SAP on AWS Implementation and Operations Guide

June 2015

Notices

Contents

Abstract

Amazon Web Services (AWS) offers you the ability to run your SAP systems in a hosted infrastructure as a service (IaaS) environment. Running SAP systems on AWS is very similar to running SAP systems in your data center. To an SAP Basis or NetWeaver administrator, there are minimal differences between the two environments. There are a number of AWS platform considerations relating to security, storage, compute configurations, management, and monitoring that will help you get the best out of your SAP implementation on AWS.

This whitepaper provides the best practices for achieving optimal performance, availability, and reliability, and lower total cost of ownership (TCO) while running SAP solutions on AWS. The target audience for this whitepaper is SAP Basis and NetWeaver administrators who have experience running SAP systems on traditional infrastructure and would like to run their SAP systems on AWS.

Introduction

This guide provides best practices and guidelines for implementing and operating SAP solutions on Amazon Web Services (AWS). It assumes that you have a basic understanding of AWS products and services discussed in the next section, which are relevant for running SAP systems. If you are new to AWS, please read the following documentation before continuing with this guide.

- [What is Amazon EC2?](#)[1]

- [Getting Started with AWS](#)[2]

This guide is not intended to replace any of the standard SAP documentation. When you install SAP solutions on AWS, you should always refer to the standard SAP installation guide and SAP notes for your SAP solution at http://service.sap.com/instguides (requires [SAP Service Marketplace credentials](#)[3]).

Amazon Web Services Overview

Amazon Web Services (AWS) provides a flexible, cost-effective, scalable, and easy-to-use cloud computing platform that is suitable for organizations of all sizes. The AWS cloud computing model allows you to pay for services on demand and to use as much or as little capacity as you need at any given time. You can use AWS as an extension of your existing infrastructure or as a complete virtual data center in the cloud.

AWS provides an extensive set of infrastructure and application services. The following section provides an overview of the AWS products and services that are most relevant for the implementation and operation of SAP solutions.

Global Infrastructure

AWS locations are composed of *regions* and *Availability Zones*. Availability Zones are distinct locations that are engineered to be insulated from failures in other Availability Zones and to provide inexpensive, low-latency network connectivity to other Availability Zones in the same region. Regions consist of one or more Availability Zones, and are geographically dispersed in different areas or countries.

For a list of the available AWS regions and to learn more about the AWS global infrastructure, see [Global Infrastructure](#) on the AWS website.[4]

Compute Services

Amazon Elastic Compute Cloud (Amazon EC2) provides scalable computing capacity in the AWS cloud.[5] You can access the components and features that Amazon EC2 provides by using a web-based GUI, command line tools, and APIs.

- *Amazon Machine Images (AMIs)* are the basic building blocks of Amazon EC2. An AMI is a system template that contains a software configuration (operating system, application server, and applications) that you can run on the AWS computing environment.

- *[Instance types](#)* are defined virtual machine configurations that offer different compute and memory capabilities.[6]

- An *instance* is virtual machine launched from an AMI.

- A *security group* acts as a firewall that controls the traffic allowed to reach one or more instances. When you launch an Amazon EC2 instance, you associate it with one or more security groups.

Storage Services

Amazon Elastic Block Store (Amazon EBS) offers persistent block storage for Amazon EC2 instances.[7] Amazon EBS volumes are network-attached and persist independently from the life of an instance. Amazon EBS volumes are highly available, highly reliable volumes that can be leveraged as an Amazon EC2 instance's boot partition or attached to a running Amazon EC2 instance as a standard block device.

- *Amazon EBS snapshots* provide the ability to create point-in-time snapshots of volumes, which are persisted to Amazon Simple Storage Service (Amazon S3). You can use snapshots as the starting point for new Amazon EBS volumes and to protect data for long-term durability. If you make periodic snapshots of a volume, the snapshots are incremental so that only the blocks on the device that have changed since your last snapshot are saved in the new snapshot. Although snapshots are saved

incrementally, the snapshot deletion process is designed so that you need to retain only the most recent snapshot in order to restore the volume.

Amazon Simple Storage Service (S3) provides a highly durable object/file storage infrastructure designed for mission-critical and primary data storage.[8] The service redundantly stores data in multiple facilities and on multiple devices within each facility.

AWS Import/Export accelerates moving large amounts of data into and out of AWS using portable storage devices for transport.[9] AWS transfers your data directly onto and off storage devices using Amazon's high-speed internal network and bypassing the Internet. For significant data sets, AWS Import/Export is often faster than Internet transfer and more cost-effective than upgrading your connectivity.

Networking Services

Amazon Virtual Private Cloud (Amazon VPC) lets you provision a private, isolated section of the AWS cloud where you can launch AWS resources in a virtual network that you define.[10] With Amazon VPC, you can define a virtual network topology that closely resembles a traditional network that you might operate in your own data center. Additionally, you can create a connection between your corporate data center and your Amazon VPC, and use the AWS cloud as an extension of your corporate data center.

Deployment and Management Services

AWS Management Console is web interface for deploying and managing AWS resources.[11]

AWS CLI is a unified tool to manage your AWS services.[12] With just one tool to download and configure, you can control multiple AWS services from the command line and automate them through scripts.

AWS CloudFormation enables developers and systems administrators to use a template file to create and delete a collection of AWS resources together as a single unit (a stack).[13]

Amazon CloudWatch enables you to monitor your Amazon EC2 resources in real time.[14] Amazon CloudWatch provides free basic monitoring for all Amazon EC2 instances. Basic monitoring provides metrics at 5-minute granularity. Optionally, you can choose to enable detailed monitoring for an instance, which provides performance metrics at 1-minute granularity.

