



Implementing SAP Solutions on Amazon Web Services

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About this Guide

This guide provides best practice guidelines for implementing SAP solutions on Amazon Web Services (AWS). The intended audience of this guide is SAP customers and partners looking to install small SAP test/training/demo systems to large SAP production systems on AWS.

This guide assumes that you have a basic understanding of Amazon Web Services. If you are new to AWS please read the following guides before continuing with this guide.

[Getting Started with AWS](#)

[What is Amazon EC2?](#)

This guide is not intended to replace any of the standard SAP documentation. When installing SAP solutions on AWS you should always refer to the standard SAP installation guide and SAP notes for the particular SAP solution. SAP installation guides and notes can be found at:

SAP Installation Guides - <http://service.sap.com/instguides>

SAP Notes - <http://service.sap.com/notes>

Please provide any feedback you have on this guide to sap-on-aws@amazon.com

Additional SAP on AWS Documentation

In addition to this guide the following SAP on AWS guides can be found at <http://aws.amazon.com/sap>

SAP on AWS Operations Guide

The *SAP on AWS Operations Guide* provides guidelines on the special considerations that must be taken into account when operating SAP environments on AWS.

SAP on AWS High Availability Guide

The *SAP on AWS High Availability Guide* provides guidelines on how to configure SAP systems on Amazon EC2 in such a way as to be able to protect the application from various single points of failure.

SAP on AWS Backup and Recovery Guide

The *SAP on AWS Backup and Recovery Guide* provides guidelines on how to backup SAP systems running on AWS. The guide focuses on the essential differences in backing up SAP systems on AWS compared to traditional infrastructure.

Overview of Amazon Web Services

AWS Overview

Amazon Web Services 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 at any given time as you need. You can use AWS as an extension to your existing infrastructure or a complete virtual data center in the cloud.

Overview of AWS Products and Services for SAP Solutions

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 to the implementation of SAP solutions.

Global Infrastructure

Amazon Web Services provides services in multiple locations across the globe. AWS locations are composed of **Regions** and **Availability Zones**:

Regions consist of one or more Availability Zones, are geographically dispersed, and will be in separate geographic areas or countries.

Availability Zones are distinct locations that are engineered to be insulated from failures in other Availability Zones and provide inexpensive, low latency network connectivity to other Availability Zones in the same Region. By launching instances in separate Availability Zones, you can protect your applications from failure of a single location.

For a list of the available AWS regions and to learn more about the AWS global infrastructure, see <http://aws.amazon.com/about-aws/globalinfrastructure/>

Compute

Amazon Elastic Compute Cloud (EC2) – <http://aws.amazon.com/Amazon EC2>

Amazon Elastic Compute Cloud (EC2) is a web service that provides resizable computing capacity, servers in Amazon's data centers—that you use to build and host your software systems. You can access the components and features that Amazon EC2 provides using a web-based GUI, command line tools, and APIs.

Components of Amazon EC2

Amazon Machine Image (AMI)

Amazon Machine Images (AMI) 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 Amazon's computing environment.

Instance

A virtual machine launched from an Amazon Machine Image (AMI)

Instance Types - <http://aws.amazon.com/Amazon-EC2/instance-types>

Amazon EC2 instance types are defined virtual machine configurations that offer different compute and memory capabilities.

Key Pair

An RSA public/private key pair, which you use to ensure that only you have access to instances that you launch

Security Group

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

Amazon Elastic Block Store (EBS) – <http://aws.amazon.com/ebs>

Amazon Elastic Block Store (EBS) offers persistent storage for Amazon EC2 instances. 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 provides two volume types:

Standard volumes offer cost effective storage that is ideal for applications with moderate or bursty I/O requirements.

Provisioned IOPS volumes are designed to deliver predictable, high performance for I/O intensive applications such as databases.

EBS Snapshot

EBS provides the ability to create point-in-time snapshots of volumes, which are persisted to Amazon S3. Snapshots can be used 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 incrementally saved in the new snapshot. Even though 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) – <http://aws.amazon.com/s3>

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

AWS Import/Export Service – <http://aws.amazon.com/importexport>

AWS Import/Export accelerates moving large amounts of data into and out of AWS using portable storage devices for transport. AWS transfers your data directly onto and off of 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.

Network

Amazon Virtual Private Cloud (VPC) – <http://aws.amazon.com/vpc>

Amazon Virtual Private Cloud (Amazon VPC) lets you provision a private, isolated section of the Amazon Web Services (AWS) Cloud where you can launch AWS resources in a virtual network that you define. With Amazon VPC, you can define a virtual network topology that closely resembles a traditional network that you might operate in your own datacenter.

Additionally, Amazon VPC enables you to create a connection between your corporate datacenter and your VPC and leverage the AWS cloud as an extension of your corporate datacenter.

VPN Connection

A hardware VPN connection between your VPC and corporate datacenter.

