Deploy SAP HANA on RHEL on AWS
Sabareesan Radhakrishnan
Solution Architect
Agenda

- AWS Overview
- Red Hat on AWS
- SAP Solutions on AWS
- Deployment of SAP HANA on AWS
- Demo
AWS Overview
What is Amazon Web Services?

- AWS Global Infrastructure
- Application Services
  - Compute
  - Storage
  - Database
- Networking
- Deployment & Administration
- AWS Global Infrastructure
11 Regions
- N. Virginia
- N. California
- Oregon
- GovCloud US
- Ireland
- Frankfurt
- Singapore
- Tokyo
- Sydney
- Sao Paulo
- China*

28 Availability Zones
53 Edge Locations

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

* Limited public release
AWS Regions and Availability Zones

**Region**
- An independent collection of AWS services in a defined geographical location
- Foundation for meeting location dependent privacy and compliance requirements
- Customer has full control - AWS does not move customer’s resources
- Contains two or more Availability Zones

**Availability Zone**
- Distinct locations engineered to be insulated from failures in other Availability Zones
- Connected via an inexpensive, low latency network
Amazon Virtual Private Cloud (VPC)

A private, isolated section of the AWS cloud where you can launch resources in a virtual network that you define.

Enables connectivity between your network and VPC via a VPN or dedicated connection. Simplifies end user access and system integration.
VPC Connectivity Options

**VPN Connection**
- Encrypted IPsec hardware VPN connection between your network and VPC
- Can create multiple VPN connections to one VPC
- Fast and simple to setup

**AWS Direct Connect**
- Dedicated network connection between your network and VPC
- Can reduce network costs, increase bandwidth throughput, and provide a more consistent network experience
- 1 Gbps or 10 Gbps ports
Amazon Elastic Compute Cloud (EC2)

On-demand virtual computing, storage and networking infrastructure

- Windows and Linux
- 34 different VM sizes available optimized for various workloads
- Self-service provisioning and management
- Monitoring, scaling and load balancing services
- Rapid provisioning from pre-built OS and SAP images
- Pay by the hour - No up-front cost or long-term commitments
# SAP Supported AWS Instances

## Compute Optimized

<table>
<thead>
<tr>
<th>Name</th>
<th>vCPU</th>
<th>Memory (GiB)</th>
<th>I/O Perf</th>
<th>SAPS</th>
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<tbody>
<tr>
<td>c4.8xlarge</td>
<td>36</td>
<td>60</td>
<td>10 Gigabit</td>
<td>37,950</td>
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<td>c4.4xlarge</td>
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<td>High</td>
<td>19,030</td>
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<td>c4.2xlarge</td>
<td>8</td>
<td>15</td>
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<td>9,515</td>
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<td>60</td>
<td>10 Gigabit</td>
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<td>3.75</td>
<td>Moderate</td>
<td>1,989</td>
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## Memory Optimized

<table>
<thead>
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<th>Name</th>
<th>vCPU</th>
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<th>I/O Perf</th>
<th>SAPS</th>
</tr>
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<td>244</td>
<td>10 Gigabit</td>
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<td>61</td>
<td>High</td>
<td>7,980</td>
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<tr>
<td>r3.xlarge</td>
<td>4</td>
<td>30.5</td>
<td>Moderate</td>
<td>3,990</td>
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<tr>
<td>r3.large</td>
<td>2</td>
<td>15</td>
<td>Moderate</td>
<td>1,995</td>
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</tbody>
</table>

- Use in 2-Tier and 3-Tier Configurations
- Certified Instances for SAP HANA
- Cluster Networking Available
- EBS Optimized Instances
- Enhanced Networking
Elastic Block Store (EBS)

- Network attached block device for persistent storage
- Virtual disks
- Custom provision sizes from 1GB to 16TB per volume
- Multiple volumes per EC2 instance
- AES-256 Based encryption available (no extra charge)

EBS Magnetic (Formerly EBS Standard)
Cost effective storage that delivers approximately 40-200 IOPS per volume on average with a best effort ability to burst to hundreds of IOPS p/volume

EBS General Purpose (SSD)
General Purpose (SSD) volumes provide the ability to burst to 3,000 IOPS per volume, independent of volume size. Designed to deliver a consistent baseline of 3 IOPS/GB.

