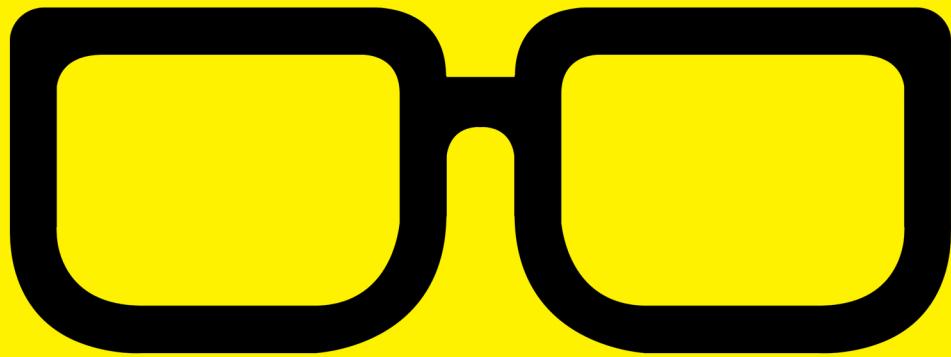


SPONSORED BY



GEEK GUIDE



Public Cloud Scalability for Enterprise Applications

Table of Contents

About the Sponsor	4
Introduction	5
The Public Cloud	6
What Is It?	6
Why Should You Consider Using It?	8
Amazon Web Services	10
Why Consider AWS?	13
SUSE Linux Enterprise Server	16
SAP and SAP HANA.....	17
SUSE Linux Enterprise Server for SAP Applications	17
High Performance	17
High Availability	19
Security and Support.....	21
Summary	21

PETROS KOUTOUPIS is currently a senior software developer at **IBM** for its **Cloud Object Storage** division (formerly **Cleversafe**). He is also the creator and maintainer of the **RapidDisk Project** (<http://www.rapiddisk.org>). Petros has worked in the data storage industry for more than a decade and has helped pioneer the many technologies unleashed in the wild today.

GEEK GUIDES:

Mission-critical information for the most technical people on the planet.

Copyright Statement

© 2016 *Linux Journal*. All rights reserved.

This site/publication contains materials that have been created, developed or commissioned by, and published with the permission of, *Linux Journal* (the “Materials”), and this site and any such Materials are protected by international copyright and trademark laws.

THE MATERIALS ARE PROVIDED “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT. The Materials are subject to change without notice and do not represent a commitment on the part of *Linux Journal* or its Web site sponsors. In no event shall *Linux Journal* or its sponsors be held liable for technical or editorial errors or omissions contained in the Materials, including without limitation, for any direct, indirect, incidental, special, exemplary or consequential damages whatsoever resulting from the use of any information contained in the Materials.

No part of the Materials (including but not limited to the text, images, audio and/or video) may be copied, reproduced, republished, uploaded, posted, transmitted or distributed in any way, in whole or in part, except as permitted under Sections 107 & 108 of the 1976 United States Copyright Act, without the express written consent of the publisher. One copy may be downloaded for your personal, noncommercial use on a single computer. In connection with such use, you may not modify or obscure any copyright or other proprietary notice.

The Materials may contain trademarks, services marks and logos that are the property of third parties. You are not permitted to use these trademarks, services marks or logos without prior written consent of such third parties.

Linux Journal and the *Linux Journal* logo are registered in the US Patent & Trademark Office. All other product or service names are the property of their respective owners. If you have any questions about these terms, or if you would like information about licensing materials from *Linux Journal*, please contact us via e-mail at info@linuxjournal.com.

About the Sponsor

SUSE®

SUSE®, a Micro Focus company, provides and supports enterprise-grade Linux and open-source solutions with exceptional service, value and flexibility. With partners and communities, we innovate, adapt and deliver secure Linux, cloud infrastructure and storage software to create solutions for mixed enterprise IT environments. We help customers harness the benefits and power of an open enterprise that can empower their possibilities.

Public Cloud Scalability for Enterprise Applications

PETROS KOUTOUPIS

Introduction

These days, the cloud has become synonymous to consumers with all things data storage. To IT decision makers, product managers and CIOs, however, it has evolved to mean so much more. In the past decade alone, the paradigm shift toward a wider and more

accessible network has forced both hardware vendors and service providers to rethink their strategies and cater to a new model of storing information and serving application resources.