Direct Connect - <http://aws.amazon.com/directconnect>

Direct Connect enables to establish a dedicated/private network connection between your corporate network and your VPC.

Components of Amazon VPC

Elastic IP Address (EIP)

An Elastic IP Address is a publicly addressable Internet IP address that you can allocate to your account. Once you allocate an EIP to your account you can then assign it to an instance so the instance has a consistent IP address. EIPs can also be used to allow instances within a public subnet of a VPC to communicate directly with the Internet.

Elastic Network Interfaces (ENI)

An Elastic Network Interface is a virtual object can be attached to an Amazon EC2 instance in a VPC. When attached, the ENI functions as an additional network interface on the Amazon EC2 instance – it can send and receive traffic with other resources on the network. You can use it to create a management network, create dual homed instances that cross subnets, or even utilize network and security appliances in your VPC.

Deployment & Management

AWS Management Console - <http://aws.amazon.com/console/>

The AWS Management Console is web interface for deploying and managing Amazon Web Services resources.

AWS Command Line Interface (CLI) - <http://aws.amazon.com/cli/>

The AWS CLI provides a command line interface for deploying and managing AWS resources.

AWS CloudFormation - <http://aws.amazon.com/cloudformation/>

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).

AWS CloudWatch - <http://aws.amazon.com/cloudwatch>

Amazon CloudWatch enables you to monitor your Amazon EC2 resources in real-time. 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 Support – <http://aws.amazon.com/premiumsupport>

AWS Basic Support is included in the use of AWS services at no additional charge. AWS Basic Support offers all AWS customers access to the AWS Resource Center, AWS Service Health Dashboard, AWS Product FAQs, and AWS Discussion Forums. Customers who desire a deeper level of support can subscribe to AWS Premium Support for an additional fee.

AWS Premium Support is a one-on-one, fast-response support channel that is staffed 24x7x365 with experienced and technical support engineers. The service helps customers of all sizes and technical abilities to successfully utilize the products and features provided by Amazon Web Services.

Planning

The process of implementing SAP solutions on AWS is very similar to the process of implementing SAP solutions on traditional infrastructure. The following section focuses on the special considerations you need to plan for when implementing SAP solutions on AWS.

SAP Notes

Before implementing an SAP solution on AWS you should read and follow all of the relevant SAP notes. The SAP notes contain the most recent 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 #	Note Description
1588667	SAP on AWS: Overview of related SAP Notes and Web-Links
1656250	SAP on AWS: Support prerequisites
1656099	SAP on AWS: Supported SAP, DB/OS and AWS EC2 products
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

SAP Licenses

Two licensing models are available for running SAP solutions on Amazon EC2:

Bring-Your-Own-License (BYOL)

Primary licensing model for SAP solutions on AWS is a Bring-Your-Own-License (BYOL) model. You can use your existing SAP licenses for systems running on Amazon EC2. AWS does not provide or sell SAP licenses. You are responsible for providing a valid SAP license and must insure that you are in compliance with SAP's licensing policies.

On-Demand / License Included

There are some SAP solutions available on Amazon EC2 with an on-demand/included license. For a list of the SAP solutions that are currently available with an on-demand/included license, see

<http://aws.amazon.com/sap>

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 insure that the SAP kernel is at the required patch level. If a hardware key is generated before patching the SAP kernel and then 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

SAP System Deployment Options

Two options are available for deploying SAP solutions on Amazon EC2:

Standard SAP Installation

Primary option for deploying SAP applications on Amazon EC2 is the standard SAP installation procedure for the particular SAP solution. Detailed guidance how to install an SAP application on Amazon EC2 is provided later in this guide.

Pre-Built SAP Images

There are some SAP solutions available as pre-built system images on Amazon EC2. A pre-built SAP system image contains a pre-installed and pre-configured SAP solution that enables you to provision a new SAP system by launching a new Amazon EC2 instance from the system image.

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

- AWS Marketplace
- SAP Trial Systems
- SAP Developer Images
- SAP Cloud Appliance Library

To learn which SAP solutions are available as pre-built system images and the different sources for pre-built system images, see <http://aws.amazon.com/sap>

Regions and Availability Zones

Amazon EC2 provides the ability to place instances in multiple locations. 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

The following factors should be considered when deciding on which AWS Region to deploy your SAP solutions in:

1. Proximity to your data center / corporate network to reduce network latency between systems running on AWS and systems and users on your corporate network.
2. The AWS services and instance types required are available in the region. For a detailed list of AWS products and services by region, see <http://aws.amazon.com/about-aws/globalinfrastructure/regional-product-services/>

Availability Zone Considerations

No special considerations are required when choosing the initial Availability Zone to begin your SAP implementation in. Once an Availability Zone has been chosen all SAP applications (ERP, CRM, SRM, etc.) and systems (DB, CI, applications servers) should be deployed in the same Availability Zone. If High Availability is a requirement then multiple Availability Zones should be utilized. For more information on High Availability see the [SAP on AWS High Availability Guide](#).