EBS Provisioned IOPS (SSD)
Designed to deliver predictable, high performance for I/O intensive workloads such as databases. Customer specifies an IOPS rate when creating a volume. Currently supports up to 20000 IOPS per volume
Amazon Simple Storage Service (S3)

Scalable file/object data storage service

Highly available and durable
Designed to provide...
- 99.99% availability
- 99.99999999% durability

Highly Secure
- Four different access control mechanisms
- Server side encryption available

SAP Use Cases
- Backup Storage
- SAP Archiving Storage
AWS CloudFormation

Enables the provisioning and management of a group of integrated AWS resources

Stacks of AWS resources are defined, deployed and managed in a single template file using JSON

**SAP Use Cases**

- Provision complete SAP landscapes from a single template
- Define and provision entire DR environment from a pre-defined and tested template
AWS CloudFormation = Significant reduction in time for deployments from weeks to minutes with consistency, repeatability, & reliability

- Software Installations
- Best practices
- Configuration
- ...

- Landscape configuration
- Network layout
- Security Policies
- ...

Amazon Machine Image (AMI)
Provisioning and Management of AWS resources is completely self-service using the AWS API.
Trusted by Enterprises Around the World
Used by Government Agencies & Educational Institutions Worldwide
Architected for Enterprise Security Requirements

“The Amazon Virtual Private Cloud [Amazon VPC] was a unique option that offered an additional level of security and an ability to integrate with other aspects of our infrastructure.”

Dr. Michael Miller, Head of HPC for R&D
Red Hat on AWS
AWS and Red Hat

Amazon Web Services and Red Hat have teamed together to offer Red Hat Enterprise Linux on Amazon EC2.

How are customers using SAP on RHEL on AWS?

- Migration of existing and implementation of new SAP environments to AWS
- Migration from UNIX to RHEL on AWS
- SAP project, POC, and test systems
- SAP HANA on RHEL for POCs, projects & production

More details available at http://aws.amazon.com/partners/redhat
How customers can run Red Hat on AWS

- Pay-as-you-go – Provision resources on-demand without long-term commitments or upfront costs.
- Reserved Instances – Lower your cost further by choosing reserved instance with all up-front, partial-upfront or no-upfront payment method.
- Bring your existing subscription – Customers with Red Hat Enterprise Linux Premium subscriptions can use Red Hat Cloud Access to move subscriptions to Amazon EC2

## Supported Red Hat products on AWS

<table>
<thead>
<tr>
<th>Product</th>
<th>Versions</th>
<th>Subscription Model</th>
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</thead>
<tbody>
<tr>
<td>Red Hat Enterprise Linux</td>
<td>5.x, 6.x and 7.x</td>
<td>On-demand, Reserved or Red Hat Cloud Access</td>
</tr>
<tr>
<td>Red Hat JBoss Enterprise Application Platform</td>
<td>6.x</td>
<td>Red Hat Cloud Access</td>
</tr>
<tr>
<td>Red Hat JBoss Web Server</td>
<td></td>
<td>Red Hat Cloud Access</td>
</tr>
<tr>
<td>Red Hat Storage Server</td>
<td></td>
<td>Red Hat Cloud Access</td>
</tr>
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</table>
SAP Solutions on AWS
How Customers Use SAP HANA on AWS

1. Production Support Systems (Development & QAS)
2. Non-Production Systems (Training, POC prototypes)
3. Production Systems and Disaster Recovery (DR)
Hybrid HANA Deployment – Customer Data Centre & AWS

SAP production landscape runs in customer’s own datacentre

- PRD
  - ECC
  - BW
  - SRM
  - SAP HANA Appliance(s)

SAP development & quality assurance landscape runs on AWS

- DEV
  - ECC
  - BW
  - HANA DB

- QAS
  - ECC
  - BW
  - HANA DB

VPN or Direct Connect

Secure connectivity between datacentre & AWS

Virtual Private Cloud
SAP HANA Disaster Recovery (DR) on AWS

SAP production (PRD) landscape runs in customer's own datacentre

PRD
- ECC
- BW
- SAP HANA Appliance(s)

SAP HANA System Replication (Async)

VPN or Direct Connect

SAP development & quality assurance landscape runs on AWS

DR
- ECC
- BW
- HANA DB

Virtual Private Cloud
Full SAP HANA Deployment on AWS

Customer runs DEV, QAS, & PRD on AWS

VPN or Direct Connect

Secure connectivity between LAN & AWS network

Virtual Private Cloud
SAP HANA for Big Data Analytics

- **VPN or Direct Connect**
  - Secure connectivity between LAN & AWS network

- SAP BI
- HANA DB
- Amazon EMR

Virtual Private Cloud
Kellogg Uses AWS to Save $900,000 over 5 Years Over Using On-premises Infrastructure

Using AWS saves us $900,000 in infrastructure costs alone, and lets us run dozens of simulations a day so we can reduce trade spend. It’s a win-win.