Support

AWS Premium Support is a one-on-one, fast-response support channel that is staffed 24/7 with experienced technical support engineers.[15] The service helps customers of all sizes and technical abilities to successfully utilize the products and features provided by AWS.

Planning

Deploying and managing SAP systems on AWS is very similar to deploying and managing SAP systems on traditional infrastructure. To an SAP Basis or NetWeaver administrator, there are minimal differences between the two environments. There are a number of AWS platform considerations relating to compute configurations, storage, security, management, and monitoring that will help you get the most out of your SAP environment on AWS. This section provides guidelines for achieving optimal performance, availability, and reliability, and lower total cost of ownership (TCO) while running SAP solutions on AWS.

Using SAP Notes

Before implementing a SAP solution on AWS, you should read and follow the relevant SAP notes. SAP notes contain the most up-to-date information on the implementation and operation of SAP solutions on AWS. SAP notes can be found at http://service.sap.com/notes. (Access to SAP notes requires a valid SAP Service Marketplace account.)

Note #	Description
1588667	SAP on AWS: Overview of related SAP Notes and Web-Links
1656099	SAP on AWS: Supported SAP, DB/OS and AWS EC2 products
1656250	SAP on AWS: Support prerequisites

Note #	Description
1618572	Linux: Support Statement for RHEL on Amazon Web Services
1588896	Linux: Support Statement for SLES on Amazon Web Services
1600156	DB6: Support statement for DB2 on Amazon Web Services
1618590	Support: Oracle database on Amazon Web Services
1697114	Determining hardware ID in Amazon clouds
1380654	SAP support in public cloud environments
1964437	SAP HANA on AWS Supported AWS EC2 products

SAP Licenses

Multiple licensing options exist for SAP solutions on AWS: the Bring Your Own License (BYOL) model and on-demand, trial, and developer licenses.

Bring Your Own License (BYOL)

Most SAP solutions use a Bring Your Own License (BYOL) model on AWS. SAP customers and partners can use their existing licenses for SAP systems running on Amazon EC2. AWS does not provide or sell SAP licenses. You are responsible for obtaining a valid SAP license, and you must ensure that you are in compliance with the SAP licensing policies.

On-Demand, Trial, and Developer Licenses

Some SAP solutions are available on Amazon EC2 with an on-demand subscription, trial, or developer license. For a list of the SAP solutions that are currently available with one of these types of licenses, see the "Starting with a prebuilt SAP system image" section of Getting Started with SAP on AWS on the AWS website.

SAP Hardware Key Generation

SAP hardware key generation for Amazon EC2 instances is dependent on a specific SAP kernel patch level. Before generating a hardware key, you should ensure that the SAP kernel is at the required patch level. If a hardware key is generated before patching the SAP kernel, and the kernel is updated at a later time, the hardware key will change, making the installed license invalid. For details on how the SAP hardware ID is generated on Amazon EC2 instances and

the required SAP kernel patch levels, see SAP Note 1697114[16] (requires SAP Service Marketplace credentials).

SAP System Deployment Options

Multiple options are available for deploying SAP systems on AWS. You can start with a prebuilt SAP system image, use an AWS Quick Start reference deployment, or build your own SAP system:

Standard SAP Installation

Most SAP applications use a bring-your-own-software deployment model on AWS. You can use the standard SAP installation procedure on AWS, just as you would install SAP on any other physical or virtual server. Detailed guidance on how to install an SAP system on Amazon EC2 is provided later in this guide.

AWS Quick Start Reference Deployment

AWS Quick Start reference deployments help you rapidly deploy fully functional enterprise software on the AWS cloud, following AWS best practices for security and availability. With each Quick Start you can easily launch, configure, and run AWS compute, networking, storage, and other services to deploy that workload on AWS, often in an hour or less.

The following SAP Quick Start reference deployments are currently available on AWS:

- SAP HANA[17]

- SAP Business One, version for SAP HANA[18]

For additional information about AWS Quick Start reference deployments, see http://aws.amazon.com/quickstart/.

Prebuilt SAP Images

Some SAP solutions are available on AWS as prebuilt system images that contain a preinstalled and preconfigured SAP system. A prebuilt SAP system image enables you to rapidly provision a new SAP system without spending the time and effort required by a traditional manual SAP installation.

Pre-built SAP system images are available from the following sources:

- [AWS Marketplace](#)[19]

- [SAP trial systems](#)[20]

- [SAP developer images](#)[21]

- [SAP Cloud Appliance Library](#)[22]

For additional information about prebuilt SAP system images on AWS, see
http://aws.amazon.com/sap.

Regions and Availability Zones

Amazon EC2 is hosted in multiple locations worldwide. Amazon EC2 locations
are composed of *regions* and *Availability Zones*. Regions are dispersed and
located in separate geographic areas. Availability Zones are distinct locations
within a region that are engineered to be isolated from failures in other
Availability Zones, and provide inexpensive, low-latency network connectivity to
other Availability Zones in the same region.

Choosing a Region

Consider the following factors when deciding which AWS region to deploy your
SAP environment in:

- Choose a region that has proximity to your data center or corporate
  network. This will reduce network latency between systems running on
  AWS and systems and users on your corporate network.

- Make sure that the AWS services and instance types you require are
  available in the region. For a detailed list of AWS products and services by
  region, see the [region table](#) on the AWS website.[23]

Choosing an Availability Zone

No special considerations are required when choosing an Availability Zone for
your SAP deployment on AWS. All SAP applications (SAP ERP, CRM, SRM, and
so on) and systems (SAP DB, SAP CI, application servers) should be deployed in
the same Availability Zone. If high availability (HA) is a requirement, use
multiple Availability Zones. For more information about high availability, see the
[SAP on AWS High Availability Guide](#).[24]

For additional information about regions and Availability Zones, see the Amazon EC2 User Guide.[25]

SAP on AWS Architectures

Two high-level architectural patterns are available for deploying SAP systems on AWS: hybrid or all systems on AWS. The following sections describe these two architectural patterns and provide examples of each.

