Backup and Recovery

of SAP Systems

on Windows / SQL Server

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Contents

### About this Guide

What is not included in this guide

### Prerequisite and Additional Documentation

- Prerequisite Documentation
- Additional Documentation

### SAP / MS SQL Server Notes

### SAP on AWS Notes

### Overview of AWS Services for Backup and Recovery

### Backup Destination on AWS

### Backup and Recovery of non-Production Systems

- Create Image Backup Method
  - How to execute an ad-hoc backup using Create Image
  - How to schedule a backup using Create Image
  - How to restore a system that was backed up using Create Image
- Other Backup Methods for non-Production Systems

### Backup and Recovery of Production Systems

- Backup to Amazon EBS Volume
  - Copying backup data to and from Amazon S3
- Backup and Recovery without 3rd party backup software
- Operating System and File System Backup and Recovery
- Database and Transaction Log Backup, Restore and Recovery
- Backup and Recovery using 3rd party backup software
  - Using 3rd party backup software on AWS
  - 3rd party backup software that supports direct backup to Amazon S3
About this Guide

This guide provides an overview of how to backup SAP systems running on Microsoft Windows Server and Microsoft SQL Server on Amazon Web Services (AWS). This guide is not intended to replace any of the standard SAP or Microsoft documentation. This guide focuses on the essential differences in backing up SAP systems on AWS as compared to traditional infrastructure.

Different backup options and methods are provided for non-production (sandbox, training, demo, POC, etc.) and production systems.

What is not included in this guide

This guide does not include detailed instructions how to execute Windows Server or SQL Server backups using either native Windows Server and SQL Server backup/recovery features or 3rd party backup tools. Please refer the standard Windows Server and MS SQL Server documentation or the documentation provided by the backup software vendor.

Backup schedules, frequency, and retention periods, are primarily based on your system type and business requirements. Please refer to the standard SAP and Microsoft documentation for guidance for these topics.

Prerequisite and Additional Documentation

Prerequisite Documentation

This document assumes that you are already familiar with implementing and operating SAP solutions on Amazon Web Services. If you have not already read the SAP on AWS Implementation Guide and the SAP on AWS Operations Guide, please read these guides before continuing. The guides can be found at the following URL: [http://aws.amazon.com.sap](http://aws.amazon.com.sap)

Additional Documentation

As mentioned earlier, this guide does not provide detailed instructions how to execute Windows Server or SQL Server backups or provide recommendations for backup frequencies or retention. For this information please refer to the standard SAP and Microsoft Server and SQL Server documentation.

- **SAP with SQL Server Best Practices Guide**
  - [http://scn.sap.com/docs/DOC-1006](http://scn.sap.com/docs/DOC-1006)

- **SAP Library (help.sap.com) – Backup with MS SQL Server**
  - [http://help.sap.com/saphelp_nw73ehp1/helpdata/EN/44/fee1419c9224dee10000000a114a6b/frameset.htm](http://help.sap.com/saphelp_nw73ehp1/helpdata/EN/44/fee1419c9224dee10000000a114a6b/frameset.htm)

- **Backup and Recovery Overview for Windows Server 2008 R2**

- **SQL Server 2008 - Backing Up and Restoring How-to Topics (SQL Server Management Studio)**
Overview of AWS Services for Backup and Recovery

This section provides an overview of the different AWS services that are required for the backup and recovery or SAP systems running on AWS. For a more detailed description of each service please refer to the links provided.

Amazon S3 provides a highly durable storage infrastructure designed for mission-critical and primary data storage. Amazon S3 is designed to provide 99.999999999% durability and 99.99% availability over a given year.

⚠️ Amazon S3 in the center of any SAP backup and recovery solution on AWS. All backups methods described in this document rely on backup data being stored in Amazon S3.

The Amazon Elastic Compute Cloud (EC2) is an IT infrastructure platform that provides on-demand access to virtual Linux and Windows servers, storage, networking, and other infrastructure services.

**Components of Amazon EC2**

**Amazon Machine Image (AMI)**
An AMI is the server template that is used to launch a new instance (virtual server). The AMI contains the base operating system (Linux/Windows) that you can then install SAP software on top of. A large selection of public AMIs is available from Amazon and the Amazon EC2 community and it is possible to create your own AMIs.

**Instance**
After an AMI is launched, the resulting running system is called an instance.
Regions and Availability Zones
Amazon EC2 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 provide inexpensive, low latency network connectivity to other Availability Zones in the same Region.

