginia)	)
		Operating Linux/OpenSolaris System*	
		Primary Instance     r3.8xlarge       Type*       Limit*     Instance Limit	
		New limit value* 10	
		Add another request	
	Use Case Description*	SAP HANA Deployment	

#### Figure 3: Sample Amazon EC2 Limit Increase Request

 Verify access to the SAP HANA Platform Edition media by logging in to the <u>SAP Software Download Center</u> and navigating to the Installation site following the steps in the <u>Download SAP HANA Media</u> section of this document. You will download media in a later step.

#### Тір

If your SAP Support Portal account doesn't allow access to the software and you believe that you should already be entitled to the software, contact SAP's Global Support Customer Interaction Center through the web form available at <a href="http://support.sap.com/contactus">http://support.sap.com/contactus</a>.

### Step 2: Launch the Virtual Network and Configure AWS Services for SAP HANA Deployment

In this step, you will launch an AWS CloudFormation template that configures the Virtual Network that provides the base AWS infrastructure for your deployment. The only mandatory input expected by the template is *KeyName*, which is the name of the key pair you created during step 1.

A successful launch of this template creates the necessary infrastructure needed to launch additional SAP HANA nodes. Specifically, an Amazon VPC is built taking security best practices into consideration, and a NAT instance is created



within the public subnet of your Amazon VPC to establish connectivity to all the SAP HANA nodes. An Amazon EC2 instance running Windows is also launched into the public subnet of your Amazon VPC where SAP HANA Studio is subsequently installed.

#### Launch the first template into your AWS account using AWS CloudFormation: Launch the Quick Start

As described previously, this template also creates an RDP Instance running Microsoft Windows Server and a NAT Instance to help provide secure internet access. An Amazon EBS volume is automatically mounted as D:\ in the RDP instance; you will download the SAP HANA media to this volume in a later step. AWS Tools and PowerShell scripts are also auto-downloaded to the RDP Instance to aid in the deployment process.

#### **Template Customization**

Template1 allows for customization of a number of parameters at template launch. You can modify those parameters or change the default values. The template parameters include the following default values:

Parameters	Default	Description
DMZCIDR	10.0.2.0/24	CIDR block for the public DMZ subnet located in the new
		Amazon VPC
KeyName	user-provided	Name of an existing Amazon EC2 key pair
NATInstanceType	t2.small	Amazon EC2 instance type for the NAT instances
PrivSubCIDR	10.0.1.0/24	CIDR block for the private subnet where SAP HANA will be
		deployed
RDPInstanceType	m3.xlarge	Amazon EC2 instance type for the Remote Desktop
		instance
RemoteAccessCIDR	0.0.0/0	IP CIDR from which you are likely to RDP into the instance
VPCCIDR	10.0.0/16	CIDR block for the Amazon VPC you are creating

Once the AWS CloudFormation status indicates "CREATE\_COMPLETE" and the RDP Instance has been launched successfully as shown below, you can continue on to the next step, which is to download the SAP HANA media.

Filter: Acti	ve - By M	ame: AWS-Inf	rastructure					Showing 1 stack
Stack N	ame		Create	d Time		Status		Description
AWS-Inf	astructure-S	AP-HANA	2014-0	5-24 14:09:14	UTC-0700	CREATE_C	COMPLETE	(0007) AWS Infrastructure Deployment for SAP HANA
Overview	Outputs	Resources	Events	Template	Parameters	Tags	Stack Policy	880
Key					Value			Description
RDPServerE	Р				RDP Ser	ver IP:54.		RDP Server located in DMZ Subnet
NATInstance	EIP				NAT Ser	/er IP:54.	- 112.122	NAT Instance located in DMZ Subnet
EBSVolume					vol-803f	5bcc		Volume allocated to RDP Instance for SAP HANA Media
VPCID					vpc-499	75c2c		VPC-ID of the newly created VPC
PublicSubne	t				subnet-c	subnet-d5072efd		Subnet-ID of the Public or DMZ Subnet
PrivateSubn	ət				subnet-c	16072efe		Subnet-ID of the Private or Subnet where HANA will be deployed

Figure 4: Template 1 Complete Example



### Step 3: Download SAP HANA Media

In this step, you will download SAP HANA media from the <u>SAP Software Download Center</u> (SAP Support Portal access required) to an Amazon EBS Volume on the Windows Server provisioned in the previous step.

#### **Connect to the RDP Instance**

Get the password to the RDP Instance by clicking the Connect button and using the key pair file used during launch. Connect to the RDP Instance with the password decrypted and IP via Remote Desktop.

Laun	ch Instance Connect Actio	ons v				
Filter	∵ All instances ➤ All instance	types 👻 🔍	Search Instances		×	
	Name 🌱 👻	Instance ID 🔺	Instance Type 🔹	Availability Zone 👻	Instance State 👻	Status Checks 👻
	NAT Instance (Public Subnet)	i-a4e06f87	m1.small	us-east-1b	running	2/2 checks
	RDP Instance (Public Subnet)	i-a9e16e8a	m3.xlarge	us-east-1b	running	2/2 checks



You can connect to your downloading and running	Windows instance using a remote desktop client of your cho the RDP shortcut file below:	ice, and by
	Download Remote Desktop File	
When prompted, connec	t to your instance using the following details:	
	Elastic IP	
	User name Administrator	
	Password	
If you need any assistan	ce connecting to your instance, please see our connection do	ocumentation.

Figure 6: Connecting to the RDP Instance

### **Download SAP HANA Media**

The RDP Instance includes a 16-GB Amazon EBS Volume mounted as D:\ as follows.



Figure 7: Windows Server Volume Layout



Download the SAP HANA Platform Edition media to D:\ from the SAP Software Download Center:

- Go to <u>http://support.sap.com/swdc</u> and log in.
- Select Installation and Upgrades in the left navigation pane, and then select A Z index.
- In the Installations and Upgrades window, select H, and then select SAP HANA Platform Edition from the list.
- Click SAP HANA Platform Edit. 1.0, and then click Installation.
- In the Downloads windows, find the revision you wish to download and download each file directly to the D:\ drive. Note that this reference deployment currently supports deployment of SAP HANA SP 7–11.
- The first file of the set is packaged to extract the contents of all the files pertaining to the revision you have downloaded. Double-click the first file to start the extraction process and make sure that the contents are extracted into drive D:\.

### Step 4: Launch and Configure the SAP HANA Servers

#### Important

With this reference deployment, you have an option to choose between SUSE Linux Enterprise Server (SLES) and Red Hat Enterprise Linux (RHEL) as the operating system for SAP HANA. If you decide to use RHEL, you must first subscribe to the Red Hat Enterprise Linux for SAP HANA AMI in the AWS Marketplace. Follow the instructions in <u>Appendix B</u> to complete the subscription before proceeding with the instructions in this section. If you decide to choose SLES as the operating system for SAP HANA, no subscriptions are required.

We are now ready for deployment. The RDP Instance that you launched in Step 3 includes AWS tools and PowerShell scripts necessary for SAP HANA deployment.

Open a PowerShell Terminal and navigate to C:\Users\Administrator\SAP and notice that the following PowerShell scripts have been auto-downloaded:

YS C:\Users\Administrator> cd sap YS C:\Users\Administrator\sap> dir								
Directory	: C:\Users\A	dministrato	r\sap					
Mode 	Lastw	riteTime	Length	Name				
d	4/10/2014	4:48 PM		Generic				
-a	4/10/2014	4:48 PM	1468	CustomParameters.ps1				
-a	4/10/2014	4:48 PM	5558	SAP_AWS_Helper.ps1				
-a	4/10/2014	4:48 PM	6179	SAP_HANA_Deploy.ps1				
PS C:\Users\∤	Administrator	\sap> _						

**Figure 8: PowerShell Scripts** 

The deployment is initiated by the SAP\_HANA\_Deploy.ps1 PowerShell script. Most input parameters are automatically inherited from the CustomParameters.ps1 file, which is generated during the deployment of Template 1.