Stover McIlwain
Senior Director of IT Infrastructure Engineering

• Needed a better way to track and model promotional costs (“trade spend”) to improve the bottom line—and needed to be able to run more than 1 trade-spend simulation/day

• Running SAP Accelerated Trade Promotion Planning (TPM) – Powered by SAP HANA

• By using SAP HANA on AWS, Kellogg estimates it will save $900,000 over 5 years versus traditional on-premises infrastructure alternatives

• Increased business agility: Company can run dozens of trade spend simulations each day, and decreases deployment time by 30x

• Leveraged existing SAP HANA software license investment on AWS

• Familiarity and Accessibility of the AWS platform enabled engineers to easily apply their existing knowledge and infrastructure skills

Kellogg produces breakfast foods for more than 180 companies worldwide, with annual revenue of almost $15 B.
SAP HANA Scalability Test for SAP BW Using In-Memory Data Fabric

- 111 SAP HANA Instances (1,776 CPU Cores)
- 8M Rows loaded per second (60 Billion Total)
- 220ms single node query (600 Million Rows)
- 330ms for federated query (60 Billion rows)
- Throughput of 3 million queries per hour

### SAP BW Enhanced Mixed Load (BW-EML) Standard Application Benchmarking on AWS

<table>
<thead>
<tr>
<th>Date of Certification</th>
<th>Instance Type</th>
<th>Number of Nodes</th>
<th>Total Memory</th>
<th>Number of Records</th>
<th>Adhoc Navigation Steps/hr</th>
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<td>244 GB</td>
<td>500 Million</td>
<td>137,510</td>
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<td>1.22 TB</td>
<td>2 Billion</td>
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<td>3.41 TB</td>
<td>5 Billion</td>
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<td>17</td>
<td>4.14 TB</td>
<td>5 Billion</td>
<td>303,270</td>
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SAP News Center - A 14-node system from Amazon Web Services (AWS) sets the record for SAP HANA scale-out in the cloud, validating it as an ideal solution for customers to cost-effectively consume SAP HANA.

Amazon EC2 Cluster Compute Instances for SAP HANA

**cr1.8xlarge**
- 2 x Intel Xeon E5-2670 processors (Sandy Bridge)
- 32 vCPUs with hyperthreading
- 64-bit
- 244 GB RAM
- 10 Gigabit Network
- NUMA and Turbo Support

**r3.8xlarge**
- 2 x Intel Xeon E5-2670 v2 processors (Ivy Bridge)
- 32 vCPUs with hyperthreading
- 64-bit
- 244 GB RAM
- 10 Gigabit Network
- NUMA and Turbo Support
- Enhanced Networking

SAP HANA Infrastructure Subscription
Multiple EC2 Pricing Options

Two options most relevant for SAP...

**On-Demand**

Pay for compute capacity by the hour with no up-front cost or long-term commitment

Pay for only the hours an instance is online

SAP system types: Test, Demo, Training, POC

**Reserved**

Make a low one-time payment and receive a significant discount on the hourly charge

1-year or 3-year term

Three types – Light, Medium and Heavy Utilization

SAP system types: DEV/QAS/PRD
What about Hardware Refreshes?

- Hardware upgrades in minutes!
- No data migration required
- Retain same IP addressing (VPC)
Deployment of SAP HANA on AWS
SAP HANA Deployment Methods

Developer Edition / Trials -> SAP Cloud Appliance Library

HANA One -> AWS Marketplace

BYOL (Multi-Node) -> AWS Quickstart

AWS API's

AWS Global Infrastructure
What is AWS Quick Start Reference Deployment?

- AWS Quick Start reference deployments help you rapidly deploy fully functional enterprise software on the AWS cloud.
- Uses AWS CloudFormation templates and custom scripts to automate end-to-end provisioning.
- Quick Starts are modular and customizable; you can layer additional functionality on top or modify them for your own implementations.
- To extend the templates and scripts, visit our GitHub repository.
Fully Automated VPC & HANA Deployment in Minutes