**Regions** consist of one or more Availability Zones, are geographically dispersed, and will be in separate geographic areas or countries. Amazon EC2 is currently available multiple regions. For a current list of regions please visit:

http://aws.amazon.com/about-aws/globalinfrastructure/

AWS Elastic Block Store (EBS) provides persistent block level storage volumes for use with EC2 instances. EBS volumes are off-instance storage that persists independently from the life of an instance. Elastic Block Store provides highly available, highly reliable storage volumes that can be attached to an Amazon EC2 instance and exposed as a device within the instance’s guest operating system.

**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 EBS volumes as well as 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.

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.

Backup Destination on AWS
The primary difference between backing up SAP systems on Amazon Web Services compared to traditional on-premises infrastructure is the backup destination. The typical backup destination used with on-premises infrastructure is tape. On AWS, instead of storing backups on tape, backups are stored in Amazon S3. There are many benefits to storing backups in Amazon S3 vs. tape. Backups stored in Amazon S3 are automatically stored “offsite” from the source system since data in Amazon S3 is replicated across multiple facilities within the AWS region.

There are primarily two different methods to store backups in Amazon S3. The first method is to backup data directly into Amazon S3, the second method involves backing up your data to a locally attached EBS volume and then subsequently copying this data into Amazon S3. Details how to copy backup data from an EBS volume into Amazon S3 are provided later in this document.
Backup and Recovery of non-Production Systems

This section provides backup options for non-production systems. Examples of non-production systems are:

- Demo systems
- Training systems
- Sandbox systems
- Proof-of-Concept systems
- Trial systems

Systems of this type share the following backup requirements:

- Infrequent backups (1-2 times per week)
- Do not require point-in-time recovery
- Can tolerate downtime to complete a backup
- Simple low cost backup solutions

Create Image Backup Method

The Amazon EC2 Create Image function can be used to create full (OS, application, and database file systems) offline backups of an SAP system. Executing a Create Image creates and registers a new Amazon Machine Image (AMI) of the running instance and creates snapshots of all EBS volumes attached to the instance. Create Image can also be used to copy complete SAP systems with very little effort. The AMI created during the Create Image process can then be used to launch additional Amazon EC2 instances that are identical to the source SAP system.

Please note that in order to enable a consistent backup, the instance is stopped at the beginning of the create image process to help ensure all I/O to the EBS volumes is quiesced. The instance is only stopped for a short period of time and is restarted while the EBS snapshot creation is continued in the background.

The following graphic show the Create Image process:

Figure 1: The Create Image process
How to execute an ad-hoc backup using Create Image

You can execute a create image from within the AWS Management Console by simply right clicking on the instance you would like to backup and selecting Create Image (EBS AMI).

For detailed documentation of the Create Image process please read the Creating Amazon EBS-Backed AMIs section of the Amazon EC2 User Guide:

How to schedule a backup using Create Image

You can schedule backups using the Create Image method using the Amazon EC2 API command line tools. The Amazon EC2 API command line tools allow you to manage Amazon EC2 resources from Windows or Linux command shell. Included in the Amazon EC2 API tools is the `ec2-create-image` command that it used to create an AMI from and existing Amazon EC2 instance.

Below is the syntax and an example how to create a new AMI using the `ec2-create-image` command:

Syntax: ec2-create-image

PROMPT> ec2-create-image -n <your_image_name> <instance_id>

Example: ec2-create-image

PROMPT> ec2-create-image -n ECC_Demo_20120401 i-eo9483uj

How to schedule the Create Image process:

1) Install and configure the Amazon EC2 API command line tools on a server on your corporate network or on another Amazon EC2 Windows instance (this can be a dedicated administration system used for tasks like this).
2) Create a batch script that contains the `ec2-create-image` command with the necessary parameters to create an image of the instance you wish to backup.
3) Schedule the batch script to run when you would like the Create Image process to take place using the Task Scheduler built into Windows.

Detailed information on the `ec2-create-image` and other Amazon EC2 API command line tools, including download information, are provided below.

Amazon EC2 Command Line Reference – ec2-create-image

Download - Amazon EC2 API command line tools
http://aws.amazon.com/developertools/351
Getting Started with the Command Line Tools

How to restore a system that was backed up using Create Image
Restoring a system that was backed up using the Create Image method is very simple. Since the Create Image process creates a complete image (AMI) of the instance being backed by creating snapshots of all attached EBS volumes, all that is needed to restore a system is to launch a new instance from the latest AMI version.