The following inputs are required during deployment:



- Specify the number of SAP HANA nodes based on your memory requirements. See the sizing section earlier in this document for more information.
- Select the instance type for the SAP HANA nodes. The r3.8xlarge instances are supported by SAP for production use.
- Specify the operating system for the SAP HANA node. You can choose SUSE Linux Enterprise Server or Red Hat Enterprise Linux for SAP HANA.
- Enter the System ID for your SAP HANA DB.
- Enter a Master password. This password is read as a secure input and is used to set the passwords during installation for the SAP HANA System DB, <sid>adm, and sapadm user accounts. Ensure that the password has a minimum of 8 characters and includes uppercase, lowercase, and numeric values.

During the deployment process, the script automatically takes an Amazon EBS snapshot of the SAP HANA Media in the D:\ drive for subsequent installation of SAP HANA master or worker nodes. SAP HANA Studio is also installed for you directly on Windows Server for later use.

PS C:\Users\Administrator> cd SAP PS C:\Users\Administrator\SAP> .\SAP_HANA_Deploy.ps1	
This Powershell script will deploy SAP HANA into AWS. Cloudformation template files are located in the Generic directory. A snapshot of HANA media downloaded in D:\ will be taken and the HANA hosts will be installed with this media.	
Initialize-AWSDefaults -Region us-west-2 Initialize-AWSDefaults: Credentials for this shell were set using instance profile Initialize-AWSDefaults: Region 'us-west-2' was set for this shell using region parameter Default credentials and/or region have been stored to credentials profile 'default' and set active for this shell.	
Verified DATA_UNITS directory exists in D:\	
Bringing disk 1 offline before taking snapshot Snapshot Status Pending (Total estimated time 10-15 minutes). Snapshot Status Pending (Total estimated time 10-15 minutes). Bringing disk 1 online snap-a940b7f9 : SAP Media Snapshot Status Complete!	
Enter number of HANA Nodes (1-5) [1]: 3	
Type Instance Description SAP Support	
1 c3.8xlarge 32 vCPU/60 G18 Non-Production 2 r3.2xlarge 8 vCPU/61 G18 Non-Production 3 r3.4xlarge 16 vCPU/122 G18 Non-Production 3 r3.4xlarge 32 vCPU/244 G18 Production for SAP HANA Platform Edition	
Enter instance type [1-4]: 3 HANA Nodes: 3, HANA Instance Type: r3.4xlarge	
Type Instance	
1 RHEL 2 SUSE	
Enter instance type [1-2]: 1 HANA Node OS: RHEL	
Enter HANA SID (Default NDB): Choosing SID: NDB	
Enter HANA Master password: *******	
CloudFormation template file found in C:\Users\Administrator\SAP\Generic\Template2-Deploy-SAP-HANA.template	
Couldn't create new Placement Group AWS-HANA-PlacementGroup. Exists already ?	
DEBUG: Credentials obtained from instance profile	
Confirm Continue with this operation? [M] Yes [A] Yes to All [H] Halt Command [S] Suspend [?] Help (default is "Y"): Y DEBUG: Region obtained from region parameter with value 'us-west-2'	
Confirm Continue with this operation? [Y] Yes [A] Yes to All [H] Halt Command [S] Suspend [?] Help (default is "Y"): Y	
Confirm Are you sure you want to perform this action? Performing operation "New-CFNStack (CreateStack)" on Target "AWS-HANA-Deployment-201506041120". [Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): Y SAP HANA deployment in AWS initiated! Check AWS at console.aws.amazon.com for deployment progress!	
Downloading JAVA before installing HANA Studio Download complete. Extracting now Installing HANA Studio PS C:\Users\administrator\SAP>	

**Figure 9: Sample Deployment** 



### **Track Deployment Progress**

The deployment process uses AWS CloudFormation scripts to provision Amazon EC2 instances and to install SAP HANA from the snapshot taken of the volume where you downloaded and extracted the SAP HANA software. The SAP HANA installation scripts are automatically downloaded from an Amazon S3 bucket during the launch of master and worker nodes. The prerequisite operating system packages required by SAP HANA are also automatically downloaded and installed per SAP requirements on each master or worker node.

A typical single-node SAP HANA deployment takes about 25 minutes, and multimode deployment takes from 35 minutes to one hour. In a multi-node scenario, the master node is deployed first and then worker nodes are deployed concurrently.

You can track the deployment process is in the AWS CloudFormation console window. The following image shows a successful deployment as CREATE\_COMPLETE.

Cr	eate Stac	k Updat	e Stack Dele	te Stack	]				
Fil	ter: Activ	ve • By N	ame: HANA						Showin
	Stack Na	ime		Create	d Time		Status		Description
ø	AWS-HAM	NA-Deployme	ent-20140524091	7 2014-0	5-24 14:17:40	UTC-0700	CREATE_C	OMPLETE	(0008) Deploy SAP HANA on AWS
	AWS-Infra	astructure-SA	AP-HANA	2014-0	5-24 14:09:14	UTC-0700	CREATE_C	OMPLETE	(0007) AWS Infrastructure Deployment for SAP HANA
0	erview	Outputs	Resources	Events	Template	Parameters	s Tags	Stack Policy	
Key	,					Value			Description
HAI	AMaster	InstanceIP				10.0.1.2	35		HANA Master Node IP Address
HAI	HANAMasterSecurityGroup				sg-499d	0e2c		Security Group created for the SAP HANA Master node	

Figure 10: SAP HANA Deployment: Create Complete

During the deployment process, an Amazon DynamoDB table is created to track the status of deployment. You can also view the status of your deployment by looking at the content of the Amazon DynamoDB table from the AWS Management Console.

### **Additional Customizations**

Here are a few additional tips, based on feedback we've received from customers:

- This Quick Start supports a maximum capacity of 244 GiB per instance. If you need additional capacity, you can split the load across multiple instances.
- If you want to use encrypted EBS volumes, you can modify the <u>template</u> to do that. Add a BlockDeviceMappings section to the template. In the Ebs property, set Encrypted to true. For more information, see the <u>AWS documentation</u>.
- If you want to change the hostname of the SAP HANA instance, you must use the <u>option to deploy SAP HANA</u> <u>into an existing Amazon VPC</u>, discussed later in this document.



## **Accessing SAP HANA Nodes**

The default network security setup for this solution follows AWS security best practices. The provisioning logic creates the solution architecture described in the <u>Overview of SAP HANA on AWS</u> section, with the SAP HANA instances in a private subnet to restrict direct exposure to the Internet. As such, the SAP HANA instances can only be accessed through instances placed in the public subnet or DMZ layer.

Through this DMZ layer, two methods of access are available:

- **SAP HANA Studio Access**: Using a remote desktop client, connect to the Windows instance where SAP HANA Studio has been preloaded.
- **OS Level Access:** SSH to the NAT instance and then to the SAP HANA instance(s) using an SSH client of your choice.

#### Тір

To connect directly to the SAP HANA systems from a corporate network, you can provision an encrypted IPSec hardware VPN connection between your corporate data center and your Amazon VPC. For more details, see the <u>Amazon Virtual</u> <u>Private Cloud</u> page.