For additional information on Regions and Availability Zones see the [Using Regions and Availability Zones](#) and [Region and Availability Zone FAQ](#) sections of the Amazon EC2 User Guide.

Network

Amazon EC2 supports the following network platforms. Your AWS account is capable of launching instances either into both platforms or only into EC2-VPC, on a region by region basis.

Platform	Description
EC2-Classic	Your instances run in a single, flat network that you share with other customers. Instances are assigned both a private and public ip address.
EC2-VPC	Your instances run in a virtual private cloud (VPC) that's logically isolated to your AWS account. Depending on the type of VPC and subnet instances may be assigned only a private ip address or both a private and public ip address.

For information about how you can tell which platforms you can launch instances into, see [Detecting Your Supported Platforms](#) in the *Amazon Virtual Private Cloud User Guide*.

For additional information on the difference between EC2-Classic and EC2-VPC, see [EC2 supported platforms](#)

Choosing a Network Platform

EC2-Classic Network

The EC2-Classic network is only recommended for SAP demo/training/test/POC type systems and simple SAP environments that do not require integration between multiple SAP solutions.

EC2-VPC Network

For most SAP on AWS use cases and scenarios the Amazon VPC network is the recommended network platform. With Amazon VPC network instead of the EC2-Classic network, you gain the ability to:

- Assign static private IP addresses to your instances that persist across starts and stops
- Assign multiple IP addresses to your instances
- Define network interfaces, and attach one or more network interfaces to your instances
- Change security group membership for your instances while they're running
- Control the outbound traffic from your instances (egress filtering) in addition to controlling the inbound traffic to them (ingress filtering)
- Add an additional layer of access control to your instances in the form of network access control lists (ACL)
- Run your instances on single-tenant hardware (optional)

Amazon VPC – Additional Information

Creating a VPC

For detailed instructions how to setup and configure a VPC and the connection between your network and VPC please read the VPC documentation at <http://aws.amazon.com/documentation/vpc/>

Connectivity Options for Amazon VPC

Described below are the two primary options for connecting a VPC to your corporate network / data center:

Hardware VPN

A physical VPN router (e.g. Cisco ISO / Juniper) on your network connected to a VPN concentrator on the Amazon side of the VPN connection. For additional information, see http://docs.aws.amazon.com/AmazonVPC/latest/UserGuide/VPC_VPN.html

AWS Direct Connect

A dedicated network connection between your network and one of the AWS Direct Connect locations using industry standard 802.1q VLANs. For additional information, see <http://aws.amazon.com/directconnect/>

Reference VPC Architectures

The following Amazon VPC reference architectures can be found in the Appendix section of this guide:

Hybrid Architecture

SAP DEV/QAS landscapes running on AWS integrated with SAP PRD landscape running on-premises

Full Hosting on AWS

Complete SAP environment (DEV/QAS/PRD, SolMan, SAProuter, etc.) running on AWS

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 please visit the [AWS Security and Compliance Center](#) and read the following guides:

- [Amazon Web Services Overview of Security Processes whitepaper \(pdf\)](#)
- [Security Best Practices \(pdf\)](#)

The foundation for security of an SAP environment on AWS is the use of Amazon VPC for providing the overall isolation. Within Amazon VPC there are security details that you must set up to enable proper access and restriction to 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 how to setup and managed security within an Amazon VPC please 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 IO capabilities. Non-production SAP systems can be run on any Amazon EC2 instance type while production SAP systems must be run on one of the SAP-certified Amazon EC2 instances types. The list of SAP-certified instances types approved for productive use can be found in SAP note # 1656250.

For a detailed description of the different Amazon EC2 instance types please see: <http://aws.amazon.com/Amazon-EC2/instance-types>

Amazon EC2 Instance Types - SAPS Ratings

Each of the SAP-certified Amazon EC2 instances types have been benchmarked using the standard SAP benchmarking procedure. The SAPS rating of each SAP-certified instance can be found in SAP note #1656250.

Operating Systems

The table below lists the operating systems that are available on Amazon EC2 for deployment of SAP solutions. Specific details of the required OS versions and patch levels for the operation of production SAP systems on AWS can be found in SAP note # 1656250.

Operating System
SUSE Linux Enterprise Server
Red Hat Enterprise Linux
Windows Server

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.

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 a new Amazon EC2 Instance before installing an SAP solution on the Instance. For additional information about the allowed hostname length and characters, see SAP note #611361.

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

- **SUSE**

- 1) Start yast
- 2) Navigate to Network Devices -> Network Settings (press enter)
- 3) Select Hostname/DNS in the menu
- 4) Change the values of the Hostname and Domain Name fields as required
- 5) Uncheck "Change Hostname via DHCP"
- 6) F10 (to save)
- 7) F9 (to exit)

- **Red Hat**

- Edit file */etc/sysconfig/network*
- Change parameter HOSTNAME and replace value with the new hostname
- Restart OS

Special Considerations for Windows

- **Windows Computer Name**

When a new Windows Amazon EC2 instance is launched it is assigned a generated Computer Name. You must change the Computer Name of a new Amazon EC2 Instance to meet the requirements of an SAP system before installing an SAP solution on the Instance. For additional information about the allowed hostname length and characters, see SAP note #611361.