Cloud computing provides a more simplified access to server, storage, database and application resources, with users provisioning and using just the right amount of infrastructure and services to build and host their applications. This new form of computing has provided many already established businesses the excuse they needed to migrate workloads from local data centers to cloud service providers.

The Public Cloud

What Is It? Based on the standard cloud computing model, the public cloud enables service providers to provide resources that include applications and storage over the internet. Relative to each respective service provider, those services may be offered under a pay-per-usage model or for free.

The public cloud differentiates itself from the private cloud in that the private cloud typically is deployed in the data center and under the proprietary network using its cloud computing technologies—that is, it is developed for and maintained by the organization it serves.

Some of the key advantages to using a public cloud service enable you to achieve the following:

- Enhance business agility with easy access and simplified deployment of operating systems/applications and

management of allocated resources.

- Reduce capital expenses and optimize budgets by reducing the need to worry about hardware and data center/networking infrastructure.
- Transform how you deliver services and IT with resources that flexibly scale to meet your constantly evolving requirements.
- Improve operations and efficiency without worrying about hardware, cooling or administration costs—you simply pay for what you need and use.

Some of the world's leading public cloud platforms include:

- Amazon Web Services (AWS).
- Microsoft Azure.
- Google Cloud Platform.
- IBM SoftLayer.

The general focus of this eBook is centered around AWS. Additionally, I explore how enterprise adoption and organizational transformation using public cloud and AWS differs from how early adopters like fast-growth start-ups and companies with cloud-native applications leverage Amazon Web Services and the

Adopting the public cloud enables developers access to the latest and greatest tools and services needed to build and deploy applications on instantly available infrastructure.

types of operating system requirements needed for mission-critical applications.

Why Should You Consider Using It? Adopting the public cloud enables developers access to the latest and greatest tools and services needed to build and deploy applications on instantly available infrastructure. Faster development cycles means that companies are under pressure to compete at a faster velocity or face being disrupted in the market. This new speed of business coupled with the mindset of “on-demand” and “everything-as-a-service” extends beyond application developers into finance, human resources and sales—it’s organizational change. Building this foundation for higher velocity innovation is a rising priority for enterprises, but there are many questions to explore, such as procurement of cloud, control and security.

Unlike private cloud and on-premises data-center deployments, public cloud consumption is designed to relieve their maintainers of the burden to invest, maintain and continuously update computing hardware and networking infrastructures. Let’s face it. Hardware

gets old, and it gets old relatively quickly. The idea is to reduce (and potentially remove) capital expenditures (Capex) significantly and focus more on the now-reduced operational expenditures (Opex). This model allows for a company to reduce its IT staffing and computing hardware/software costs. Instead of investing heavily upfront, companies are subscribing to the infrastructure and services they need—remember, it’s a pay-as-you-go model with many cloud service providers also offering enterprise purchasing agreements or the ability to pre-pay and maximize economic efficiency based on forecasted usage.

While the public cloud can enable cost savings, it’s the modernization of IT and service delivery that is compelling adoption in the enterprise. However, the cost of outsourcing infrastructure-as-a-service includes trading some level of control in exchange for scalability. Public clouds are designed to scale, theoretically, without limit. As you need to provision more resources, the service providers are well equipped to meet those requirements. The point here is that you never will consume all of the capacity of a public cloud. This is not the case with both private cloud and on-premises solutions, where there always will be a need to (re-)invest continuously in additional hardware and software resources. Control and ownership over the data center also entails full responsibility for compliance and availability—a burden that can be outsourced using a public cloud with an SLA and externally audited and certified security management standards that fit

your requirements.

Private cloud and on-premises solutions generally are assumed to be more secure, but recent studies have shown this not to be the case. Public cloud service providers spend more time and resources consulting with security experts and updating their software framework to limit security breaches. Leading analyst firms like Gartner take a distinct position when it comes to enterprise adoption of public cloud and the issues of security. In a recent press release highlighting the growth of public cloud adoption worldwide, Ed Anderson, Research Vice President at Gartner, was quoted as saying, “Gartner’s position on cloud security has been clear—public cloud services offered by the leading cloud providers are secure. The real security challenge is using public cloud services in a secure manner.” For enterprise organizations this means choosing a best-in-class public cloud platform and working with partners that offer enterprise-level support, with guidance and best practice for secure cloud adoption that minimizes lock-in where possible and maximizes availability and uptime.