You can also set up AWS Direct Connect between your data center and AWS to gain direct access to your AWS resources. See the <u>Amazon Direct Connect</u> web pages for details.

### **Establish a Connection to the RDP Instance**

Before you access SAP HANA Studio, establish a Connection to the RDP Instance.

- 1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
- 2. From the console dashboard, click Running Instances.

Lau	nch Instance Connect	Actions ¥						
Filte	r: Running instances 👻	All instance types	C Search Ins	stances	×			
	Name	Tinstance ID 🔻	Instance Type 🔹	Availability Zone -	Instance State 👻	Status Checks 👻	Alarm Status	Public DNS ~
	NAT Instance (Public Subnet)	i-38c82d33	m1.small	us-west-2a	running	2/2 checks	None 🍃	ec2-54-187-156-243.us
	RDP Instance (Public Subnet)	i-72cb2e79	m3.xlarge	us-west-2a	running	2/2 checks	None 🍾	ec2-54-187-154-54.us

#### Figure 11: Amazon EC2 Running Instances with RDP Instance Selected

- 3. Get the Windows administrator password from the Amazon EC2 console:
  - a. Select your RDP instance and click Connect.
  - b. In the **Connect To Your Instance** dialog box, click **Get Password**.
  - c. Either paste the contents of your private key in the space provided or click **Browse** and navigate to your private key file, select the file, and click **Open** to copy the entire contents of the file into contents box.

The password will be decrypted and displayed.

- 4. In the **Connect To Your Instance** dialog box, click **Download Remote Desktop File** or connect via an RDP client of your choice.
- 5. Start SAP HANA Studio and add a system with the following parameters:



- IP address master node
- Instance Number: 00
- User: SYSTEM
- Password: *<enter password>* (This will be the same as the Master password you entered during Step 4)

#### Note

We recommend that you make a backup of your newly installed SAP HANA instance using SAP HANA Studio at this point. You can also use the Amazon EC2 console to make a complete system image (Amazon Machine Image) that can be used for recovery or for addition system builds. Keep in mind that this image is only a point-in-time snapshot.

### **Establish a Connection to SAP Nodes**

You can also connect to the NAT instance to establish a remote SSH connection to any of the SAP HANA master or worker nodes.

- 1. On the Amazon EC2 console, click **Running Instances**.
- 2. Select your NAT instance and note the public Elastic IP address displayed below your running instances.

ilte	n All instances Y All in	stance	types 😁	Q	Search Instances		×					K	<	1 to 50 of 10
	Name	9 -	Instance ID	Ŧ	Instance Type 👻	Availability Zone -	Instance State 👻	Sta	tus Checks 👻	Alarm Status	-	Public DNS	Ke	y Name 🗸 –
	HANA Worker 4		i-d08c70ad		cr1.8xlarge	us-east-1c	🥥 running	0	2/2 check	None	20		hai	na
	HANA Worker 2		i-29897a53		cr1.8xlarge	us-east-1c	🥥 running	0	2/2 check	None	20		har	na
	HANA Worker 3		i-00f1867d		cr1.8xlarge	us-east-1c	🥥 running	0	2/2 check	None	10		hai	na
	HANA Worker 1		i-38f18645		cr1.8xlarge	us-east-1c	orunning	0	2/2 check	None	10		har	na
	HANA Master		i-919f9df5		cr1.8xlarge	us-east-1c	🥥 running	0	2/2 check	None	-		hai	na
	NAT Instance		i-058c537d		m1.small	us-east-1c	🥚 running	0	2/2 check	None	10	ec2-54-208-208-247.co	hai	na

#### Figure 12: NAT – Elastic IP Address

3. Using an SSH client of your choice (for example, Putty or ITerm), SSH into the NAT instance and use the key pair specified during the deployment process.

#### Note

If your connection times out, you may need to adjust the security group rules for the NAT instance to allow access from your computer's IP address or proxy server. For more information, see <u>Security Group Rules</u> in the *Amazon Elastic Compute Cloud User Guide*.

#### ITerm Example:

- a. Add private key to authentication agent (ssh-add)
- b. SSH to the NAT instance with -A option to forward the key, specifying the username ec2-user.
- c. SSH to the SAP HANA server by IP address. Specify either root as the destination user for SUSE.



	:\$
_	:\$
-	\$ssh-add hanapoc.pem
	Identity added: hanapoc.pem (hanapoc.pem)
-	:\$
-	\$ssh -A 54.208.179.131 -1 ec2-user
	Last login: Fri May 23 23:15:36 2014 from 72-21-198-68.amazon.com
	)
	_I ( / Amazon Linux AMI
	11
	https://aws.amazon.com/amazon-linux-ami/2013.09-release-notes/
	Amazon Linux version 2014.03 is available.
	[ec2-user@ip-10-0-2-177 ~]\$
-	<del>[ec2-uscr@ip-10-0-2-1777]                                  </del>
	The authenticity of host '10.0.1.235 (10.0.1.235)' can't be established.
	ECDSA key fingerprint is dd:0e:4c:e9:9a:ec:d4:8c:c5:a9:c6:63:28:a1:67:20.
	Are you sure you want to continue connecting (yes/no)? yes
	Warning: Permanently added '10.0.1.235' (ECDSA) to the list of known hosts
	SUSE Linux Enterprise Server 11 SP3 x86_64 (64-bit)
	As "root" use the:
	- zypper command for package management
	- yast command for configuration management
	Management and Config: https://www.suse.com/suse-in-the-cloud-basics
	Documentation: http://www.suse.com/documentation/sles11/
	Have a lot of fun
	imdbmaster:~ #

Figure 13: SSH – ITERM Example

#### **Putty Example:**

- a. Download PuTTY (putty.exe), PuTTY Key Generator (puttygen.exe), and Pageant (pageant.exe).
- b. Load your private key into PuTTY Key Generator and save as a .ppk file that PuTTY can use.
- c. Execute Pageant.exe, and add your new .ppk key. The Pageant process must be running in order for agent forwarding to work.
- d. Configure PuTTY with the private key and select **Allow agent forwarding**.





#### Figure 14: SSH – Putty Example

- e. Save the configuration.
- f. Open up the connection to SSH to the NAT instance.
- g. Subsequently SSH to the SAP HANA server.

f
Authenticating with public key "imported-openssh-key" from agent
Last login: Sat Nov 2 00:08:26 2013 from 10.0.2.167
I I ) Amazon Linux AMT
Beta
See /usr/share/doc/amzn-ami/image-release-notes for latest release notes. :-)
g [ee3-weer8ig-10-0-0-100]; ssh root@imdbmaster
Last login: Sat Nov 2 00:08:30 2013 from 10.0.2.85
SUSE Linux Enterprise
_I ( / Server II SP2
\  x86_64 (64-bit)
For more information about using SUSE Linux Enterprise Server please see
http://www.suse.com/documentation/sles11/
Have a lot of fun
indomister:~ #

Figure 15: SSH – Putty Example Continued



## Deploy SAP HANA into an Existing Amazon VPC (Option 2)

This section guides you through deployment of SAP HANA into an existing Amazon VPC using AWS CloudFormation templates.

### Step 1: Download SAP HANA Media

In this step, you will download SAP HANA media from the <u>SAP Software Download Center</u> (SAP Support Portal access required) to an Amazon EBS Volume and create a snapshot of the volume.