- **Amazon EC2ConfigService**

Amazon Windows AMIs contain a service installed by Amazon Web Services; the Amazon EC2Config service. Although optional, this service 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 start the instance. It can also perform tasks on demand. Some of these tasks are automatically enabled, while others must be enabled. Amazon EC2Config uses settings files to control its operation. You can update these settings files using either a graphical tool or by directly editing XML files. To learn more about the EC2ConfigService, see the [Amazon EC2 Windows User Guide](#).

- **Updated PV Drivers**

On 3/27/2012 new AMIs for Windows 2003 R2, 2008 and 2008 R2 that included new para-virtualized (PV) drivers. The new PV driver offers the following benefits:

- Launch any Microsoft Windows Server AMI (2003 R2 to 2012, 64 bit) on any instance type
- Increase your Microsoft Windows Server instance storage by mounting up to 25 EBS volumes
- Improved network reliability and performance

An update script is available to update the PV drivers on existing Windows 2003 R2, 2008 and 2008 R2 instances that were created before 3/27/2013. The update script is available for download on the [AWS PV driver for Microsoft Windows Server page](#).

Databases

When deploying an SAP solution on Amazon EC2 you must install, configure and managed the required database system in the same manner as you would on any other physical or virtual server. For production SAP systems you must use one of the SAP-certified for AWS databases listed in SAP note # 1656250. For non-production SAP systems you may use any database listed in the Product Availability Matrix (PAM) of the particular 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 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 table describes the primary storage options and their primary uses for SAP solutions.

Storage Type	Description and Use
Instance Store	<ul style="list-style-type: none"> 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 persistent beyond the runtime of the instance <p><u>SAP Uses</u> – OS swap</p>
Amazon EBS	<ul style="list-style-type: none"> Persistent block level storage volumes for use with Amazon EC2 instances Two type: <ul style="list-style-type: none"> Standard Provisioned IOPS <p><u>SAP Uses</u> – SAP/DB software / DB log files / DB data files / Intermediate backup storage</p>
Amazon S3	<ul style="list-style-type: none"> Object/file based storage Highly available and durable Not intended to be used as a file system <p><u>SAP Uses</u> – Backups and SAP Archiving storage</p>

SAP Support and Monitoring

To ensure full support of SAP solutions on AWS you must follow the guidelines in SAP note # 1656250 - *SAP on AWS: Support prerequisites*.

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. The primary steps to enable SAP monitoring on AWS are:

- ✓ **AWS CloudWatch Detailed Monitoring** must be enabled on each Amazon EC2 instance to ensure that the required AWS metrics are provided in one-minute intervals. For additional information on Amazon CloudWatch please see <http://aws.amazon.com/cloudwatch>
- ✓ **AWS Data Provider for SAP** must be installed, configured and running 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 AWS CloudWatch. For detailed installation instructions of the AWS Data Provider for SAP, see SAP note# 1656250

SAP Installation Media

There are two primary options for copying SAP installation media to Amazon EC2. Each method is described below:

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 since Amazon EC2 instances have very fast connections to the Internet. You can create a dedicated EBS volume to store installation media which can then be attached to different Instances as needed. You can also create a Snapshot of the EBS volume and create multiple EBS 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 Solution Manager and SAProuter

The following section describes options for SAP Solution Manager and SAProuter when running SAP solutions on AWS. For additional information see the VPC reference architecture diagrams in the appendix section of this guide.

Hybrid Architecture

When using AWS as an extension to your IT infrastructure you can use your existing SAP Solution Manager system and SAProuter running in your datacenter to manage SAP systems running on AWS within a VPC. See the reference VPC architecture diagram in the Appendix section for additional information.

Full Hosting on AWS

When setting up an SAP environment on AWS, as with any infrastructure, you will need to setup an SAP Solution Manager system and a SAProuter with a connection to the SAP support network.

Solution Manager

No special considerations are needed when setting up and configuring an SAP Solution Manager on Amazon EC2.

SAProuter and connection to the SAP support network

When setting a the SAProuter and SAP support network connection the following guidelines should be followed:

- The instance that the SAProuter software will be installed on should be launched into a public subnet of a VPC and should be 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
- The type of Internet connection that should be used is **Secure Network Communication (SNC)**, see <https://service.sap.com/internetconnection>

High Availability

For guidelines on the planning and setup of high availability for SAP solutions on AWS see the [SAP on AWS High Availability Guide](#)

Backup and Recovery

For guidelines on the planning and setup of a backup and recovery strategy for SAP solutions on AWS see the [SAP on AWS Backup and Recovery Guide](#)

Sizing and Performance

SAP Sizing - SAPS

Sizing of SAP systems on AWS uses the standard SAP sizing procedure. Information about SAP sizing can be found at <http://service.sap.com/sizing>

The first step of any SAP sizing is to use the **SAP Quick Sizer** to determine the SAPS needed to support your business requirements. Once you know the SAPS required you can then use the SAPS ratings of the SAP-certified Amazon EC2 instance types listed in SAP note # 1656099 to architect your SAP system.