**AWS**
- Amazon S3
- S3 Backup Bucket

**VPC**
- 10.0.0.0 / 16
- 10.0.1.x / 24 (Private Subnet)
- 10.0.2.x / 24 (Public)

**SAP HANA**
- **(Master)**
- **(Workers)**

**Mount Global Shares:**
- /hana/shared
- /backup

**Push/Pull Backup to/from S3**

**Private IP Address(es)**

**Internet Traffic**
- Studio (50013/14)
- HLM (1128/9)
- JDBC (30015/17)
- XS App (8000/4300)

**Inbound SSH**

**Outbound Internet Traffic**

**Easy connect to your own network post deployment**

**Corporate Data Center**

**Internet Gateway**

**Virtual Private Gateway**

**VPN Tunnel or AWS Direct Connect**

**Virtual Private Cloud (VPC)**
- Fully Automated VPC & HANA Deployment in Minutes

**Availability Zone**

**Virtual Private Cloud (VPC)**

**Amazon S3**
- S3 Backup Bucket

**HANA Studio**
- Elastic IP Address

**Internet**

**Easily connect to your own network post deployment**

**Corporate Gateway**

**AWS**
- S3 Backup Bucket

**Fully Automated VPC & HANA Deployment in Minutes**

**Easily connect to your own network post deployment**
A Quick Start SAP HANA Deployment in 3 simple steps...

1. Create Virtual Private Cloud (VPC)
2. Download SAP HANA software
3. Deploy SAP HANA
Pre-Requisites: Open an AWS Account

- Sign-up at http://aws.amazon.com
- Decide Amazon EC2 Region where you want to deploy

<table>
<thead>
<tr>
<th>Region</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>ap-northeast-1</td>
<td>Asia Pacific (Tokyo)</td>
</tr>
<tr>
<td>ap-southeast-1</td>
<td>Asia Pacific (Singapore)</td>
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<tr>
<td>ap-southeast-2</td>
<td>Asia Pacific (Sydney)</td>
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<td>eu-central-1</td>
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<td>eu-west-1</td>
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<td>sa-east-1</td>
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<tr>
<td>us-east-1</td>
<td>US East (Northern Virginia)</td>
</tr>
<tr>
<td>us-west-1</td>
<td>US West (Northern California)</td>
</tr>
<tr>
<td>us-west-2</td>
<td>US West (Oregon)</td>
</tr>
</tbody>
</table>
Pre-Requisites: Create or Import a Key-Pair

Amazon EC2 uses public-key cryptography to encrypt and decrypt login information. To be able to log into your instances, you must create a key pair.

Uses:

- Linux: SSH access to virtual machine where SAP HANA is installed
- Windows: Key used to decrypt Windows Administrator Password via the EC2 console. User can then log in using Remote Desktop Protocol (RDP)

Action:

- Create or import a key-pair in your previously selected region in the AWS Console

* For more information go to [EC2 User Guide](http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ec2-key-pairs.html)
Pre-Requisites: Sizing for SAP HANA

- **New Implementation:** Use the SAP QuickSizer ([http://service.sap.com/quicksizer](http://service.sap.com/quicksizer))

- **Migrating an Existing SAP Netweaver BW System:** Use the new ABAP sizing report for SAP NetWeaver BW described in SAP note 1736976*

- **Migrating an Existing SAP Business Suite System to HANA:** See SAP note 1872170* to estimate the main memory requirements of the HANA virtual appliance.

* SAP ID Required
Pre-Requisite: Subscribe for RHEL for SAP HANA AMI

**Action:** Subscribe for RHEL for SAP HANA AMI from AWS Marketplace

https://aws.amazon.com/marketplace -> Search for RHEL for SAP HANA
Optional Pre-Requisite: Amazon EC2 Limit Increase

**Action:** Request a limit increase for Amazon EC2 instances

[https://aws.amazon.com/support/createCase](https://aws.amazon.com/support/createCase) -> Service Limit Increase -> Limit Type = EC2

- SAP HANA Deployments leverage the **r3.8xlarge** instance type
- The default limit for r3.8xlarge instances is 5
- If your deployment needs will exceed the default limits please request a limit increase for the instance type in the region of your choice
Step 1: Create VPC and Supporting Infrastructure

Virtual Private Cloud

VPC 10.0.0.0 / 16

10.0.1.x / 24 (Private Subnet)

10.0.2.x / 24 (Public)

NAT

Internet Gateway

Internet

EBS Volume for HANA Media

RDP Server

RDP

SSH
Step 2: Download SAP HANA Software

- Open up RDP session to Windows Server via the Elastic IP Address
  - Decrypt the Windows Administrator Password in the EC2 Console using the Private Key created earlier.
- Download SAP HANA Media from SAP Software Download Center
  [http://service.sap.com/swdc](http://service.sap.com/swdc) (SP8 is supported!)
- Extract SAP HANA Media to D:\ drive
Step 3: Launch Automated Deployment of SAP HANA