Hybrid Architecture

In this architecture, SAP systems are hosted both on your own on-premises infrastructure and on the AWS infrastructure. Example scenarios include:

- Running SAP test, trial, training, POC, and similar systems on AWS

- Running SAP DEV and QAS landscapes on AWS, integrated with an SAP PRD landscape running on premises

- Deploying a new SAP application on AWS to be integrated with an existing SAP environment on premises

Figure 1 depicts a hybrid architecture with SAP DEV and QAS landscapes and SAP test, training, and POC systems running on AWS. These systems are integrated with SAP systems and users on the corporate network. Connectivity between the Amazon VPC and the corporate network is provided with either a VPN connection or an AWS Direct Connect connection. The existing SAProuter and SAP Solution Manager running on the corporate network are used to manage the SAP systems running within the Amazon VPC.

Figure 1: SAP Hybrid Architecture on AWS

Notes:

- Figure 1 shows a single Availability Zone architecture. If you require high availability, see the SAP on AWS High Availability Guide.

- Security groups and network access control lists (ACLs) are not depicted in the diagram. For detailed documentation about how to set up and manage security within an Amazon VPC, see the Security in Your VPC section of the *Amazon VPC User Guide*.[26]

All-on-AWS Architecture

In this architecture, the AWS infrastructure hosts your entire SAP environment. Example scenarios include:

- Implementation of a new SAP customer's complete SAP environment on AWS

- Migration of a customer's existing complete SAP environment to AWS

Figure 2 depicts a complete SAP environment (DEV, QAS, and PRD landscapes, Solution Manager, SAProuter, and so on) running on AWS. This environment is integrated with on-premises systems and users via a VPN connection or an AWS Direct Connect connection. SAProuter runs in a public subnet and is assigned an elastic IP (EIP) address to enable integration with the SAP OSS network via a virtual network computing (VNC) connection. The network address translation (NAT) instance in the public subnet enables instances in the private subnet to initiate outbound traffic to the Internet, but prevents the instances from receiving inbound traffic that is initiated by someone on the Internet (see the NAT documentation on the AWS website[27]).
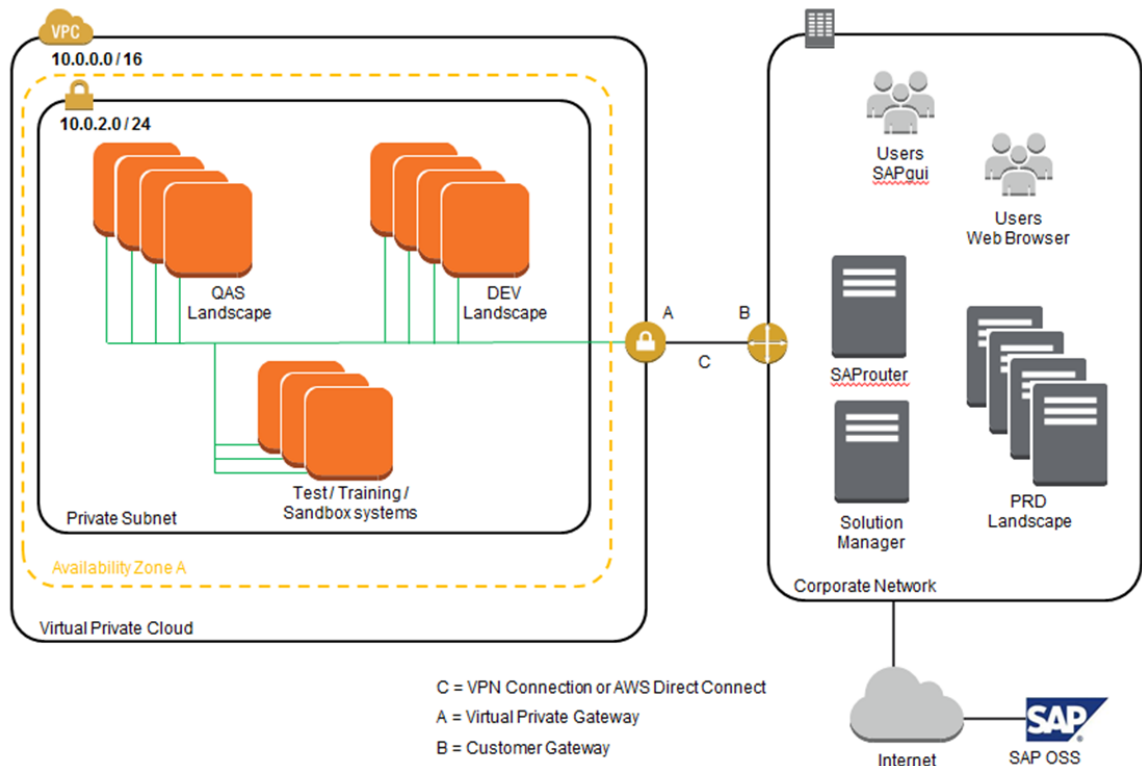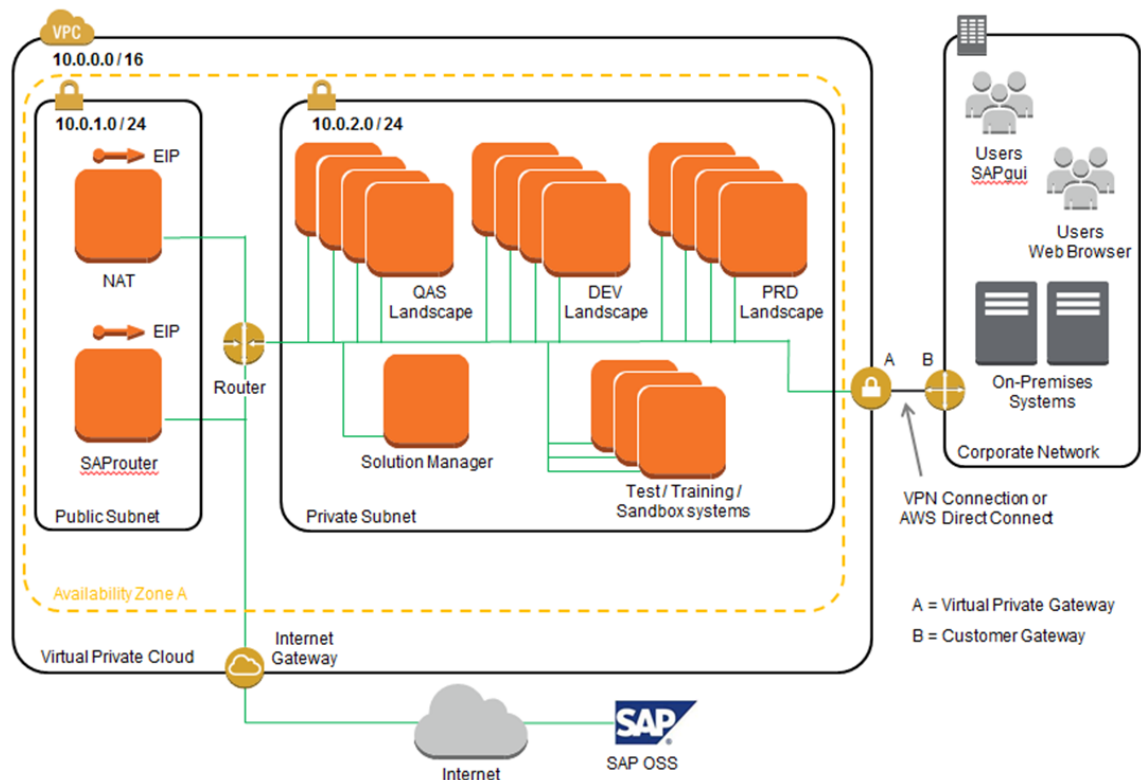