AWS is continually introducing new Amazon EC2 instance types and enhancing the AWS platform. You should frequently check SAP note # 1656099 for the latest SAPS ratings of the different Amazon EC2 instance types.

I/O and Storage Performance

Instance I/O Performance

Amazon EC2 provides virtualized server instances. While some resources like CPU, memory and instance storage are dedicated to a particular instance, other resources like 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. Each of the instance types has an I/O performance indicator (low, moderate, or high). Instance types with high I/O performance have a larger allocation of shared resources. Allocating larger share of shared resources also reduces the variance of I/O performance. For many applications, low or moderate I/O performance is more than enough. However, for those applications requiring greater or more consistent I/O performance like SAP, you may want to consider instances with high I/O performance.

The I/O performance indicator for each of the different Amazon EC2 instance types can be found at <http://aws.amazon.com/Amazon-EC2/instance-types>

Standard Instances / EBS Optimized Instances

Standard Amazon EC2 instance types use a shared interface for network and I/O throughput. Certain standard instance types are available as EBS-Optimized instances. An EBS-Optimized instance uses an optimized configuration stack and provides additional, dedicated capacity for EBS I/O. EBS-Optimized instances deliver dedicated throughput between Amazon EC2 and Amazon EBS, with options between 500 Mbps and 1000 Mbps depending on the instance type used. When you use an EBS-Optimized instance, you pay an additional low, hourly fee for the dedicated capacity.

To see which Amazon EC2 instance types are available in as an EBS-Optimized instances, see - <http://aws.amazon.com/Amazon-EC2/instance-types/>

Cluster Compute Instances

Like standard instances Cluster Compute instances use a shared interface for network and I/O throughput. Cluster Compute instances have very high I/O performance using 10 Gigabit Ethernet.



Instance I/O Performance Recommendation

For SAP production systems and other system types that need high I/O performance it is recommended to use an EBS-Optimized or Cluster Compute instance type when available.

Amazon EBS Volume Performance

Amazon EBS provides two volume types: Standard volumes and Provisioned IOPS volumes. The different 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 of either type to increase the I/O performance available to your applications.

Two types of EBS:

Standard EBS volumes offer cost effective storage for applications with moderate or bursty I/O requirements. Standard volumes deliver approximately 100 IOPS on average with a best effort ability to burst to hundreds of IOPS. Standard volumes are also well suited for use as boot volumes, where the burst capability provides fast instance start-up times.

Provisioned IOPS volumes are designed to deliver predictable, high performance for I/O intensive workloads such as databases. With Provisioned IOPS, you specify an IOPS rate when creating a volume, and then Amazon EBS provisions that rate for the lifetime of the volume. Amazon EBS currently supports up to 2000 IOPS per Provisioned IOPS volume. You can stripe multiple volumes together to deliver thousands of IOPS per Amazon EC2 instance to your application.

Volume Stripping

If the total IOPS or total GBs required for one file system exceeds the maximums of a single Amazon EBS volume then multiple Amazon EBS volumes can be striped together to achieve a greater level of IOPS and total GBs. Stripping can be used with both Standard and Provisioned IOPS EBS volumes.

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*.

EBS Performance Recommendation

For SAP production systems and other SAP system types that require high I/O performance it is recommended to use Provisioned IOPS EBS volumes. Standard EBS volumes are well suited for SAP test, demo, POC type systems.

Sample EBS Configurations

Sample EBS configurations for different SAP system types can be found in the Appendix section of this guide.

Implementation

This section provides a high level overview of the steps required to implement SAP solutions on AWS.

Create an Amazon EC2 Account

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

To sign up for AWS

1. Go to <http://aws.amazon.com> and click **Sign Up Now**.
2. Follow the on-screen instructions.

Choose an AWS Region

Before provisioning any new AWS resources you need to determine which AWS region you will use. See the resources listed below for information to help you decide which AWS region to use.

- Read the *Planning – 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 Users Guide

Note: When you first log into the AWS Management Console your account will be set to a default region. Before provisioning any new resources you need to make sure the correct region is chosen. See the [Launch an Instance from an AMI](#) section of the Amazon EC2 User Guide for instructions how to set the region within the AWS Management Console.

Network Setup and Configuration

The next step before launching new Amazon EC2 instances is to setup and configure the network. See the resources listed below for information to help you with the planning and setup of an Amazon VPC.