For detailed instruction how to launch and instance from an AMI please refer to the Amazon EC2 Users Guide:

Other Backup Methods for non-Production Systems
If you require the ability to perform online backups of non-production systems please see the backup methods discussed in the following section.
Backup and Recovery of Production Systems

The backup options covered in this section address the following backup requirements that are common for production systems:

• Frequent backups via a scheduled backup
• Online database backup
• Transaction log backup
• Point-in-time database recovery
• Closely synchronized file system and database backups

For production system, a regular restore of their backups to a separate system is strongly recommended, so that:

• Restore and recovery procedures, and Service Level Agreement (SLA) objectives can be validated
• Restored data can be checked for their consistency by using DBCC CHECKDB

Backup to Amazon EBS Volume

The backup options covered in this section involve first writing the backup data to a local “backup” Amazon EBS volume and then copying the backup data to Amazon S3 to ensure the data is protected in case of failure.

The following graphic shows how backups are first created on a local Amazon EBS volume and then the backup data is copied to Amazon S3:

Figure 3: Backup to EBS then Snapshot/Copy to S3
The table below shows a sample drive layout of an SAP Windows/SQL Server system on AWS with “backup” EBS volumes attached and mounted as Windows drives. For additional information on recommend drive/EBS configuration for SAP systems on AWS please refer to the SAP on AWS Implementation Guide referenced at the beginning of this guide.

Figure 4: Sample drive/EBS layout with backup drives/EBS volumes

<table>
<thead>
<tr>
<th>Drive</th>
<th>EBS Volumes</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>C:\</td>
<td>1</td>
<td>Root volume (included with instance)</td>
</tr>
<tr>
<td>D:\</td>
<td>1</td>
<td>SAP / MS SQL software</td>
</tr>
<tr>
<td>S:\</td>
<td>1</td>
<td>Swap</td>
</tr>
<tr>
<td>E:\</td>
<td>1</td>
<td>DB Log file</td>
</tr>
<tr>
<td>F:\</td>
<td>1</td>
<td>DB Data file 1</td>
</tr>
<tr>
<td>G:\</td>
<td>1</td>
<td>DB Data file 2</td>
</tr>
<tr>
<td>H:\</td>
<td>1</td>
<td>DB Data file 3</td>
</tr>
<tr>
<td>I:\</td>
<td>1</td>
<td>DB Data file 4</td>
</tr>
<tr>
<td>J:\</td>
<td>1</td>
<td>DB Data file 5</td>
</tr>
<tr>
<td>K:\</td>
<td>1</td>
<td>DB Data file 6</td>
</tr>
<tr>
<td>X:\</td>
<td>1</td>
<td>File system backup</td>
</tr>
<tr>
<td>Y:\</td>
<td>1</td>
<td>DB log backup</td>
</tr>
<tr>
<td>Z:\</td>
<td>1-n</td>
<td>DB backup</td>
</tr>
</tbody>
</table>

Copying backup data to and from Amazon S3

Once you have created a backup on an Amazon EBS volume, you need to copy the backup data to Amazon S3 to protect the data against failure.

Amazon S3 stores data as objects within buckets. An object is comprised of a file and optimally and metadata that describes that file. It is recommended that you create a dedicated Amazon S3 bucket to store your backups. You can use one bucket to store backups from multiple systems. To help organize backups from different systems and different backup types (i.e. file system, DB, transaction log, etc) you can create multiple folders within a bucket.

For detailed instructions how to create an Amazon S3 bucket please refer to the Amazon S3 Getting Started Guide: http://docs.amazonwebservices.com/AmazonS3/latest/psg/CreatingABucket.html

AWS provides three methods to copy data to Amazon S3:

- AWS Management Console
- AWS SDK API
- Amazon S3 REST API

Fortunately you do not need to develop your own command line interface to copy data to Amazon S3. Various command line interfaces exist that you can incorporate into a script to copy data to or retrieve data from Amazon S3. A few of these Amazon S3 command line interfaces are listed below:

- CloudBerry Labs – S3 backup command line interface
Backup and Recovery of SAP Systems on Windows / SQL Server


• s3cmd
  http://s3tools.org/s3cmd

• s3.exe
  http://s3.codeplex.com

Below are sample commands using s3cmd:

Copy a backup stored on an EBS volume to Amazon S3:

PROMPT> s3cmd put <backup_file> <s3://bucket_name/folder_name>

Retrieve a backup from Amazon S3 to an Amazon EBS volume to be used for a restore:

PROMPT> s3cmd get <s3://bucket_name/folder_name/backup_file>

Backup and Recovery without 3rd party backup software

This section describes how to backup an SAP Windows/SQL Server system using only native Windows Server and SQL Server backup software and AWS services. This option is most appropriate for a small SAP environments with only a few systems that need to be backed up so the additional cost of a 3rd party backup solution is not warranted.