Figure 2: SAP All-on-AWS Architecture

Notes:

- Figure 2 shows a single Availability Zone architecture. If you require high availability, see the SAP on AWS High Availability Guide.

- Security groups and network access control lists (ACLs) are not depicted in the diagram. For detailed documentation about how to set up and manage

security within an Amazon VPC, see the [Security in Your VPC](#) section of the *Amazon VPC User Guide*.

Network

Amazon Virtual Private Cloud (Amazon VPC)

Amazon Virtual Private Cloud (Amazon VPC) enables you to define a virtual network in your own logically isolated area within the AWS cloud. You can launch your AWS resources, such as instances, into your VPC. Your VPC closely resembles a traditional network that you might operate in your own data center, with the benefits of using the AWS scalable infrastructure. You can configure your VPC; you can select its IP address range, create subnets, and configure route tables, network gateways, and security settings. You can connect instances in your VPC to the Internet. You can connect your VPC to your own corporate data center, making the AWS cloud an extension of your data center. To protect the resources in each subnet, you can use multiple layers of security, including security groups and network access control lists. For more information, see the [Amazon VPC User Guide](#).[28]

For detailed instructions for setting up and configuring an Amazon VPC and the connection between your network and Amazon VPC, see the [Amazon VPC documentation](#).[29]

Amazon VPC Connectivity Options

Amazon VPC provides several options for connecting your users and on-premises systems with systems running on AWS:

Direct Internet Connection

The quickest and simplest way to connect to your SAP systems running on AWS. For additional information, see [Scenario 1: VPC with a Public Subnet Only](#) in the *Amazon VPC User Guide*.[30]

Use cases: Most suitable for SAP demo, training, and test type systems.

Hardware VPN

An industry standard, encrypted IPsec hardware site-to-site VPN connection between your network and Amazon VPC. For additional information, see [Adding](#)

a Hardware Virtual Private Gateway to your VPC in the *Amazon VPC User Guide*.[31]

Use cases: Recommended for any SAP environments on AWS that require integration with on-premises users and systems.

AWS Direct Connect

A dedicated, private network connection between your network and one of the AWS Direct Connect locations using industry standard 802.1Q VLANs. For additional information, see the Direct Connect User Guide.[32]

Use cases: Recommended for customers who require greater bandwidth and lower latency than possible with a hardware VPN.

For additional information about the different Amazon VPC connectivity options, see the Amazon Virtual Private Cloud Connectivity Options whitepaper.[33]

Security

In order to provide end-to-end security and end-to-end privacy, AWS builds services in accordance with security best practices, provides appropriate security features in those services, and documents how to use those features. In addition, AWS customers must use those features and best practices to architect an appropriately secure application environment. Enabling customers to ensure the confidentiality, integrity, and availability of their data is of the utmost importance to AWS, as is maintaining trust and confidence.