### Create a New Amazon EBS Volume to Store SAP HANA Media

To attach a new volume to store SAP HANA media, follow the instructions on these pages of the Amazon EC2 User Guide for Microsoft Windows:

- Creating a New Amazon EBS Volume
- Attaching an Amazon EBS Volume to an Instance
- Making an Amazon EBS Volume Available for Use

### **Download and Extract SAP HANA Media**

Download the SAP HANA Platform Edition media from the SAP Software Download Center to the drive to which the EBS volume has been mapped:

- Go to <u>http://support.sap.com/swdc</u> and log in.
- Select Installation and Upgrades in the left navigation pane, and then select A Z index.
- In the Installations and Upgrades window, select H, and then select SAP HANA Platform Edition from the list.
- Click SAP HANA Platform Edit. 1.0, and then click Installation.
- In the Downloads windows, find the revision you wish to download and download each file directly to the drive to which the EBS volume has been mapped. Note that this reference deployment currently supports deployment of SAP HANA Platform Edition 1.0 SP 7–11.
- The first file of the set is packaged to extract the contents of all the files pertaining to the revision you have downloaded. Double-click the first file to start the extraction process and make sure that the contents are extracted into the drive to which the EBS volume has been mapped.

### Prepare a Media Volume Snapshot

To create a snapshot of the volume containing extracted media, follow these steps. The snapshot will be used to create a media volume, which will be mounted on the Linux SAP HANA instance under the **/media** folder to install the SAP HANA software.



- Detach the volume from the instance to ensure that there is no I/O activity during the snapshot. Follow the steps in the Amazon EC2 User Guide to detach a volume from an instance. Alternatively, you can take the disk offline from Windows before you take the snapshot.
- 2. In the Amazon EC2 console, navigate to **Elastic Block Store** > **Volumes** and select the volume containing SAP HANA media.
- 3. From the **Actions** drop down menu select **Create Snapshot**. Provide a Name and Description for the snapshot and click **Create**. Snapshot creation may take from 15 to 30 minutes.

Create Sna	pshot	t	×
Volume	()	vol-b17f48b9 (HANA Software Download Volume)	
Name		HANA Media Snapshop	]
Description	()	Media Containing extracted HANA bits	]
Encrypted	()	No	
		Cancel	ate

Figure 16: Creating an Amazon EBS Snapshot

After the snapshot is created, navigate to Elastic Block Store > Snapshots and make a note of the Snapshot ID, which will be required input when you launch the AWS CloudFormation template.

Create Snapshot	Actions v				÷	۰	?
Filter: Owned By Me	SAP HANA		×	K <	1 to 1 of 1	>	>
Name 💡 -	Snapshot ID 🔹	Capacity 👻	Description				
	snap-b69b8d5b	15 GiB	SAP HANA SP8				

#### Figure 17: Amazon EBS Snapshot ID

You will also need the Amazon VPC ID and Subnet ID to launch the AWS CloudFormation template. To locate the VPC ID, open the Amazon VPC console at https://console.aws.amazon.com/vpc/and click **Your VPCs**. Make a note of the VPC ID where you want to deploy your SAP HANA instance(s).



Create VPC Delete VPC			단 🕈 🛛
SAP HANA	X		$ \langle \langle 1 \text{ to 1 of 1 VPC} \rangle \rangle $
Name	+ VPC ID	- State	VPC CIDR
SAP HANA VPC	vpc-e8ea058d	available	10.0.0/16

#### Figure 18: Amazon VPC ID

Next, click **Subnets** and make a note of the Subnet ID where you want to create your Amazon EC2 resources.

Create Subnet Delete Sub	Modify Auto-Ass	sign Public IP	근 🕈 🛙
Q SAP HANA Private	×		$ \langle \langle$ 1 to 1 of 1 Subnet $\rangle$ $>$
Name	- Subnet ID	<ul> <li>✓ State</li> </ul>	VPC
SAP HANA Private Subnet	subnet-ac6d73d8	available	vpc-e8ea058d (10.0.0.0/16)

Figure 19: Subnet ID

## **Step 2: Deploy SAP HANA Nodes**

#### Important

With this reference deployment, you have an option to choose between SUSE Linux Enterprise Server (SLES) and Red Hat Enterprise Linux (RHEL) as the operating system for SAP HANA. If you decide to use RHEL, you must first subscribe to the Red Hat Enterprise Linux for for SAP HANA AMI in the AWS Marketplace. Follow the instructions in <u>Appendix B</u> to complete the subscription before proceeding with this steps in this section. If you decide to choose SLES as the operating system for SAP HANA, no subscriptions are required.

### **Deploy SAP HANA Nodes with AWS CloudFormation**

This automated AWS CloudFormation template deploys SAP HANA nodes into an Amazon VPC. Please make sure that you have created your media snapshot as explained in the previous section before launching the stack.

#### To launch the AWS CloudFormation template in the US-West (Oregon) region, launch the Quick Start.

This stack takes approximately one hour to create.

#### Note

You are responsible for the cost of AWS services used while running this Quick Start Reference Deployment. The cost for running the template with default settings is between \$1.78 and \$4.35 an hour, depending on the instance size you select. See the pricing pages of the AWS services you will be using for full details.



You can also download the template directly from <u>https://s3.amazonaws.com/quickstart-</u>reference/sap/hana/latest/templates/Template2-Deploy-SAP-HANA.template.

### Enter Parameters for the Amazon VPC and SAP HANA Snapshot

You will need to input the following parameters manually for deployment.

Parameter	Default	Description
DMZCIDR	10.0.2.0/24	CIDR block for the public DMZ subnet located in the new Amazon VPC
DomainName	local	Domain name to be used for fully qualified domain names
HANAMasterHostname	imdbmaster	Hostname to be used for SAP HANA Master Nodes (DNS Shortname)
HANAMasterPass	user-provided	SAP HANA master password. Must be at least 8 characters containing upper case, lower case, and numeric values.
HANASubnet	subnet-xxxxxxxx	Subnet-ID of the existing subnet in your Amazon VPC where you want to deploy SAP HANA
HostCount	1	Number of SAP HANA hosts in the cluster
KeyName	user-provided	Name of an existing Amazon EC2 key pair. All instances will launch with this key pair.
MyInstanceType	r3.8xlarge	Instance type of SAP HANA host (r3.8xlarge/r3.4xlarge/r3.2xlarge/c3.8xlarge)
MyOS	user-provided	Operating system of the SAP HANA host (SUSE or RHEL)
MyRegionAMI	ami-xxxxxxx	Region-specific AMI containing the operating system image for master/worker nodes (currently, SUSE 11.3 or RHEL 6.6 for SAP HANA). See <u>Appendix C</u> to find the right AMI for SLES and RHEL.
PlacementGroupName	user-provided	Name of existing Placement Group where SAP HANA should be deployed
PrivSubCIDR	10.0.1.0/24	(Optional) CIDR block for private subnet where SAP HANA should be deployed
SAPInstanceNum	00	SAP HANA instance number. This instance number will also impact the open ports for the SAP HANA security group. The instance number value must be two digits; the first number must be between 0 and 9, the second digit must be between 0 and 7.
SID	NDB	SAP HANA SID
SpanShotID	snap-xxxxxxx	SnapShot-ID for your SAP HANA installation media volume (requires DATA_UNITS Directory)
VPCID	vpc-xxxxxxx	VPC-ID of the existing Amazon VPC where you want to deploy SAP HANA

You can create optional placement groups to participate in a low-latency, 10 Gbps network. For information about creating placement groups, see <u>Placement Groups</u> in the AWS documentation. The deployment typically takes between 30 and 45 minutes.