- Read the *Planning – Network* section of this guide
- View the [Amazon VPC Documentation](#) for detailed instructions how to setup and configure a VPC and the connection between your network and your VPC
- See the VPC reference architectures in the Appendix section of this guide
 - [Reference VPC Architecture 1 – Complete SAP Environment on AWS](#)
Complete SAP environment (DEV/QAS/PRD, Solution Manager, SAProuter, etc.) running on AWS integrated with on-premises systems and users via VPN or AWS Direct Connect
 - [Reference VPC Architecture 2 - Hybrid SAP Architecture on AWS](#)

SAP DEV/QAS landscapes and/or SAP test/training/POC systems running on AWS integrated with SAP PRD landscape running on-premises

Server Setup and Configuration

Once your network has been set up you can begin the task of creating the various server instances required to support your SAP deployment. The follow section provides the high level steps you need to perform to prepare new Amazon EC2 instances for the installation of an SAP solution:

- 1) **Choose AMI** - The first step to provision a new Amazon EC2 instance is to choose the base operating system AMI you will use. 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, SUSE Linux and Red Hat Linux AMIs follow the steps below:
 - 1) Log into the [AWS Management Console](#)
 - 2) Select **Instances** in the left frame
 - 3) Click on the **Launch Instance** button
 - 4) Choose **Classic Wizard** and then click on **Continue**
 - 5) The latest versions of the Windows, SUSE and Red Hat AMIs can be found on the **Quick Start** tab
- 2) **Choose Instance Type** – The next step before launching a new instance is to choose the instance type or virtual machine size you will launch your new instance on. Use the resources below to help decide which instance type(s) are best based on your specific requirements.
 - Read *Planning and Sizing and Performance* sections in this guide
 - List of Amazon EC2 instance types - <http://aws.amazon.com/ec2/instance-types/>
 - Read [Instance Basics](#) section of the Amazon EC2 Users Guide
 - See SAP note #1656099 for SAPS ratings for SAP-certified for production instance types

*Note: SAP certified instances types are only required for production systems
- 3) **Launch Instance(s)** – Once you know the AMI(s) and instance type(s) you will use you can begin the process of launching the required server instances. Detailed steps for launching and connecting to new Windows and Linux instances can be found at the links below:
 - [Getting Started with Amazon EC2 Linux Instances](#)
 - [Getting Started with Amazon EC2 Windows Instances](#)
- 3) **Configure 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.
- 4) **Provision and Configure Storage** – Use the list of resources below 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 *Planning – Storage* and *Sizing and Performance* sections in this guide
 - Read the [Storage](#) section of the Amazon EC2 Users Guide

- Read the [Increasing EBS Performance](#) section of the Amazon EC2 Users Guide
- See the appendix section of this guide for sample EBS configurations

5) **Prepare SAP installation media** – See *SAP Installation Media* in the previous section of this guide

6) **Create AMI backup** – Before you proceed with the installation of the SAP solution it is recommend that you create an image of the instance at this point to capture all of the work that has been done. For detailed instructions how to create an image ee the [Creating AMIs](#) section of the Amazon EC2 User Guide.

Installing 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 following the standard SAP installation processes documented in the SAP installation guide.

Post-Installation

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

Create AMI backup – Once you have completed the SAP installation and post-installation steps you should create an image of the instance. For detailed instructions how to create an image, read the [Creating AMIs](#) section of the Amazon EC2 User Guide.

Next Steps

Backup and Recovery

For guidelines on the planning and setup of a backup and recovery strategy for SAP solutions on AWS see the [SAP on AWS Backup and Recovery Guide](#)

Operations

For guidelines on the planning and setup of a backup and recovery strategy for SAP solutions on AWS see the [SAP on AWS Operations Guide](#)

High Availability

For guidelines on the planning and setup of high availability for SAP solutions on AWS see the [SAP on AWS High Availability Guide](#)

Appendix:

How to Migrate an SAP System to AWS

This section describes the different options available to migrate an existing SAP systems to Amazon EC2.

VM Import / Export

AWS VM Import/Export enables 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 about VM Import/Export, see <http://aws.amazon.com/ec2/vmimport/>

SAP Homogeneous/Heterogeneous System Copy

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

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

- 1) Create export of the source system using *sapinst*
- 2) Copy/ship the export / DB backup data to Amazon EBS or Amazon S3 (see guidelines below)
- 3) Install new target system on Amazon EC2 using *sapinst* to import the export of the source system

Copy SAP export / DB backup data to Amazon EC2

The two primary options for copying SAP export/backup data to Amazon EC2 are 1) network copy or 2) ship data via AWS Import/Export service. Each method is described below:

Option 1 – Network copy

For SAP systems with export / DB backup data sizes less than 1TB it is possible to copy the data over the network directly to the target Amazon EC2 instance or to Amazon S3. Many factors will impact the time to copy an SAP export / DB backup to AWS: like amount of data, speed/bandwidth of network connection, ability to load data in parallel. Various open source and commercial file transfer acceleration utilities and services exist that can greatly reduce the amount of time to transfer data to AWS. To find a commercial file transfer acceleration utility or service offered by an AWS partner, see the [AWS Partner Network](#). An open source utility that has been used successfully by many customers is Tsunami UDP - <http://tsunami-udp.sourceforge.net>

Option 2 – Ship data using Amazon Import/Export service

For SAP systems with export / DB backup data sizes greater than 1TB the recommended method for transferring the data to AWS is the AWS Import/Export service. The Amazon Import/Export service enables you to ship data on portable storage devices to AWS. The data can be copied to one of your Amazon S3 buckets or to an EBS snapshot that can be used to create a new EBS volume. You can then download the data from Amazon S3 directly to your Amazon EC2 instance via the local AWS high speed network or create a new EBS volume from the snapshot.