Amazon Web Services

First launched in 2006, Amazon Web Services (AWS) began by offering a suite of on-demand cloud computing, storage and networking resources. Specifically, with AWS, these on-demand services are offered under a pay-as-you-go pricing model with additional purchasing options, such as Reserved Instances, which allow you to save costs and

Today, AWS provides an extensive list of services that focus on compute, storage, networking, database, analytics, developer tools and many more.

pre-pay for infrastructure that has recognizable usage patterns. Today, AWS provides an extensive list of services that focus on compute, storage, networking, database, analytics, developer tools and many more. The most well known of these services are the Amazon Elastic Compute Cloud (EC2) and the Amazon Simple Storage Service (S3).

AWS places its data centers across 33 availability zones within 12 regions worldwide. Each availability zone has one or more data centers. Each data center is equipped with 50,000–80,000 servers, and each data center is configured with redundant power for stability, networking and connectivity.

Honestly, one could spend days discussing Amazon's impressive list of offerings, which is why, for the sake of this guide, I focus only on the Infrastructure as a Service (IaaS) EC2 and its capabilities to serve virtual machines via a Xen API. Xen is an open-source and free hypervisor with the ability to host multiple operating systems (that is, virtual machines) on the same physical hardware. Xen is designed to simulate multiple CPU architectures, which include Intel (x86 and x86-64), ARM, PowerPC and MIPS. Through a web-based front

end, you are in complete control of all your allocated computing resources and also are able to obtain and boot a new server instance within minutes.

Think about it for a second. You can commission a single or thousands of server instances simultaneously and *within minutes*—not in hours or days, but in minutes. Pretty impressive, right? All of this is controlled with the web service Application Program Interface (API). For those less familiar, an API is what glues services, applications and entire systems together. Typically, an API acts as a public persona for a company or a product by exposing business capabilities and services. An API geared for the cloud can be invoked from a browser, mobile application or any other internet-enabled endpoint.

With each deployed server instance, again, you are in full control. Translation: you have root access to each one (with console output) and are able to interact with them however you need. Through that same web service API, you are able start or stop whichever instance is necessary.

AWS provides its users with the choice of selecting (virtual) hardware configurations—that is, memory, CPU and storage with partition sizes. Users also are given the choice to install from a list of multiple operating systems (including Linux distributions and Microsoft Windows Server) and software packages. Remember, the more resources selected, the more expensive the server instance becomes. Each instance is marked with a fixed price per hour of usage.

Historically, you would read about smaller (and lesser known) start-ups and companies leveraging the public

Amazon has always put customer success at the forefront, and you could spend hours reading about how some of its biggest and more prominent users like Netflix, Airbnb, Lamborghini and Autodesk are solving incredible problems using the public cloud.

cloud to build and release apps and services rapidly. However, it's becoming more and more often that you read of well established companies making use of the public cloud. Amazon has always put customer success at the forefront, and you could spend hours reading about how some of its biggest and more prominent users like Netflix, Airbnb, Lamborghini and Autodesk are solving incredible problems using the public cloud.

Why Consider AWS?

Amazon has been in this game for at least a decade. Being the first to market such an extensive offering provided the company with the opportunity to dominate the then-emerging market. Even today, Amazon continues to dominate. By the end of 2015, it held 31% of the public cloud market. In a distant second place was Microsoft with 9%. Third place was awarded to IBM (7%), and Google came in fourth (4%).