## Troubleshooting

If you run into a problem running this Quick Start reference deployment, first make sure that the version of the SAP HANA Platform Edition you've downloaded is supported by this Quick Start, and that you don't have multiple versions of SAP HANA staged on your system. This Quick Start currently supports SAP HANA SP 7–11.

Most deployment issues stem from problems downloading and extracting the SAP HANA media, or from problems creating the snapshot. If you run into problems during deployment, check the **/media** folder on the Linux SAP HANA instance. If the **/media** folder doesn't exist or doesn't contain any files, the problem might be caused by one of the following:



• Internet traffic isn't flowing through the Internet gateway and NAT instance, or the SAP HANA instance was launched in the public subnet but no public IP was assigned. If there's an issue with Internet access, the installation of the ntfs-3g package might fail. This package is required to access the NTFS volume on the Linux SAP HANA instance.

To resolve: Choose a subnet that has Internet access over the Internet gateway and NAT instance, and then relaunch the Quick Start.

- Media files weren't extracted at all, or were extracted improperly.
   To resolve: Repeat the process for downloading and extracting the SAP HANA media (see <u>step 3</u> for end-to-end deployment, or <u>step 1</u> when deploying into an existing Amazon VPC). After the extraction is complete, check the contents of the */media* folder to make sure it contains files.
- The media volume snapshot is not usable.
   To resolve: Follow the <u>instructions</u> to take a new snapshot, making sure that the drive is detached first, and then relaunch the Quick Start.

The following diagram illustrates where issues might arise, and steps you can take to fix them.





Figure 20: Troubleshooting the SAP HANA Deployment



If you encounter a CREATE\_FAILED error, we recommend that you relaunch the template with **Rollback on failure** set to **No**. (This setting is under **Advanced** in the AWS CloudFormation console, **Options** page.) With this setting, the stack's state will be retained and the instance will be left running, so you can troubleshoot the issue.

**Important** When you set **Rollback on failure** to **No**, you'll continue to incur AWS charges for this stack. Please make sure to delete the stack when you've finished troubleshooting.

CREATE_FAILED error message	Possible cause	What to do
API: ec2: RunInstances Not authorized for images: <i>ami-ID</i>	The template is referencing an AMI that has expired	We refresh AMIs on a regular basis, but our schedule isn't always synchronized with AWS AMI updates. If you get this error message, notify us, and we'll update the template with the new AMI ID. If you'd like to fix the template yourself, you can <u>download it</u> and update the Mappings section with the latest AMI ID for your region.
We currently do not have sufficient m1.small capacity in the AZ you requested	NAT or RDP instance requires larger instance type	Switch to an instance type that supports higher capacity, or complete the <u>request form</u> in the AWS Support Center to increase the Amazon EC2 limit for the instance type or region. Limit increases are tied to the region they were requested for.
Instance <i>ID</i> did not stabilize	You have exceeded your IOPS for the region	Request a limit increase by completing the <u>request form</u> in the AWS Support Center.
WaitCondition timed out. Received 0 conditions when expecting 1	Internet access or SAP HANA installation issues	Check the <b>/media</b> folder. If the folder doesn't exist or doesn't contain any files, follow the troubleshooting process illustrated in Figure 20. You might also get this timeout error if you have an existing DynamoDB table from a previous Quick Start deployment. In this case, the table might contain duplicate entries with the same hostname but different IP addresses, and the deployment script might fail to read it properly. Delete the table and retry the deployment.
WaitCondition received failed message: 'The HANA installation did not succeed. Please check installation media.' for uniqueld: HANAMaster"	SAP HANA installation issues	Check the <b>/media</b> folder. If the folder doesn't exist or doesn't contain any files, follow the troubleshooting process illustrated in Figure 20.
System Administrator password must contain at least 8 characters	The SAP HANA master password contains \$ or	Change the SAP HANA master password ( <b>HANAMasterPass</b> parameter in the <u>second template</u> ), and then relaunch the Quick Start.

The following table provides a list of specific CREATE\_FAILED error messages you might encounter.



CREATE_FAILED error message	Possible cause	What to do
	other special characters	The password must be at least 8 characters, consisting of uppercase and lowercase letters and numbers. Avoid using special characters such as @ or \$.

For additional information, see <u>Troubleshooting AWS CloudFormation</u> on the AWS website. If the problem you encounter isn't covered on that page or in the table, please visit the <u>AWS Support Center</u>. If you're filing a support ticket, please attach the install.log file from the SAP HANA master instance (this is the log file that is located in the /root/install folder) to the ticket.

## Security

The AWS cloud provides a scalable, highly reliable platform that helps enable customers to deploy applications and data quickly and securely.

When you build systems on the AWS infrastructure, security responsibilities are shared between you and AWS. This shared model can reduce your operational burden as AWS operates, manages, and controls the components from the host operating system and virtualization layer down to the physical security of the facilities in which the services operate. In turn, you assume responsibility and management of the guest operating system (including updates and security patches), other associated application software such as SAP HANA, as well as the configuration of the AWS-provided security group firewall. For more information about security on AWS, visit the <u>AWS Security Center</u>.

## **Network Security**

The default network security setup of this solution follows security best practices of AWS. The provisioned SAP HANA instances can only be accessed in three ways:

- By connecting to either the SAP HANA Studio Windows instance using Remote Desktop Client or the NAT Linux instance using SSH.
- From the CIDR block specified as RemoteAccessCIDR during the provisioning process.
- Alternatively, access can be restricted to a known CIDR block if there exists a provisioned VPN tunnel between your own data center and AWS.

## Identity and Access Management (IAM)

This solution leverages an IAM role with least privileged access. It is not necessary or recommended to store SSH keys or secret keys or access keys on the provisioned instances.

## **OS Security**

The root user on Linux or the administrator on the Windows RDP instance can only be accessed using the SSH key specified during the deployment process. Amazon Web Services does not store these SSH keys, so if you lose your SSH key you can lose access to these instances.

Operating system patches are your responsibility and should be performed on a periodic basis.

## **Security Groups**

A security group acts as a firewall that controls the traffic for one or more instances. When you launch an instance, you associate one or more security groups with the instance. You add rules to each security group that allow traffic to or



from its associated instances. You can modify the rules for a security group at any time. The new rules are automatically applied to all instances that are associated with the security group.

The security groups created and assigned to the individual instances as part of this solution are restricted as much as possible while allowing access to the various functions of SAP HANA. See Appendix A for a complete list of ports and protocols configured as part of this solution.

## **Additional Information**

This guide is meant primarily for the deployment of the SAP HANA Solution on AWS. Additional administration and operations topics can be found in the <u>SAP HANA On AWS Implementation and Operations Guide</u>. More general documentation for operating SAP solutions on AWS can be found at <u>http://aws.amazon.com/sap/whitepapers</u>.