Amazon Import/Export enables you to import data from your storage device to an Amazon S3 bucket, an Amazon EBS snapshot. The import to Amazon EBS snapshot option is currently limited to 1TB. In order

to utilize the import to EBS option the physical device shipped to AWS must be less than or equal to 1TB.
For additional information see [Creating Amazon EBS Import Jobs](#)

For additional information on the Amazon Import/Export services please visit:
<http://aws.amazon.com/importexport>

Sample EBS Configurations

This section provides a few sample EBS configurations for sample SAP systems.

When configuring Amazon EC2 instances and storage for the deployment of an SAP solution you have many different options to choose from on how to best configure the instance and storage. Which configuration is best for your scenario will be dependent on factors like:

- IO performance requirements
- Cost
- Level of administrative effort to setup, configure and manage

Sample EBS Configuration - #1

System Description:

- Small SAP test/training/POC type system installed as a Central System on one server

Requirements / Characteristics:

- Low IO performance requirements
- Low level of administration
- Minimized cost: only EBS standard volumes used

Linux

File system	# of EBS Volumes	Volume Type	GB p/volume	GB Total	IOPS p/volume	IOPS Total	Striping
/ [root]	1	Standard	30	30	N/A	N/A	No
/ [usr/sap]	1	Standard	300	300	N/A	N/A	No

Windows

File system	# of EBS Volumes	Volume Type	GB p/volume	GB Total	IOPS p/volume	IOPS Total	Striping
C:\	1	Standard	30	30	N/A	N/A	No
G:\	1	Standard	300	300	N/A	N/A	No

Sample EBS Configuration - #2

System Description:

- Small to medium SAP DEV/test/training/POC type system installed as a Central System on one server.
- System requires higher level of IO performance than sample EBS configuration #1

Requirements / Characteristics:

- Moderate IO performance requirements
- Moderate level of administrative effort to setup and manage multiple volumes and striped file system
- Minimized cost: only EBS standard volumes used. Increasing number of standard EBS volumes does not increase cost

Linux

File system	# of EBS Volumes	Volume Type	GB p/volume	GB Total	IOPS p/volume	IOPS Total	Striping
/ [root]	1	Standard	10	30	N/A	N/A	No
/ [usr/sap]	8	Standard	65	520	N/A	N/A	Yes

Windows

File system	# of EBS Volumes	Volume Type	GB p/volume	GB Total	IOPS p/volume	IOPS Total	Striping
C:\	1	Standard	30	30	N/A	N/A	No
G:\	8	Standard	65	520	N/A	N/A	Yes

Sample EBS Configuration - #3

System Description:

- Medium to large SAP PRD/QAS system
- Distributed / 3-tier deployment across multiple instances (DB, CI and multiple DI instances)

Requirements / Characteristics:

- Sample SAP sizing requirements: 24,000 SAPS 6,000 IOPS
- Moderate to high level of administrative effort to setup and manage multiple volumes and striped file systems
- Higher cost due to use of Provisioned IOPS volumes to meet high IO requirements of a production SAP system
- To enable instance to fully utilize the IOPS provisioned on an EBS volume, "EBS-Optimized" instance or Cluster Compute instance type should be used

Linux

File system	# of EBS Volumes	Volume Type	GB p/volume	GB Total	IOPS p/volume	IOPS Total	Striping
Root	1	Standard	10	10	N/A	N/A	No
/swap	1	Standard	100	100	N/A	N/A	No
/usr/sap	1	Standard	100	100	N/A	N/A	No
/[DB log &data files]	3	PIOPS	500	1,500	2,000	6,000	Yes

Windows

File system	# of EBS Volumes	Volume Type	GB p/volume	GB Total	IOPS p/volume	IOPS Total	Striping
C:\	1	Standard	30	30	N/A	N/A	No
G:\ [swap]	1	Standard			N/A	N/A	No
H:\ [usr/sap]	1	Standard			N/A	N/A	No
I:\ [DB log & data files]	3	PIOPS	500	1,500	2,000	6,000	Yes