Shared Responsibility Environment

There is a shared responsibility model between you, the customer, and AWS. 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, Amazon VPC setup and configuration, as well as the configuration of the AWS-provided security group firewall. For additional information on AWS security, visit the AWS Security[34] and Compliance Center[35] and read the following guides:

- Amazon Web Services: Overview of Security Processes[36]

- [AWS Security Best Practices](#)[37]

Amazon Virtual Private Cloud (VPC)

The foundation for security of an SAP environment on AWS is the use of Amazon VPC for providing the overall isolation. Amazon VPC includes security details that you must set up to enable proper access and restrictions for your resources. Amazon VPC provides two features that you can use to control the security for your VPC:

- **Security groups** act as a firewall for associated Amazon EC2 instances, controlling both inbound and outbound traffic at the instance level

- **Network access control lists (ACLs)** act as a firewall for associated subnets, controlling both inbound and outbound traffic at the subnet level

For detailed documentation about how to set up and managed security within an Amazon VPC, see the [Security in Your VPC](#) section of the *Amazon VPC User Guide*.

Amazon EC2 Instance Types

Amazon EC2 offers a number of instance types (virtual machine sizes) for deploying SAP solutions. Each instance type offers different CPU, memory, and I/O capabilities. You can run non-production SAP systems on any Amazon EC2 instance type, but you must use one of the SAP-certified Amazon EC2 instance types for production SAP systems. For a list of SAP-certified instance types approved for production use, see [SAP Note 1656250](#).[38]

For detailed descriptions of Amazon EC2 instance types, see [Amazon EC2 Instances](#) on the AWS website.[39]

Each SAP-certified Amazon EC2 instance type has been benchmarked using the standard SAP benchmarking procedure. For the SAPS rating of each SAP-certified instance, see [SAP Note 1656250](#).

Operating Systems

Amazon EC2 currently supports the following operating systems for running SAP systems:

- SUSE Linux Enterprise Server (SLES)

- Red Hat Enterprise Linux (RHEL)

- Microsoft Windows Server

For specific details of the required operating system versions and patch levels for the operation of production SAP systems on AWS, see SAP Note # 1656250.

Base Operating System Images

Pre-installed base operating system images are provided via Amazon Machine Images (AMIs). AWS works with operating system vendor partners to provide you with up-to-date, optimized operating system images. For additional information about AMIs, see the Amazon EC2 User Guide.[40]

Operating System Licenses

Operating system licenses are included in the hourly price of the Amazon EC2 instance. You are not required to provide your own operating system licenses.

Operating System Patching

The base operating system AMIs provided by AWS and by operating system vendor partners are updated regularly with the latest technical and security patches. After you launch an instance from a base operating system AMI, you are responsible for the ongoing updating and patching of the guest operating system.

Special Considerations for Linux

Hostnames

The generated hostname that is assigned to a new Amazon EC2 Linux instance does not meet the requirements of an SAP system. You must change the hostname of the instance before installing an SAP solution on the instance. For additional information about the allowed hostname length and characters, see SAP Note 611361.[41]

By default, when Amazon EC2 Linux instances are stopped or started, a new hostname is generated. This behavior is not appropriate for an SAP system and can be disabled by following these steps:

For SUSE Linux Enterprise Server (SLES):

1. Start YaST.

2. Navigate to **Network Devices**, **Network Settings**, and then press **Enter**.

3. In the menu, choose **Hostname/DNS**.

4. Change the values of the **Hostname** and **Domain Name** fields as required.

5. Clear the **Change Hostname via DHCP** check box.

6. Press F10 to save.

7. Press F9 to exit.

For Red Hat Enterprise Linux (RHEL):

1. Edit the file /etc/sysconfig/network.

2. Change the HOSTNAME parameter and replace its value with the new hostname.

3. Restart the operating system.

Special Considerations for Microsoft Windows

Windows Computer Name

When a new Amazon EC2 Windows instance is launched, it is assigned a generated computer name. Before you install an SAP solution on the instance, you must change this computer name to meet the requirements of an SAP system. For additional information about the allowed computer name length and characters, see [SAP Note #611361](#).

Amazon EC2Config Service

AWS Windows AMIs contain a service called the Amazon EC2Config service, which is installed by AWS. Although this service is optional, it provides access to advanced features that are not otherwise available. The Amazon EC2Config service is started when the instance is booted. It performs tasks during initial instance startup and each time you stop and restart the instance. It can also perform tasks on demand. Some of these tasks are automatically enabled, whereas others must be enabled. Amazon EC2Config uses settings files to control its operation. You can update these files either by using a graphical tool or by directly editing XML files. To learn more about the EC2Config service, see the

[Configuring a Windows Instance Using the EC2Config Service](#) in the *Amazon EC2 User Guide for Microsoft Windows*.[42]

Databases

When deploying an SAP solution on Amazon EC2, you must install, configure, and manage the underlying database system as you would on any other physical or virtual server. For production SAP systems, you must use one of the databases certified by SAP for AWS; these are listed in [SAP Note 1656250](#). For non-production SAP systems, you may use any database listed in the Product Availability Matrix (PAM) of the SAP solution.

Database Licenses

Database licensing for SAP solutions uses a Bring Your Own License (BYOL) model. When deploying an SAP solution on AWS that requires a BYOL, you are responsible for providing the required database license, and you must ensure that you are in compliance with the database vendor's licensing terms and conditions.

Storage

Amazon EC2 provides you with flexible, cost-effective, and easy-to-use data storage options for your instances. Each option has a unique combination of performance and durability. These storage options can be used independently or in combination to suit your requirements. The following sections describe storage options and their primary uses for SAP solutions.

Instance Store

- Local, temporary, instance based storage located on the physical host server

- Provided in the hourly price of some instance types

- Data stored on instance store storage volumes does not persist beyond the run time of the instance

- **SAP uses:** OS swap

Amazon Elastic Block Store (EBS)

- Persistent block-level storage volumes for use with Amazon EC2 instances

- Three different volume types:

  — Magnetic

  — General Purpose (SSD)

  — Provisioned IOPS (SSD)

- **SAP uses:** SAP DB software, DB log files, DB data files, intermediate backup storage

Amazon S3

- Object or file-based storage

- Designed for highly availability and high durability

- Not intended to be used as a file system

- **SAP uses:** Backup storage and SAP archiving storage

SAP Support and Monitoring

To ensure full support of SAP solutions on AWS, you must follow the guidelines in SAP Note # 1656250.