## **Appendix A: Security Group Specifics**

The following are the configured inbound and outbound protocols and ports allowed for the various instances deployed as part of this solution:

RDP Security Group						
Inbound						
Source	Protocol	Port Range (Service)	Comments			
Restricted to CIDR block specified during deployment	ТСР	3389 (RDP)	Allow inbound RDP access to Windows instance from your network (over the Internet gateway)			
Outbound						
Destination	Protocol	Port Range	Comments			
0.0.0/0	ТСР	1 - 65535	Allow outbound access from RDP server to anywhere			

NAT Security Group							
Inbound							
Source	Protocol	Port Range (Service)	Comments				
Restricted to CIDR block specified during deployment	ТСР	22 (SSH)	Allow inbound SSH access to Linux instance from your network (over the internet gateway)				
10.0.0/16	ТСР	80 (HTTP)	Allow inbound HTTP access only from instances deployed in the VPC				
10.0.0/16	ТСР	443 (HTTPS)	Allow inbound HTTPS access from only instances deployed in the VPC				
Outbound							
Destination	Protocol	Port Range	Comments				
10.0.1.0/24	ТСР	22 (SSH)	Allow SSH access from NAT instance to 10.0.1.0 subnet				
0.0.0/0	ТСР	80 (HTTP)	Allow outbound HTTP access from instances deployed in the VPC to anywhere.				
0.0.0/0	ТСР	443 (HTTPS)	Allow outbound HTTPS access from instances deployed in the VPC to anywhere.				



Г

SAP HANA Master & Worker** Security Groups							
Inbound							
(## corresponds to the SAP Instance Number)							
Source	Protocol	Port Range (Service)	Comments				
10.0.1.0/24	ТСР	1 - 65535	Communication between instances within private subnet				
10.0.1.0/24	TCP/UDP	111,2049, 4000- 4002	Ports used for NFS communication				
10.0.1.0/24	ТСР	3##00 – 3##10	Database Internal Communication & SAP Support Access				
**10.0.1.0/24	ТСР	22 (SSH)	Allow SSH access from other SAP HANA nodes				
10.0.2.0/24	TCP	22 (SSH)	Allow SSH access from NAT instance				
10.0.2.0/24	ТСР	1128 - 1129	Host Agent Access				
10.0.2.0/24	ТСР	43##	Access to XSEngine (HTTPS) from 10.0.2.0 subnet				
10.0.2.0/24	ТСР	80##	Access to XSEngine (HTTP) from 10.0.2.0 subnet				
10.0.2.0/24	ТСР	8080 (HTTP*)	Software Update Manager (SUM) access (HTTP)				
10.0.2.0/24	ТСР	8443 (HTTPS*)	Software Update Manager (SUM) access (HTTPS)				
10.0.2.0/24	ТСР	3##15	DB Client Access				
10.0.2.0/24	ТСР	3##17	DB Client Access				
10.0.2.0/24	ТСР	5##13 – 5##14	Allow access for HANA Studio from RDP instance				
Outbound							
0.0.0/0	ТСР	1 - 65535	Outbound access from SAP HANA Master allowed to anywhere				



## Appendix B: Subscribing to Red Hat Enterprise Linux for SAP HANA

- 1. Log in to the AWS Marketplace at http://aws.amazon.com/marketplace.
- 2. Type **RHEL for SAP HANA** in the search box, and choose **Red Hat Enterprise Linux for SAP HANA** from the results.



Figure 21: RHEL for SAP HANA in the AWS Marketplace

3. From the Red Hat Enterprise Linux for SAP HANA page, choose Continue.



Figure 22: Choosing RHEL for SAP HANA



4. Choose the Manual Launch tab. Read the terms and conditions of software usage, and then choose Accept Terms.



Figure 23: Reviewing the Terms of the License Agreement

You will get a confirmation page confirming your subscription, and an email confirmation will be sent to the account owner.

	etplace	Hello, assumed-role/Ad (Sign out)	Amazon Web Services Horr Your Account   Help   Sell on AWS Marketpla				
Shop All Categories -	Search AWS Marketplace	I	GO F Your Softwa				
AWS hourly usage fees apply when the instance is running. These fees will appear on your monthly bill. Please refresh this page later to enable launch with ec2 console.							
Thank you! Your subscription will be completed in a few moments.							

Next Steps	Related Links
<ul> <li>will receive an email shortly to c</li> <li>Once you've received the email, you can click the "Laun below and follow the instructions to launch an instance of the short o</li></ul>	ch with EC2 Console" buttons of this software.

- onsole 🗖
- n AWS Marketplace

#### Figure 24: Completing the Subscription Request

5. When you receive the confirmation email for your subscription, proceed with the SAP HANA reference deployment.



## Appendix C: Finding the Right SLES or RHEL AMI for SAP HANA

## **Procedure for SLES**

- 1. Open the Amazon EC2 console.
- 2. In the navigation pane, choose AMIs.
- 3. To filter the list of AMI IDs, choose **Public Images**, and then type **SUSE-SLES-11-SP3** in the search box.

🎁 AWS 🗸 Serv	ices ~	Edit 🗸								
EC2 Dashboard Events	Launo	h Actio	ons 🗸							
Tags	Publi	c images 👻	Q search : SUSE-SLES-11-	SP3 💿 Add filter						
Reports			<b>b</b>							
Limits		Name	AMI Name	*	AMI ID	Source	Owner	Visibility	Status	Creation Date
INSTANCES			suse-sles-11-sp3-byos-v201	41023-hvm-ssd-x86_64	ami-9b1a76a1	amazon/suse-sl	amazon	Public	available	October 23, 2014 at 3:44:05
Instances			suse-sles-11-sp3-byos-v201	41023-pv-ssd-x86_64	ami-bf1a7685	amazon/suse-sl	amazon	Public	available	October 23, 2014 at 3:40:00
Spot Requests			suse-sles-11-sp3-hvm-bld48	5-v1.0.0.x86_64	ami-cff297f5	amazon/suse-sl	amazon	Public	available	June 11, 2014 at 8:28:59 AM
Reserved Instances			suse-sles-11-sp3-hvm-bld48	5-v1.0.0.x86_64_ssd	ami-3760040d	amazon/suse-sl	amazon	Public	available	June 18, 2014 at 5:17:47 A
IMAGES			suse-sles-11-sp3-hvm-v1.00	x86_64	ami-ab70ee91	amazon/suse-sl	amazon	Public	available	January 30, 2014 at 11:56:5
AMIs			suse-sles-11-sp3-hvm-v2014	0903.x86_64	ami-756c0c4f	amazon/suse-sl	amazon	Public	available	September 3, 2014 at 5:45:4
Bundle Tasks			suse-sles-11-sp3-pv-v20140	903.i386	ami-316d0d0b	amazon/suse-sl	amazon	Public	available	September 3, 2014 at 7:12:5
ELASTIC BLOCK STORE			suse-sles-11-sp3-pv-v20140	903.x86_64	ami-336d0d09	amazon/suse-sl	amazon	Public	available	September 3, 2014 at 7:12:3
Volumes			suse-sles-11-sp3-rightscale-	/1.03.x86_64	ami-d148d6eb	amazon/suse-sl	amazon	Public	available	January 27, 2014 at 5:28:34
Snapshots			suse-sles-11-sp3-rightscale-	/1.05.x86_64	ami-59452263	amazon/suse-sl	amazon	Public	available	July 9, 2014 at 10:37:39 AM
NETWORK & SECURITY			suse-sles-11-sp3-rightscale-	/20141003-hvm-ssd-x8	ami-c3365bf9	amazon/suse-sl	amazon	Public	available	October 11, 2014 at 10:19:0
Security Groups			suse-sles-11-sp3-rightscale-	/20141003-pv-ssd-x86	ami-f3365bc9	amazon/suse-sl	amazon	Public	available	October 11, 2014 at 10:11:3
Elastic IPs			suse-sles-11-sp3-rightscale-	/20141224-hvm-ssd-x8	ami-a32a4099	amazon/suse-sl	amazon	Public	available	December 31, 2014 at 1:04:
Placement Groups			suse-sles-11-sp3-rightscale-	/20141224-pv-ssd-x86	ami-492a4073	amazon/suse-sl	amazon	Public	available	December 31, 2014 at 12:57
Load Balancers			suse-sles-11-sp3-rightscale-	/20150127-hvm-ssd-x8	ami-0d0e7a37	amazon/suse-sl	amazon	Public	available	January 27, 2015 at 7:36:41
Key Pairs Network Interfaces	Select	an AMI abo	ve							

#### Figure 25: Filtering AMIs for SLES

4. To scope the list by virtualization type, click the search bar, choose **Virtualization type**, and then choose **HVM**.