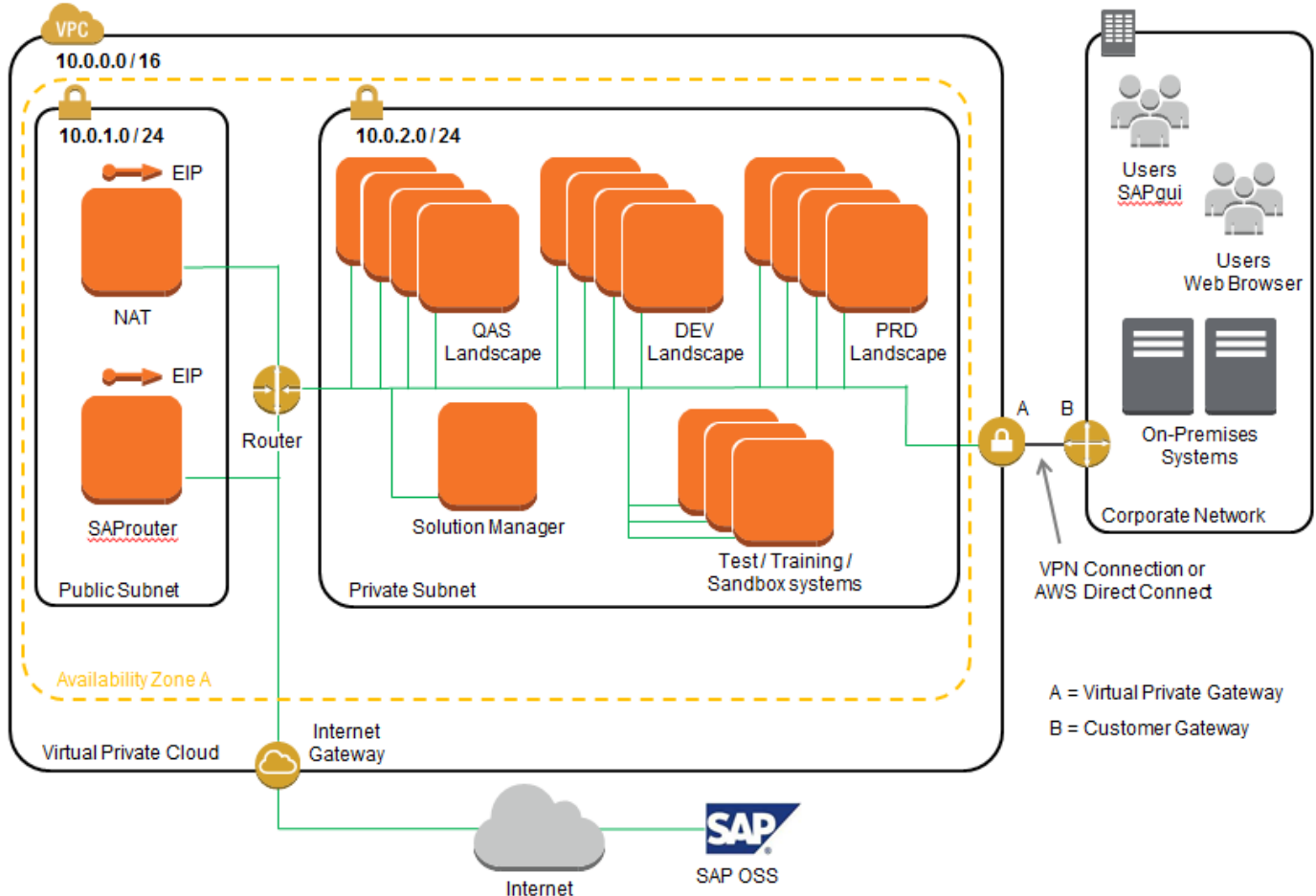
Reference VPC Architecture 1

Complete SAP Environment on AWS

The diagram below depicts a complete SAP environment (DEV/QAS/PRD, Solution Manager, SAProuter, etc.) running on AWS integrated with on-premises systems and users via a VPN connection or AWS Direct Connect. The SAProuter is run in a public subnet and is assigned an Elastic IP (EIP) address to enable integration with the SAP OSS network via a VNC connection. The NAT instance in the public subnet enables instances in the private subnet to initiate outbound traffic to the Internet, but prevent the instances from receiving inbound traffic initiated by someone on the Internet (see [NAT](#) documentation).

Notes:

- Only a single Availability Zone architecture is shown. If you require HA please 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 how to setup and managed security within an Amazon VPC please see the [Security in Your VPC](#) section of the Amazon VPC User Guide.



Reference VPC Architecture – 2

Hybrid SAP Architecture on AWS

The diagram below depicts SAP DEV/QAS landscapes and/or SAP test/training/POC systems running on AWS integrated with SAP systems and users on the corporate network. Connectivity between the Amazon VPC and the corporate network is enabled with either a VPN connection or 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 VPC.

Notes:

- Only a single Availability Zone architecture is shown. If you require HA please 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 how to setup and managed security within an Amazon VPC please the [Security in Your VPC](#) section of the Amazon VPC User Guide.