- Run `.SAP_HANA_Deploy.ps1` Powershell script
- Wait for snapshot of D:\ drive to complete (10-15 minutes)
- Choose size & number of SAP HANA Nodes to deploy
- Enter a Master Password to be used during the HANA Deployment
Relax for 30-40 minutes…
Checking your Deployment

- Monitor console output for CREATE_COMPLETE status
- Verify Status Checks for all created Instances in the Main EC2 Console
Result: Fully Automated VPC & HANA Deployment in Minutes

- **SAP HANA (Master)**
  - Push/Pull Backup to/from S3
  - Root Volume
  - SAP Volume
  - LVM Group
  - HANA Data
  - HANA Log
  - & Backup Area
  - Shares From Master
  - Private IP Address(es)
  - Internal (30000-10)
  - NFS (Various)
  - SSH (22)

- **SAP HANA (Workers)**
  - Root Volume
  - SAP Volume
  - LVM Group
  - HANA Data
  - HANA Log

- **S3 Backup Bucket**
  - Amazon S3
  - Internet Gateway

- **VPC**
  - 10.0.0.0/16
  - 10.0.1.x/24 (Private Subnet)
  - 10.0.2.x/24 (Public)
  - Studio (3003/14)
  - HLM (1128/9)
  - JDBC (30015/17)
  - XS App (8000/4300)

- **NAT**
  - Elastic IP Address
  - Outbound internet Traffic

- **Corporation**
  - Internet
  - RDP
  - SSH
  - Corporate Network
  - Inbound SSH
  - VyprVPN Tunnel or AWS Direct Connect
  - Virtual Private Gateway
  - Customer Gateway

- **Virtual Private Cloud**
  - Availability Zone
  - Corporate Data Center

- **Shares From Master**
  - /hana/shared
  - /backup

- **Mount Global Shares**
  - Fully Automated VPC & HANA Deployment in Minutes
  - Result: Easily connect to your own network post deployment

- **Internet**
  - NAT
  - Elastic IP Address
  - Outbound internet Traffic

- **Virtual Private Cloud**
  - Availability Zone
  - Corporate Data Center

- **Easily connect to your own network post deployment**
Configure HANA Studio on Windows Server

Add System

Enter IP Address of Master Node

User System / Master Password
EBS Storage Architecture for HANA

Production configuration leverages SAP certified EBS for SAP HANA Data, Log, and Backup areas
- Backed by solid-state drives (SSD)
- Single-digit millisecond latency

Each Amazon EBS volume data is replicated across multiple servers in an Availability Zone

Each SAP HANA node carries the same Amazon EBS configuration regardless of whether it is configured as master or worker node

Shared nothing storage concept for the SAP HANA data and log areas

Backup area is shared amongst all members of a cluster
Live Demo
Next Steps
SAP HANA on AWS “Pilot” Program Offer

- Customers may receive up to US$1,000 in AWS Promotional Credits to evaluate SAP HANA on a much larger instance (Amazon EC2 cr1 or r3.8xlarge Instance type)

- The credit will fund the AWS infrastructure costs for customers to trial SAP HANA through a choice of deployment methods:
  - The SAP Business Warehouse (BW) Trial powered by SAP HANA on AWS or the SAP HANA Infrastructure subscription offering—both offered and available through SAP
  - Or if the customer has their own license of SAP HANA, they may leverage it in a “BYOL” model and use the SAP HANA on AWS Quick Start Reference Deployment Guide as a tool to setup and run it themselves on the AWS Cloud

- Learn more about the Pilot offer, including terms and how to apply for up to US$1,000 in AWS Promotional Credits at http://aws.amazon.com/sap/saphana/pilot/
Where to Find SAP HANA on AWS Resources

http://aws.amazon.com/sap/saphana/

- Latest updates
- How to Get Started
- Deployment Information
- Support Information
- SAP HANA on AWS Implementation and Operations Guide

Contact us: saphana@amazon.com

SAP HANA in the AWS Cloud Quick Start Deployment Guide
http://aws.amazon.com/quickstart/
SAP on AWS Operations Guide
The SAP on AWS Operations Guide discusses the special considerations for operating SAP environments on AWS.

SAP on AWS High Availability Guide
The SAP on AWS High Availability Guide explains how to configure SAP systems on Amazon EC2 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 explains how to backup SAP systems running on AWS. The guide contrasts backing up SAP systems on AWS with traditional infrastructure.

http://aws.amazon.com/sap/whitepapers

Additional SAP on AWS Documentation
THANK YOU