Events	Launch Act	ions 👻				
Tags	Public images	Q search : SUSE-SLES-11	-SP3 😣 Add filter			
Reports			Resource Attributes			
Limits	Name	AMI Name	AMI ID	P	Source	
INSTANCES		suse-sles-11-sp3-byos-v20	141023-hv AMI Name	b1a76a1	amazon/suse-sl	
Instances		suse-sles-11-sp3-byos-v20	141023-pv Architecture	f1a7685	amazon/suse-sl	
Spot Requests		suse-sles-11-sp3-hvm-bld4	85-v1.0.0.	ff297f5	amazon/suse-sl	
Reserved Instances		suse-sles-11-sp3-hvm-bld4	85-v1.0.0.	760040d	amazon/suse-sl	
IMAGES		suse-sles-11-sp3-hvm-v1.0	0.x86_64 Kernel ID	b70ee91	amazon/suse-sl	
AMIs		suse-sles-11-sp3-hvm-v20	140903.x86 Owner	56c0c4f	amazon/suse-sl	
Bundle Tasks		suse-sles-11-sp3-pv-v2014	0903.i386 Permissions	16d0d0b	amazon/suse-sl	
ELASTIC BLOCK STORE		suse-sles-11-sp3-pv-v2014	0903.x86 Platform	36d0d09	amazon/suse-sl	
Volumes		suse-sles-11-sp3-rightscale	Product Code	148d6eb	amazon/suse-sl	
Snapshots		suse-sles-11-sp3-rightscale	HAM disk ID e-v1.05.x86 Boot Device Name	9452263	amazon/suse-sl	
NETWORK & SECURITY		suse-sles-11-sp3-rightscale	-v2014100 Root Device Type	3365bf9	amazon/suse-sl	
Security Groups		suse-sles-11-sp3-rightscale	-v2014100 Size	365bc9	amazon/suse-sl	
Elastic IPs		suse-sles-11-sp3-rightscale	Source	32a4099	amazon/suse-sl	
Placement Groups		suse-sles-11-sp3-rightscale	Status	92a4073	amazon/suse-sl	
Load Balancers		auro alos 11 ap2 rightacak	Virtualization type	d0o7o27	amazon/ouso ol	
FC2 Dashboard	Services 🗸 E	idit v				
Events	Launch	Actions *				
LVOING	Public in	nages y O search S	ISE-SI ES-11-SP3 🔕 Virtu	alization t	VD8 :	
Tags	· ubito il	Gouldi. St		anzaron t		
Tags Beports						
Tags Reports Limits	Nar	ne AMI Name			Paravirtuali	zation
Tags Reports Limits	Nar	ne AMI Name suse-sles-11-	sp3-byos-v20141023-hvm-ss	d-x86_64	Paravirtuali: ami-9b1a76a1	zation amazon/s
Tags Reports Limits INSTANCES Instances	Nar	ne AMI Name suse-sles-11- suse-sles-11-	sp3-byos-v20141023-hvm-ss sp3-býjos-v20141023-pv-ssd-	:d-x86_64 -x86_64	Paravirtuali ami-9b1a76a1 ami-bf1a7685	amazon/s amazon/s

5. To filter the list by creation date, click the search bar, choose **Creation Date**, and search for AMIs that were created in the last few months.



🎁 AWS 🗸 Servi	ces 🗸 Edit 🗸					
EC2 Dashboard	Launch Action	s v				
Events		-				
Tags	Public images v	Q search : SUSE-SLES-11-SP3 8	Virtualization typ	e:HVM 😣 /	Add filter	
Reports					Resource Attributes	
Limits	Name	AMI Name	*	AMI ID	AMI ID	Owner
INSTANCES		suse-sles-11-sp3-byos-v20141023-h	vm-ssd-x86_64	ami-9b1a76	AMI Name	amazon
Instances		suse-sles-11-sp3-hvm-bld485-v1.0.0	x86_64	ami-cff297f5	Architecture	amazon
Spot Requests		suse-sles-11-sp3-hvm-bld485-v1.0.0	x86_64_ssd	ami-376004	Creation Date	amazon
Reserved Instances		suse-sles-11-sp3-hvm-v1.00.x86_64		ami-ab70ee	Image Type	amazon
IMAGES		suse-sles-11-sp3-hvm-v20140903.x8	6_64	ami-756c0c4	Kernel ID	amazon
AMIs		suse-sles-11-sp3-rightscale-v201410	03-hvm-ssd-x8	ami-c3365bi	Owner	amazon
Bundle Tasks		suse-sles-11-sp3-rightscale-v201412	24-hvm-ssd-x8	ami-a32a40	Permissions	amazon
ELASTIC BLOCK STORE		suse-sles-11-sp3-rightscale-v201501	27-hvm-ssd-x8	ami-0d0e7a	Platform	amazon
Volumes		suse-sles-11-sp3-sap-hvm-v1.00.x86	_64	ami-73138d	Product Code RAM disk ID	amazon
Snapshots		suse-sles-11-sp3-sap-hvm-v1.02.x86	_64	ami-8fc6a1b	Root Device Name	amazon
NETWORK & SECURITY		suse-sles-11-sp3-sap-hvm-v2014090	4.x86_64	ami-5d7b1b	Root Device Type	amazon
Security Groups		suse-sles-11-sp3-sap-v20141003-hv	m-mag-x86_64	ami-89a5c7l	Size	amazon
Elastic IPs		suse-sles-11-sp3-sap-v20141003-hv	m-ssd-x86_64	ami-81a5c7l	Source	amazon
Placement Groups		suse-sles-11-sp3-sap-v20141224-hv	m-mag-x86_64	ami-312a40	Status	amazon
Load Balancers		suse-sles-11-sp3-sapcal-v20150127	hvm-mag-x86	ami-6b0e7a	amazon/suse-si	amazon
			, i i i i i i i i i i i i i i i i i i i			
AWS × Services	× Edit ×					
ANG CONCES						
EC2 Dashboard	unch Actions V					
Events					(	Search back from last 3 - 4 months
Tags Pu	ublic images 👻 🔍 sea	rch : SUSE-SLES-11-SP3 O Virtualization	ype : HVM 🔕 Creati	on Date :		
Limits	Name AMI N	ame	AMI ID	Source 2	ate 015-01-01	Time 00:00 UTC-8
INSTANCES	SUSE-S	les-11-sp3-byos-v20141023-hvm-ssd-x86_64	ami-9b1a76a1	amazon/s	Before this date • After	this date
Instances	suse-s	les-11-sp3-hvm-bld485-v1.0.0.x86_64	ami-cff297f5	amazon/s		
Spot Requests	SUS0-S	les-11-sp3-hvm-bld485-v1.0.0.x86_64_ssd	ami-3760040d	amazon/s		Cancel Set
Reserved Instances	suse-s	les-11-sp3-hvm-v1.00.x86_64	ami-ab70ee91	amazon/suse-s	il amazon P	ublic available
IMAGES	suse-s	les-11-sp3-hvm-v20140903.x86_64	ami-756c0c4f	amazon/suse-s	i amazon P	ublic available
AMIs	SUSE-S	les-11-sp3-rightscale-v20141003-hvm-ssd-x8	ami-c3365bf9	amazon/suse-s	il amazon P	ublic available

Figure 27: Filtering SLES AMIs by Creation Date

6. You should now have a small result set of AMIs. Choose the AMI whose name follows the pattern **suse-sles-sp3-vYYYYMMDD-hvm-ssd-x86\_64**, and note its ID.