One of the primary requirements for support is to enable the built-in SAP monitors to retrieve information about configuration and resource utilization from the underlying AWS infrastructure. There are two steps to enable SAP monitoring on AWS:

- Enable detailed monitoring for **Amazon CloudWatch** on each Amazon EC2 instance to ensure that the required AWS metrics are provided in one-minute intervals. For additional information on Amazon CloudWatch, see http://aws.amazon.com/cloudwatch.

- Install, configure, and run the **AWS Data Provider for SAP** on each Amazon EC2 instance. The AWS Data Provider collects the required performance and configuration data from a variety of sources, including the Amazon EC2 API, Amazon EC2 Instance Metadata Service, and Amazon CloudWatch. For detailed installation instructions, see SAP Note 1656250.

SAP Installation Media

There are two main options for copying SAP installation media to Amazon EC2:

- **Download from SAP Service Marketplace to Amazon EC2.** From your Amazon EC2 instance, connect to the SAP Service Marketplace and download the required installation media. This option will most likely be the fastest method for getting SAP installation media to AWS, because Amazon EC2 instances have very fast connections to the Internet. You can create a dedicated Amazon EBS volume to store installation media, and then attach the volume to different instances as needed. You can also create a snapshot of the Amazon EBS volume and create multiple volumes that you can attach to multiple instances in parallel.

- **Copy from your network to Amazon EC2.** If you already have the required SAP installation media downloaded to a location on your network, you can copy the media from your network directly to an Amazon EC2 instance.

SAP Router and SAP Solution Manager

The following sections describe options for SAP Solution Manager and SAProuter when running SAP solutions on AWS.

Hybrid Architecture

When using AWS as an extension to your IT infrastructure, you can use your existing SAP Solution Manager system and SAProuter that are running in your data center to manage SAP systems running on AWS within an Amazon VPC. See the hybrid architecture diagram (Figure 1) for additional information.

All-on-AWS Architecture

When setting up an SAP environment on AWS, you will need to set up an SAP Solution Manager system and a SAProuter with a connection to the SAP support network, as you would with any infrastructure. See the all-on-AWS architecture diagram (Figure 2) for an illustration.

When setting up the SAProuter and SAP support network connection, follow these guidelines:

- The instance that the SAProuter software will be installed on should be launched into a public subnet of an Amazon VPC and assigned an elastic IP address (EIP).

- A specific security group should be created for the SAProuter instance with the necessary rules to allow the required inbound and outbound access to the SAP support network.

- You should use the Secure Network Communication (SNC) type of Internet connection. For more information, see https://service.sap.com/internetconnection.

High Availability

For guidelines on planning and setting up high availability for SAP solutions on AWS, see the SAP on AWS High Availability Guide.[43]

Backup and Recovery

For guidelines on planning and setting up a backup and recovery strategy for SAP solutions on AWS, see the SAP on AWS Backup and Recovery Guide.[44]

Sizing and Performance

Sizing of SAP systems on AWS follows the same methodology for sizing SAP systems on traditional infrastructure. The starting point to determine the infrastructure requirements for an SAP system on AWS is the SAP Quick Sizer. SAP Quick Sizer will provide you with the SAPS, storage, and I/O performance requirements for selecting the AWS resources to support your SAP environment.

For additional information about the SAP sizing process, see http://service.sap.com/sizing.

Instance Types and SAPS

AWS has benchmarked and certified a group of Amazon EC2 instance types using the standard SAP Sales and Distribution (SD) benchmark. For benchmark results and SAPS ratings of Amazon EC2 instance types, see SAP Note #1656099.[45]

Storage and I/O
Amazon EBS Volume Performance

Amazon EBS provides three volume types: Magnetic, General Purpose (SSD), and Provisioned IOPS (SSD). These volume types differ in performance characteristics and price, allowing you to tailor your storage performance and cost to the needs of your SAP system. You can attach and stripe across multiple volumes to increase the I/O performance available to your applications.

- **Magnetic volumes** provide the lowest cost per GiB of all Amazon EBS volume types. Magnetic volumes are backed by magnetic drives and are ideal for workloads where data is accessed infrequently, and scenarios where the lowest storage cost is important. Magnetic volumes provide approximately 100 IOPS on average, with an ability to burst to hundreds of IOPS.

    Magnetic volumes are not recommended for SAP systems.

- **General Purpose (SSD)** volumes are the default EBS volume type for Amazon EC2 instances. General Purpose (SSD) volumes are backed by solid-state drives (SSDs) and are suitable for a broad range of workloads, including small to medium-sized databases, development and test environments, and boot volumes. General Purpose (SSD) volumes are designed to offer single-digit millisecond latencies, deliver a consistent baseline performance of 3 IOPS/GiB to a maximum of 10,000 IOPS, and provide up to 160 MBps of throughput per volume. General Purpose (SSD) volumes that are smaller than 1 TiB can also burst up to 3,000 IOPS. I/O is included in the price of these volumes, so you pay only for each GiB of storage you provision.

    General Purpose (SSD) volumes are recommended for all types of SAP systems, including most SAP production systems.

- **Provisioned IOPS (SSD)** volumes are designed to offer single-digit millisecond latencies, deliver a consistent baseline performance of up to 30 IOPS/GiB to a maximum of 20,000 IOPS, and provide up to 320 MBps of throughput per volume. Additionally, you can stripe multiple volumes together to achieve up to 48,000 IOPS or 800 MBps when attached to larger EC2 instances.