With so many years under its belt, Amazon has been

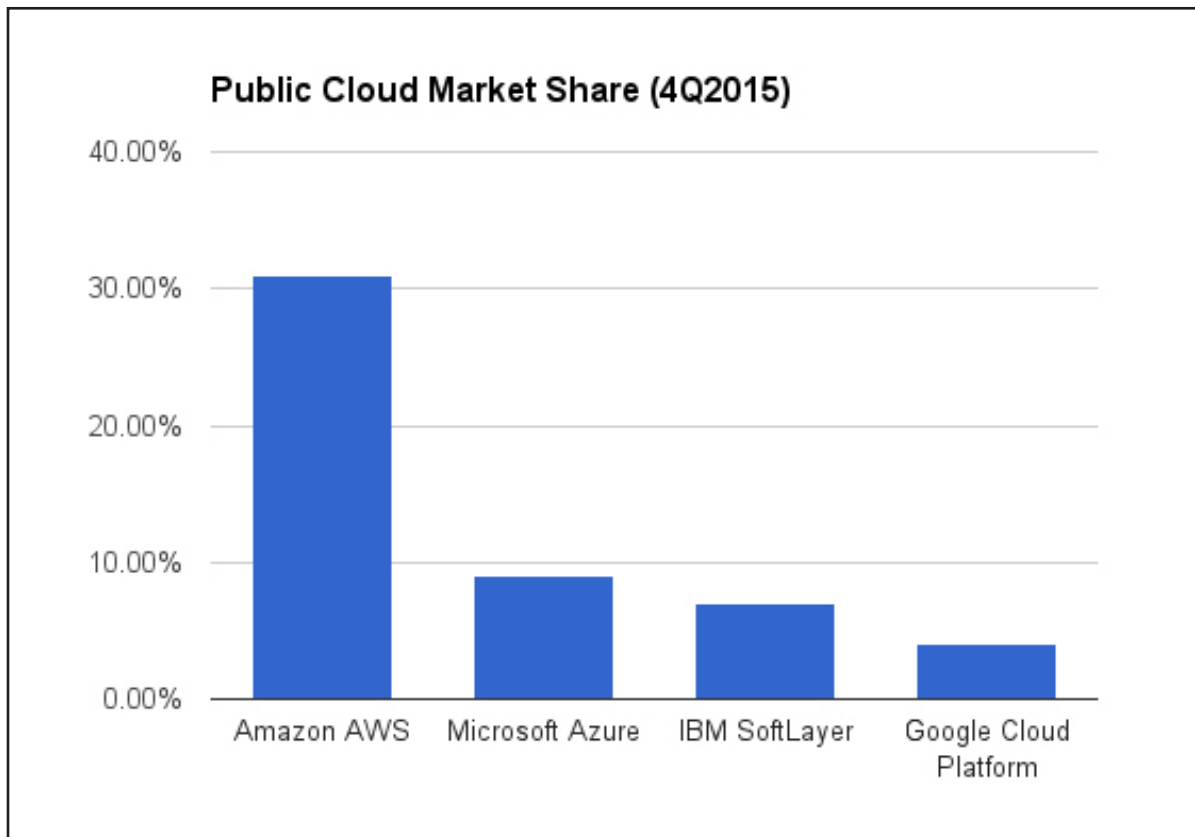


FIGURE 1. Public Cloud Market Share

able to learn from consumer workloads and refine its offerings to accommodate and scale to meet that always-varied workload. Amazon also maintains a very competitive pricing model.

Amazon's Representational State Transfer (RESTful) API has become an industry standard, and the competition strives to maintain compatibility with it. This includes the increasingly popular OpenStack. OpenStack is an Apache-licensed open-source framework designed to build and manage both public and private

clouds. Much like AWS, its interrelated components control hardware pools of processing, storage and networking resources, all managed through a web-based dashboard or through its RESTful API. Although the OpenStack project maintains its own standard, it too is compatible with AWS.

The availability of a public cloud platform that offers best-of-breed performance, an incredibly wide and ever-growing selection of services, and global coverage such as AWS, is a powerful, and I'd say even necessary, addition to your IT strategy. The reality is for larger organizations, you may also have to plan on building your own internal cloud for certain types of workloads—and the availability of OpenStack grants the best of both worlds in terms of scalability, ownership and utilization of existing data center assets. Whether your organization is already alight with AWS instances, planning the design of a dedicated private cloud or somewhere in between, it's important to remember that the foundation for modern IT and application delivery is being overwhelmingly built on Linux. Statistics from data analysis of an AWS-managed service providers customer base (<http://blog.intronis.com/bid/a-peek-inside-amazon-web-services>) to an EC2 image tracking tool monitoring tens of thousands of AWS instances show that 75% of AWS instances run Linux (<http://thecloudmarket.com/about.html>).

Cloud service providers offer a variety of Linux distributions on-demand, with many free options available; however, it's important to consider another



FIGURE 2. The Operating System Market Share on AWS

variety of requirements, such as reliability, availability, interoperability and security of the underlying OS as well as the availability of support offerings that enhance and extend what your cloud service provider will cover.