Image: AWS with a constraint of the second secon	Launch Actions	search : SUSE-SLES-11-SP3 (Virtualization type	: HVM 🔕 Creation D	ate : > January 1, 201	5 at 12:00:00 AM UT	C-8 🖸 Add filter		
Reports Limits	Name	AMI Name	∿ AMI ID	Source	Owner	Visibility	Status	Creation Date
INSTANCES		suse-sles-11-sp3-rightscale-v20150127-hvm-ssd-x86_64	ami-0d0e7a37	amazon/suse-sl	amazon	Public	available	January 27, 2015 at 7:36:41
Instances		suse-sles-11-sp3-sapcal-v20150127-hvm-mag-x86_64	ami-6b0e7a51	amazon/suse-sl	amazon	Public	available	January 27, 2015 at 7:40:36
Spot Requests		suse-sles-11-sp3-v20150127-hvm-ssd-x86_64	ami-810d79bb	amazon/suse-sl	amazon	Public	available	January 27, 2015 at 7:16:48
Reserved Instances  MAGES  AMIS  Duratio Toolog								

Figure 28: Choosing a SLES AMI



### **Procedure for RHEL**

- 1. Go to the AWS Marketplace at <u>http://aws.amazon.com/marketplace</u>.
- 2. Type **RHEL for SAP HANA** in the search box, and choose **Red Hat Enterprise Linux for SAP HANA** from the results.

<b>Waws</b> marketpla	ce	Sign in or Create a new account	Amazon Web Services Home Your Account   Help   Sell on AWS Marketplace
Shop All Categories - RHEL f	or SAP HANA		GO F Your Software
Categories All Categories Software Infrastructure (1)	RHEL for SAP I	HANA (1 result) showing 1 of 1 Red Hat Enterprise Linux for SAP H	
Filters Operating System	reunat.	Version 6.6   Sold by <u>Amazon Web Services</u> <b>\$0.00/hr</b> for software + AWS usage fees Red Hat Enterprise Linux for SAP HANA brings worlds leading enterprise Linux platform to SAF Linux/Unix, Red Hat Enterprise Linux 6.6   64-bit Amaz	s the reliability, scalability, and performance of the P HANA, the in-memory database zon Machine Image (AMI)
Amazon Machine Image (1) Architecture 64-bit (1)			
Region US East (N. Virginia) (1) US West (Oregon) (1)			

Figure 29: RHEL for SAP HANA in the AWS Marketplace

3. From the **Red Hat Enterprise Linux for SAP HANA** page, choose **Continue**.



Figure 30: Choosing RHEL for SAP HANA



4. Choose the **Manual Launch** tab, and select the version of RHEL from the list. Note the AMI ID for your target region.

#### Note

Using Red Hat Enterprise Linux for SAP HANA requires a subscription. Follow the instructions in <u>Appendix B</u> to complete the subscription if you haven't already done so.

<b>Waws</b> marke	etplace	н	ello, assumed-role/Ad (Sign out)	Υοι	Aur Account   He	Amazon Web alp   Sell on	Services Home AWS Marketplace
Shop All Categories -	Search AWS Marke	etplace				GO	Your Software
Launch on EC2: Red Hat Enterp	orise Linux	for SAP	HANA				
1-Click La Review, modify, a	unch and launch	M With E	anual Launch C2 Console, APIs or CLI	Pricing Details			
Launching Options     You can click the "Laun instructions to launch a	nch with EC2 Console in instance of this sof	e" buttons belov ftware	v and following the	US East (N. Virginia) Hourly Fees Total hourly fees will v	vary by instance	e type and E	• C2 region.
You can also find and la	aunch these AMIs by	searching for t	he AMI IDs (shown below)	EC2 Instance Type	Software	EC2	Total
in the "Community AMI	s" tab of the EC2 Co	nsole 🗗 Laun	ch Wizard	c3.8xlarge	\$0.00/hr	\$1.81/hr	\$1.81/hr
You can view this inform	mation at a later time	by visiting the	Your Software page, For	c4.8xlarge	\$0.00/hr	\$1.986/hr	\$1.986/hr
help, see step-by-step	instructions 🗗 for la	aunching Marke	tplace AMIs from the AWS	r3.2xlarge	\$0.00/hr	\$0.83/hr	\$0.83/hr
Console.		-		r3.4xlarge	\$0.00/hr	\$1.53/hr	\$1.53/hr
Usage Instruction Select a Version 6.6, released 06/02/2015	15			EBS General Purpos \$0.10 per GB-mont Assumes On-Demand EC will be lower. See pricing	se (SSD) volum n of provisioned 22 pricing; prices f details.	nes 🕑 d storage for Reserved an	nd Spot Instances
Region		D		Data transfer fees not inc	luded. 🎴		
US East (N. Virginia)	а	mi-23ea0648	Launch with EC2 Console	Learn about instance type	es 🗖		
US West (Oregon)	а	mi-15e1df25	Launch with EC2 Console				
US West (N. California)	а	mi-3311fa77	Launch with EC2 Console				
EU (Frankfurt)	а	mi-4c073e51	Launch with EC2 Console				
EU (Ireland)	а	mi-99126fee	Launch with EC2 Console				
Asia Pacific (Singapore)	а	mi-a6d5eef4	Launch with EC2 Console				
Asia Pacific (Sydney)	а	mi-a74c349d	Launch with EC2 Console				
Asia Pacific (Tokyo)	а	mi-dce538dc	Launch with EC2 Console				
South America (Sao Paul	o) a	mi-b3e666ae	Launch with EC2 Console				

Figure 31: Selecting a RHEL for SAP HANA Version



## Send Us Your Feedback

We welcome your questions and comments. Please post your feedback on the <u>AWS Quick Start Discussion Forum</u>.

You can visit our <u>GitHub repository</u> to download the templates and scripts for this Quick Start, and to share your customizations with others.

## **Document Revisions**

Date	Changes	Location
December 2015	Added troubleshooting information.	Troubleshooting section
June 2015	<ul> <li>You can now choose between the RHEL and SLES operating systems for SAP HANA deployment.</li> <li>The Quick Start now supports configurations of up to 17 nodes.</li> </ul>	<ul> <li>New <i>MyOS</i> parameter in <u>Step 2: Deploy SAP</u> <u>HANA Nodes</u>, and other changes to reflect RHEL support throughout guide</li> <li>New <u>Appendix B</u> and <u>Appendix C</u></li> <li>Adjustments to <u>storage size of SAP HANA</u> <u>volumes</u></li> <li>Updated <u>pricing information</u></li> </ul>
April 2015	Replaced SAP Business One notes with a link to the <u>SAP Business One, version for SAP HANA, Quick Start</u> <u>deployment guide</u> .	Implementing SAP Business One, Version for SAP HANA
December 2014	<ul> <li>Updated approximate pricing information.</li> <li>In the first template, changed the default type for NATInstanceType to t2.small to support the EU (Frankfurt) region.</li> <li>Added clarifications for deploying SAP Business One, version for SAP HANA.</li> </ul>	Changes throughout guide
July 2014	Initial publication.	-

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