Provisioned IOPS (SSD) volumes are recommended for SAP production systems that require a greater level of I/O performance than that available with General Purpose (SSD) volumes.

Volume Striping

If the total IOPS, throughput, or GiBs required for one file system exceeds the maximum of a single Amazon EBS volume, you can stripe multiple Amazon EBS volumes together. This enables you to achieve a higher level of performance for a file system than what you can provision on a single Amazon EBS volume.

For additional information about EBS volume performance and how to create a striped file system, see the Increasing EBS Performance section of the *Amazon EC2 User Guide*.[46]

Instance I/O Performance

Amazon EC2 provides virtualized server instances. While some resources (such as CPU, memory, and instance storage) are dedicated to a particular instance, other resources (such as the network and the disk subsystem) are shared among instances. Different instance types will provide higher or lower minimum performance from the shared resources depending on their size. When you plan and configure EBS volumes for your system, you should consider the configuration of the instances that you will attach the volumes to. In order to get the most performance out of your EBS volumes, you should attach them to an instance that has enough bandwidth to support your volumes, such as an Amazon EBS-optimized instance or an instance with 10 gigabit network connectivity. This is especially important when you use General Purpose (SSD) or Provisioned IOPS (SSD) volumes, or when you stripe multiple volumes together in a RAID configuration.

Any performance-sensitive workloads that require minimal variability and dedicated Amazon EC2 to Amazon EBS traffic, such as production databases or business applications, should use General Purpose (SSD) or Provisioned IOPS (SSD) volumes that are attached to an Amazon EBS-optimized instance or an instance with 10 gigabit network connectivity. EC2 instances that do not meet this criteria offer no guarantee of network resources. To see which instance types include 10 gigabit network connectivity, see the instance types matrix on the Amazon EC2 Instances webpage.[47]

Instance I/O Performance Recommendations

For SAP production systems and other system types that need high I/O performance, we recommend that you use an Amazon EBS-optimized or 10 gigabit instance type when available.

Implementation

As discussed earlier in the Planning section, there are multiple options for deploying SAP systems on AWS. This section provides instructions for building your own SAP system and migrating an existing SAP system to AWS.

Building Your Own SAP System on AWS

Installation of an SAP system on AWS follows the same process as installing an SAP system on any other physical or virtual server.   The following sections provide instructions.

Create an Amazon EC2 Account

The first step to begin using AWS is to create an AWS account. When you sign up for AWS, you gain access to all AWS services, but you are charged only for the services you use.

To sign up for AWS:

1. Go to http://aws.amazon.com and click **Create an AWS Account**.

2. Follow the on-screen instructions.

Choose an AWS Region

Before you provision any new AWS resources, you need to determine which AWS region you will use. Use these resources for guidance:

- Read the Regions and Availability Zones section of this guide.

- View the Global Infrastructure page on the AWS website.

- Read the Regions and Availability Zones section of the *Amazon EC2 User Guide*.

Note   When you first log in to the AWS Management Console, your account will be set to a default region. Before you provision any new resources, you need to make sure the correct region is selected. Use the region selector in the navigation bar to choose the Amazon EC2 region where you want to deploy your SAP system.

Set up and Configure the Network

The next step is to set up and configure the network. Use the following resources for guidance in planning and setting up an Amazon VPC:

- Read the Network section of this guide.

- View the Amazon VPC documentation for detailed instructions about how to set up and configure an Amazon VPC and connect it to your network.

Set up and Configure the Server

Once your network has been set up, you can start creating the server instances required to support your SAP deployment. Here are the high-level steps you need to perform to prepare new Amazon EC2 instances for the installation of an SAP solution:

Choose the base operating system AMI. You should always start with the latest version of the Amazon-published AMI of the operating system required. To find the latest version of the Windows Server, SLES, and RHEL AMIs:

1. Log in to the Amazon EC2 console at https://console.aws.amazon.com/ec2/.

2. From the console dashboard, choose **Launch Instance**.

3. The latest versions of the Windows, SLES, and RHEL AMIs can be found on the Quick Start tab. Choose the latest version of the AMI for the operating system you want to use.

Choose the instance type. The next step is to choose the instance type or virtual machine size you will launch your new instance on. Use the following resources to determine which instance type(s) meet your specific requirements:

- Read the Amazon EC2 Instance Types and Sizing and Performance sections of this guide.

- See the full list of Amazon EC2 instance types on the AWS website.

- Read the <u>Getting Started with Amazon EC2 Linux Instances</u> section of the *Amazon EC2 User Guide*.[48]

- See <u>SAP Note 1656099</u> for SAPS ratings for instance types that are certified by SAP for production.

Launch instances. Once you know the AMIs and instance types you will use, you can begin the process of launching the required server instances. See the following documentation for detailed instructions:

- <u>Getting Started with Amazon EC2 Linux Instances</u>[49]

- <u>Getting Started with Amazon EC2 Windows Instances</u>[50]

Configure the operating system. Follow the guidelines in the SAP installation guide to prepare the operating system just as you would with any other physical or virtual server.

Provision and configure storage. Use the following list of resources to plan, provision, and configure the required storage for the SAP solution you are deploying:

- Follow the standard disk and storage guidelines in the SAP installation guide of the SAP solution you are deploying.

- Read the <u>Storage</u> and <u>Sizing and Performance</u> sections of this guide.

- Read the <u>Storage</u> section of the *Amazon EC2 User Guide*.[51]

- Read the <u>Increasing EBS Performance</u> section of the *Amazon EC2 User Guide*.[52]

Prepare SAP installation media. See the <u>SAP Installation Media</u> section of this guide.