SUSE Linux Enterprise Server

When it comes to Linux, it goes without saying that SUSE is one of the most influential companies to build and offer open-source solutions for the enterprise space. SUSE released the very first comprehensive Linux in 1992, and in the years following, it continuously refined and adapted to the constantly changing market. SUSE's success in the enterprise space in the late 1990s created a sharp focus on providing enterprise-grade open-source

solutions backed by exceptional service and support. SUSE's 24+ years of Linux engineering experience extends into the cloud with SUSE Linux Enterprise Server available on-demand from cloud service providers like AWS with the same reliability and security that 80% of the Fortune Global 50 rely on to power their mission-critical applications today.

SAP and SAP HANA SAP is one of the largest enterprise software companies in the world with a vision to help businesses of all sizes, in all industries, run better. SAP HANA is an in-memory relational database management system that performs a variety of analytic functions, which include predictive analytics, spatial data processing, text analytics, text search, streaming analytics and graph data processing. It holds its data in memory for one reason alone: high performance for enterprise applications. When it was time for SAP to select a development platform to support its cutting-edge in-memory technology, SAP chose SUSE Linux Enterprise Server.

SUSE Linux Enterprise Server for SAP Applications

SUSE Linux Enterprise Server for SAP Applications is optimized for mission-critical SAP software solutions. Here I'll explore how SAP HANA takes advantage of an optimized SUSE operating system available for on-demand delivery through the AWS Marketplace (<https://aws.amazon.com/marketplace/pp/B01E9GPLB8>) to develop, test and run on-demand and at scale.

High Performance One of the most compelling reasons to run SAP HANA on AWS is that the database has been certified by SAP to run Amazon's EC2 in

Whether you're looking to deploy and test a stack on HANA or building cloud-native applications that leverage the in-memory database, you will be able to get up and running quicker than ever on Amazon Web Services in a production environment.

production environments using X1 instances offering 2TB of memory (scale out to seven nodes for 14TB) and powered by four 2.3GHz Intel Xeon E7 8880 processors. Whether you're looking to deploy and test a stack on HANA or building cloud-native applications that leverage the in-memory database, you will be able to get up and running quicker than ever on Amazon Web Services in a production environment.

AWS provides a Quick Start Reference Deployment that launches a SUSE Linux Enterprise SAP HANA cluster of one to five server nodes with minimal effort. Available at the AWS Marketplace, you can use this same reference guide for an overview of the architecture and to obtain links to the AWS CloudFormation template that automates software configuration and installation. Quick Start Reference Deployments and CloudFormations are also available for a wide variety of other essential building blocks to build, test and automate deployment of cloud applications powered by SUSE Linux Enterprise Server.

High Availability SUSE solutions help customers reduce business risk with a resilient IT infrastructure that is designed to reduce downtime and ensure availability of business-critical applications and services. Whether it's live patching to enable kernel updates without the need to reboot or high availability extensions built to enable continuous service following disruptive incidents (planned or unplanned), SUSE solutions are engineered to enable business continuity on cloud or on-premises.

As an example, SUSE Linux Enterprise Server for SAP Applications has been specifically developed with two custom Pacemaker resource agents to ensure the high availability of SAP HANA clusters. Pacemaker is an open-source resource manager used in computer clusters. It runs as a service on top of the Corosync clustering engine. Its sole purpose is to ensure that a desired resource is running on at least a single server node within an active cluster. If that resource is not running on the designated preferred or master server node, it then will fail over to a designated secondary or slave server node. This approach is referred to as an active/passive configuration, and it is this feature that enables high availability. SUSE and SAP have tailored Pacemaker resource agents specifically for SAP applications. The two resource agents are SAPHana and SAPHanaTopology, which collectively enable fault tolerance in the event of a server node failure while replicating and monitoring SAP HANA data, status and configurations across the cluster.