Operating System and File System Backup and Recovery

Backup and recovery of the operating system and critical SAP file systems is accomplished using the Windows Server Backup feature built into Windows Server 2008 R2. The Windows Server Backup feature is not installed by default on the standard Windows Server 2008 R2 AMI but can be easily added by following the steps provided below:

1) Click on the Start button and then right click on Computer
2) Select Manage
3) On the left select Server Manager
4) On the right scroll down to Features Summary and click on Add Features
5) Select Windows Server Backup Features and then click on Install

Once the Windows Server Backup Feature installed, you can then schedule backups of the drives and/or directories that need to be backed up using the Windows Server Backup wizard.

While scheduling a backup in the Windows Server Backup wizard you will be asked to choose a Destination Type, choose Local Drives and then select the drive that is the Amazon EBS volume you wish to backup to.
Backup and Recovery of SAP Systems on Windows / SQL Server

For detailed instructions how to schedule a backup using the Windows Server Backup feature, please refer to:

**Backup and Recovery Overview for Windows Server 2008 R2**

**Database and Transaction Log Backup, Restore and Recovery**
Backup and Recovery of the SAP database and transaction log are accomplished using the native SQL Server backup functionality that can either be scheduled and executed interactively from the SQL Server Management Studio or via a script using Transact-SQL commands.

Just as with the file system backup described earlier, the only special consideration when scheduling and executing SQL Server backups on AWS is the backup destination. Instead of choosing the backup destination **Tape** you need to select **Disk** and point to the drive that is the “backup“ EBS volume that you have designated for backups.

In case of database Restore and Recovery:
- First check if all required Data and Transaction Log backups are still available on the designated “backup“ EBS volumes
- If the available backups are not usable or incomplete, retrieve the missing Data and Transaction Log backups from Amazon S3 as described in the section “Copying backup data to and from Amazon S3”.
- Perform SQL Server Restore and Recovery, using the Data and Transaction Log backups that are available on the EBS Volumes

For detailed instructions how to schedule database and transaction log backups, and perform restore and recovery by using either the SQL Server Management Studio or via a script using Transact-SQL commands please refer to:

**SQL Server 2008 - Backing Up and Restoring How-to Topics (SQL Server Management Studio)**

**Backup and Recovery using 3rd party backup software**
This section discusses using 3rd party backup solutions to backup SAP systems running on AWS. Many of the same reasons why you would choose to use a 3rd party enterprise backup solutions for managing the backup and recovery of SAP systems running on traditional on-premise infrastructure also apply to backing up SAP systems on AWS:
- Centralized backup schedule management
- Automated Data Retention and Disposition Policy
- Clients and agents for various operating systems and databases
- Reporting

**Using 3rd party backup software on AWS**
Using an enterprise backup solution on AWS is similar to how you would operate it in a traditional on-premises infrastructure. The only special consideration, as discussed early in this guide, is the backup
destination. Most existing enterprise backup solutions do not yet support backup directly to Amazon S3. For enterprise backup solutions that do not support backup directly to Amazon S3 you can first backup to a local Amazon EBS volume attached to the instance and then copy the backup data to Amazon S3. Most all enterprise backup solutions allow you to run pre and post scripts before and after the backup is run. One of the post scripts you would run would be a script to copy the backup data to Amazon S3 as described earlier in this section.

3rd party backup software that supports direct backup to Amazon S3
Below is a list of 3rd party backup products that support direct backup to Amazon S3.

**Zmanda – Amanda Enterprise Backup**
Zmanda’s – *Amanda Enterprise* backup suite supports direct backup to Amazon S3. *Amanda Enterprise* has backup clients and agents for different operating systems and databases. For additional information on the *Amazon Enterprise* backup suite please visit Zmanda’s website: [http://www.zmanda.com/amanda-agent-overview.html](http://www.zmanda.com/amanda-agent-overview.html)

**CloudBerry Lab**
CloudBerry Lab offers a suite of products designed to work with Amazon S3. Two products offered by CloudBerry Lab that can be used to backup Windows Server and MS SQL are listed below:

- **Online Backup for Winders Server**
- **Online Backup for MS SQL Server**

For additional information on the visit CloudBerry Lab’s website: [http://www.cloudberrylab.com/](http://www.cloudberrylab.com/)

The following graphic shows a direct backup to Amazon S3:

**Figure 4: Backup directly to S3**