Create AMI backup. Before you proceed with the installation of the SAP solution, we recommend that you create an image of the instance to capture all the work that has been done up to this point. For detailed instructions for creating an image, see the <u>Creating AMIs</u> section of the *Amazon EC2 User Guide*.[53]

Install the SAP Solution

Once you have provisioned and configured the required Amazon EC2 instances, you are ready to begin the installation of the SAP solution. Proceed with the SAP installation just as you would on any other physical or virtual server, by following the standard SAP installation processes documented in the SAP installation guide.

Follow Post-Installation Steps

Following the standard post-installation steps documented in the SAP installation guide.

Create an AMI Backup

Once you have completed the SAP installation and post-installation steps, you should create an image of the instance. For detailed instructions, read the Creating AMIs section of the *Amazon EC2 User Guide*.

Migrate an Existing SAP System to AWS

There are two options for migrating your existing SAP systems to Amazon EC2: you can use the AWS VM Import/Export tools or perform an SAP homogeneous or heterogeneous system copy.

VM Import/Export Tools

AWS VM Import/Export tools enable you to easily import virtual machine images from your existing environment to Amazon EC2 instances. This method is recommended for small SAP systems that are already virtualized. For additional information, see VM Import/Export on the AWS website.[54]

SAP Homogeneous and Heterogeneous System Copy

The recommended method for copying an existing SAP system to Amazon EC2 is the standard SAP homogeneous and heterogeneous system copy procedure.

The high-level steps to migrate/copy an existing SAP system to AWS are:

1. Create an export of the source system by using SAPinst.

2. Copy the export and DB backup data to Amazon EBS or Amazon S3. There are two ways to do this:

— **Network copy.** For SAP systems with export and DB backup data sizes that are under 1 TiB, you can copy the data over the network directly to the target Amazon EC2 instance or to Amazon S3. The transfer time depends on the amount of data, the speed and bandwidth of the network connection, whether you can load data in parallel, and similar factors. See the [AWS Partner Network](#) for open source or commercial file transfer acceleration tools you can use to reduce the transfer time.[55] An open-source utility that has been used successfully by many customers is [Tsunami UDP](#).[56]

— **Amazon Import/Export service.** For SAP systems that have export or DB backup data sizes greater than 1 TiB, we recommend that you use the [AWS Import/Export service](#) to transfer your data.[57] This service enables you to transfer data on portable storage devices to AWS. The data can be copied to one of your Amazon S3 buckets or to an Amazon EBS snapshot that can be used to create a new Amazon EBS volume. You can then download the data from Amazon S3 directly to your Amazon EC2 instance by using the local AWS high-speed network or create a new Amazon EBS volume from the snapshot.

Note   The import to Amazon EBS snapshot option is currently limited to 1 TiB. In order to utilize the import to Amazon EBS option, the physical device shipped to AWS must be less than or equal to 1 TiB. For additional information, see [Creating Amazon EBS Import Jobs](#) in the AWS documentation.[58]

3. Install the new target system on Amazon EC2 by using SAPinst to import the files you exported from the source system.

Operations

Backup and Recovery

For guidelines on planning and setting up backup and recovery for SAP systems on AWS, see the [SAP on AWS Backup and Recovery Guide](#).

Starting and Stopping SAP Systems on AWS

When you start or stop an Amazon EC2 instance, just as with a physical server, the SAP instance and database will not be automatically started or stopped. To

automatically start or stop SAP and database services when an Amazon EC2 instance is being stopped or started, you need to create appropriate scripts that correctly link into the shutdown and startup sequences of the operating system.

For additional information about the SAP Start Service framework, see http://help.sap.com/.

SAP System Copy

There are two options for copying SAP systems on AWS: You can use the SAP standard system copy process or an AMI.

SAP Standard System Copy Process

You can use the standard SAP homogeneous and heterogeneous system copy process on AWS to copy SAP systems. For additional information, see the standard SAP documentation.

Amazon Machine Image (AMI)

AWS provides a very simple and quick way to copy an SAP system. You can use the AWS Management Console or the AWS CLI to create a new AMI of an existing SAP system. The AWS CLI create-image command creates a new AMI based on an existing Amazon EC2 instance.[59] The new AMI contains a complete copy of the operating system and its configuration, software configurations, and all EBS volumes that are attached to the instance. From the new AMI you can launch exact copies of the original system. For details on how to create an AMI of an existing EC2 instance, see:

- Creating an Amazon EBS-Backed Linux AMI[60]

- Creating an Amazon EBS-Backed Windows AMI[61]

SAP Change and Transport System
Hybrid Architecture

If you are using a hybrid architecture on AWS, we do not recommend sharing a common transport directory between your SAP on-premises landscapes and AWS landscapes. The recommended configuration is to create local transport directories for each landscape, and configure automatic synchronization of

transport files between systems. For additional information about this configuration, see the following SAP documentation:

- [SAP Systems Without a Common Transport Directory](#)[62]

- [SAP Note 2030463](#)[63]

All-on-AWS Architecture

If you are using an all-on-AWS architecture for your SAP systems, follow standard SAP best practices for change and transport management. For additional information, see the SAP [Transport and Change Management](#) documentation.[64]

Conclusion

Deployment of SAP systems on AWS differs very little from deployment of SAP systems on traditional infrastructure. There are a number of AWS platform considerations relating to security, storage, compute configurations, management, and monitoring that need to be considered to get the best out of your SAP implementation on AWS. Following the best practices provided in this paper will help you achieve optimal performance, availability, reliability, and lower total cost of ownership (TCO) of your SAP implementation on AWS.

Document Revisions

Date	Changes
June 2015	Extensive updates throughout guide
April 2013	Initial publication

Notes

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