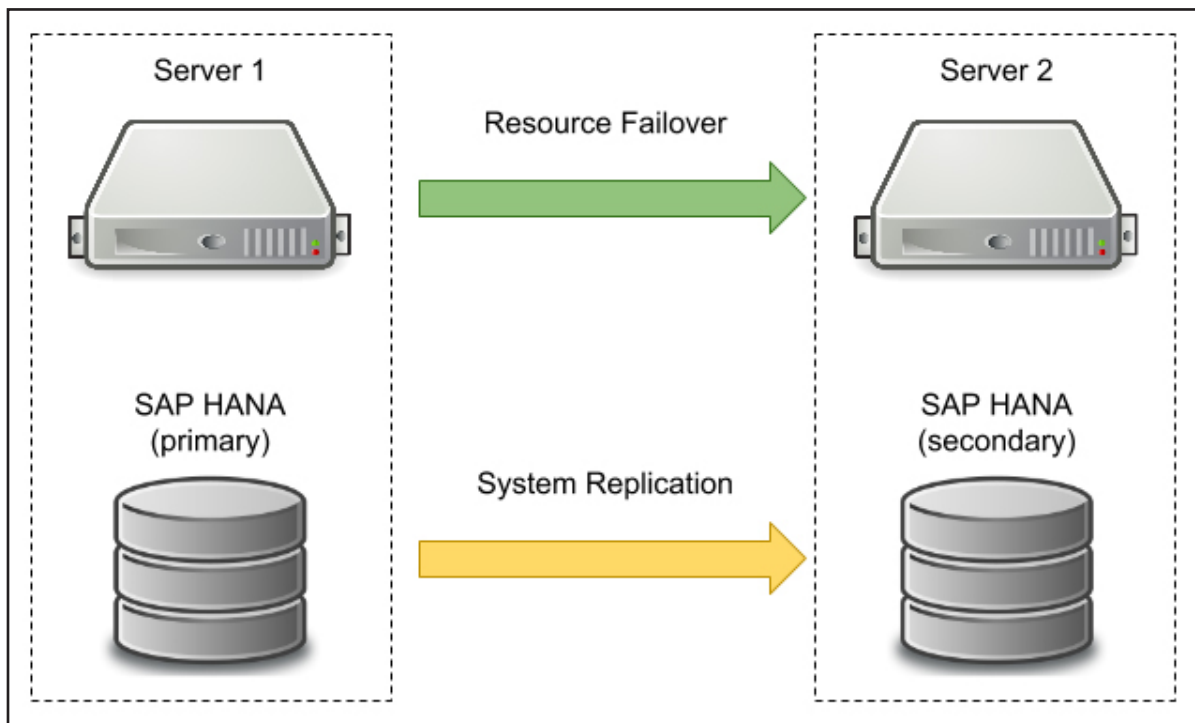


FIGURE 3. SAP HANA High Availability

The SAPHanaTopology resource agent actively runs on all server nodes to synchronize SAP HANA status and configurations. The SAPHana resource agent is what configures the database instances into a master or slave resource. The master assumes responsibility for the SAP HANA databases running in primary mode, while the slave is responsible for instances operating in a synchronous and secondary status.

When SAP HANA replicates the in-memory data across the multiple server nodes of the cluster, it is capable of making these copies within the same and across two data centers. This specific feature is called SAP HANA Systems

Replication. The idea is to protect the applications from entire site failures.

Security and Support Let's face reality here; no system is immune to attacks. Many attackers use the Linux operating system as a preferred gateway to attack applications. This is why SUSE continuously enhances the security of its solutions by pushing security patches and package updates, security certifications and maintaining a proper configuration of the SUSE firewall. The high standard for security from SUSE also extends to the cloud, as all instances of SLES on Amazon EC2 receive updates at the same time that updates are made available from SUSE and available to install using standard SLES systems management tools.

I already discussed some key IT requirements: reliability, availability and security. But, I have yet to discuss support. One huge advantage of working with SUSE is its support options. The availability of the Extended Service Pack increases the overlapping period for updating to the latest service packs from 6–18 months. SUSE Linux Enterprise Server is also available with Expanded Support, which will actually cover other distributions of Linux, giving you a single point of contact for seamless, first-class support.

Summary

When you make a long-term technology investment, you want to protect that investment from future issues. When it comes to public cloud adoption, choosing a cloud platform and operating system that provide

best-in-class performance, reliability, availability and security backed by enterprise-class support will be a key to long-term success and stability of your IT modernization strategy. Whether architecting real-time analytics applications on HANA or a new mobile app for your business group, building it on SUSE will ensure that you can leverage the full benefits of the public cloud combined with open-source innovation.

Getting up and running with SUSE Linux Enterprise Server on AWS is easy, but if the available documentation and installation tools are not enough, SUSE offers a course specifically designed for system administrators who need to configure and manage SUSE Linux Enterprise Server. The course takes the administrator through some basic Linux concepts and SUSE Enterprise Linux, with the availability of storage and SAP-specific administration as well. Visit <https://aws.amazon.com/partners/suse> today to get started! ■